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Earlier versions of the papers in this volume were presented at the Banca d'Italia workshop on "Beyond the Austerity Dispute: New Priorities for Fiscal Policy", held in Perugia, S.A.Di.Ba., on 9-11 April, 2015. We wish to thank the staff of S.A.Di.Ba. for their assistance in all aspects of the organization of the workshop.

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FOREWORD

Sandro Momigliano[*]

This volume brings together the papers presented at the Banca d'Italia workshop held in Perugia from 9 to 11 April 2015.

In Europe, the euro-area sovereign debt crisis had spurred the implementation of structural reforms as well as fiscal consolidation efforts in several Member states. Sovereign bond yields lowered significantly in many countries and reached very low levels across the area, reflecting also more responsible and credible fiscal plans. The recovery progressed, though at low pace. Against this background, it was felt that it could be the right time to re-discuss fiscal policy in a longer-term perspective. This assessment, taking also into account the experience non-European countries, was the first objective of the workshop. The second one was to examine how the European fiscal framework – whose level of complexity has increased over time – could be made simpler, more consistent and enforceable.

Session 1 was mainly devoted to inequality: its roots, its consequences in terms of political instability, its relationship with fiscal choices. The first paper of the Session studies the effects of fiscal consolidation on inequality. Using a sample of 17 OECD countries over the last 30 years the authors show that consolidation episodes, measured by changes in the cyclically adjusted primary balance or identified by the narrative approach, increase income inequality in the order of 0.2-1 per cent over the short and medium term. Using a very large database containing both developed and emerging markets, the second paper provides evidence that inequality, as measured by the Gini index, has increased over time and that the key driving factor behind this dynamics has not been the declining labor share of income but the strong increase in wage inequality. Going beyond the standard *GDP per capita* measure of material well-being, the third paper studies welfare inequality, measured by the expected discounted sum of future consumption plans, at the global level. The authors show that, starting from the '80s, there is evidence of polarization across world population, with a share of countries "trapped" at medium-low levels of welfare. The analysis also shows that in the future such pattern could persist and the trend of reducing inequality observed over the 1960-2011 period could be stopped and even reversed. The fourth study examines the relationship between inequality and government crises, finding that the latter are likely to rise when inequality increases. The authors also find that expansionary (and increasing expansionary) fiscal stimuli may contribute to reduce political instability. The following paper presents an overview of wealth distribution and asset-based taxation in the EU, provides a range of arguments in favour of asset-based taxation and discusses design and implementation issues. The last study of Session 1 computes the "marginal cost of homeownership" for France, Italy, Spain and UK, showing significant differences across countries and, within countries, across income deciles. As a function of income, such cost is broadly constant in France and it decreases in the other countries.

In the fiscal adjustment process following the sovereign debt crisis most European countries reduced public investments. The first two papers in Session 2 investigate to what extent this cut has been detrimental for growth. The first study presents updated and systematic estimates of public capital stock in advanced economies and, using a recursive VAR analysis, finds no evidence about higher productivity of public capital in recent years; the results does not suggest, therefore, that there is a general lack of public investment. The second paper finds that the effects of higher public investment on growth, investigated on the basis of its effect on private investment, are time- and country-specific. The clearer evidence concerns France, where increases of public investment

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generally trigger increases of private investment. The third study uses a spatial Computable General Equilibrium model to evaluate ex ante the impact on growth in EU countries of four expenditures items (Human capital, R&D, Aid to Private Sector, and Infrastructure) considered by the EU Cohesion policy 2014-20. These expenditure are assumed to affect a set of parameters including factor productivity and transport costs that determine the model outcome.

Session 3 deals with two important policy issues: the fiscal effects of low inflation and the impact on welfare of mandatory pension savings. The first paper analyses the impact of an unanticipated disinflation shock on the primary balance and the debt-to-GDP ratio for a set of selected EU countries (Austria, France, Germany, Greece and Italy). Country specific features are found to play an important role; in general, the effects on the debt ratio tends to be stronger and more persistent, given the denominator effect. The second paper studies the effects of a major reform in Israel: the introduction of mandatory pension contributions. Results suggest that the program forced low-income to save too much, early in their working lives and that, concerning the incidence of the contribution, 5 years after the latter was introduced, wages of its target population were reduced by nearly the full amount of the increase in employers' contributions.

The works included in the last session identify possible reforms of the European fiscal framework in order to make it more transparent and efficient. The first study looks at possible improvements in fiscal indicators, both for the headline deficit – to avoid creative accounting – and for the structural deficit, based on international best practices. Moreover, the paper argues that a more decentralized fiscal framework is desirable, as country-specific circumstances can be taken into account by local fiscal councils. At the central level, only compliance to minimum standards would be monitored, avoiding yearly fine-tuning of fiscal policies. The second paper presents options for simplifying the EU fiscal governance framework while enhancing its overall effectiveness. Options are evaluated on the basis of model-based simulations and of additional considerations. It is argued that moving to a two-pillar approach with a single fiscal anchor the public debt ratio) and a single operational target (an expenditure rule) would be particularly effective in stabilizing output and in meeting the dual objective of providing operational guidance to policymakers and achieving transparency.

The panel discussion, at the end of the conference, examined the EU fiscal rules and possible ways forward. The views set forth by Lucio Pench and Fabrizio Saccomanni were often close. They both recognized the complexity of the current set of rules and agreed on its main cause: the lack of a fully legitimated central authority and insufficient trust among member states. They both stressed that improving the institutional design was a precondition for simplifying rules and indicated the need to introduce an "authoritative referee" in the system. While Pench discussed possible ways of flanking the Commission with a body possessing "strictly operational independence from politics" and a "mandate restricted to fiscal surveillance", Saccomanni examined a bolder institutional change: separating fiscal surveillance from the other activities of the European Commission and creating a specific institution with that task.

Banca d'Italia is grateful to the institutions that contributed to the success of the initiative, to the experts who provided research papers and to all who came to Perugia to take part in the discussion.

This volume extends the analysis of fiscal policy issues carried out in the previous workshops, which were devoted to *Indicators of Structural Budget Balances* (1998), *Fiscal Sustainability* (2000), *Fiscal Rules* (2001), *The Impact of Fiscal Policy* (2002), *Tax Policy* (2003), *Public Debt* (2004), *Public Expenditure* (2005), *Fiscal Indicators* (2006), *Fiscal Policy: Current Issues and Challenges* (2007), *Fiscal Sustainability: Analytical Developments and Emerging Policy Issues* (2008), *Pension Reform, Fiscal Policy and Economic Performance* (2009), *Fiscal Policy: Lessons from the Crisis* (2010), *Rules and Institutions for Sound Fiscal Policy after the Crisis* (2011), *Fiscal Policy and Growth* (2012), *Fiscal Policy and Macroeconomic Imbalances* (2013) and *Public Finances Today: Lessons Learned and Challenges Ahead* (2014).

Session 1

BUDGETARY POLICIES AND INEQUALITY

FISCAL CONSOLIDATION AND INEQUALITY IN ADVANCED ECONOMIES: HOW ROBUST IS THE LINK?

Davide Furceri,[*] João Tovar Jalles[**] and Prakash Loungani[***]

This paper examines the robustness of the link distributional effects of fiscal consolidation. Using a sample of 17 OECD countries over the period 1978-2009, we show that fiscal consolidations increase income inequality and lower wage income shares in the short and medium term. Our results are robust to the use of "traditional" methods of identifying fiscal episodes based on changes in the cyclically-adjusted primary balance (CAPB) as well as the policy-action narrative approach. They are also robust to the use of alternate sources for the data on income inequality.

"[we need a] fiscal policy that focuses not only on efficiency, but also on equity, particularly on fairness in sharing the burden of adjustment, and on protecting the weak and vulnerable."

Christine Lagarde (2012)

1 Introduction

Fiscal policy played a key role in the response to the global financial crisis. At the onset of the crisis, many G20 countries implement comprehensive support packages, mainly based on expenditure hikes, to try to stave off the crisis. Combined with the decline in tax revenues (as incomes fell), the increase in social spending (particularly unemployment benefits) and the costs of financial bailouts of banks and companies, the net result has been a sharp rise in government debt. Public debt rose on average from 70 per cent of GDP in 2007 to slightly over 100 per cent of GDP in 2014 – its highest level in 50 years (IMF, *Fiscal Monitor*, 2014a).

Concerned about the long-term sustainability of public finances, many governments across the world have turned to implementing budgetary consolidation measures. The effects of such fiscal consolidations on output remain a matter of some debate which revolves in part around the measurement of fiscal consolidation. Using the cyclically-adjusted primary balance (CAPB), some work suggests that fiscal consolidation could be expansionary (see, e.g., Alesina and Perotti, 1995; Alesina and Ardagna, 2010, 2012).[1] In contrast, using a narrative approach to measuring consolidation, Guajardo *et al.*, (2014) argue that consolidations are contractionary.

In addition to the aggregate effects of fiscal consolidations, the distributional impacts are also starting to receive attention. Many recent studies suggest that fiscal consolidation episodes are usually associated with increases in income inequality (Roe and Siegel, 2011; Ball, Leigh, Loungani, 2012; Furceri *et al.* 2013; Bova *et al.*, 2013; Agnello and Sousa, forthcoming; Agnello *et al.*, 2014).

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The authors are grateful to Branko Milanovic for comments on related work and for providing his data on Gini coefficients. The opinions expressed herein are those of the authors and do not necessarily reflect those of the IMF, its member states or its policy

1 In neoclassical models, fiscal policy affects economic activity by means of wealth effects, intertemporal substitution and distortions. If consolidation measures remove uncertainty with respect to fiscal sustainability (signaling tax cuts in the future and raising discounted disposable income), hence boosting confidence, then the negative impact on output may be limited or even give rise to an "expansionary fiscal contraction".

In this paper we examine the robustness of the link between fiscal consolidation and inequality. This is important for a couple of reasons. First, as noted above, the aggregate effects of fiscal consolidation appear to depend on how consolidation is measured. Are the distributional effects also sensitive to the measurement of consolidation?

Second, the measurement of inequality is also the subject of some controversy. Many of the studies use the Standardized World Income Inequality Database (SWIID). But there are concerns abut this data set because of the extensive use of interpolation and other assumptions to fill in missing data (Jenkins 2014). In light of this, we examine how robust the consolidation-inequality link is to the use alternate measures of inequality.

A third contribution of the paper is to revisit the issues of whether spending-based and tax-based consolidations have different effects on inequality and whether the consolidation-inequality link is symmetric (*i.e.*, do fiscal *expansions* lower inequality?). Lastly, we carry out a number of technical robustness checks.

The remainder of the paper is organized as follows. Section 2 details the definitions and sources the data while Section 3 presents the econometric methodology. Section 4 analyses the main empirical findings and the last section concludes and discusses some policy considerations.

2 Data

2.1 Inequality and income shares

Many studies use the Standardized World Income Inequality Database (SWIID) because it provides long time-series of Gini coefficients for a large group of countries. But problems with comparability of data across years and countries, and with the imputation methodology used, have long been noted (see Atkinson and Brandolini, 2001) and have recently been reconfirmed in a comprehensive assessment by Jenkins (2014).

In light of such concerns, we test the robustness of the consolidation-inequality link using several measures of distributional outcomes. They comprise: (1) the Gini coefficient for disposable income (both gross and net concepts), taken from SWIID; (2) the shares of wage and profit in GDP, obtained from the OECD Analytical Database; (3) the Gini coefficient for disposable income retrieved from the OECD Stats; and (4) the combined "*all the Ginis*" index compiled by Branko Milanovic (2014) from merging several sources.[2]

2.2 Fiscal consolidation episodes

The literature addressing the identification of fiscal episodes is vast and has, for a long time, relied on changes in the cyclically adjusted primary balance (CAPB). Some caveats surrounding this approach have been highlighted recently. In particular, the CAPB approach could bias empirical estimates towards finding evidence of non-Keynesian effects (see Afonso and Jalles, 2014 for a recent study). Many non-policy factors, such as price fluctuations, influence the CAPB and can lead to erroneous conclusions regarding the presence of fiscal policy changes.[3] In addition, even when the CAPB accurately measures fiscal actions these include discretionary responses to economic developments, such as fiscal tightening to restrain rapid domestic demand growth.

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[2] Publicly available at: http://econ.worldbank.org/WBSITE/EXTERNAL/EXTDEC/EXTRESEARCH/0,,contentMDK:22301380~menuPK:64 214916~pagePK:64214825~piPK:64214943~theSitePK:469382,00.html

[3] For example, a stock price boom raises the CAPB by increasing capital gains tax revenue, and also tends to coincide with an expansion in private domestic demand (Morris and Schuknecht, 2007).

With these considerations in mind, an alternative "narrative approach" is considered, which relies on the identification of fiscal episodes on the basis of concrete policy decisions. The episodes are identified by looking at IMF and OECD historical reports and by checking what countries intended to do at the time of publication.[4] This policy-action based approach makes use of descriptive historical facts that usually describe what happened to the deficit in a particular period but they do not go into the details of policy makers' intentions, discussions and congressional records. Proponents of this approach argue that the estimated size of the fiscal measures during the episodes identified have the advantage of not being affected by the cycle (since their construction is "bottom-up"), can minimize identification problems,[5] and are unlikely to imply risks of reverse causation (Guajardo *et al.*, 2014). That said, the narrative approach could also have some drawbacks: it largely relies on judgment calls, and it may not eliminate entirely endogeneity problems (*i.e.*, fiscal policy reacting to the output performance and not the other way around).

The analysis that follows thus relies on both the narrative and CAPB-based approaches. On the former, the analysis uses the publicly available dataset compiled by Devries *et al.* (2011) based on the policy-action based method for 17 advanced economies between 1978 and 2009.[6] On the latter, the analysis relies on:

i) Alesina and Ardagna (1998), who adopted a fiscal episode definition that allows that some stabilization periods may have only one year. More specifically, they consider the change in the primary cyclically adjusted budget balance that is at least 2 percentage points of GDP in one year or at least 1.5 percentage points on average in the last two years.
ii) Giavazzi and Pagano (1996), who decrease the probability of fiscal adjustment periods with only one year by using a limit of 3 percentage points of GDP for a single year consolidation. They proposed using the cumulative changes in the primary cyclically adjusted budget balance that are at least 5, 4, 3 percentage points of GDP in respectively 4, 3 or 2 years, or 3 percentage points in one year.
iii) Afonso (2010), who defines the occurrence of a fiscal episode when either the change in the primary cyclically adjusted balance is at least one and a half times the standard deviation (from the panel sample of 17 countries) in one year, or when the change in the primary cyclically adjusted balance is at least one standard deviation on average in the last two years.

Table 1 reports the fiscal episodes identified according to the above-mentioned four alternative methods. The number of fiscal contractions ranges from 29, in the approach proposed by Afonso (2010), to 43, using the approach from Alesina and Ardagna (1998). In the Devries *et al.*'s (2011) narrative approach the magnitude of the fiscal consolidation episode ranges between 0.1 per cent and about 5 per cent of GDP, with an average of about 1 per cent of GDP. Moreover, it reports a much higher number of years where fiscal contractions take place (171 years against an average of 70 for the CAPB approaches). For fiscal consolidations, the average duration of the reported fiscal episodes is, on average, 1.7 years for the CAPB approaches and around 3.8 years for the narrative approach. Moreover, the three CAPB-based methods essentially coincide in about 50 per cent of total number of years with those of the narrative approach.

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[4] Note, however, that this approach differs from the one used in Romer and Romer (2010), who identify exogenous tax policy changes by carefully analyzing US congressional documents.

[5] However, as Jorda and Taylor (2013) argue, fiscal shocks may not be exogenous and can be predicted.

[6] The countries are: Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Ireland, Italy, Japan, Netherlands, Portugal, Spain, Sweden, the United Kingdom and the United States.

Table 1

Fiscal Episodes Based on the Change in the Primary Cyclically-adjusted Budget Balance and on the Narrative Approach

Country	Devries *et al.* (2011)	Giavazzi and Pagano (1996)		Alesina and Ardagna (1998)		Afonso (2010)	
	Contractions	Expansions	Contractions	Expansions	Contractions	Expansions	Contractions
Australia	1985-88, 1994-99	2009	1987-88	1975, 2009	1987-88	2009	1987-88
Austria	1980-81, 1984, 1996-97, 2001-02,	1976, 2004	1997	1976, 2004	1984, 1997, 2001, 2005	2004	1984, 1997, 2001, 2005
Belgium	1982-87, 1990-97	1981, 2005, 2009	1982-87	1981, 2005, 2009	1982-85, 1993, 2006	1981, 2005, 2009	1982-85
Canada	1984-97	1975, 1977-78, 2002, 2009	1987, 1996-98	1977, 2001-02, 2009	1981, 1986-87, 1996-97	1975, 2009	1987, 1996-97
Denmark	1983-86, 1995	1975-76, 1982, 1991, 2010	1983-87	1975-76, 1982, 1990-91, 1994, 2009-10	1983-86	1975-76, 1982, 1991, 2010	1983-86
Finland	1992-97	1979-80, 1991-93, 2010	1976-77, 1997-98, 2000-1	1978-79, 1987, 1991-92, 2009-10	1976-77, 1981, 1984, 1988, 1996-97, 2000-01	1978-79, 1987, 1991-92, 2010	1976-77, 1996-97, 2000-01
France	1987-92, 1995-2000	2009-10		2009-10		2009-10	
Germany	1982-84, 1991-2000, 2003-07	1975, 1991, 2001-03		1975, 1990-91, 2001-02		1975, 1990-91, 2001-02	
Ireland	1982-88, 2009	1975, 1979, 2001-03, 2007-10	1976-77, 1983-86, 1988-9, 2010	1974-75, 1978-79, 1995, 2001-02, 2007-09	1976-77, 1983-84, 1988, 2010	1974-75, 1978-79, 2001-02, 2007-09	1976-77, 1983-84, 1988, 2010

Table 1 (continued)

Fiscal Episodes Based on the Change in the Primary Cyclically-adjusted Budget Balance and on the Narrative Approach

Italy	1991-98, 2004-07	2001	1977, 1982-83, 1992-94	1981, 2001	1977, 1982-83, 1992-93	1981, 2001	1977, 1982-83, 1992-93
Japan	1980-83, 1997-98, 2003-07	1993-95, 1998 2009-10	1998-2000, 2005-07	1975, 1994-95, 1998, 2009-10	1998-99, 2005-06	1993-94, 1998, 2009-10	1999-00, 2006-07
Netherlands	1981-88, 1991-93, 2004-05	2002, 2010	1991, 1993	2001-02, 2009-10	1991, 1993	2002, 2009-10	1991
Portugal	1983, 2000-07	1978-80, 2005, 2009-10	1977, 1983-84, 1986	1978-79, 1985, 1990, 1993, 2005, 2009-10	1977, 1983-84, 1986, 1988, 1992, 1995, 2006	1978-79, 1993, 2005, 2009-10	1977, 1983-84, 1986, 1988, 1992
Spain	1983-84, 1989-97	2008-10	1987	2008-09	1986, 1987, 2010	2008-09	1987
Sweden	1984, 1993-98	1974, 1979-80, 1991-94, 2002-03	1984, 1987, 1996-99	1974, 1979, 1991-93, 2002-03, 2010	1976, 1983-84, 1987, 1996-97	1974, 1979, 1991-93, 2002	1984, 1987, 1996-97
United Kingdom	1980-82, 1994-99	1972-75, 1992-94, 2001-04, 2009-10	1981-82, 1997-2000	1972-73, 1990, 1992-93, 2001-02, 2009-2010	1981, 1997-98, 2000	1972-73, 1992-93, 2001-03, 2009-10	1981, 1997-98
United States	1980-81, 1985-8	2001-02, 2007-10		2001-02, 2007-08		1974, 2001-02, 2007-08	
Years with episodes	171	95	73	95	79	78	59
Average duration (years)	3.8	2.0	2.1	1.6	1.5	1.6	1.6

Notes: all measures computed by the authors, except the Devries *et al.* (2011) one. See main text for definitions.

3 Methodology

To estimate the distributional impact of fiscal consolidation episodes over the short and medium run, we follow the method proposed by Jorda (2005) which consists of estimating impulse response functions directly from local projections. For each period k the following equation is estimated on annual data:

$$G_{i,t+k} - G_{i,t} = \alpha_i^k + Time_t^k + \sum_{j=1}^{l} \gamma_j^k \Delta G_{i,t-j} + \beta_k D_{i,t} + \varepsilon_{i,t}^k \tag{1}$$

with $k=1,...,8$ and where G represents one of our measures of distributional outcomes; $D_{i,t.}$ is a dummy variable that takes the value equal to 1 for the starting date of a consolidation episode incountry i at time t and is 0 otherwise; α_i^k are country-fixed effects; $Time_t^k$ is a time trend; and β_k measures the distributional impact of fiscal consolidation episodes for each future period k. Since fixed effects are included in the regression the dynamic impact of consolidation episodes should be interpreted as compared to a baseline country-specific trend. In the main results, the lag length (l) is set at 2, even if the results are extremely robust to different numbers of lags included in the specification (see robustness checks and sensitivity presented in the next section). Equation (1) is estimated using the panel-corrected standard error (PCSE) estimator (Beck and Katz, 1995).

Impulse response functions are obtained by plotting the estimated β_k for k= 1,…,8, with confidence bands computed using the standard deviations of the estimated coefficients β_k. While the presence of a lagged dependent variable and country fixed effects may in principle bias the estimation of γ_j^k and β_k in small samples (Nickell, 1981), the length of the time dimension mitigates this concern.[7] Reverse causality is addressed by estimating the distributional effect in the years that follow a fiscal consolidation episode. In addition, robustness checks for endogeneity confirm the validity of the results.

An alternative way of estimating the dynamic impact of fiscal consolidation episodes is to estimate an ARDL equation of changes in inequality and consolidation episodes and to compute the IRFs from the estimated coefficients (Romer and Romer, 1989; and Cerra and Saxena, 2008). However, the IRFs derived using this approach tend to be sensitive to the choice of the number of lags this making the IRFs potentially unstable. In addition, the significance of long-lasting effects with ARDL models can be simply driven by the use of one-type-of-shock models (Cai and Den Haan, 2009). This is particularly true when the dependent variable is highly persistent, as in our analysis. In contrast, the approach used here does not suffer from these problems because the coefficients associated with the lags of the change in the dependent variable enter only as control variables and are not used to derive the IRFs, and since the structure of the equation does not impose permanent effects. Finally, confidence bands associated with the estimated IRFs are easily computed using the standard deviations of the estimated coefficients and Monte Carlo simulations are not required.

4 Empirical results

4.1 Gini coefficient for disposable income

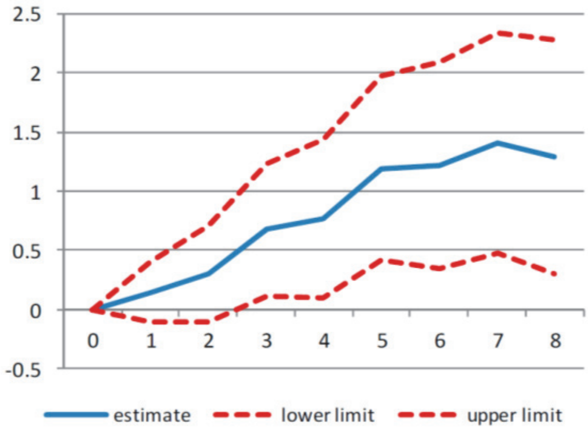
The impacts of fiscal consolidation (using Devries *et al.* (2011) narrative approach to identifying episodes) on the four alternative definitions of the Gini index are shown in Figure 1. Each figure shows the estimated impulse response function and the associated one standard error bands (dotted lines). The horizontal axis measures years after the start of the episode of fiscal consolidation.

[7] The finite sample bias is in order of $1/T$, where T in our sample is 32.

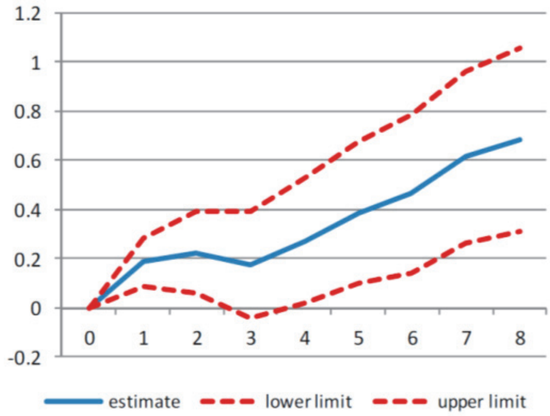
Figure 1

Impact of Fiscal Consolidation on Inequality-comparing Different Gini Indices

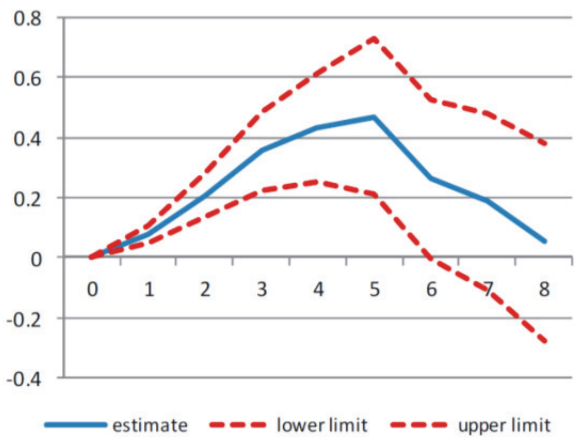
a).SWIID Gross Gini Index (Interpolated)



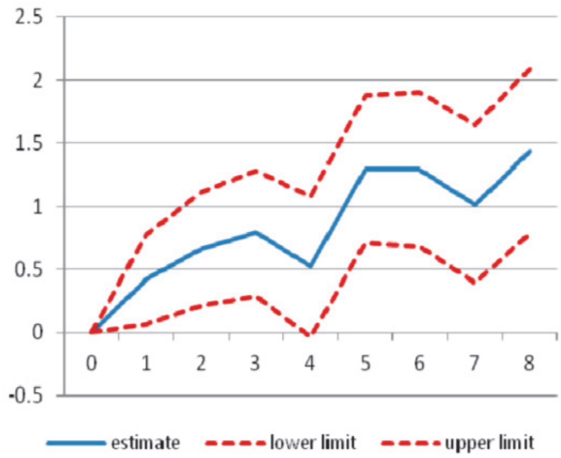
b).SWIID Net Gini Index (Interpolated)



c) OECD Gini Index (Interpolated)



d).Milanovic's *All Ginis* Index (Interpolated)



Note: Dotted lines equal one standard error confidence bands. See main text for more details.

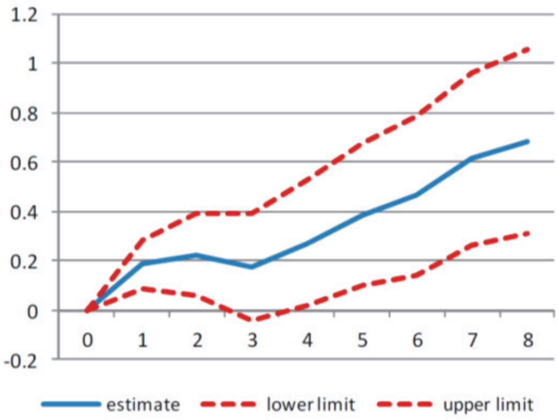
In general, fiscal consolidation is followed by a persistent rise in income inequality. The Gini index increases by an average (across different proxies) of about 0.2 per cent in the short term (one year after the occurrence of the consolidation episode) and by nearly 0.9 per cent in the medium term (eight years after the occurrence of the consolidation episode). This is consistent with Agnello and Sousa (forthcoming) who find that fiscal consolidations lead to a short-term increase in the Gini of about 0.3 per cent.

The results of several additional robustness checks are shown in Figure 2. These results are shown for one particular measure of inequality, the SWIID net Gini index but similar findings hold for the other measures as well. First, equation (1) is re-estimated by including time fixed effects to control for specific time shocks, such as those affecting world interest rates. The results for this specification remain statistically significant and broadly unchanged (Figure 2 panel (b)).

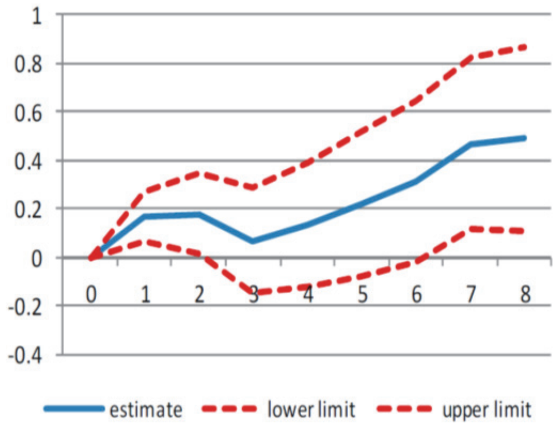
Figure 2

Sensitivity and Robustness: Different Set of Regressors Using SWIID Net Gini Index (Interpolated)

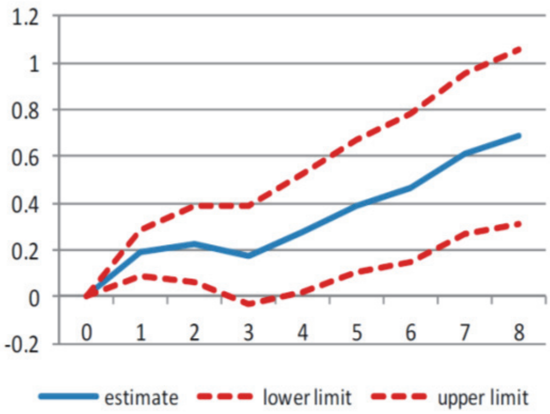
a) Baseline



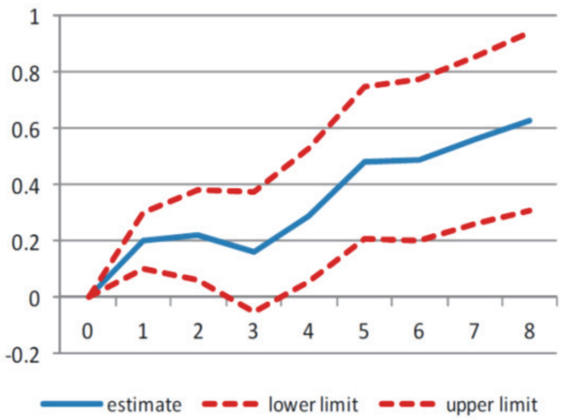
b) Time FE



c) Without Country FE



d) Additional Controls



Note: Dotted lines equal one standard error confidence bands. See main text for more details.

As shown by Tuelings and Zubanov (2010), a possible bias from estimating Equation (1) using country-fixed effects is that the error term of the equation may have a non-zero expected value, due to the interaction of fixed effects and country-specific arrival rates of consolidation episodes. This would lead to a bias in the estimates that is a function of *k*. To address this issue and check the robustness of our findings, Equation (1) was re-estimated by excluding country fixed effects from the analysis. The results reported in Figure 2 panel (c) suggest that this bias is negligible (the difference in the point estimate is small and not statistically significant).

Estimates of the impact of consolidation on inequality could be biased because of endogeneity, as unobserved factors influencing the dynamics of the Gini coefficient may also affect the probability of the occurrence of a consolidation episode. In particular, a significant deterioriation in economic activity, which would affect unemployment and inequality, may determine an increase in the public debt ratio via automatic stabilizers, and therefore increase the

Table 2

Panel Estimations of different Gini indices

Specification	SWIID Gini Index, Gross	SWIID Gini Index, Net	OECD Gini Index	Milanovic's *All Ginis* Index
Baseline	1.332** (0.646)	0.585** (0.297)	0.595*** (0.185)	1.491*** (0.418)
Robustness				
Time FE	0.672	0.241	0.598***	1.822***
	(0.631)	*(0.293)*	*(0.195)*	*(0.544)*
Without country FE	1.392**	0.564*	0.453*	1.478***
	(0.640)	*(0.301)*	*(0.263)*	*(0.459)*
Additional controls	0.915	0.487	0.685***	1.729***
	(0.699)	*(0.313)*	*(0.219)*	*(0.476)*

Note: The dependent variable is the 5^{th} year forward difference of the corresponding inequality proxy as identified in the first row. The coefficients presented in the table denote the estimates of the consolidation episode (narrative approach). Each entry corresponds to an independent regression where non-relevant regressors (including a constant term) are omitted for reasons of parsimony. Robust standard errors are in parenthesis. *, **, *** denote statistical significance at the 10, 5 and 1% levels, respectively.

probability of consolidation. To address this issue, Equation (1) was augmented to control for: i) contemporaneous and past crises episodes (banking, debt and currency crises); ii) change in economic activity (proxied by real GDP growth); iii) change in total unemployment rate. The results of this exercise are reported in Figure 2 panel (d) and confirm the robustness of the previous findings.

As an additional sensitivity check, Equation (1) was re-estimated for different lags (l) of changes in the Gini coefficient. The results confirm that previous findings are not sensitive to the choice of the number of lags (results are not shown for reasons of parsimony but are available upon request).

Finally, as noted earlier, another concern is that the different Gini alternatives use interpolations where there are gaps in the inequality data. While this adds to the number of observations, it also adds some concerns about data quality. We have therefore used raw data and estimated panel regressions with the fifth forward difference of the relevant Gini index as the dependent variable. We find that the results are very robust (Table 2). Moreover, these results are also robust to a number of more technical checks as shown in the table, including: the inclusion of time fixed effects; the exclusion of country fixed effects; and inclusion of a different set of control variables in the estimated regressions.

4.2 The role of the composition of consolidation packages: spending vs. tax-based

Does the composition of fiscal consolidation (spending versus taxes-based) matter for inequality? There is a broad consensus in the literature that taxes-based consolidations are typically more contractionary than spending-based ones, particularly over the medium term (Alesina and Ardagna, 2010; IMF, 2010a). In normal times, spending cuts tend to be more successful in enhancing economic growth than tax increases (Alesina and Perotti, 1995; Alesina and Ardagna, 2012) because the former are generally perceived as more credible by economic agents (Hernández de Cos and Moral-Benito, 2012).[8] At the same time, however, most of the direct redistributive impact of fiscal policy in advanced economies has been achieved through the expenditure side of the budget – especially non-means-tested transfers (Bastagli *et al.*, 2012). Therefore, whether taxes-based or spending-based consolidations are more harmful for income inequality is not a priori clear.

In order to test this hypothesis, Equation (1) is separately estimated for taxes and spending-based adjustments, by constructing starting dummies of taxes and spending consolidation episodes (in the Devries *et al.* (2011) dataset the average magnitude of both spending and taxes-based consolidation is about 1 per cent of GDP). The results presented in Figure 2, panel A for a selected measure of income inequality, namely the SWIID net Gini index (though results are consistent across alternative proxies), show that spending and tax-based programs have similar effect over the short and medium term. This result however has to be treated with caution given that most of past fiscal adjustments have involved both spending cuts and tax increases. In order to address this issue, following Guajardo *et al.* (2014), Equation (1) is separately estimated for: i) episodes where taxes-based adjustments have been larger than spending adjustments; ii) episodes where spending adjustments have been larger than tax based adjustments. These correspond to the "alternative definition" of tax and spending-based consolidations. The results obtained with this exercise suggest that spending-based consolidations tend to have larger effects – Figure 3, panel B. In particular, the short (medium)-term effect of fiscal consolidations on income inequality is about 0.24 (1.05) per cent after one (eight) year(s) for spending-based consolidations and 0.09 (0.13) per cent respectively for tax-based ones.[9]

4.3 Wage versus profit and rent income

Another way to assess the distribution effects of fiscal consolidation measures is to look at the effect of fiscal consolidations on different types of income. A traditional way of splitting total income is into wages, profits and rents. This harks back to times when the roles of workers, capitalists and landlords were fairly distinct. While these distinctions have eroded somewhat over time, the split between wages and other forms of income represents a starting point for describing how income is divided between the *Main Street* and *Wall Street*. To assess the effects of fiscal consolidations on the distribution of income between wage earners and others, Equation (1) is estimated for the share of wage income in GDP and the share of profits in GDP.

The results of this empirical exercise are reported in Figure 4.a and 4.b respectively for wage and profits. They suggest that fiscal consolidation measures typically reduce the slice of the pie going to wage earners and increase the slice of the pie going to profit recipients. These findings are consistent with the results resulted in panels B of these two figures which suggest that fiscal consolidations have a larger negative effect on the level of (inflation-adjusted) wage income than on the level of (inflation-adjusted) profit and rent incomes. Moreover, as before, spending-based adjustments seem to be the most detrimental, at least as far as wage incomes are concerned. In the case of profits such distinction does not matter much as evidenced by confidence bands above and below the horizontal axis.

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8 The majority of the empirical literature also supports the view that expenditure-driven consolidations increase the likelihood of success of the episode of adjustment (see, e.g., Giavazzi and Pagano, 1996; McDermott and Wescot, 1996; Alesina and Ardagna, 1998; and Giavazzi *et al.*, 2000). There is also evidence that consolidations and particularly reductions in public expenditure can contribute to reducing sovereign debt spreads, and therefore the cost of servicing sovereign debt (Akitoby and Stratmann, 2006).

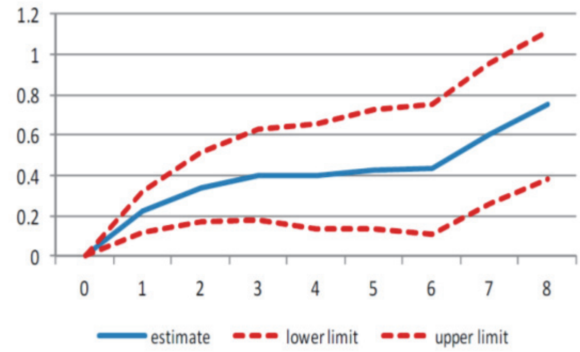
9 It must be recognized that also this approach is imperfect. Indeed, to properly differentiate between spending versus tax-based consolidations one should consider episodes characterized by only spending or taxes-based adjustments. This however would dramatically reduce the number of "pure" spending and taxes-based consolidations in our sample.

Figure 3

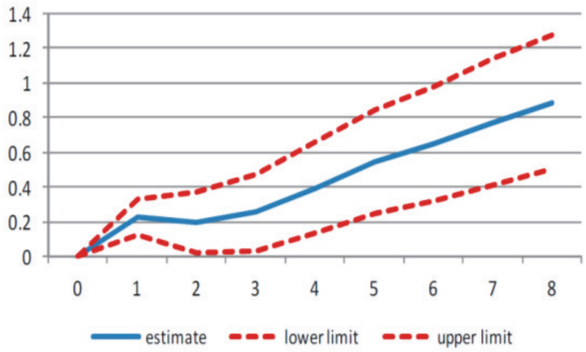
Composition of Fiscal Adjustments Using SWIID Net Gini Index (Interpolated): Tax vs. Spending Based

Panel A

Standard Definition, Spending Based

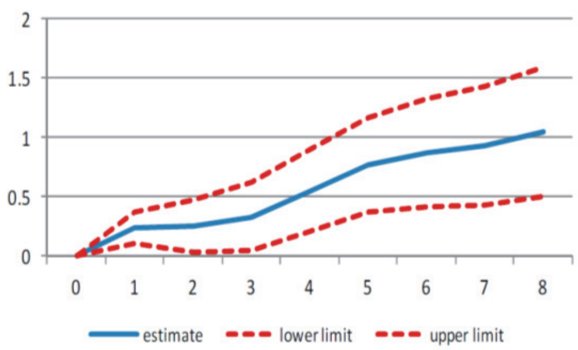


Standard Definition, Tax Based

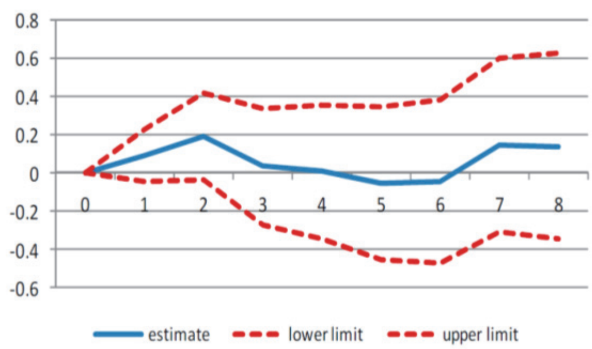


Panel B

Alternative Definition, Spending Based



Alternative Definition, Tax Based



Note: Dotted lines equal one standard error confidence bands. See main text for more details.
The standard definition denotes starting date dummies of taxes and spending consolidation episodes. Because most of past fiscal adjustments have involved both spending and taxes-based measures, we follow Guajardo *et al.* (2011) and redefine the dummies as follows: i) episodes where taxes-based adjustments have been larger than spending adjustments; ii) episodes where spending adjustments have been larger than taxes-based adjustments. This corresponds to the alternative definition.

4.4 Narrative approach vs. CAPB-based methods to identifying fiscal episodes

So far we have based our results on the use of the Devries *et al.* (2011) narrative approach dataset. What if we use the "traditional" method of identifying fiscal episodes using changes in the CAPB. Taking the three alternative approaches detailed in Section 2 and estimating Equation (1) for the SWIID net Gini index (though results are consistent across alternative proxies) gives the IRFs displayed in Figure 5. In general, we still find that fiscal consolidations lead to an increase in income inequality irrespectively of the approach under scrutiny.

Picking one approach, say Afonso's (2010), one can observe in Figure 6 that our previous results are invariant to the choice of the dependent variable, *i.e.*, the source of the Gini index employed.[10]

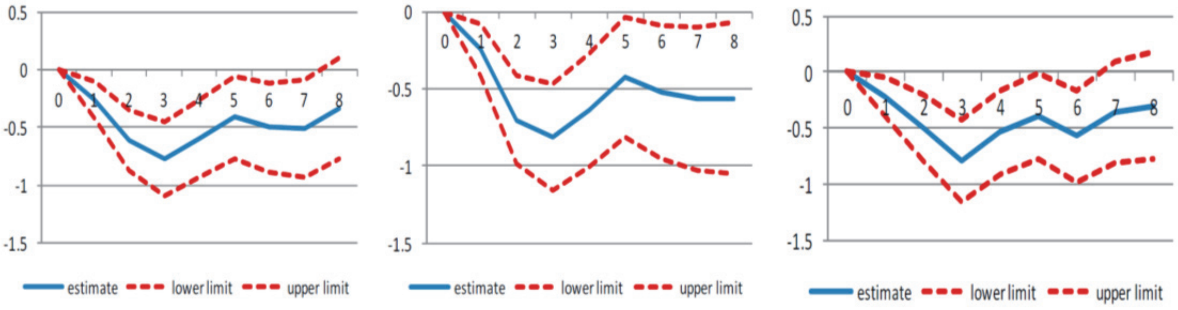
[10] Using either Giavazzi and Pagano (1996) or Alesina and Ardagna (1998) instead does not qualitatively change our results.

Figure 4.a

The Impact of Fiscal Consolidations on Wage Income

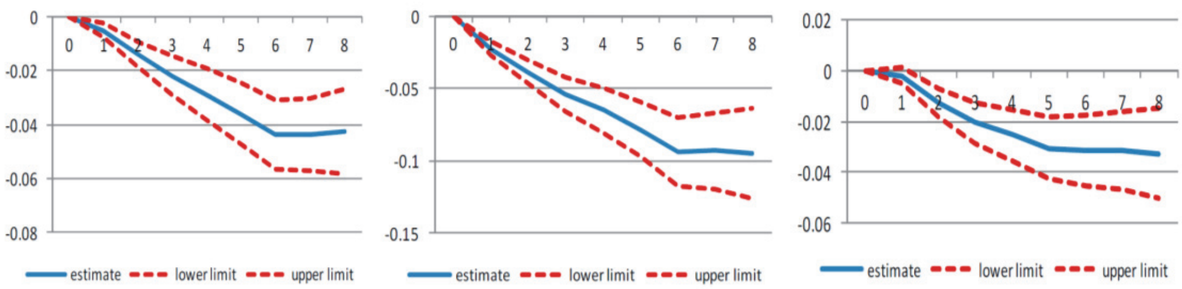
Panel A, Income
(percent of GDP)

Baseline, All Episodes **Spending Based** **Tax Based**



Panel B, Income
(percent change)

Baseline, All Episodes **Spending Based** **Tax Based**



Note: Dotted lines equal one standard error confidence bands. See main text for more details.

4.5 What about fiscal expansions?

A final aspect is the following: to what extent is there symmetry in our results when one considers a fiscal expansion instead of a fiscal consolidation? In this case, only the CAPB-based methods can provide us with a tentative answer. Re-estimating Equation (1) and constructing a figure analogous to Figure 5 where now our $D_{i,t.}$ denotes the starting year of a fiscal expansion episode, yields the IRFs displayed in Figure 7. Results seem to suggest that the fiscal expansions lower inequality, but the impact is generally short-lived, dissipating after 2-3 years. This finding holds when using the SWIID net Gini index as well as the Milanovic's *all Ginis* index, but not in the case of the SWIID gross Gini index or the OECD Gini index – see Figure 8.

5 Concluding remarks and policy considerations

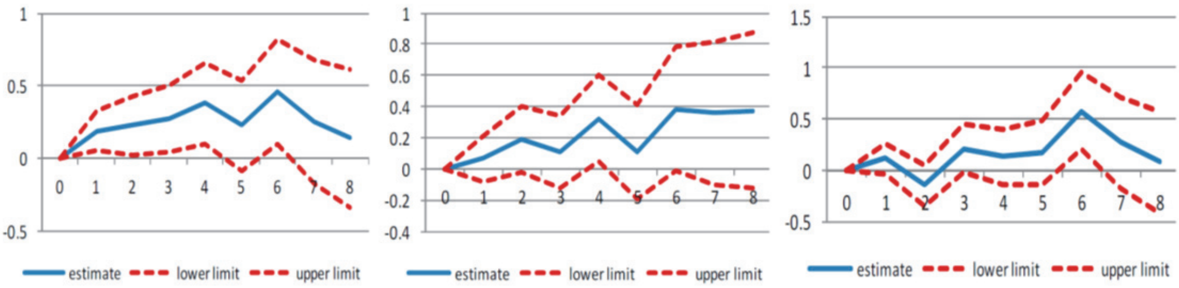
We find, for a sample of 17 OECD countries over the period 1978-2009, that fiscal consolidations tend to lead to an increase in income inequality in the short and medium term.

Figure 4.b

The Impact of Fiscal Consolidations on Profit Income

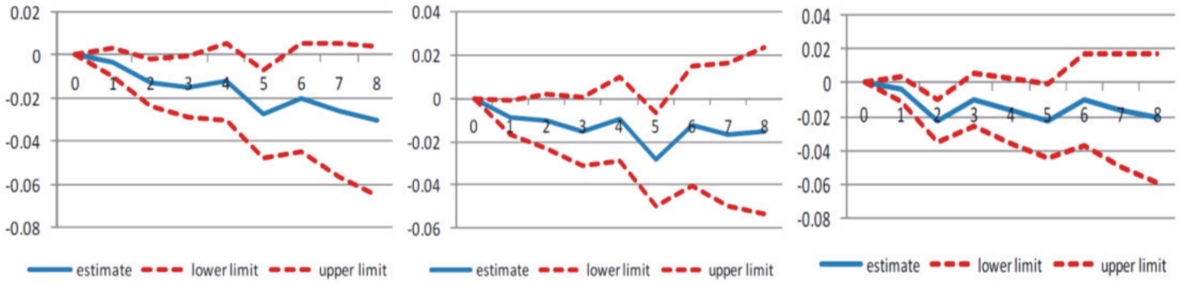
Panel A, Profit
(percent of GDP)

Baseline, All Episodes | **Spending Based** | **Tax Based**



Panel B, Profit
(percent change)

Baseline, All Episodes | **Spending Based** | **Tax Based**



Note: Dotted lines equal one standard error confidence bands. See main text for more details.

Typical fiscal consolidations lead to an increase in income inequality in the order of 0.2-1 per cent over the short and medium term. This main finding of our paper is robust to the use of alternate measures of consolidation (in particular the 'traditional' methods of identifying fiscal episodes based on changes in the cyclically-adjusted primary balance, CAPB) and to the use of alternate measures and sources of inequality data. The main finding is also robust to a vast array of technical checks such as inclusion of time fixed effects, the exclusion of country fixed effects, and inclusion of different sets of control variables. We also find that more work is needed to sort out the differences between tax-based and spending-based fiscal adjustments and on whether the consolidation-inequality link is symmetric.

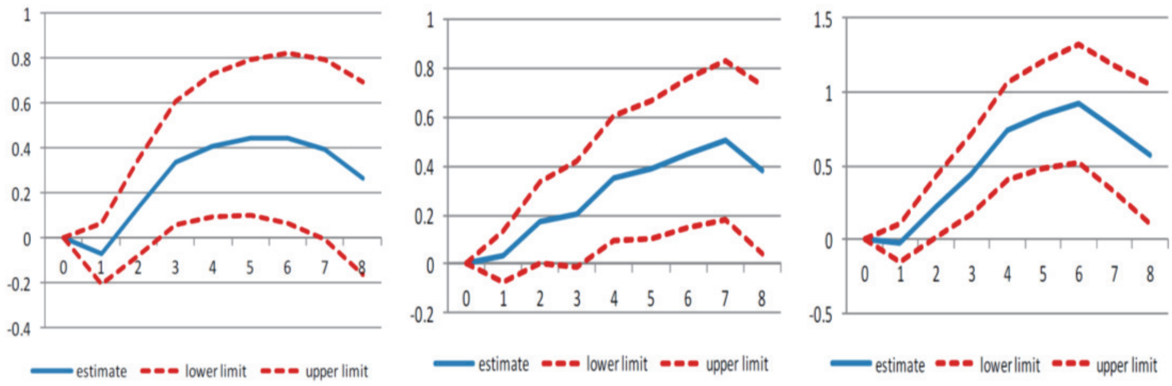
Our findings do not imply that countries should not undertake fiscal consolidation. The results do suggest however that the benefits of fiscal adjustments should be weighed against their likely distributional impact. Many governments assign some weight to distributional outcomes and, as discussed in other chapters of the book, may have the flexibility to design the consolidation in a way that mitigates at least some of the distributional impacts. History shows that fiscal plans succeed when they permit "some flexibility while credibly preserving the medium term consolidation objectives" (IMF, 2010b; Mauro, 2011).[11] In general, the distributional effects of

[11] For instance, plans could specify that unemployment benefits would be shielded from cuts in the event of slower growth than assumed in the plan.

Figure 5

CAPB-based Identification of Fiscal Adjustments
Comparing 3 methods, SWIID Net Gini Index (Interpolated) (Baseline)

Giavazzi and Pagano (1996) Alesina and Ardagna (1998) Afonso (2010)

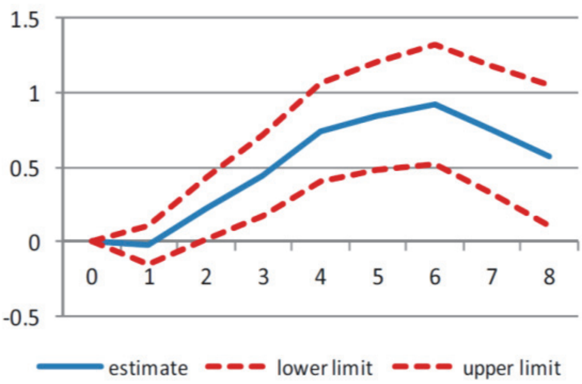


Note: Dotted lines equal one standard error confidence bands. See main text for more details.

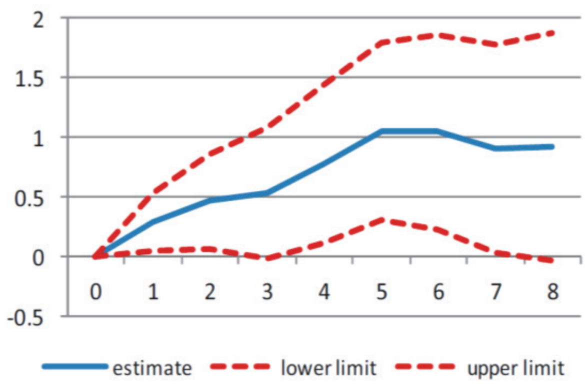
Figure 6

Afonso (2010) Method on Different Inequality Proxies

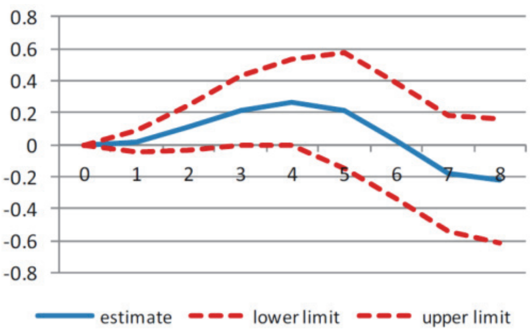
SWIID Net Gini Index (Interpolated) (Baseline)



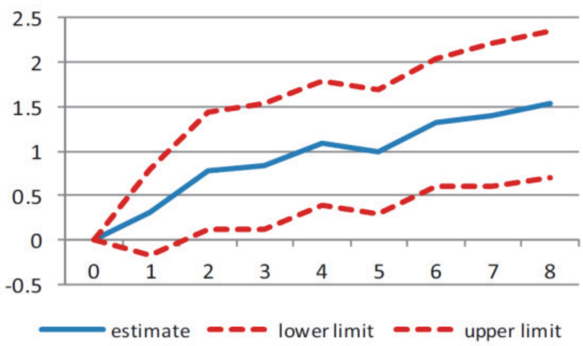
SWIID Gross Gini Index (Interpolated)



OECD Gini Index (Interpolated) (Baseline)



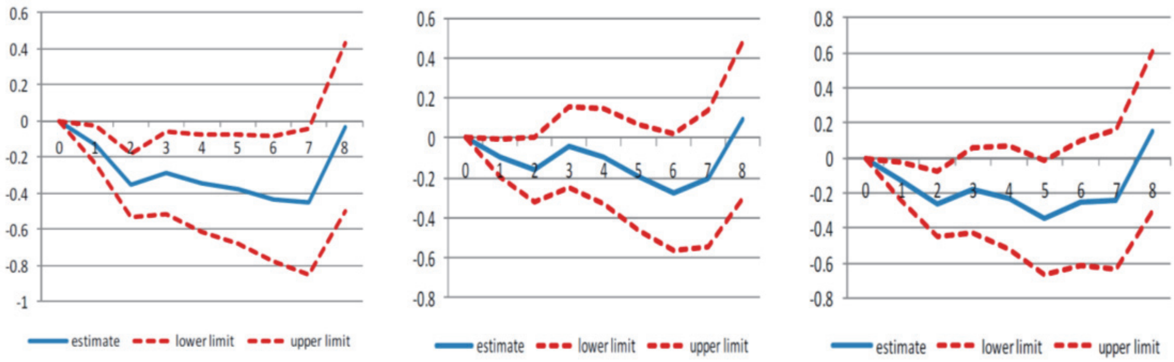
Milanovic's *All the Ginis* Index (Interpolated)



Note: Dotted lines equal one standard error confidence bands. See main text for more details.

Figure 7

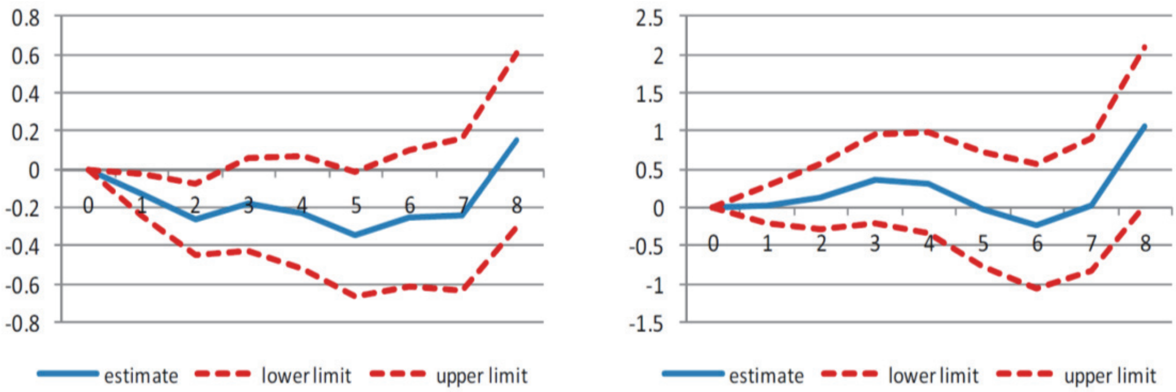
CAPB-based Identification of Fiscal Expansions
Comparing 3 Methods, SWIID Net Gini Index (Interpolated) (Baseline)
Giavazzi and Pagano (1996) Alesina and Ardagna (1998) Afonso (2010)



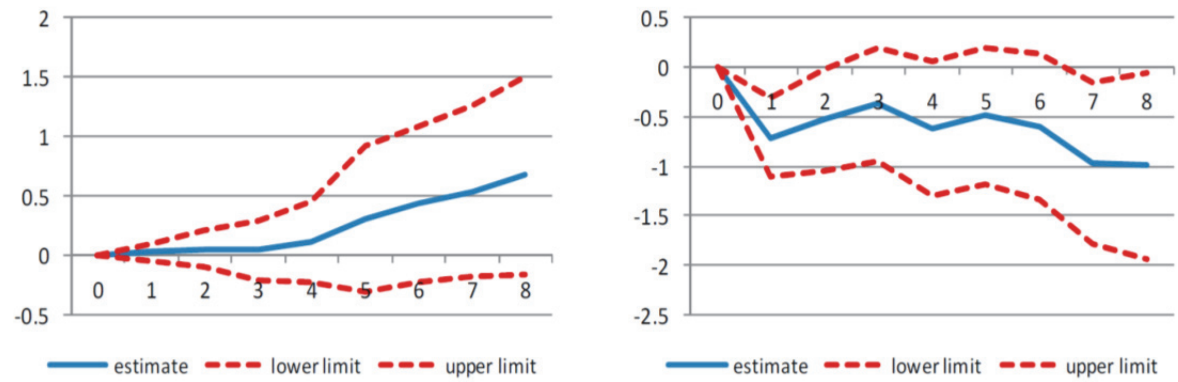
Note: Dotted lines equal one standard error confidence bands. See main text for more details.

Figure 8

Fiscal Expansions: Afonso (2010) Method on Different Inequality Proxies
SWIID Net Gini Index (Interpolated) (Baseline) SWIID Gross Gini Index (Interpolated)



OECD Gini Index (Interpolated) (Baseline) Milanovic's *All the Ginis* Index (Interpolated)



Note: Dotted lines equal one standard error confidence bands. See main text for more details.

consolidation must be balanced against the potential longer term benefits that consolidation can confer benefits as interest rates decline and the lighter burden of interest payments permits cuts in distortionary taxes.

As noted in IMF (2013), the results on the impact of consolidation on equity "strengthens the case for better targeting of both spending and revenue measures." Specifically, the paper notes that "equity considerations suggest that a larger share of the adjustment burden could be borne by the rich, which could be achieved through revenue measures targeted at the higher income segments of the population. Revenue increases can therefore be an important component of consolidation packages, even in countries where the adjustment should focus on the expenditure side, as in a number of European countries. However, better targeted spending can also help achieve equity objectives, though there may be a trade-off between growth and equity concerns when choosing consolidation measures."

Overall, our results bolster the IMF's general fiscal policy advice to advanced economies. At the onset of the Great Recession, the IMF played a key role in making the case for – and helping coordinate through the auspices of the G20 – a coordinated global fiscal stimulus (Spilimbergo *et al.*, 2008). Since many governments entered the crisis with high debt-to-GDP ratios, attention turned to consolidation once financial conditions started to stabilize. But cognizant of the adverse impact of fiscal consolidation on growth (IMF, 2010b), the policy stance has been to support "a case-by- case assessment of what is an appropriate pace of consolidation" and to emphasize the need "to make fiscal policy more growth-friendly" (Lipton, 2013). The results here bolster that policy stance by suggesting that not only does consolidation lower aggregate incomes in the economy, but it adds to the pain of those who are likely to be already suffering the most – the people in lower income deciles.

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COMMENT TO
"FISCAL CONSOLIDATION AND INEQUALITY IN ADVANCED ECONOMIES: HOW ROBUST IS THE LINK?" BY DAVIDE FURCERI, JOÃO TOVAR JALLES AND PRAKASH LOUNGANI

Jan Babecký[*]

The paper deals with a topical issue of distributional effects of fiscal consolidation. The objective of the paper is to test a nexus between fiscal consolidation and inequality in a group of 17 OECD economies during the period 1978-2009 employing two alternative measures of consolidation such as the Cyclically Adjusted Primary Balance (CAPB) and the narrative approach, several alternative measures of inequality, and distinguishing between expenditure-based and tax-based consolidations.

The main contributions of the paper are the following:

A robust result emerges: fiscal consolidations increase income inequality in the short and medium term. This link holds with respect to the alternative measures of fiscal consolidations – CAPB and the narrative approach by Devries *et al.* (2011) – as well as for the alternative inequality indicators such as the Gini coefficient for disposable income (taken from the alternative sources: the Standardized World Income Inequality Database, SWIID, and from the OECD database), the share of wage and profit in GDP (OECD) and the combined "all the Ginis" indicator (Milanovic, 2014).

Concerning tax- versus expenditure-based consolidations, some evidence is found for stronger effects of expenditure -based consolidations.

Regarding the link between fiscal expansion and consolidation (CAPB), fiscal expansion is found to lower inequality in the short run, although this is valid for two measures only (the Gini coefficient from the SWIID and "all Ginis" by Milanovic, 2014).

Overall, fiscal consolidations are found to be associated with raising income inequality (by about 0.2-1.0 per cent in the short- and medium-term).

My comments and suggestions are mainly aimed at making the paper more accessible to a general reader, who is not an expert on the topic studied.

A first suggestion would be to comment on a link between inequality and wealth (or on the underlying assumption) and elaborate on motivation, which is mainly explained in the concluding section.

A second suggestion would be to add a literature review section. In particular, it would be useful to discuss the existing methodological approaches on assessing a link between fiscal consolidation and inequality and explain why the method by Jorda (2005) is chosen in this paper. What are its pros and cons? What are other popular methodological approaches (e.g., those used in the cited studies)? Why the approach by Jorda (2005) is particularly useful?

Third, the authors might wish to discuss their choice of countries and mention the specific features of the OECD-17 group. It would be useful to provide some stylized facts, for example, correlation between wealth (income per capita) and inequality (the Gini coefficient) in the sample countries. Is there any link? To facilitate the interpretation of the results for a general reader, the authors could also comment on how big is a "0.2-1.0 per cent increase in Gini"? Is it perceivable in practical terms? It would be useful to provide some benchmark.

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Fourth, more details on the data and estimations could be provided. In particular, what are the time series properties of the data used in equation (1)? The assumption of a linear time trend is used. How is it valid during the crisis period? What is the degree of persistence of the dependent variable? ("the dependent variable is highly persistent"). It would be useful to provide numbers.

Relatedly, the authors could perform poolability tests, to assess whether 17 countries represent a homogenous group, and provide diagnostic tests for regressions. To ensure that the results of the study are not driven by country-specific outliers, it would be helpful to plot the estimation residuals.

Fifth, on the conceptual side, it could be discussed how to separate the effects of shocks and fiscal consolidations, in particular in small open economies. Some of these shocks (e.g. shocks to expenditures/taxes) are not are not always exogenous, but might represent a result of another factors (external shocks), eventually also a changing legislation. One practical way to address this issue would be to perform robustness check sto the sample composition (e.g. group countries by income and by the degree of openness) and time period (e.g., check how sensitive the results are to the inclusion of the recent crisis – the sample ends in 2009).

Finally, a reader might wonder if there is an answer to the call stated in the epigraph: "[we need] a fiscal policy that focuses not only on efficiency but also on equity, particular on fairness".

Are there examples of such fiscal policy, e.g. in some of the countries covered by the study?

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FUNCTIONAL INCOME DISTRIBUTION AND ITS ROLE IN EXPLAINING INEQUALITY

Maura Francese[*] *and Carlos Mulas-Granados*[*]

This paper is motivated by two parallel trends at the center of the policy debate – the declining labor share of income and increasing income inequality. We use samples drawn from both household surveys and macroeconomic data, covering up to 93 advanced, emerging and developing countries between 1970 and 2013, and assess whether the declining labor share of income has been a key factor driving growing inequality. The major conclusion is that the most important determinant of income inequality is not the share of the labor income, but inequality in wages, which has increased notably in the recent past. Behind the increase in the dispersion of wages, we find that financial globalization has played an important role. Industry unionization, higher educational attainment and larger welfare states help reduce wage dispersion.

1 Introduction

In the years preceding the crisis, analysts and policy makers have wondered about diverging trends between aggregate measures of economic performance (such as economic growth) and stagnating wages and household incomes. This also revived public interest in the issue of whether capital was receiving too high a share of the economic pie.[1] In 2006 Ben Bernanke, the Chairman of the Federal Reserve, expressed the hope that "corporations would use some of those profit margins to meet demands from workers for higher wages" and in 2007, Germany's finance minister asked European companies to "give a fairer share of their soaring profits."[2] Interest in these contrasting trends has deepened since the onset of the financial crisis. It has been driven in part by the rescue of financial institutions by many governments juxtaposed with rising unemployment and inequality.[3]

A brief examination of the time series of income inequality (measured by the Gini index) and the labor share of income[4] in Group of Seven countries shows that the wage share has indeed been declining since the 1970s while inequality has been on the rise (Figure 1). On average, the wage share declined by 12 percent while income inequality increased by 25 percent in some advanced economies in barely three decades.

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The authors wish to thank Andrea Brandolini, Benedict Clements, and Sanjeev Gupta for their helpful comments and suggestions. They are also grateful to participants at the Fiscal Affairs Department seminar and at the 17th Banca d'Italia Workshop on Public Finance (Perugia, April 9-11, 2015) for their valuable feedback and to IMF colleagues for their comments. Ryan Espiritu and Louis Sears provided excellent research assistance. The views expressed in this paper are those of the author(s) and do not necessarily represent the views of the IMF, its Executive Board, or IMF management.

A version of this paper will be published as Chapter 6 in *Inequality and Fiscal Policy*, edited by Benedict Clements, Ruud de Mooij, Sanjeev Gupta, and Michael Keen (International Monetary Fund, 2015).

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1 In this paper, capital incomes include both profits and rents, that is, all value added that does not accrue to labor (including self-employment).

2 See Glyn (2009) citing Bernanke's statement reported by the New York Times (July 20, 2006), and Germany's finance minister declaration reported by the Financial Times (February 28, 2007).

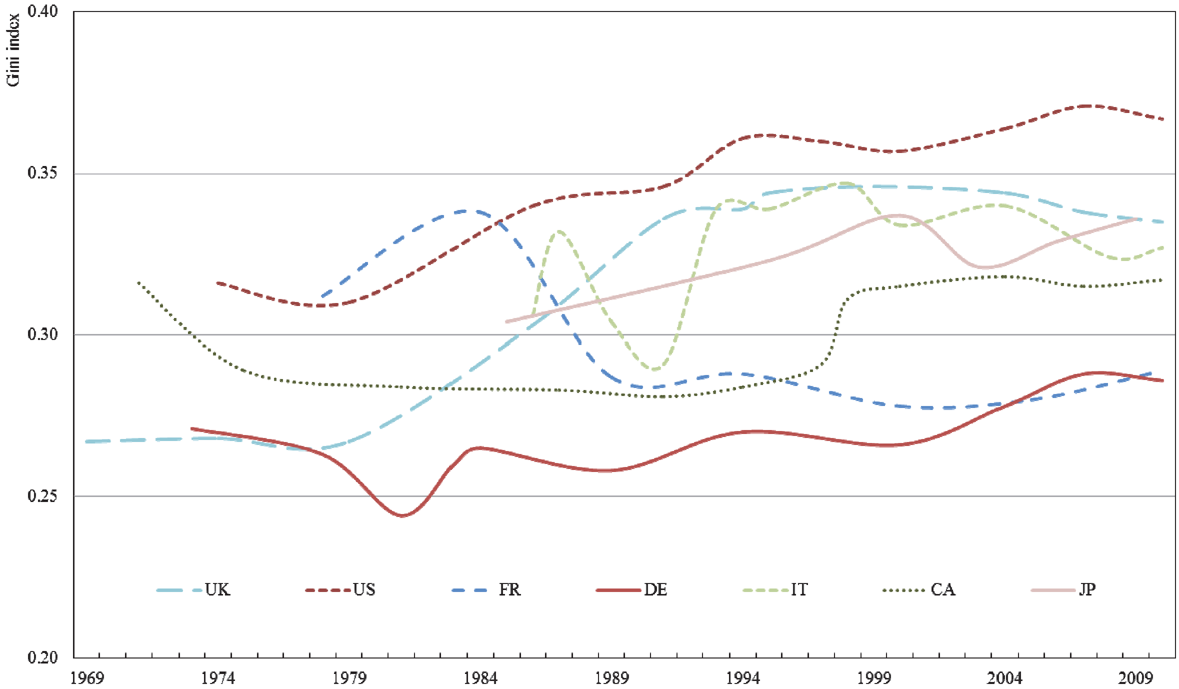
3 The flurry of ensuing policy work and analysis has even caught Wall Street companies like Standard's and Poor and Morgan Stanley, who released their first reports on inequality in the fall of 2014 (Rotondare 2014).

4 For the rest of the paper, "labor share" of income and "wage share" of income are used as synonymous.

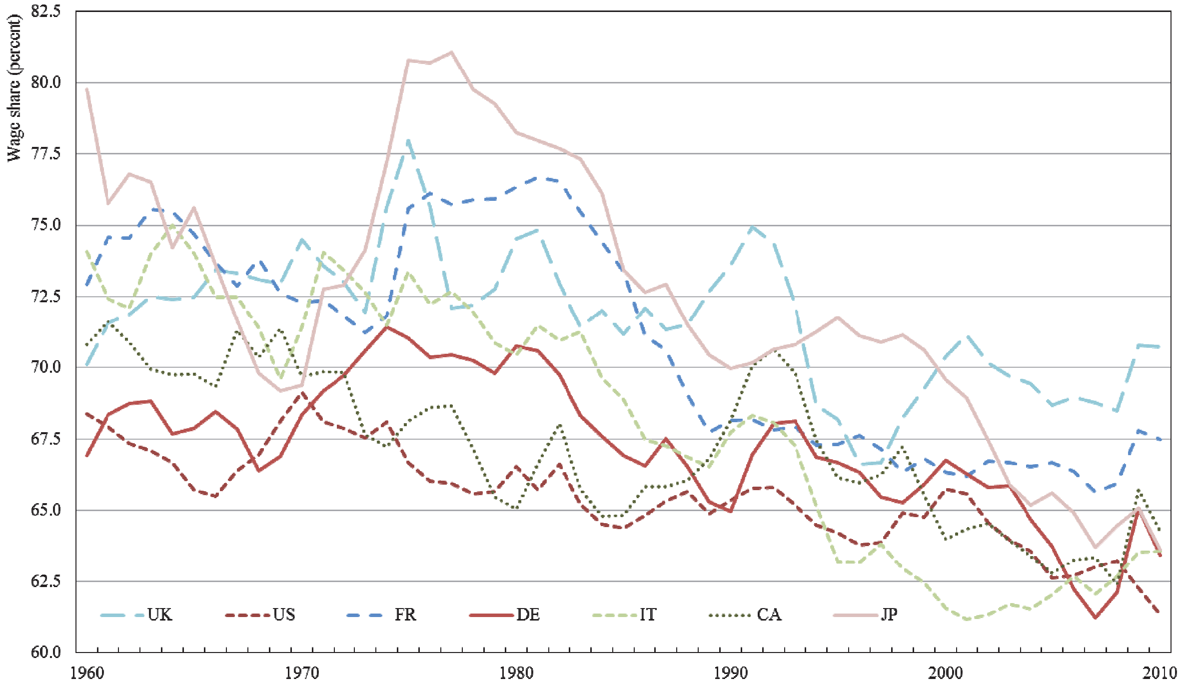
Figure 1

Income Inequality and Wage Share in Group of Seven Countries

Income Inequality



Wage Share



Sources: Luxembourg Income Study for Canada, France, Germany, Italy, United Kingdom, and United States and Organisation for Economic Co-operation and Development for Japan (panel 1). For the years in which the Gini coefficient is available both from the OECD and LIS, data are in line and show similar patterns; European Commission AMECO database (panel 2).

While apparently correlated, these two phenomena may not be directly linked in a causal relationship. Income inequality refers to the personal distribution of income, and the labor share refers to the remuneration of employees in total factor income (value added) in a given year. The classical economists of the 19th century took for granted that capitalists were rich and their income was solely based on the returns on capital, while laborers where poor and only relied on wages. But the world has evolved during the 20th century, and scholars working in this field acknowledged that the study of factor shares and inequality became more difficult as evidence started to show mixed realities where "many employees earn more than capitalists, many property owners work and many workers own property" (Lydall, 1968: 2).

In this paper, we test if the declining labor share of income has been a key driving factor for growing inequality. We conclude that it is not – the most important determinant of rising income inequality has been the growing dispersion of wages, especially at the top of the wage distribution. This echoes the results of Piketty (2014), who concludes that inequality of total income is closer to inequality of income from labor.

While these results confirm previous findings in the literature, the paper makes an important contribution by providing evidence from a wide sample of countries and simultaneously analyzing microeconomic data from household surveys and macroeconomic data from national accounts. As it is well known, micro and macro data do not always perfectly match. However, we find that they reveal broadly similar trends.

The remainder of the paper is organized as follows. Section 2 briefly reviews the relevant literature. Section 3 explains how the Gini index can be decomposed and linked to factor shares and pseudo-Gini indexes of the income sources, and applies this decomposition to available micro data. For this exercise we use the vast sample of income surveys made available to researchers by the Luxembourg Income Study (LIS) data center. Working on 231 household surveys covering 43 countries over the period 1978-2010, we compute the marginal effects of changes in factor shares and in the dispersion of labor and capital on the Gini index for market income. Section 4 broadens the scope of our analysis and uses macroeconomic data for a large set of 93 countries over the period 1970 to 2013, to explore the aggregate effect of the labor share on income inequality. Finally, Section 5 presents final remarks and our main conclusions.

2 Review of the literature

The analysis of factor shares of income was considered the principal problem of political economy by classic economists like David Ricardo. Up until the 1960s, this topic was given great preeminence in economic textbooks and academic research. When Kaldor famously summarized the long term properties of economic growth (Kaldor, 1961), he stated that the shares of national income received by labor and capital were roughly constant over long periods of time. The analysis of factor income shares was the subject of ninety percent of the papers presented at the conference of the International Economic Association in 1965 (Marchal and Ducros, 1968; Glyn, 2009). The dominant theme was that factor shares were important for the macroeconomic performance of economies, as they are linked to the potential problem of profits squeeze or real wages growing above productivity (Glyn and Sutcliffe, 1972; Bruno and Sachs, 1985; Eichengreen, 2007).

Since the 1970s, however, the analysis of factors shares has no longer been at the center of economic debates, given their lack of volatility and reflecting the fact that "the division of income could be easily explained by a Cobb-Douglas production function" (Makiw, 2007: 55). Those concerned with personal income distribution emphasized that there was no direct (or mechanical) link with factors shares, and that difference in personal income were related to differences in educational attainment (Stigler, 1965; Goldfard and Leonard, 2005). In addition, a broader share of the population was starting to enjoy some kind of capital income. As home ownership, financial assets holdings and capital-funded pensions expanded in advanced economies, the division into (pure) workers receiving only wages and (pure) capitalists/landlords receiving only profits/rents became blurred, thus contributing to the decline in attention paid to this theme.

Interest in the analysis of factors shares returned in the early 2000s. Atkinson (2009) cites three reasons to explain this growing attention: first, the analysis of factors shares is useful for understanding the link between incomes at the macroeconomic level (national accounts) and incomes at the individual/household level; second, factor shares can potentially help explain inequality in the personal income (at least partly, if certain types of income are mainly received by some type of economic agents); and last “they address the concern of social justice with the fairness of different sources of income” (Atkinson 2009, 5).

Initially, researchers returning to work in this area focused on explaining the shifts in the labor share (Bentolila and Saint Paul, 2003), its gradual but constant decline (De Serres and others, 2001; Gollin, 2002) and the relationship between wages and productivity (Dew-Becker and Gordon, 2005; Feldstein, 2008). The perception that citizens were not fully enjoying the fruits of the long period of economic expansion of the late 1990s and early 2000s attracted the attention also of national policy-makers and international organizations. The IMF (2007, 2014), the European Commission (2007), the Bank for International Settlements (Ellis and Smith, 2007) and the OECD (2008) all published reports that documented the decline in the labor share of income and provided several explanations of this trend, mainly linked to the impact of globalization and technological change on labor skills, international capital mobility, and wage bargaining.

Since then, contributions in this field can be divided into two groups: a group of papers that document the recent and constant decline in the labor share and seek to explain the main drivers of this decline; and another group of studies that focuses more on its consequences for economic inequality. In the first group of papers, most researchers have used survey data and focused on single countries – mainly the US (Gomme and Rupert, 2004; Harris and Sammartino, 2011; Elsby and others, 2013); others have analyzed instead macroeconomic data and cross-country developments (ILO, 2011 and 2012). In particular, the ILO contributions have highlighted the impact of capital mobility on the evolution of factors shares over the last decades. Stockhammer’s report published by ILO (Stockhammer, 2013) finds a strong negative effect of financial liberalizaiton on the wage share and documents the consequences of cutbacks in welfare payments and globalization. The available evidence on the effects of technological change on labor income shares are mixed (positive in developing economies and modestly negative in advanced ones). Recently, Karabarbounis and Neiman (2014) attribute the declining share of labor income to the decrease in the relative price of investment goods, often ascribed to advances in information technology and the computer age, which have induced firms to shift away from labor and towards capital. According to these authors “the lower price of investment goods explains roughly half of the observed decline in the labor share, even when we allow for other mechanisms influencing factor shares such as increasing profits, capital-augmenting technology growth, and the changing skill composition of the labor force” (Karabarbounis and Neiman, 2014, 16).

In the second group of studies, mostly focused on the interplay between functional income distribution and income inequality, researchers have also worked with survey household data from single countries. This is the case of Adler and Schmid (2012) who find that declining labor income shares are associated with growing inequality and an increasing concentration of market income in Germany. Similarly, Jacobson and Occhino (2012a, 2012b) follow Lerman and Yitzhaki (1985) and decompose the Gini coefficient into the weighted average of the pseudo-Gini indeces of labor and capital income, with the weights equal to the two income shares. Using household data for the US, they confirm that the decline in the labor share made total income less evenly distributed and more concentrated at the top of the distribution, thus increasing income inequality in the US.

According to their results, a 1 percent decrease in the labor share of income increases the Gini coefficient in the US by 0.15-0.33 percent. A recent ILO report addresses the relation between wages and inequality using several sources, and it comes to the conclusion that “inequality starts in the labor market” (ILO, 2015: xvii), meaning that developments in the distribution of wages have been key factors for inequality dynamics.

In this context, the major contribution of this paper is that we perform a deeper empirical analysis than previous studies, by using more micro and macro data sources and pooling them across a larger set of countries.

3 Income shares or the distribution of income? A look at household data

In this section we explore how changes in labor and capital income shares and their distribution have impacted on the dynamics of income inequality. The inequality measure that we use is the Gini index because it is the most widely income inequality measure used both in the literature and in policy analysis. The data source is the Luxembourg Income Study Database (LIS). We use a very wide set of household surveys covering a large sample of economies and spanning more than three decades. This allows us to look for regularities that are supported by a broad empirical base.

We start by writing down a decomposition of the Gini index which can then be applied to micro-data. Our decomposition analysis follows an established path in the literature (Lerman and Yitzhaki, 1985 and CBO, 2011) and breaks down changes in the Gini index into changes in the income components and variations in their pseudo-Gini (or concentration) indices. In particular, assuming that household’s income (y) comes from K sources, the following relation applies (see Appendix A for details on how the decomposition is obtained):

$$G_y = \sum_{k=1}^{K} C_{y_k} s_k \tag{1}$$

where G_y is the Gini index for total income y, and C_{y_k} and s_k are respectively the pseudo-Gini (or concentration) indexes and the shares of each income component (given that $y = \sum_{k=1}^{K} y_k$). Pseudo-Gini indeces capture the level of ‘unevenness’ of the distribution of each income component and are proportional to the Gini index of the income category ($C_{y_k} = \rho_k^{Gini} G_{y_k}$).[5] As equation (1) indicates the Gini index can therefore be represented as a weighted average of the pseudo-Gini indeces of income components, where the weights are the income shares.

Changes in the overall Gini index occurring over a period starting at time $t=t_0$ can therefore be summarized as follows:

$$\Delta G_y = \underbrace{\sum_{k=1}^{K} \Delta s_k C_{y_k}^0}_{\substack{\text{impact of changes} \\ \text{in the income shares}}} + \underbrace{\sum_{k=1}^{K} \Delta C_{y_k} s_k^0}_{\substack{\text{impact of changes} \\ \text{in the concentration} \\ \text{of the income components}}} + \underbrace{\sum_{k=1}^{K} \Delta s_k \Delta C_{y_k}}_{\approx 0} \tag{2}$$

where the third addend can safely be assumed to be close to zero.

[5] See Appendix A also for a discussion of the relation between Gini and pseudo-Gini indexes and its interpretation.

Given equation (1) it is also possible to recover the marginal impact of changes in pseudo-Gini indices:

$$\frac{\delta G_y}{\delta C_{y_k}} = s_k \tag{3}$$

As to the impact of changes in the income shares, assuming that a variation in labor income (*l*) is compensated by an opposite change in capital income (*c*), while everything else stays the same, we have:

$$\frac{\delta G_y}{\delta s_l} = C_l - C_c \tag{4}$$

If the pseudo-Gini index of capital is higher than that of labor, an increase in the labor share reduces inequality (while a reduction raises the Gini index). This condition requires the Gini index for capital income to be 'sufficiently' higher than that of labor.

We compute empirical values for the decomposition of the Gini index using the LIS database; Appendix B presents how the breakdown is computed.

In terms of analysis, we start first by considering a small sample of advanced countries: the United States, the United Kingdom, Germany and France. These countries are the Group of Seven members with the highest and the lowest income inequality level (Figure 1); in addition, we can exploit longer series, allowing us to consider developments over an extended period, which is useful given that inequality tends to move slowly.

Table 1 reports the results of decomposing the change in the Gini index (according to the breakdown described in (2)) observed in these countries over the last three decades.[6] We start by considering disposable income y_{net} (market income plus transfers and minus taxes); the increase in inequality has been significant: more than 25 per cent and 35 per cent respectively in the US and the UK, almost 10 per cent in Germany. In France, inequality is lower than in the seventies and mid eighties, and has been substantially stable since the mid nineties with a slight pickup in recent years.[7] If we look at market income *m*, for all the countries the increase in inequality has also been substantial.

Given the wealth of data offered by the LIS database, the empirical decomposition of the Gini index for market income can be extended to a larger sample of countries (43 in total) that includes not only advanced economies (26) but also emerging ones (17). Selecting as a starting year the oldest available income survey in each country since the late 1970s, the analysis can be expanded to include a total of 231 income surveys covering the past three decades (Appendix Table 7).[8]

Once we have calculated the components of the Gini index, we can compute for each country the average marginal effects of changes in the income composition and the pseudo-Gini

6 The results presented here are robust to using alternative decomposition measures to calculate the contribution of income components to overall inequality. See the discussion in Appendix A and in footnote 30.

7 The Gini index for disposable income for France published by the OECD, which covers the period 1996-2011, displays values close to those that can be computed using LIS data. For the most recent years it shows that inequality has been slightly increasing also in this country.

8 Household surveys over such a long period and covering a broad set of countries are obviously heterogeneous. Of course, pooling all the data would not be advisable. The analysis therefore proceeds by considering each survey separately (taking into account whether income and income components are recorded net or gross of taxes), then assessing the impact on inequality of the different factors for each country and finally across the entire sample.

Table 1

Decomposition of Changes in Inequality (Measured by the Gini Index)

			US 1979-2013	UK 1979-2010	DE 1978-2010	FR 1978-2010
DG_{ynet}			0.08	0.10	0.03	-0.01
Impact of changes in taxation			0.01	0.00	-0.02	0.00
DGy			0.07	0.10	0.05	-0.01
Impact of changes in transfers			-0.03	-0.03	-0.03	-0.03
DGm			0.10	0.13	0.08	0.02
Impact of changes in income shares						
	labour	$Ds_l(C^0_l\text{-}C^0_c)$	0.00	0.00	0.01	0.00
Impact of changes in pseudo-Gini indexes						
	labour	$s^0_lDC_l$	0.09	0.13	0.06	0.03
	capital	$s^0_cDC_c\text{=-}s^0_lDC_c$	0.01	0.00	0.02	0.00
Residual			0.00	0.00	0.00	0.00
G^0_{ynet}			0.31	0.27	0.26	0.33
G_{ynet} in the final year			0.40	0.36	0.29	0.31
G^0_y			0.36	0.30	0.29	0.34
G_y in the final year			0.43	0.40	0.34	0.33
G^0_m			0.41	0.39	0.42	0.44
G_m in the final year			0.51	0.52	0.49	0.47
G^0_l			0.44	0.43	0.45	0.46
G_l in the final year			0.53	0.57	0.54	0.53
G^0_c			0.92	0.88	0.61	0.97
G_c in the final year			0.94	0.97	0.87	0.88

Source: authors calculations on LIS data. The decomposition of changes in market income inequality (lines 6 to 9 in the table) follows equation (19) in Appendix B. Appendixes A and B detail the methodology used for the Gini index decomposition.

indices for labor and capital. The results we obtain from this extended sample mirror those described for the US, UK, Germany and France. The main hypothesis is confirmed. The variable that has had the most sizeable impact on market income inequality (as measured by Gini coefficients) is the change in the pseudo-Gini index of labor income; increases in the unevenness of capital income also raise inequality, but by a much smaller degree given that wages represent the lion's share of market income for the vast majority of the surveyed households (see Table 2 and Figure 2 which report average marginal effects on inequality). Computed at sample average values, we find that a 10 per cent increase in the pseudo-Gini index of labor income would increase the Gini index for market income by more than 9 per cent.

Table 2

Average Effects on the Gini Index for Market Income

	All countries	St. Dev	T	P>|t|
Impact of a 0.01 change in the share of labor income				
dG_m/ds_l	-0.0004 **	0.0012	-2.2889	0.0272
impact of a 0.01 increase in the pseudo-Gini index				
dG_m/dC_l	0.0096 ***	0.0003	250.3138	0.0000
dG_m/dC_c	0.0004 ***	0.0003	9.8787	0.0000

Significance levels are computed using standard deviations calculated over the sample of 43 countries (26 advanced and 17 emerging) considering the avilable income surveys since the late 1970s.

Significance level: * 10%, ** 5%, *** 1%

Subsamples	Advanced economies	Emerging economies
Impact of a 0.01 change in the share of labor income		
dG_m/ds_l	-0.0001	-0.0010
impact of a 0.01 increase in the pseudo-Gini index		
dG_m/dC_l	0.0096	0.0097
dG_m/dC_c	0.0004	0.0003

Source: authors calculations on LIS data.

Consistent with previous studies, we find that on average increases (reductions) in the wage share reduce (raise) the Gini index. In our sample, however, this effect is small but statistically significant. For the average values observed in our sample, a 10 per cent decline in the labor share would increase the inequality index of market income by about 0.9 per cent. This result is mostly driven by emerging market economies, due to the larger difference between the pseudo-Gini index of capital and labor income relative to advanced countries.[9] The overall picture, in terms of magnitude and relevance, of the marginal effects of changes in income shares and pseudo-Gini indices, however, is not very different in the two subsamples of countries (Figure 3).

A few remarks may also help qualify our findings and underscore some important aspects. As observed, our micro data analysis suggests that shifts in functional income distribution have an effect, even though a small one, that depends on the difference between the unevenness of the distribution of labor and capital incomes. If the 'unevenness' in the distribution of labor income approaches that of capital income (which has historically been higher), then how income is functionally distributed no longer matters for inequality.

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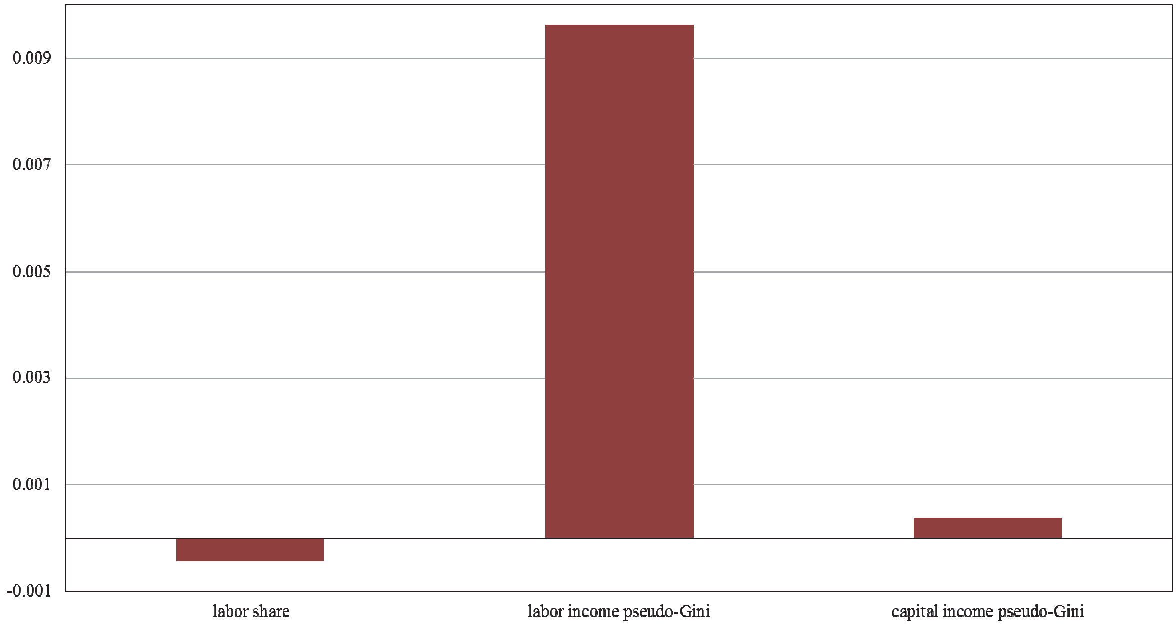
[9] The pseudo-Gini index for capital income in emerging economies is on average higher (by 0.16) than in advanced economies, the difference for labor income is less than half (0.07).

Figure 2

Marginal Impact on the Gini index for Market Income of Changes in the Labor Share and Pseudo-Gini Indexes for Labor and Capital



Source: authors' calculation on LIS data.

Note: average values across countries (43 countries; 231 observations/income surveys).

As to the estimates obtained in our empirical exercise, it is worth remembering that they are affected by the weaknesses traditionally associated with income surveys: the latter generally underreport the extent of capital income; they also do not capture very accurately the tail of the income distribution (generally, the exceptionally rich are poorly represented). Our analysis therefore likely underestimates what has been happening at the top of the income scale and the relevance of developments concerning capital earnings. Recent work (Alvaredo *et al*., 2013) on the top 1 per cent (or even smaller groups of very rich earners) would suggest that the share of income accruing to top earners has been increasing even more rapidly than that appropriated by other (less) rich percentiles. Even though our estimates may not appropriately incorporate these developments, we think, however, that our empirical results capture well the general trends.

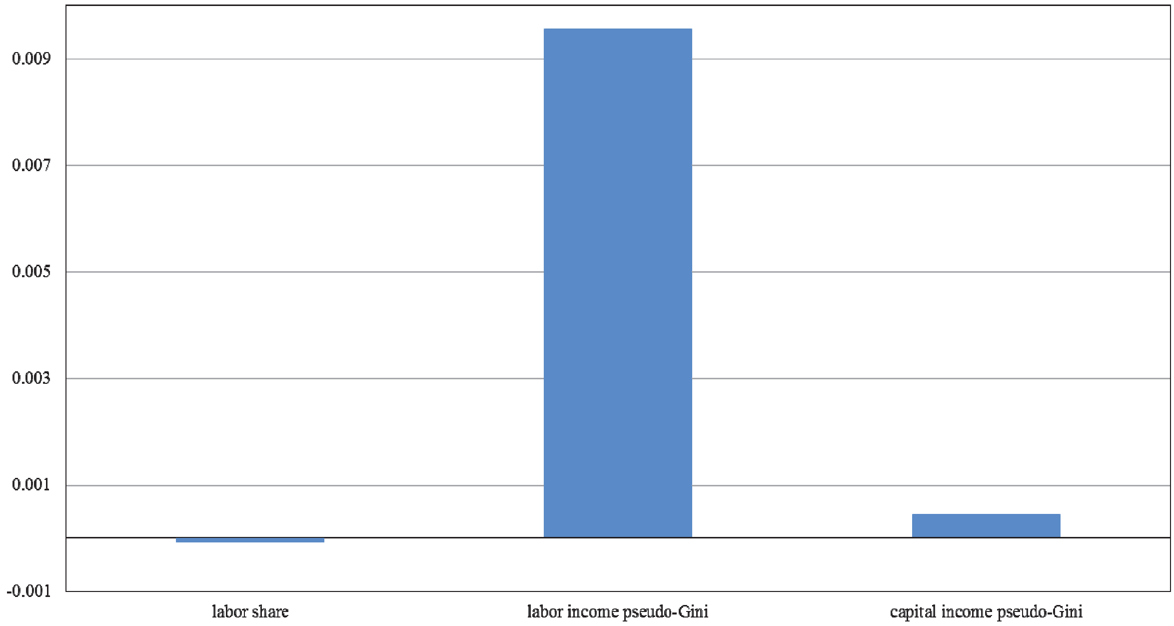
4 Labor share and inequality in a macro framework

This section addresses the same issue (the link between functional income distribution and inequality) in a different framework. We move to a macro framework to verify whether the main findings (that the increasing inequality of labor income is more important than the declining labor share to explain the observed increase in total income inequality) still hold. The estimations presented in this section have the purpose to ascertain if robust correlations exists, while a fully-fledged analysis of the determinants of income shares and inequality is beyond the scope of this paper. The framework also controls for simultaneous additional factors that affect the labor share and the Gini index.

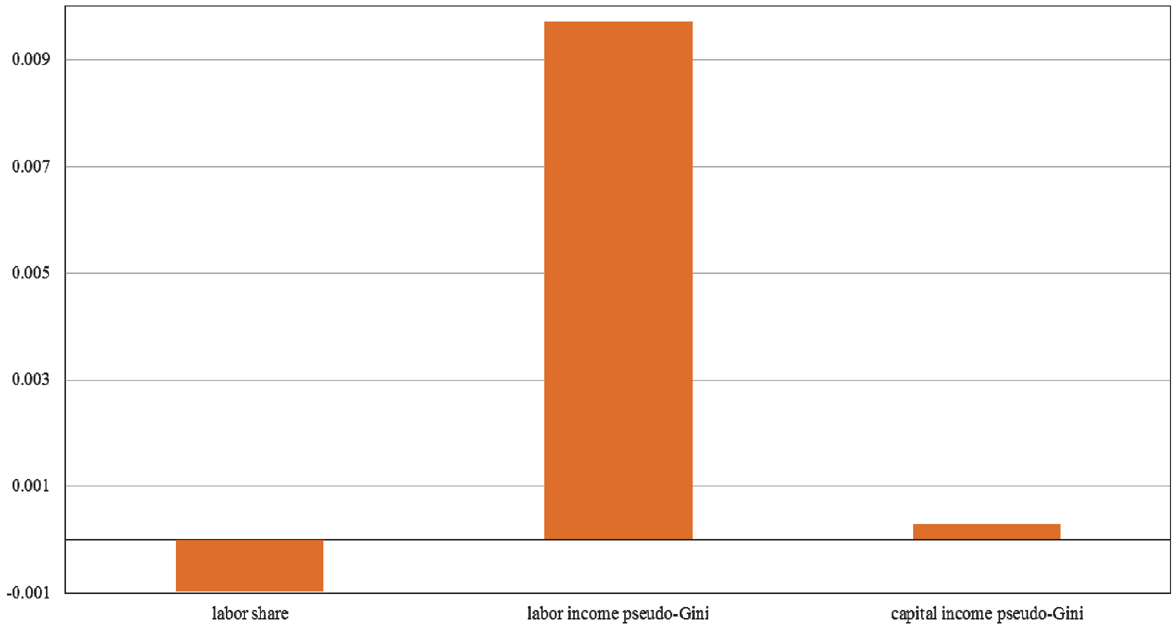
Figure 3

Marginal Impact on the Gini Index for Market Income of Changes in the Labor Share and Pseudo-Gini Indexes for Labor and Capital

a) Advanced Economies



b) Emerging Economies



Note: average values across countries (panel a: 26 countries; 174 observations/income surveys; panel 2: 17 countries; 57 observations/income surveys)
Source: authors' calculations on LIS data.

To preserve continuity with the definition we used in Section 3, we write the Gini coefficient for disposable income as:

$$G_{y^{net}} = C_c + (C_l - C_c)s_l + r \tag{5}$$

where r is the redistributive impact of the tax/welfare system (which we is proxied by public revenues to GDP, and social protection and health spending to GDP).[10] It should be noted that government action may also have an indirect impact on inequality, via an effect on market income allocation. In the analysis presented here, we do not aim at disentangling the direct and indirect effects, but at controlling for this factor when estimating the correlation between inequality and the wage share.

From (5) we derive an equation that we estimate for a sample of 93 advanced, emerging and low income countries. We recognize that the labor share reflects underlying economic developments (mainly in the labor market) and end up with the following specification:

$$\begin{cases} G_{y^{net},it} = \alpha_i + \beta s_l + \gamma r_{it} + \varepsilon_{it} \\ s_{l,it} = a_i + \sum_{j=1}^{J} \theta_j x_{j,it} + \upsilon_{it} \end{cases} \tag{6}$$

where ε_{it} and υ_{it} are error terms; i and t are indices for country and time; x_j are J factors that impact the labor share of income, such as the rate of unemployment, the share of employment in the services sector, and the type and intensity of wage-setting coordination.

The dataset we use in our empirical exercise (an unbalanced panel) covers a large sample of countries; the number of observations drops when we add control variables and when we move to a structural model that allows simultaneous estimation of the wage share and Gini equations as in (6).[11] The period covered is from the 1970s to 2013, although the coverage for each country varies (Appendix Table 8 reports the earliest and latest value for the Gini index for the countries included in our sample). The database is explained in detail in Appendix C. As to the estimation methodology we start exploring separately the wage share and Gini equations using panel techniques.[12] We then run a structural model which includes simultaneously both equations (to account for the endogeneity of the wage share in the Gini equation).[13] Our interest is in the Gini equation, to ascertain whether the small effect of the wage share is confirmed.

Table 3 presents the results we obtain when estimating separately a wage share equation. Our preferred specification (columns 4 and 5)[14] captures the effect of labor market indicators and

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[10] The analysis on micro data (also reflecting data limitations for tax and transfers for our very wide sample of countries) allowed us to recover marginal effects on market income inequality. Since here we use the Gini index for disposable income as a dependent variable, the impact of the tax/transfers system must be taken into account in order to present a framework which is as consistent as possible with that of section 3.

[11] The sample includes about 800 observations for our preferred specification of the wage share equation (Table 3, columns 4 and 5) and 350 for our preferred specification of the Gini equation (Table 4, columns 6 and 7). When the two equations are estimated together the sample size drops to 300 and 150 observations (Table 5, columns 5 and 6); the largest fall in the number of observations is caused by the addition of the variables that capture the wage bargaining set up, which are available for a reduced number of countries. Another factor that reduces the sample size is related to the Gini coefficient not being available for all the years but at a lower frequency.

[12] We run both a fixed and a random effect model. The Breusch and Pagan LM test suggests that a fixed effect model is appropriate.

[13] Our model includes two linear simultaneous equations. The labor income share is treated as an observed endogenous variable in the Gini equation. The model is estimated using a (full information) maximum likelihood estimator.

[14] The first 3 columns report results of parsimonious specifications that have been our starting point. They show that signs and significance of coefficients are robust when explanatory variables are added. We compute robust standard errors to determine statistical significance of coefficients.

institutional characteristics on the labor share;[15] results are in line with those generally found in the literature (Stockhammer, 2013). The wage share does not display large and erratic changes from one year to the other and its lagged value is significant. The lagged value is included because the objective here is to obtain a good explanatory power for the wage share which can then be exploited to solve the simultaneity problem in the Gini equation. As expected the wage share is negatively related to unemployment: a large slack on the labor market negatively affects the income share flowing to workers. With regard to structural indicators, the labor share is lower when the share of employment in the services sector is higher, since unionization is typically higher in the industry and lower among service workers. The wage bargaining framework matters: more centralized and coordinated set ups (including social dialogue with government participation) are associated with higher aggregate income from work.[16]

Results for the Gini equation, when estimated separately, are reported in Table 4. The preferred specifications, the most complete ones, are reported in columns 6 and 7.[17] As to the relationship between the labor income share and the Gini index, the analysis indicates that inequality declines when the wage share increases, however the estimated coefficient is significant only when the dispersion of labor income is not taken into account. When we add a proxy for the dispersion of wages (measured by the ratio of top 10 percent salaries to bottom 90 percent salaries), the wage share seems to no longer matter, whereas the dispersion variable turns out to be positively (and significantly) related to inequality.[18] As to the other control variables, all proxies aimed at capturing the redistributive impact of public policies have the expected negative effect on the Gini index (revenues and health spending display a significant coefficient, while social protection spending does not).[19]

The outcome of the estimation remains stable when we turn to estimating (6) with a structural model that treats the labor share as an endogenous variable (Table 5). The dispersion of labor income remains more important than the wage share to explain income inequality; the estimated coefficient of the wage share continues to be negative, and even if small in magnitude, it is now statistically significant. Government action keeps playing a role; government revenue (as a proxy for redistributive tax policies), social protection spending and health expenditure all contribute significantly to reducing income inequality.[20] Finally in line with the literature we find that economic and financial globalization lead to higher income inequality. As to the wage share equation, control variables are now not significant.[21]

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15 Since we use a panel estimator, other country specific factors (such as for example technology) are absorbed by country effects and in our set up we are not explicitly singling out all determinants of the labor share or inequality (even though they are taken care of by country dummies).

16 This is consistent with results obtained by Checci and García-Peñalosa (2010). On a smaller sample of OECD economies they study in detail the role of market institutions on personal income distribution and conclude that greater unionization and greater wage bargaining are important factors affecting inequality.

17 Again the first columns report results of parsimonious specifications that have been our starting point. Also in this case signs and significance of coefficients are robust when we start adding explanatory variables.

18 Note that the variable that measures the ratio of the top 10 percent of salaries to the bottom 10 percent reported in table 4 reflects total income dispersion. This choice guarantees a larger number of observations which is consistent with our large dataset of countries. The 10-to-90 income ratio of labor income (that would capture directly wage dispersion) is only available for OECD countries. Nonetheless, both variables are highly correlated. Estimation results are the same when the model is run using the reduced sample of OECD countries and the 10-to-90 income ratio of labor income.

19 These results are robust to the inclusion of the unemployment rate as control variable, as in Checci and García-Peñalosa (2010). The inclusion of the unemployment rate in the Gini equation takes into account that labor income is nil for the unemployed. The structural model presented in Table 5 duly takes into account the impact of the unemployment rate; for consistency we maintain the same specification both for the fixed effect and structural model estimations.

20 Revenue is always significant; health and social protection spending are significant when our complete set of explanatory variables is taken into account.

21 To verify that the adopted specification is suitable, we also estimate the model using instrumental variables panel techniques for the Gini equation (instruments for the wage share are the explanatory variables used in the labor share equation, i.e. the lagged wage

(continues)

Table 3

Determinants of Labor Share, Fixed Effects

Labor Share	*(1)*	*(2)*	*(3)*	*(4)*	*(5)*
Labor Share (t-1)	0.8074 ***	0.7788 ***	0.7493 ***	0.8134 ***	0.7748 ***
	(62.33)	*(55.78)*	*(42.23)*	*(41.4)*	*(36.5)*
Unemployment (t-1)		-0.197 ***	-0.1587 ***	-0.151 ***	-0.133 ***
		(10.28)	*(6.95)*	*(8.33)*	*(6.07)*
Employment Service Sector			-0.0655 ***	-0.064 ***	-0.07 ***
			(5.90)	*(5.59)*	*(5.3)*
Type of Wage Setting Coordination				0.0887 **	
				(2.28)	
Intensity of Wage Setting Coordination					0.1976 **
					(2.11)
Constant	9.8812 ***	13.441 ***	18.568 ***	16.041 ***	18.767 ***
	(14.64)	*(16.53)*	*(13.37)*	*(9.51)*	*(10.23)*
Observations	2184	1845	1305	775	856
Number of Country	106	83	80	31	38
R-squared	0.6516	0.6824	0.6753	0.8193	0.7441

Absolute value of t statistics in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%.

Table 4

Determinants of Income Inequality, Fixed Effects

Gini Disposable Income	*(1)*	*(2)*	*(3)*	*(4)*	*(5)*	*(6)*	*(7)*
Labor Share	-0.0008 ***	-0.0006	-0.0003	-0.0001	0.0000	0.0004	0.0006
	(2.70)	(1.50)	(0.69)	(0.30)	(0.02)	(1.03)	(1.21)
Dispersion of Labor		0.0242 ***	0.0203 ***	0.0174 ***	0.0173 ***	0.0173 ***	0.0161 ***
		(4.77)	(4.23)	(3.80)	(3.80)	(3.83)	(3.54)
Public Revenues			-0.0011 ***	-0.0008 **	-0.0007 **	-0.0008 **	-0.0008 **
			(3.40)	(2.28)	(2.19)	(2.39)	(2.29)
Public Social Protection Spending				-0.0011	-0.0006	-0.0009	-0.0007
				(1.24)	(0.67)	(0.98)	(0.74)
Public Health Spending					-0.0046 *	-0.0055 **	-0.0070 ***
					(1.89)	(2.25)	(2.67)
Economic Globalization						0.0007 ***	
						(2.80)	
Financial Globalization							0.0094 **
							(2.38)
Constant	0.3847 ***	0.3888 ***	0.4158 ***	0.4129 ***	0.4231 ***	0.3650 ***	0.4051 ***
	(25.89)	(22.28)	(19.26)	(19.32)	(19.28)	(12.18)	(17.58)
Observations	683	445	393	353	353	352	353
Number of Countries	93	84	83	71	71	70	71
R-squared	0.2817	0.4626	0.6363	0.6609	0.5810	0.3756	0.4252

Absolute value of t statistics in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%.

share, lagged unemployment, the share of employment in the services sector, the proxy for the coordination of the wage setting set up). Results are in line with those reported in the paper (i.e. that while the labor share has small effect on inequality, the impact of the unevenness of labor income is sizeable and dominant). Results are confirmed also when we expand the set of control variables in the Gini equation to include the whole set of explanatory factors for the labor share (to control for an indirect effect on inequality).

Table 5

Determinants of Labor Share and Income Inequality, Structural Model

	(1)		(2)		(3)		(4)		(5)		(6)	
	Labor Share											
Labor Share (t-1)	0.9796	***	0.9631	***	0.9809	***	0.9809	***	0.9809	***	0.9256	***
	(95.44)		*(87.00)*		*(80.56)*		*(80.56)*		*(80.56)*		*(33.48)*	
Unemployment (t-1)			-0.0561	***	-0.0574	***	-0.0574	***	-0.0574	***	-0.1330	***
			(2.92)		*(2.87)*		*(2.87)*		*(2.87)*		*(3.56)*	
Employment Service Sector					-0.0093		-0.0093		-0.0093		-0.0035	
					(0.85)		*(0.85)*		*(0.85)*		*(0.16)*	
Intensity of Wage Setting Coordination											-0.0733	
											(0.56)	
Constant	0.7250		2.1850	***	0.7235		0.7235		0.0723		5.6232	**
	(1.43)		*(3.53)*		*(0.91)*		*(0.91)*		*(0.91)*		*(2.80)*	
	Gini Disposable Income											
Labor Share	-0.0027	***	-0.0013	***	-0.0012	***	-0.0013	***	-0.0012	***	-0.0015	***
	(10.41)		*(4.75)*		*(3.80)*		*(3.98)*		*(3.59)*		*(3.68)*	
Dispersion of Labor income	0.1619	***	0.1772	***	0.1668	***	0.1626	***	0.1623	***	0.6036	***
	(14.46)		*(14.95)*		*(13.71)*		*(12.84)*		*(12.99)*		*(19.38)*	
Public Revenues			-0.0038	***	-0.0039	***	-0.0040	***	-0.0037	***	-0.0014	***
			(14.18)		*(9.75)*		*(9.82)*		*(8.90)*		*(3.16)*	
Public Social Protection Spending					-0.0006		-0.0011		-0.0013		-0.0039	*
					(0.79)		*(1.17)*		*(1.42)*		*(1.76)*	
Public Health Spending							-0.0028		-0.0038	*	-0.0039	*
							(1.17)		*(1.59)*		*(1.78)*	
Economic Globalization									0.0007	**	0.0003	*
									(2.72)		*(1.61)*	
Constant	0.4628	***	0.5275	***	0.5386	***	0.5384	***	0.5671	***	0.0459	***
	(34.06)		*(38.13)*		*(32.85)*		*(32.91)*		*(30.00)*		*(14.51)*	
Observations	425		351		309		309		309		148	
Chi2	0.08		4.93		15.66		14.58		21.38		33.39	
Prob>Chi2	0.9613		0.2943		0.0157		0.0418		0.0062		0.0001	

Absolute value of z statistics in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%.

Table 6

Determinants of Dispersion of Labor Income

	(1)	*(2)*	*(3)*	*(4)*	*(5)*
Financial Globalization	0.0719 **	0.0701 *	0.037 *	0.1531 *	0.0788 ***
	(2.07)	*(1.69)*	*(1.79)*	*(1.74)*	*(2.62)*
Unemployment		0.0082 *	0.0066 *	0.0231 **	0.0075 **
		(1.65)	*(1.69)*	*(2.05)*	*(2.25)*
Industry Unionization			-0.0118 ***	-0.024 ***	-0.01 ***
			(2.86)	*(2.72)*	*(3.39)*
Tertiary Education				-0.018 ***	-0.009 ***
				(2.96)	*(4.47)*
Government Spending					-0.009 ***
					(5.22)
Constant	0.2295 ***	0.1601 ***	0.5643 ***	1.0694 ***	0.8488 ***
	(9.73)	*(2.89)*	*(3.72)*	*(3.31)*	*(6.86)*
Observations	1,045	810	785	405	342
Number of countries	142	91	90	74	67
R-squared	0.004	0.006	0.017	0.062	0.257

Absolute value of z statistics in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%.

If the major conclusion that can be extracted from the previous empirical analysis is that higher income inequality is more driven by wage dispersion rather than by the wage share of national income, then the question becomes, what explains that dispersion? This is not the major focus of the paper and could be a topic for further analysis. Without aiming at providing a comprehensive analysis, Table 6 shows the results of simply regressing the dispersion of wages on different factors.[22] We recognize that this exercise is very simple and that a fully-fledged analysis would require a more sophisticated discussion. Column 5 shows that higher financial globalization and higher unemployment levels are associated with higher dispersion of wages. In contrast, higher unionization in the industry,[23] higher share of educated workers and higher primary government spending (as a proxy for the size of the state) are factors that help reduce the distance between higher and lower wages.

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[22] Again we estimated this model using both versions of income dispersion (total and wage). Results reported in table 6 are those from total dispersion to guarantee a larger sample. As noted in a previous footnote, these results are very similar when we estimate the model on a subsample of OECD countries and using wage dispersion.

[23] Jaumotte and Osorio Buitron (2015) also find evidence that a decline in union density – the fraction of union members in the workforce – affects inequality, in particular that it is associated with the rise of top income shares.

5 Conclusion

This paper analyzes the relationship between functional and personal income distributions, which has returned to center stage in the academic and policy discussion. In the advanced world, the wage share and inequality have shown opposite trends in recent decades: the share of factor income to labor has been declining, while inequality has risen. This paper has addressed this issue from different angles, first by analyzing what is behind widely used inequality measures based on micro data (i.e. Gini indices), and second by running regression analysis on macro data.

Empirical evidence suggests that the most important determinant of income inequality is not the share of income that accrues to labor or capital, but the dispersion of labor income. This result reflects the fact that the lion's share of household income is labor earnings and its distribution has become more unequal. The increase in wage dispersion has been associated with growing financial globalization, a decrease in industry unionization and a decline in the size of the state.

From a policy perspective our results suggest that to avoid unfavorable (or undesired) distributional consequences, policymakers will have to pay attention to labor market outcomes and to the dispersion of wages, including distortions induced in the labor market by different policy interventions or by changes in labor market institutions.[24] Public policies that support inclusive growth (by for example promoting participation in the labor market and strengthening the human capital of low-income groups) may prevent the rise in economic disparities. In addition, tax and transfer policies should be properly assessed in terms of their costs and the relative effectiveness in correcting market income inequalities while minimizing distortions.

[24] These indications are also in line with findings from recent research on Latin America (the most unequal region in the world), where the recent decline in inequality appears to be mostly related to labor income developments (Lustig *et al*., 2015).

APPENDIX A
GINI COEFFICIENTS, PSEUDO-GINI (OR CONCENTRATION) INDEXES AND GINI CORRELATIONS

The Gini coefficient for income *y* can be written as:

$$G_y = \frac{2\operatorname{cov}(y, F(y))}{\bar{y}} \quad \text{or:} \tag{7}$$

$$\operatorname{cov}(y, F(y)) = \frac{\bar{y}G_y}{2} \tag{8}$$

The Gini index captures the distance of the observed income distribution from a hypothetical condition of perfect equality in which each individual would be endowed with exactly the same income (in this case the Gini index would be equal to zero).[25]

If income *y* comes from *K* sources, the Gini index can be decomposed as follows:[26]

$$G_y = \sum_{k=1}^{K} \underbrace{\underbrace{\left[\frac{\operatorname{cov}(y_k, F(y))}{\operatorname{cov}(y_k, F(y_k))}\right]}_{\text{Gini correlation } \rho_k^{Gini}} \underbrace{\left[\frac{2\operatorname{cov}(y_k, F(y_k))}{\bar{y}_k}\right]}_{\text{Gini index for income component k}}}_{\text{pseudo-Gini (or concentration) index for income component k}} \underbrace{\left[\frac{\bar{y}_k}{\bar{y}}\right]}_{\text{component k's share of total income}} \tag{9}$$

$$G_y = \sum_{k=1}^{K} \underbrace{\underbrace{\rho_k^{Gini}}_{\text{Gini correlation}} \quad \underbrace{G_{y_k}}_{\text{Gini index for income component k}}}_{\text{pseudo-Gini index for income component k}} \quad \underbrace{s_k}_{\text{component k's share of total income}} = \sum_{k=1}^{K} C_{y_k} s_k \tag{10}$$

where the pseudo-Gini (or concentration) index is given by:

$$C_{y_k} = \rho_k^{Gini} G_{y_k} = \frac{2\operatorname{cov}(y_k, F(y))}{\bar{y}_k} \tag{11}$$

and the Gini correlation index is:

$$\rho_k^{Gini} = \frac{\operatorname{cov}(y_k, F(y))}{\operatorname{cov}(y_k, F(y_k))} = \frac{2\operatorname{cov}(y_k, F(y))}{\bar{y}_k G_{y_k}} \tag{12}$$

As equation (10) indicates, the Gini index is a weighted average of the pseudo-Gini indexes of income components, where the weights are the income shares. But what is the difference between a Gini and a pseudo-Gini index for an income component y_k? As can be seen by comparing (7) and (11) the difference is due to the reference ranking of individuals used in the two calculations. For the pseudo-Gini index C_{y_k} the weights attached to each individual correspond to the ranking in the distribution of total income ($F(y)$), while for the Gini index G_{y_k} the reference

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[25] A Gini index equal to 1 would be instead observed in the case of extreme inequality in which one individual would appropriate all available income leaving nothing to the others.

[26] See Lerman and Yitzhaki (1985) and CBO (2011).

ranking would be that of the distribution of the *k*th income component ($F(y_k)$). The two indexes would be the same if the ranking of individuals in the two distributions was the same, that is if no re-ranking would take place when moving from the income component distribution to the total income distribution. It should also be noted that the higher an income component share (on total income) is, the lower the possibility of re-ranking (and therefore the closer C_{y_k} and G_{y_k} would be).[27]

BOX 1
DIFFERENCE BETWEEN THE GINI CORRELATIONS AND CORRELATION COEFFICIENTS

The standard (Pearson) correlation coefficient (ρ) and the Gini correlation index have the same numerator: $\operatorname{cov}(y_k, F(y))$. But while the correlation coefficient denominator is the product of the standard deviations, the denominator of the Gini correlation index is half the product between the Gini coefficient and the average for the income component under consideration:

$$\rho = \frac{\operatorname{cov}(y_k, F(y))}{\sigma_{y_k}\sigma_{F(y)}} \tag{i}$$

$$\rho_k^{Gini} = \frac{\operatorname{cov}(y_k, F(y))}{\operatorname{cov}(y_k, F(y_k))} = \frac{\operatorname{cov}(y_k, F(y))}{\frac{\bar{y}_k G_{y_k}}{2}} = \frac{2\operatorname{cov}(y_k, F(y))}{\bar{y}_k G_{y_k}} \tag{ii}$$

The decomposition of the Gini index presented here has been used in many empirical studies. We use the Gini index because it is the most widely used inequality measure used both in the literature and in policy analysis. The literature has however shown that the classical Gini decomposition suffers some limitations. In particular Shorrocks (1982) and (1983) show that there is no unique way to decompose inequality, and proposes an alternative decomposition rule that satisfies a set of desirable properties[28] and delivers contributions for each income component to inequality, which are not anchored to the use of a specific measure. The measure proposed by Shorrocks is:

$$SH_k = \frac{\operatorname{cov}(y_k, y)}{\operatorname{var}(y)} \tag{13}$$

[27] See Pyatt, Chen and Fei (1980).

[28] For example symmetry (meaning that the order of the income components does not affect the decomposition results) and continuity (which requires that for each income component the results do not depend on the number of other income components).

In the framework set forth in this paper, the contributions to inequality of each income component are instead given by:

$$SH_k^G = \frac{\mathrm{cov}(y_k, F(y))}{\mathrm{cov}(y, F(y))} \tag{14}$$

There are several reasons why the standard Gini decomposition is appropriate in the analysis presented in this paper. First, since we decompose market income into only two exhaustive components (see Appendix B), the Gini decomposition is unique (Shorrocks, 1982). Second as also highlighted by Lerman ans Yitzhaki (1985) this approach provides an economic interpretation of the empirical results and allows to derive marginal effects of changes in the income sources (wage and capital shares) and their distributional characteristics (pseudo-Gini indexes). Finally, the standard Gini decomposition and the Shorrocks measure provide very close results.[29]

[29] If we consider the four countries whose results are summarizes in Table 1, the standard Gini decomposition and the Shorrocks' measure provide very similar assessments of the contribution of each income component to inequality. In particular for the observed period for the US the average contribution of labor income to inequality is 0.94 (0.6 for capital income) using the standard Gini decomposition; the corresponding Shorrocks measure is 0.92 (0.8). For the UK the corresponding average values are: SH_l^G =0.97 (SH_c^G =0.03) and SH_l =0.95 (SH_c =0.05); for France: SH_l^G =0.96 (SH_c^G =0.04) and SH_l =0.94 (SH_c =0.06); and for Germany: SH_l^G =0.94 (SH_c^G =0.06) and SH_l =0.83 (SH_c =0.17).

The results therefore confirm that the largest impact on inequality is to be expected from labor income variations.

APPENDIX B
INEQUALITY DECOMPOSITION USING THE LIS DATASET

Bringing equation (1) and (2) to the LIS data implies singling out the empirical counterparts of total income and of income components. The reference unit in calculations is the household and the income definition is the per capita equivalent income computed using LIS equivalence scale.[30] The list of countries considered in the analysis is reported in Table 7.

We define total gross income as market *m* income plus transfers *g*:

$$y = m + g \tag{15}$$

Transfer income is given by both private (such as alimony, remittances, transfers from non-profit institutions) and public transfers (such as pensions, unemployment benefits, disability benefits). Public transfers makeup the bulk of transfer income.

Gross market income *m* is the sum of labor[31] *l* and capital income *c* (from financial or non financial types of investments):

$$m = l + c \tag{16}$$

Net (or disposable) household income is obtained by subtracting taxes from total income:

$$y^{net} = y - t \tag{17}$$

Using (10), the breakdown of changes in inequality in market income over a certain period can be obtained as:

$$\Delta G_m = \underbrace{\left[\Delta s_l C_l^0 + \Delta s_c C_c^0\right]}_{\text{incomesharesimpact}} + \underbrace{\left[s_l^0 \Delta C_l + s_c^0 \Delta C_c\right]}_{\text{concentraition indexesimpact}} + \underbrace{\left[\Delta s_l \Delta C_l + \Delta s_c \Delta C_c\right]}_{\approx 0} \tag{18}$$

where s_l, s_c and C_l, C_c are, respectively, the income shares and pseudo-Gini indexes for *l* and *c* and 0 is the base year (or the initial year in our analysis, which varies depending on the country).

Given that income shares add up to 1, it follows that $\Delta s_c = -\Delta s_l$ (changes in the labor share are absorbed by an opposite change in the capital share), so that (18) can be rewritten as:

$$\Delta G_m = \underbrace{\Delta s_l \left[C_l^0 - C_c^0\right]}_{\text{incomesharesimpact}} + \underbrace{\left[s_l^0 \Delta C_l + s_c^0 \Delta C_c\right]}_{\text{concentraition indexesimpact}} + \Delta s_l \underbrace{\left[\Delta C_l - \Delta C_c\right]}_{\approx 0} \tag{19}$$

and the observed impact of changes in income composition on inequality will depend on the initial values of the pseudo-Gini indexes for labor and capital.

The impact of transfers and taxation on inequality can be measured respectively by:

$$\Delta G_y - \Delta G_m \tag{20}$$

$$\Delta G_{y^{net}} - \Delta G_y \tag{21}$$

[30] The LIS equivalence scale is defined as the square root of the number of individuals in the household.

[31] The labor income definition we use includes both wages from paid employment and income from self employment.

Marginal effects on income inequality can be calculated from the following equation for the Gini index for gross market income:

$$G_m = C_l s_l + C_c s_c \tag{22}$$

Remembering that:

$$s_c = 1 - s_l \tag{23}$$

we have that at any point in time the marginal impact from a variation in market income composition is expressed by:

$$\frac{\delta G_m}{\delta s_l} = C_l - C_c \tag{24}$$

If the pseudo-Gini index for capital is higher than that for labor, then an increase (reduction) in the labor share reduces (raises) inequality. In terms of Gini indexes of the income components this requires that:

$$G_c > \frac{\rho_l^{Gini}}{\rho_c^{Gini}} G_l \tag{25}$$

which implies that the Gini index for capital has to be 'sufficiently' larger than the Gini index for labor.

Condition (25) can also be written in terms of average labor and capital incomes:

$$\bar{l} > \frac{\text{cov}(l, F(m))}{\text{cov}(c, F(m))} \bar{c} \tag{26}$$

which requires average labor income to be 'sufficiently' higher than average capital income.

Table 7

List of Countries Considered

(and indication if income components are recorded gross or net of taxes; definition may vary by year of survey, in this case both gross, net or mixed are listed

Australia (gross)	1981; 1985; 1989; 1995; 2001; 2003; 2008; 2010
Austria (net; gross)	1994; 1997; 2000; 2004
Belgium (net; gross)	1985; 1988; 1992; 1995; 1997; 2000
Brazil (gross)	2006; 2009; 2011
Canada (gross)	1981; 1987; 1991; 1994; 1997; 1998; 2000; 2004; 2007; 2010
China (gross)	2002
Colombia (gross)	2004; 2007; 2010
Czech Republic (gross)	1992; 1996; 2004
Denmark (gross)	1987; 1992; 1995; 2000; 2004; 2007; 2010
Egypt (net)	2012
Estonia (mixed, gross)	2000; 2004; 2007; 2010
Finland (mixed, gross)	1987; 1991; 1995; 2000; 2004; 2007; 2010
France (mixed; gross)	1978; 1984; 1989; 1994; 2000; 2005; 2010
Germany (gross)	1978; 1981; 1983; 1984; 1989; 1994; 2000; 2004; 2007; 2010
Greece (net; gross)	1995; 2000; 2004; 2007; 2010
Guatemala (gross)	2006
Hungary (net)	1991; 1994; 1999; 2005; 2007; 2009; 2012
Iceland (gross)	2004; 2007; 2010
India (net)	2004
Ireland (gross; net)	1987; 1994; 1995; 1996; 2000; 2004; 2007; 2010
Israel (gross)	1979; 1986; 1992; 1997; 2001; 2005; 2007; 2010
Italy (net; mixed)	1986; 1987; 1989; 1991; 1993; 1995; 1998; 2000; 2004; 2008; 2010
Japan (gross)	2008
Luxembourg (net; gross)	1985; 1991; 1994; 1997; 2000; 2004; 2007; 2010
Mexico (net)	1984; 1989; 1992; 1994; 1996; 1998; 2000; 2002; 2004; 2008; 2010
Netherlands (gross)	1983; 1987; 1990; 1993; 1999; 2004; 2007; 2010
Norway (gross)	1979; 1986; 1991; 1995; 2000; 2004; 2007; 2010
Peru (net)	2004
Poland (net; mixed; gross)	1992; 1995; 1999; 2004; 2007; 2010
Romania (gross)	1995; 1997
Russia (net)	2000; 2004; 2007; 2010
Serbia (net)	2006; 2010; 2013
Slovak Republic (gross; net)	1992; 1996; 2004; 2007; 2010
Slovenia (net)	1997; 1999; 2004; 2007; 2010
South Africa (gross)	2008; 2010
South Korea (Gross)	2006
Spain (net; gross)	1980; 1985; 1990; 1995; 2000; 2004; 2007; 2010
Sweden (gross)	1981; 1987; 1992; 1995; 2000; 2005
Switzerland (gross)	1982; 1992; 2000; 2002; 2004
Taiwan (gross)	1981; 1986; 1991; 1995; 1997; 2000; 2005; 2007; 2010
United Kingdom (gross)	1979; 1986; 1991; 1995; 1994; 1999; 2004; 2007; 2010
United States (gross)	1979; 1986; 1991; 1994; 1997; 2000; 2004; 2007; 2010; 2013
Uruguay (net)	2004

Source: LIS database. Cut off date for data February 24, 2015.
Note: for a detailed definition of the recording method (gross, net or mixed) of taxes see http://www.lisdatacenter.org/

APPENDIX C
DESCRIPTION OF THE DATABASE

Annex Table 8 reports the earliest and latest value for the Gini index for the countries included in the estimation sample.

The data sources for the estimation analysis are the following:

1) For the disposable Gini index (which is a discontinuous variable observed only in some years that vary depending on the country) we use data from various sources with the aim of covering the largest possible sample. The sources are the OECD, Eurostat, the World Bank's World Development Indicators, LIS, and the Socio-Economic Database for Latin America and the Caribbean.
2) For the wage share, the main data source is the ILO database. When available the adjusted wage share is used. For many countries longer time series for wage shares are also published in the European Commission's Annual Macroeconomic Database (AMECO). For these countries the two datasets display similar patterns, and AMECO data can be used to extrapolate developments over a longer time period.
3) The unemployment rate has been taken from the IMF *World Economic Outlook*.
4) The employment rate in the services sector come from ILO.
5) For the variables capturing the wage setting set up we have used the Institutional Characteristics of Trade Unions, Wage Setting, State Intervention and Social Pacts dataset, 1960-2011 (ICTWSS) (produced by Jelle Visser, Amsterdam Institute for Advanced Labour Studies). The variable used (ictwss_Coord and ictwss_Type) capture the following aspects: coordination of wage-setting, and the type, or the modality or mechanism through which coordination of wage bargaining behavior is produced. The higher the value of the variable the higher is degree of coordination/centralization of the wage bargaining framework.
6) The dispersion of labor income is measured as the ratio of total income of the top 10 percent to the bottom 10 percent and data are taken from the World Bank's World Development Indicators;
7) The ratios of public revenue, social protection spending and health expenditure to GDP are taken from IMF *World Economic Outlook*, Eurostat, OECD, World Health Organization, the United Nations Educational, Scientific and Cultural Organization; CEPALSTAT; the Asian Development Bank; the World Bank; and the IMF International Financial Statistics.
8) Economic globalization is measured as a score based on actual flows and trade restrictions, and the data are drawn from KOF Index of Globalization (Dreher, Gaston, and Martens 2008).
9) Financial globalization is proxied by the log of total foreign assets and liabilities divided by GDP, which is computed from data from updated and extended versions of the dataset constructed by Lane and Milesi-Ferretti (2007).

Table 8

Countries Considered in the Estimation and Descriptive Statistics for Inequality

Country		Earliest Observation		Latest Observation	
		Gini	Year	Gini	Year
Argentina	EME	0.46	1995	0.44	2007
Armenia	EME	0.34	2003	0.31	2008
Australia	ADV	0.28	1981	0.34	2008
Austria	ADV	0.23	1987	0.27	2011
Azerbaijan	EME	0.35	1995	0.34	2008
Belarus	EME	0.29	1995	0.27	2008
Belgium	ADV	0.23	1985	0.24	2011
Bhutan	LIDC	0.47	2003	0.38	2007
Bolivia	LIDC	0.56	1997	0.44	2009
Bosnia and Herzegovina	EME	0.36	2007	0.36	2007
Brazil	EME	0.55	2004	0.52	2008
Bulgaria	EME	0.31	1995	0.26	2012
Burkina Faso	LIDC	0.40	2003	0.40	2003
Burundi	LIDC	0.33	2006	0.33	2006
Cameroon	LIDC	0.41	1996	0.40	2001
Canada	ADV	0.32	1971	0.32	2008
Chile	EME	0.54	1996	0.51	2009
China	EME	0.36	1996	0.42	2005
Colombia	EME	0.55	2000	0.53	2009
Costa Rica	EME	0.43	1995	0.49	2009
Côte d'Ivoire	LIDC	0.37	1995	0.44	1998
Croatia	EME	0.27	1998	0.37	2011
Cyprus	ADV	0.29	1997	0.31	2012
Czech Republic	ADV	0.26	1996	0.27	2004
Denmark	ADV	0.26	1987	0.27	2012
Dominican Republic	EME	0.46	1996	0.46	1996
Egypt	EME	0.30	1996	0.31	2008
Estonia	ADV	0.36	2000	0.30	2012
Finland	ADV	0.21	1987	0.26	2012

France	ADV	0.29	1979	0.31	2012
Gabon	EME	0.41	2005	0.41	2005
Georgia	EME	0.40	2003	0.41	2008
Germany	ADV	0.27	1973	0.28	2012
Greece	ADV	0.35	1995	0.35	2012
Guatemala	EME	0.56	2002	0.53	2006
Honduras	LIDC	0.52	2001	0.58	2005
Hong Kong SAR	ADV	0.43	1996	0.43	1996
Hungary	EME	0.29	1999	0.28	2012
India	EME	0.33	2005	0.33	2005
Iran	EME	0.44	1998	0.38	2005
Ireland	ADV	0.33	1987	0.30	2011
Israel	ADV	0.34	1997	0.36	2008
Italy	ADV	0.31	1986	0.34	2012
Japan	ADV	0.30	1985	0.33	2008
Jordan	EME	0.36	1997	0.34	2008
Kazakhstan	EME	0.35	1996	0.29	2009
Kenya	LIDC	0.43	1997	0.48	2005
Korea	ADV	0.31	2006	0.31	2006
Kyrgyz Republic	LIDC	0.36	1998	0.36	2009
Latvia	ADV	0.27	1993	0.35	2012
Lesotho	LIDC	0.53	2003	0.53	2003
Lithuania	EME	0.34	1993	0.36	2012
Luxembourg	ADV	0.24	1985	0.28	2012
Macedonia, FYR	EME	0.28	1998	0.43	2009
Malta	ADV	0.30	2000	0.27	2012
Mexico	EME	0.52	1996	0.45	2010
Moldova	LIDC	0.37	1997	0.33	2010
Mongolia	LIDC	0.33	2002	0.37	2008
Morocco	EME	0.39	1999	0.41	2007
Mozambique	LIDC	0.47	2003	0.46	2008
Namibia	EME	0.64	2004	0.64	2004
Nepal	LIDC	0.44	2003	0.33	2010

Netherlands	ADV	0.25	1983	0.22	2012
New Zealand	ADV	0.32	1990	0.33	2008
Niger	LIDC	0.44	2005	0.35	2008
Nigeria	LIDC	0.43	2004	0.43	2004
Norway	ADV	0.22	1979	0.23	2012
Panama	EME	0.55	1997	0.50	2008
Papua New Guinea	LIDC	0.51	1996	0.51	1996
Philippines	EME	0.46	1997	0.43	2009
Poland	EME	0.26	1992	0.32	2004
Portugal	ADV	0.35	1975	0.34	2012
Romania	EME	0.28	1995	0.28	1997
Senegal	LIDC	0.41	2001	0.39	2005
Serbia	EME	0.33	2002	0.28	2009
Sierra Leone	LIDC	0.43	2003	0.43	2003
Singapore	ADV	0.42	1998	0.42	1998
Slovak Republic	ADV	0.25	1996	0.26	2012
Slovenia	ADV	0.23	1997	0.23	2004
South Africa	EME	0.57	1995	0.63	2009
Spain	ADV	0.32	1980	0.34	2012
Sri Lanka	EME	0.41	2002	0.40	2007
Sweden	ADV	0.26	1967	0.25	2011
Switzerland	ADV	0.31	1992	0.27	2012
Tajikistan	LIDC	0.33	2003	0.33	2007
Tanzania	LIDC	0.35	2000	0.38	2007
Tunisia	EME	0.41	2000	0.41	2005
Turkey	EME	0.42	1994	0.39	2008
Ukraine	EME	0.39	1995	0.26	2009
United Kingdom	ADV	0.27	1969	0.36	2011
United States	ADV	0.32	1974	0.37	2010
Uruguay	EME	0.42	1998	0.44	2005
Venezuela	EME	0.46	1997	0.39	2007

Sources: see text of this Appendix.
Note: ADV = advanced economy; EME = emerging market economy; LIDC = low-income and developing countries.

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THE EVOLUTION OF WORLD WELFARE INEQUALITY

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*The paper proposes a measure of countries' well-being based on individuals' lifetime utility and applies it to a large sample of countries in the period 1960-2011. Together with a decreasing trend in welfare inequality across world populations, we find clear evidence of polarization with the formation of three groups: those with high welfare levels, those in transition towards the upper part of the distributions and those "trapped" at medium-low levels. Such tendencies to polarization shall strengthen in the future, jointly with an increase in the world welfare inequality. We also suggest a method to take into account within country-inequality along the two relevant dimensions of welfare we are considering, namely income and health (*i.e., *life expectancy). The analysis not only confirms the evidence in favour of polarization but also points to a level of inequality remarkably higher.*

1 Introduction

Despite the wide consensus on the multidimensionality of human well-being, most of the studies that analyse the dynamics of world inequality mainly focus on the distribution of income or consumption alone. Bourguignon and Morrisson (2002) and Becker *et al.* (2005), however, have argued how a more meaningful analysis of the evolution of welfare inequality across countries/among world citizens should jointly consider at least the dynamics of income and life expectancy, even by simply looking at some composite indicator of welfare such as lifetime income or utility.[1] In particular, Bourguignon and Morrisson (2002) observe that inequality in the per capita GDP across the world population increased from the beginning of the 19th century to World War II, and then stabilized (or slightly increased). On the contrary inequality in life expectancy decreased markedly after 1920-1930. Taking lifetime income as a proxy of welfare, they conclude that the decreasing trend observed in welfare inequality since 1950 has stopped since the main determinant of such dynamics, *i.e.*, the pronounced drop in life expectancy disparities, has lost its momentum or even reversed its path. Becker *et al.* (2005) propose a more sophisticated approach to the measurement of welfare based on the concept of lifetime utility as previously discussed in Rosen (1988), computing the countries' "full income" growth rates, *i.e.*, growth rates which include the monetary value of the gains in longevity experienced by countries' populations. They conclude in favour of an even stronger convergence in the world welfare distribution over the period 1960-2000 – with the partial exception of the populations from Sub-Saharan countries – than the one that would emerge looking at income alone.

In this paper we make both a theoretical and an empirical contribution to the current literature: we propose a methodology to measure welfare based on the lifetime utility of individuals; we then apply it to a large sample of countries to assess the evolution of world inequality of well-being using non-parametric techniques to identify the possible emergence of polarisation.

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[1] Many different approaches to the measurement of multidimensional well-being have been proposed in the literature so far, based on very diverse definitions of well-being itself. Those measures range from the identification of a single (usually utility-based) "sufficient statistics" for welfare to a dashboard of non-comparable dimensions. For a critical review of the literature, see Aaberge and Brandolini (2015).

Starting from the concept of lifetime utility of Becker *et al.* (2005), we directly consider the indirect utility function as a cardinal index of welfare. Our approach brings some advantages, among which the potential inclusion of the expected income growth rates on the determinants of welfare, and, mainly, the possibility to directly compare welfare across populations.[2]

Using such an index, we find evidence of a decreasing trend in welfare inequality (as Becker *et al.* (2005)), but also of a strong pattern of polarization. Polarization in welfare is more pronounced than the one characterising income distribution, and is expected to persist in the future. In particular, we first consider as a proxy of the world distribution of welfare, the population-weighted cross-country distribution (in the following, "cross-population distribution" or "PWCC") in the period 1960-2011. We find a clear pattern of polarization with the emergence of three clusters in 2011, together with of a fall in welfare inequality. The populations of Sub-Saharan countries represent the poorest part of the low-welfare cluster, but the most of the mass is constituted by the populations of South Asia. The second cluster is in a relatively higher position and, with the notable exception of China, is constituted by Latin American populations. The upper cluster is instead mainly formed by populations from Western Europe and Western Offshoots and some Asian Tigers (Hong Kong, Korea and Singapore).

The clusters differ by some typical features discussed in literature as determinant of poverty traps, as the level of life expectancy, the degree of social conflict, the quality of institutions and the quality of labour force (human capital).[3]

The estimate of the long-run tendencies suggests that polarization should be a persistent phenomenon, while welfare inequality is expected to increase in the future. This expected pattern results from a stop in income and life expectancy convergence across the medium and high-income populations, and from a divergent dynamics of the lower income group.

We show how the polarization in welfare appears the result of the polarization in the cross-population distribution of income,[4] jointly with the positive relationship between income and life expectancy also at high levels of per capita GDP.[5] The complementarity between life expectancy and income in our welfare index implies that under a general upward trend of per capita income, a constant absolute difference in life expectancy, as the one observed between medium and high-income countries, leads to an increasing gap between welfare levels. In our sample this divergent dynamics is indeed only partially counterbalanced by the (recent) higher income growth rates of medium-income countries.

The estimate of the cross-population distribution disregards within-country disparities. However, there is increasing evidence that such inequalities both in income and life expectancy can be sizeable and changing over time. A more comprehensive approach should aim at directly considering the entire world population, ranking the individuals from the poorest to the richest irrespective of their nationality.[6] We then make a further step ahead with respect to Becker *et al.*

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[2] The methodology proposed by Becker *et al.* (2005) allows to compute only variations in "full income"; absolute welfare levels can be computed only if income and "full income" are assumed to coincide in a chosen base year (Becker *et al.* (2005) consider 1960 as base year, p. 283). Fleurbaey (2005) discusses how the income equivalent variations may depend on the choice of the base year, and, in turn, how it may lead to intransitive comparisons. An alternative method directly compute money-metric indices, which however need arbitrary references for both the income and non-income dimensions to be fixed. Fleurbaey and Gaulier (2009) applied such a method to 24 OECD countries in 2004, obtaining a ranking which strongly differs from the one based only on per capita GDP. Similarly the work by Jones and Klenow (2010) considers 134 countries and takes into account consumption, life expectancy as well as leisure and inequality.

[3] See Durlauf *et al.* (2005).

[4] See Quah (1997) and, for a more recent evidence, Vollmer *et al.* (2010)).

[5] This evidence partially contrasts with the so called "Preston curve" (see Preston (2007)), which points to convergence in life expectancy for medium/high-income countries.

[6] In terms of Milanovic's taxonomy the cross-population distribution corresponds to *Concept 2 inequality*, while this second approach is labelled as *Concept 3 inequality*.

(2005), estimating the world population distribution (in the following, "WP") of welfare by taking into account also within-country inequalities in the period 1993-2005.[7] With respect to the estimates based on the cross-population distribution, the world welfare inequality as measured by the Gini index appears to be remarkably higher (by 8 percentage points on average), but the qualitative pattern of its dynamics is confirmed: decreasing inequality over time and evidence of polarization.

Bourguignon and Morrisson (2002) and Becker *et al.* (2005) are the main sources of inspiration of the paper. Our theoretical model follows the approach in Rosen (1988), while the empirical analysis is inspired by the work of Danny Quah on income distribution and club-convergence dynamics (see, for example, Quah (1997)).

Our methodology is strongly related to the recent literature which proposes a more theoretically grounded approach towards the analysis of non-market dimensions of inequality and the evaluation of gains in quality and quantity of life.[8]

In the estimate of individual welfare by lifetime utility we are close to Murphy and Topel (2006); their goal, however, is different, since they aim at valuing improvements in overall longevity and health care. From a theoretical point of view Anderson (2005) presents a similar framework: however, no randomness in the length of life is considered; moreover, the empirical analysis is limited to African countries. Finally, Nordhaus (2003) and Hall and Jones (2007) provide stimulating discussions on the evaluation of welfare associated to extensions in life expectancy.

The non-parametric methodology used in the empirical analysis is based on Fiaschi and Lavezzi (2003). The estimate of the long-run distribution follows Johnson (2005), thus avoiding the discretization of the state space. In addition, we propose a novel bootstrap procedure to identify confidence intervals for the estimation of the long-run distributions.

The paper is organized as follows: Section 2 presents the theoretical measure; Section 3 reports and discusses the empirical results; Section 4 concludes. The appendices contain proofs, some extensions of the analysis, and other technicalities.

2 A measure of individual welfare

The measure of individual welfare we propose is based on the model in Rosen (1988) with state dependent utility. In particular, we apply it in a framework with long-run growth and CIES instantaneous utility function, in order to calculate an explicit formulation of the lifetime utility of agents. Consider an agent born at time 0 with a maximum length of life equal to T and a positive probability of dying before $T > 0$. Given her initial wealth, $\bar{p}_0$, and a flow of potential labour incomes $(yl_0, yl_1, ..., yl_T)$, the intertemporal budget constraint of the agent is:

$$\int_0^T c_t \exp(-rt)\, S_t dt \leq w, \tag{1}$$

where r is the interest rate, S_t the probability to survive at age t, and w is the lifetime wealth of the agent, given by:

$$w = \bar{p}_0 + \int_0^T yl_t \exp(-rt)\, S_t dt. \tag{2}$$

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7 Limitation in data availability constraints the time span we can consider.

8 For a review on these issues, cf. Decancq *et al.* (2015) and Weil (2014).

We assume that r is constant over time and non-negative.

Budget constraint (1) assumes full annuity insurance, or the existence of a complete contingent claims market (see Becker *et al.* (2005)): the agent can borrow in perfect capital markets all her potential future labour incomes at the current interest rate r, and the survival function S is common knowledge across all the agents in the economy.

When the agent is alive, her preferences are described by the following *CIES* instantaneous utility function:[9]

$$u(c) = \begin{cases} \frac{c^{1-\sigma}}{1-\sigma} - M & \text{for} \quad \sigma > 0 \text{ and } \sigma \neq 1; \\ \log(c) - M & \text{for} \quad \sigma = 1, \end{cases} \tag{3}$$

Preferences (3) depend on two additive components: a constant term, M, which represents the utility of the state "dead",[10] and the term $c1-\sigma$ / $(1 - \sigma)$ describing the utility of the state "alive".[11] Subtracting M from utility in each state (both "dead" and "alive") normalizes the utility of non-survival to zero.

If $\sigma \in (0, 1)$ and $M < 0$ being alive has a positive utility *per se*; the agent would prefer a longer life independently of her consumption level. On the contrary, if $\sigma > 1$, then M should be negative, otherwise $u(c) < 0$ for all c and therefore "dead" would be always the preferred state of the agent. We therefore assume that:[12]

$$\begin{aligned} &1. \quad \text{if } \sigma \in (0,1) \text{ then } M > 0; \\ &2. \quad \text{if } \sigma = 1 \text{ then } M \in (-\infty, +\infty); \text{ and} \\ &3. \quad \text{if } \sigma > 1 \text{ then } M < 0. \end{aligned} \tag{4}$$

Under Assumption (4) there exists a *zero utility consumption*, c^{ZUC}, such that $u(c^{ZUC}) = 0$, *i.e.*:

$$c^{ZUC} = [(1-\sigma) M]^{\frac{1}{1-\sigma}}. \tag{5}$$

The expected utility of the agent is given by:[13]

$$E[U] = \int_0^T \left(\frac{c^{1-\sigma}}{1-\sigma} - M \right) \exp(-\rho t) S dt, \tag{6}$$

where ρ is the discount rate.

Assume that:[14]

$$\dot{S}/S = -\pi^D, \tag{7}$$

---

9 The form of the utility function for $\sigma \to 1$ in Eq. (3) is obtained by adding the constant term $-1/(1-\sigma)$ to the term $c^{1-\sigma}/(1-\sigma)$.

10 The presence of the constant term M allows the utility elasticity to decline with consumption. Under reasonable assumptions on the parameters' values, this implies that an agent would eventually prefer to substitute consumption with additional years of life.

11 The latter term is commonly used in the literature on economic growth, because it ensures constant growth rates in steady state.

12 Rosen (1988), p. 287, argues that the economically interesting cases are those for which the elasticity of the instantaneous utility function $\varepsilon \in (0, 1]$. This corresponds to the cases: i) if $\sigma \in (0, 1)$ then $M > 0$ or ii) if $\sigma > 1$ then $M < 0$.

13 In the following, we omit the time index whenever it does not cause confusion.

14 See Nordhaus (2003) for a similar framework

where $\pi^D > 0$ is the mortality rate. Under Assumption 7 life expectancy at birth (*i.e.*, at time $t = 0$) is given by:

$$LE = \frac{1 - \exp\left(-\pi^D T\right)}{\pi^D}. \tag{8}$$

If $T \to \infty$ then $LE = 1/\pi^D$, while if $\pi^D = 0$ then $LE = T$.

We also assume that the agent's expected labour income grows at a rate equal to the steady-state growth rate g, *i.e.*:[15]

$$yl_t = yl_0 \exp\left(gt\right) \text{ for } t \in [0, T]. \tag{9}$$

When the agent has no initial wealth, *i.e.*, $\bar{p}_0 = 0$, her indirect lifetime utility is given by:[16]

$$V\left(T, yl_0, g\right) = \left(\frac{1}{1-\sigma}\right)\left\{yl_0^{1-\sigma}\left[\frac{\exp\left(\left(g-\hat{r}\right)T\right)-1}{g-\hat{r}}\right] + \frac{\left(1-\sigma\right)M\left[\exp\left(-\hat{\rho}T\right)-1\right]}{\hat{\rho}}\right\}, \tag{10}$$

where $\hat{r} = r + \pi^D$ and $\hat{\rho} = \rho + \pi^D$ are respectively the interest rate and the discount rate adjusted for the instantaneous probability of dying before T.[17]

In our analysis, V is considered as a direct index of human well-being. We depart from Becker *et al.* (2005), whose index of well-being is the sum of per capita GDP in 1960 plus the gains in both material income and longevity expressed in "full income" variations, assuming that in 1960 "full income" and income coincide. In the empirical analysis, under the hypothesis of equal preferences across world population, the two approaches lead to the same results.

A key feature of lifetime utility in Eq. (10) is that income and life expectancy are complements, which means that the same gain life expectancy is valued more by rich individuals than by poor ones (both in absolute and relative terms). This element has been partially embodied also in the new formulation of the *Human Development Index* (HDI), which before the revision showed the opposite (and mostly criticized) feature, *i.e.*, income and life expectancy were pure substitutes. The HDI retains however the drawback of the lack of a clear microfoundation (cf. Weil (2014), p. 668). The same objection applies to the more recent *OECD Better Life Index*. In this regard our index based on lifetime utility overcomes this limit.[18] As we will discuss below, this has relevant implication for the analysis: under a general upward trend of per capita income, a constant absolute difference in life expectancy, as the one we will observe between medium and high-income countries, leads to an increasing gap between welfare levels.

3 Empirical evidence

This section studies the evolution of world inequality in welfare, per capita GDP and life expectancy and their distribution dynamics. Ideally, in order to derive the proper distribution we

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15 For the sake of simplicity, in Eq. (9) we are considering that the agent works over her whole life; however, the analysis could be easily extended to the case in which the agent retires at age T^R, with $T^R \in (0, T]$.

16 See Appendix A for the details.

17 Lifetime utility V can be a non-monotonic function of life expectancy. The parameters' setting adopted in the paper excludes such possibility. We refer to Fiaschi and Romanelli (2010) for a more detailed analysis of this issue.

18 On the other side, we do not incorporate dimensions other than health and income (consumption) in measuring welfare while both of those indices include other aspects, more or less correlated with income, such as education, environmental quality, civic engagement, etc.

should estimate the welfare of each individuals in the world. This would require a tremendous amount of microdata which is so far not available. Our *first* approximation is then deriving an estimate of the population-weighted welfare distribution among countries.

3.1 Methodology of the empirical investigation

As in Becker *et al.* (2005), the welfare of a population in a given country is assumed to be equal to the (indirect) lifetime utility of a representative agent with no initial wealth, *i.e.*, $\bar{p}_0 = 0$, whose first yearly income, yl_0, is proxied by the per capita GDP of that country and whose life expectancy, LE, is equal to the average life expectancy at birth of its citizens; it is therefore equal to the utility of a representative newborn.

Given our welfare indicator for each country in each year of the considered time-span (1960-2011), we can estimate the population-weighted distributions over time. Such analysis provides a picture of the dynamics of inequality across individuals and possibly allows to identify the emergence of clusters of populations. Such estimates contain a bias since they neglect the *within-country* distribution of welfare.[19] However, in Section 3.4 we will show for the period 1993-2005 how the inclusion in the analysis of the *within-country* distribution of welfare substantially confirm our findings.

Concerning the empirical analysis, we depart from Becker *et al.* (2005) in a key methodological aspect: the use of non-parametric techniques, which crucially affects the results because of the presence of non-linearities in the distribution dynamics. As discussed by Durlauf and Johnson (1995) the presence of σ (or, in our case, Gini) and β (absolute) convergence does not exclude the existence of multiple equilibria, *i.e.*, polarization.

Finally, Eq. (10) shows that a proper estimate of the welfare distribution should take into account all the non-linearities between growth rates, income and life expectancy, especially in presence of high cross-country heterogeneity in income growth rates. However, estimating g for a given country in a given year is not a simple task, because it should represent the *expected* income growth rate for a newborn in that country in that year. This suggests to limit the analysis to the baseline case of $g = 0$.[20] We checked the sensitivity of our results to the assumption $g = 0$ by considering non-null country-specific growth rates. The picture is qualitatively confirmed, that is the presence of polarization, even tough with higher welfare inequality. Therefore, cross-country heterogeneity in income growth rates does seem only to exert a second-order effect on the dynamics of welfare inequality.[21]

3.2 Calibration of individual welfare

The sample in the empirical analysis includes 103 countries, for which we have complete information on per capita GDP, life expectancy and population size for the period 1960-2011. Countries' GDP is measured by the expenditure-based real GDP at chained PPPs in 2005

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[19] Bourguignon and Morrisson (2002) show that in modern economic history the within-country component was the main source of inequality in per capita GDP until World War II, accounting for almost 3/4 of total inequality on average. However, since the 1950s, its contribution to world inequality has been halved, given that the dynamics of between-country inequality is the leading factor in determining inequality across world citizens.

[20] In fact, the decomposition of changes in welfare into additive separable components, namely changes in income and changes in life expectancy or in other non-income dimensions, as for example in Becker *et al.* (2005) or in Jones and Klenow (2010), relies on such assumption.

[21] For the sake of brevity, we omit to report such robustness check here. For more details, we refer the interested reader to Section 4 in Fiaschi and Romanelli (2009).

international prices (I$) drawn from Penn World Table 8.1 (PWT 8.1); the population is taken from the same dataset, while life expectancy at birth comes from the 31st January 2015 release of the World Development Indicators (WDI 2014).[22]

For the model parameters, we use almost the same set as in Becker *et al.* (2005); in particular $\rho = 0.005$, $\pi^D = 0$, so that $LE = T$,[23] and $\sigma = 1/1.250$. For what concerns the estimation of M , we derive it from Eq. (5), setting c^{ZUC} equal to the minimum level of per capita GPD observed in our sample (*i.e.*, I$225.2 for Nigeria in 1995; which implies that $M = 14.8$). This setting represents a lower bound: indeed, no country (not even Nigeria) displays a per capita GDP permanently lower than that (remind that no agent in any case would be willing to consume permanently less than c^{ZUC} and still survive). An alternative specification is proposed by Becker *et al.* (2005), who calibrate M using parameters values estimated from the U.S. economy: specifically, $\varepsilon = u'(c)\, c/u(c) = 0.346$ and $c = 31,439$I$ in 1990, from which $M = 16.7$.[24] The implied zero utility consumption, c^{ZUC} , would be equal to I$419 (see Eq. (5)): an individual whose consumption in every period is equal to I$419 would be indifferent between living or dying independently of her life expectancy. In our sample there are 3 countries for which per capita GDP would be lower than I$421 for at least 20 per cent of the time span (Mozambique, Democratic Republic of the Congo, Nigeria). This leads us to focus on the first and more conservative calibration for *M*. However, the findings discussed below appear robust to alternative specification of the model's parameters.[25] What could make a difference is a (implausible) value of c^{ZUC} close to zero, which would determine a collapse in the Gini index.

As discussed above, a country's welfare is computed by Eq. (10) assuming $g = 0$.[26]

In order to gain an intuition of the relationships between per capita GDP, life expectancy and welfare, Figure 1 displays a series of level curves for welfare in the space *(per capita GDP*, *life expectancy)*. It also reports the positions of some representative countries in 1980 (diamond) and in 2011 (grey circle).

Between 1980 and 2011, for example, Cote d'Ivoire and Democratic Republic of the Congo show a decrease in their welfare, while China and India a large increase. Some developed countries present a relatively high increase in their life expectancy (Italy and Japan), while others a relatively marked increase in their per capita GDP (*i.e.*, the United States). The numbers reported in the three triangles along the dashed line (which represents an estimation of the "Preston Curve" in 2011) are the marginal rates of substitution (MRS) between life expectancy and per capita GDP (expressed in ten 2005 international dollars). As expected, at very low levels of life expectancy and per capita GDP (respectively around 35 years and I$440), individuals value income relatively more than life expectancy (*i.e.*, individuals value I$10 more in each year of their life equal to 1.4 years of life expectancy at birth). Instead, at very high level of life expectancy and per capita GDP (respectively 82 years and I$39100), the opposite occurs (*i.e.*, individuals value I$10 per year equal

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22 Appendix B reports the country list; expenditure-side real GDP at chained PPPs in 2005 international prices: variable *rgdpe* in Penn World Table 8.1, see http://www.ggdc.net/pwt; population: variable *pop* in Penn World Table 8.1; life expectancy at birth: variable *SP.DYN.LE00.IN* in World Development Indicators, see http://databank.worldbank.org/data/home.aspx/

23 An alternative specification could consider $T \to \infty$, from which $LE = 1/\pi^D$, thus setting π^D equal to the inverse of the observed life expectancy, in the estimates of the agent's utility. All the empirical results reported below are robust to this alternative specification.

24 Indeed, from Eq. (3) $M = c^{(1-\sigma)}\,[1/(1-\sigma) - 1/\varepsilon]$.

25 See Fiaschi and Romanelli (2009) for a broader discussion.

26 For example, the expected welfare of a representative American newborn in 2011 is:

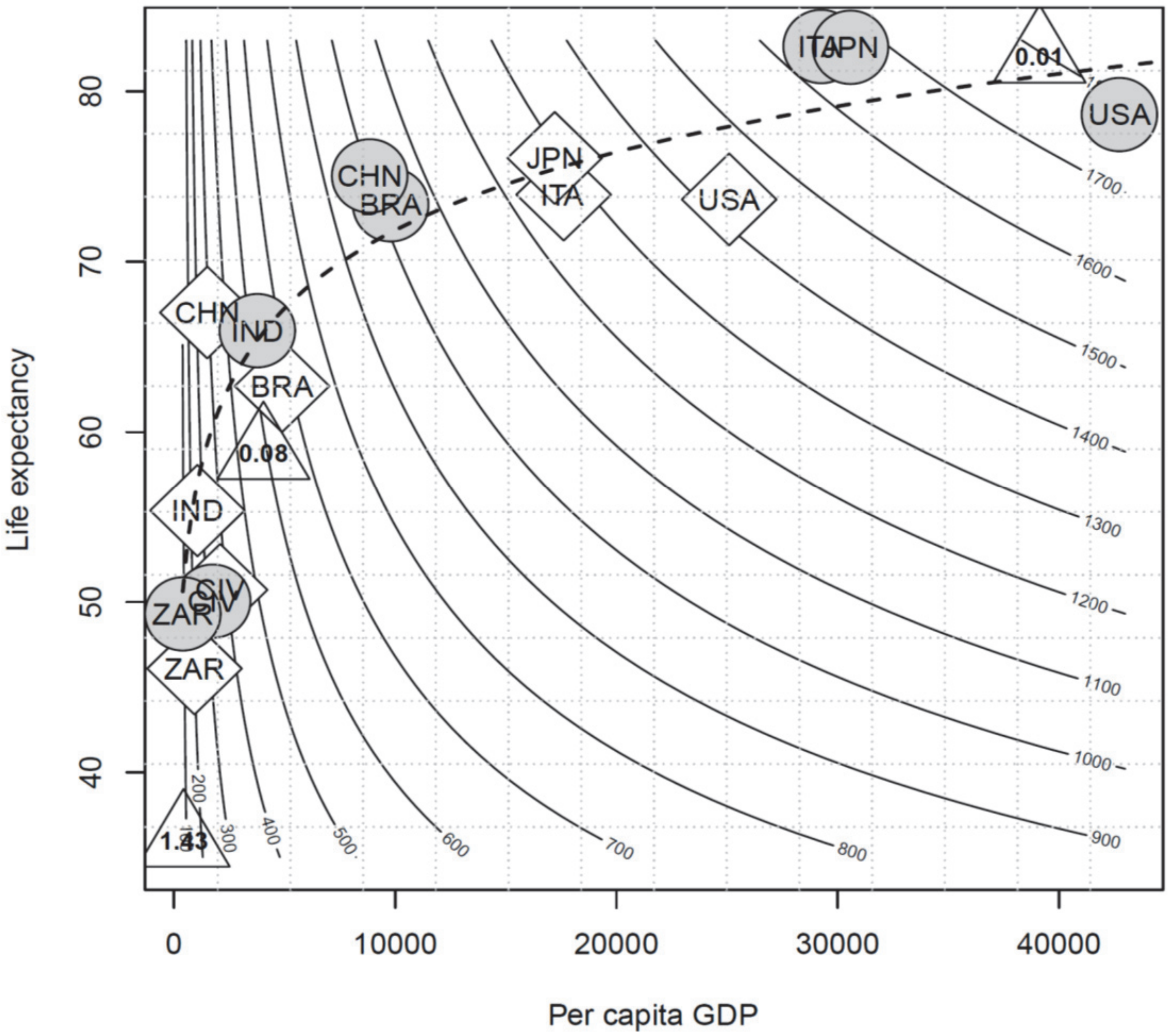
$$V_{US} = \left(\frac{1}{1-\sigma}\right)\left\{\frac{\exp\left(-\rho LE_{US}\right)-1}{\rho}\left[(1-\sigma)\,M - yl_{US}^{1-\sigma}\right]\right\} = 1782.1,$$

where $yl_{US} = $ I$42734 and $LE_{US} = 78.64$.

Figure 1

Welfare Calculated with *g* = 0 for a Sample of Countries in 1980 (Diamond) and in 2011 (Grey Circle)

(ten international dollars)



Country codes: Brazil (BRA), China (CHN), Cote d'Ivoire (CIV), India (IND), Italy (ITA), Japan (JPN), Democratic Republic of the Congo (ZAR), United States (USA).
Numbers in Triangles are the Marginal Rate of Substitution Between Life Expectancy and per capita GDP.

to 0.01 years of life expectancy at birth).[27] The marginal rate of substitution in the bottom part of the distribution clearly depends on c^{ZUC}: for example, if c^{ZUC} is around I\$100 at the same low level of life expectancy and per capita GDP (35 years and I\$440)individuals value I\$10 per year equal to 0.7 years of life expectancy at birth, while at high level of per capita GDP and life expectancy (82 years and I\$39100) the MRS remains unchanged (at 0.01). The latter finding is not surprising, given that for rich people the level of c^{ZUC} is almost irrelevant.

27 This feature stems from the fact that while marginal utility of consumption decreases, that of life expectancy does not. Hall and Jones (2007) discuss such element as an explanation for the increasing size in health care expenditure the richer the country.

Table 1

Descriptive Statistics for the Sample's Variables

Year		**1960**	**1980**	**2000**	**2007**	**2011**
Per capita GDP						
	Mean	3536	5779	8612	10493	10962
	Gini	0.56	0.60	0.60	0.54	0.51
	Top 5%	0.323	0.272	0.254	0.232	0.222
	Bottom 5%	0.005	0.005	0.003	0.004	0.004
Life expectancy						
	Mean	51	63	68	70	71
	Gin	0.12	0.07	0.07	0.06	0.06
Welfare (g = 0)						
	Mean	425	588	753	872	917
	Gini	0.40	0.35	0.32	0.28	0.26
	Top 5%	0.203	0.152	0.128	0.119	0.117
	Bottom 5%	0.009	0.012	0.006	0.01	0.011
Pop						
	Total (*millions*)	2548	3789	5272	5752	6024

Table 1 reports some descriptive statistics of the sample, including a set of inequality indices for selected years (1960, 1980, 2000, 2007 and 2011). Following the standard in the literature on income distribution, inequality is measured in relative terms, even though we are aware of the possible important consequences of such choice in our analysis with variables generally growing over time. For example, if the average welfare is increasing over time a constant relative inequality would mean an increasing absolute inequality.[28]

Inequality in both per capita GDP and life expectancy across populations decreased markedly from 1960 to 2011, with the inequality of per capita GDP always higher than the one of life expectancy. Accordingly, we can also observe a strong reduction in the inequality of welfare and a level that is systematically lower than that of income inequality. However, looking at two sub-periods, namely 1960-1980 and 1980-2011, per capita GDP and life expectancy seem to follow two different patterns: inequality in income first rose and then started declining, while disparities in life expectancy shrank dramatically in the first sub-period and then remained substantially constant. This is consistent with Ram (2006) who finds in fact a reversal in the convergence dynamics of life expectancy at the country level after 1980 (see also Bloom and Canning (2007) and Becker *et al.* (2005) for similar findings). This is also the reason why we will focus on such two sub-periods to elicit long-run tendencies.

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[28] See Anand and Segal (2008) for a discussion on this issue.

3.3 Distribution dynamics of welfare

To further investigate the evolution of welfare inequality over time, we use the non-parametric methodology proposed in Fiaschi and Lavezzi (2003). In particular, Section 3.3.1 reports the estimated growth path of welfare so to detect possible non-linearities, a necessary condition for the presence of polarization; Section 3.3.2 then analyses how the distribution of welfare has changed, estimating also the evolution of the joint dynamics of per capita GDP and life expectancy over time and the related stochastic kernels; and, finally, Section 3.3.4 discusses the long-run tendencies by comparing the actual distributions and the estimated ergodic distributions.

3.1.1 Con(Di)vergence in welfare

Figures 2-3 report the population-weighted estimate of the growth paths of welfare. In particular, they show the estimate of Model (11) over different time-spans, where *x* is the log of welfare level.

$$\overline{GR}_i^x = m\left(x_i^{INI}\right) + \epsilon_i; \tag{11}$$

$\overline{GR}_i^x$ is the average growth rate of *x* in country *i* in a given period, x_i^{INI} is the initial value of *x* and ε_i is an independently distributed random variable with zero mean.[29]

The estimate of *m* (.) is made using the Nadaraya-Watson estimator with the optimal normal bandwidth.[30]

A note of caution is needed. It is well-known that in presence of measurement errors related to the initial value of *x*, the linear estimate of Model (11) can be biased in favour of convergence (*i.e.*, at low level of x is associate a higher growth rate). Heuristically, non-parametric regressions, given their nature of "local" regressions, should be more robust to the presence of non-classical measurement errors, in particular larger errors in the lower tail of the distribution, because they would not affect the whole range of the variable; however, the problem still remains.[31]

The growth path welfare is estimated for the whole period 1960-2011 and for the subperiod 1980-2011.[32] The figures report the cross-population estimates, where the weights used are the population sizes at the initial year. Dotted lines represent the pointwise confidence intervals at 95 per cent (see Ha¨rdle *et al.* (2004)) and the red line signals the overall annual average growth rate. We also report countries' observations by circles, whose area is proportional to their population at the initial year (the country-codes reported in the figures refer to the top ten countries by population size). Finally, Sub-Saharan countries are represented by grey circles.

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29 Usually, the relationship between the income growth rates of a cross-section of countries and their levels of income is called "growth path" because, under the assumption of an equal stochastic process governing income growth in all countries, this relationship should represent the path followed by each country in its development. With a slight abuse we use the same denomination for the case of our welfare measure.

30 All the calculations and estimates in the paper are made using R. The estimates of nonparametric regressions are made using the package *sm* (see Bowman and Azzalini (2005)).

31 For example, one of the two main components of the welfare measure, that is life expectancy, can suffer from an upward bias particularly relevant at lower levels of the variable and which could decline over time, affecting the estimates for poor countries, see Becker *et al.* (2005), p. 278.

32 We also performed the same estimation for per capita GDP and life expectancy separately. In the case of life expectancy, the growth rate is replaced by the average difference. The estimates for the subperiod 1960-1980 and all the estimates for per capita GDP and life expectancy are available upon request.

Figure 2

Growth Path for Welfare in 1960-2011

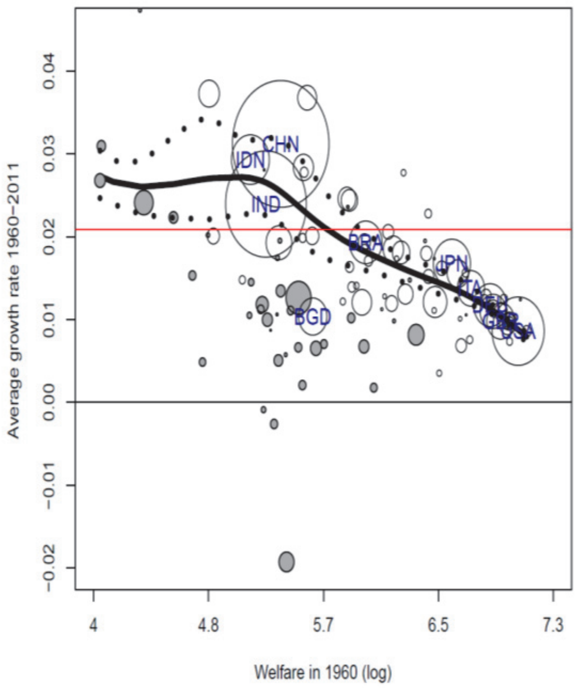
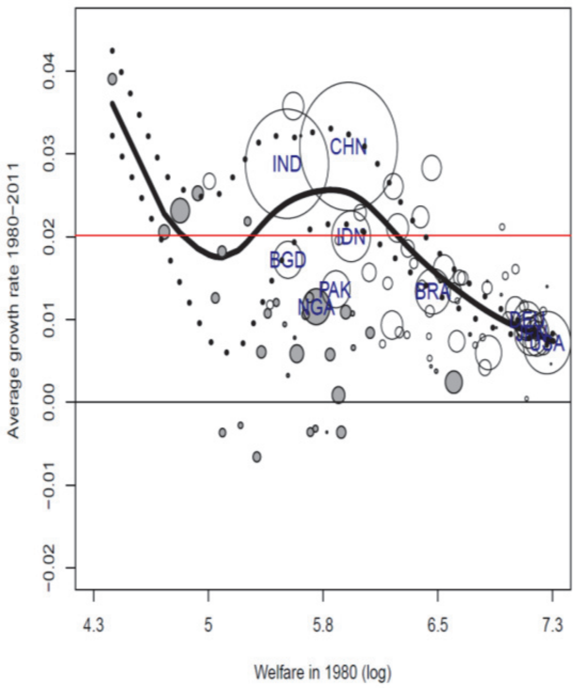


Figure 3

Growth Path for Welfare in 1980-2011



For the entire timespan 1960-2011, the growth path of welfare points to convergence, at least at medium-low levels of welfare (see Figure 2). The main driver of such dynamics is the evolution characterising the populations of some of the largest (and still poor in 1960) countries in the world, such as China, India and Indonesia,[33] and in particular their spectacular performance both in terms of income growth rates and life expectancy gains.

However, at lower levels of welfare the caching up process seems less robust and some populations appear instead to be getting trapped into middle-welfare levels. Focusing on the period 1980-2011 (Figure 3), such club-convergence dynamics appears clearer. As some of the Asian largest countries continue along their convergence path, other large populations with similar welfare levels (for example, those from Bangladesh or Pakistan) get relatively stuck. Indeed they have not over-performed compared to the people from high-income countries, so that the gap between those populations and the rich people has been growing in absolute terms.

A specific case can then be made for the populations of Sub-Saharan countries, whose wellbeing is rather diverging, with general stagnant or even negative growth rates. This is owed both to their gloomy performance in terms of GDP growth rates compared with that of China and India and to their very small increases in life expectancy mainly due to AIDS epidemics which had, and, unfortunately, continue to have, a devastating impact on mortality rates in the area (see, e.g., Bloom and Canning (2007)). Such evidence is not substantially reverted even when we take a look at the years of the "African growth miracle", which has characterised African countries' income growth rates in the first decade of the XXI century (Rodrik (2014)): even though a light convergence toward the medium-welfare club could be detected (Figure 4), it seems to have lost its momentum after the beginning of the Great Recession (Figure 5).

[33] They represent almost 50 per cent of the total population in the sample in 2011.

Figure 4

Growth Path for Welfare in 2000-2011

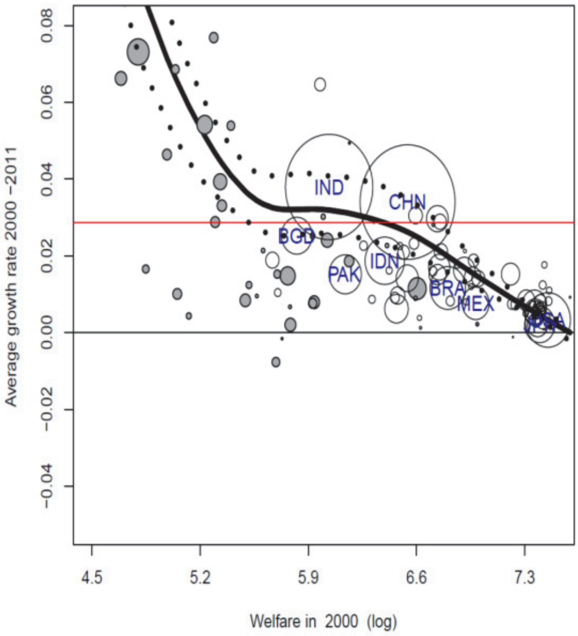
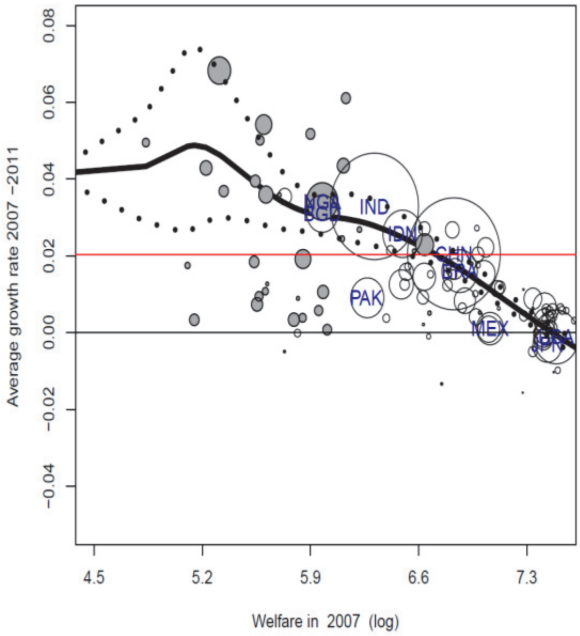


Figure 5

Growth Path for Welfare in 2007-2011



Looking separately at the two welfare components, namely income and life expectancy, a clear convergence path across the world population over the entire period considered (1960-2011) is observable only at very high levels of per capita GDP. However, focusing on the period 1980 onwards, the picture is rather different, with convergence regarding populations only at low-medium level of income. This pattern is mainly due to the high growth rates of four big Asian countries, Bangladesh, China, India and Indonesia, as already mentioned. Instead, very poor people, *i.e.*, people from Sub-Saharan countries, tends to diverge.

On the contrary, life expectancy across population shows a clear path of convergence between 1960 and 2011, driven by large gains in life expectancy of highly populated Asian countries. Again, since 1980 things seem to change and convergence stops. The population of the Sub-Saharan countries are left behind, and no convergence of the people with medium life expectancy to those with high expectations occur. Also high life expectancy countries stop converging. Various explanations have been proposed, among which the increasing difficulties in transferring medical technology among countries with respect to the past (e.g., immunization and antibiotics), and the different role of the governments in the health system.[34]

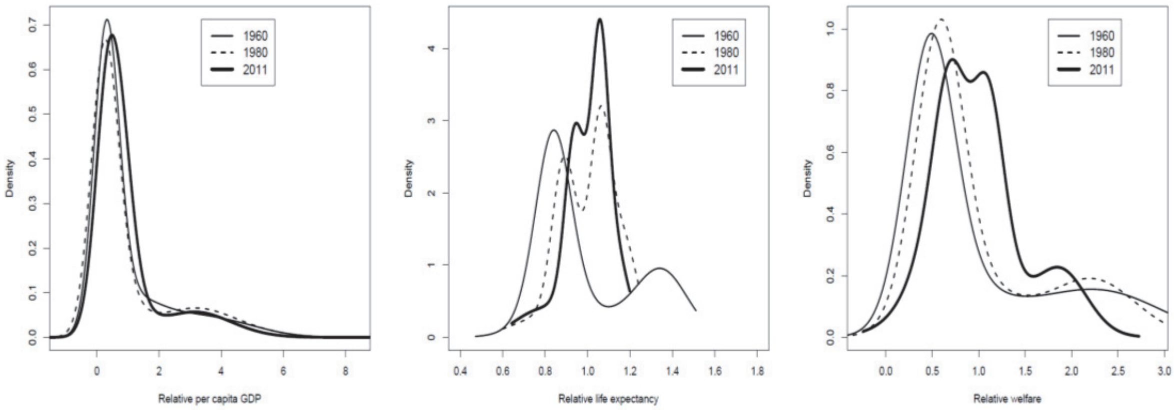
Overall the evidence suggests the presence of polarization across world population. In particular, the '80ies seem to mark a change in the dynamics of convergence. The evolution of welfare appear highly non-linear and affected by a strong cross-country heterogeneity. The next section discusses the implications for the distribution dynamics.

[34] We refer to Easterlin (2004), Cap.7, and Becker *et al.* (2005) for a more detailed discussion of the possible causes.

Figure 6

Estimated Distributions

(a) Relative GDP **(b) Relative Life Expectancy** **(c) Relative Welfare**



3.3.2 The evolution of the distribution of per capita GDP, life expectancy and welfare from 1960 to 2011

In the following we first report estimates of the distribution of welfare in three significant moments – at the beginning, in the middle and at the end of the period considered (Figure 6) – and then we analyse the dynamics of such distribution focusing on the period 1980 onwards. In particular, for this second step we estimate the evolution of the joint distribution of per capita GDP and life expectancy and then the stochastic kernel for welfare, so to take into account non-linearities.[35]

In estimating densities, we use the *adaptive kernel estimation* with the Gaussian kernel as suggested by Silverman (1986).[36]

Turning to the results, we already noted that inequality of per capita GDP among the world population decreased between 1960 and 2011 (actually the declining trend started in 1980). The Gini index indeed falls slightly but significantly from 0.56 in 1960 to 0.51 in 2011 (see Table 2). Looking at the distributions of relative GDP (Figure 6a), apparently they seem to be always single-peaked (around 0.5) with a thick right tail in all three years, even though as time goes by a second peak around 3.5 becomes more and more evident: indeed tests for the presence of multimodality in the per capita GDP distributions suggest that while unimodality cannot be rejected for the distribution in 1960, bimodality is instead a likely feature already in 1980 (see Table 3).[37] This in turn points to a stronger identification of at least two clusters of populations.

The picture for life expectancy is slightly different (Figure 6b). Inequality decreases from 1960 to 1980, and then remains steady. The Gini index almost halves in the first twenty years considered (from 0.12 in 1960 to 0.07 in 1980; see Table 2) and then stops. Polarization is clearly present since 1960, as suggested by the multimodality tests which support the presence of multiple modes in the distribution from the very beginning (see Table 3). However, the two groups (*i.e.*, the two modes), although neatly separated, tend to be closer over time.

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[35] The stochastic kernels of per capita GDP and life expectancy are not reported for the sake of brevity. They are all available upon request.

[36] See Appendix C.

[37] For the 1980 distribution, the null hypothesis of unimodality is rejected with a p-value of 0.024, while the null hypothesis of bimodality would be rejected only with a p-value equal to 0.346. Details on the tests of multimodality are presented in Appendix D.

Table 2

The Gini Index of the Distributions of Per Capita GDP, Life Expectancy and Welfare (*g* = 0)

Year	GDP	Life exp.	Welfare ($g = 0$)
1960	0.56 ** (0.015)	0.12 *** (0.006)	0.40 *** (0.011)
1980	0.60 *** (0.013)	0.07 ** (0.005)	0.35 *** (0.012)
2011	0.51 (0.022)	0.06 (0.005)	0.26 (0.017)

Note: Standard errors are in parentheses. The results of the test on the equality between Gini indices (base-year 2011) are reported as follows: ”#”15 per cent significance level, ”*” 10 per cent significance level, ”**” 5 per cent and ”***” 1 per cent.

Table 3

P-value of the Null-hypothesis of Unimodality and Bimodality of the Cross-population Distribution of Per Capita GDP, Life Expectancy and Welfare

	Unimodality Test			Bimodality Test		
Year	**GDP**	**Life Expectancy**	**Welfare**	**GDP**	**Life Expectancy**	**Welfare**
1960	0.722	0.000	0.022	0.374	0.194	0.528
1980	0.024	0.026	0.016	0.346	0.036	0.272
2011	0.020	0.028	0.016	0.342	0.130	0.000

As a result of the dynamics of per capita GDP and life expectancy, the inequality of the cross-population distribution of welfare decreases remarkably, while clusterization strengthens over time. Not only all the distributions are two-peaked, but the 2011 distribution seems to be characterised by the emergence of a third peak (supported also by the tests for multimodality), made of some of the populations in the lower welfare group who turn out to be less able to catch up (Figure 6c).

Both the growth paths and the distribution estimates support the idea of a polarization or club convergence dynamics of welfare across populations, besides an overall reduction in inequality. In particular, such dynamics starts realizing in the ’80ies. Per capita GDP tends to polarize and life expectancy stops converging. The evidence is towards the formation of at least two clusters over the last 3 decades, with the possibility of a third cluster in the lower part of the distribution of welfare. Analysing the evolution of the joint dynamics of (relative) per capita GDP and life expectancy between 1980 and 2011 across populations can shed some lights on what forces are at play.

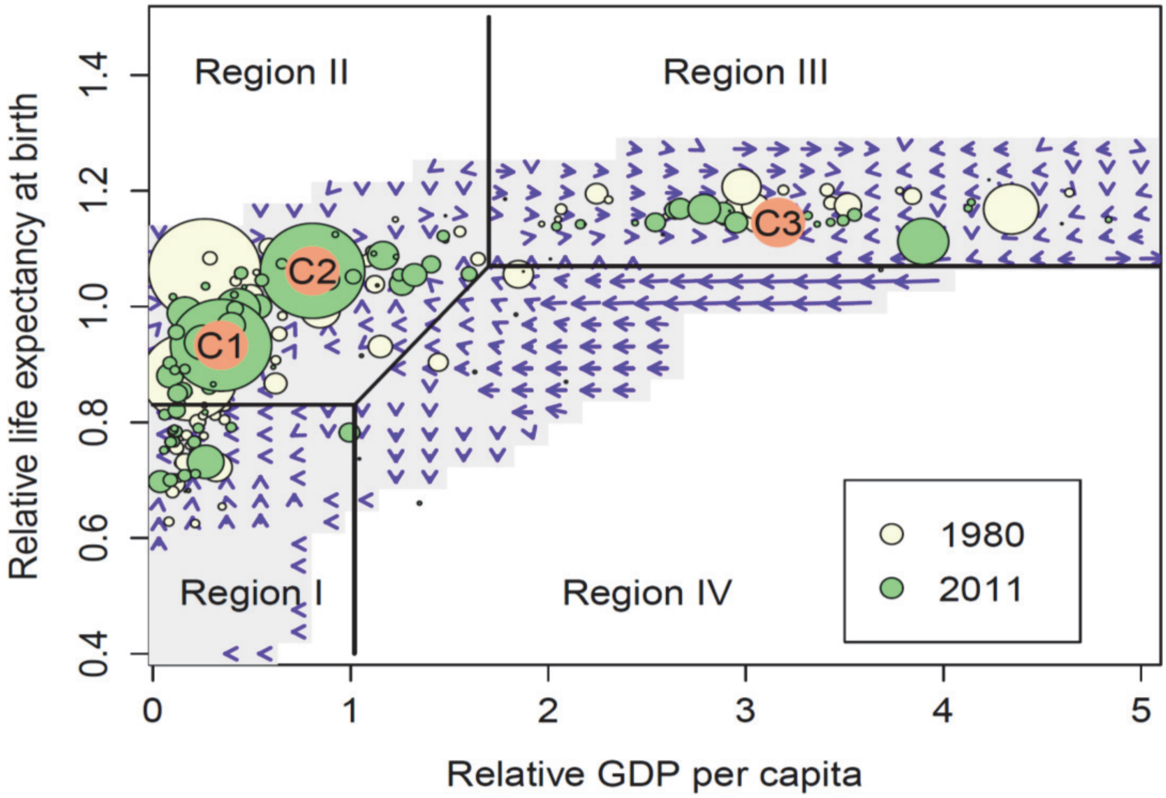
3.3.3 *Club-convergence in welfare*

Figure 7 depicts a vector field, where the arrows indicate the direction and magnitude of

Figure 7

The Joint Dynamics of Relative Per Capita GDP and Relative Life Expectancy, 1980-2011

(circles represent countries in 1980 (light yellow) and in 2011 (light green)
and their size is proportional to countries' populations)



the joint dynamics of per capita GDP and life expectancy at different points in the space *(per capita GDP*, *life expectancy)*.[38]

Circles, representing countries observations in 1980 (light yellow) and in 2011 (light green), are proportional to the size of the countries population.

Four regions are defined on the basis of the pattern of the arrows: in particular, the frontiers of the regions are drawn where the vector field displays divergent dynamics. The Sub-Saharan countries lay in Region I, the highly populated countries (*i.e.*, China and India) are located in Region II and the OECD countries in Region III. Basically, no country is located in Region IV, suggesting that a high per capita GDP is always associated with a long life expectancy.

From 1980 to 2011 the distribution of populations across the four regions changes in favour of Region II: the probability mass varies from (0.1, 0.72, 0.16, 0.02), respectively, in Region I, II, III and IV in 1980 to (0.09, 0.75, 0.16, 0.0) in 2011. The change mainly reflects the transition into Region II of some large Sub-Saharan populations, such as Ethiopian and Tanzanian. Mobility across regions however is very low (with the obvious exception of Region IV, which is basically empty): the probabilities that an individual in Region I, II, III and IV were in the same region in 1980 and in 2011 are respectively equal to (0.64, 0.97, 1, 0).

[38] For the methodology used, refer to Appendix E.

In terms of per capita GDP at least two clusters of populations seem to exist in 2011, one in Region II (*i.e.*, populations with relative per capita GDP of around 0.5) and the other one in Region III (*i.e.*, populations with relative per capita GDP of around 3).[39] Similarly, the distribution of life expectancy shows at least two clusters in 2011, one in Region II (around 1.0) and one in Region III (around 1.15). The joint distribution of life expectancy and per capita GDP, therefore, suggests the existence of (at least) two clusters of populations also in terms of welfare. However, looking at both lower levels of per capita GDP (around 0.10.2) and life expectancy (around 0.8) a non-negligible mass of countries can be detected, pointing to the possible presence of a third cluster (in line with the observation drawn from the analysis of the welfare distribution in 2011, cf. Figure 6c).

For descriptive purposes only, we applied the *k-medians algorithm* to the observations in 2011 assuming the existence of such three clusters;[40] the centroids of these three possible clusters are located in C1 = (0.34, 0.93), C2 = (0.81, 1.06) and C3 = (3.16, 1.15): we refer to Appendix B for the list of countries (and their share of the world population) in the different clusters.

Cluster 1 is centred at low levels of per capita GDP (about 34 per cent of the average) and life expectancy (about 93 per cent of the average); it is mainly composed by populations from Sub-Saharan countries, some very large countries in South Asia, like India, Indonesia and Bangladesh, and few North African countries, like Egypt and Morocco. All low-income populations present on average also a low life expectancy, as suggested by the Preston curve. Cluster 2 is centred at relatively low levels of per capita GDP (about 80 per cent of the average) and medium-high levels of life expectancy (around 106 per cent of the average); apart from China, the cluster is mainly composed of Latin American populations and people from Central Asia. Finally, Cluster 3 is centred at high levels of per capita GDP and life expectancy (both variables are well above the average, *i.e.*, 316 and 115 per cent); the cluster is formed by OECD countries located in Western Europe, Western Offshoots and by some Asian Tigers, like Hong Kong, Korea and Singapore. The three clusters therefore appear to have a strong regional characterization.

Table 4 reports some descriptive statistics of the three clusters.[41] Cluster 1 only partially fits the description made by Collier (2007) of the poverty trap: even tough it is characterised by very low income and life expectancy levels, a relatively high level of social conflict, lowquality institutions and governance and the lowest level of human capital, income growth rates are not dissimilar to that of Cluster 3 and output does not seem to rely only on natural resources (as suggested by the even share of manufactures exports of the total of merchandise exports). Moreover, saving rates are substantial.

Also Cluster 2 seems to be partially plagued by high political instability and social conflict, as well as by low-quality institutions. However, it presents a very high level of savings, a higher stock of human capital, a higher share of output deriving from manufactures and a lower population growth rate. Moreover, the growth rate on average is by far the largest. Overall this results in substantially higher levels of both per capita income and life expectancy with respect to Cluster 1. Finally, Cluster 3 is, by far, the cluster with the highest living standards under several points of view (e.g., not only for the high level of per capita income and life expectancy, but also for less growth volatility, low intensity of social conflicts, etc). Moreover, remarkably larger than

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39 Quah (1997) finds a similar feature.

40 See Leisch (2006) for details. We choose the *k-medians algorithm* since its objective is to minimize the total intra-cluster absolute distance; it thus appears more robust to outliers than *k-means algorithm.*

41 In particular, we report some average characteristics of the countries belonging to the three different clusters in 2011, weighted by populations' size. Apart from average income, average life expectancy and population growth, we consider the average volatility of the income growth within the clusters, indicators of capital accumulation (gross fixed capital formation) and human capital accumulation (the share of the labour force with at least a secondary or a tertiary degree) and measures of the quality of governance and political instability.

Table 4

Descriptive Statistics for the Three Clusters of Countries in 2011 Selected Variables

	Cluster 1	**Cluster 2**	**Cluster 3**
Average per Capita GDP (PPP $2005)	3,240	9,944	35,792
Average Growth Rate of per Capita GDP 1980-2011 *(annual percent)*	2.73	4.5	2.15
Stand. Dev. of the Growth Rate of per Capita GDP 1980-2011	1.76	1.92	1.04
Average Life Expectancy	64	74	81
Gross capital formation *(percent of GDP)*	27.60	36.61	20.43
GG public expenditure *(percent of GDP)*	23.32	28.26	41.78
Total health expenditure *(percent of GDP)*	4.22	5.71	12.28
Labor force with secondary education *(percent of total)*	28.68	36.79	44.55
Labor force with tertiary education *(percent of total)*	14.50	20.27	29.55
Manufactures exports *(percent of merchandise exports)*	50.41	74.36	70.29
Political Stability and Absence of Violence *(percentile rank)*	13.78	29.04	69.03
Regulatory Quality *(percentile rank)*	35.62	47.04	88.24
Rule of Law *(percentile rank)*	37.88	44.42	88.41
Population growth *(annual percent)*	1.71	0.69	0.56
Population *(percent of total)*	47.28	36.52	16.20

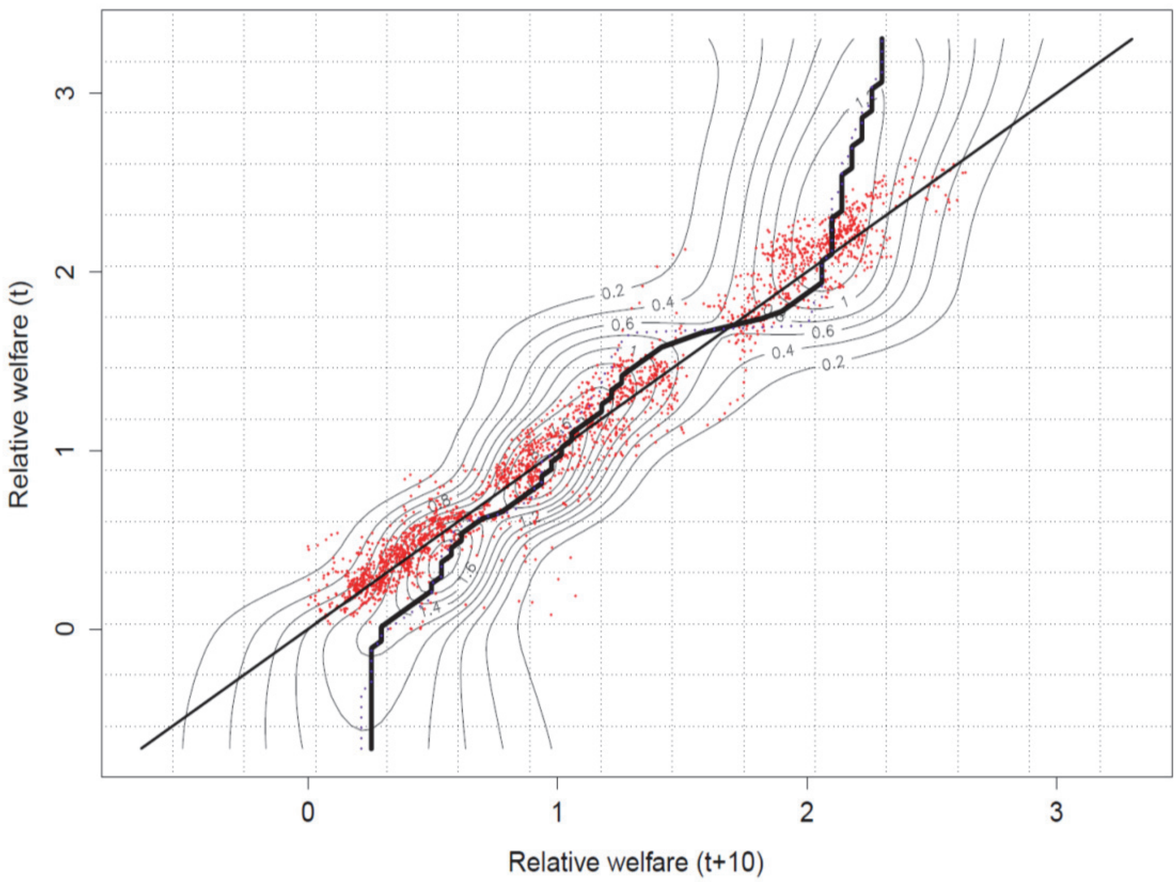
Source: PWT 8.1, World Development Indicators 2014 (January 2015 release), World Economic Outlook (April 2015) and Worldwide Governance Indicators (www.govindicators.org).

in the other two clusters are also the size of the public sector and the resources (both public and private) devoted to health care.

Given the evolution of the joint distribution of income and life expectancy, a clearer picture on how welfare (that is on how the non-linear combination of per capita GDP and life expectancy) evolves can be given by the estimation of its stochastic kernel over the period 1980-2011, which overcomes the bias in the estimates of the growth paths caused by the presence of cross-country heterogeneity.

Figure 8

Stochastic Kernel Estimation of the Relative Welfare (*g* = 0)



The stochastic kernel indicates for each level of *x* at time t the probability distribution of *x* at time $t + \tau$.[42] In the estimate, τ is set at ten years to reduce the influence of short-run fluctuations. The total number of observations is 2163).

Figure 8 reports also a solid line representing the estimated median value at $t + \tau$ conditional on the value at time *t*, a dotted light-blue line indicating the "ridge" of the stochastic

kernel (which is the mode at t + τ conditional on the value at time t), and the 45° line. The red dots represents observations.

Two clusters of populations are located around 1 and slightly above 2 can be clearly detected (see Figure 8) even though a third substantial mass can be noticed at lower level of welfare. Accordingly, in terms of relative welfare in 2011, Centroid C1, C2 and C3 of Figure 7 correspond to around 0.5, 1 and 2.1 respectively.

[42] More formally, let q $(x_t, x_{t-\tau})$ be the joint distribution of $(x_t, x_{t-\tau})$ and f $(x_{t-\tau})$ be the marginal distribution of $x_{t-\tau}$, then the stochastic kernel is defined as $g_\tau (x_t|x_{t-\tau}) = q(x_t, x_{t-\tau}) / f(x_{t-\tau})$. The ergodic distribution $f_\infty(x)$ is implicitly defined as $f_\infty(x) = \int_0 g_\tau(x|z) f_\infty(z)\, dz$

Table 5

The Gini Index of the Estimated Ergodic Distributions of Per Capita GDP, Life Expectancy and Welfare (g = 0)

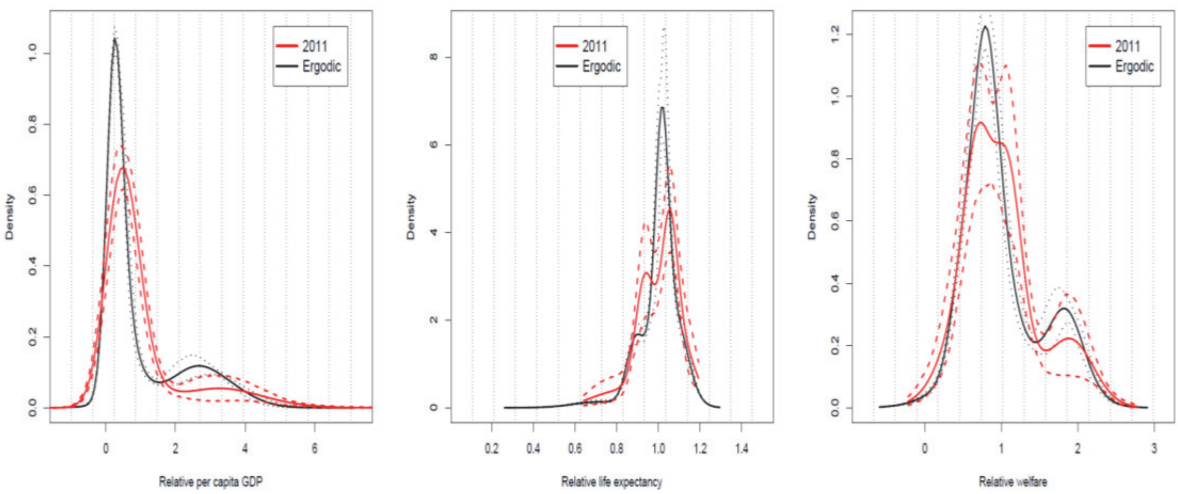
Year	GDP	Life Expectancy	Welfare (g = 0)
2011	0.51	0.06	0.26
	(0.022)	(0.005)	(0.017)
Ergodic	0.61	0.05	0.27
	(0.006)	(0.001)	(0.005)

Note: Standard errors in parentheses; those relative to the ergodic distribution are calculated by the bootstrap procedure described in Appendix G.

Figure 9

Estimated Ergodic Distributions

(a) Relative GDP **(b) Relative Life Expectancy** **(c) Relative Welfare (g = 0)**



3.3.4 The ergodic distribution of per capita GDP, life expectancy and welfare

The estimate of the ergodic distribution of per capita GDP, life expectancy and welfare by stochastic kernel aims at assessing the long-run tendencies resulting from the distribution dynamics just discussed. In other words, the ergodic distribution shows if the estimated distribution dynamics in the period 1980-2011 have completely exhausted their effects on the distribution in 2011 or, instead, whether significant distributional changes are embedded in the ongoing process. Clearly, such estimate of the long-run tendencies does not take into account structural shocks which could lead to non-stationarity.

The ergodic distributions are estimated following the procedure in Johnson (2005), adjusted for the use of normalised variables (with respect to the average) in the estimate.[43] Both the ergodic distribution and the distribution in 2011 are depicted with their confidence intervals at 95 per cent significance level, computed via a bootstrap procedure suggested in Bowman and Azzalini (1997) (Figure 9).[44]

Both inequality and polarization of the cross-population distribution of per capita GDP would increase. The Gini index of the ergodic distribution is indeed equal to 0.61 versus 0.51 in 2011 (see Table 5). The presence of two clearly identified group of populations becomes neater and neater.

By contrast, inequality in life expectancy would continue to stay stable (the Gini index of the ergodic distribution is substantially unchanged with respect to 2011: 0.05 vs. 0.06; see Table 5), while polarization would probably slightly decrease.

As a result, inequality of the cross-population distribution of welfare will stop decreasing (or even increase; see Table 5). The high-welfare peak already present in 2011 is more and more evident and identified, while the two lower peaks tend to merge and locate at a relative welfare level lower than 1 (see Figure 9c).

3.4 The world distribution of welfare

So far we have neglected within-country inequality in welfare; however, several contributions related to the world distributions of life expectancy and, mainly, income suggest that such source of inequality can be sizeable and changing over time (see Anand and Segal (2008) for a survey of the literature on the world distribution of income and Pradhan *et al.* (2003) and Ryan (2010) for the world distribution of life expectancy).

In order to have a proper estimate of within-country welfare inequality we need information on the joint distribution of income *and* life expectancy, which could be calculated starting from the two single distributions by a random-matching procedure if the variables were independently distributed. Unfortunately, there is strong evidence which points to the existence of a within-country negative correlation between mortality and socio-economic conditions (see, e.g., Cutler *et al.* (2006) for developed countries, and Grimm *et al.* (2010) for the poor ones). The variability of life expectancy among different income groups can therefore be quite large.[45]

Several works estimate the joint distribution of life expectancy and socio-economic indicators,[46] but very few (three to our knowledge) directly put into relation income and life expectancy. In particular, Gerdtham and Johannesson (2000) estimate life expectancy by income deciles in Sweden, McIntosh *et al.* (2009) make the same for a sample of Canadian population, and, finally, Khang *et al.* (2010) quantify the differences in life expectancy by income quartiles for 4 million public servants in South Korea. Visual inspections of the data supplied by these three

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43 See Appendix F for more details.

44 See Appendix G for more details.

45 For example, Marmot (2004) calculates a difference of almost 15 per cent in the life expectancy at 45 years of age between the lowest and the highest employment grades among the British civil servants.

46 For example Grimm *et al.* (2010) apply a principal component analysis on data collected in the Demographic and Health Surveys to proxy income at household level for 32 countries and use life tables and the survival status information on all children born in the 5 years preceding the surveys to estimate life expectancy; a very similar analysis is made by Harttgen and Klasen (2010) on a smaller sample of developing countries; Singh and Siahpush (2006) study changes in the extent of inequalities in life expectancy at birth in US between 1980-2000 by socio-economic deprivation status computed at counties' level (it is worth to notice that their deprivation index relies, among other things, on the *m*edian incomes of the counties); other studies proxy socio-economic status by education attainment (see, among others, Brønnum *et al.* (2008) for Denmark, Leinsalu *et al.* (2003) for Estonia and Hoi *et al.* (2009) for Vietnam).

studies suggests to model the within-country relationship between relative life expectancy and income in the following way:

$$\frac{LE_i}{\overline{LE}} = \beta_0 + \beta_1 \log\left(\frac{y_i}{\bar{y}}\right), \tag{12}$$

where LE_i and y_i are respectively the life expectancy and the average income of the *i*-th income quantile, and $\overline{LE}$ and $\bar{y}$ the sample averages of life expectancy and income respectively.[47] Indeed, the estimation of Model (12) on the data of Canada, Sweden and South Korea results in an adjusted R-squared which ranges from 0.95 up to 0.98, which provides a strong support in favour of the proposed specification (see Appendix H).

In light of the parameters' estimates reported in Appendix H, we set $\beta_0 = 1.009$ and $\beta_1 = 0.054$ in building the joint distribution of life expectancy and income for all the countries in the sample.[48] In general, such assumption could appear to be very strong, since it implies that the relationship between relative life expectancy and relative income is invariant across countries (notwithstanding, e.g., possible heterogeneity in their health systems) and over time. However, and surprisingly, the differences in the parameters' estimates across countries, also with very different levels of per capita income and life expectancy, are quite modest (see Appendix H), and the analysis will concern a quite short time-span for data unavailability.

The second piece of information we need to estimate the joint distribution of life expectancy and income is the world distribution of income. In this respect we exploit the WYD (World Income Distribution) dataset built and used by Milanovic (2012), which contains income distribution by quantiles drawn from nationally representative household surveys for a large set of countries (covering up to around 95 per cent of the world population).[49] Unfortunately, so far data are available only for a relatively small time period. In particular, we will use the data labelled "1993" for the estimate of the world income distribution in 1993 and those labelled "2005" for the 2005 estimate.[50] The data on within-country inequality are then combined (scaled) with countries' per capita GDP (for consistency with respect to the previous analysis),[51] for deriving the world income distribution; finally, by Model (12) we calculate the joint world distribution of income and life expectancy.

As expected the estimate of the world inequality by the population-weighted crosscountry distribution (Milanovic's Concept 2 inequality) that we have previously discussed,

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47 In the estimate of Model 12 we expect $\beta_0 = 1$ by definition, and β_1 positive, but strongly less than 1. It is indeed reasonable to expect that an increase in the variance of income positively affects the variance of life expectancy but to some limited extent.

48 Such values corresponds to those for Canada, but the use of alternative parameters do not appear to alter the results. In Appendix H we also report the estimates of Model 12 using data for the US, taken from Singh and Siahpush (2006), and for other 15 developing countries, taken from Harttgen and Klasen (2010). Model (12) seems to fit very well all the datasets (expect for Armenia's), according to the adjusted R-squared (the lowest value being equal to 0.74).

49 Other approaches have been followed in the literature. For example, Bourguignon and Morrisson (2002) and Sala-i-Martín (2006) overcome the lack of data on the within-country distribution of income by assuming that similar countries have similar income distributions. Other scholars (e.g. Chotikapanich *et al.* (1997), Schultz (1998) and, for recent estimations, Holzmann *et al.* (2007) and Vollmer *et al.* (2010)) estimate the countries' income distributions assuming a lognormal density function whose first two moments are inferred by the countries' mean income (or per capita GDP) and by a summary of inequality statistics as Gini index. Milanovic (2012) dataset is available at http://go.worldbank.org/IVEJIU0FJ0 to which we refer for more details.

50 In fact, the surveys composing the dataset are not available at annual intervals for most countries. Milanovic (2012) aggregates them around benchmark years, spaced approximately at 5-year intervals so that all countries that have had surveys within that interval are included.

51 This implies that the discrepancy between national accounts GDP and household surveys aggregate income is evenly spread across the distribution. Other approach could be followed: for example allocating the entire gap to the top tail of the distribution or making correction according to a Pareto tail estimate of right tail. Our assumption however is more conservative and reduces the risk of artificially inflating inequality. See Anand and Segal (2008) for a discussion of the issues related to this choice of rescaling.

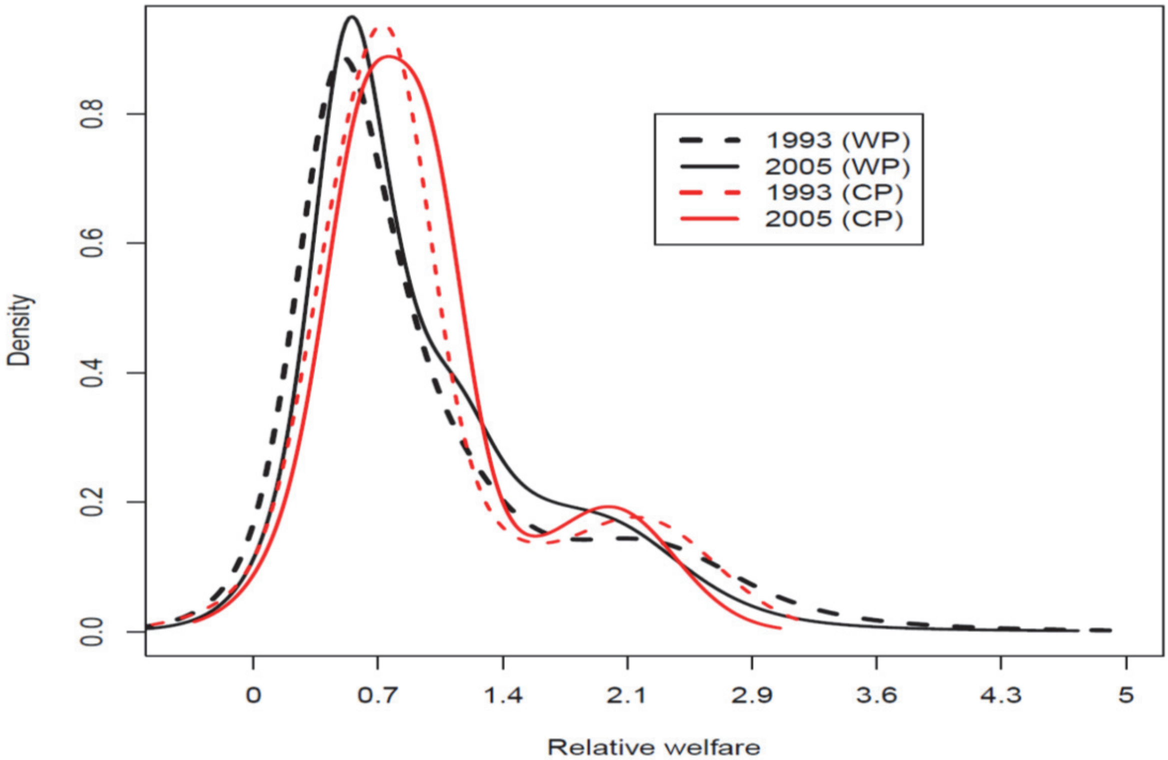
Table 6

A Comparison of Different Levels of Inequality for the World Distribution of Welfare (*g* = 0)

Year	1993	2005
Cross Population	0.34	0.30
World Population	0.42	0.38

Figure 10

The World Distributions and the Cross-population Distribution of Relative Welfare (*g* = 0; with Respect to the Average of the Period) in 1993 and 2005



leads to a substantial undervaluation (by about 8 percentage points in terms of Gini index, see Table 6). However, the downwards trend in welfare inequality is confirmed also for the world distribution of welfare, with a fall of around 4 percentage points from 1993 to 2005, which contrasts with the substantial stability of the Gini index of the world income distribution that several studies observed for the same period (see Anand and Segal (2008) and Milanovic (2012)).

Figure 10 displays the estimates of the world distribution of welfare in 1993 and 2005 and the analogue cross-population distributions.

In 2005 the world distribution presents a two-peaked distributions, with the peaks approximately around the same position (around 0.7 and 2) as in the cross-population distribution, but with a larger mass at the center of distribution. The within-country inequality, therefore, seems to mainly affect the middle-welfare individual.

The comparison of the estimates in 1993 and 2005 gives less clear-cut conclusions for the evolution of world distribution. The two modes are better identified in 2005, but also closer to each other; moreover a non-negligible probability mass is shifting away from the upper tail toward the center of distribution.

4 Concluding Remarks

This paper presents two main contributions to the existing literature on growth empirics: i) it provides a methodology to measure the welfare of a country/individual and ii) it finds evidence of polarization across world population; moreover, such pattern is expected to be persistent in the future.

This evidence is not in contrast with the recent observed impetuous income growth of some large Asian countries nor with the so called ”African growth miracle”; indeed, those countries appear to be converging in terms of populations to a cluster of medium-welfare countries; but these, in turn, are not converging to the high-welfare cluster, because their higher growth of per capita GDP is counterbalanced in terms of welfare growth by the relative large increase in life expectancy experienced by the countries in the high-welfare cluster (equal *absolute variations* in life expectancy have a higher impact in terms of welfare at higher levels of income).

This suggests the existence of middle-welfare traps with relevant policy implications. For countries in the medium-welfare cluster welfare-enhancing policies should complement income growth with health-improving measures. Moreover, assuming the “Preston curve” as a causal relationship at low levels of income (higher levels of income lead to higher levels of life expectancy) implies that the best welfare-improving policy for the very poor countries should be mainly income-growth oriented (as suggested by Sachs (2005) and Collier (2007)). On the contrary, if the causality run from life expectancy to income, as suggested by Lorentzen *et al.* (2008), the limited diffusion of recent medical technology (see Easterlin (2004) and Becker *et al.* (2005)) should increase the concern to provide an appropriate support to health-enhancing policies in poor countries.

Finally, our findings on the distribution dynamics of welfare can integrate the analysis of the effect of globalization on income distribution provided by Milanovic (2012). For example, we can account for many phenomena, such as the migration of the relatively poor people, where the difference in living standards is one of the crucial explanatory factors (see Anand and Segal (2008)).

Four aspects need to be further investigated. First, the methodology used to measure welfare might be extended to account for factors which appear very different across countries, such as the labour market structure, the provision of public goods and the level of taxation, and the market incompleteness. Second, in our approach we do not distinguish between changes in life expectancy at birth due to changes in infant mortality or changes in adult mortality. Given an increase in life expectancy at birth, welfare could differently change if such increase is the result of a fall in infant or in adult mortality. So far the lack of data for a sufficiently large set of countries and years makes this extension problematic; however the observation of the dynamics of infant mortality and adult mortality, that have recently shown opposite trends (being the first one characterized by a strong convergence pattern across countries, while for the second one divergence prevails, see Edwards (2010)), suggests that such extension could provide further support to the conclusion of polarization in welfare. Third, the methodology related to the inclusion of the within-country distribution should be refined. Indeed, taking into account the within-country inequality seems to have a non-negligible impact on the magnitude and the dynamics of the world welfare distribution; however, the non-availability of comparable microdata on the relationship between income and life expectancy for a large sample of countries represents a serious obstacle.

Finally, for a more thorough picture of the world welfare inequality, it could be interesting to consider cases where inequality is measured in absolute terms, and/or where inequality by itself produces a welfare loss (see Gruen and Klasen (2008) and Atkinson and Brandolini (2010), who respectively discuss the same issues but related to the world income inequality).

APPENDIX A
SOLUTION OF THE AGENT'S PROBLEM

The agent solves the following problem:

$$V = \max_{\{c_t\}_{t=0}^{T}} \int_0^T \left(\frac{c^{1-\sigma}}{1-\sigma} - M \right) \exp(-\rho t) S dt \tag{13}$$

$$s.t. \begin{cases} \dot{p} = p\hat{r} + yl - c; \\ p_0 = \bar{p}_0; \\ \lim_{t \to T} p \exp(-\hat{r}t) \geq 0; \end{cases}$$

where $\hat{r} = r + \pi^D$ is the interest rate adjusted for the instantaneous probability of dying before T. Dynamic constraint $\dot{p} = p\hat{r} + yl - c$ in Problem 13 is derived directly from the intertemporal budget constraint given in Eq. (1).

The Hamiltonian of Problem (13) is given by:

$$\mathcal{H} = \left(\frac{c^{1-\sigma}}{1-\sigma} - M \right) \exp(-\rho t) S + \lambda (p\hat{r} + yl - c) \tag{14}$$

and the necessary and sufficient conditions of Problem (13) are the following:

$$\lambda = c^{-\sigma} \exp(-\rho t) S; \tag{15}$$

$$\dot{\lambda} = -\lambda \hat{r}; \tag{16}$$

$$\lim_{t \to T} \lambda p = 0, \tag{17}$$

from which:

$$\frac{\dot{c}}{c} = \frac{r - \rho}{\sigma} = g. \tag{18}$$

Given $\lambda(0) > 0$ and the constraints in Problem 13, Eq. (17) is always satisfied. Since r is assumed constant over time, we have:

$$c_t = c_0 \exp(gt). \tag{19}$$

The growth rate of consumption g is independent of T and S and it represents the steadystate growth rate.

Because of the strict monotonicity of $u(c)$, budget constraint (1) holds with strict equality. Hence, the initial consumption level c_0 is given by:

$$c_0(T, w) = w \left[\frac{g - \hat{r}}{\exp((g - \hat{r}) T) - 1} \right]. \tag{20}$$

Substituting Eq. (19) into Eq. (13) yields the agent's (indirect) utility:

$$V(T, w) = \frac{1}{(1-\sigma)} \left\{ c_0(T, w)^{1-\sigma} \left[\frac{\exp[((1-\sigma) g - \hat{\rho}) T] - 1}{(1-\sigma) g - \hat{\rho}} \right] + \frac{(1-\sigma) M [\exp(-\hat{\rho} T) - 1]}{\hat{\rho}} \right\} \tag{21}$$

where $\hat{\rho} = \rho + \pi^D$. *V* in Problem (13) is an improper integral for $T \to +\infty$ if $(g - \hat{r}) \geq 0$ Therefore if $T \to +\infty$ we must assume that $(g - \hat{r}) < 0$ in order to have a well-defined maximisation problem.

The agent's lifetime wealth w is therefore given by:

$$w = \frac{yl_0 \left[\exp\left(\left(g - \hat{r}\right)T\right) - 1\right]}{g - \hat{r}} + \bar{p}_0, \tag{22}$$

which substituted in Eq. (21) yields:

$$V\left(T, yl_0, g\right) = \frac{1}{1-\sigma}\left\{\left(\frac{yl_0 \left[\exp\left(\left(g - \hat{r}\right)T\right) - 1\right]}{g - \hat{r}} + \bar{p}_0\right)^{1-\sigma}\left(\frac{\exp\left(\left(g - \hat{r}\right)T\right) - 1}{g - \hat{r}}\right)^{\sigma} + \frac{\left(1-\sigma\right)M\left[\exp\left(-\hat{\rho}T\right) - 1\right]}{\hat{\rho}}\right\}. \tag{23}$$

APPENDIX B
COUNTRY LIST WITH THE INDICATION OF CLUSTERS

Table 7

Country List with the Indication of Clusters

Country Name	Population 2011 *(million)*	Cluster in 2011	Country Name	Population 2011 *(million)*	Cluster in 2011
Bangladesh	150.49	1	Chile	17.27	2
Benin	9.10	1	China	1324.35	2
Bolivia	10.09	1	Colombia	46.93	2
Burkina Faso	16.97	1	Costa Rica	4.73	2
Burundi	8.58	1	Dominican Republic	10.06	2
Cabo Verde	0.5	1	Ecuador	14.67	2
Cameroon	20.03	1	Equatorial Guinea	0.72	2
Central African Republic	4.49	1	Gabon	1.53	2
Chad	11.53	1	Iran, Islamic Rep.	74.8	2
Comoros	0.75	1	Jordan	6.33	2
Congo, Dem. Rep.	67.76	1	Malaysia	28.86	2
Congo, Rep.	4.14	1	Mauritius	1.31	2
Cote d’Ivoire	20.15	1	Mexico	114.79	2
Egypt, Arab Rep.	82.54	1	Panama	3.57	2
El Salvador	6.23	1	Peru	29.4	2
Ethiopia	84.73	1	Romania	21.44	2
Fiji	0.87	1	South Africa	50.46	2
Gambia, The	1.78	1	Sri Lanka	21.05	2
Ghana	24.97	1	Thailand	69.52	2
Guatemala	14.76	1	Trinidad and Tobago	1.35	2
Guinea	10.22	1	Tunisia	10.59	2
Guinea-Bissau	1.55	1	Turkey	73.64	2
Honduras	7.75	1	Uruguay	3.38	2
India	1241.49	1	Venezuela, RB	29.44	2
Indonesia	242.33	1	Australia	22.61	3
Jamaica	2.75	1	Austria	8.41	3
Kenya	41.61	1	Belgium	10.75	3
Lesotho	2.19	1	Canada	34.35	3
Madagascar	21.32	1	Cyprus	0.82	3
Malawi	15.38	1	Denmark	5.57	3
Mali	15.84	1	Finland	5.38	3
Mauritania	3.54	1	France	65.09	3
Morocco	32.27	1	Germany	82.16	3
Mozambique	23.93	1	Greece	11.39	3
Namibia	2.32	1	Hong Kong SAR, China	7.12	3
Nepal	30.49	1	Iceland	0.32	3
Niger	16.07	1	Ireland	4.53	3
Nigeria	162.47	1	Italy	60.79	3
Pakistan	176.75	1	Japan	126.5	3
Paraguay	6.57	1	Korea, Rep.	48.39	3
Philippines	94.85	1	Luxembourg	0.52	3
Rwanda	10.94	1	Malta	0.42	3
Senegal	12.77	1	Netherlands	16.66	3
Syrian Arab Republic	20.77	1	New Zealand	4.41	3
Tanzania	44.92	1	Norway	4.92	3
Togo	6.15	1	Portugal	10.69	3
Uganda	34.51	1	Singapore	5.19	3
Zambia	13.47	1	Spain	46.45	3
Zimbabwe	12.75	1	Sweden	9.44	3
Argentina	40.76	2	Switzerland	7.7	3
Barbados	0.27	2	United Kingdom	62.42	3
Botswana	2.03	2	United States	313.09	3
Brazil	196.66	2			

APPENDIX C
ADAPTIVE KERNEL ESTIMATION

When observations vary in sparseness over the support of the distribution, the adaptive kernel estimation is a two-stage procedure which mitigates the drawbacks of a fixed bandwidth in density estimation (see Silverman (1986), p. 101). In general, given a multivariate data set $X = \{X_1, ..., X_n\}$ and a vector of sample weights $W = \{\omega_1, ..., \omega_n\}$, where X_i is a vector of dimension d and $\sum_{i=1}^{n} \omega_i = 1$, we first run the pilot estimate:

$$\tilde{f}(\boldsymbol{x}) = \frac{1}{n \det(\boldsymbol{H})} \sum_{i=1}^{n} \omega_i k \left\{ \boldsymbol{H}^{-1} (\boldsymbol{x} - \boldsymbol{X}_i) \right\}, \tag{24}$$

where $k(u) = (2\pi)^{-1} \exp(-1/2u)$ is a Gaussian kernel and *bandwidth matrix* H is a diagonal matrix $(d \times d)$ with diagonal elements $(h_1, ..., h_d)$ given by the optimal normal bandwidths, *i.e.*,

$$h_i = [4/(d+2)]^{1/(d+4)} \hat{\sigma}_i n^{-1/(d+4)}$$

$\hat{\sigma}_i$ is the estimated standard error of the distribution of X_i. The use of a diagonal bandwidth matrix instead of a full covariance matrix follows the suggestions in Wand and Jones (1993). In the case of $d = 1$ we have:

$$H = \det(H) = (4/3)^{1/5} n^{-1/5} \hat{\sigma}$$

In the cross-population estimate we consider $W = \{p_i, ..., p_n\}$, where p_i is the population of country i. We then define local bandwidth factors λ_i by:

$$\lambda_i = \left[\tilde{f}(\boldsymbol{X}_i) / g \right]^{-\alpha}, \tag{25}$$

where $\log(g) = \sum_{i=1}^{n} \omega_i \log\left(\tilde{f}(\boldsymbol{X}_i)\right)$ and $\alpha \in [0, 1]$ is a sensitivity parameter. We set $\alpha = 1/2$ as suggested by Silverman (1986), p. 103. Finally the adaptive kernel estimate $\hat{f}(x)$ is defined as:

$$\hat{f}(\boldsymbol{x}) = \frac{1}{n \det(\boldsymbol{H})} \sum_{i=1}^{n} \lambda_i^{-d} \omega_i k \left\{ \lambda_i^{-1} \boldsymbol{H}^{-1} (\boldsymbol{x} - \boldsymbol{X}_i) \right\}. \tag{26}$$

The Gaussian kernel guarantees that the number of modes is a decreasing function of the bandwidth; this property is at the basis of the test for unimodality (see Silverman (1986), p. 139). In all the estimates we use package *sm* (see Bowman and Azzalini (2005)).

APPENDIX D
MULTIMODALITY TEST

The multimodality test follows the bootstrap procedure described in Silverman (1986), p. 146. Given a data set $X = \{x_1, \ldots, x_n\}$ and a vector of sample weights $W = \{\omega_1, \ldots, \omega_n\}$, we calculate the smallest value of bandwidth, $\hat{h}_0$, for which the estimated distribution is unimodal and the corresponding local bandwidth factors $\Lambda = \lambda_1, \ldots, \lambda_n$. We then perform a *smoothed bootstrap* from the estimated density of observed data set. Since we use the Gaussian kernel, it amounts to: i) draw (with replacement) a vector I = $\{i_1, \ldots, i_n\}$ of size n from $\{1, \ldots, n\}$, given the sample weights W; ii) define $Y = \{x_{i_1}, \ldots, x_{i_n}\}$ and $W^* = \{\omega_{i_1}, \ldots, \omega_{i}\}$, calculate:

$$x_j^* = \bar{\mathbf{Y}} + \left(1 + \left(\hat{h}_0\lambda_{i_j}\right)^2 / \hat{\sigma}_{\mathbf{Y}}^2\right)^{-\frac{1}{2}} \left(y_j - \bar{\mathbf{Y}} + \hat{h}_0\lambda_{i_j}\epsilon_j\right), \quad j = 1, \ldots, n; \qquad (27)$$

where $\bar{Y}$ and $\hat{\sigma}_{\mathbf{Y}}^2$ are respectively the mean and the estimate variance of sample Y and ε_j are standard normal random variables; iii) find the minimum value of bandwidth, $\hat{h}^*$, for which the estimated density of X^* is unimodal; iv) repeat point i)-iii) B times in order to obtain a vector of critical values of bandwidth $\left\{\hat{h}_1^*, \ldots, \hat{h}_B^*\right\}$. Finally, p-value of null-hypothesis of unimodality is given by:

$$\#\left\{\hat{h}_b^* \geq \hat{h}_0\right\} / B.$$

For testing the bimodality, point iii) has to be modified accordingly. We set $B = 1000$.

APPENDIX E
VECTOR FIELD ESTIMATION

Assume that the dynamics of economy j at period t only depends on (GDP_{jt} , LE_{jt}), *i.e.*, (GDP_{jt} , LE_{jt}) follows a *time invariant* and *Markovian* stochastic process.

The dynamics of the sample in the space (*GDP*, *LE*) can be therefore represented by a random vector field (RVF). In particular, given a subset L of the possible realization of (*GDP*, *LE*) (*i.e.*, a lattice, see small black points in Figure 7), a RVF is represented by a random variable $\Delta_\tau z_i$, where $\Delta_\tau z_i \equiv (\Delta_\tau GDP_i , \Delta_\tau LE_i) \equiv (GDP_{it+\tau} - GDP_{it}, LE_{it+\tau} - LE_{it})$, indicating the dynamics (*i.e.*, the dynamics from period t to period $t + \tau$ represented by a movement vector) at $z_i \equiv (GDP_i, LE_i) \in L$. For each point in the lattice z , with i = 1, ..., L, we therefore estimate the distribution of probability $Pr(\Delta_\tau z|z_i)$ on the $N (T - \tau)$ observed movement vectors $\Delta_\tau^{OBS} z$. In $\Pr\left(\Delta_\tau^{OBS} z_{jt}|z_i\right)$ measures the probability that the dynamics at z_i follow $\Delta_\tau^{OBS} z_{jt}$; this suggests $\Pr\left(\Delta_\tau^{OBS} z_{jt}|z_i\right)$ should decrease as function of the distance between z_{jt}^{OBS} d .

A convenient way to calculate these probabilities is to use a kernel function to measure the distance between z_i and z_{jt}^{OBS} . In particular:

$$\omega\left(z_i, z_{jt}^{OBS}\right) = \frac{K\left(\frac{(z_i - z_{jt}^{OBS})^T S^{-1} (z_i - z_{jt}^{OBS})}{h^2}\right) \frac{\det(S)^{-\frac{1}{2}}}{2h^2}}{\sum_{t=1}^{T-\tau} \sum_{j=1}^{N} K\left(\frac{(z_i - z_{jt}^{OBS})^T S^{-1} (z_i - z_{jt}^{OBS})}{h^2}\right) \frac{\det(S)^{-\frac{1}{2}}}{2h^2}} \tag{28}$$

is assumed to be an estimate of the probability that at zi dynamics follows observed movement vectors $\Delta_\tau^{OBS} z_{jt}$, where $K(\cdot)$ is the kernel function, h is the smoothing parameter and S is the sample covariance matrix of z^{OBS}. The kernel function $K(\cdot)$ is generally a smooth positive function which peaks at 0 and decreases monotonically as the distance between the observation z_{jt} and the point of interest z_i increases (see Silverman (1986) for technical details). The smoothing parameter h controls the width of the kernel function.[52] In the estimation we use a multivariate Epanechnikov kernel (see Silverman (1986) pp. 76-78), *i.e.*:

$$K(u^T S^{-1} u) = \begin{cases} \frac{2}{\pi}(1 - u^T S^{-1} u) & \text{if } u^T S^{-1} u < 1 \\ 0 & \text{if } u^T S^{-1} u \geq 1, \end{cases} \tag{29}$$

where $u \equiv \left(z_i - z_{jt}^{OBS}\right)/h$. Multivariate Epanechnikov kernel is particularly adapted to our scope because it assigns zero probability to observed movement vectors very far from z_i. Other possible kernels, as the Gaussian, does not allow such possibility. The exact quantification of "very far" is provided by bandwidth h, *i.e.*, higher bandwidth means higher number of observed movement vectors entering in the calculation of the movement at z_i.

Given Eq. (28) for each point in the lattice z_i we estimate the τ-period ahead *expected movement* $\mu_{\Delta_\tau} z_i \equiv E[\Delta_\tau z_i \mid z_i]$ using a *local mean estimator*, first proposed by Nadaraya (1964) and Watson (1964), where the observations are weighted by the probabilities derived from the kernel function, *i.e.*, (see Bowman and Azzalini (1997) for details):

$$\widehat{\mu}_{\Delta_\tau z_i} = \sum_{t=1}^{T-\tau} \sum_{j=1}^{N} \omega\left(z_i, z_{jt}^{OBS}\right) \Delta_\tau z_{jt}^{OBS} = \widehat{\Pr(\Delta_\tau z|z_i)} \Delta_\tau z^{OBS}. \tag{30}$$

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52 In all the estimation we use the optimal normal bandwidth; for a discuss on the choice of bandwidth see Silverman (1986).

The estimation of Eq. (30) strongly depends on the choice of τ . This choice is the result of a trade-off: from one hand, a too short τ can increase the noise in the estimation due to the possible presence of short-run fluctuations; on the other hand, a too long τ could contrast with the local characteristics of the estimate, increasing the probability that observed movement vectors very far from z_i affects the estimate of $\mu_{\Delta_\tau} z_i$. In the estimate we set $\tau = 10$.

Below we discuss in details how we have conducted the inference on the estimated expected movements by a bootstrap procedure, whose results is reported in Figure 7.

Given the observed sample of observations z_{jt}^{OBS} with $j = 1, ..., N$ and $t = 1, ..., T$, the bootstrap procedure consists of four steps.

1) Estimate the expected value of the τ-period ahead movement $\mu_{\Delta_\tau} z_i$ by Eq. (30) for each point of the lattice ($i = 1, ..., L$).
2) Draw B samples $z^b = \left(z_1^b, ..., z_{N(T-\tau)}^b\right)$ and the associated $\Delta_\tau^b z = \left(\Delta z_1^b, ..., \Delta z_{N(T-\tau)}^b\right)$, with $b = 1, ..., B$, by sampling with replacement from the observed z^{OBS} and the associated movement vectors $\Delta^{OBS} z$.
3) For every bootstrapped sample b and for each point of the lattice i estimate by Eq. (30) the expected value of the τ-period ahead movement $\mu_{\Delta_\tau z_i}^b$.
4) Calculate the two-side p-value of the estimated movement vector at point i in the lattice under the null hypothesis of no dynamics (note that null hypothesis of no dynamics is separately tested in the two directions y and Wy) as:

$$\widehat{ASL}_i = 2 \times \min\left(\sum_{b=1}^{B} \hat{\mu}_{\Delta_\tau z_i}^b \leq 0, \sum_{b=1}^{B} \hat{\mu}_{\Delta_\tau z_i}^b > 0\right) / B. \tag{31}$$

In the analysis we have set $B = 300$, and used the usual significance level of 5 per cent to decide which expected movements to report.

APPENDIX F
THE ESTIMATE OF ERGODIC DISTRIBUTION

The ergodic distribution solves:

$$f_\infty(x) = \int_0^\infty g_\tau(x|z)\, f_\infty(z)\, dz, \tag{32}$$

where x and z are two levels of the variable, $g_\tau(x|z)$ is the density of x, given z, τ periods ahead, under the constraint:

$$\int_0^\infty f_\infty(x)\, dx = 1. \tag{33}$$

Since in our estimates all variables are normalized with respect to their average, the ergodic distribution, moreover, must respect the additional constraint:

$$\int_0^\infty f_\infty(x)\, x dx = 1. \tag{34}$$

Following the methodology proposed by Johnson (2005) we first estimate the distribution $\tilde{f}_\infty(x)$, which satisfies Constraints 32 and 33, but not Constraint 34. We then calculate

$$f_\infty(x) = \tilde{\mu}_x \tilde{f}_\infty(x)$$

where:

$$\tilde{\mu}_x = \int_0^\infty \tilde{f}_\infty(x)\, x dx$$

which will satisfy all Constraints 32, 33 and 34. In particular, Theorems 11 and 13 in Mood *et al.* (1974), pp. 200 and 205 prove that if $\tilde{f}_\infty(x)$ satisfies Constraints 32 and 33 then $f_\infty(x)$ satisfies Constraints 32, 33 and 34. In fact, $g_\tau(z|x) = f_{z,x}(z, x) / f_x(x)$ and $f_{y,q}(y, q) = \mu_z \mu_x f_{z,x}(z, x)$, where $y = z/\mu_z$ and $q = x/\mu_x$. In all computations we set $\tau = 10$.

APPENDIX G
BOOTSTRAP PROCEDURE TO CALCULATE CONFIDENCE INTERVALS FOR DENSITY ESTIMATION

The following is a description of the bootstrap procedure used to calculate the confidence intervals for the estimates of densities and ergodic distributions; this is based on the procedure reported in Bowman and Azzalini (1997), p. 41. Given a sample $X = \{X_1, ..., X_n\}$ of observations and a vector of sample weights $W = \{\omega_1, ..., \omega_n\}$, where $\sum_{i=1}^{n} \omega_i = 1$ and X_i is a vector of d dimensions, the bootstrap procedure is as follows.

1) Construct a density estimate $\hat{\phi}$ from sample X, given the sample weights W.
2) Resample X with replacement, taking into account the sample weights W, to produce a bootstrap sample X^*.
3) Construct a density estimate $\hat{\phi}^*$ from X^*.
4) Repeat steps 2. and 3. B times in order to create a collection of bootstrap density estimates $\left\{\hat{\phi}_1^*, ..., \hat{\phi}_n^*\right\}$.

The distribution of $\hat{\phi}_i^*$ about $\hat{\phi}$ can therefore be used to mimic the distribution of $\hat{\phi}$ about $\phi_.$, as discussed by Bowman and Azzalini (1997), p. 41, *i.e.*, to calculate confidence intervals for the estimates. In particular, the confidence interval for the distribution in 2000 corresponds to the case $\hat{\phi} = \hat{f}_.$, while for the ergodic distribution to the case $\hat{\phi} = \hat{f}_\infty$. In the bootstrap procedure $\hat{\phi}^*$ are calculated taking the bandwidth(s) equal to the bandwidth(s) calculated for the observed sample X, as suggested in Bowman and Azzalini (1997), p. 41. We set $B = 300$.

APPENDIX H
ESTIMATION RESULTS FOR THE RELATIONSHIP BETWEEN INCOME AND LIFE EXPECTANCY

Table 8

Estimation Results for Model (12) Various Countries

Country	β_0	β_1	Adjusted R^2	Source
Canada (2001)	1.009	0.054	0.95	McIntosh *et al.* (2009)
Sweden (1996)	1.004	0.039	0.98	Gerdtham and Johannesson (2000)
South Korea (2002)	1.006	0.033	0.97	Khang *et al.* (2010)
US (1981)	1.001	0.057	0.88	Singh and Siahpush (2006)
US (1990)	1.001	0.053	0.95	Singh and Siahpush (2006)
US (1999)	1.002	0.076	0.97	Singh and Siahpush (2006)
Armenia (2005)	1.000	0.003	–0.09	Harttgen and Klasen (2010)
Burkina Faso (2003)	1.001	0.086	0.86	Harttgen and Klasen (2010)
Bolivia (2003)	1.000	0.069	0.92	Harttgen and Klasen (2010)
Egypt (2007)	1.000	0.066	0.97	Harttgen and Klasen (2010)
Ethiopia (2005)	1.006	0.123	0.74	Harttgen and Klasen (2010)
India (2005)	1.000	0.024	0.81	Harttgen and Klasen (2010)
Indonesia (2003)	1.000	0.063	0.95	Harttgen and Klasen (2010)
Kyrgyz Republic (1997)	1.001	0.065	0.84	Harttgen and Klasen (2010)
Nicaragua (2000)	1.000	0.052	0.82	Harttgen and Klasen (2010)
Nigeria (2003)	1.000	0.107	0.97	Harttgen and Klasen (2010)
Pakistan (2007)	1.000	0.085	0.85	Harttgen and Klasen (2010)
Peru (2005)	1.000	0.059	0.89	Harttgen and Klasen (2010)
Senegal (2005)	1.000	0.116	0.91	Harttgen and Klasen (2010)
Vietnam (2002)	1.000	0.039	0.81	Harttgen and Klasen (2010)
Zambia (2002)	0.996	0.091	0.76	Harttgen and Klasen (2010)

Note: All the coefficients are significantly different from zero at 1 per cent level, with the exception of the β_1 for Armenia.

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**COMMENT TO
"THE EVOLUTION OF WORLD WELFARE INEQUALITY"
BY DAVIDE FIASCHI AND MARZIA ROMANELLI**

*Nikola Altiparmakov**

1 Introduction

In their well written and very elaborate analysis Davide Fiaschi and Marzia Romanelli take on several issues in the area of welfare measurement and welfare dynamics, going beyond the standard *GDP per capita* measure of material well-being. In particular, the authors look to expand existing results in the relevant literature (Becker *et al.*, 2005; Bourguignon and Morrisson, 2002) in several directions. On the theoretical front, the authors assume relevant utility functions to be cardinally measurable in order to gain further insights. On the empirical front, the authors introduce more sophisticated non-parametric techniques in order to infer future trends in world welfare and identify potential polarization among countries.

In this comment I will briefly describe reasons for measuring welfare beyond traditional GDP per capita statistics and show major trends in GDP per capita and life expectancy over the last two centuries. Then I will highlight major results presented by Davide and Marzia, elaborate how these results fit into existing literature and make a couple of suggestions how to strengthen existing results and possibly expand them.

2 Background

It is well known that GDP (per capita) is not a perfect measure of well-being or welfare. Standard GDP statistics are an imperfect measure of material well-being since they fail to capture some relevant aspects, such as the household production of goods and services, or to incorporate undesirable effects of the production process, such as the deterioration of natural environment or climate change. Furthermore, the welfare of people is a multi-dimensional concept that goes beyond material well-being. The existing literature on welfare dynamics tries to incorporate other aspects of well-being, most notably the life expectancy. The idea is basically not only to capture the quality of life (as measured by GDP per capita) but also the quantity of life (measured by life expectancy). This has been done in the existing literature either by relying on the *lifetime income* concept (Bourguignon and Morrisson, 2002) or on the *lifetime utility* approach (Becker *et al.*, 2005; Rosen, 1988). In their paper, Davide Fiaschi and Marzia Romanelli follow the latter lifetime utility approach. They augment this approach by assuming lifetime (indirect) utility function to be cardinally measurable, which allows them to directly compare welfare level across countries and also to analyze the effects of (expected) income growth on the welfare (inequality) across the world.

Since the dynamics of GDP per capita and life expectancy are driving the empirical results in this strand of literature, it is instructive for readers to be familiar with basic dynamics of these two (related) variables in a longer time perspective. Namely, it is interesting to note that both GDP per capita and life expectancy were basically stagnant for centuries, until the start of industrial revolution in early 19th century, which resulted in parallel increase in both GDPpc and life expectancy inequality across (industrial and non-industrial) countries. This parallel increase lasted until the first half of 20th century, when trends in GDPpc and life expectancy (inequality) diverged.

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Most of the results from the empirical literature seem to suggest that income inequality (measured by GDPpc) increased until 1950's and has stagnated since (or decreased slightly). On the other hand, the divergence of life expectance inequality turned into strong converge after 1930's, as a result of less developed countries catching up with the developed ones (mostly by implementing non-expensive measures to reduce mortality at early stages in life).

Table 1

Graph from Bourguignon and Morrisson, 2002

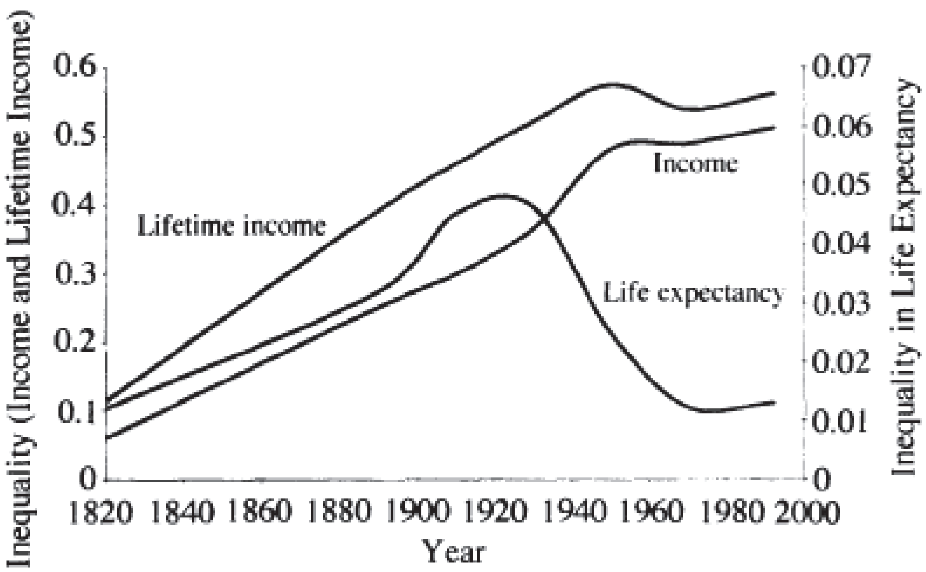

FIGURE 3. EVOLUTION OF INTERNATIONAL INEQUALITY IN INCOME, LIFETIME INCOME, AND LIFE EXPECTANCY (THEIL INDEX)

Davide Fiaschi and Marzia Romanelli focus on the 1960 to 2011 period by analyzing GDP per capita, life expectancy and consequently welfare dynamics on a panel consisting of 103 countries. Most of their paper is based on the between-country analysis of inequality, although in one (very preliminary) section the authors try to incorporate within-country inequality in order to measure the overall inequality among all individuals in the world. This preliminary section tries to expand the approach used by Bourguignon and Morrisson (2002) that included the analysis of within-country inequality of income but not the within-country inequality of lifetime (which was assumed to be zero). Davide and Marzia instead build a (log-linear) model of joint distribution of income and life expectancy within countries. As the authors themselves note, assuming invariant relationship between relative life expectancy and relative income across countries might be a restrictive research approach. Nonetheless, it represents a welcome improvement over the zero life expectancy inequality assumption made by Bourguignon and Morrisson (2002).

3 Results

As mentioned earlier, Davide and Marzia use non-parametric estimation techniques to analyze welfare dynamics on the panel of 103 countries over the 1960-2011 period. In doing so, the authors confirm the results and dynamics in the existing literature. Namely, that life expectancy inequality has been on the downward trend throughout the referenced time period, while the reduction in income (GDPpc) inequality was less clear-cut and less pronounced. Overall, these two trends combined into unambiguous decline in welfare inequality over the entire period (Table 1). The use of more sophisticated non-linear empirical analysis allows the authors to test for the existence of polarization among countries, and also to extrapolate the likely trend of welfare inequality in the future.

The results presented do indicate polarization among countries, into two or likely three clusters. Besides the cluster of countries with high standard of living and high life expectancy, countries with low-to-medium standard of living seem to be forming two different clusters depending on their ability to catch-up with more developed countries or being trapped at low levels of development and low life expectancy. Analysis also indicates that the trend of reduced welfare inequality observed over the 1960-2011 period would be stopped and even reversed in the future, due to the stagnation of life expectancy convergence and increase in income (GDPpc) inequality. The results from preliminary section that includes within-country inequality seem to confirm these conclusions.

4 Comments

The authors conclude that the (expected) growth rate *g* has rather negligible influence on the final results and have thus been assuming growth rate $g = 0$ throughout the paper. Although the authors state that simulations and scenario analysis of different growth rate assumptions confirm their conclusions, it could be beneficial to include some more (intuitive) evidence on this result, which might contradict *a priori* expectations that vastly heterogeneous growth rates across the would should/could more tangibly influence welfare dynamics.

The authors conclude that ignoring within-country inequality "seems to have a non-negligible impact on the magnitude and the dynamics of the world welfare distribution". While the impact on magnitude is obvious and documented not only by the authors but also in the existing literature, the impact of ignoring within-country inequality on the welfare dynamics seems to be less clear-cut (to me at least). In fact, my reading of Table 6 that the authors present in the (preliminary) section that includes within-country inequality is that within-country inequality tangibly impacts the magnitude but not the trend or dynamics of welfare inequality.[1]

When making policy recommendations in the concluding section, the authors explore whether (very) poor countries should focus on improving health outcomes or increasing GDP per capita. Implicit in these considerations seems to be the assumption of exclusive influence on one of these two outcomes. However, these considerations could be broadened to common factors that seem to improve both health and income, such as the quality of institutions and government capacity (Deaton, 2015).

[1] A small note on the terminology – the authors could consider using the term "between-country" inequality instead of "cross-population" inequality, in order to make the wording more comparable to the terminology used in other papers in the literature.

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THE IMPACT OF INCOME INEQUALITY AND FISCAL STIMULI ON POLITICAL (IN)STABILITY

Luca Agnello[*], *Vítor Castro*[**], *João Tovar Jalles*[***] *and Ricardo Sousa*[****]

We use data for a panel of developed and developing countries to assess the impact of income inequality and fiscal stimuli episodes on political instability. We find that government crises are likely to rise when inequality increases and this effect is especially important in the case of OECD countries. However, expansionary and increasingly expansionary fiscal stimuli episodes can help dampening the detrimental impact of an uneven distribution of income on political stability. From a macroeconomic point of view, economic growth and low inflation seem to be crucial to avoid the occurrence of government crises.

1 Introduction

By fuelling political disaffection, income inequality is typically seen as being at the roots of political instability. Yet, the severity of the most recent financial turmoil that emerged in 2008 forced fiscal authorities in many G20 countries to implement comprehensive support packages based on expenditure hikes. These ended up leading to sharp increases in budget deficits.

As concerns about long-term (un)sustainability of public finances started mounting, governments across the world faced the need to implement budgetary consolidation measures and decided to shift wealth towards banks and debtors and away from taxpayers, fuelling public anger about the unfairness of such decisions.

While the recent literature has started to provide some guidelines about the linkages between fiscal policy and income inequality (Agnello and Sousa, 2012a, b), there is still an important gap regarding our understanding about the effects of an uneven distribution of income and the implementation of fiscal adjustments on the occurrence of government crises.

Is an increase in income inequality likely to shorten a government's mandate? Can fiscal stimuli reduce the probability of a government crisis? Is the impact of inequality on political instability abated in the context of fiscal stimuli episodes?

From a theoretical point of view, the tentative answer to the above mentioned questions should be *"yes"*. Fiscally constrained governments loose popularity and this is particularly true when restrictive fiscal measures and fiscal consolidation programs are implemented in countries experiencing a high degree of income inequality. Contrarily, the effects of inequality (on political stability) might be muted when fiscal adjustments are perceived as equalizing and stimuli programs are put into place. In this context, investigating the impact of inequality and fiscal stimuli on political instability emerges as the main goal of our paper.

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The opinions expressed herein are those of the authors and do not necessarily reflect those of the OECD or its member countries. The usual disclaimer applies.

We show that inequality raises the prospects of political instability. More specifically, when the income gap rises, the likelihood of a government crisis increases. This effect of inequality on political instability is particularly important for OECD countries, as economies characterized by high inequality in income distribution are more susceptible to face an unstable political environment.

With regard to fiscal stimulus programs, the empirical findings reveal that both expansionary and increasingly expansionary fiscal stimuli help preserving political stability. Moreover, when conditioning the effect of inequality on the occurrence of fiscal stimuli episodes, our results suggest that such episodes abate the impact of inequality on political instability. This finding is corroborated, in particular, when fiscal stimuli are expansionary (and, thus, promote economic growth) or when they lead to an increasingly expansionary environment (and, therefore, contribute to a sustainable growth path).

Additionally, we show that some factors characterizing the legislature, such as whether the government has a majority of seats in the parliament and whether the government consists of a coalition or not, help explaining a reduction in political instability. Similarly, while the level of government fractionalization increases the number of government crises, the regime durability and the level of political competition provide the ground for a more stable legislature. Moreover, the political regime (as measured by the level of democracy) has a positive effect on the occurrence of government crises, signalling a potentially nonlinear relationship between political instability and the level of democracy. We also find that the larger the number of years in office of the chief executive is, the more likely the number of government crises will fall.

Finally, economic growth seems to be the key for a stable legislature, but inflation tends to deteriorate political stability. Consequently, economic growth and low inflation appear to be crucial ingredients for avoiding the occurrence of government crises.

The rest of the paper is organized as follows. Section 2 briefly looks at the related literature. Section 3 presents the econometric methodology. Section 4 describes the data and discusses the empirical results. Section 5 provides the sensitivity analysis. Finally, Section 6 concludes.

2 Literature review

Several studies looked at the relationship between political instability and the economic performance of a country, as weak growth is likely to shorten policymakers' horizons leading to the implementation of sub-optimal macroeconomic policies in both democracies and dictatorships (Kramer, 1971; Fair, 1978). These studies find that, in general, high income growth rates during pre-election years are likely to increase the probability of the re-election of the incumbent government in democratic countries. A finding that is supported by the idea of the political business cycle developed by Nordhaus (1975) and the partisan effects emphasized by Hibbs (1977). As for dictatorships and military regimes, the likelihood of experiencing coups increases with the decline of GDP per capita. Londregan and Poole (1990) consider the number of coups experienced by 121 countries over the period 1950-1982 and uncover a pronounced inverse relationship between coups and income. In addition, coups are more likely to occur among the poorest countries than among the wealthiest ones. Alesina *et al.* (1996) use data on 113 countries from 1950 to 1982 and show that a high propensity of government collapse is characterized by low GDP growth. Klomp and de Haan (2009) note that economic volatility and political instability and policy uncertainty tend to be positively linked. More recently, Aisen and Veiga (2013) show that higher degrees of political instability are associated with lower growth rates of GDP per capita, as a reflex of the lower rates of productivity growth and physical and human capital accumulation.

Other studies assessed the relationship between political instability and the dynamics of inflation. Paldam (1987) compares the path of consumer price with the incidence of political change for eight Latin American countries over the period 1946-1984. The author uncovers a significant connection between the frequency of military regimes and the level of inflation. Interestingly, while military regimes are relatively strong in fighting inflation, civilian regimes are less stringent about the level of inflation. In addition, just a few regimes survive to the spell of hyperinflation. Aisen and Veiga (2008a) use a dataset covering around 100 countries for the period 1960-1999 and show that greater political instability is associated with high inflation, especially, in developing, less democratic and socially-polarized countries, with low access to domestic and external debt financing and high turnover of central bank presidents. One important policy implication of their study is the need to develop strong institutions conducive to greater political stability. Similar conclusions are found by Aisen and Veiga (2008b) concerning the linkages between political instability and inflation volatility.

Another strand of the literature investigated how the institutional framework affects political instability. Taylor and Herman (1971) find a fairly strong relation between government stability and the fractionalization of the parliamentary party system: the more fragmented the party system is, the more unstable the cabinet is. Gates *et al.* (2006) show that regimes exhibiting a mix of democracy and autocracy characteristics tend to be short-lived. The least stable political system is the dictatorship with a large degree of political participation. Similarly, when the executive is highly constrained and the electorate is very small, the political configuration will be unstable.

With regard to the relationship between political instability and income inequality, Alesina and Perotti (1996) show that the two variables are positively related because of the social discontent associated with income inequality. Perotti (1996) and Odedokun and Round (2001) show that countries with high income inequality are more likely to be politically unstable. Acemoglu and Robinson (2006) develop a theoretical model of democracy and income inequality where they argue that high income inequality in Latin America can be one of the main causes of weak democracy in the region. Blanco and Grier (2009) investigate the underlying causes of political instability in a panel of 18 Latin American countries from 1971 to 2000 and find that income inequality, in particular, have an important nonlinear effect on political instability: increases in income inequality raise instability up to a point, after which any further increases lower instability.

Despite the recent mounting interest of the effects of fiscal consolidation on growth prospects (Cimadomo *et al.*, 2010; Cimadomo, 2012), a thorough analysis of the impact of fiscal retrenchment on political stability has been neglected. To the best of our knowledge, only a few works assess how budget cuts affect the lack of political stability. Paldam (1987) points that fiscal austerity measures are typically associated with higher levels of social unrest. Haggard *et al.* (1995) show that the IMF interventions in developing countries were accompanied with greater instability. Rogoff and Sibert (1988) and Persson and Tabellini (2000) focus on the role played by political budget cycles, that is, the idea that incumbent governments tend to raise spending or cut taxes before elections in order to maximize the probability of re-election. Using data for OECD countries up to the nineties, Alesina *et al.* (1998) do not uncover a statistically significant relationship between fiscal adjustments and the probability of re-election. More recently, Alesina *et al.* (2012) use data for a group of 19 OECD countries from 1975 to 2008 and find no evidence that governments that quickly reduce budget deficits are systematically voted out of office. In fact, many governments are able to decisively reduce deficit and avoiding an electoral defeat.

Other works tackle a somewhat related question from a different angle. Agnello and Sousa (2013) stress that fiscal prudence – *i.e.*, a low and stable public deficit – is essential for the achievement of economic prosperity, while Agnello and Sousa (2014) suggest that more political instability (as expressed by an incoming signal of a government crisis) increases the likelihood of fiscal policy discretion. Agnello *et al.* (2013a) emphasize that fiscal variables (such as the budget deficit and the level of public debt) and economic factors (such as the degree of openness, the inflation rate, the interest rate and per capita GDP) are crucial for the fiscal consolidation process. Agnello *et al.* (2013b) find evidence pointing that fiscal fatigue may compromise the implementation and successfulness of fiscal consolidation programs. The authors conclude that chronic fiscal imbalances might lead to a vicious austerity cycle, while discipline in the behaviour of fiscal authorities is a means of achieving credible and shorter adjustments.

Our paper contributes to the existing literature in three major directions. First, it specifically looks at the relationship between fiscal stimuli and political instability (as proxied by episodes of government crises). Second, given the strong linkage between income inequality and fiscal adjustment programs (Agnello and Sousa, 2012b), we assess the interaction between fiscal stimuli and the gap in income distribution in determining the likelihood of government crises. Therefore, we evaluate the impact of inequality on political instability, in particular, when countries undertake fiscal stimulus programs. Finally, because of the crucial role played by the composition of the fiscal adjustments (Alesina and Ardagna, 1998), we identify several measures of fiscal stimuli with the aim of assessing their effect on political stability. These are avenues of research that the previous theoretical and empirical works have not fully addressed, but denote important dimensions to be considered for a better understanding of the relationship between income inequality, fiscal stimuli and political (in)stability. With the current paper, we aim at fill such gaps.

3 Econometric methodology

Our modelling strategy consists of three steps. First, we explore the empirical relationship between income inequality and political stability by estimating the following equation:

$$C_{i,t} = \boldsymbol{Y}_{i,t}^{'}\Gamma + \boldsymbol{X}_{i,t}^{'}\beta + \lambda Gini_{i,t} + \alpha_i + \varepsilon_{i,t} \tag{1}$$

where $C_{i,t}$ denotes, for each country i included in the sample, our proxy of government instability; $\boldsymbol{Y}_{i,t}$ and $\boldsymbol{X}_{i,t}$ are a set of institutional and macroeconomic controls, respectively, that we assume to be correlated with the degree of government fragility; and $Gini_{i,t}$ is the income inequality index.

Then, we broaden our analysis and extend the model specification (1) by considering the relationship between fiscal stimuli episodes ($F_{i,t}$) and government stability. Specifically, we evaluate the impact of specific fiscal episodes on political instability. Similarly to Alesina and Ardagna (1998), we use a statistical approach to identify episodes of: (i) fiscal stimuli; (ii) expansionary fiscal stimuli; (iii) increasingly expansionary fiscal stimuli; (iv) contractionary fiscal stimuli; (v) increasingly contractionary fiscal stimuli; (vi) successful fiscal stimuli; and (vii) unsuccessful fiscal stimuli. A detailed description of these events is presented in the data section. Formally, we run the following regression model:

$$C_{i,t} = \boldsymbol{Y}_{i,t}^{'}\Gamma + \boldsymbol{X}_{i,t}^{'}\beta + \lambda Gini_{i,t} + \phi F_{i,t} + \alpha_i + \varepsilon_{i,t} \tag{2}$$

where $F_{i,t}$ is a binary variable taking the value of one when a specific fiscal stimuli episode ((i)-(vii)) occurs, and zero otherwise.

Finally, we assess the importance of the interplay between income inequality and fiscal stimuli by running the following regression:

$$C_{i,t} = \boldsymbol{Y}_{i,t}^{'}\Gamma + \boldsymbol{X}_{i,t}^{'}\beta + \lambda_1 Gini_{i,t} + \lambda_2 Gini_{i,t} \cdot 1_F\left(F_{i,t}\right) + \alpha_i + \varepsilon_{i,t} \tag{3}$$

where $1_F(F_{i,t})$ is a fiscal indicator function taking value of one during periods of fiscal stimuli, and zero otherwise. Its inclusion aims at checking whether the effects of income inequality on government stability change during periods of fiscal stimuli. Under the assumption that fiscal consolidation plans are detrimental for income distribution (Agnello and Sousa, 2012b), we would expect, for instance, that the impact of inequality on government stability is reduced during the years of the implementation of programs of fiscal stimulus.

Due to the endogenous nature of the regressors, models (1)-(3) are estimated using an instrumental variables (IV) approach. As is standard in the literature, we instrument the endogenous variables with their own lags.

4 Data and empirical results

4.1 Data

We start by using a panel dataset consisting of 128 countries. However, the presence of missing values for several variables and the limited time span of fiscal variables (mainly, for developing countries) reduce the number of countries in the estimation to at most 58.

The dependent variable, $C_{i,t}$, used in our specification is Government Crisis, which is provided by the Cross-National Time-Series Data Archive (CNTS). It counts the number of any rapidly developing situation that might lead to the fall of the current regime and remove a particular government from power with the exclusion of situations of revolt.

The set of institutional variables (Y) is retrieved from the Database of Political Institutions (DPI) of the World Bank, the Polity IV Database (Polity IV) and the CNTS and includes:

- *military* (DPI): It is a dummy variable that takes the value one if the Chief Executive is military officer and zero otherwise.
- *stabs* (DPI): It counts the percentage of veto players who drop from the government in a specific year and, as such, it provides information about the veto points in the decision making process and the constraints that governments face in the course of policy implementation.
- *system* (DPI). This variable characterizes the political system. A value of 0 is given in the case of a presidential system, a value of 1 is allocated in the case of an Assembly-elected presidential system, and a value of 2 is associated to a parliamentary system.
- *govfrac* (Polity IV). It refers to the degree of government fragmentation as measured by the probability that two deputies picked at random from among the government parties will be of different parties.
- *polity2* (Polity IV). This describes how democratic a country is. It subtracts the country's score in an "Autocracy" index from its score in a "Democracy" index and produces a polity scale ranging from -10 (strongly autocratic) to +10 (strongly democratic).
- *durable* (DPI). This variable counts the number of years that a cabinet has been in power, up to the current year. A cabinet that falls during its first year in power is counted as 1. Every time there is a government termination, the variable is reset to 1 the year after the termination.
- *polcomp* (Polity IV). It measures the level of political competition in the next election that is expected by the incumbent when making policy decisions over the administration cycle.
- *yrsoffc* (DPI). It counts the number of years the chief executive has been in office.
- *maj* (DPI). It is a dummy variable equal to 1 if the cabinet has majority support in parliament.
- *party_coal* (DPI). It is a dummy variable equal to 1 if a coalition cabinet (including ministers from two or more parties) is in power.

The set of macroeconomic variables (X) is provided by the World Economic Outlook (WEO) of the International Monetary Fund (IMF) and includes: the GDP growth rate, the inflation rate and the real interest rate.

The net income Gini inequality index data comes from the Standardized World Income Inequality Database (SWIID).

Finally, fiscal data are retrieved from the WEO of the IMF. The cyclically adjusted budget balance is computed as in Alesina and Perotti (1995) and Alesina and Ardagna (1998, 2010), and is based on the method proposed by Blanchard (1990). Data on public debt are retrieved from the Historical Public Debt Database assembled by the Fiscal Affairs Department of the IMF (Ali Abbas *et al.*, 2011). In addition, the fiscal stimuli episodes considered in our study can be defined as follows:

- *Fiscal stimulus*. A period of fiscal stimulus is a year in which the cyclically adjusted primary balance deteriorates by at least 1.5 per cent of GDP.
- *Expansionary (contractionary) fiscal stimulus*. It corresponds to a period of fiscal stimulus followed by a positive (negative) GDP growth for two consecutive years.
- *Increasingly (decreasingly) expansionary fiscal stimulus*. It is a period of fiscal stimulus followed by an increasing (declining) GDP for two consecutive years. As we are not able to identify increasingly contractionary fiscal stimuli episodes, we do not consider these in the analysis.
- *Successful (unsuccessful) fiscal stimulus*. It is a period of fiscal stimulus followed by the cumulative reduction of the debt to GDP ratio greater (smaller) than 4.5 percentage points over two consecutive years after the beginning of a fiscal stimulus.

4.2 Political instability

We start by investigating the institutional and economic determinants of political instability and the impact of income inequality on the occurrence of government crises. Therefore, we estimate the baseline model and provide a summary of the findings in Table 1. In Column 1, we focus on the set of institutional variables; in Column 2, we add a set of economic determinants; in Column 3, we also consider the level of inequality; and, in Column 4, we condition the results on the strength of the income gap.

Looking at the set of institutional variables, we find that some factors providing details on the legislature, such as whether the government has a majority of seats in the parliament (*maj*) and whether the government consists of a coalition or not (*party_coal*), are important determinants of political instability. Both variables have a negative effect on the number of episodes of government crisis, in line with the conventional wisdom, being particularly relevant in the case of *party_coal* as shown by the large magnitude of the estimated coefficient. Similarly, the level of government fractionalization (*govfrac*) – which represents a Party variable in the legislature – helps explaining the occurrence of government crises and it has a positive and statistically significant impact on the dependent variable, in line with the findings of Taylor and Herman (1971). As expected, the regime durability (*durable*) reduces the probability of government crisis and the level of political competition (*polcomp*) seems to provide the ground for a more stable legislature. In what concerns to the political regime (*polity2*), the evidence suggests that it has a positive effect on the number of government crises, which indicates that the relationship between political instability and the level of democracy might be nonlinear. Indeed, Gates *et al.* (2006) show that regimes that are strongly autocratic and strongly democratic display a high degree of stability, as the maintenance of the institutional framework is in the interest of the political elites. In contrast, inconsistent regimes (as those with a mix of characteristics of autocracy and democracy) lack self- enforcing equilibrium and tend to be shorter. As for the chief executive variables (*yrsoffc*, *system* and *military*) and the stability and checks and balances determinants, our results show that only the number of years in office of the chief executive contributes significantly for a more stable political environment.

Table 1

Political Instability

Government Crisis	**[1]**	**[2]**	**[3]**	**[4]**
military	0.0131 *[0.020]*	0.0027 *[0.027]*	0.1035* *[0.062]*	0.0909 *[0.062]*
stabs	0.0091 *[0.035]*	-0.0088 *[0.041]*	-0.0816 *[0.057]*	-0.0852 *[0.056]*
system	0.0105 *[0.012]*	-0.0071 *[0.015]*	0.0214 *[0.025]*	-0.001 *[0.025]*
govfrac	0.0751** *[0.037]*	0.0822* *[0.044]*	0.0688 *[0.063]*	0.0945 *[0.064]*
polity2	0.0183*** *[0.004]*	0.0156*** *[0.005]*	0.0335*** *[0.010]*	0.0347*** *[0.010]*
durable	-0.0010*** *[0.000]*	-0.0006* *[0.000]*	-0.0009** *[0.000]*	-0.0011*** *[0.000]*
polcomp	-0.0217*** *[0.008]*	-0.0219** *[0.009]*	-0.0557*** *[0.019]*	-0.0563*** *[0.019]*
yrsoffc	-0.0014 *[0.001]*	-0.0026** *[0.001]*	-0.0031 *[0.002]*	-0.0031 *[0.002]*
maj	-0.2345*** *[0.054]*	-0.1939*** *[0.062]*	-0.1815* *[0.108]*	-0.2317** *[0.111]*
party_coal	-0.0308*** *[0.008]*	-0.0124 *[0.012]*	-0.0430* *[0.024]*	-0.0572** *[0.025]*
GDP growth rate		-1.3798*** *[0.359]*	-2.7839*** *[0.767]*	-2.7863*** *[0.769]*
inflation		0.0144*** *[0.004]*	0.0290*** *[0.008]*	0.0291*** *[0.008]*
real interest rate		0.0001 *[0.000]*	0.0000 *[0.000]*	0.0000 *[0.000]*
inequality			0.0047** *[0.002]*	
(inequality < average)				0.0155*** *[0.004]*
(inequality > average)				0.0098*** *[0.003]*
constant	0.4721*** *[0.071]*	0.4492*** *[0.087]*	0.5410*** *[0.189]*	0.3482* *[0.195]*
Observations	2690	1752	991	991
R-squared	0.053	0.068	0.093	0.102
Hansen Statistic	-	3.242	4.991	5.221
p-value	-	0.518	0.288	0.265

Note: Robust standard errors in brackets. *** $p<0.01$, ** $p<0.05$, * $p<0.1$.

Turning to the group of economic variables, the empirical findings interestingly reveal that while economic growth contributes to stable legislature, an increase in inflation tends to deteriorate it, corroborating the findings of Aisen and Veiga (2008a, 2008b). In light of the magnitude of the coefficient associated to real GDP growth, the baseline model suggests that the underlying performance of the economy is, perhaps, the most important determinant of political stability. In addition, the positive coefficient of inflation shows that government crises are likely to rise as a result of an increase in inflation. As for the interest rate, it does not seem to play a significant role in explaining the number of government crises.

Moving to the analysis of the impact of inequality on political instability, our results clearly suggest that when the income gap rises, the likelihood of a government crisis increases (Column 3). This, in turn, highlights that countries which fail to address the problem of inequality in income distribution are more susceptible to face social polarization and, hence, an unstable political environment. Alesina and Perotti (1996), Perotti (1996) and Odedokun and Round (2001) show that income inequality affects growth, but the problem is more complex since in this process worse income distribution generates social dissatisfaction which in turn leads to social and political instability, as we show in our analysis. Moreover, we also find that this effect does not seem to depend on how large the income gap is, as shown in Column 4. Hence, income inequality arises as an important trigger for political instability as soon as it is spotted by society.

4.3 Political instability and fiscal stimuli

We now move a step forward and assess the effects of fiscal stimuli on political (in)stability, as proxied by the number of episodes of government crises. We consider different typologies of fiscal episodes, namely: (i) fiscal stimuli, (ii) increasingly expansionary fiscal stimuli, (iii) expansionary fiscal stimuli, (iv) increasingly contractionary fiscal stimuli, (v) contractionary fiscal stimuli, (vi) successful fiscal stimuli, and (vii) unsuccessful fiscal stimuli. The results are summarized in Table 2.

It can be seen that episodes of fiscal stimuli are not associated with more unstable political environments *per se*. In fact, the results suggest that fiscal stimuli episodes do not significantly reduce the occurrence of government crises. However, the typology of fiscal stimuli matters. Indeed, expansionary and increasingly expansionary fiscal stimuli programs help reducing the likelihood of political instability. Thus, the fall in unemployment and the effectiveness of such programs in boosting the economy are likely to contribute to less political instability. Contractionary fiscal stimuli reforms have not proven to contribute to more political stability. These results suggest that it might be easier for political forces to reach an agreement when an expansionary package is being discussed than when a contractionary one is *on the table*. Hence, additional political stability is more likely to be obtained in the first kind of stimuli. In sum, our empirical findings show that the design of fiscal packages exerts an effect on the occurrence of government crises that cannot be neglected. Due to their redistributive nature, expansionary programs are more easily accepted by society, therefore, generating a higher social cohesion and stability than contractionary packages. In fact, social stability is also an important driver for a higher degree of political stability (Annett, 2000).

Additionally, the results are still indicating that when the income inequality increases social discontent is fuelled and, therefore, it contributes to more politically unstable governments, no matter the kind of fiscal stimuli that is considered. Regarding the institutional and economic conditionings the main results and conclusions remain unchanged.

4.4 Political instability and interaction between inequality and fiscal consolidation

We concluded above that income inequality contributes to political instability regardless the type of fiscal stimuli program put in place by the fiscal authority. However, in the previous analysis, we did not disentangle the interaction between these two effects on political (in)stability. Hence, next, we condition the effect of inequality on political instability by accounting for the occurrence of fiscal stimuli episodes, that is, we interact the net income Gini inequality index with the various fiscal stimuli episodes and assess whether the impact on the likelihood of a government crisis is dampened.

The results are summarized in Table 3 and show that when expansionary and increasingly expansionary fiscal stimuli programs are implemented, the detrimental impact that inequality has on political instability is abated. The results also point out to the fact that the more expansionary the program is, the larger the reduction in the degree of political instability will be.

All in all, these findings interestingly suggest that in countries where income distribution is uneven, governments implementing fiscal stimuli programs are more likely to avoid political instability. In particular, these expansionary stimuli generate a redistribution of income in favour of a sizeable group of the population, which helps to reduce the overall level of inequality. Fiscal policy can favourably influence long-term trends in both inequality and growth by promoting education and training among low- and middle-income workers. This is more relevant when the initial level of inequality is high. Agnello and Sousa (2012a) show that expansionary fiscal adjustments are more effective in shortening the income gap, which means that growth-promoting consolidation programs lead to a more stable social and political environment. Hence, fiscal authorities, in countries where income inequality is more striking, should carefully design their fiscal stimuli programs: ultimately, they need to be expansionary (*i.e.*, generate economic growth) or increasingly expansionary (in the sense of generating positive sustainable growth) in order to be able to significantly reduce the likelihood of government crises. In sum, the redistributive role of these programs helps mitigating some of the inequalities in society and, therefore, reduce social and political instability.

5 Sensitivity analysis

In this section, we provide the sensitivity analysis. We assess the robustness of the previous findings along different dimensions, namely: (i) by analysing the evidence for OECD and non-OECD countries; and (ii) by estimating an ordered probit model.

5.1 Evidence for OECD and non-OECD countries

We start by investigating the effects of income inequality on political instability in two sets of countries: (i) OECD countries and (ii) non-OECD countries. In Tables 4-6, we present the main findings using data for OECD countries. As we are not able to identify contractionary fiscal stimuli episodes for OECD countries, we do not consider these in the analysis. In Tables 7-9, we provide the evidence for non-OECD countries.

Tables 4-6 show that the results for OECD countries are similar to the ones found when using the full sample. More specifically, among the list of institutional variables, the fact that the government in power is made of a coalition (*party_coal*) and the regime durability (*durable*) are positively associated with political stability. An increase in the level of political competition (*polcomp*) also seems to go along in tandem with a more stable legislature. Moreover, while the

Table 2

Political Instability and Fiscal Stimuli

Government Crisis	[1]	[2]	[3]	[4]	[5]	[6]
military	0.0833	0.0896	0.0863	0.0853	0.0854	0.0857
	[0.067]	*[0.068]*	*[0.067]*	*[0.068]*	*[0.069]*	*[0.068]*
stabs	–0.0889	–0.0935	–0.0908	–0.0854	–0.088	–0.0873
	[0.062]	*[0.064]*	*[0.063]*	*[0.063]*	*[0.063]*	*[0.063]*
system	0.0263	0.0257	0.0257	0.0249	0.0245	0.0256
	[0.027]	*[0.027]*	*[0.027]*	*[0.027]*	*[0.028]*	*[0.028]*
govfrac	0.0299	0.0299	0.0287	0.0305	0.0328	0.0307
	[0.065]	*[0.065]*	*[0.065]*	*[0.065]*	*[0.065]*	*[0.065]*
polity2	0.0349***	0.0347***	0.0348***	0.0343***	0.0341***	0.0351***
	[0.011]	*[0.011]*	*[0.011]*	*[0.011]*	*[0.011]*	*[0.011]*
durable	–0.0010**	–0.0009**	–0.0010**	–0.0010**	–0.0010**	–0.0010**
	[0.000]	*[0.000]*	*[0.000]*	*[0.000]*	*[0.000]*	*[0.000]*
polcomp	–0.0571***	–0.0562**	–0.0564**	–0.0556**	–0.0557**	–0.0572**
	[0.022]	*[0.022]*	*[0.022]*	*[0.022]*	*[0.023]*	*[0.022]*
yrsoffc	–0.0031	–0.0032	–0.0032	–0.0033	–0.0035	–0.0031
	[0.003]	*[0.003]*	*[0.003]*	*[0.003]*	*[0.003]*	*[0.003]*
maj	–0.1989*	–0.1942	–0.2009*	–0.1814	–0.1955	–0.1969*
	[0.119]	*[0.119]*	*[0.119]*	*[0.118]*	*[0.119]*	*[0.119]*
party_coal	–0.0457**	–0.0447*	–0.0454**	–0.0428*	–0.0435*	–0.0458*
	[0.023]	*[0.023]*	*[0.023]*	*[0.023]*	*[0.024]*	*[0.023]*

GDP growth rate	–3.0762***	–3.0260***	–3.0409***	–2.8864***	–3.0040***	–3.0661***
	[0.802]	*[0.807]*	*[0.800]*	*[0.796]*	*[0.804]*	*[0.819]*
inflation	0.0321***	0.0315***	0.0318***	0.0300***	0.0312***	0.0318***
	[0.008]	*[0.008]*	*[0.008]*	*[0.008]*	*[0.008]*	*[0.008]*
real interest rate	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	[0.000]	*[0.000]*	*[0.000]*	*[0.000]*	*[0.000]*	*[0.000]*
inequality	0.0057**	0.0058**	0.0057**	0.0053**	0.0055**	0.0055**
	[0.002]	*[0.002]*	*[0.002]*	*[0.002]*	*[0.002]*	*[0.002]*
fiscal stimuli	–0.0616					
	[0.040]					
increasingly expansionary fiscal stimuli		–0.1099*				
		[0.066]				
expansionary fiscal stimuli			–0.0743*			
			[0.042]			
contractionary fiscal stimuli				0.5332		
				[0.647]		
successful fiscal stimuli					–0.0305	
					[0.081]	
unsuccesful fiscal stimuli						–0.0596
						[0.047]
Constant	0.5610***	0.5371***	0.5590***	0.5316***	0.5419***	0.5634***
	[0.196]	*[0.196]*	*[0.196]*	*[0.196]*	*[0.196]*	*[0.195]*
Observations	914	914	914	914	907	909
R–squared	0.102	0.102	0.103	0.102	0.10	0.101
Hansen Statistic	5.371	5.345	5.387	5.313	5.529	5.15
p–value	0.251	0.254	0.25	0.257	0.237	0.272

Note: Robust standard errors in brackets. *** $p<0.01$, ** $p<0.05$, * $p<0.1$.

Table 3

Political Instability and Interaction Between Inequality and Fiscal Stimuli

Government Crisis	[1]	[2]	[3]	[4]	[5]	[6]
military	0.0832	0.09	0.0858	0.0853	0.0862	0.0857
	[0.067]	*[0.068]*	*[0.067]*	*[0.068]*	*[0.069]*	*[0.068]*
stabs	–0.0885	–0.0945	–0.0902	–0.0857	–0.0873	–0.0864
	[0.062]	*[0.064]*	*[0.063]*	*[0.063]*	*[0.063]*	*[0.063]*
system	0.0263	0.0262	0.0262	0.0248	0.0243	0.0259
	[0.027]	*[0.027]*	*[0.027]*	*[0.027]*	*[0.028]*	*[0.028]*
govfrac	0.0306	0.0299	0.029	0.0311	0.033	0.0312
	[0.065]	*[0.065]*	*[0.065]*	*[0.065]*	*[0.065]*	*[0.065]*
polity2	0.0348***	0.0345***	0.0347***	0.0344***	0.0343***	0.0351***
	[0.011]	*[0.011]*	*[0.011]*	*[0.011]*	*[0.011]*	*[0.011]*
durable	–0.0010**	–0.0009**	–0.0010**	–0.0010**	–0.0010**	–0.0010**
	[0.000]	*[0.000]*	*[0.000]*	*[0.000]*	*[0.000]*	*[0.000]*
polcomp	–0.0567**	–0.0556**	–0.0560**	–0.0557**	–0.0558**	–0.0571**
	[0.022]	*[0.022]*	*[0.022]*	*[0.022]*	*[0.023]*	*[0.022]*
yrsoffc	–0.0031	–0.0032	–0.0031	–0.0033	–0.0034	–0.003
	[0.003]	*[0.003]*	*[0.003]*	*[0.003]*	*[0.003]*	*[0.003]*
maj	–0.1985*	–0.1941	–0.2015*	–0.1826	–0.1945	–0.1979*
	[0.118]	*[0.118]*	*[0.119]*	*[0.118]*	*[0.119]*	*[0.119]*
party_coal	–0.0460**	–0.0458**	–0.0462**	–0.0428*	–0.0436*	–0.0462**
	[0.023]	*[0.023]*	*[0.023]*	*[0.023]*	*[0.024]*	*[0.023]*

GDP growth rate	–3.0479***	–3.0292***	–3.0244***	–2.8953***	–2.9889***	–3.0562***
	[0.797]	*[0.802]*	*[0.797]*	*[0.795]*	*[0.803]*	*[0.815]*
inflation	0.0318***	0.0315***	0.0317***	0.0301***	0.0310***	0.0317***
	[0.008]	*[0.008]*	*[0.008]*	*[0.008]*	*[0.008]*	*[0.008]*
real interest rate	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	[0.000]	*[0.000]*	*[0.000]*	*[0.000]*	*[0.000]*	*[0.000]*
inequality	0.0060**	0.0061**	0.0061**	0.0053**	0.0055**	0.0058**
	[0.002]	*[0.002]*	*[0.002]*	*[0.002]*	*[0.002]*	*[0.002]*
inequality x fiscal stimuli	–0.0013					
	[0.001]					
inequality x increasingly expansionary fiscal stimuli		–0.0033**				
		[0.001]				
inequality x expansionary fiscal stimuli			–0.0019*			
			[0.001]			
inequality x contractionary fiscal stimuli				0.0097		
				[0.014]		
inequality x successful fiscal stimuli					–0.0002	
					[0.002]	
inequality x unsuccessful fiscal stimuli						–0.0015
						[0.001]
constant	0.5441***	0.5266***	0.5407***	0.5327***	0.5424***	0.5513***
	[0.196]	*[0.196]*	*[0.197]*	*[0.196]*	*[0.196]*	*[0.196]*
Observations	914	914	914	914	907	909
R–squared	0.101	0.104	0.103	0.102	0.099	0.101
Hansen Statistic	5.396	5.348	5.413	5.331	5.454	5.133
p–value	0.249	0.253	0.247	0.255	0.244	0.274

Note: Robust standard errors in brackets. *** p<0.01, ** p<0.05, * p<0.1.

number of years in office of the chief executive reduces the occurrence of government crises, the political regime (in the form of increased democracy) seems to lead to more political tensions. In general, these results show that within the group of OECD countries, those with better and more solid political institutions tend to show lower levels of political instability, but very liberal democratic systems can, nevertheless, be counterproductive in achieving political stability. Hence, our results suggest the need for these countries to find a balance between their usually higher degree of democracy and the building up of a solid set of political institutions.

Among the group of economic variables, we find that economic growth and inflation have, once again, opposite effects on political instability: while economic growth strongly reduces the occurrence of government crises in OECD countries, an increase in inflation tends to erode the stability of the political environment. It is easy to understand that a more favourable economic environment provides better opportunities for all economic agents and the population in general, creating favourable conditions for a more equal distribution of income. As mentioned before, this is a key factor for social and, consequently, political stability. On one hand, a higher economic growth is *per se* a fundamental catalyst for this stability; on the other hand, higher inflation levels generate an erosion of wealth and an unfair redistribution of the income among the economic agents, promoting social and political tensions.

In what concerns inequality, we clearly uncover a positive effect on the number of episodes of government crisis. However, this impact does not appear to depend on the magnitude of the income gap, as the coefficients associated with inequality above the average and inequality below the average are very similar in magnitude. This result confirms the important role that income distribution has at the social and political level. Without an adequate and fair distribution of income, social tensions will become more frequent with consequential repercussions at the political level.

With regard to the effects of fiscal episodes, we find that fiscal stimuli programs are particularly important at reducing the likelihood of government crises (as shown in Table 5). Moreover, for OECD countries, what matters is the implementation of such programs, independently of their kind. As developed democracies, these programs are usually perceived as needed when supported by the society, so it is easier to reach a consensus for its implementation, which will ultimately contribute to strengthen the political environment. This piece of evidence is corroborated in Table 6, when we interact the level of inequality with the implementation of fiscal stimuli. Indeed, the table shows that conditioning the impact of inequality during periods of fiscal stimulus significantly reduces the number of government crisis episodes. As this group of countries tend to present higher levels of political stability, a simple fiscal stimuli might be enough to reinforce that stability, even when the degree of inequality is higher. Reforms since the 1980s in this group of countries have been a factor behind rising income inequality by lessening the generosity of social benefits and the progressiveness of income tax systems. So, a well designed fiscal package can mitigate inequalities in the society, reinforcing the social and political stability that usually characterizes the group of OECD countries.

As for the evidence for non-OECD countries (reported in Tables 7-9), our results show that the level of political competition (*polcomp*) and, to some extent, the fact that the government in power has a majority of seats in the parliament (*maj*) or is made of a coalition (*party_coal*) reduces the occurrence of government crises, while more democracy (*polity2*) may exacerbate political instability. However, only political competition and the degree of democracy remain relevant when the economic environment and the level of inequality are controlled for. In fact, non-OECD countries need political competition to promote a more stable political system. However, like the OECD countries, stronger democratic systems tend to generate more instability, maybe because the complex nature of the political system under these regimes – perhaps not very well apprehended by the political authorities in such developing countries – might complicate the quest for political

Table 4

Political Instability – Evidence for OECD Countries

Government Crisis	[1]	[2]	[3]	[4]
military	0.5912** *[0.244]*	–0.1103 *[0.176]*	–0.0019 *[0.146]*	–0.1583 *[0.127]*
stabs	–0.0835 *[0.080]*	–0.074 *[0.086]*	–0.1339 *[0.090]*	–0.1279 *[0.089]*
system	0.0123 *[0.033]*	–0.0339 *[0.048]*	0.1567*** *[0.056]*	0.0955* *[0.052]*
govfrac	–0.0507 *[0.102]*	–0.0334 *[0.109]*	–0.0092 *[0.119]*	0.1047 *[0.132]*
polity2	0.1334*** *[0.044]*	0.1416*** *[0.036]*	0.1514*** *[0.039]*	0.1279*** *[0.035]*
durable	–0.0016*** *[0.000]*	–0.0006 *[0.001]*	–0.0016*** *[0.001]*	–0.0017*** *[0.001]*
polcomp	–0.1407** *[0.068]*	–0.1323** *[0.060]*	–0.1582* *[0.081]*	–0.1786** *[0.078]*
yrsoffc	–0.0154* *[0.008]*	–0.0135* *[0.008]*	–0.0118 *[0.008]*	–0.0118 *[0.008]*
maj	0.1355 *[0.193]*	0.0319 *[0.186]*	–0.0207 *[0.194]*	–0.0968 *[0.201]*
party_coal	–0.0986* *[0.054]*	–0.1017* *[0.058]*	–0.1084* *[0.061]*	–0.0836 *[0.061]*
GDP growth rate		–2.6183*** *[0.815]*	–3.4111*** *[0.906]*	–3.1144*** *[0.878]*
inflation rate		0.0397** *[0.009]*	0.0394*** *[0.010]*	0.0374*** *[0.010]*
real interest rate		–0.0042** *[0.002]*	–0.0027 *[0.005]*	–0.0005 *[0.005]*
inequality			0.0181*** *[0.005]*	
(inequality < average)				0.0286*** *[0.007]*
(inequality > average)				0.0173*** *[0.005]*
constant	0.606 *[0.391]*	0.5154 *[0.387]*	–0.0619 *[0.563]*	0.1326 *[0.532]*
Observations	671	520	461	461
R–squared	0.054	0.081	0.11	0.125
Hansen Statistic	–	0.993	3.008	2.488
p–value	–	0.803	0.39	0.477

Note: Robust standard errors in brackets. *** p<0.01, ** p<0.05, * p<0.1.

Table 5

Political Instability and Fiscal Stimuli – Evidence for OECD Countries

Government Crisis	**[1]**	**[2]**	**[3]**	**[4]**	**[5]**
military	–0.1435	–0.1467	–0.1417	–0.1049	–0.1934
	[0.116]	*[0.120]*	*[0.116]*	*[0.125]*	*[0.121]*
stabs	–0.1391	–0.1289	–0.1401	–0.1319	–0.1387
	[0.092]	*[0.092]*	*[0.092]*	*[0.092]*	*[0.092]*
system	0.1487**	0.1492**	0.1496**	0.1520**	0.1466**
	[0.062]	*[0.063]*	*[0.062]*	*[0.063]*	*[0.062]*
govfrac	0.0227	0.0261	0.0247	0.0275	0.0196
	[0.123]	*[0.123]*	*[0.124]*	*[0.124]*	*[0.123]*
polity2	0.1510***	0.1604***	0.1528***	0.1555***	0.1551***
	[0.040]	*[0.039]*	*[0.040]*	*[0.039]*	*[0.040]*
durable	–0.0015**	–0.0016**	–0.0016**	–0.0016**	–0.0016**
	[0.001]	*[0.001]*	*[0.001]*	*[0.001]*	*[0.001]*
polcomp	–0.1146	–0.1302	–0.1176	–0.1276	–0.1157
	[0.091]	*[0.090]*	*[0.091]*	*[0.090]*	*[0.092]*
yrsoffc	–0.0112	–0.012	–0.0111	–0.0116	–0.0117
	[0.008]	*[0.008]*	*[0.008]*	*[0.008]*	*[0.008]*
maj	–0.079	–0.0429	–0.0664	–0.0477	–0.074
	[0.205]	*[0.204]*	*[0.204]*	*[0.203]*	*[0.204]*
party_coal	–0.0977	–0.0954	–0.0958	–0.0935	–0.0991
	[0.061]	*[0.062]*	*[0.061]*	*[0.062]*	*[0.061]*

GDP growth rate	–3.8643*** *[1.024]*	–3.3767*** *[0.981]*	–3.6856*** *[0.993]*	–3.4776*** *[0.949]*	–3.7889*** *[1.014]*
inflation	0.0458*** *[0.012]*	0.0403*** *[0.011]*	0.0441*** *[0.012]*	0.0417*** *[0.011]*	0.0442*** *[0.012]*
real interest rate	–0.0012 *[0.006]*	–0.0025 *[0.006]*	–0.0017 *[0.006]*	–0.0026 *[0.006]*	–0.0009 *[0.006]*
inequality	0.0192*** *[0.005]*	0.0195*** *[0.006]*	0.0193*** *[0.005]*	0.0197*** *[0.006]*	0.0191*** *[0.005]*
fiscal stimuli	–0.1087** *[0.053]*				
increasingly expansionary fiscal stimuli		0.0503 *[0.131]*			
expansionary fiscal stimuli			–0.0825 *[0.055]*		
successful fiscal stimuli				–0.091 *[0.077]*	
unsuccessful fiscal stimuli					–0.0982* *[0.057]*
Constant	–0.5024 *[0.834]*	–0.4929 *[0.823]*	–0.5151 *[0.832]*	–0.4831 *[0.834]*	–0.5244 *[0.835]*
Observations	453	453	453	453	453
R–squared	0.118	0.113	0.115	0.113	0.116
Hansen Statistic	2.091	2.306	1.965	2.093	2.153
p–value	0.554	0.511	0.58	0.553	0.541

Note: Robust standard errors in brackets. *** p<0.01, ** p<0.05, * p<0.1.

Table 6

Political Instability and Interaction Between Inequality and Fiscal Stimuli Evidence for OECD Countries

Government Crisis	[1]	[2]	[3]	[4]	[5]
military	–0.1195	–0.146	–0.1246	–0.0944	–0.1963
	[0.119]	*[0.120]*	*[0.119]*	*[0.135]*	*[0.125]*
stabs	–0.1398	–0.1303	–0.14	–0.1328	–0.138
	[0.092]	*[0.092]*	*[0.093]*	*[0.092]*	*[0.092]*
system	0.1524**	0.1490**	0.1520**	0.1522**	0.1491**
	[0.063]	*[0.063]*	*[0.063]*	*[0.063]*	*[0.062]*
govfrac	0.025	0.0263	0.0266	0.0285	0.0197
	[0.124]	*[0.123]*	*[0.125]*	*[0.125]*	*[0.123]*
polity2	0.1478***	0.1607***	0.1503***	0.1549***	0.1540***
	[0.040]	*[0.039]*	*[0.040]*	*[0.039]*	*[0.041]*
durable	–0.0015**	–0.0016**	–0.0016**	–0.0016**	–0.0016**
	[0.001]	*[0.001]*	*[0.001]*	*[0.001]*	*[0.001]*
polcomp	–0.1123	–0.1304	–0.1158	–0.1269	–0.115
	[0.092]	*[0.089]*	*[0.092]*	*[0.090]*	*[0.094]*
yrsoffc	–0.0111	–0.0121	–0.0111	–0.0118	–0.0115
	[0.008]	*[0.008]*	*[0.008]*	*[0.008]*	*[0.008]*
maj	–0.0717	–0.0451	–0.0628	–0.0465	–0.0677
	[0.205]	*[0.203]*	*[0.204]*	*[0.203]*	*[0.203]*
party_coal	–0.0969	–0.0949	–0.0954	–0.0932	–0.0991
	[0.061]	*[0.061]*	*[0.062]*	*[0.062]*	*[0.061]*

GDP growth rate	–3.7924***	–3.4079***	–3.6468***	–3.4745***	–3.7094***
	[1.015]	*[0.967]*	*[0.989]*	*[0.949]*	*[1.004]*
inflation	0.0450***	0.0406***	0.0436***	0.0416***	0.0433***
	[0.012]	*[0.011]*	*[0.012]*	*[0.011]*	*[0.012]*
real interest rate	–0.0009	–0.0025	–0.0014	–0.0025	–0.0006
	[0.006]	*[0.006]*	*[0.006]*	*[0.006]*	*[0.006]*
inequality	0.0198***	0.0195***	0.0197***	0.0197***	0.0195***
	[0.006]	*[0.006]*	*[0.006]*	*[0.006]*	*[0.006]*
inequality x fiscal stimuli	–0.0033*				
	[0.002]				
inequality x increasingly expansionary fiscal stimuli		0.0012			
		[0.004]			
inequality x expansionary fiscal stimuli			–0.0025		
			[0.002]		
inequality x successful fiscal stimuli				–0.0022	
				[0.002]	
inequality x unsuccessful fiscal stimuli					–0.0028
					[0.002]
constant	–0.5337	–0.4915	–0.5346	–0.4882	–0.5495
	[0.844]	*[0.819]*	*[0.840]*	*[0.834]*	*[0.847]*
Observations	453	453	453	453	453
R–squared	0.117	0.112	0.115	0.113	0.115
Hansen Statistic	2.033	2.219	1.962	2.094	2.101
p–value	0.566	0.528	0.58	0.553	0.552

Note: Robust standard errors in brackets. *** $p<0.01$, ** $p<0.05$, * $p<0.1$.

Table 7

Political Instability – Evidence for Non-OECD Countries

Government Crisis	**[1]**	**[2]**	**[3]**	**[4]**
military	–0.0034 *[0.020]*	0.0024 *[0.027]*	0.0831 *[0.065]*	0.0726 *[0.066]*
stabs	0.0176 *[0.038]*	–0.0129 *[0.047]*	–0.1121 *[0.077]*	–0.1158 *[0.077]*
system	0.0055 *[0.014]*	–0.0147 *[0.016]*	–0.0436 *[0.031]*	–0.0482 *[0.031]*
govfrac	0.0659 *[0.043]*	0.0773 *[0.052]*	0.1347 *[0.086]*	0.1307 *[0.086]*
polity2	0.0161*** *[0.004]*	0.0137*** *[0.005]*	0.0307*** *[0.010]*	0.0303*** *[0.011]*
durable	0.0001 *[0.001]*	–0.0003 *[0.001]*	–0.0014 *[0.001]*	–0.0012 *[0.001]*
polcomp	–0.0198** *[0.008]*	–0.0175* *[0.009]*	–0.0528** *[0.021]*	–0.0480** *[0.022]*
yrsoffc	–0.0015 *[0.001]*	–0.0024* *[0.001]*	–0.0033 *[0.003]*	–0.0031 *[0.003]*
maj	–0.2584*** *[0.058]*	–0.1987*** *[0.067]*	–0.1872 *[0.125]*	–0.2139 *[0.130]*
party_coal	–0.0237*** *[0.009]*	–0.0069 *[0.012]*	–0.0216 *[0.026]*	–0.0353 *[0.030]*
GDP growth rate		–1.3826*** *[0.380]*	–2.6312*** *[0.966]*	–2.6612*** *[0.968]*
inflation rate		0.0143*** *[0.004]*	0.0271*** *[0.010]*	0.0275*** *[0.010]*
real interest rate		0.0001* *[0.000]*	0.0000 *[0.000]*	0.0000 *[0.000]*
inequality			–0.0006 *[0.003]*	
(inequality < average)				0.0069 *[0.006]*
(inequality > average)				0.0033 *[0.004]*
constant	0.4577*** *[0.074]*	0.4207*** *[0.088]*	0.7517*** *[0.247]*	0.5759** *[0.246]*
Observations	2019	1297	568	568
R–squared	0.058	0.093	0.121	0.125
Hansen Statistic	–	2.625	5.312	5.364
p–value	–	0.453	0.15	0.147

Note: Robust standard errors in brackets. *** p<0.01, ** p<0.05, * p<0.1.

parties to reach a consensus. This in turn, generates political instability and delays in the implementation of important programs necessary to stabilize the economy when affected by adverse shocks. Indeed, the state of the economic environment is a crucial determinant of the number of government crises. We observe that economic growth is undoubtedly the most important factor contributing to the stability of the government, as can be seen by the large magnitude of the coefficient associated to this variable. In contrast, inflation and increasing funding costs (as expressed in a higher interest rate) boost the possibility of political tensions (albeit weakly in the later variable). This is because many developing countries are characterized by less democratic and socially-polarized environments with low access to either domestic or external sources of debt financing (Aisen and Veiga, 2008a).

Finally, we show that inequality does not have a significant impact on the number of government crises, a result that is in sharp contrast with the evidence found for OECD countries. Moreover, this impact does not seem to rely on the size of the income gap, as the coefficients associated with inequality above and below the average are also statistically insignificant. In non-OECD countries the average lower literacy rates and education levels act as obstacles for the median voter to exert active civic and political pressure and demand public accountability from their political leaders and governments. Moreover, the traditionally higher average starting level of income inequality means that any marginal increase in the Gini coefficient is not felt as much as in OECD countries. Moreover, contrary to the group of OECD countries, non-OECD countries are usually characterized by a higher level of political instability and even periods of dictatorship and repression. This might mean that institutional and economic conditions can be overcastting the impact of income inequality on political instability that is observed in more stable political systems. In fact, we observe that the degree of democracy (*polity2*), GDP growth and inflation are the most relevant factors for this group of non-OECD countries.

Turning to the effects of fiscal episodes, our results suggest that it is the kind of program that ultimately matters: both expansionary and increasingly expansionary fiscal stimuli are particularly important in reducing the likelihood of government crises (as shown in Table 8). This, to some extent, can be interpreted as the mirror image of the finding of Haggard *et al.* (1995) that contractionary measures implemented in developing countries towards fiscal adjustments, as a result of external interventions, were accompanied by greater instability. Thus, the simple implementation of a program is not enough, like it has proven to be the case for the group of OECD countries; in non-OECD economies, only expansionary fiscal stimuli seem to be able to promote political stability.

Our previous piece of evidence is corroborated in Table 9, when we interact the level of inequality with the implementation of fiscal stimuli. Indeed, the table shows that conditioning the impact of inequality during periods of fiscal stimulus significantly reduces the number of government crisis episodes, since the magnitude of the resulting interacting coefficients gets significantly smaller. Blanco and Grier (2009) show that Latin American countries with low levels of inequality tend to suffer, on average, less political instability. In fact, in low-income countries and some emerging market economies, reforms of fuel and food subsidies are crucial to improving the equity impact of fiscal policy (Coady *et al.*, 2010). For non-OECD countries, we also observe that trend but only when redistributive expansionary measures are put in place. They seem to provide some positive re-adjustments in the income distribution, which in turn contributes to a more peaceful social and political environment.

Table 8

Political Instability and Fiscal Stimuli – Evidence for Non-OECD Countries

Government Crisis	[1]	[2]	[3]	[4]	[5]	[6]
military	0.0674	0.076	0.0717	0.0697	0.0733	0.074
	[0.070]	*[0.071]*	*[0.071]*	*[0.072]*	*[0.073]*	*[0.072]*
stabs	–0.1204	–0.1326	–0.1215	–0.1143	–0.1174	–0.1184
	[0.094]	*[0.098]*	*[0.094]*	*[0.093]*	*[0.094]*	*[0.095]*
system	–0.0326	–0.0303	–0.0339	–0.0362	–0.0378	–0.0357
	[0.033]	*[0.033]*	*[0.033]*	*[0.033]*	*[0.032]*	*[0.033]*
govfrac	0.053	0.0555	0.0461	0.0563	0.063	0.0579
	[0.093]	*[0.092]*	*[0.092]*	*[0.091]*	*[0.092]*	*[0.093]*
polity2	0.0263**	0.0270**	0.0258**	0.0265**	0.0256**	0.0261**
	[0.012]	*[0.012]*	*[0.012]*	*[0.012]*	*[0.012]*	*[0.012]*
durable	–0.0015	–0.0013	–0.0015	–0.0015	–0.0015	–0.0014
	[0.001]	*[0.001]*	*[0.001]*	*[0.001]*	*[0.001]*	*[0.001]*
polcomp	–0.0416*	–0.0422*	–0.0404*	–0.0422*	–0.0407	–0.0411*
	[0.024]	*[0.024]*	*[0.024]*	*[0.024]*	*[0.025]*	*[0.025]*
yrsoffc	–0.0046	–0.0046	–0.0047	–0.0046	–0.005	–0.0045
	[0.003]	*[0.003]*	*[0.003]*	*[0.003]*	*[0.003]*	*[0.003]*
maj	–0.2101	–0.2046	–0.2152	–0.1904	–0.2116	–0.2094
	[0.135]	*[0.136]*	*[0.135]*	*[0.135]*	*[0.136]*	*[0.136]*
party_coal	–0.0372	–0.0373	–0.0386	–0.0322	–0.0353	–0.0389
	[0.026]	*[0.026]*	*[0.026]*	*[0.026]*	*[0.027]*	*[0.027]*

GDP growth rate	–2.9778***	–2.9986***	–2.9605***	–2.8007***	–2.9399***	–3.0044***
	[1.015]	*[1.026]*	*[1.016]*	*[1.018]*	*[1.028]*	*[1.042]*
inflation	0.0307***	0.0309***	0.0307***	0.0288***	0.0301***	0.0308***
	[0.010]	*[0.010]*	*[0.010]*	*[0.010]*	*[0.010]*	*[0.010]*
real interest rate	0.000	0.000	0.000	0.000	0.000	0.000
	[0.000]	*[0.000]*	*[0.000]*	*[0.000]*	*[0.000]*	*[0.000]*
inequality	–0.0012	–0.0007	–0.0013	–0.0014	–0.0014	–0.0013
	[0.004]	*[0.004]*	*[0.004]*	*[0.004]*	*[0.004]*	*[0.004]*
fiscal stimuli	–0.0598					
	[0.052]					
increasingly expansionary fiscal stimuli		–0.1761**				
		[0.069]				
expansionary fiscal stimuli			–0.1042*			
			[0.054]			
contractionary fiscal stimuli				0.5274		
				[0.629]		
successful fiscal stimuli					0.0001	
					[0.095]	
unsuccessful fiscal stimuli						–0.0734
						[0.063]
constant	0.8334***	0.8031***	0.8440***	0.7990***	0.8194***	0.8331***
	[0.253]	*[0.255]*	*[0.253]*	*[0.251]*	*[0.253]*	*[0.252]*
Observations	493	493	493	493	485	487
R–squared	0.137	0.143	0.141	0.139	0.134	0.137
Hansen Statistic	5.78	5.656	5.777	5.707	5.793	5.528
p–value	0.123	0.13	0.123	0.127	0.122	0.137

Note: Robust standard errors in brackets. *** $p<0.01$, ** $p<0.05$, * $p<0.1$.

Table 9

Political Instability and Interaction Between Inequality and Fiscal Stimuli Evidence for Non-OECD Countries

Government Crisis	[1]	[2]	[3]	[4]	[5]	[6]
military	0.0675	0.0767	0.0712	0.0697	0.075	0.0746
	[0.070]	*[0.071]*	*[0.071]*	*[0.072]*	*[0.073]*	*[0.072]*
stabs	–0.1204	–0.1339	–0.1216	–0.1149	–0.1155	–0.1173
	[0.094]	*[0.098]*	*[0.094]*	*[0.093]*	*[0.095]*	*[0.095]*
system	–0.0329	–0.0307	–0.0341	–0.0363	–0.0387	–0.0354
	[0.033]	*[0.033]*	*[0.033]*	*[0.033]*	*[0.032]*	*[0.033]*
govfrac	0.054	0.0578	0.0471	0.0574	0.0647	0.0586
	[0.093]	*[0.092]*	*[0.092]*	*[0.092]*	*[0.092]*	*[0.093]*
polity2	0.0263**	0.0268**	0.0259**	0.0266**	0.0258**	0.0260**
	[0.012]	*[0.012]*	*[0.012]*	*[0.012]*	*[0.012]*	*[0.012]*
durable	–0.0015	–0.0013	–0.0015	–0.0015	–0.0015	–0.0014
	[0.001]	*[0.001]*	*[0.001]*	*[0.001]*	*[0.001]*	*[0.001]*
polcomp	–0.0417*	–0.0420*	–0.0406*	–0.0422*	–0.041	–0.0408
	[0.024]	*[0.024]*	*[0.024]*	*[0.024]*	*[0.025]*	*[0.025]*
yrsoffc	–0.0045	–0.0046	–0.0045	–0.0046	–0.0049	–0.0044
	[0.003]	*[0.003]*	*[0.003]*	*[0.003]*	*[0.003]*	*[0.003]*
maj	–0.2106	–0.2037	–0.2147	–0.192	–0.2106	–0.212
	[0.135]	*[0.135]*	*[0.135]*	*[0.135]*	*[0.136]*	*[0.135]*
party_coal	–0.0372	–0.038	–0.0388	–0.0323	–0.0353	–0.0402
	[0.026]	*[0.026]*	*[0.026]*	*[0.026]*	*[0.027]*	*[0.027]*

GDP growth rate	–2.9705***	–3.0033***	–2.9479***	–2.8123***	–2.9253***	–3.0201***
	[1.013]	*[1.023]*	*[1.016]*	*[1.018]*	*[1.027]*	*[1.041]*
Inflation	0.0306***	0.0309***	0.0306***	0.0289***	0.0299***	0.0310***
	[0.010]	*[0.010]*	*[0.010]*	*[0.010]*	*[0.010]*	*[0.010]*
real interest rate	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	[0.000]	*[0.000]*	*[0.000]*	*[0.000]*	*[0.000]*	*[0.000]*
inequality	–0.0008	–0.0003	–0.0006	–0.0014	–0.0015	–0.0009
	[0.004]	*[0.004]*	*[0.004]*	*[0.004]*	*[0.004]*	*[0.004]*
inequality x fiscal stimuli	–0.0013					
	[0.001]					
inequality x increasingly expansionary fiscal stimuli		–0.0042***				
		[0.001]				
inequality x expansionary fiscal stimuli			–0.0024*			
			[0.001]			
inequality x contractionary fiscal stimuli				0.0096		
inequality x successful fiscal stimuli					0.0006	
					[0.002]	
Inequality x unsuccessful fiscal stimuli						–0.002
						[0.001]
constant	0.8169***	0.7867***	0.8145***	0.8015***	0.8207***	0.8210***
	[0.253]	*[0.256]*	*[0.253]*	*[0.251]*	*[0.253]*	*[0.253]*
Observations	493	493	493	493	485	487
R–squared	0.137	0.144	0.141	0.138	0.134	0.138
Hansen Statistic	5.808	5.707	5.826	5.73	5.715	5.476
p–value	0.121	0.127	0.12	0.126	0.126	0.14

Note: Robust standard errors in brackets. *** p<0.01, ** p<0.05, * p<0.1.

5.2 Evidence from an Ordered Probit Model

As a final robustness exercise, we estimate an ordered probit model, which assesses the institutional and economic determinants of the probability of political instability and evaluates the impact of inequality and fiscal stimuli on the likelihood of government crises.

Table 10 provides evidence of the relationship between political instability and inequality. The results are in line with our baseline model estimated using an IV approach. Indeed, they suggest that variables providing detailed information about the legislature, such as the existence of a majority of seats in the parliament by the incumbent government (*maj*) as well as whether it consists of a coalition or not (*party_coal*), strongly reduce the probability of occurrence of government crises. Similarly, the regime durability (*durable*) and the level of political competition (*polcomp*) both have a negative effect on the likelihood of political instability. In contrast, the level of government fractionalization (*govfrac*) and the political regime (*polity2*) increase the probability of occurrence of government crises, while the number of years in office of the chief executive (*yrsoffc*) warrants a more stable government (albeit only weakly from a statistical point of view).

In what concerns the group of economic determinants, our results show that economic growth increases the likelihood of a stable legislature. The importance of the economic environment is, therefore, clear and robust. In fact, Alesina *et al.* (1996) have also found, for a large heterogeneous sample, a higher propensity for government collapses in countries characterized by lower growth. Moreover, this different specification confirms that high inflation erodes the likelihood of a stable legislature and contributes to an increase in the probability of government crises. Inflation always creates an environment of instability at the economic, social and political levels.

With regard to inequality, the empirical findings do not corroborate the existence of a significant impact on the likelihood of government crises, despite the fact that the coefficient estimate has the expected positive sign. However, we uncover a nonlinear effect of inequality on the probability of the occurrence of government crises in that the magnitude of the income gap matters for political instability. When inequality is above average, the likelihood of political instability almost doubles relatively to the case in which it is below average. Therefore, political parties must pay attention to the distribution of income, otherwise they might end up trapped in an unstable social and political setup.

In Table 11, we include the different fiscal stimuli episodes in the group of regressors. Such type of programs and, in particular, expansionary fiscal stimuli strongly reduce the prospects of government crises. A similar conclusion is reached when we interact inequality with fiscal stimuli programs, as can be seen in Table 12. Thus, the impact of the income gap on the occurrence of government crises is dampened during periods of fiscal stimuli. This may reflect the fact that incumbent governments tend to raise spending or cut taxes before elections in order to maximize the probability of re-election (Rogoff and Sibert, 1988; Persson and Tabellini, 2000). In this way, they can erode any underlying social tensions arising from worse income distribution and, consequently, lower the prospects of political instability.

6 Conclusion

In this paper, we use data for a panel of developed and developing countries to assess the impact of income inequality and fiscal stimuli on political instability.

Table 10

Political Instability – Ordered Probit Model

Government Crisis	[1]	[2]	[3]	[4]
military	0.0961 *[0.117]*	0.039 *[0.154]*	0.2489 *[0.196]*	0.2372 *[0.197]*
stabs	–0.0279 *[0.117]*	–0.1138 *[0.138]*	–0.3570* *[0.183]*	–0.3940** *[0.184]*
system	0.0461 *[0.039]*	0.0039 *[0.048]*	0.0588 *[0.072]*	–0.0058 *[0.074]*
govfrac	0.2652** *[0.121]*	0.3312** *[0.148]*	0.1942 *[0.192]*	0.315 *[0.197]*
polity2	0.0857*** *[0.021]*	0.0729*** *[0.024]*	0.1026*** *[0.035]*	0.1114*** *[0.036]*
durable	–0.0048*** *[0.001]*	–0.0037*** *[0.001]*	–0.0047*** *[0.002]*	–0.0055*** *[0.002]*
polcomp	–0.0907** *[0.036]*	–0.0800* *[0.041]*	–0.1237* *[0.064]*	–0.1400** *[0.066]*
yrsoffc	–0.014 *[0.009]*	–0.0229** *[0.010]*	–0.0195 *[0.013]*	–0.0201 *[0.013]*
maj	–0.7961*** *[0.199]*	–0.6213*** *[0.231]*	–0.2869 *[0.319]*	–0.4234 *[0.334]*
party_coal	–0.1055** *[0.047]*	–0.0336 *[0.062]*	–0.1858** *[0.081]*	–0.2082** *[0.082]*
GDP growth rate		–4.7104*** *[0.926]*	–7.0495*** *[1.411]*	–7.2997*** *[1.440]*
inflation rate		0.0491*** *[0.009]*	0.0725*** *[0.014]*	0.0753*** *[0.014]*
real interest rate		0.0000 *[0.000]*	0.0000 *[0.000]*	0.0000 *[0.000]*
inequality			0.011 *[0.007]*	
(inequality > average)				0.0491*** *[0.014]*
(inequality < average)				0.0290*** *[0.009]*
threshold 1	0.0782 *[0.260]*	0.2456 *[0.306]*	0.2116 *[0.594]*	0.921 *[0.625]*
threshold 2	0.9558*** *[0.261]*	1.1501*** *[0.309]*	1.0962* *[0.601]*	1.8182*** *[0.632]*
threshold 3	1.6334*** *[0.277]*	1.9940*** *[0.337]*	2.0061*** *[0.608]*	2.7302*** *[0.646]*
threshold 4	1.9386*** *[0.304]*	2.3781*** *[0.369]*	2.3653*** *[0.620]*	3.0881*** *[0.642]*
Observations	2690	1922	1079	3.3254***

Note: Robust standard errors in brackets. *** p<0.01, ** p<0.05, * p<0.1.

Table 11

Political Instability and Fiscal Stimuli – Ordered Probit Model

Government Crisis	[1]	[2]	[3]	[4]	[5]	[6]
military	0.1218	0.1396	0.1306	0.1388	0.1223	0.1308
	[0.226]	*[0.226]*	*[0.226]*	*[0.228]*	*[0.226]*	*[0.227]*
stabs	–0.3864**	–0.3850*	–0.3868**	–0.3670*	–0.3785*	–0.3700*
	[0.196]	*[0.199]*	*[0.196]*	*[0.197]*	*[0.197]*	*[0.197]*
system	0.0853	0.078	0.0835	0.0755	0.0792	0.0823
	[0.080]	*[0.079]*	*[0.079]*	*[0.078]*	*[0.078]*	*[0.079]*
govfrac	0.033	0.0352	0.0247	0.0377	0.0456	0.0367
	[0.205]	*[0.204]*	*[0.204]*	*[0.205]*	*[0.205]*	*[0.204]*
polity2	0.0921**	0.0903**	0.0929**	0.0896**	0.0910**	0.0944**
	[0.038]	*[0.038]*	*[0.038]*	*[0.038]*	*[0.038]*	*[0.038]*
durable	–0.0044**	–0.0041**	–0.0044**	–0.0042**	–0.0043**	–0.0043**
	[0.002]	*[0.002]*	*[0.002]*	*[0.002]*	*[0.002]*	*[0.002]*
polcomp	–0.1038	–0.0993	–0.1032	–0.0987	–0.1033	–0.108
	[0.072]	*[0.071]*	*[0.072]*	*[0.071]*	*[0.072]*	*[0.073]*
yrsoffc	–0.0221	–0.0225	–0.0218	–0.0228	–0.0225	–0.0212
	[0.015]	*[0.015]*	*[0.015]*	*[0.015]*	*[0.015]*	*[0.015]*
maj	–0.2325	–0.2037	–0.2269	–0.1843	–0.1992	–0.2077
	[0.341]	*[0.337]*	*[0.341]*	*[0.338]*	*[0.338]*	*[0.340]*
party_coal	–0.2119**	–0.2054**	–0.2111**	–0.2023**	–0.1974**	–0.2058**
	[0.087]	*[0.088]*	*[0.087]*	*[0.088]*	*[0.089]*	*[0.088]*

GDP growth rate	–7.4400***	–7.1514***	–7.2552***	–6.9170***	–7.0966***	–7.2202***
	[1.558]	*[1.513]*	*[1.524]*	*[1.508]*	*[1.525]*	*[1.533]*
inflation	0.0771***	0.0737***	0.0754***	0.0712***	0.0732***	0.0744***
	[0.015]	*[0.015]*	*[0.015]*	*[0.015]*	*[0.015]*	*[0.015]*
real interest rate	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	[0.000]	*[0.000]*	*[0.000]*	*[0.000]*	*[0.000]*	*[0.000]*
inequality	0.0169**	0.0164**	0.0167**	0.0155**	0.0164**	0.0158**
	[0.008]	*[0.008]*	*[0.008]*	*[0.008]*	*[0.008]*	*[0.008]*
fiscal stimuli	–0.2217*					
	[0.127]					
increasingly expansionary fiscal stimuli		–0.2222				
		[0.204]				
expansionary fiscal stimuli			–0.2338*			
			[0.133]			
contractionary fiscal stimuli				0.5772		
				[0.728]		
successful fiscal stimuli					–0.1791	
					[0.188]	
unsuccessful fiscal stimuli						–0.1724
						[0.137]
threshold 1	0.4178	0.4936	0.432	0.4979	0.4876	0.4128
	[0.657]	*[0.654]*	*[0.657]*	*[0.655]*	*[0.653]*	*[0.654]*
threshold 2	1.2980*	1.3711**	1.3130**	1.3757**	1.3649**	1.2913*
	[0.664]	*[0.661]*	*[0.664]*	*[0.662]*	*[0.660]*	*[0.661]*
threshold 3	2.1816***	2.2606***	2.2008***	2.2634***	2.2501***	2.1744***
	[0.674]	*[0.671]*	*[0.675]*	*[0.674]*	*[0.670]*	*[0.671]*
threshold 4	2.5407***	2.6269***	2.5601***	2.6251***	2.6088***	2.5384***
	[0.678]	*[0.677]*	*[0.679]*	*[0.678]*	*[0.676]*	*[0.678]*
threshold 5	2.7732***	2.8598***	2.7911***	2.8562***	2.8380***	2.7730***
	[0.727]	*[0.728]*	*[0.726]*	*[0.726]*	*[0.721]*	*[0.728]*
Observations	959	959	959	959	951	953

Note: Robust standard errors in brackets. *** p<0.01, ** p<0.05, * p<0.1.

Table 12

Political Instability and Interaction Between Inequality and Fiscal Stimuli Ordered Probit Model

Government Crisis	[1]	[2]	[3]	[4]	[5]	[6]
military	0.1176	0.1405	0.1257	0.1386	0.1254	0.1281
	[0.225]	*[0.225]*	*[0.225]*	*[0.228]*	*[0.226]*	*[0.226]*
stabs	−0.3826*	−0.3894*	−0.3826*	−0.3676*	−0.3758*	−0.3639*
	[0.197]	*[0.199]*	*[0.197]*	*[0.197]*	*[0.197]*	*[0.198]*
system	0.0867	0.0804	0.086	0.0753	0.0783	0.0843
	[0.080]	*[0.079]*	*[0.079]*	*[0.078]*	*[0.078]*	*[0.080]*
govfrac	0.0401	0.0353	0.0298	0.0392	0.0461	0.0409
	[0.205]	*[0.204]*	*[0.204]*	*[0.205]*	*[0.205]*	*[0.204]*
polity2	0.0918**	0.0901**	0.0931**	0.0896**	0.0911**	0.0949**
	[0.038]	*[0.038]*	*[0.038]*	*[0.038]*	*[0.038]*	*[0.038]*
durable	−0.0043**	−0.0041**	−0.0043**	−0.0042**	−0.0043**	−0.0043**
	[0.002]	*[0.002]*	*[0.002]*	*[0.002]*	*[0.002]*	*[0.002]*
polcomp	−0.1032	−0.0987	−0.1034	−0.0986	−0.1032	−0.1088
	[0.072]	*[0.071]*	*[0.072]*	*[0.071]*	*[0.072]*	*[0.073]*
yrsoffc	−0.0218	−0.0223	−0.0214	−0.0228	−0.0223	−0.0208
	[0.015]	*[0.015]*	*[0.014]*	*[0.015]*	*[0.015]*	*[0.015]*
maj	−0.2398	−0.2071	−0.2369	−0.1865	−0.1962	−0.2155
	[0.340]	*[0.337]*	*[0.340]*	*[0.338]*	*[0.338]*	*[0.340]*
party_coal	−0.2130**	−0.2080**	−0.2133**	−0.2024**	−0.1980**	−0.2066**
	[0.087]	*[0.088]*	*[0.087]*	*[0.088]*	*[0.089]*	*[0.088]*

GDP growth rate	–7.4083***	–7.1908***	–7.2275***	–6.9318***	–7.0538***	–7.2242***
	[1.553]	*[1.509]*	*[1.522]*	*[1.507]*	*[1.520]*	*[1.529]*
inflation	0.0769***	0.0743***	0.0753***	0.0713***	0.0727***	0.0745***
	[0.015]	*[0.015]*	*[0.015]*	*[0.015]*	*[0.015]*	*[0.015]*
real interest rate	0.000	0.000	0.000	0.000	0.000	0.000
	[0.000]	*[0.000]*	*[0.000]*	*[0.000]*	*[0.000]*	*[0.000]*
inequality	0.0182**	0.0171**	0.0181**	0.0156**	0.0162**	0.0167**
	[0.008]	*[0.008]*	*[0.008]*	*[0.008]*	*[0.008]*	*[0.008]*
inequality x fiscal stimuli	–0.0054*					
	[0.003]					
inequality x increasingly expansionary fiscal stimuli		–0.0082*				
		[0.005]				
inequality x expansionary fiscal stimuli			–0.0063*			
			[0.003]			
inequality x contractionary fiscal stimuli				0.0106		
				[0.016]		
inequality x successful fiscal stimuli					–0.0026	
					[0.004]	
inequality x unsuccessful fiscal stimuli						–0.0048
						[0.003]
threshold 1	0.4723	0.515	0.483	0.4965	0.4886	0.4437
	[0.654]	*[0.654]*	*[0.655]*	*[0.655]*	*[0.653]*	*[0.652]*
threshold 2	1.3524**	1.3939**	1.3647**	1.3740**	1.3653**	1.3226**
	[0.662]	*[0.662]*	*[0.662]*	*[0.662]*	*[0.659]*	*[0.659]*
threshold 3	2.2345***	2.2862***	2.2520***	2.2611***	2.2501***	2.2046***
	[0.672]	*[0.672]*	*[0.674]*	*[0.674]*	*[0.670]*	*[0.670]*
threshold 4	2.5919***	2.6536***	2.6091***	2.6231***	2.6101***	2.5680***
	[0.676]	*[0.678]*	*[0.678]*	*[0.678]*	*[0.676]*	*[0.675]*
threshold 5	2.8237***	2.8867***	2.8389***	2.8544***	2.8400***	2.8028***
	[0.723]	*[0.729]*	*[0.723]*	*[0.726]*	*[0.721]*	*[0.726]*
Observations		959	959	959	951	953

Note: Robust standard errors in brackets. *** p<0.01, ** p<0.05, * p<0.1.

We find that government crises are more frequent when inequality increases. This result is particularly important for OECD countries, where a widening of the income gap leads to less stable legislatures. Considering that economic agents are sensitive to changes in the income gap, they will react more actively when they feel penalized, which in turn fuels social and political instability. This is an aspect to which political authorities should pay attention to and address by implementing measures aimed at promoting a fair distribution of income and wealth. In fact, our results show that expansionary and increasingly expansionary fiscal stimuli can help improving the stability of the political system. As they tend to promote a more equitative distribution of income and it is easier to reach a consensus for their implementation, they contribute to a more stable environment. Moreover, the implementation of fiscal stimuli is likely to abate the impact of inequality on political instability, especially, when fiscal stimuli are effective at inducing growth.

Finally, we find that the existence of a majority of seats or a coalition government, the regime durability, the level of political competition and the number of years in office of the chief executive reduce political instability, while the level of government fractionalization and the political regime has a positive effect on the occurrence of government crises. These results confirm that the political setup (the composition of the political spectrum, the level of competition among parties, their structure, …) play an important role in promoting political stability. Therefore, the more solid the underlying political institutions is, the more stable the political environment will be.

In addition, and from a macroeconomic point of view, economic growth and low inflation seem to be key determinants for political stability. This is another important result that arises from our study and consolidates the idea that fiscal and monetary authorities must act to promote a stable economic framework: fiscal authorities should take special care in designing growth promoting packages, such like expansionary fiscal stimuli programs; while monetary authorities must play their role in stabilizing inflation. If these roles are successfully accomplished, the necessary conditions for a stable economic, social and political environment are observed and the economy can thrive therein.

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COMMENT TO "THE IMPACT OF INCOME INEQUALITY AND FISCAL STIMULI ON POLITICAL (IN)STABILITY" BY LUCA AGNELLO, VÍTOR CASTRO, JOÃO TOVAR JALLES AND RICARDO SOUSA

*Martin Larch**

In the past several years the distribution of income and income inequality have experienced a remarkable comeback in macroeconomics. Largely ignored before, the post-2007 financial and economic crisis has made the economic profession more sensitive to a trend that actually had been going on for years, if not decades. More and more questions are being raised about the macroeconomic and political impact of inequality as in some advanced economies indicators of income distribution returned to levels observed at the beginning of the 20th century.

The paper by Agnello, Castro, Tovar Jalles and Sousa is part of this new wave of interest. It sets out to explore the empirical nexus between income inequality and political (in)stability. The underlying, and a priori perfectly sound assumption is that unequal societies are more prone to political instability and that fiscal expansions can quell political discontent. The results of the empirical analysis carried out by authors – a panel regressions covering 128 OECD and non-OECD countries – broadly confirm these priors. In fact, all of their findings look very sensible from a macro perspective and seem to confirm popular priors as well as existing findings in the literature. I do not review them in detail here. The presentation in the paper is very clear and comprehensive.

There is only one specific finding, which in my view stands out (at least in the version of the paper that I had the pleasure to review for the 2015 edition of the Banca d'Italia workshop on public finances) and which I personally find rather delicate. Notably, too much democracy is reported to be bad for political stability, especially in non-OECD countries. While I am not a political scientist and hence may not be familiar with the relevant literature, I find such statements too sweeping especially when based on results from reduced form regressions. The sign and statistical significance of a coefficient in a panel regression do probably not represent ultimate and compelling pieces of evidence to conclude on the role of democracy for political stability. Are we sure of the causality? Are the proxies for democracy really robust? Do we really understand how the alleged transmission between democracy and political (in)stability works? These are only some of the question that came to my mind when I stumbled across this particular finding and which, after all, is not crucial to the main focus of the paper and could possibly be toned down.

At the same time, by taking issue with the paper's conclusion on democracy I implicitly open up to a more general difficulty of empirical papers that address very weighty macro questions via reduced-form relationships. The number of possible interactions is large, the direction of causality very complex and the existing empirical literature correspondingly rich. Figure 1 tries to illustrate in a very simplistic manner the space of macro factors at play.

The parts in colour highlight the specific angle taken by the authors whereby political instability is expected to be influenced by income inequality and fiscal policy making while at the same time controlling for the possible role played by the macroeconomic situation and a number of institutional features. Of course, as becomes clear from the illustration, there are many other possible angles from which one can look at the space of macro relations. In fact, the literature

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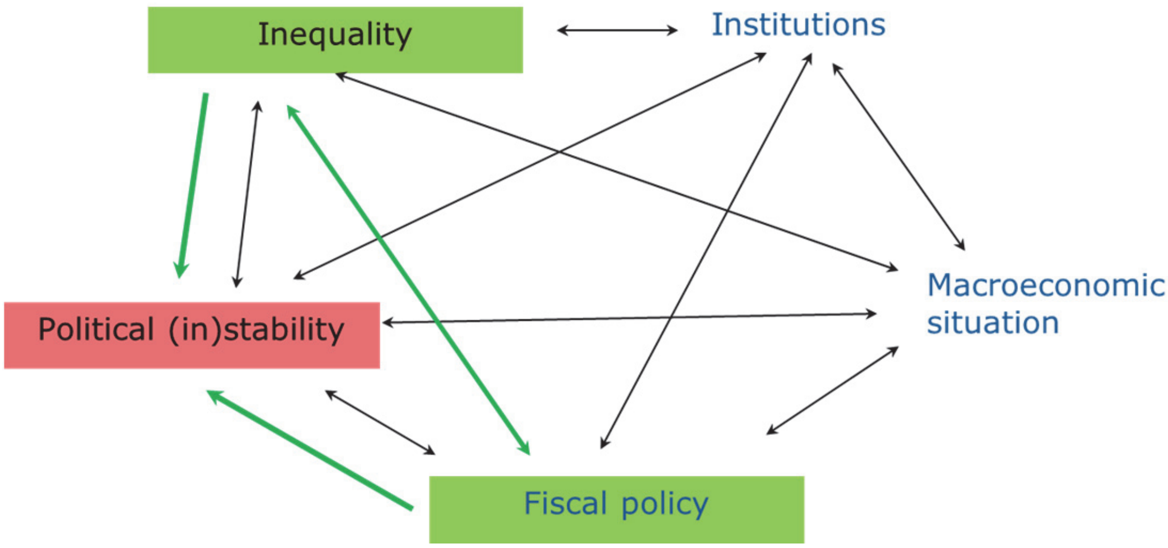
Figure 1

Macro Factors at Play in the Inequality Arena



review included in the paper is very extensive covering almost all possible combinations such as the impact of institutions on macroeconomic performance or political stability, the impact of fiscal policy on economic performance, the link between institutions and fiscal performance to mention a few.

I am not making this point to put into question the paper by Angello *et al.* In particular, I am not trying to argue that the empirical strategy chosen by Angello et al. is inappropriate, inadequate or not granular enough. There are far too many papers in the empirical literature following the same or a similar path, including one of my own papers.[1] In fact, the econometrics used in the paper is fairly solid.

What is lacking for my taste is a more detailed description or a theory of how the postulated nexus is expected to operate. As indicated earlier, the presumption that income inequality may nurture political instability is intuitive. However, the microeconomics of the link is not spelled out and not that obvious. Since the space of possible linkages is so complex and allows for many different narratives it would be very useful to refer to relevant political economy models. Without such a theoretical reference or compass that would help navigate the data many questions concerning the results spring to mind and remain unanswered.

Firstly, and going beyond the apparent intuition behind the presumption of the paper, the political science literature known to me does not establish unconditional links between income distribution and political (in)stability. To be more concrete, political instability is rarely driven by the 'bottom 5 or 10%' of society. Most of the times political discontent, which eventually translates into instability, originates in fears of the politically more involved middle or upper middle class. Keeping this in mind, how would changes at the upper or lower end of the income distribution

[1] Larch, M. (2012), Fiscal Performance and Income Inequality: Are Unequal Societies More Deficit-Prone?, *Kyklos*, No. 65, pp. 53-80. doi: 10.1111/j.1467-6435.2011.00527. The paper looks at whether income inequality has a direct and indirect effect (via political instability) effect on fiscal policy. The findings are consistent with those of Angelo *et al.* in the sense that I find a significant link between inequality and fiscal performance. The crucial difference is that I postulate a different causality.

effectively translate into political (in)stability? Can we assume a linear relationship, or are we more likely to deal with non-linear relationships where thresholds may play an important role?

Also, since the early 1980s income distribution has become increasingly more unequal in OECD countries, in some cases reaching all-time highs. Has political instability increased? On the face of it, no. What are then the other factors at play? Better political institutions? While I am quite sure there is no single theoretical framework capable of providing an answer to all these questions, finding and describing relevant models would further improve an already interesting paper.

Another key aspect of the paper that deserves a moment of reflection is the assumed link between income inequality and fiscal expansion. Again, the intuition underlying the paper is straightforward: To the extent that fiscal policy can influence the distribution of income, specific fiscal episodes should help mitigate political instability. In practical terms, and assuming that fiscal consolidation is detrimental for income distribution, Agnello *et al.* proxy the relevant fiscal policy episodes with indicators of fiscal stimuli where the indicator looks at a given change in the cyclically-adjusted primary budget balance.

As before, this approach looks perfectly reasonable from a certain distance but triggers a number of important questions. For instance, is a fiscal stimulus necessarily beneficial for the distribution of income? Is fiscal consolidation always detrimental? One can easily think of tax cuts that favour individuals with above median income. While I am not an expert of recent or less recent tax reforms that lead to a reduction in the tax burden, I am sure there are quite a few reforms that increased the inequality of income rather than reducing it. By the same token, it is not at all obvious that fiscal consolidation will always increase the gap between the rich and the less well off. A recent and quite prominent example is the EU-IMF financial assistance programme for Ireland which encompassed a very significant fiscal retrenchment. However, the expenditure cuts and tax increases were implemented in such a way as to minimise their social impact. A quick look at relevant data shows that the consolidation episode was successful in two ways. It brought public finances back to a sustainable path while keeping indicators of the distribution of disposable income, that is, after taxes and transfers, essentially unchanged throughout the adjustment period.

To use fiscal stimuli as proxy was most likely dictated by the availability of relevant indicators. As far as I am aware, there are no datasets providing cross-country comparable indicators measuring the distributional impact of fiscal policy measures. However, even leaving aside the issue of data availability the question of how fiscal policy actually affects income distribution remains. Does the effect work directly and predominantly through taxes and transfers or rather indirectly through the effect on aggregate demand and unemployment? The paper could provide some more insights in this regard. Unemployment is one of the most incisive events that lead to a loss of personal income. Hence, the rate of unemployment would be a natural candidate to be added to the list or variables controlling for economic conditions in the panel regressions. Apart from affecting the distribution of income, unemployment is arguably also a factor that should directly impact on people's sentiment *vis-à-vis* government even if social protection is effective. I may be wrong, but my prior is that once the rate of unemployment is included, inequality may lose some of its statistical significance. This would not invalidate or undermine the findings of the paper. It may clarify the actual channel through which fiscal policy and inequality affect the political stability of a country.

WEALTH DISTRIBUTION AND TAXATION IN EU MEMBERS

Anna Iara[*]

After a short overview of the distribution of private wealth and asset-based taxation in EU Members, this paper provides a range of economic arguments to make the case for asset-based taxation. Thereafter, aspects of design and implementation of specific asset-based taxes, notably housing, net wealth, and gifts and inheritances, are discussed from a distributional perspective. Finally, the possible role of the EU level of policy making in the adoption of such tax instruments is addressed.

1 Introduction

Calls for the taxation of wealth have become more vocal recently, underpinned by different objectives. The possibility to raise Treasury revenue from wealth has received increased interest in light of the struggle of EMU Members with high public debt. The IMF (2013) established for 15 euro area countries that that a net wealth levy of about 10 per cent could reduce public debt to the levels of 2007, but highlighted the experience of limited success due to implementation delays. In the same vein, the Bundesbank (2014) contemplated a wealth levy as a pre-condition to foreign public debt relief to affected countries. Wealth taxes are also increasingly seen as an instrument to foster equity. This view has received prominent support by Piketty's (2014) historical analysis of wealth distributions in industrialized countries. The argument goes that wealth tends to concentrate due to higher returns to capital than growth, which is particularly acute in ageing societies. A tax on wealth is expected to counteract both widening wealth inequality within populations and its transmission to next generations. Finally, more tax revenue from specific assets, residential property, is seen to improve the growth-friendliness of taxation systems. Recurrent taxes on land and residential buildings have received support by the OECD (2010)'s analysis on taxation and growth, based on the assertion that such taxes affect labour supply, investment, human capital investment, and innovation decisions to a lesser degree than other taxes, and are more difficult to evade.

The renewed interest in wealth taxation has also been echoed by analysis and public debate within EU Members, typically driven by concerns about equity. In Austria, in late 2013, a broad platform of economists and social scientist launched a call to re-introduce a tax on gifts and inheritances that was abolished in 2008.[1] In Germany, the taxation of wealth has been put on hold since 1997 but its reactivation has been picked up by public debate lately (Bräuninger, 2012); besides, an investigation by the Constitutional Court is ongoing on the privileges to private assets offered by the gift and inheritance taxation rules applied to business assets. In Spain, a net wealth tax had been effectively abolished in 2008 but re-introduced in 2011. In the UK, the debate has been ongoing, with analytical contributions made e.g., by IPPR, one of the country's leading think-tanks, extending micro-simulation over household assets. In France, a "solidarity tax on wealth" has been levied since 1982. After a reduction in the overall burden in 2012, most recently again higher rates of up 1.5 per cent on assets over EUR 10 mn are being applied. In Belgium, public

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[*] European Commission, Secretariat-General. Email: anna.iara@ec.europa.eu. Disclaimer: Most of this paper was written while the author was staff member of the European Commission's Directorate-General for Taxation and Customs Union. The views expressed in the paper are the author's alone and do not necessarily correspond to those of the European Commission and its Services. Comments by Cécile Denis, Kees Heineken, Thomas Hemmelgarn, Gaëtan Nicodème, Alvaro Pina, and participants of the 17th Banca d'Italia Workshop on Public Finance in Perugia, 9-11 April 2015, are gratefully acknowledged. Errors and omissions remain those of the author.

[1] See the website www.erbschaften-besteuern.at

debate on the possibility to tax wealth to the benefit of decreasing the high tax burdens on labour has also become more vocal recently. On the other hand, in Italy, hostility against wealth taxes – in particular against those on residential property, that had been introduced in 2011 but abolished for non-luxury dwellings later – is wide-spread and appears consistent with high and broadly spread levels of net household wealth against the highly indebted state.

This paper contributes to the dissemination of information for policy choices considering taxes on wealth in EU Members. In the EU policy framework so far, the recurrent taxation of immovably property in particular has been in the focus of the tax policy recommendations for the EU Members, backed by the growth-friendliness of this instrument. However, a comprehensive assessment of different approaches to the taxation of assets with regard to different objectives has not yet been undertaken. This paper intends to fill this gap by discussing the rationale, design choices, and scope of action at the EU level with regard to asset based taxation. We first describe household wealth distributions in euro area Member States derived from the Eurosystem Household Finance and Consumption Survey, and provide a sketch of wealth taxation in EU Members applied at present (Section 3). Next we review basic arguments for and against the taxation of wealth (Section 3). Thereafter we discuss specific design aspects, relating to the choice of the base, and the timing resp. frequency of levies, as well as some implementation challenges (Section 4). Finally we explain what role could possibly be assumed by policy making at the EU level (Section 5).

2 The distribution and taxation of wealth in EU Members

2.1 The distribution of wealth in euro area Members

The Eurosystem Household Finance and Consumption Survey (HFCS) provides comparative information on the distribution and composition of household wealth in more than half of the EU Members as of 2010. The HFCS survey was conducted in 2010 and the data were released in spring 2013. For all members of the euro area as of 2010 but Ireland and Estonia, it contains ex ante harmonized information on real and financial assets, liabilities, and expenses of private households. The country samples are established on the grounds of complex survey design, aiming at allowing for statistical inference that is representative of the population. Among others, item non-response is dealt with by multiple imputation.[2] In spite of the ambitious survey design and the explicit oversampling of the wealthy by some but not all participating countries (Eurosystem Household Finance and Consumption Network, 2013), the caveat holds that the top tail of the wealth distribution is heavily under-estimated, as suggested by comparison with rich lists compiled by journalists (Vermeulen, 2014). Therefore, conclusions on the wealthiest fractions of the households should be understood as based on lower bound estimates of their wealth.

Descriptive analysis derived from the Eurosystem HFCS[3] shows the following (see also the tables in the Annex).

- **Net household wealth is relatively highly concentrated across households in EU Members, but considerable country differences exist (Fig. 1; Table A2 in the Annex).** By the share of the net wealth holdings of the top decile of households in the net wealth distribution, net wealth

[2] This technique helps preserve observations on which responses on some items are missing. The missing values are predicted by a regression including a residual to reflect uncertainty. With multiple imputation, several imputed values are created from different random draws for each missing variable. This procedure allows preserve the characteristics of the distribution of the variables and consider uncertainty. For a detailed description, see Eurosystem Household Finance and Consumption Network (2013), pp. 46ff.

[3] The reported results have been obtained using the multiple imputation structure of the data and the estimation weights provided by the data providers.

Table 1

Correlation Between Gross Income, Gross Wealth and Net Wealth of Households in 15 Euro Area Countries

Country	Gross Income		Gross Wealth
	Gross Wealth	Net Wealth	Net Wealth
Austria	0.28	0.27	1.00
Belgium	0.19	0.18	0.99
Cyprus	0.44	0.42	1.00
Germany	0.39	0.36	0.99
Greece	0.44	0.42	0.99
Spain	0.26	0.25	1.00
Finland	0.65	0.59	0.98
France	0.46	0.44	1.00
Italy	0.49	0.48	1.00
Luxembourg	0.48	0.47	1.00
Malta	0.19	0.19	1.00
Netherlands	0.33	0.25	0.88
Portugal	0.49	0.48	1.00
Slovenia	0.39	0.38	1.00
Slovakia	0.29	0.28	0.99

Source: HFCS, own calculations.

is most concentrated in Austria, Germany, and Cyprus, where the wealthiest households hold about 57-61 per cent of total net household wealth. Countries with comparatively little concentration of net household wealth are the Slovak Republic, Slovenia, Greece, and the Netherlands, where the top decile of households holds about 33-40 per cent of net household wealth. For Belgium, Italy, Finland, Malta, France, Luxembourg, and Portugal, the top decile's share is between 44 and 53 per cent of total net wealth.

- **Across households, gross and net wealth is highly correlated, but wealth and income is less so (Table 1).** Lower correlations among gross and net wealth are characteristic of the Netherlands, reflecting the effect of mortgage debt. Highest correlations among gross income of wealth (net or gross) can be seen in Finland (with correlation coefficients around 0.6); these correlations are more moderate in Italy, Luxembourg, Portugal, France, Cyprus, and Greece (correlation coefficients around 0.45), and relatively low in Austria, Slovakia, Belgium, and Malta (correlation coefficients below 0.3). By decile of net wealth, in most of the countries considered, households' gross income is below or around average up to the 7th decile; gross incomes are somewhat higher in the first decile where low net wealth might reflect high stocks of debt than in the second. Average incomes moderately increase in the eighth and ninth decile up to 115 to 160 per cent of the average (in the Netherlands and Slovenia respectively), and are about 130 to 225 per cent of the average in the tenth decile (in the Netherlands and Portugal and France, respectively). Information on post-tax household income is unavailable from the HFCS dataset but tax-benefit systems can be expected to attenuate differences of household income across net wealth deciles. As a second caveat, as suggested by a growing literature, top incomes are likely to be underestimated.

- **Net wealth constituted by the household main residence (HMR) net of outstanding HMR mortgages is less concentrated across households than overall net wealth.** The top net wealth decile of households possesses 22 to 42 per cent of overall household wealth constituted by the household residence net of mortgages. Particularly high shares of the top decile are found in Austria and Germany, two countries with broad rental housing markets, but also in the Netherlands, which has high levels of households' mortgage debt with downward adjusting home values. Countries with a relatively low concentration of overall net wealth, where the top 10 per cent of households hold about a quarter of total net HMR wealth, are Belgium, Spain, Greece, Malta, and Slovenia (see Table 7 in the Appendix).
- **In nearly all countries considered, households in the fifth to ninth decile of net wealth hold relatively more HMR net wealth than net assets overall.** The comparison of the distribution of overall net wealth and net HMR wealth across households show that HMR wealth plays a considerably lesser role in the portfolio of households in the tenth decile in all countries but the Netherlands. Households in the first four net wealth deciles tend to hold relatively more overall net wealth then HMR net wealth, but the difference in the shares of these deciles' net HMR wealth and overall wealth in total household net wealth is relatively small, in most cases less than one percentage point (see Table 4).

2.2 Taxation of capital and wealth: main characteristics of EU Countries

Ernst and Young carried out for the European Commission a cross-country overview of taxes on wealth and transfers of wealth (ibid., 2014). The study provides information on taxes in place and on revenue raised from these taxes. Taxes on assets and their transfers are classified in three categories: inheritance and gift, real estate and land, and net wealth. On the prevalence of such taxes the following is found (see Figure 1).

- Inheritance is taxed in all EU Members except Sweden, Latvia, Estonia, the Czech Republic, Austria, Romania, Bulgaria, Cyprus, and Malta. Two further Members – the Czech Republic and Portugal – have a provision on inheritance taxation in other tax schedules. Although bases are normally broad and rates can be high, spouses and children are largely exempt. Typically, the tax is charged upon the beneficiaries (not donors) and is based on the fair market value of the assets. Inheritance taxes favor close relatives up to total exemption; they are progressive in 14 Members. Inheritance tax rates vary from complete exemption in the most favored group (e.g., in Greece, Luxembourg, Slovenia, Finland, and the UK) to up to 80 per cent for the most heavily taxed group (e.g., in Brussels and the Walloon region in Belgium). Family businesses enjoy exemptions up to 100 per cent (the Netherlands up to a ceiling, and Germany) in 12 EU Members applying a tax on inheritances; Bulgaria, Denmark, Croatia, Lithuania, Luxembourg, and Slovenia have no such exemption.
- In most countries the approach to inheritance and gift taxation is similar, except for Belgium (that applies a moderate registration duty on gifts, in comparison with the taxation of inheritances that is among the highest in the EU), and Latvia and Lithuania respectively (that have a provision for gifts in the personal income tax schedule). Exemptions of close relatives and differential rates depending on the relation between donor and done apply for gift taxes as well as.

Table 2

Average Gross Household Income Across Deciles of Net Household Wealt, 2010
(percent of the overall average in 15 euro area countries)

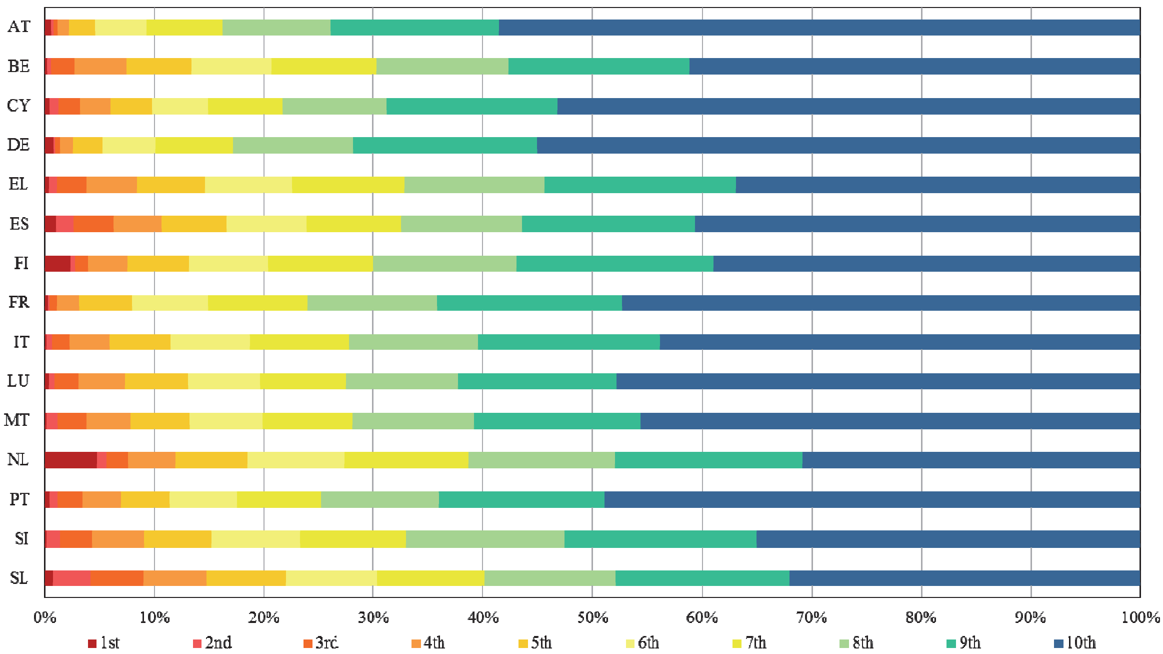
Country/decile	1	2	3	4	5	6	7	8	9	10
AT	0.55	0.54	0.64	0.83	0.87	0.90	1.06	1.14	1.43	2.04
BE	0.58	0.52	0.68	0.99	0.94	0.94	1.10	1.23	1.30	1.71
CY	0.49	0.60	0.59	0.72	0.87	1.05	1.01	1.18	1.33	2.16
DE	0.52	0.42	0.59	0.76	0.92	1.02	1.05	1.20	1.36	2.17
EL	0.56	0.80	0.78	0.72	0.80	0.91	1.05	1.18	1.37	1.83
ES	0.65	0.72	0.68	0.71	0.77	0.89	1.02	1.09	1.33	2.15
FI	0.86	0.48	0.64	0.87	0.85	0.88	1.00	1.17	1.26	1.99
FR	0.59	0.53	0.68	0.81	0.85	0.89	0.98	1.08	1.32	2.26
IT	0.45	0.62	0.81	0.75	0.82	0.86	1.00	1.14	1.42	2.13
LU	0.40	0.55	0.70	0.85	0.89	0.87	1.04	1.26	1.46	1.97
MT	0.58	0.78	0.77	0.82	0.93	0.99	1.05	1.30	1.13	1.63
NL	1.01	0.74	0.87	0.89	0.97	0.97	0.97	1.08	1.15	1.35
PT	0.53	0.70	0.72	0.70	0.77	0.88	0.96	1.08	1.41	2.25
SI	0.41	0.80	0.73	0.91	0.85	0.87	0.99	0.91	1.57	1.97
SK	0.65	0.84	0.83	0.86	1.11	0.98	0.92	1.06	1.17	1.57

Source: HFCS, own calculations.

- Taxes on real estate and land are in place in nearly all EU Members. All Member States except Slovenia and Malta tax the possession of real estate, while all but Slovenia, France, and Romania levy taxes on real estate transfers.
- Recurring taxes on net wealth are in use in about one third of the Member States: in seven cases, this involves vehicles and is mainly motivated by environmental policy concerns. In one case, Italy, there is a tax on bank accounts and financial assets with a genuine aim to tax wealth. General net-wealth taxes are in place in Spain and France, while the Netherlands has a provision practically providing for wealth taxation in its income tax regime.

Figure 1

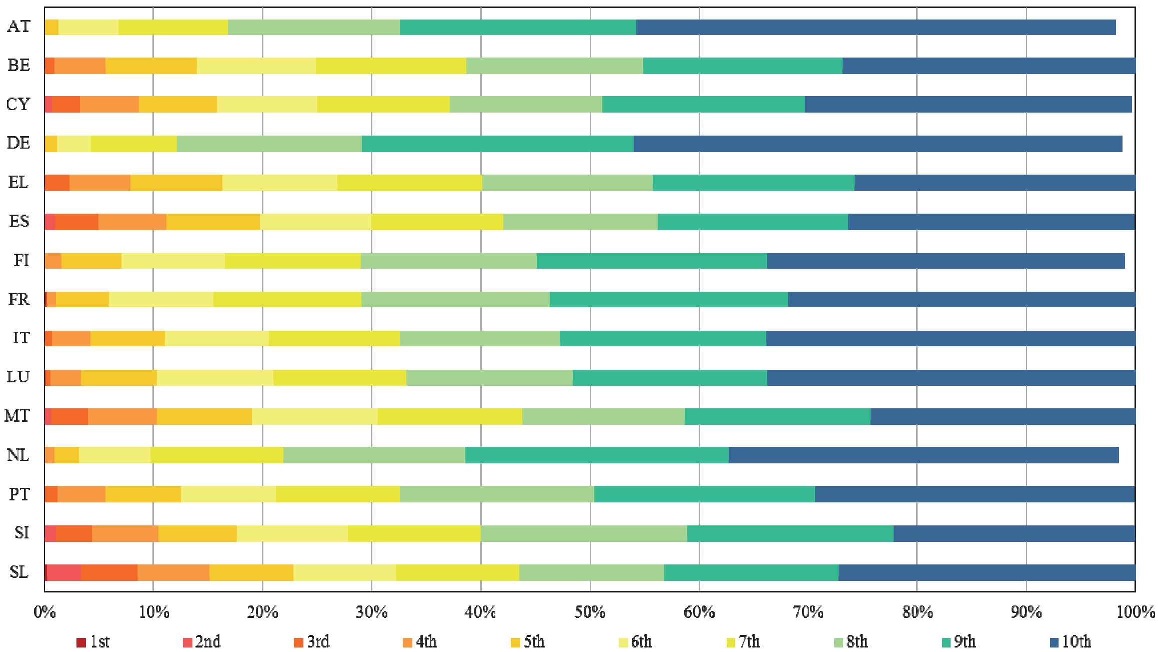
Distribution of Net Wealth of Households in 15 Euro Area Countries Across Deciles, 2010



Source: HFCS, own calculations.

Figure 2

Distribution of HMR Wealth Net of Outstanding HMR Mortgage of Households in 15 Euro Area Countries Across Deciles, 2010



Source: HFCS, own calculations.

Table 3

Overview of Taxes on Wealth and Transfers on Wealth in EU Members

Member State	Inheritance tax	Inheritance provision	Gift tax	Gift provision	Real estate possession tax	Real estate poss. provision	Real estate transfer tax	Real estate trans. provision	General net-wealth tax	General net-wealth provision	Specific net-wealth tax
BE	✓	✗	✗	✓	✗	✓	✗	✓	✗	✗	✗
BG	✓	✗	✓	✗	✓	✗	✓	✗	✗	✗	✓
CZ	✗	✓	✗	✓	✓	✗	✓	✗	✗	✗	✗
DK	✓	✗	✓	✓	✓	✗	✗	✓	✗	✗	✓
DE	✓	✗	✓	✗	✓	✗	✓	✗	✗	✗	✗
EE	✗	✗	✗	✗	✓	✗	✗	✓	✗	✗	✓
IE	✓	✗	✓	✗	✓	✗	✗	✓	✗	✗	✗
EL	✓	✗	✓	✗	✓	✗	✓	✗	✗	✗	✗
ES	✓	✗	✓	✗	✓	✗	✓	✗	✓	✗	✗
FR	✓	✗	✓	✗	✓	✗	✓	✗	✓	✗	✗
HR	✓	✗	✓	✗	✓	✗	✓	✗	✗	✗	✓
IT	✓	✗	✓	✗	✓	✗	✗	✓	✗	✗	✓
CY	✗	✗	✗	✗	✓	✗	✓	✗	✗	✗	✗
LV	✗	✗	✗	✓	✓	✗	✓	✗	✗	✗	✗
LT	✓	✗	✗	✓	✓	✗	✗	✗	✗	✗	✗
LU	✓	✗	✓	✗	✓	✗	✓	✗	✗	✗	✗
HU	✓	✗	✓	✗	✓	✗	✓	✗	✗	✗	✗
MT	✗	✗	✗	✗	✗	✗	✓	✗	✗	✗	✓
NL	✓	✗	✓	✗	✓	✗	✓	✗	✗	✓	✗
AT	✗	✗	✗	✗	✓	✗	✓	✗	✗	✗	✗
PL	✓	✗	✓	✗	✓	✗	✓	✗	✗	✗	✓
PT	✗	✓	✗	✓	✓	✗	✓	✗	✗	✗	✗
RO	✗	✗	✗	✗	✓	✗	✗	✓	✗	✗	✗
SI	✓	✗	✓	✗	✓	✗	✗	✗	✗	✗	✓
SK	✗	✗	✗	✗	✓	✗	✗	✓	✗	✗	✗
FI	✓	✗	✓	✗	✓	✗	✓	✗	✗	✗	✗
SE	✗	✗	✗	✗	✓	✗	✓	✗	✗	✗	✗
UK	✓	✗	✓	✗	✓	✗	✓	✗	✗	✗	✗

Source: Ernst and Young (2014), p. 5.

Table 4

Difference Between the Share of Overall and HMR Net Wealth of Households in 15 Euro Area Countries Across Deciles, 2010

Country/decile	1	2	3	4	5	6	7	8	9	10
AT	-1.55	-1.12	-0.47	-0.93	-1.13	1.02	3.34	6.43	6.82	-13.33
BE	-0.21	-0.33	-1.29	-0.12	2.51	3.52	4.32	4.17	1.66	-14.25
CY	-0.79	-0.19	0.69	2.61	3.46	4.08	5.45	4.62	3.05	-22.99
DE	-1.41	-0.71	-0.52	-1.04	-1.66	-1.59	0.79	6.36	8.58	-9.40
EL	-0.38	-0.66	-0.50	0.94	2.25	2.62	3.09	2.86	0.90	-11.11
ES	-1.11	-0.71	0.37	1.77	2.83	2.83	3.50	3.09	1.82	-14.38
FI	-3.42	-0.41	-1.10	-2.13	0.09	2.31	3.24	3.36	3.65	-5.58
FR	-0.15	-0.17	-0.55	-1.29	-0.04	2.72	4.51	5.42	4.98	-15.43
IT	-0.19	-0.42	-0.99	-0.14	1.20	2.38	2.92	2.89	2.30	-9.95
LU	-0.31	-0.47	-1.76	-1.43	1.17	4.09	4.37	5.08	3.24	-13.97
MT	-0.17	-0.44	0.71	2.32	3.43	4.74	5.04	3.85	1.84	-21.32
NL	-6.31	-0.97	-1.88	-3.48	-4.16	-2.12	1.19	3.87	7.76	6.08
PT	-0.62	-0.72	-1.11	0.97	2.37	2.62	3.76	7.16	5.18	-19.61
SI	-0.20	-0.30	0.38	1.42	1.05	2.12	2.47	4.49	1.34	-12.77
SL	-0.53	-0.34	0.32	0.78	0.56	1.10	1.45	1.25	0.19	-4.79

Source: HFCS, own calculations.

The contribution of wealth taxes to government revenue is limited in EU Members. Among the taxes on wealth, those levied on real estate and land have been the most important for generating revenue: in the countries applying such taxes, real estate transfers and possession taxes have been found to raise about 3 per cent of total revenue, i.e. about 0.85 per cent of GDP on average in 2012. Inheritance and gift taxes have brought about 0.27 per cent of GDP – 0.6 per cent of total revenue. Their limited revenue reflects the relatively low taxes when assets pass over to close relatives. Finally, taxes on the possession of net wealth have contributed about 0.5 per cent to total revenue (0.17 per cent of GDP) on average. This relatively low figure reflects the relatively narrow base: in the two countries applying such a tax, along with large tax free thresholds, business assets are fully exempt from the base.

3 New arguments in favour of asset based taxation

During the past two decades, the assessment of wealth related taxation was predominantly negative. A tax on wealth is ultimately a tax on capital income, potentially at a high rate relative to a flow-type base. Therefore the arguments for a lighter tax treatment of capital income also translate to capital stocks. In the optimal taxation framework, the distortionary effect of capital taxation was well entrenched since Atkinson and Stiglitz (1979), Chamley (1986), and Judd (1985).[4] From a policy perspective, the favorable tax treatment of capital income is seen to encourage investment, notably by enabling more projects with positive expected after-tax return. Furthermore, due to its higher mobility, taxes on capital income other than real estate are considered more distortive than on labour, hence justifying lighter burdens.

The negative assessment of wealth related taxation warrants reconsideration given new theoretical insight and economic and policy developments to date. A light approach to capital taxation is being questioned on the grounds of fuzzy distinctions between capital and labour income, a positive correlation between earnings opportunities and saving propensities, positive incentive effects on labour supply and human capital investment, the efficiency enhancing scope of lighter burdens on borrowing constrained households, and its aptitude as an instrument of redistribution above what could be achieved with labour income taxes alone (Diamond and Saez, 2011; ibid., 2012; Jacobs, 2013).[5] Recent theoretical work (Straub and Werning, 2014) goes even further, to refute the optimality of capital non-taxation in the long run within the logic of the modelling framework of Chamley (1986) and Judd (1995).

The terms of a consequentialist evaluation of wealth taxes – concerning avoidance and administrative costs – are also changing. From a practical point of view, evasion and difficulties of valuation have been considered key arguments against the taxation of wealth. Opportunities of avoidance and evasion reduce the capacity of wealth taxes to generate revenue, and they contribute to the perception that wealth taxes produce little net benefit. Because the better off are rather able to exploit avoidance opportunities, wealth taxes have also been seen to fail to deliver on equity. Opponents of wealth taxation quote that the recurrent re-valuation of infrequently traded assets, such as antiquities but also housing stock in areas with few market transactions, is impeded by the lack of information on market values of comparable items. This makes such revaluation costly in principle and risks creating inequitable treatment of taxpayers. With new international standards of third-party reporting and information exchange on asset holdings and capital income, avoidance of capital taxation is about to become less profitable. Likewise, these new standards and the declining cost of processing large databases can be expected to lower the administrative costs of wealth taxation, valuation included. In countries with net taxes on wealth, information on assets is seen as an important complement to enhance the validity of capital income reporting.

Its ability to provide utility to the owner also suggests consider wealth as a tax base. In the welfarist framework, the normative yardstick of tax design is individual utility. Empirical evidence supports that wealth is a source of utility in its own right (Carroll, 1998; Yang and De Nardi, 2014; Peichl and Pestel, 2013). Such utility might include power by the command over resources providing advantage in bargaining situations (Bowles, 2012), and result in over-

4 Since Atkinson and Stiglitz (1976), optimal taxation theory has maintained that capital income should not be taxed on condition that non-linear income taxes can be levied: taxing capital income would imply burdens on future consumption and distort the inter-temporal consumption decision. The zero capital income tax result has been famously corroborated by Chamley (1986) and Judd (1985), on account of a growing tax wedge between current and future consumption over time. Policy recommendations from the highly stylized analytical framework of optimal taxation theory and the proposition not to tax capital were not followed by policy in full but were influential in policy debates nevertheless.

5 Some theoretical work (Straub and Werning, 2014) goes even further to refute the optimality of capital non-taxation in the long run within the logic of the modelling framework of Chamley (1986) and Judd (1995).

proportional political influence and rent-seeking.[6] Income and wealth are positively correlated overall, but deviations might occur for reasons other than life-cycle consumption smoothing, so that income cannot be taken as a proxy for wealth with regard to taxation. Also some people argue that taxing wealth is expropriation, but it is not clear why the right to private property should protect stocks of assets more than pre-tax income flows. The consideration of wealth taxation, but not of income taxation, as non-respect of the right to private property might relate to features of tax salience. Concerning the protection of private property, political philosophy approaches other than radical individualism have been calling for a balance between the right to property and the common good.[7]

Political considerations further add to the case for the taxation of wealth. The "one dollar one vote" hypothesis expresses the idea that political voice is mediated by the command over material resources, which is at odds with the normative underpinnings of democratic regimes. Evidence from OECD countries in the late 20th century provides support of principle to this argument (Karabarbounis, 2011);[8] The over-proportional political influence of the wealthy bears risks to efficiency via securing means of rent-seeking; [9] indicative cross-country evidence suggests that wealth inequality is damaging for growth notably when coupled with political influence (Bagchi and Svejnar, 2014).

The specific fiscal situation in the aftermath of the financial crisis provides a particular rationale for asset based taxation. The paramount importance of financial stability for growth and job creation notwithstanding, financial stabilization policies have importantly served the stabilization of asset values, while crisis-driven fiscal adjustment tends to burden those with incomes from labour and social transfers more heavily.[10] Taxes on wealth could extend the notion of the ability to pay for the costs of crisis.

The restoration of comprehensive income taxation systems could contribute to a fairer distribution of tax burdens, but reasons to complement such systems with asset-based systems will still remain. Lately, there have been three trends providing for challenges to distributional equity: first, the effective taxation of capital income has been declining over the past decades (European Commission, 2015) – against the background of international tax competition and the proliferation of dual income taxation systems –, putting recipients of labour income at a disadvantage. Second, the link between aggregate capital accumulation and household welfare

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6 The over-proportional influence of the affluent to tilt political deliberations in their interest has received attention in the context of financial regulation in the United States in particular. Indeed the large wage premia in the pre-crisis financial industry in the UK and the US appear to relate to the ability of the sector to enjoy and share rents (Philippon and Reshef, 2012). On the role of political lobbyism in the incomplete implementation of the Dodd-Frank act more recently see Rivlin (2013), quoted from Oxfam (2014).

7 For advocates of a lean state, wealth should be an ideal tax base candidate: the protection of private property is considered the core responsibility of the state even by those who do not grant much *raison d'être* to redistribution. Among the rules that govern polities to date, the principle that 'property has its duties as well as its rights' coined by B. Disraeli (1804-81) is, e.g., found in the German Basic Law, Art. 14 (1) of which stipulates: "property entails obligations. Its use shall also serve the public good". Other countries' practice to tax wealth shows a similar approach.

8 Karabarbounis (ibid.) argues that the decline in redistribution in the US reflects declining relative incomes of both the lower and the middle class, while an increase in redistribution in Europe can be explained with declining relative incomes of the upper class. These developments are explained by two hypotheses, indeed deviating from the median voter proposition: first, that political influence increases with income ("one dollar, one vote"), and second, that the political participation of poorer populations increases with income, resulting in redistribution increasing with the relative wealth of populations at the bottom of the income distribution. The empirical relevance of these assertions has to be assessed against the background of country-specific income and wealth distributions.

9 The over-proportional influence of the affluent to tilt political deliberations in their interest has received attention in the context of financial regulation in the United States in particular. Indeed the large wage premia in the financial industry developed over the past decade in the UK and the US appear to relate to the ability of the sector to enjoy and share rents (Philippon and Reshef, 2012). On the role of political lobbyism in the incomplete implementation of the Dodd-Frank act more recently see Rivlin (2013), quoted from Oxfam (2014).

10 A full account of the distributional effects of crisis policies falls outside the scope of the present note. A comprehensive approach would need to consider the effects of monetary policy as well; on this see e.g., Bank of England (2012).

irrespective of type of income has weakened: globally, in the past decades, the labour share of income has been falling (Karabarbounis and Neiman, 2014; ibid., 2012), and increasing corporate profitability has been coinciding with subdued job creation (International Labour Organisation, 2014); going further, technological progress might accelerate the substitution of capital for labour (Brynjolfsson et al., 2014): thus, fostering the accumulation of capital might not do enough to increase the welfare of households mainly living from labour income. Third, market income inequality appears to be on the rise not only as a matter of unequal distribution of capital endowments, as highlighted by the broad debate about the top 1 per cent of income earners; going forward, innovation might render income processes less predictable and distributions more skewed (Brynjolfsson et al., ibid.). Income tax systems' fairness to treat households with different types but similar levels of income equally could be reinforced by restoring synthetic income taxation instead of dual taxation schemes, and eliminating regressive deduction and avoidance possibilities, while ensuring that all incomes and wealth increases are taxed, including capital gains and imputed income of homeowners. Also reinforcing the progressivity of income taxation could attenuate the differences in households' ability to save. However, it might be politically unfeasible to institute income tax progressivity and top marginal rates specifically to a degree that mitigates socio-economic inequality to a socially desired extent. Also, the equal application of high top marginal income tax rates at all ranks of wealth might act as a disincentive to valorising talent and to social mobility. Instead of very high top marginal income tax rates, income tax systems could be complemented by asset-based taxation. Another argument for the taxation of assets relates to the trend of shifting the tax base to consumption. Such taxation leaves the utility of accumulated wealth unaddressed, and it benefits those households whose members can afford unconsumed lifetime wealth.[11] Such advantage could be counter-balanced by taxing high stocks of wealth.

Going beyond possibilities of income taxation, wealth taxation would allow for progressivity based on assets, with benefits of its own. Reinforced capital income taxation and notably the return to universal income taxation, more rigor in defining the base, and higher progressivity would do a lot to meet concerns of distributional equity seen to date. Still there are economic challenges innate to the distribution of wealth that could be addressed by tax instruments that differentiate by the stock of capital. First, incentivising a more balanced distribution of savings might help macroeconomic stability. Households are not homogeneous by saving behaviour: saving rates increase steeply with wealth (Carroll, 1998; Saez and Zucman, 2014). However, the highly unequal distribution of net assets can be a source of macroeconomic instability. In the US household debt has been an instrument to mitigate consumption inequality against widening disparities in household income, resulting in a highly vulnerable pre-crisis growth model (Cynamon and Fazzari, 2008; ibid., 2014). In Europe, difficulties to adjust household portfolios to income and wealth shocks had an important role in depressing consumption and growth in crisis countries (Pontuch, 2014). The impact of the distribution of household saving rates might also have implications on external imbalances, via the substantial effect of the saving behaviour of the wealthiest on the aggregate, and the responsiveness of consumption to changes in stocks of wealth, with country-specific mechanics and magnitudes. Second, broader asset ownership might spur entrepreneurial activity and growth. By the commitment value of pledgeability, asset ownership is an important prerequisite to the access of credit: by easing funding constraints for less wealthy sub-populations, a more equitable distribution of assets might release entrepreneurship and innovation, and improve performance (Piketty, 1997; Bowles, 2012).[12] And finally, differentiating tax burdens

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[11] Indeed lifetime savings of the wealthy importantly contribute to wealth inequality (Yang and De Nardi, 2014); meanwhile, indirect taxes are proportional or progressive with respect to total expenditure, but regressive with respect to disposable income (Decoster *et al.*, 2010).

[12] On a detailed discussion of the effects of wealth inequality on macroeconomic efficiency, see Bowles (2012, ch. 4): the key argument goes that asset concentration prevents residual claims of individuals providing non-contractible work for owners of productive assets on the results of their action, which dis-incentivises performance. The positive impact of wealth and notably home

(continues)

by levels of wealth might also enhance the efficiency of taxation. At lower levels, to the extent that wealth is built up for later consumption, wealth taxation appears inefficient, incentive incompatible with the need for households to save for retirement, and indeed add a third layer of taxation on a base that has been taxed as income and will be taxed as consumption. Stock based progressivity aimed at wealth holdings beyond levels used for life cycle consumption smoothing, however, would allow to correct for the advantage of households holding such wealth, in particular in tax systems with reinforced indirect taxation, and complement the role of the income tax system to mitigate socio-economic inequality.[13]

4 Stock based capital taxation: aspects of design and implementation

4.1 The taxation of housing

The efficiency implications of increased housing taxation are straightforward. To date, in many EU Members the consumption of housing services by owner-occupiers receives a privileged treatment relative to other investment, mostly due to outdated valuations of the base. Neutrality would require align housing taxation with the approach to other investment on the one hand,[14] and to savings on the other. Increasing the role of housing taxation in overall revenue, not least to make up for the tax shift away from labour, is recommended by international policy advice, spearheaded by the OECD (2010). Its beneficial efficiency effects are straightforward: reducing incentives for housing investment could free up resources for more productive investment, asset price increases allow for the taxation of economic rents; and housing taxation is evasion proof.

When it comes to equity, the effects of housing taxation require differentiated consideration. The case for taxing imputed net income from housing in line with income from other investment is straightforward, in order to put home owners and renters with otherwise similar characteristics who invest in other assets on an equal footing. However, an increase of the tax burden on housing beyond that level, in the sense of genuine asset taxation, requires more careful consideration. True, among the households in the bottom deciles of the income distribution, the share of owner-occupiers is considerably lower than in higher ranks, and their housing consumption is more modest (ECB, 2013). Therefore, the increased taxation of household main residences appears to contribute to more equity. However, a closer examination shows that household main residence assets constitute equalising wealth. In several euro area countries, over half of the households even in the bottom income quintile are homeowners. Typically, home equity is the characteristic asset of the middle class, while home equity possessions of households on the top of both the income and the wealth distribution are under-proportional relative to their share in overall household wealth. According to statistical decomposition analysis, precisely because its share in total net wealth of low wealth households tends to be disproportionately larger, owner-occupied housing has an equalising effect in euro area countries. At the same time, wealth inequality is found to be lower in countries with higher rates of owner-occupant housing (Bezrukovs, 2013; Sierminska and Medgyesi, 2013).[15] Indeed home ownership appears effective to

ownership on entrepreneurial activity in the presence of credit constraints is backed by empirical evidence (e.g., Evans and Jovanovic, 1989; Schmalz *et al.*, 2013). However, implications of capital concentration on growth have not yet been fully explored. Possible benefits of asset concentration might include the availability of venture capital at a lower cost, given that risk aversion is decreasing in wealth (Carroll, 2000).

13 To the extent that such taxation of higher stocks of wealth reduces incentives for further wealth accumulation, such taxation might also facilitate social mobility by chaning the distribution of investment risk along the wealth distribution.

14 Such neutrality warrants the taxation of imputed income net of costs, including interest for debt-financed homeownership, maintenance costs, as well as an equity allowance where this is granted for business investment.

15 Based on decomposition analysis of wealth inequality, Sierminska and Medgyesi (2013) argue in favour of encouraging home ownership throughout the wealth distribution to promote a more equitable distribution of wealth. For a similar point on the role of home equity for most citizens but those on the very top at the wealth distribution in the US, see Yellen (2014).

build up savings: controlling for anterior savings and other relevant covariates, home owners are found to accumulate significantly higher wealth than renters (Di et al., 2007, Turner and Luea, 2009).[16] Increasing the tax burden on owner-occupied housing relative to other assets, even if beneficial for neutrality, might make modestly and moderately wealthy households more worse off relative to the most affluent, and deter households from investing in an own home, thereby aggravating rather than mitigating wealth inequality. For taxation policy, therefore, it might be useful to consider appropriate thresholds in order not to discourage home ownership at the extensive margin and block access to this vehicle of wealth accumulation. Furthermore, a more balanced distribution of wealth can only be supported if the taxation of owner-occupied housing beyond the level of imputed income is aligned with that of other assets, notably those held by the wealthiest. This is especially important in light of evidence that socio-economic inequality is driven by the concentration of income and wealth at the top of the distributions.

When considering taxing housing beyond the point of neutrality, the impacts of a shift of households' portfolio composition away from housing should be weighed with care. Taxing imputed income of owner-occupiers is without question with regard to achieving neutrality with other investment. Efficiency arguments can be invoked to support the taxation of owner-occupied housing beyond this point; however a perspective focused on equity suggests the pursuit of this approach with diligence, notably with regard to the incentives of home-ownership at the extensive margin.

- **After plenty of inconclusive research and detailed scrutiny, home ownership is still found to have positive social impacts. At the same time, some of its alleged economic costs only indirectly relate to homeownership as such.** It has been long posited that high levels of owner occupancy foster local social externalities such as higher local political participation. Empirical research has failed to produce conclusive evidence on most asserted advantages, mostly due to the difficulties to isolate exogenous variation in home ownership from other variables. One area where benefits of home ownership are robustly established, however, is on socially desirable traits of children (Dietz and Haurin, 2003). This is particularly noteworthy in light of the growing recognition of the long-run impacts of interventions early in life. On the cost side, home ownership came into discredit in the wake of the economic and financial crisis. However, house price bubbles in some countries and excessive leverage being at the center of the crisis are a result of inappropriate prudential and lending regulation. Another, frequently raised argument is that home ownership acts as an impediment to labour market adjustment by migration. This, however, can again be addressed by keeping the costs of household relocation low, notably by eliminating excessive fees and taxes on real estate transactions, and by possibilities to exchange pledged assets and early repayment of mortgages without large penalties.[17]
- **When reviewing incentives for different types of assets in household portfolios, it is important to consider the risks associated with different choices.** Most households have only limited capacity to absorb large financial losses. Provided that prudent mortgage lending, policy measures to curb large boom-bust cycles in housing markets, and consumer friendly credit regulations are in place, the financial risks associated with leveraged home-ownership might be better understood and managed by households with average financial literacy than those implied in many other products available for long-term investment.

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[16] Leveraged home ownership offers a commitment technology to stick to a saving plan: the high (psychical) cost and some delay in liquidation might promote short-term discipline among dynamically inconsistent savers as described by the "golden egg" model of Laibson (1997).

[17] Furthermore, recent work has highlighted that a high level of labour mobility is not uniquely associated with economic benefits: studying the impact of mobility on macroeconomic adjustment in currency unions, Farhi and Werning (2014) highlight that labour outflows produce internal demand shortfalls in the non-tradable sector, so that out-migration provides no relief to the stayers.

- **Home ownership has specific qualities to maintain households' well-being upon retirement.** Retiree owner-occupiers have an important determinant of household wellbeing kept constant and providing a shield against price level developments and house price inflation transmitted into rents over the longer run. In addition, they don't face the risk of consuming up their assets before death, be it by unplanned longevity or time inconsistent consumption behaviour. At times where the generosity of income replacement by public pensions is expected to decline and with private pension funds being subject to political risk, owner-occupied housing might gain in importance in households' aspirations to maintain their standard of living upon retirement. These aspects might be part of the explanation why reform plans to introduce taxes on owner-occupied housing without appropriate qualifications tend to be unpopular. For this reason, the fiscal approach to housing should be integrated into the policy framework on retirement wealth, possibly putting housing investment on par with other forms of retirement saving.
- **In turn, extending the taxation of housing over rental property raises the issue consideration of incidence.** To the extent that the supply of housing is fixed (and foremost determined by building regulation), part of a tax on income from renting will fall on the renters, weakening the case for housing taxation for the sake of equity, and likely to necessitate measures to mitigate the burden for low-income households.

When introducing housing taxation reforms, issues of intergenerational equity should be borne in mind. Typically, elderly homeowners are mortgage-free; in many countries today's pensioners were shielded from the effects of fiscal adjustment policies relative to younger households (Darvas and Tschekassin, 2015). Mortgaged younger households, in turn, might have seen their net worth severely decline in countries undergoing a decline in home prices, perhaps into negative territory, and might have experienced negative income shocks that increase their repayment rates. In times of income instability and more cautious lending in some countries, youngest households have a more difficult time to acquire housing assets altogether. In order not to reinforce inequities among generations, it would be pertinent to consider net wealth positions in the approach to housing taxation.[18]

4.2 The taxation of net wealth

For the pursuit of a distributional perspective in asset taxation and the full advantage of the stock based approach, a comprehensive net base appears appropriate. A partial approach to wealth taxation, in particular including broadly held assets but excluding those held by the wealthiest households, might worsen wealth inequality instead of mitigating it. Putting higher burdens on housing but not addressing and financial wealth risks such outcomes: in terms of overall wealth, it affects households in the middle of national wealth distributions relatively highly but provides an advantage to the households at the top of the distribution, who tend to held most of a country's financial and business wealth.

Net wealth taxes avoid the challenges of capital import and export neutrality but might produce other challenges instead. Capital export neutrality requires that income from capital invested at home or abroad receive similar tax treatment. This cornerstone of allocation efficiency has become increasingly important in countries' approaches to capital income taxation over the past decades. In contrast, capital import neutrality requires that capital income from both domestic and foreign investors receive the same tax treatment; non-compliance leads to differences in inter-

[18] In the wake of the financial crisis, broad-spread home ownership tended to be associated with the build-up of real estate bubbles and impediments to macroeconomic adjustment. It should not be forgotten that many such economic difficulties do not follow from home ownership as such, but from policy mistakes in other areas such as credit regulation.

temporal marginal rates of substitution across countries and distortions in the international allocation of savings. Both principles are impossible to achieve across countries with non-uniform capital taxation; policy choices have rather favored the first principle. Within the EU, however, the European Court of Justice has increasingly pushed toward the respect of the second, making the taxation of capital flows by Member States increasingly difficult, contributing to lowering standards of taxing capital income. A tax on net wealth based on residents' wealth world-wide would allow for the correction of the resulting bias in favor of capital income while avoiding immediate conflict with the principles of capital import and export neutrality. The group of taxpayers would have to be carefully circumscribed; the domicile concept in the UK shows the scope for policy choices in this regard. Distortions in the international allocation of high net worth individuals might arise but should not be overrated at moderate rates of a net wealth tax. However, if more countries choose to tax net wealth, challenges of double taxation might require the adoption of common international principles.

The economic effects of a net wealth tax should be overstated: but such a tax could enhance the fairness of taxation. Other than a tax on capital income, a tax on worldwide net wealth of resident taxpayers would not necessarily have to increase the cost of capital, because it would apply to households, not enterprises. Furthermore, it would not affect foreigners' investment. At the macroeconomic level, the broader distribution of wealth can be expected to have positive effects, such as the loosening of credit constraints at the lower part of the wealth distribution to support entrepreneurship, and improved self-reliance in life cycle savings to alleviate pressure on public budgets. Such objectives will not be achieved by a moderate wealth tax alone, but such a tax might contribute to a broader stream of policies to distribute net benefits of economic development more evenly and enhance economic and social stability.

To serve the purpose of equity, the taxation of wealth has to build on a strong international reporting and anti-avoidance framework. Levying taxes on broadly distributed assets but excluding those held by the wealthiest households is deficient in fairness terms and might contribute to socio-economic inequality instead of mitigating it. Restricting the taxation of wealth on assets held domestically might invite to capital flight. Hence a net wealth tax on worldwide assets of taxable residents appears appropriate. This, however, is associated with difficulties similar to capital income taxation. Complementing taxation systems with asset based components will require the development international standards to avoid double taxation, as well as mechanisms of third party reporting and international information exchange on residents' assets held abroad. Recent advancement with the international reporting of capital income suggests that this perspective should not be dismissed as unrealistic.

From an efficiency point of view, a progressive wealth tax should not affect lifetime consumption smoothing of average citizens. A part of wealth inequality across households is driven by the age structure of the population, notably by savings for retirement and insurance against longevity and health risks. In particular in countries where private savings for such purposes are part of the welfare system, a tax on the build-up of wealth at average levels would provide disparate incentives. This suggests appropriate zero-tax allowance thresholds, also supported by lighter administration; however no-duty thresholds must not be so high to jeopardize the production of revenue. Finally, mechanisms for the adjustment of the bands have to be considered to avoid the erosion of equity by long-run asset price increases. In addition to a broad base, the setting of the rate structure of a wealth tax is also a prerequisite of broader political acceptance.

Possibly high wealth tax duties relative to realized or earned income require appropriate administrative solutions. Wealth taxation might be considered confiscatory if it consumes a large share of income flows or if it hits the substance of the asset. This can happen if returns are reinvested, in particular in combination with low labour or public pension income, or if assets yield low or negative returns. To yield to such arguments, practice has been to draw an upper bound to wealth taxes as a share of overall income, e.g., in the Netherlands: however this obviously invites to evasion. In any case the normative argument of confiscation is questionable if wealth is considered a different dimension of utility than income. In addition, under assumptions that public funds provide social benefits and that bounded wealth inequality is valued by society, there is no obvious reason to encourage the reinvestment of business profits while keeping realized income flows and tax payments low. Finally, difficulties of tax compliance of wealth-rich but income-poor households could be handled with provisions for deferral.

The effectiveness and fairness of wealth taxation also rests upon limitations to tax shelters available to the wealthiest and to outright exclusions of certain assets from the base. Such shelters include legal vehicles to conceal the beneficial ownership of assets, limitations of wealth taxes as a share of realised income combined with generous write-off possibilities, and exemptions of business wealth from taxation, which is most acute in the context of inheritance taxation (see Section 4.3).

Switzerland provides an example that a net wealth tax is feasible. Switzerland's sub-federal entities have been traditionally operating taxes on individuals' net wealth. Typically also today, they cover real estate and other real and financial capital, including businesses and life insurance and pension wealth, as well as collections of art, assessed as close as possible to fair market value. Liabilities are deducted; retirement savings are exempted before access. Taxpayers must declare world-wide assets, but enterprises, permanent establishments and real estate abroad are not included in the base; non-residents face limited net wealth tax liability. Rates are progressive usually between 0.3 to 0.7 per cent of net wealth, up to 1 per cent. Some but not all cantons operate shields to prevent the depletion of assets by tax burdens above income; indeed flexibility in the valuation of assets together with this shield allows diminish the effective tax burden and the performance of the tax in terms of fairness. The net wealth tax can provide up to 10 per cent of sub-national revenue. Among its benefits, it is considered helpful to provide information to assess the reliability of income reporting.

4.3 Event-based wealth taxation: gifts and bequest

Instead of taxing assets in a recurrent fashion, taxes on assets can also be levied upon transfer of ownership. Apart from the real estate transfer tax, the economic effects of which are unambiguously assessed negative, the most important of these are gift and inheritance taxes. The design of these two is similar in some countries and dissimilar in others, reflecting different approaches to the encouragement of planned bequests. Inheritance taxation is of particular interest to date, given that the oldest cohorts in many European countries could participate in the accumulation of some wealth relatively broadly, that will change ownership in the forthcoming years.

Economic theory provides arguments in support of taxation of inheritances, but the precise policy prescriptions are not clear. To start with, from the perspective of heirs, bequests are unearned income: it appears straightforward to apply the prevailing rate of (capital) income tax on them. Besides, from an efficiency point of view, unintended bequests offer an ideal situation to tax, since a behavioural response has not been made in a forward-looking fashion and cannot be given ex post. Complications arise if the utility of the bequeather is considered. Here, policy prescriptions depend on the normative approach taken (Boadway et al., 2010). In the welfarist public policy framework that builds on the strict consideration of sources of individual well-being, accidental bequests should receive lighter taxation because they offer no utility to the bequeather: this, however, contrasts with the efficiency argument. In turn, bequests that provide utility to the bequeather, in particular strategic bequests offered in return for services such as caring, might be taxed similar to other consumption on the side of the bequeather. In two other cases, 'warm glow' and altruistic bequests – where the utility of the bequeather is increased by good deeds, or by the utility of the recipient – their consideration for taxation is ambiguous. Furthermore, social norms about family raise some questions on the intuition to subject bequests to income tax in the heir's schedule. Notably the recognition of parenting as socially beneficial activity that involves some altruism also beyond the accumulation of assets suggests some leeway for the possibility to pass on resources to one's offspring with lighter taxation than a separate income stream.

At the current juncture, inheritance taxation is expected to address two important policy challenges: the mitigation of dynastic wealth inequality and the redistribution of resources across generations. As taxation overall, inheritance and gift taxation first and foremost serves the objective of generating revenue. At the current economic and social conditions in EU Members, two other policy objectives are increasingly gaining recognition: first, contributing to a more equitable distribution of resources in the sake of equality of opportunity, and second, contributing to a more balanced distribution of resources and opportunities across generations where older generations tend to have higher lifetime incomes and savings than younger generations can expect to have, while the capacity of the latter to save and invest is squeezed by high dependency ratios.

Inherited wealth has become increasingly relevant in advanced economies, while the role of taxation to mitigate the intergenerational transmission of wealth inequality is less clear. Empirical evaluations disagree on the volume of inherited wealth. For the US, influential estimates on the share of inherited wealth in overall household wealth in the late 1980s suggest a range of about one to two fifths (Modigliani, 1988, Barthold and Ito 1992). Looking at another metric, for France, Piketty (2011) finds that the annual flow of inheritance made up for about 15 per cent of national income in France most recently, up from about 5 per cent in the post-war period. How inheritance translates the distribution of wealth to the next generation is not well understood: in this regard a complex interplay of factors such as the intergenerational transmission of earnings inequality, family size, (dis-) similar socioeconomic status of parents, preferences on the splitting of bequests, etc. are at play, as well as opportunities to amass 'new' wealth from income and income mobility over the life cycle. Indeed inherited wealth might be scattered by the heirs' generation,[19] putting a brake on the build-up of longer-term dynastic wealth accumulation.

Irrespective of impact, taxing inheritances appears to be a command of justice: implementation can be adjusted to country-specific norms of solidarity within the family. No matter what the impact of taxation on the long-term distribution of wealth, inheritance constitutes unearned advantage. This makes a very strong case for the taxation of inheritances, in particular in view of creating a level playing field and fostering justice in terms of opportunity in the generation of heirs. At the same time, norms of justice leave scope for variation in the approach to inheritance taxation. Survey-based cross-country comparisons reveal significant differences in households' bequest motives that correspond to prevailing social norms, most importantly those regulating inheritance irrespective of legal provisions (Horioka, 2014). Variants of welfarism suggest taxing bequests involving some altruism more lightly than strategic bequeathing;[20] this corresponds to inheritance tax provisions in many countries that typically levy lower rates on bequests to close relatives and exempt bequests to charities. In fact today's plurality of family types and sequential family formation notwithstanding, families continue to be economic units with risk sharing, the

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[19] In their theoretical analysis supported by calibration with German data, Grossmann and Strulik (2010) argue that the continuation of family firms by unable managers has important negative welfare effects on the third generation of heirs.

[20] See the discussion of Boadway *et al.* (2010). They argue that under the "restricted welfarism" approach, with some arguments the case can be made even for the non-taxation of wealth transfers.

pooling of resources, and joint investment decisions;[21] welfare systems of EU Members acknowledge these roles to different extents,[22] e.g., by means-testing social benefits against spouses' resources, or explicitly positing a duty of children to provide for the care of aged parents before drawing on social budgets. These considerations support the taxation of bequests but suggest some leeway to yield to social norms prevailing in the country by preferential treatment of some bequeathing within the family. This can be done with reduced rates and thresholds to allow populations with modest wealth to pass it down to offspring. The acknowledgment of intergenerational solidarity in the policy discussion about inheritance taxation might promote its political acceptability, to the extent that it meets norms shared by the affected citizens; this approach does not preclude the promotion of distributional justice by the taxation of higher inheritances that arguably contribute more to wealth inequality. Acknowledging a positive role of resource sharing across generations and some dynastic asset-based welfare could also be done by tax exempt amounts of bequests granted per heir: overall donee based elements of inheritance taxation are more conducive to distributional equity because they provide privilege to split bequests.

The positive role of intergenerational provision notwithstanding, the case for the unlimited continuation of family assets' unity is weak. A central challenge to distributional equity in inheritance taxation in practice relates to the reduction of effective taxation at high levels of wealth among others by exempting business assets. This is often posited to be crucial for the vitality of family businesses and the national economies more broadly, including the preservation of jobs. At the same time, the opportunity to shelter private wealth from inheritance taxation under business tax exemption schemes appears a key driver of inequity in approaches to tax bequests. Dynastic family businesses might be a framework to pass on not only productive assets but firm specific know-how and entrepreneurial behaviour: still it is difficult to comprehend that recipients of such privilege to foster their productivity should be unable to foot a bill of inheritance taxation over an extended redemption period. Also empirical findings support the hypothesis that dynastic family management might slow down productivity increases within the firm and the Schumpeterian process of creative destruction in the overall economy (Bloom, 2006; Grossmann and Strulik, 2010). As for business assets, the case is often made to exclude the family home from the taxation of bequests, referring to the cost of adjustment for surviving family members. On economic grounds however there is no reason to favour this specific type of assets over others in the overall framework of inheritance taxation: the diminution of hardship to the survivors can be mitigated with appropriate schemes for deferral; besides, with appropriate thresholds, the fraction of affected populations can be expected to be small.

The design of inheritance taxation could usefully consider different generations' needs within an overall approach of equity. With increased longevity, the age to become heir is also increasing on average. From the perspective of potential heirs, expecting a bequest is a risky strategy to provide for retirement wealth; the timing of relative certainty about bequests leaves little possibilities to step up own savings if necessary (Pfeiffer and Braun, 2011). At the same time, some economists posit that speeding up the flow of assets to younger generations in higher need to invest could be more productive economically (Arrondel and Masson, 2013). To this end it might be useful to incentivise the skipping of generations in bequeathing, e.g., by equal rates for children and grandchildren, or the possibility of tax-exempt lifetime gifts of heirs to their children within a certain period. A further way to foster the transfer of resources to younger generations is to provide

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21 From a sociological point of view it has been argued the aging societies of the advanced economies tend to be age-segregated with age-homogeneous institutions, where resource transfers across generations are crucial to maintain age integration (Uhlenberg and Riley 2000, quoted after Kohli, 2004).

22 The heterogeneity of European and other OECD economies with regard to the role of the family as a welfare provider along with the market and the state has been extensively analysed by G. Esping-Andersen (1999), the founding father of the research on the typology of welfare states.

preferential tax treatment for lifetime gifts relative to bequests. This is problematic however as lower levels of wealth must be held by the donor for precaution: certainty about the size of the bequest will only come with death. Schemes that provide relief for the transfer of assets with the reservation of usufruct to the donor give preference to the most wealthy whose asset income is sufficient to meet precautionary needs, and are thus inimical to the objective of equity.

With regard to equity, unlimited tax exemptions to gifts made to charities are doubtful. The tax exemption of donations to charities appears to kill two birds with one stone: it fosters the pro-social behaviour of the wealthy and might alleviate the burden of the state to deliver social services. The delivery of services of public interest by charities might be efficient and show social organisation in line with norms of subsidiary. However by the financing of such charities the most affluent are better able than average citizens to shape societies according to their preferences; but charitable donations should not discharge the wealthy from the duty to pay inheritance taxes in line with the approach valid for any citizen. In this context it should not be overlooked that among the wealthy insight for the need to support the state – and not just of private social welfare providers – notably in times of economic duress for broader populations does exist.[23]

Norms of equity are central to approaches to inheritance taxation; in this regard some clarifications are due. First, distinctions of sources of wealth do not provide the only points of departure to support inheritance taxation. Proponents of taxing bequests tend to assert that this could correct for the advantageous treatment of capital income during bequeathers' lifetime, building on the idea that high levels of wealth stem from unearned income, which is more straightforward to tax post mortem than the fruits of a laborious life. However in some cases large estates can be accumulated from labour income as well. Second, capital gains constitute a challenge to equal treatment and offer a route for dynastic wealth accumulation: rebasing assets upon inheritance without taxation gives advantage to those that are able to delay realising those gains into the next generation. Such advantage is hard to justify; at the same time considering inheritance taxation a substitute to a capital gains tax on bequeathed assets provides unfair treatment to bequeathers of non-appreciated assets. Therefore, capital gains taxation should be consistently implemented at the moment of separation from assets by either sale or bequest, and kept conceptually separate from inheritance taxation. With appropriate periods of deferral, liquidity concerns do not appear valid against such an approach. Finally, proponents advocate inheritance taxation as a key instrument of the state to foster a specific perspective on equity, namely the equality of opportunity. Substantial bequests obviously violate equality of opportunity: but taxation alone only goes half-way to foster this objective. Therefore a more comprehensive policy commitment to the promotion of equal opportunity might also raise support to the taxation of bequests.

The small amounts of revenue collected and the cost of administration are not arguments against inheritance taxes as such. To date, the contribution of inheritance taxes to overall public revenue in EU Members is relatively small (see Section 2.2). However this might be due to an easy approach toward larger estates. Opponents of inheritance taxation also invoke the difficulties and costs to establish the value of certain assets. This question pertains to any approach to link tax burdens to wealth: the related difficulties should not be overstated (see Section 3.2). In any case, proportionality suggests some tax-free threshold to provide relief to administrations from the burden of valuation.

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23 In the US, in 2012 the "Responsible estate tax proposal" calling for lowering the estate tax threshold and rising applicable rates was supported by 33 highly wealthy individuals such as Warren Buffet and George Soros (http://faireconomy.org/sites/default/files/2012%20Estate%20Tax%20Sign%20On%20Statement%202_0.pdf, accessed on 20/02/2014). Already in 2011, similar statements were made by highly wealthy French citizens, summarised by http://www.ft.com/intl/cms/s/2/9e6cd460-cf40-11e0-b6d4-00144feabdc0.html#axzz1WY8h9o5H

Antagonism of broad populations against the taxation of inheritances might be due to weaknesses of policy design and credibility, as well as insufficient information. The taxation of inheritances importantly builds on core social concepts and norms like property rights, family, opportunity, and merit prevailing in a society; norms of justice and equity have a key role in the justification of such a tax. However where practiced, inheritance taxation often tends to shelter portfolios of the most wealthy from the tax:[24] this considerably weakens the case for the taxation of bequests as an instrument to foster a more equitable distribution of wealth, in particular as household wealth tends to be concentrated at the top of the distribution. If operated as a redistributive instrument with revenue mainly generated by the middle class, such a tax might clash with middle class quests of upward social mobility and of self-insurance against downward mobility in a dynastic perspective. Such reservations might be particularly strong where perspectives of increased well-being are no longer seen ascertained to younger generations, and where the ability of the state to provide status-preserving insurance is questioned. These arguments are not to exculpate policy-makers from promoting the equality of opportunity, but need to be taken into consideration in view of the necessary support of appropriate tax instruments in the electorate. Finally, insufficient information about the distribution of bequests and suspicions of time-inconsistent policies and fiscal drag will make even those citizens reject the idea of inheritance taxation who would normally benefit from it.[25] In order to avoid timing decisions around expectations of change, the adoption of an approach to tax inheritances has to build on constancy and broad policy consensus (Boadway et al., 2010). Its acceptance can be expected to increase if the right balance is found between redistribution and self-providence in line with the prevailing social norms and on the one hand, and the promotion of equal opportunity by policies more broadly on the other.

In comparison with a net wealth tax, the taxation of inheritances and gifts has specific pros and cons. The former levies a small tax on capital at a relatively high frequency, the latter do the same at a higher rate and lower frequency. Over 30 years, an annual asset tax of 1 per cent diminishes the capital stock by about the same amount than a one-off levy of 26 per cent every 30 years. Inheritance taxation has the advantage of efficiency as it allows for fluctuations of wealth during the course of life, and also does more for the comparable treatment of individuals with pension income and asset-based post-retirement wellbeing respectively.[26] On the downside, the burden put on individuals' and families' wealth put by inheritance taxation has some individual variation, reflecting differences in life spans. Also, broad reservations against inheritance taxes across populations as suggested by anecdotal evidence raise the question of salience: in this regard there might be a trade-off between the frequency and the rate of taxation. In countries where neither tax is present, with appropriate thresholds, a continuous capital tax for high net worth individuals might be easier to accept than a cumulative burden associated with the emotionally charged event of death. As concerns the challenge of administration costs and notably valuation, both approaches to capital taxation tend to be heavily criticised. Against this background a less frequent valuation of taxpayers' assets might have some appeal. However, this approach ignores potential informational benefits to tax administrations from obtaining higher frequency stock and flow data about individuals' ability to pay taxes. Finally, net wealth taxes appear less complex in international environments because the dimension of the donee is missing and does thus not create additional variation and complication. Likewise, net wealth taxes imply a lesser need for normative

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[24] This perception is found e.g., in the United Kingdom (Boadway *et al.*, 2010).

[25] It is questionable if better information improves the possibility to promote better policies, though (Bartels, 2004; Krupnikov *et al.*, 2006).

[26] Depending on the organisation of retirement income for different populations, the consideration of pension entitlements might change household wealth inequality considerably. E.g., for Germany 2007, Frick and Grabka (2010) show that the Gini coefficient of net wealth inequality among individuals aged 17 and more drops from 0.79 to 0.64 once the net present value of pension rights is taken into consideration.

choices: the main question at stake is the rationale of taxing assets, while the ambiguity of bequest motives and judgment about altruistic preferences does not come into play.

4.4 Implementation challenges to wealth taxation

Arguments often brought up against more comprehensive taxes on wealth refer to difficulties with implementation. Policy approaches to taxing assets tend to be piecemeal, either excluding certain assets, or incomplete to address particular challenges of introduction: this might add to the difficulty of the subject in the policy debate. Addressing the main challenges to implementation – some of which are technical, while others relate to social contract more broadly – might enhance the public acceptance of wealth taxation.

The availability of information is crucial for a fair and effective net wealth tax: in this regard a shift of paradigm is underway. Owner-occupied housing is fiscally attractive because it is near-impossible to avoid, while the main argument against comprehensive wealth tax that would be more equitable in principle is avoidance: thus there is an inherent challenge to fairness in wealth taxation. But as the damage to tax bases by the lack of an international taxation framework is increasingly recognized, encouraging developments are underway, that might help implement broader based taxes on wealth as well. Notably since 2010, the US Foreign Account Tax Compliance Act (FATCA) has set new standards of worldwide information sharing on taxpayers' income.[27] Among EU Members, advances toward better tax policy enforcement have been made in particular by the adoption of Directive 2011/16/EU on administrative cooperation in the field of taxation; the OECD Global Forum creates yet another international framework for strengthening tax policy cooperation. As an example at the national level, recognizing that quality regulation cannot be based on double standards, in 2013, the UK government committed to create a publicly accessible central registry of company beneficial ownership in the framework of the international "Open Government Partnership" platform and the then-G8 respectively (Cabinet Office, 2013). These encouraging developments notwithstanding, there is still a long way to go to restrict possibilities of tax avoidance at high levels of income and wealth (Zucman, 2014; Johannessen and Zucman, 2014). This will also require action against tax havens and domestic tax shelters that allow for tax planning strategies only affordable to the wealthy. Eliminating such loopholes would improve the acceptance of taxes on asset holdings at lower levels of wealth.

Difficulties of valuation and administration costs are associated with challenges to wealth taxes, but they do not constitute arguments against them. Illiquid assets' valuation gains changes are notoriously difficult to establish, which might jeopardize the perception of fairness in the taxation of net wealth. Also, high administration costs have been long-stated arguments against the taxation of net wealth. However, as the immediate cost of processing information has been rapidly declining thanks to IT advances, the administrative costs of wealth taxation might rather depend on establishing the standards to compile information. Stock and flow data, third party reporting and international cooperation, asset registries, socially appropriate "nil bands", and punishment of under-reporting could develop the necessary technical underpinnings of equitable wealth taxation in the longer term. Such information could also be used to establish appropriate methods of asset valuation. Where this fails, retroactive taxation upon change of ownership via market transaction could be applied.

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[27] The FATCA framework establishes a worldwide system of reporting information on income derived from US assets or sales, including interest, dividends, annuities, royalties, rents, and realized valuation gains. Financial institutions including the shadow banking sector are incentivized to comply by a withholding tax of 30 per cent on payments to such institutions related to the covered income flows unless reporting agreements are entered with the US Inland Revenue Service.

Cash constraints are a weak argument against recurrent wealth taxes. Cash constraints affect (notional) asset returns that do not translate into liquidity, in particular utility from owner-occupied housing, gains from asset appreciation, and reinvested earnings. A progressive design of wealth taxation – with low rates for the least wealthy – mitigates the problem of cash constraints, as wealthier individuals will be more likely to receive higher liquid income. Hardship to the “wealthy hand-to-mouth” can be avoided by the deferral of the tax liability to the moment of liquidation. For businesses, equity finance of investment is a strong case for keeping liquidity outflows low: but tax-free thresholds might help small businesses, while owners or heirs of substantial business wealth can be expected to service tax obligations from capital gains, possibly stretched out over several years.

Citizens’ reservations against wealth taxation need to be taken seriously. Objections against taxes on wealth will differ across types of households. To the extent that considerable parts of populations possess some wealth in most EU Members, the proposition of a wealth tax without qualifications or progressivity or a tax on housing in isolation will be perceived unfair unless attempts are made to raise contributions at the top of the wealth distribution. The tracking of ownership of mobile assets, on the other hand, might be seen with suspicion for fears of coercive and time inconsistent wealth levies. Against such reservations, the taxation of wealth will not gain political support as long as the public fails to perceive the benefits of public goods provision and the potential of the specific instrument proposed to mitigate socio-economic inequality. Therefore, public administrations and tax-benefit systems that deliver both on efficiency and fairness are cornerstones of wealth taxation. Special fiscal mechanisms, such as earmarking wealth tax receipts to fund forward-looking social objectives such as access to opportunity instead of plain redistributive spending might also enhance the acceptance of wealth taxes, notably among entrepreneurs who are less appreciative of social safety nets. Finally, safeguards and principles to preclude perceptions of unjust confiscation and expropriation might also be helpful.

5 Asset based taxation: the role of policy at the EU level

5.1 Wealth taxation in the framework of EU economic policy guidance

Taxes on wealth could be studied in the framework of policy guidance to EU Members. As a potential source of revenue, wealth taxation could be assessed just as other possible sources in terms of efficiency and equity. In the follow-up of the publication of Piketty’s (2014) “Capital in the 21st century”, citizens EU-wide have become more sensitive to inequalities in the distribution of wealth. The containment of wealth inequality might be a policy objective in itself but also in the sake of economic and social stability. Choices whether or not to adopt taxes on net wealth and how to design these are fully in the remit of EU Members; the role of the EU institutional level is only ancillary. Therefore it might be appropriate to consider wealth-based taxation in the policy advice process in particular in countries where broad debates have developed on the issue. In considering such a tax, its design has to be carefully evaluated with regard to distributional implications; a partial approach might enhance wealth inequality instead of mitigating it.

- To enable a thorough assessment of the potential of asset-based taxation in EU Members, better statistical information is necessary. To date, reliable information on the distribution of wealth is unavailable for a number of countries, mostly outside the euro area; also the Eurosystem HFCS is found to underestimate the upper tail of the wealth distribution, and does not consider public pension entitlements. The need to improve Member States’ tax systems in terms of efficiency and equity under the challenge of population ageing, as well as the increasing relevance of wealth as compared to income as projected by Piketty (2014) will continue to provide valid arguments for the improvement of data availability and analysis to this end.

- To date, aggregate characteristics of tax systems might guide judgment on the suitability of taxing wealth. In the absence of robust micro data on asset distribution, as a first approximation, summary information on tax systems might help decide if the taxation of wealth might contribute to the improvement of national tax systems in terms of efficiency and equity. With regard to equity, taxes on wealth could appear useful in particular in countries with a high share of indirect taxation (as the former is regressive with regard to disposable income, see Decoster et al., 2010), large differences between the implicit tax rates of capital and labour, or flat and dual tax systems or little progressivity of income taxation respectively: these tax systems will in general be weak to mitigate income and consumption inequality, or disproportionately favor capital income, making the build-up of assets difficult for those receiving relatively low income, or living from labour income alone. Likewise, high post-tax income inequality might also hint at the fact that socio-economic inequality is only moderately attenuated by income taxation: here, asset based taxation at high levels of wealth might have an ancillary role to play.
- The potential of wealth taxes has to be evaluated under consideration of the total capital stock, private and public, as well as the welfare policy framework. Asset inequality might coincide with less social exclusion where efficient public administrations are able to offer quality social housing, and public pension systems are the main mechanism for income redistribution between life cycles: in such systems, life cycle driven variations in asset holdings are less relevant, and assessments of wealth inequality would warrant the consideration of pension entitlements. Another question concerns the taxation of net asset holdings in catching up economies. The impact of a tax on the concentration of wealth might have implications on the structure of production. The efficiency gain from concentrated business assets might be necessary for catching up economies to robustly integrate into global production chains. In addition, even in one generation's time after the demise of socialism, wealth inequality appears less pronounced in the new as compared to the pre-2004 EU Members. Therefore, wealth based tax instruments appear to have a weaker case in those countries.

5.2 Tax cooperation to allow the efficient and equitable taxation of wealth

Further to the European Semester, the need for administrative and policy co-operation constitutes another avenue for European perspectives in approaches towards taxing assets.

- With cross-country wealth holdings, issues of double taxation might arise; affected citizens as well a Member States would benefit from a common set of principles. As the taxation of net wealth is the exception rather than the rule among EU Members, cross-border issues with asset based taxation are mostly confined to inheritances and gifts, with multiple combinations of citizenship and residency of the bequeather and the heir and the location of the asset allowing for substantial complexity. In addition, to date, EU Members tend to levy higher inheritance taxes on border-crossing bequests (Hirst, 2015). The European Court of Justice requires EU Members not to discriminate among resident or own-citizen and other EU citizens as bequeathers or recipients of bequests. It has, however, no power to prevent the taxation of assets by two Member States, which is left to bilateral agreement between jurisdictions. In order not to create a complex set of bilateral agreements with mismatches and the possible effect of base erosion, a common framework for the taxation of asset, including inheritance and gift taxation, would be helpful. With the Commission Recommendation 2011/856/EU regarding relief for double taxation of inheritances, first steps have been taken in this regard.
- The effective taxation of financial wealth necessitates administrative cooperation and bank reporting also from beyond the border of the EU. As argued above, a comprehensive approach to asset based taxation needs to include financial wealth; this is likely to be a prerequisite of the broader acceptance of wealth taxation, including inheritances and gifts, among citizens.

However as shown by a number of recent scandals, tax avoidance makes it difficult for national tax administrations to verify information on wealth holdings, let alone to tax wealth. Recently substantial progress has been made to move toward administrative cooperation among tax authorities and bank reporting on foreign accounts. However as tax evasion is becoming increasingly difficult in some internationally cooperative jurisdictions, incentives for the remainder and new jurisdictions world-wide are high to provide frameworks conducive to tax evasion (Elsayyad and Konrad, 2012). EU Members can best address this problem at the international level when acting together.

5.3 A wealth levy to restore macro-financial stability: difficulties of implementation

As a conditionality item of macro-financial support for ailing sovereigns, the scope of wealth-based tax contributions appears limited. The perspective of a wealth levy to mitigate funding constraints of illiquid states has been brought up by the Bundesbank (2014). It is difficult to conceive the implementation of such an instrument in an effective and equitable way, however. To meaningfully add to debt reduction, such a levy will have to be imposed with a nontrivial rate up to 10 per cent (IMF, 2013) Fairness and the application of the residence principle would require equal consideration of residents' wealth kept domestically and abroad. Historical experience shows that the time needed for implementation of a wealth levy meeting such criteria is used to substantially erode the tax base by avoidance measures (Eichengreen, 1988). Besides, a levy on financial assets would probably necessitate capital controls, which require very strong conditions to be admissible in the EU. Ultimately, wealth taxation is less likely to be successful to remedy large-scale fiscal imbalances and should better be seen as a preventive instrument to maintain fiscal and social stability.

6 Conclusion

Asset ownership, in addition to income, has received increased interest with regard to shouldering the burdens of public finance lately. With the Eurosystem Household Finance and Consumption Survey, comparable data on households' asset holdings in euro area Member States have become available recently, showing country-specific characteristics of household wealth distribution in terms of composition, relation to income, and correlates.[28] Also, with the Ernst and Young (2014) cross-country review of wealth-related taxes commissioned by the European Commission, a comparative stock-taking of such taxes in place in EU Members to date exists, providing a detailed picture of these instruments.

Wealth is an indicator of the ability to contribute to the public purse in its own right, and the distribution of assets is a matter of economic policy relevance. A more equitable distribution of wealth has some positive impacts at the micro- and macroeconomic level that have not yet received sufficient attention. Furthermore, in the advent of improved means to process information, counter-arguments to wealth-based taxation on grounds of their ineffectiveness might lose their strength. While the restoration of universal income taxation with appropriate progressivity could do much to support a fairer distribution of tax burdens, wealth taxation has the additional advantage of allowing for progressivity based on assets, not income, thereby attenuating asset inequality arguably without inciting strong negative behavioural effects on capital accumulation for most taxpayers.

[28] This paper disregards multivariate analyses of these household wealth distributions. A growing body of empirical evaluations of the Eurosystem HFCS dataset can be found at the ECB's homepage: https://www.ecb.europa.eu/pub/economic-research/research-networks/html/researcher_hfcn.en.html

There are several approaches to taxing wealth, with pros and cons of their own. Increasing the tax burden on owner-occupied housing has become a constant strain of policy advice on tax reform in EU Members lately: on this point, a careful approach is needed in order not throw out the baby with the bath water. A net wealth tax, in turn, is the fairest approach from an equity point of view: but certain conditions have to be met to implement it successfully. Taxes on inheritances, finally, are most used to tax assets, but conceptually they involve most complexity, due to the presence of two parties with possibly different jurisdictional affiliations, and due to the normative choices inherent to the taxation of bequeathing. To garner voters' support for inheritance taxation – that could, if appropriately designed, benefit a majority of voters as well as society as a whole – a circumspect approach is necessary, rendering account to country-specific social norms. To be in line with norms of justice and contribute to attenuating dynastic wealth inequality, inheritance taxation must not provide preferential treatment to assets held by the wealthiest.

Concerning wealth taxation, there is scope for approaches at the European level of policy making. Competence for direct taxation is allocated at the Member States' level; notwithstanding this, in the European Semester framework of economic policy advice asset based taxation might be considered – and indeed a sub-set of the base, housing, is considered – in the context of a budget neutral tax shift away from labour. For such policy advice to be appropriate to country-specific conditions, broader statistical information on household asset holdings is necessary, also including countries not yet covered by the Eurosystem HFCS. Beyond such policy advice, a more widespread application of wealth related taxes might increasingly result in issues of double taxation and non-taxation, leading to the need for a common framework of principles at the EU level. Finally, a fair approach to asset based taxation not sparing out assets held by the wealthiest is impossible without administrative cooperation and information exchange. Such cooperation has to go beyond the borders of the EU, calling EU Members to speak with one voice in the relevant international fora.

ANNEX
STATISTICAL TABLES

Table 5

Distribution of total assets across deciles of total household gross income in some euro area Members, 2010, Euro and per cent respectively

Decile		1	2	3	4	5	6	7	8	9	10
Austria	no. obs.	1101	1224	1208	1197	1223	1341	1173	1171	1109	1153
	mean	62838	85208	137843	156925	200882	233834	250171	366511	401310	925087
	s.e.	21082	15100	71556	50977	55303	61054	51859	126709	81437	249360
	mean/GDP	1.84	2.50	4.04	4.60	5.89	6.86	7.34	10.75	11.77	27.13
	decile sha	2.31	3.05	4.93	5.56	7.15	8.29	8.94	12.82	14.43	32.53
Belgium	no. obs.	867	1097	1122	1055	1110	1196	1204	1155	1292	1537
	mean	150811	168236	279225	245557	368106	321232	403572	449226	500980	804864
	s.e.	28810	17264	44854	29938	60801	31003	34751	44672	37715	59691
	mean/GDP	4.42	4.93	8.19	7.20	10.79	9.42	11.83	13.17	14.69	23.60
	decile sha	4.11	4.55	7.58	6.69	10.03	8.61	10.93	12.22	13.59	21.69
Cyprus	no. obs.	412	471	513	538	520	581	750	714	732	954
	mean	249349	342777	372584	380075	418342	552521	625011	981427	1373982	2141730
	s.e.	69686	130884	130277	59135	145181	119674	95315	205748	192370	404335
	mean/GDP	11.87	16.32	17.74	18.10	19.92	26.31	29.76	46.73	65.43	101.99
	decile sha	3.41	4.58	5.12	5.06	5.66	7.38	8.43	13.21	18.54	28.59
Germany	no. obs.	1228	1127	1204	1262	1464	1643	1689	2075	2615	3518
	mean	41159	53231	70272	97224	134176	150365	179936	274419	442485	783719
	s.e.	12240	13716	16426	19253	15878	16364	12337	51375	73663	94859
	mean/GDP	1.35	1.75	2.30	3.19	4.40	4.93	5.90	9.00	14.51	25.70
	decile sha	1.92	2.37	3.10	4.39	6.01	6.82	8.04	12.40	19.82	35.13
Spain	no. obs.	2482	3150	2717	2763	2637	2541	2756	2825	3120	5994
	mean	133447	160260	172219	223873	238645	300106	303371	353589	449885	911153
	s.e.	7889	9000	8927	13715	21126	32913	20725	23172	29065	60023
	mean/GDP	5.88	7.06	7.59	9.86	10.51	13.22	13.36	15.58	19.82	40.14
	decile sha	4.13	4.96	5.30	6.95	7.47	9.20	9.38	11.06	13.49	28.06
Finland	no. obs.	3665	3250	4065	4660	4680	5515	6110	6215	7185	9600
	mean	57267	66635	95618	123239	140213	170715	210365	242927	286079	585926
	s.e.	3970	4403	4461	4837	5081	5737	6208	6594	6800	15244
	mean/GDP	1.72	2.00	2.87	3.70	4.21	5.13	6.32	7.30	8.59	17.60
	decile sha	2.89	3.37	4.83	6.23	7.08	8.63	10.64	12.27	14.46	29.61
France	no. obs.	6860	6115	6195	6225	6230	6605	6585	7110	7930	15175
	mean	82069	84987	103995	149564	154193	192076	239680	278044	366258	932269
	s.e.	10316	6014	6729	12148	7699	9005	10163	14401	9867	54991
	mean/GDP	2.74	2.84	3.48	5.00	5.16	6.42	8.02	9.30	12.25	31.18
	decile sha	3.21	3.26	4.02	5.81	5.95	7.44	9.28	10.76	14.18	36.09
Greece	no. obs.	1436	1451	1498	1601	1530	1487	1547	1424	1422	1459
	mean	66085	85012	93032	120821	137101	162965	165658	187711	227395	353503
	s.e.	8150	6702	6180	10287	9502	15451	16885	19023	14039	23649
	mean/GDP	3.32	4.27	4.67	6.07	6.89	8.19	8.32	9.43	11.43	17.76
	decile sha	4.16	5.36	5.78	7.95	8.30	10.07	10.30	11.75	14.26	22.07
Italy	no. obs.	3975	4015	3905	4030	3635	4105	4045	3980	4120	3945
	mean	108758	112185	145638	173529	199735	225736	288400	316128	386400	914981
	s.e.	19329	9406	9266	14328	10271	11860	18626	15987	16082	46946
	mean/GDP	4.23	4.37	5.67	6.75	7.77	8.78	11.22	12.30	15.04	35.60
	decile sha	3.80	3.90	5.07	6.05	6.95	7.86	10.09	10.98	13.48	31.81
Luxembourg	no. obs.	413	331	329	355	369	393	551	523	646	840
	mean	255428	286496	479022	363635	510705	590730	663460	994111	1248895	2547354
	s.e.	52162	72994	127005	50473	70911	76489	51219	203665	296445	446076
	mean/GDP	3.30	3.70	6.19	4.70	6.60	7.63	8.57	12.84	16.14	32.91
	decile sha	3.28	3.62	6.05	4.58	6.65	7.17	8.39	12.47	15.83	31.96
Malta	no. obs.	463	486	469	439	398	386	425	371	394	384
	mean	164142	198366	224412	276607	249900	266936	324982	422015	474172	1197901
	s.e.	25501	31192	27304	37496	34070	50565	49986	53064	57821	514910
	mean/GDP	10.52	12.72	14.39	17.73	16.02	17.11	20.83	27.05	30.40	76.79
	decile sha	4.37	5.24	5.94	7.29	6.62	7.06	8.66	11.04	12.77	31.01
Netherlands	no. obs.	527	458	501	571	528	660	671	779	875	935
	mean	209423	153435	174193	193547	189349	229478	265284	327899	340775	438820
	s.e.	29812	30568	32121	29753	31519	27520	28849	42959	30899	37759
	mean/GDP	5.93	4.35	4.93	5.48	5.36	6.50	7.52	9.29	9.65	12.43
	decile sha	8.38	6.06	6.95	7.71	7.47	9.05	10.53	13.01	13.52	17.32
Portugal	no. obs.	2531	2087	2165	2205	2034	2029	2157	2167	2152	2493
	mean	75956	67679	81798	103073	112799	141854	147628	162344	229282	582353
	s.e.	7357	10013	11184	11940	9525	14126	10988	11156	19414	68064
	mean/GDP	4.66	4.15	5.02	6.32	6.92	8.70	9.06	9.96	14.07	35.73
	decile sha	4.59	3.86	4.85	6.00	6.63	8.34	8.66	9.57	13.40	34.11
Slovenia	no. obs.	110	121	121	195	209	218	144	192	225	180
	mean	131029	44842	129073	100119	137651	140398	124661	146604	253508	335286
	s.e.	28780	13274	17398	13544	23948	22315	42521	21271	33193	55061
	mean/GDP	7.57	2.59	7.46	5.79	7.96	8.12	7.21	8.47	14.65	19.38
	decile sha	8.79	2.87	8.45	6.41	8.95	9.09	8.18	9.39	16.83	21.03
Slovak Republic	no. obs.	988	984	1072	1137	1206	1182	1034	933	908	841
	mean	52491	51780	54092	82963	76579	78528	83345	94882	114552	142233
	s.e.	5685	4518	4238	7416	5582	4461	7555	7746	7728	12558
	mean/GDP	4.34	4.28	4.47	6.86	6.33	6.49	6.89	7.84	9.47	11.75
	decile sha	6.46	6.65	6.12	9.75	9.35	9.41	9.99	11.43	13.80	17.05

Table 6

Distribution of total assets across deciles of net wealth in some euro area Members, 2010, Euro and per cent respectively

Decile		1	2	3	4	5	6	7	8	9	10
Austria	no. obs.	1073	1150	1249	1173	1148	1192	1228	1261	1228	1198
	mean	17720	5219	13007	27675	65611	129122	193664	271026	429072	1668932
	s.e.	11885	876	1329	2618	4973	5074	7124	5377	11747	472624
	mean/GDP	0.52	0.15	0.38	0.81	1.92	3.79	5.68	7.95	12.58	48.94
	decile sha	0.62	0.19	0.47	1.00	2.36	4.67	6.97	9.78	15.40	58.54
Belgium	no. obs.	937	929	944	900	1012	1139	1278	1377	1418	1701
	mean	9006	12904	80119	175699	217861	269905	351975	443196	610682	1523092
	s.e.	3199	2940	6591	6498	5364	8544	8699	8494	9612	75571
	mean/GDP	0.26	0.38	2.35	5.15	6.39	7.92	10.32	13.00	17.91	44.67
	decile sha	0.25	0.35	2.16	4.75	5.90	7.33	9.53	12.02	16.53	41.18
Cyprus	no. obs.	546	474	454	480	586	592	691	709	701	952
	mean	32262	65111	144104	207727	277935	382553	501996	708649	1148692	3975569
	s.e.	12977	9260	11162	10154	9674	15908	18674	18966	38303	454122
	mean/GDP	1.54	3.10	6.86	9.89	13.24	18.22	23.90	33.75	54.70	189.31
	decile sha	0.44	0.88	1.92	2.81	3.76	5.14	6.76	9.54	15.53	53.22
Germany	no. obs.	1250	1175	1223	1379	1294	1395	1508	2027	2713	3861
	mean	17988	2576	11487	26156	60014	106579	158208	242182	373586	1226479
	s.e.	4255	324	1891	2459	5429	5392	5870	4655	6695	103196
	mean/GDP	0.59	0.08	0.38	0.86	1.97	3.49	5.19	7.94	12.25	40.21
	decile sha	0.81	0.12	0.52	1.18	2.69	4.79	7.11	10.93	16.77	55.08
Spain	no. obs.	2061	1927	2007	2180	2250	2349	2785	2811	3595	9020
	mean	32612	55079	116675	144439	187610	238676	279252	357728	510121	1320130
	s.e.	7871	4062	4958	3838	3442	6756	4378	4377	6787	61577
	mean/GDP	1.44	2.43	5.14	6.36	8.26	10.51	12.30	15.76	22.47	58.16
	decile sha	1.01	1.70	3.59	4.46	5.80	7.36	8.62	11.05	15.75	40.66
Finland	no. obs.	4510	3450	3960	4465	4525	5010	5705	6810	7285	9225
	mean	47269	8067	22503	72194	109903	145259	188166	258946	353892	773511
	s.e.	2336	1042	1481	2223	1985	1918	1902	2239	2185	14963
	mean/GDP	1.42	0.24	0.68	2.17	3.30	4.36	5.65	7.78	10.63	23.23
	decile sha	2.39	0.41	1.14	3.65	5.55	7.35	9.51	13.07	17.91	39.03
France	no. obs.	5327	5069	4981	5512	6582	6590	6889	7658	9166	17256
	mean	8104	4602	15919	53714	124854	179372	233947	304212	436406	1222366
	s.e.	3715	466	1467	2678	2729	2744	2404	2279	3141	55008
	mean/GDP	0.27	0.15	0.53	1.80	4.18	6.00	7.82	10.17	14.60	40.88
	decile sha	0.31	0.18	0.62	2.08	4.83	6.94	9.07	11.77	16.89	47.32
Greece	no. obs.	1884	1673	1513	1328	1351	1389	1459	1378	1418	1462
	mean	5805	12945	43049	74426	99283	126469	162445	204302	280371	590801
	s.e.	1224	1523	2115	2291	2775	2433	2407	3119	3771	20673
	mean/GDP	0.29	0.65	2.16	3.74	4.99	6.36	8.16	10.27	14.09	29.69
	decile sha	0.39	0.77	2.66	4.65	6.23	7.91	10.17	12.76	17.54	36.91
Italy	no. obs.	3800	3640	3535	3705	4385	4090	4010	4250	4205	4135
	mean	5464	13344	47626	105168	159688	206821	259843	337190	476965	1261566
	s.e.	1656	1502	2525	2492	1842	1548	1374	2650	3868	44963
	mean/GDP	0.21	0.52	1.85	4.09	6.21	8.05	10.11	13.12	18.56	49.09
	decile sha	0.20	0.45	1.64	3.66	5.56	7.21	9.10	11.75	16.57	43.86
Luxembourg	no. obs.	370	400	439	451	389	425	419	496	632	729
	mean	32681	38195	173280	336935	455703	519844	620949	811570	1152668	3799252
	s.e.	11830	12587	19559	16657	20221	14251	15074	18786	21132	483666
	mean/GDP	0.42	0.49	2.24	4.35	5.89	6.72	8.02	10.49	14.89	49.09
	decile sha	0.42	0.48	2.18	4.26	5.74	6.59	7.84	10.21	14.54	47.75
Malta	no. obs.	436	461	426	411	397	429	453	391	414	397
	mean	6276	40388	98740	151459	203269	252402	309548	421220	572983	1736915
	s.e.	860	3043	5460	4812	8489	4522	5249	9233	16454	503717
	mean/GDP	0.40	2.59	6.33	9.71	13.03	16.18	19.84	27.00	36.73	111.34
	decile sha	0.17	1.07	2.62	4.01	5.35	6.68	8.23	11.05	15.16	45.66
Netherlands	no. obs.	388	364	419	483	481	649	698	820	990	1213
	mean	119281	23307	48979	109468	163967	223678	286206	338295	430587	779153
	s.e.	22333	10236	12715	12899	15750	18035	10872	11047	23581	35118
	mean/GDP	3.38	0.66	1.39	3.10	4.64	6.34	8.11	9.58	12.20	22.07
	decile sha	4.79	0.92	1.95	4.33	6.51	8.87	11.29	13.43	17.05	30.87
Portugal	no. obs.	2481	2160	2189	1873	2038	2046	2136	2283	2261	2553
	mean	7798	13461	37859	59073	76722	104753	130959	181717	257666	834756
	s.e.	1672	2232	3295	2594	1816	2370	2135	3114	4327	65583
	mean/GDP	0.48	0.83	2.32	3.62	4.71	6.43	8.03	11.15	15.81	51.21
	decile sha	0.46	0.79	2.21	3.47	4.52	6.13	7.68	10.67	15.14	48.93
Slovenia	no. obs.	145	144	171	163	199	175	166	182	166	204
	mean	2658	19558	45701	72145	93198	125008	153762	215752	275891	550724
	s.e.	916	3434	4059	3703	4218	4089	7052	11803	11969	61998
	mean/GDP	0.15	1.13	2.64	4.17	5.39	7.23	8.89	12.47	15.95	31.83
	decile sha	0.18	1.32	2.92	4.67	6.12	8.11	9.70	14.40	17.60	34.97
Slovak Republic	no. obs.	2089	1126	883	933	917	848	830	869	882	908
	mean	6471	28301	39980	48464	59512	69113	81340	99729	130724	267218
	s.e.	820	1073	821	1054	923	778	704	979	2089	11602
	mean/GDP	0.53	2.34	3.30	4.01	4.92	5.71	6.72	8.24	10.80	22.08
	decile sha	0.78	3.42	4.85	5.79	7.17	8.33	9.81	12.02	15.75	32.08

Table 7

Distribution of HMR assets across deciles of total household net wealth in some euro area Members, 2010, Euro and per cent respectively

Decile		1	2	3	4	5	6	7	8	9	10
Austria	no. obs.	1073	1150	1249	1173	1148	1192	1228	1261	1228	1198
	mean	9477	9477	1624	3627	23302	81623	130171	191669	264807	526242
	s.e.	9793	9793	1314	2708	4826	5080	8747	5433	11211	47873
	mean/GDP	0.28	0.28	0.05	0.11	0.68	2.39	3.82	5.62	7.77	15.43
	decile sha	0.77	0.77	0.13	0.30	1.89	6.65	10.54	15.61	21.46	42.65
Belgium	no. obs.	937	929	944	900	1012	1139	1278	1377	1418	1701
	mean	4484	2913	40814	132234	175209	207152	262448	288495	323567	466588
	s.e.	2496	1744	6385	7685	6358	10416	10956	11206	10775	27770
	mean/GDP	0.13	0.09	1.20	3.88	5.14	6.07	7.70	8.46	9.49	13.68
	decile sha	0.24	0.15	2.13	6.93	9.21	10.91	13.79	15.18	16.99	24.47
Cyprus	no. obs.	546	474	454	480	586	592	691	709	701	952
	mean	14634	32424	90949	149779	186373	236507	292260	336317	426729	673381
	s.e.	7741	7724	11428	11877	12730	19767	23751	24814	38272	66401
	mean/GDP	0.70	1.54	4.33	7.13	8.87	11.26	13.92	16.02	20.32	32.07
	decile sha	0.61	1.34	3.69	6.16	7.67	9.68	11.99	13.79	17.58	27.48
Germany	no. obs.	1250	1175	1223	1379	1294	1395	1508	2027	2713	3861
	mean	7972	7972	2230	4824	22584	48949	82069	153664	216846	371480
	s.e.	2222	2222	1459	1447	4095	4926	6298	6341	6685	20017
	mean/GDP	0.26	0.26	0.07	0.16	0.74	1.60	2.69	5.04	7.11	12.18
	decile sha	0.88	0.88	0.25	0.53	2.48	5.37	9.01	16.94	23.78	40.76
Spain	no. obs.	2061	1927	2007	2180	2250	2349	2785	2811	3595	9020
	mean	17548	38816	91552	116717	150978	181739	201639	233929	286778	427021
	s.e.	3930	3883	4015	3982	4095	5037	6896	8562	9698	17762
	mean/GDP	0.77	1.71	4.03	5.14	6.65	8.01	8.88	10.31	12.63	18.81
	decile sha	1.01	2.23	5.23	6.69	8.66	10.39	11.55	13.41	16.43	24.41
Finland	no. obs.	4510	3450	3960	4465	4525	5010	5705	6810	7285	9225
	mean	36245	5468	12437	48827	81483	107937	129357	161704	198953	299114
	s.e.	2037	940	1320	2196	1986	1989	2248	2550	3186	5627
	mean/GDP	1.09	0.16	0.37	1.47	2.45	3.24	3.88	4.86	5.97	8.98
	decile sha	3.36	0.51	1.15	4.51	7.53	9.99	11.96	14.94	18.43	27.62
France	no. obs.	5327	5069	4981	5512	6582	6590	6889	7658	9166	17256
	mean	3777	322	3527	24383	80464	129917	165585	202562	251895	366227
	s.e.	3316	292	1238	2716	3432	4503	4007	3845	5023	7977
	mean/GDP	0.13	0.01	0.12	0.82	2.69	4.35	5.54	6.77	8.42	12.25
	decile sha	0.31	0.03	0.29	1.98	6.55	10.57	13.49	16.48	20.49	29.81
Greece	no. obs.	1884	1673	1513	1328	1351	1389	1459	1378	1418	1462
	mean	2101	4873	27830	56240	77829	95705	116978	135495	158946	218731
	s.e.	865	1448	2254	2784	2997	2914	3626	5333	7327	13609
	mean/GDP	0.11	0.24	1.40	2.83	3.91	4.81	5.88	6.81	7.99	10.99
	decile sha	0.25	0.52	3.08	6.29	8.73	10.70	13.09	15.12	17.78	24.43
Italy	no. obs.	3800	3640	3535	3705	4385	4090	4010	4250	4205	4135
	mean	897	2447	20006	73343	122206	165969	203962	252297	325382	580342
	s.e.	559	1508	2639	3262	2624	2974	3154	3703	6395	33142
	mean/GDP	0.03	0.10	0.78	2.85	4.76	6.46	7.94	9.82	12.66	22.58
	decile sha	0.05	0.13	1.14	4.20	7.00	9.51	11.75	14.45	18.59	33.18
Luxembour	no. obs.	370	400	439	451	389	425	419	496	632	729
	mean	10708	7343	102109	218314	344924	435669	480280	591847	671484	1252332
	s.e.	6946	6817	18921	22418	20781	17026	21246	25616	33162	272802
	mean/GDP	0.14	0.09	1.32	2.82	4.46	5.63	6.21	7.65	8.68	16.18
	decile sha	0.26	0.18	2.48	5.33	8.37	10.65	11.69	14.35	16.33	30.35
Malta	no. obs.	436	461	426	411	397	429	453	391	414	397
	mean	0	11117	62527	110088	146126	187717	215442	257110	282192	401354
	s.e.	0	2774	6648	5686	9022	8600	9621	14467	19795	35760
	mean/GDP	0.00	0.71	4.01	7.06	9.37	12.03	13.81	16.48	18.09	25.73
	decile sha	0.00	0.66	3.76	6.59	8.71	11.25	12.96	15.27	16.91	23.89
Netherlanc	no. obs.	388	364	419	483	481	649	698	820	990	1213
	mean	94724	14764	28849	63557	91940	144723	199411	225240	278639	403750
	s.e.	18827	9469	10125	14861	15873	18757	20143	12951	15709	16248
	mean/GDP	2.68	0.42	0.82	1.80	2.60	4.10	5.65	6.38	7.89	11.44
	decile sha	6.21	0.95	1.88	4.10	5.96	9.37	12.83	14.60	18.00	26.10
Portugal	no. obs.	2481	2160	2189	1873	2038	2046	2136	2283	2261	2553
	mean	5190	8806	24794	45157	58172	74545	89074	136602	155151	216568
	s.e.	1483	2135	3285	2502	2573	3570	2748	3884	4553	8598
	mean/GDP	0.32	0.54	1.52	2.77	3.57	4.57	5.46	8.38	9.52	13.29
	decile sha	0.64	1.08	3.03	5.56	7.18	9.13	10.93	16.79	19.09	26.58
Slovenia	no. obs.	145	144	171	163	199	175	166	182	166	204
	mean	667	11986	35538	64638	77203	106135	127317	187254	196437	233753
	s.e.	673	3792	4675	4204	6275	6986	13015	13359	10668	25640
	mean/GDP	0.04	0.69	2.05	3.74	4.46	6.13	7.36	10.82	11.35	13.51
	decile sha	0.07	1.20	3.38	6.21	7.55	10.24	11.95	18.61	18.69	22.11
Slovak Rep	no. obs.	2089	1126	883	933	917	848	830	869	882	908
	mean	3782	22964	33330	41250	48746	57834	67617	80181	96470	165682
	s.e.	804	1270	1321	1175	1296	1186	1744	2012	2706	8818
	mean/GDP	0.31	1.90	2.75	3.41	4.03	4.78	5.59	6.63	7.97	13.69
	decile sha	0.61	3.73	5.44	6.63	7.90	9.37	10.97	12.99	15.62	26.75

Note: No ownership of the household main residence is considered 0.

Table 8

Distribution of HMR assets net of HMR mortgage across deciles of total household net wealth in some euro area Members, 2010, Euro and per cent respectively

Decile		1	2	3	4	5	6	7	8	9	10
Austria	no. obs.	1073		1249	1173	1148	1192	1228	1261	1228	1198
	mean	-10728		-60	59	4563	24233	39725	54414	70065	176466
	s.e.	15336		156	393	1547	3859	7837	8404	13077	39586
	mean/GDP	-0.31		0.00	0.00	0.13	0.71	1.16	1.60	2.05	5.17
	decile sha	-3.27	-0.01	-0.02	0.01	1.26	6.79	11.03	15.24	19.54	49.42
Belgium	no. obs.	937	929	944	900	1012	1139	1278	1377	1418	1701
	mean	228	201	9152	44273	68675	62948	81696	92240	87270	76165
	s.e.	358	195	2163	4548	7286	11774	12168	12242	12086	15895
	mean/GDP	0.01	0.01	0.27	1.30	2.01	1.85	2.40	2.70	2.56	2.23
	decile sha	0.04	0.04	1.74	8.45	13.14	12.08	15.62	17.66	16.68	14.54
Cyprus	no. obs.	546	474	454	480	586	592	691	709	701	952
	mean	-7194	5830	21816	48956	57254	85071	99090	139272	172049	231191
	s.e.	7636	2157	4940	8441	10145	12790	21604	24716	37339	53261
	mean/GDP	-0.34	0.28	1.04	2.33	2.73	4.05	4.72	6.63	8.19	11.01
	decile sha	-0.85	0.69	2.53	5.75	6.74	9.95	11.61	16.34	20.27	26.96
Germany	no. obs.	1250	1175	1223	1379	1294	1395	1508	2027	2713	3861
	mean	-4475	-4475	-75	23	3793	12568	21531	38992	63730	86316
	s.e.	2004	2004	340	507	965	2224	3413	4450	6147	12745
	mean/GDP	-0.15	-0.15	0.00	0.00	0.12	0.41	0.71	1.28	2.09	2.83
	decile sha	-2.02	-2.02	-0.03	0.01	1.70	5.65	9.69	17.60	28.63	38.79
Spain	no. obs.	2061	1927	2007	2180	2250	2349	2785	2811	3595	9020
	mean	-1895	6463	26668	37136	39508	50745	54146	52557	58547	69882
	s.e.	1481	1085	2821	3974	4446	5151	6343	8490	11735	11733
	mean/GDP	-0.08	0.28	1.17	1.64	1.74	2.24	2.39	2.32	2.58	3.08
	decile sha	-0.48	1.65	6.76	9.44	10.05	12.87	13.76	13.37	14.87	17.72
Finland	no. obs.	4510	3450	3960	4465	4525	5010	5705	6810	7285	9225
	mean	-8063	-67	231	8681	23023	33401	40297	48100	59337	85192
	s.e.	1008	81	313	687	1143	1750	2077	2405	3315	4828
	mean/GDP	-0.24	0.00	0.01	0.26	0.69	1.00	1.21	1.44	1.78	2.56
	decile sha	-2.79	-0.02	0.08	2.99	7.93	11.53	13.89	16.57	20.49	29.33
France	no. obs.	5327	5069	4981	5512	6582	6590	6889	7658	9166	17256
	mean	-184	19	396	4589	22047	35494	43053	46725	48708	59935
	s.e.	289	33	211	616	1602	2960	3553	4177	4711	5095
	mean/GDP	-0.01	0.00	0.01	0.15	0.74	1.19	1.44	1.56	1.63	2.00
	decile sha	-0.07	0.01	0.15	1.76	8.45	13.61	16.53	17.91	18.67	22.98
Greece	no. obs.	1884	1673	1513	1328	1351	1389	1459	1378	1418	1462
	mean	31	416	4475	10387	9991	16225	20655	23390	16349	28076
	s.e.	119	182	872	1796	2055	3145	3792	4364	3320	7399
	mean/GDP	0.00	0.02	0.22	0.52	0.50	0.82	1.04	1.18	0.82	1.41
	decile sha	0.03	0.30	3.40	7.99	7.71	12.49	15.91	17.98	12.59	21.59
Italy	no. obs.	3800	3640	3535	3705	4385	4090	4010	4250	4205	4135
	mean	-306	53	2311	10353	15312	15394	15439	28287	37225	54883
	s.e.	219	31	536	1468	2182	2604	2504	4966	6316	9627
	mean/GDP	-0.01	0.00	0.09	0.40	0.60	0.60	0.60	1.10	1.45	2.14
	decile sha	-0.18	0.03	1.28	5.79	8.57	8.61	8.68	15.82	20.76	30.64
Luxembour	no. obs.	370	400	439	451	389	425	419	496	632	729
	mean	2108	263	10853	85688	150114	175575	123805	242455	225125	159690
	s.e.	2034	2500	4014	12736	17491	29361	26143	33704	39555	40227
	mean/GDP	0.03	0.00	0.14	1.11	1.94	2.27	1.60	3.13	2.91	2.06
	decile sha	0.18	0.02	0.92	7.31	12.74	15.02	10.55	20.57	19.15	13.54
Malta	no. obs.	436	461	426	411	397	429	453	391	414	397
	mean	0	1825	10543	23498	14868	25939	29189	40046	32778	25259
	s.e.	0	1247	3076	6146	5394	8329	10282	11419	12042	15922
	mean/GDP	0.00	0.12	0.68	1.51	0.95	1.66	1.87	2.57	2.10	1.62
	decile sha	0.00	0.90	5.20	11.55	7.27	12.75	14.39	19.52	16.11	12.33
Netherlanc	no. obs.	388	364	419	483	481	649	698	820	990	1213
	mean	-13742	-451	715	7478	19206	52267	93888	112305	111082	158263
	s.e.	7830	1023	1500	2753	6177	12160	11242	11094	14329	17856
	mean/GDP	-0.39	-0.01	0.02	0.21	0.54	1.48	2.66	3.18	3.15	4.48
	decile sha	-2.58	-0.08	0.13	1.38	3.56	9.66	17.29	20.82	20.56	29.26
Portugal	no. obs.	2481	2160	2189	1873	2038	2046	2136	2283	2261	2553
	mean	-1194	223	2746	10076	14869	20600	20210	38758	37323	53874
	s.e.	508	253	499	1333	1796	2194	2496	4178	4703	6594
	mean/GDP	-0.07	0.01	0.17	0.62	0.91	1.26	1.24	2.38	2.29	3.31
	decile sha	-0.61	0.11	1.38	5.11	7.56	10.40	10.22	19.63	18.93	27.25
Slovenia	no. obs.	145	144	171	163	199	175	166	182	166	204
	mean	-212	-212	3553	16318	13890	15745	4654	13979	18147	50128
	s.e.	213	213	4848	10110	7379	7448	4118	9383	11780	18700
	mean/GDP	-0.01	-0.01	0.21	0.94	0.80	0.91	0.27	0.81	1.05	2.90
	decile sha	-0.16	-0.16	2.68	11.81	10.44	11.61	3.28	10.85	12.92	35.67
Slovak Rep	no. obs.	2089	1126	883	933	917	848	830	869	882	908
	mean	632	2913	3415	2497	4578	3451	2563	5306	5899	20927
	s.e.	265	537	759	845	1030	1059	1010	1605	1569	4258
	mean/GDP	0.05	0.24	0.28	0.21	0.38	0.29	0.21	0.44	0.49	1.73
	decile sha	1.22	5.60	6.60	4.75	8.78	6.63	4.92	10.18	11.32	40.01

Note: No ownership of the household main residence is considered 0.

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COMMENT TO "WEALTH DISTRIBUTION AND TAXATION IN EU MEMBERS" BY ANNA IARA

Álvaro Pina[*]

This very interesting study by Anna Iara contains three main contributions. First, it presents an overview of wealth distribution and wealth taxation in European Union (EU) countries, drawing on the Eurosystem Household Finance and Consumption Survey (HFCS) and on Ernst and Young (2014). Second, the paper offers a summary of arguments in favour of asset-based taxation, taking account of efficiency, equity, political economy and tax administration considerations. Third, Iara's study discusses design and implementation issues, at both national and supranational levels, for taxation of three forms of wealth: housing, net wealth, and bequests and gifts.

My discussion will be structured along similar lines. I will start by reporting some evidence on wealth taxation, resorting to an alternative statistical source. I will then briefly discuss the case for taxation of wealth transfers and net wealth on both efficiency and equity grounds. In my view, arguments for taxation are stronger as regards wealth transfers, but there are considerable design and implementation challenges. While efforts to overcome these challenges are called for, priority should nonetheless be given to improving the taxation of capital income: progress in this area, highly desirable in itself, may also make the taxation of wealth transfers more feasible in the future.

Revenues from wealth taxation are small

In the OECD classification of taxes (OECD, 2014), wealth taxation can be approximated by taxes on property. Average revenue across the OECD from this category of taxes is summarised in Table 1.

Unsurprisingly, these taxes often yield limited revenue, and are heavily tilted towards recurrent taxes on real estate and, to a smaller extent, transaction taxes (falling on either real estate or on other assets). Recurrent taxes on net wealth and estate, inheritance and gift taxes have on average a residual dimension, and in some countries simply do not exist (Figure 1). There is broad consensus that recurrent taxes on immovable property tend to be among the most growth-friendly forms of taxation (for instance, by avoiding that capital allocation is distorted into housing and by penalising vacant property), and that transaction taxes are often highly distortive (Johansson *et al.*, 2008). In contrast, there is less agreement among economists on whether wealth transfers and net wealth should be taxed. Some discussion on the pros and cons of these latter taxes therefore ensues.

The case for taxing wealth transfers tends to be stronger than for taxing net wealth

If my interpretation is correct, the general balance of arguments in Anna Iara's paper tends to favour taxing net wealth over taxing wealth transfers (see, e.g., the last paragraph of Section 4.3). One of the arguments invoked is the ambiguity of bequest motives.

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The opinions expressed are those of the author, and do not necessarily reflect those of the OECD or its member countries.

Table 1

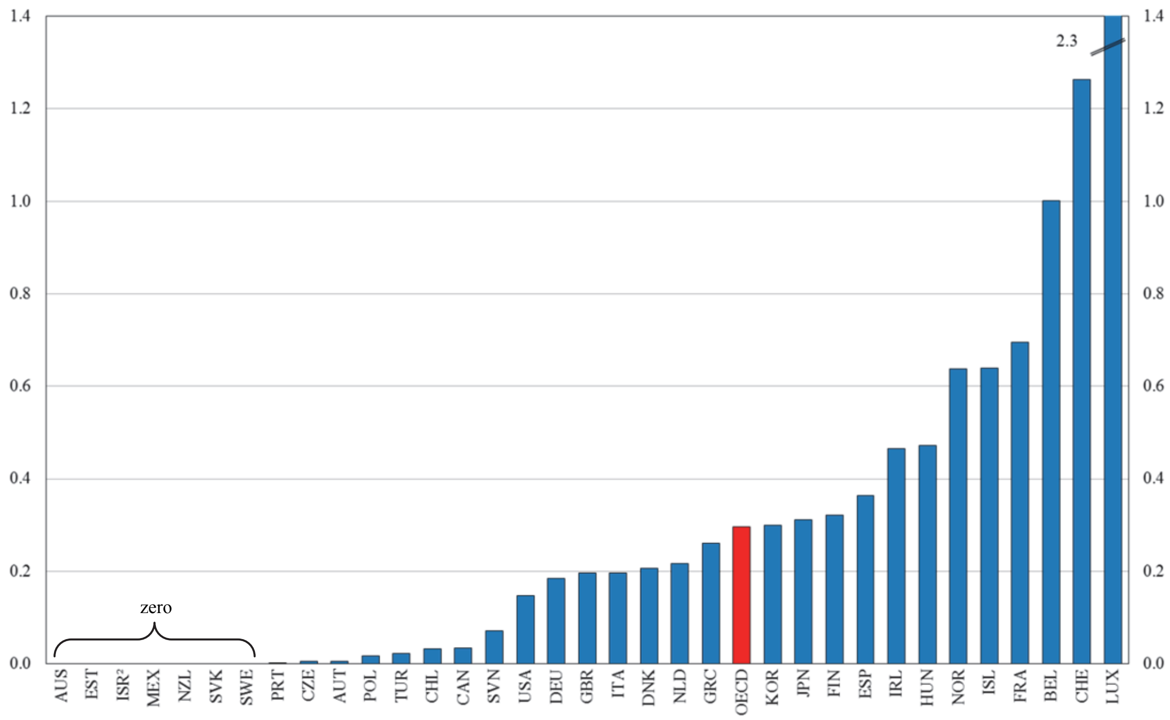
Wealth Taxation in the OECD, 2013
(tax revenue as a percentage of GDP)[1]

	OECD Average
Taxes on property	**1.82**
Recurrent taxes on immovable property	1.09
Recurrent taxes on net wealth	0.18
Estate, inheritance and gift taxes	0.13
Taxes on financial and capital transactions	0.40
Non-recurrent taxes	0.03
Other recurrent taxes on property	0.01

1. Estimate calculated using 2012 data for Australia, Greece, Mexico, Netherlands and Poland.
Source: OECD (2015), "Revenue Statistics: Comparative tables", OECD Tax Statistics (database).

Figure 1

Wealth Taxation in OECD Countries, 2103
(recurrent taxes on net wealth plus estate, inheritance and gift taxes as a percentage of GDP)[1]



2012 for Australia, Greece, Mexico, Netherlands, Poland and the OECD average.
The statistical data for Israel are supplied by and under the responsibility of the relevant Israeli authorities. The use of such data by the OECD is without prejudice to the status of the Golan Heights, East Jerusalem and Israeli settlements in the West Bank under the terms of international law.
Source: OECD (2015), "Revenue Statistics: Comparative tables", OECD Tax Statistics (database).

This ambiguity – or rather, variety – of motivations can in my view help justify wealth transfer taxation on efficiency grounds. To the extent that bequests are unplanned or accidental – which would correspond to wealth accumulation driven only by consumption smoothing or precautionary motivations – taxation, even at a high rate, entails no disincentive to save (Cremer, 2010). Bequests guided by strategic considerations (e.g., in exchange for care or attention) should also arguably be taxed. It is only when bequests are driven by pure altruism that, under certain additional conditions, zero taxation would be optimal from an efficiency viewpoint. While some altruism will likely be behind many bequests, making taxation distortive to some extent, a counterargument is that inheritances also reduce the incentives to save and work of recipients (Mirrlees et al., 2011).

The efficiency case for a periodic tax on the stock of wealth, especially on top of capital income taxation, appears weaker. Adverse effects on capital accumulation and growth are a common concern, especially with high capital mobility. Further, while a tax on wealth is roughly equal to a tax on capital income from that wealth, the wealth tax is more exposed to the objection of taxing normal returns to savings but not taxing excess returns (for instance, in the corporate context, capital income taxation can be designed to avoid taxing normal returns on capital through an ACE – allowance for corporate equity – system). Wealth taxation could be advocated as a backstop to taxing capital income, but it is far from clear whether taxing wealth stocks is any easier than capital income.

On equity grounds, both taxes on net wealth and on wealth transfers are generally desirable. As Anna Iara's paper shows, wealth tends to be highly concentrated across households in European countries. In most of these countries, the recent crisis has made distributional concerns more pressing, with increases in income inequality, poverty incidence and poverty intensity. An important goal in itself, greater equity is also likely to bring benefits on a number of other fronts, such as efficiency gains associated to less scope for rent-seeking by politically-influent wealthy citizens, a better functioning of democracy and possibly less macroeconomic instability (by avoiding that low-income households take excessive debt to keep up with consumption norms). The paper has the merit of highlighting these different potential benefits.

Given major challenges to taxing wealth transfers, improving capital income taxation is key

Taxing wealth transfers would often be desirable, but would also face considerable challenges. There are ample avoidance opportunities, especially for transfers *inter vivos* concerning non-real estate assets. This tends to have regressive implications: the wealthy are in a better position to avoid taxation than the middle classes, for whom wealth often largely consists of owner-occupied housing and other (modest) assets hard to dispose of (Mirrlees *et al.*, 2011). Other hurdles include valuation difficulties and cash constraints on some asset owners (e.g. family businesses), though these constraints could at least in some cases be alleviated by tax deferrals. Failure to successfully implement taxation of wealth transfers – ideally falling on the recipient and taking account of all gifts and bequests received over a lifetime, possibly with an exemption level for small amounts – decreases potential efficiency and equity gains, and likely leads to (even) greater political resistance to such taxes.

These difficulties, and the drawbacks of net wealth taxation briefly discussed above, are arguments to give priority to improving the taxation of capital income, for which international cooperation is key. A major breakthrough in this domain was the recent (2014) adoption of a single, global standard (the Common Reporting Standard, CRS) for Automatic Exchange of Information (AEOI) in tax matters. Developed by the OECD at the request of G20 countries, the CRS asks jurisdictions to obtain information from their financial institutions and automatically share that information, on an annual basis, with foreign countries. Over 90 jurisdictions have now committed to implementing the CSR by 2017 or 2018, thus giving tax authorities automatic access to data on account balances and multiple types of investment income. Progress in AEOI might also enable countries to tax capital income of individuals resident for tax purposes in the country at (modestly) progressive rates through dual progressive income taxation, which would be equity-enhancing. In the future, better information on capital income, and associated cross-checking between wealth stocks and income flows, will also likely make it more feasible to successfully implement taxation of wealth transfers.

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PROPERTY TAX REFORM AND THE USER COST OF OWNER-OCCUPIED HOUSING IN THE EU

Salvador Barrios,[*] *Serena Fatica*[**] *and Jonathan Pycroft*[**]

In this paper we compute the user cost of housing capital investment in four EU countries (France, Italy, Spain and the UK) following Poterba (1984, 1992) and Poterba and Sinai (2008) to investigate the role played by tax policy during the recent period. Our results suggest that current tax provisions – including both recurrent property taxes and mortgage interest tax deductions – bring about significant differences in the user cost of capital across income deciles. Taking a normative perspective, we also simulate the effects of taxing imputed rental income. In a sensitivity analysis, we show that house price evolutions have dominated other considerations about the user cost over the recent period, leading to large variations in the cost of housing investment. This even occurs when prospective homeowners incorporate a long-term view of the housing market.

1 Introduction

The housing bubble boom and bust represent a key element of the recent global financial crisis. In certain instances tax incentives have played a non-trivial role toward incentivising home acquisition in the wake of buoying asset prices and credit access. While home ownership is often considered as positive from a social perspective (e.g., higher civic behaviour of home owners), sharp fluctuations in house prices might also have disrupting effect on the economy as a whole, including for public finances, consumption and the labour market, (see Bover and Jimeno, 2007 and Bover, 2006). For instance countries such as Ireland and Spain have experienced substantial tax revenues windfalls and shortfalls in close connection with the house price evolutions, (see Barrios and Rizza, 2010). From a household perspective, housing investment often represent the most important lifetime investment and house price fluctuations and mortgages can have very large effects on net wealth and consumption, see Bover (2012).

In this paper we investigate this issue taking a user cost of capital approach to owner-occupied housing (Poterba, 1984 and 1992; Poterba and Sinai, 2008). Based on this approach, home ownership is considered as an investment decision and an indicator for the marginal cost of investing in housing against investment alternatives is considered taking explicitly the role of tax incentives (through property taxes and mortgage deductibility) into account. We compute country-specific average user costs of capital to analyse the role of tax policy and housing price expectations on the cost of housing investment per income decile based on micro-data across a set of EU countries.

The paper utilises the EUROMOD microsimulation model, which makes use of the EU-SILC data set, to provide detailed household-level information, including incomes, tax rates and demographic characteristics. Individual variations in the determination of the user cost of housing investment is introduced across a number of key variables, namely marginal income tax rates, mortgage interest relief and property taxes (including a hypothetical imputed rent tax). Indicators on the effective tax burden are calculated at household level considering explicitly the interaction of the tax system, including specific housing tax provisions, with the benefit system.

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These tax indicators are combined with long-run time series on house prices in order to consider alternative hypotheses regarding the housing price expectations.

The analysis is carried out for selected EU countries, namely France, Italy, Spain and the UK, focusing on the distributional impacts by income decile, which allows for a focus on which household groups are (dis)favoured by the current tax system, and how this has possibly changed under the various tax reforms implemented in the countries considered. Our results show that house price expectations are key to determine the evolutions of the cost of housing investment and that the tax systems, which often provide generous tax rebate on mortgage interest payments, can lead to significant differences in the cost of owner-occupied households across income deciles.

The following section outlines the theoretical background to our approach. Section 3 explains how the baseline estimates were obtained and shows the baseline values by income decile. Section 4 explains the simulations carried out and analyses the results, and Section 5 concludes drawing out some policy implications of the research.

2 Theoretical framework

2.1 The user cost of housing

Incentives to homeownership can be captured by a synthetic measure, the user cost of capital (Himmelberg et al., 2005). Under this approach, homeownership is considered an investment decision, and treated as such according to the neoclassical investment theory (Poterba, 1984). In such framework, an equilibrium relationship is derived between the imputed rental income accruing to homeowners and the cost associated with homeownership, which in turn identifies the marginal cost of purchasing additional housing services. The user cost has been extensively used to measure tax expenditures favouring owner-occupied housing, such as the tax exemption of imputed rents and the deductibility of mortgage interest payments, in the US (Poterba, 1992; Poterba and Sinai, 2008a; Poterba and Sinai, 2008b).

Our analysis follows this well-established literature closely. As a starting point, it is useful to consider the hypothetical case where homeownership is treated as a business, and thus the associated economic profits are subject to taxation. With income tax deductions on the interest paid on mortgage the net-of-tax income could be expressed as:

$$(1-t)[R-\{i+t_p+\beta+m+\delta-\pi\}P_H]$$

where R is the imputed rental income from housing capital, P_H is the price of a unit of housing capital, t is the income tax rate, i is the owner's interest, or foregone equity cost, t_p is the recurrent property tax rate.[1] In addition, β is a risk premium associated with the housing investment, δ is the economic depreciation rate, m denotes maintenance costs (assumed not tax-deductible), and π is the nominal asset revaluation term (capital gain).

In equilibrium, the net income from homeownership must be zero. This allows the derivation of the user cost of capital (denoted with c) as the ratio R/P_H or:

$$R/P_H \equiv c = \{i+t_p+\beta+m+\delta-\pi\}$$

Keeping in mind that the equilibrium relationship is valid with unchanged tax rules, the expression for the cost of capital can be modified to account for the different tax provisions

[1] Throughout the analysis, we rule out the possibility recurrent property taxes are benefit taxes. In other words, we do not consider the case where, by financing local public services, property taxes can indirectly provide a positive utility to taxpayers.

potentially applicable to homeownership. In particular, some taxes fall on ownership in a recurrent fashion. They can be designed as taxes on the flow of services from ownership (taxation of imputed rents), or on (a proxy of the value of) the stock, such as the recurrent property tax. Furthermore, a tax relief might be offered to the cost of financing housing by debt. In addition, taxes might be levied upon acquisition or disposal of immovable property, when they normally take the form of transfer (or registration) taxes and capital gains taxes, respectively.

Accounting for these taxes, while assuming – consistent with common practice – that imputed rents are not taxed, leads to the following general formulation for the cost of capital for an additional unit of housing investment:

$$c = \{i(1 - t_M\varphi)\lambda + t_p + \beta(1 - t_y) + m + \delta - \pi(1 - t_{capgain}) + (1 - \lambda)i(1 - t_y)\}(1 + t_{trans}) \tag{1}$$

The new elements in (1) are explained in turn. First, (1) assumes that, in the presence of a transfer tax, the actual disbursement for a housing unit of price P_H is $(1 + t_{trans})P_H$, where t_{trans} is the statutory transfer tax rate.[2] Moreover, when a capital gains tax is applied, the after-tax asset revaluation term becomes $\pi(1 - t_{capgain})$, with $t_{capgain}$ being the tax rate on the capital gains.

An important component of the generalised cost of capital relates to the financing of the house purchase. The formulation in (1) takes the traditional view that the financial cost is equal to a weighted average of the cost of equity and the cost debt, with weights given by the corresponding shares of finance (Poterba, 1992). However, we do not differentiate between the cost of equity and that of debt, and hence use a single interest rate to capture the cost of finance. As noted by Himmelberg *et al.* (2005), mortgage interest rates reflect the risk-adjusted required return on a housing loan, as well as a premium for the borrower's refinancing and default options. The cost of funds for a housing investment should not include these additional factors. Thus, in the empirical application, we use the 10-year government bond rate as a measure for the cost of funds. In the presence of a tax relief for mortgage interest payments, the after-tax nominal cost of debt becomes $\mathrm{i}(1 - t_M\varphi)$, where $t_M$is the rate at which the relief is granted, and the φ is the fraction of interest benefitting for the tax subsidy. In the case of a deduction granted via the PIT system, t_M represents the marginal tax rate for the taxpayer. In the case of a tax credit reducing the individual tax liability proportionally to the interest paid, $\mathrm{t_M}$ would be the same across all taxpayers. The possibility of a cap to the amount of subsidised interest payments is introduced through the parameter φ, which ranges between 0 (no tax relief) to 1 (full tax relief). In practice, the parameter φ allows for additional heterogeneity to be included in the empirical model, since tax systems in Europe often link the amount of deductible interest to individual and household characteristics. The requirement of a down payment is incorporated via λ, the loan-to-value ratio. Hence, the fraction of the house that is equity-financed, $(1 - \lambda)$, foregoes earned interest at the unit yield of i, which is taxed, not necessarily under the PIT schedule, at the rate t_y, for which we employ the effective marginal tax rate (EMTR). The fact that housing and alternative assets are not in the same risk class is reflected in the pre-tax risk premium term β, for which the relevant tax rate is again t_y. Admittedly, the calibration of the risk premium is somewhat arbitrary, and is not explicitly derived from optimised portfolio choices based on the risk-return trade-off. In that, we again follow the available literature (Poterba and Sinai, 2008a).

2 In order to isolate the impact of transaction taxes, this formulation explicitly assumes no capitalisation of taxes into property prices.

2.2 A closer look at housing-related taxes

There is consensus in the literature that the tax exemption of imputed rental income represents the main tax expenditure for owner-occupied housing, in terms both of foregone revenue and induced economic distortions. Imputed rent refers to the amount that an owner would pay to rent a property of equivalent quality. The argument for taxing imputed rent can be derived from the Haig-Simons approach set forth in Haig (1921) and Simons (1938). The theoretical argument is that a comprehensive income tax base should reflect all the potential consumption opportunities – both monetary and non-monetary – while leaving the stock of wealth unaffected. Imputed rent clearly constitutes part of the homeowner's non-monetary consumption set (and hence, expands their monetary consumption set). Therefore excluding imputed rent from the tax base is argued to be undesirable on the grounds of horizontal equity (compared with otherwise similar renters), and also on efficiency grounds, as it would lead to distortions in the housing and rental markets.

The Haig-Simons approach would entail taxing the rental income it generates while allowing deduction of the costs incurred, including maintenance costs and interest payments in the case of debt-financed investment, depreciation and other costs of providing housing services. In this way, only the net return on investment would be subject to taxation. Capital gains from housing transactions would also be taxed to achieve neutrality *vis-à-vis* the taxation of other assets in countries where realised capital gains are subject to taxation more broadly.

In practice, however, while national tax systems vary significantly in their treatment of immovable property, they tend to be biased in favour of owner-occupied housing, in a way which is hard to justify from a purely economic point of view. For the purpose of our analysis, this warrants some qualifications of the general expression in (1). While the imputed rent tax exemption is duly reflected therein, in practice capital gains taxation of primary residences is usually either tax-exempt, or subject to specific conditions, for instance in terms of the duration of tenure. Likewise, recurrent property taxes present a high degree of heterogeneity, in terms of both design and revenue yield, thus entailing a very different effective tax burden across countries.

2.3 Calculating effective marginal tax rates with the EUROMOD microsimulation model

In order to calculate the individual rate of income tax, t_y, we calculate the effective marginal tax rate using EUROMOD, which is a microsimulation model of EU countries personal income taxes and benefits (including benefits such as unemployment, family benefits, etc.) applied to all household revenues sources, including wages, self-employment income, pensions and unemployment benefits. The model generates gross and net household income applying countries' tax codes and calculates theoretical benefit entitlements and tax liabilities. EUROMOD is a static model, *i.e.*, simulations abstract from potential behavioural reactions of a representative sample of individuals and of changes in the socio-demographic characteristics of the population. EUROMOD is managed, maintained, developed and updated by the Microsimulation Unit of the Institute for Social and Economic Research, based at the University of Essex, which is specialised in socio-economic research and surveys, in particular as regards the production and analysis of longitudinal data. The model is developed in collaboration with national experts who update the tax and benefit coding and provide updated reports on the tax and benefit system of each country. The European Commission has recently adopted the model for its tax modelling activities. The model is run and physically located at the Joint Research Centre premises in Seville (Institute for Prospective Technological Studies).The aggregate estimates for expenditure and number of recipients of each benefit (and revenue and number of tax payers of each tax) are regularly compared with the same information from external sources (e.g., administrative statistics and national microsimulation models, whenever available) including detailed tax and benefit simulation as well as income distribution indicators. The results of the validation exercises are included in the country reports (available on the EUROMOD website at https://www.iser.essex.ac.uk/euromod) which contain background information on the tax-benefit system for each country, a detailed description of all tax-benefit components simulated in EUROMOD, a general overview of the input data (including information on sample quality, weights, data adjustment, imputations and assumptions) and an extended summary of the validation process. EUROMOD baseline results do not comprehensively take into account non take-up of benefits or tax evasion.

In order to calculate the EMTRs we follow the approach of Jara and Tumino (2013). Thus, the EMTRs for each individual are evaluated taking account of taxes paid by, and benefits paid to all members of a household and affecting household current cash disposable income. Individual level EMTRs are calculated according to the following formula:

$$EMTR = 1 - \frac{Y_{HH}^{1} - Y_{HH}^{0}}{G_k^{1} - G_k^{0}}$$

where *YHH* represents the household disposable income to which the individual *k* belongs and *G* represents the earnings of the individual. The household disposable income is calculated first and then individual earnings are increased sequentially by a given margin for each earner in the household accounting for all new tax liabilities and benefits entitlements for all individuals *k* in the same household *HH*. The same procedure is then applied to the successive income earners in the household. In computing the EMTR we have chosen to increase only the largest component of an individuals' aggregate income which, in our sample, is gross labour income. As in Jara and Tumino (2013), the margin applied is equal to 3 per cent which corresponds approximately to a one hour increase for a worker working 40 hours per week.

In most countries the EMTR is high for low income earners (mostly because they begin to lose means-tested benefits). These high EMTR values are thus reflective of the disincentive effect of existing tax and benefit systems in the EU on the extensive margin of labour supply. The EMTR tends to be relatively stable in the middle of the distribution, before it becomes more progressive for the higher income deciles.

3 Empirical implementation

Calculating the user cost requires calibrating and simulating a number of parameters that enter equation (1).

In what follows, we focus on taxes and relief that are levied in a recurrent fashion, as they can immediately be related to ownership. Operationally, they can also be simulated using the microsimulation model. By contrast, the rates of transaction taxes used are the statutory ones (for France and Italy) or the average statutory rates (for Spain and the UK, where a progressive scale applies).

For the interest rate we use the 10-year government bond rate, which represents a non-risky alternative return on investment.[3] The risk premium estimate, and the maintenance and depreciation estimates are taken from Poterba and Sinai (2008a). The loan-to-value ratio is taken from Calza *et al.* (2013), who report country-specific averages for some European countries. Although this

3 Ideally one would have used bond rates of longer maturity, e.g., 20-year. However such bonds are more rarely issued than 10-year bonds or bonds with shorter maturity. The 20 and 10- year bond yield are usually highly correlated such that we opted for the 10-year bond maturity rate as better and more representative data was available.

clearly does not account for differences in access to finance within countries, it allows us to focus on tax variables as the only source of heterogeneity across households.

To account for house price dynamics, as reflected in individual expectations, for the majority of our simulations we use the average growth in house prices for 1989 to 2013 (OECD House Price Index). Using this time frame gives a reasonable estimate of the underlying growth in house prices and its foreseeable evolutions for potential buyers. In a sensitivity analysis, we also look at the impact that house price variation has on the user cost of housing, by varying the assumptions on how households' expectations on future house prices are formed (the methodology is described in Section 4.5).

For the individual/household-level analysis, we use the EUROMOD microsimulation model, which is based on the EU Statistics on Income and Living Conditions (EU-SILC) data (for France, Italy and Spain) and the FRS data (for the UK). The sample size of the survey is as follows:

Table 1

Sample Size of EU-SILC and FRS Data Used for EUROMOD
(2010 wave)

Country	Individuals	Households
France	26,387	11,042
Italy	47,420	19,147
Spain	36,922	13,597
UK	57,380	25,200

The survey data is for 2010, which is the most recent wave for both EU-SILC and the FRS. EUROMOD then applies uprating factors to each of the relevant variables to account for the year-on-year anticipated changes. For example, variables may be uprated by the change in average earnings, average gross pension changes, the harmonised index of consumer prices or the change in aggregate tax receipts.[4]

3.1 Baseline results

To highlight the country-level differences, we first report the country-level values, shown in Table 2.

One can see large variations between the countries, with the UK having the lowest user cost of housing followed by France, Spain and lastly Italy, where the user cost is more than twice that of the UK. Building on this, we move to estimates for the user cost of housing calculated disaggregated by decile.

[4] See *EUROMOD Country Reports* for more details.

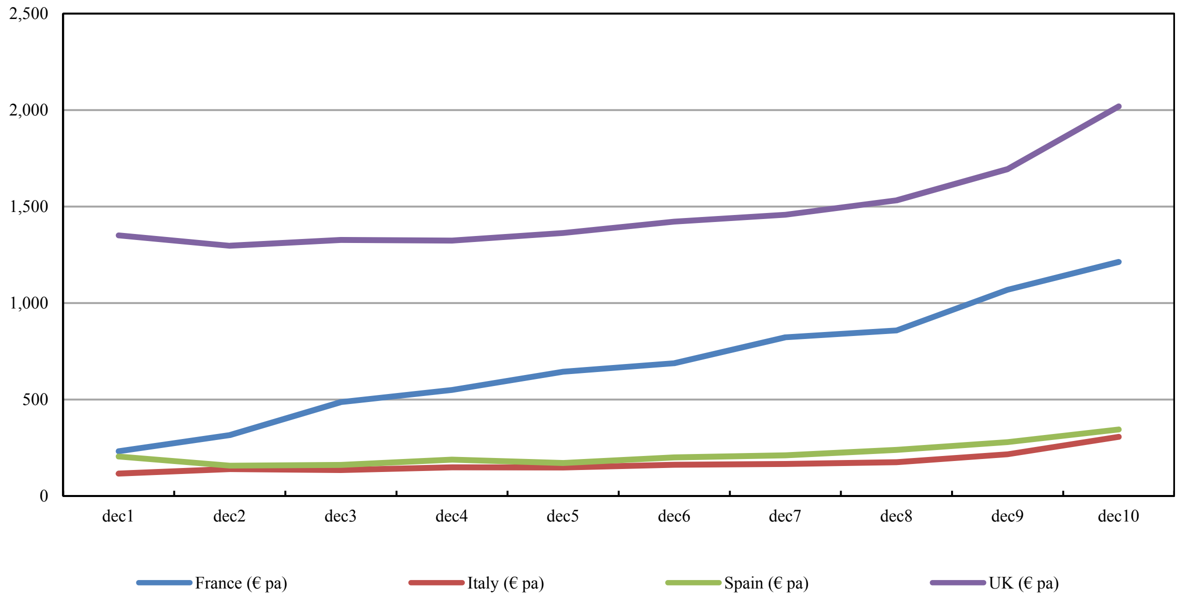
Table 2

User Cost of Housing by Country in 2013

Country	Average User Cost of Housing
France	0.0309
Italy	0.0486
Spain	0.0424
UK	0.0236

Figure 1

Existing Property Taxes per Unit of Housing by Deciles, 2013



Note: The UK figures have been converted from pounds sterling to euros at the average exchange rate for 2013: 1.178 euros = 1 pound sterling.
Source: EUROMOD and authors' calculations.

3.1.1 Existing property tax values

Information on property taxes paid by household is available in EUROMOD. The microsimulation model estimates by household, the value of the tax liability. The values themselves are shown by decile for the four countries in Figure 1. As can be seen, the value of the property tax paid is progressive across countries, although to different degrees. The progressivity in the value of the property tax paid is the most pronounced in the case of the UK and France and it is the least pronounced in the case of Italy and Spain.

Alternatively, Figure 2 provides an indication on the progressivity of actual property taxes as measured in terms of the gross disposable income. Figures are provided by income quintile so as to simplify the reading of this graph. Accordingly, property tax systems appear to be largely regressive in most countries, with the regressivity being the most pronounced in the UK and Spanish cases while being mildly regressive in the Italian case. In the French case the property tax system appears to be progressive until the third quintile and regressive afterward. In the Italian case the property tax system appears to be relatively neutral.

Additionally using EUROMOD one can simulate the tax credit that is received by household from the mortgage interest relief (in those countries where it applies, namely France, Spain and Italy). The values in euros themselves are shown by decile for the three countries in Figure 8. [5]

As for the property taxes, the mortgage tax relief appears to be regressive when considering level values. Considering relative values (in percent of net disposable income) as in Figure 4 confirm the regressive nature of mortgage interest relief. This is especially so in the Spanish case.

The property taxes and subsidies need to be entered into the user cost of housing equation in *per unit of housing* terms. In order to estimate house price value we use an indirect estimate based on the concept of the imputed rent, for which we have estimates at the household-level.

Estimates of the imputed rent have been made by Verbist *et al.* (2015), which use the rental equivalence method (sometimes referred to as the opportunity cost approach).[6] The relationship between imputed rent and the value of the house will vary, though the literature tends to take five percent as a rule of thumb (e.g. Mirrlees *et al.*, 2011:384). The accuracy of this estimate will also vary across individuals, though we argue that for the distribution as a whole and for the deciles, it will be a reasonable approximation. Taking this estimate of the house price, we calculate the property taxes and subsidies per unit of housing, as required for the user cost equation.

These individual-level values are entered into the user cost of housing equation, resulting in the baseline user cost of housing estimates shown in Table 3. The baseline figures are represented graphically in Figure 3.

As already noted, the differences across countries are substantial. Table 3 and Figure 3 show the within country differences. In France, the user cost is fairly stable across deciles, whereas in Italy, Spain and the UK, it is regressive. In the UK the user cost is nearly 59 per cent higher for the poorest decile compared to the richest. To a lesser extent, this is the case in Italy and Spain (39 and 27 per cent respectively).

4 Simulations of tax reforms

In the following we consider the influence of the various components of the cost of capital, namely the mortgage tax deduction, property taxes, the impact of substituting current property taxes with an imputed-rent based tax. We also pay specific attention to the role played by housing price expectations. The latter is particularly relevant to consider the evolution of the user cost of capital during the period given the large fluctuations in house prices.

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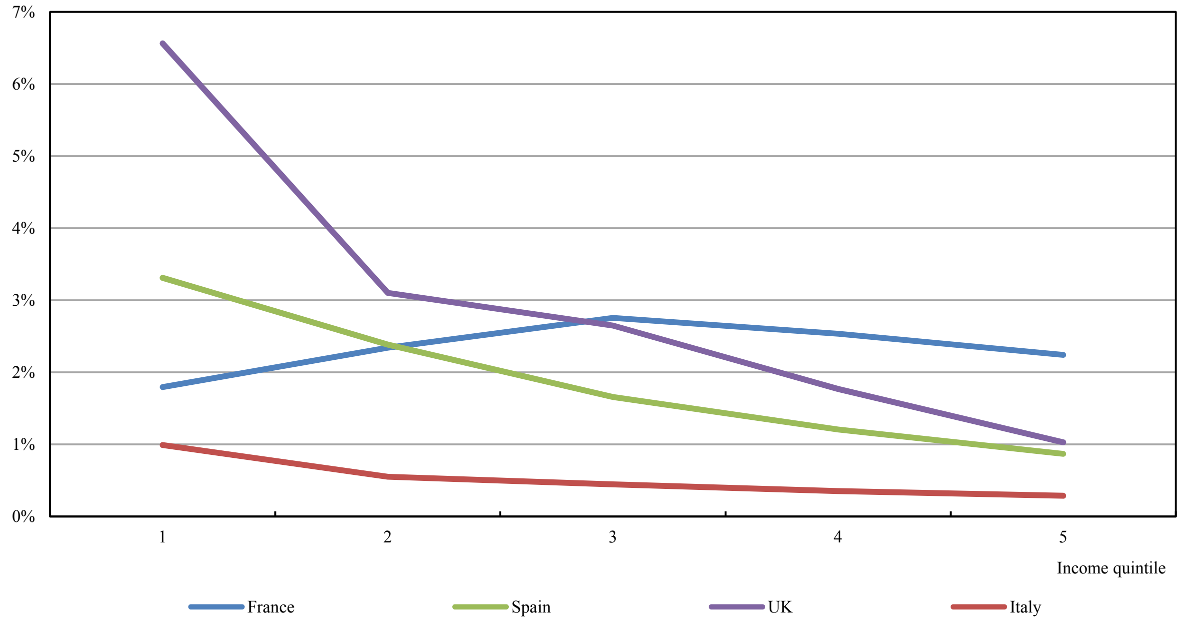
5 In the UK, mortgage interest tax relief was fully abolished in 2000 (having been phased out over many years).

6 These estimates are calculated using hedonic price estimations of the rental value of owned housing based on the EU-SILC micro-data from EUROSTAT. Note that the EU-SILC database already provides estimates of imputed rent, but as Juntto and Reijo (2010) indicate, these suffer from lack of comparability between countries given the variety of approaches used to collect this data. The Verbist et al. (2015) estimations on the contrary use the same empirical model applied to EU-SILC micro- data (with the only exception of United Kingdom, where analysis will be based on a national household budget survey, the Family Resources Survey). Verbist *et al.* (2015) estimate the imputed rent equivalent in two steps. The first step being a regression on private market tenants with rent as the dependent variable. The second step takes the coefficients of the explanatory variables and applies them to owner occupiers, correcting for the selection bias using a Heckman procedure and adding an error component in order to account cross-households' heterogeneity observed in the rent data.

Figure 2

Existing Property Taxes per Unit of Housing by Quintile, 2013



Source: EUROMOD and authors' calculations.

Figure 3

Mortgage Interest Tax Relief per Unit of Housing by Deciles, 2013

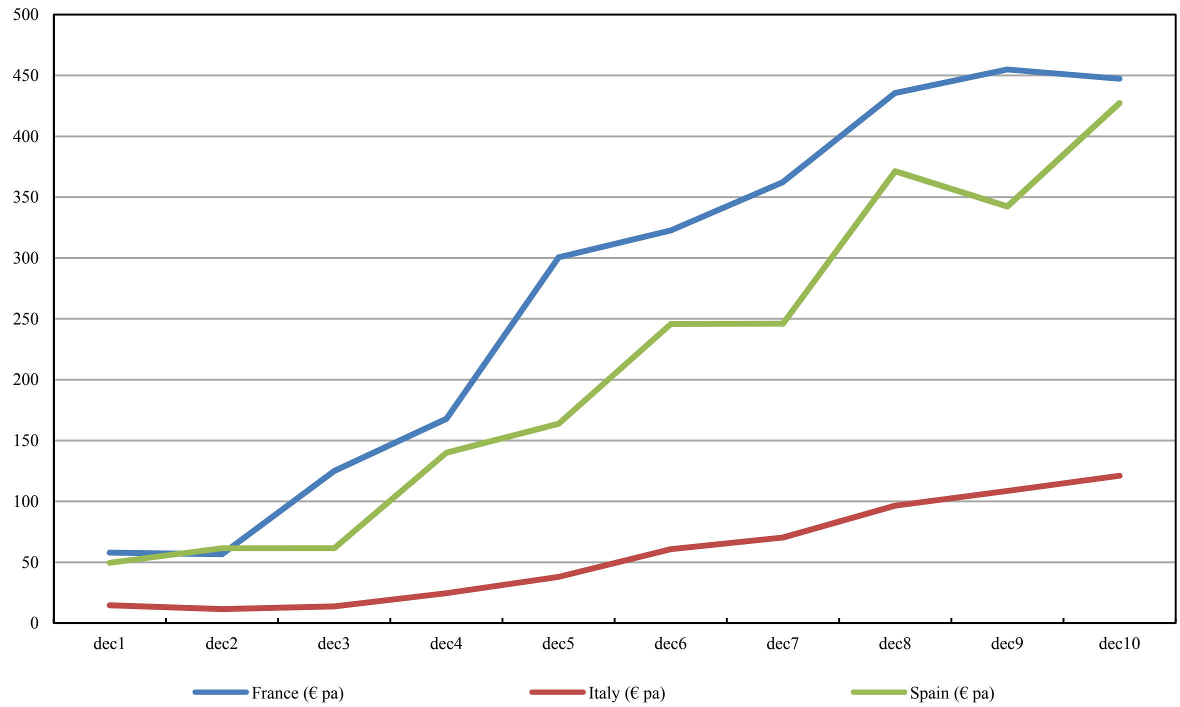


Figure 4

Mortgage Interest Tax Relief, 2013
(percentage of net disposable income)

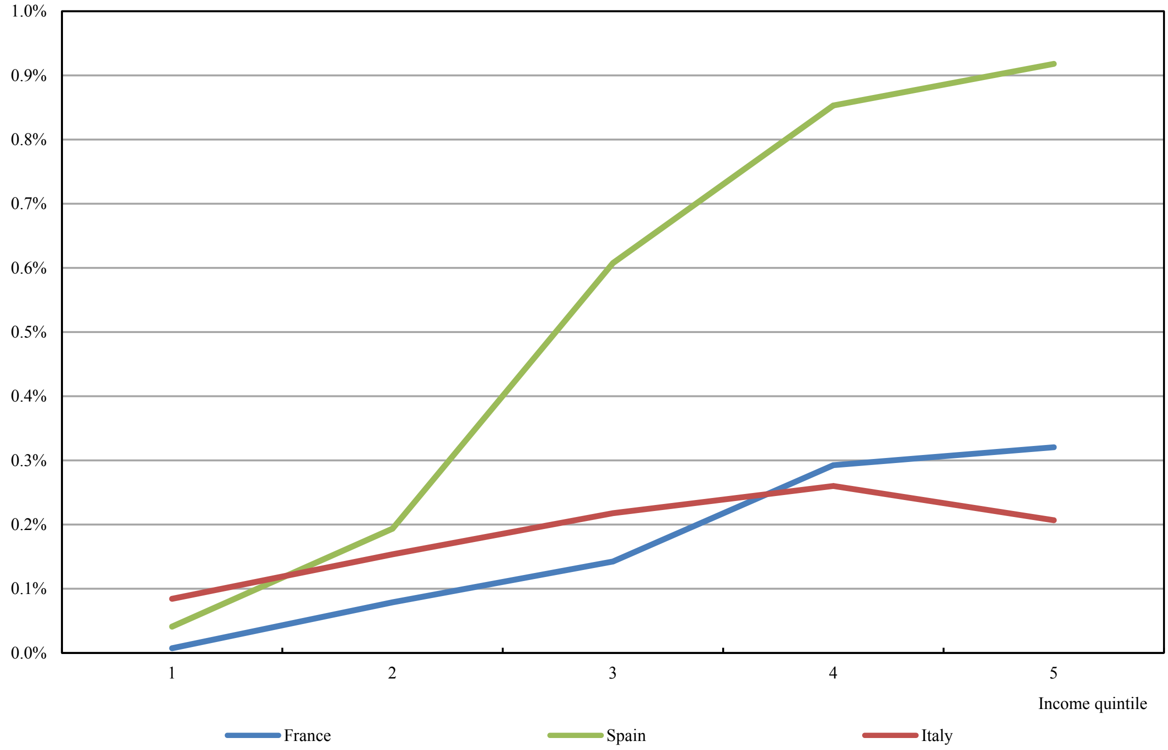


Table 3

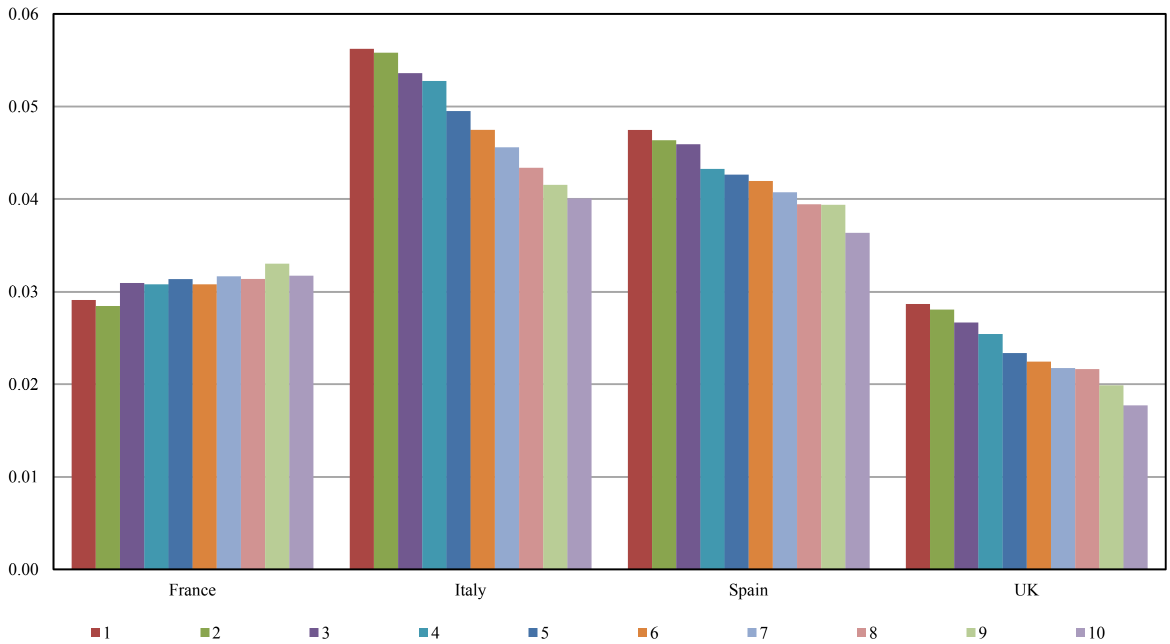
Baseline User Cost of Housing:
Individual-level EMTR and Property Tax and Subsidy Estimates, 2013

Country	User Cost of Housing		by Income Decile									
	Average	CoV*	1	2	3	4	5	6	7	8	9	10
France	0.0309	4.25%	0.0291	0.0285	0.0309	0.0308	0.0313	0.0308	0.0317	0.0314	0.0330	0.0317
Italy	0.0486	12.14%	0.0562	0.0558	0.0536	0.0527	0.0495	0.0475	0.0456	0.0434	0.0415	0.0401
Spain	0.0424	8.31%	0.0475	0.0464	0.0459	0.0433	0.0427	0.0420	0.0407	0.0394	0.0394	0.0364
UK	0.0236	15.21%	0.0287	0.0281	0.0267	0.0254	0.0234	0.0224	0.0218	0.0216	0.0199	0.0177

* Coefficient of variation.

Figure 3

Baseline User Cost of Housing by Income Decile (2013)



4.1 *Impact of removing mortgage interest subsidy*

The consequences of removing the mortgage interest deduction are shown in the following tables.

Table 4 shows the new user cost of housing, while Table 5 shows the percentage change relative to the baseline.

Table 4

User Cost of Capital: Baseline Calculation with Mortgage Interest Relief Removed (2013)

Country	User Cost of Housing	by Income Decile									
	Average	1	2	3	4	5	6	7	8	9	10
France	0.0344	0.0326	0.0319	0.0344	0.0343	0.0348	0.0343	0.0351	0.0349	0.0365	0.0352
Italy	0.0531	0.0607	0.0603	0.0581	0.0572	0.0540	0.0520	0.0501	0.0479	0.0460	0.0446
Spain	0.0474	0.0525	0.0514	0.0510	0.0483	0.0477	0.0470	0.0458	0.0445	0.0445	0.0415
UK	0.0236	0.0287	0.0281	0.0267	0.0254	0.0234	0.0224	0.0218	0.0216	0.0199	0.0177

Table 5

Change in User Cost of Capital:
Baseline v Baseline Calculation with Mortgage Interest Relief Removed, 2013

Country	User Cost of Housing	by Income Decile									
	Average	1	2	3	4	5	6	7	8	9	10
France	10.1%	10.7%	10.9%	10.1%	10.1%	10.0%	10.1%	9.9%	10.0%	9.5%	9.8%
Italy	8.4%	7.4%	7.4%	7.7%	7.8%	8.3%	8.6%	8.9%	9.3%	9.7%	10.0%
Spain	10.7%	9.7%	9.9%	10.0%	10.5%	10.6%	10.8%	11.1%	11.4%	11.4%	12.2%
UK	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%

The change in user cost is shown graphically below.

Figure 4

Change in User Cost Due to Removal of Mortgage Interest Relief by Income Decile, 2013

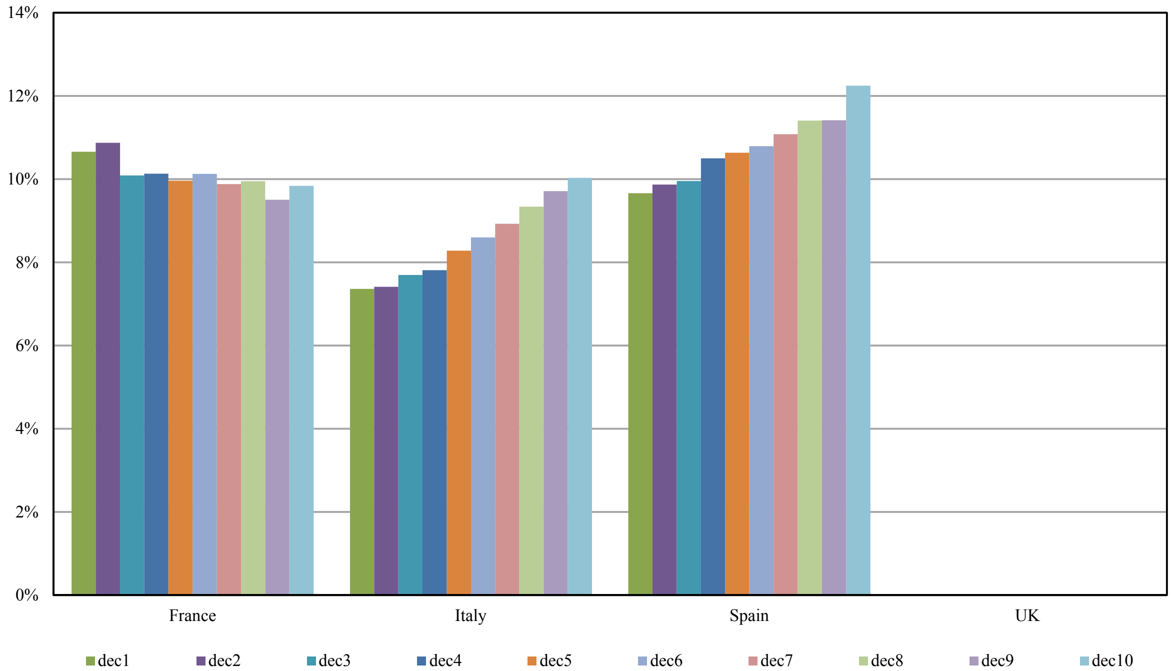


Table 6

User Cost of Capital: Baseline Calculation with Existing Property Taxes Removed, 2013

Country	User Cost of Housing	by Income Decile									
	Average	1	2	3	4	5	6	7	8	9	10
France	0.0243	0.0261	0.0247	0.0254	0.0248	0.0247	0.0241	0.0239	0.0235	0.0234	0.0221
Italy	0.0469	0.0548	0.0540	0.0520	0.0510	0.0480	0.0459	0.0440	0.0418	0.0396	0.0376
Spain	0.0401	0.0450	0.0444	0.0440	0.0411	0.0409	0.0398	0.0386	0.0372	0.0369	0.0335
UK	0.0161	0.0208	0.0198	0.0185	0.0174	0.0156	0.0149	0.0144	0.0145	0.0132	0.0119

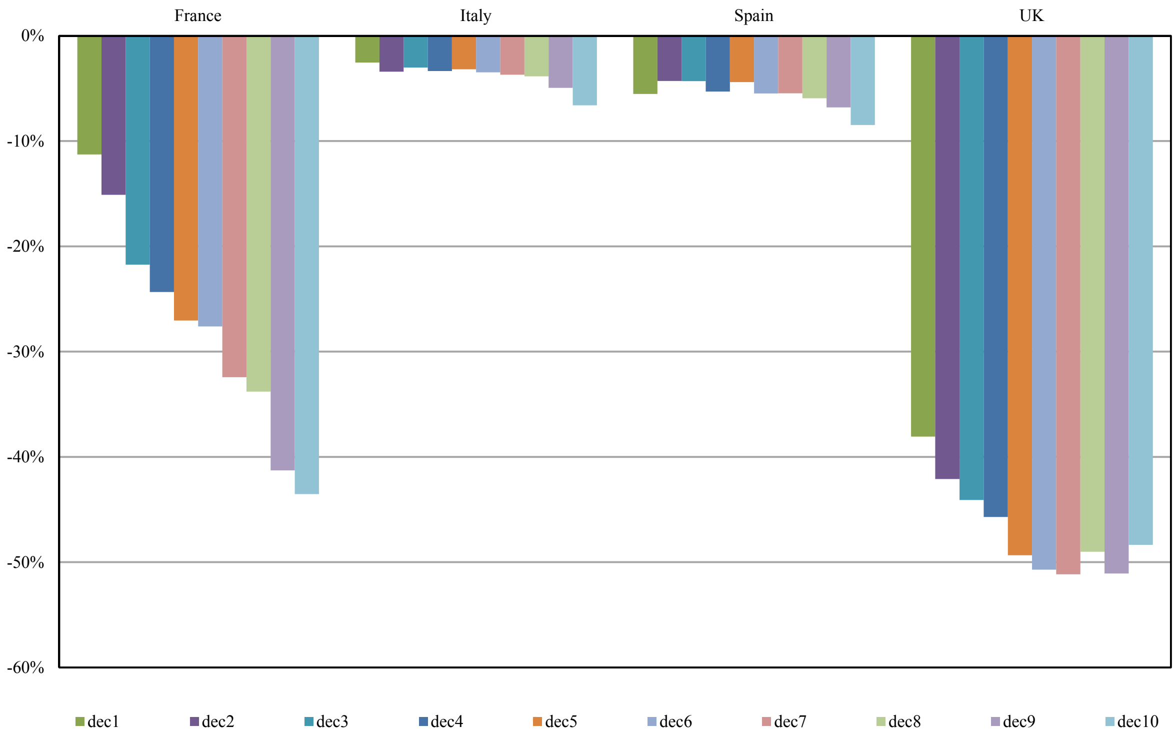
Table 7

Change in User Cost of Capital:
Baseline v Baseline Calculation with Existing Property Taxes Removed, 2013

Country	User Cost of Housing	by Income Decile									
	Average	1	2	3	4	5	6	7	8	9	10
France	-27.4%	-11.3%	-15.1%	-21.7%	-24.3%	-27.1%	-27.6%	-32.4%	-33.8%	-41.3%	-43.5%
Italy	-3.7%	-2.5%	-3.4%	-3.0%	-3.4%	-3.2%	-3.5%	-3.7%	-3.8%	-4.9%	-6.6%
Spain	-5.5%	-5.5%	-4.3%	-4.3%	-5.3%	-4.4%	-5.5%	-5.5%	-5.9%	-6.8%	-8.5%
UK	-46.3%	-38.1%	-42.1%	-44.1%	-45.7%	-49.3%	-50.7%	-51.2%	-49.0%	-51.1%	-48.4%

Figure 5

Change in User Cost Due to Removal of Existing Property Taxes by Income Decile, 2013



Clearly, the user cost of housing rises in all cases as a subsidy is being removed, except for the UK where mortgage interest relief has long been abolished (the values shown equal the baseline values). In the case of France, the change in the user cost is large, despite only being applied to a minority of homeowners, with an average increase in the user cost of 10.1 per cent. The relief is also important in Italy and Spain with average increases of 8.4 per cent and 10.7 per cent respectively. In all cases, one sees some regressivity in the existing subsidy, as removing it impacts the higher deciles more than the lower deciles.

4.2 Impact of removing existing property taxes

This simulation removes the existing recurrent property taxes compared with the baseline (both mortgage interest relief and transaction taxes are left in place). Table 6 showing the value of the user cost of housing and Table 7 the percentage change from the baseline.

The change in user cost is shown graphically in Figure 5.

One sees that the recurrent property taxes represent an important component of the user cost of housing in both France and the UK, where removing them would reduce the value by 27.4 per cent and 46.3 per cent respectively. In France, the existing tax is shown to be progressive, as higher income deciles pay a higher tax as a share of the property value. In Italy and Spain, the recurrent property taxes are less important for the user cost, though the changes observed are still significant.

4.3 Impact of introducing an imputed rent tax

This simulation adds an imputed rent tax to the baseline, and therefore *in addition* to the existing taxes and subsidies. (The tax reform scenario is shown in Section 4.4 below.) The imputed rent for each household is taxed at the standard rate for VAT in each country (between 20 and 22 per cent), which follows the notion that housing services should be taxed in the same way as other consumption services.

By design, a tax on imputed rent has a fairly uniform impact across the deciles. The variation in the percentage changes in Table 9 are due the fact that it is charged on net imputed rent (which differs from gross imputed rent by the costs of mortgage interest, and varies by individual) and from the different baseline values (the denominator in the percentage calculation).

4.4 Replacing existing property taxes with imputed rent tax

The previous section showed an imputed rent tax charged in addition to current taxes and subsidies. A more likely simulation involves having such a tax replace the existing recurrent property tax. In these simulations, the rate of the imputed rent tax has been adjusted so as to remain revenue neutral overall. The appropriate rate for a revenue-neutral imputed rent tax is shown in Appendix 1.

The change in user cost is shown graphically below.

Figure 6

Change in User Cost Due to Introduction of Imputed Rent Tax by Income Decile, 2013

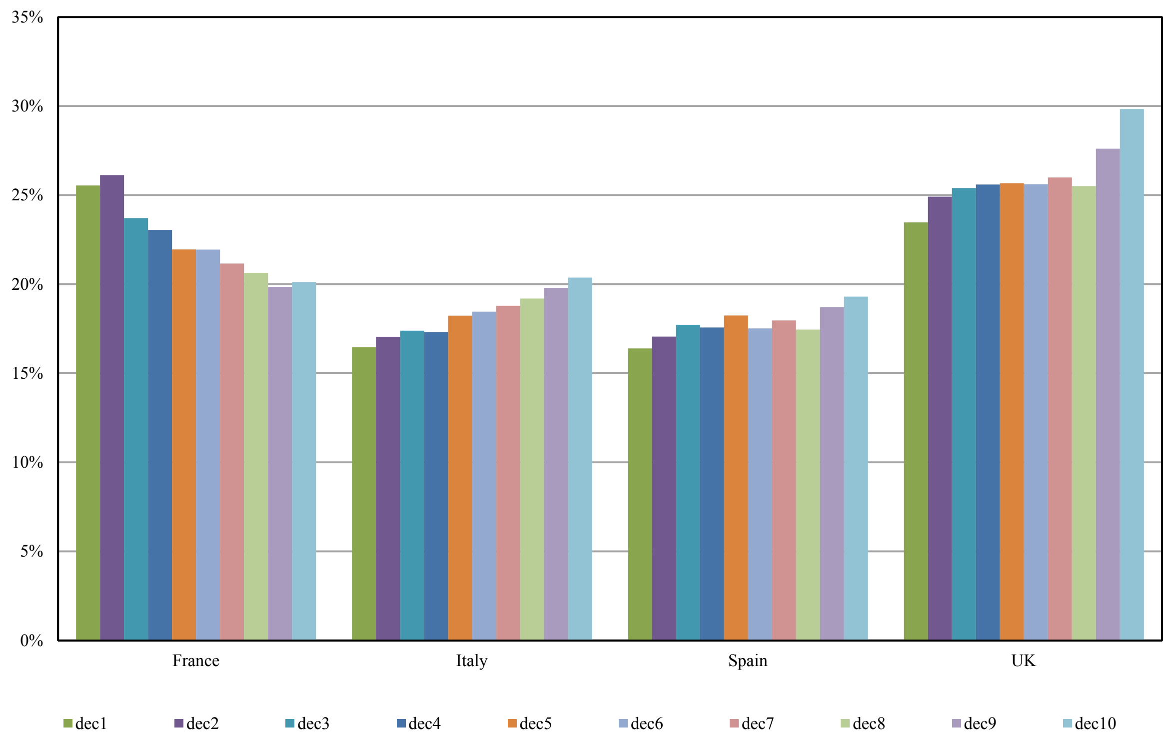


Table 8

User Cost of Capital: Baseline Calculation with Imputed Rent Tax Introduced, 2013

Country	User Cost of Housing	by Income Decile									
	Average	1	2	3	4	5	6	7	8	9	10
France	0.0398	0.0391	0.0385	0.0405	0.0400	0.0402	0.0395	0.0401	0.0396	0.0412	0.0397
Italy	0.0594	0.0673	0.0673	0.0649	0.0638	0.0605	0.0582	0.0561	0.0537	0.0518	0.0503
Spain	0.0515	0.0568	0.0559	0.0558	0.0525	0.0522	0.0509	0.0497	0.0478	0.0485	0.0451
UK	0.0317	0.0375	0.0374	0.0358	0.0342	0.0314	0.0302	0.0294	0.0290	0.0275	0.0252

Table 9

Change in User Cost of Capital: Baseline v Baseline Calculation with Imputed Rent Tax Introduced, 2013

Country	User Cost of Housing	by Income Decile									
	Average	1	2	3	4	5	6	7	8	9	10
France	22.4%	25.5%	26.1%	23.7%	23.0%	22.0%	21.9%	21.2%	20.6%	19.8%	20.1%
Italy	18.2%	16.5%	17.1%	17.4%	17.3%	18.2%	18.5%	18.8%	19.2%	19.8%	20.4%
Spain	17.7%	16.4%	17.1%	17.7%	17.6%	18.2%	17.5%	18.0%	17.5%	18.7%	19.3%
UK	25.8%	23.5%	24.9%	25.4%	25.6%	25.7%	25.6%	26.0%	25.5%	27.6%	29.8%

Table 10

User Cost of Capital: Baseline Calculation with Imputed Rent Tax Introduced and Other Property Taxes Removed, 2013

Country	User Cost of Housing	by Income Decile									
	Average	1	2	3	4	5	6	7	8	9	10
France	0.0313	0.0340	0.0326	0.0329	0.0320	0.0316	0.0309	0.0306	0.0299	0.0298	0.0284
Italy	0.0486	0.0566	0.0559	0.0539	0.0528	0.0498	0.0477	0.0457	0.0435	0.0413	0.0393
Spain	0.0424	0.0473	0.0468	0.0465	0.0434	0.0432	0.0420	0.0408	0.0393	0.0391	0.0357
UK	0.0235	0.0287	0.0281	0.0267	0.0253	0.0229	0.0219	0.0213	0.0212	0.0200	0.0187

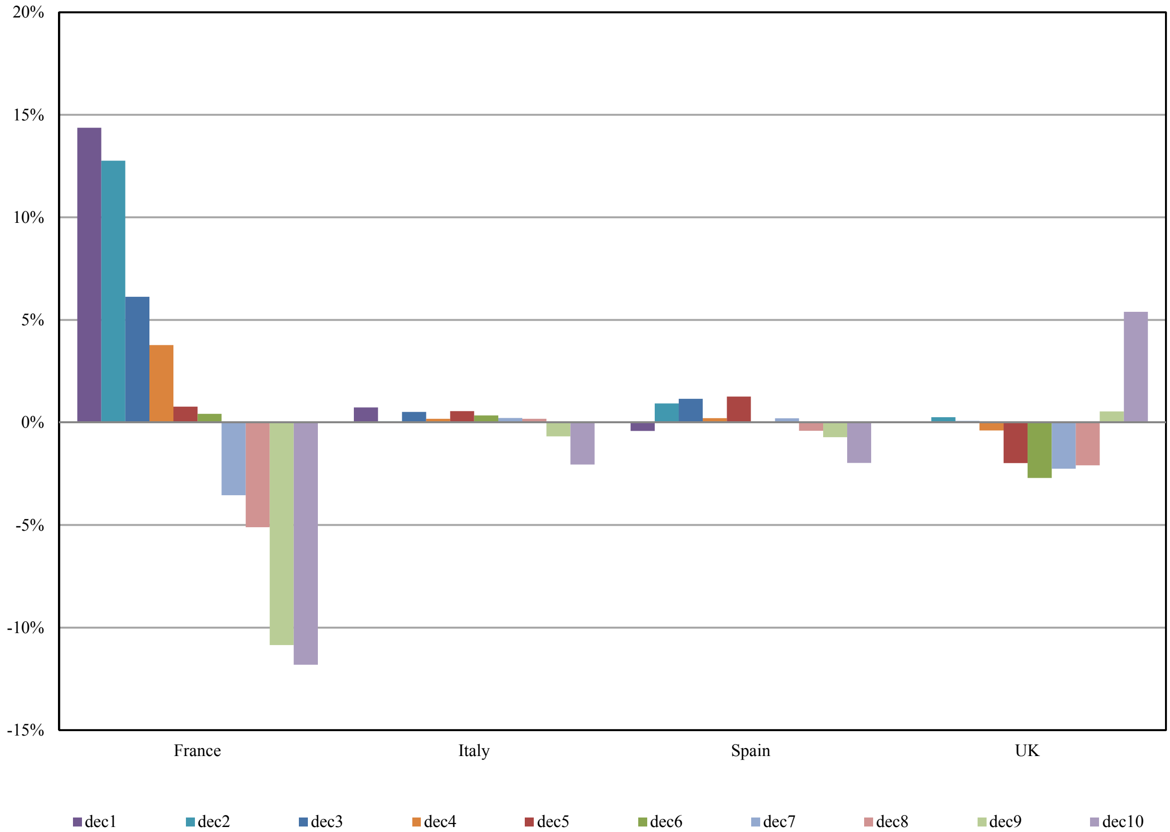
Table 11

Change in User Cost of Capital: Baseline v Baseline Calculation with Imputed Rent Tax Introduced and Other Property Taxes rEmoved, 2013

Country	User Cost of Housing	by Income Decile									
	Average	1	2	3	4	5	6	7	8	9	10
France	1.1%	14.4%	12.8%	6.1%	3.8%	0.8%	0.4%	-3.5%	-5.1%	-10.8%	-11.8%
Italy	0.1%	0.7%	0.1%	0.5%	0.2%	0.6%	0.3%	0.2%	0.2%	-0.7%	-2.1%
Spain	0.1%	-0.4%	0.9%	1.2%	0.2%	1.3%	0.0%	0.2%	-0.4%	-0.7%	-2.0%
UK	-0.4%	0.1%	0.3%	0.1%	-0.4%	-2.0%	-2.7%	-2.3%	-2.1%	0.5%	5.4%

Figure 7

Change in User Cost Due to Introduction of Imputed Rent Tax and Removal of Other Property Taxes by Income Decile, 2013



The change in user cost is shown graphically above.

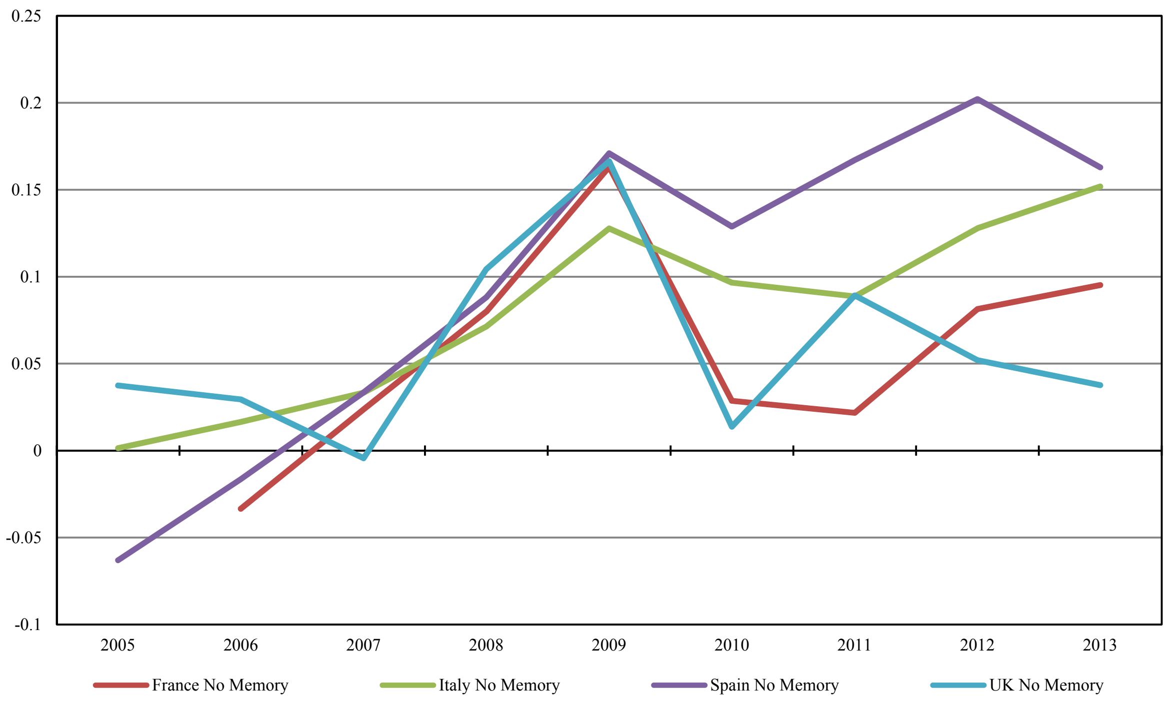
As we have argued, imputed rent represents a useful benchmark aim for economists, rather than a precise practical tax base from a policy perspective. Current deviations are an indication of how the policy has drifted from this idea over time from a "neutral" Haig-Simons-style property tax and the actual property tax. Part of this drift is due to the non-updating of house prices, often for many decades. In this sense, the imputed rent values used in this paper (from Figari *et al.*, 2014) are likely better than the legislated values.

The imputed rent was been used to guide policy in France. When the French property tax was originally designed to closely follow the imputed rent idea, see Verbist *et al.* (2015) France's results regarding the reform suggest that the existing property tax is more progressive than an imputed rent tax would be.

Spain and Italy (where the property tax is a smaller component of the user cost) show less impact overall, while the UK shows that an imputed rent would shift some of the taxes, especially from the 5th to 8th deciles to the 10th decile. This reflects the banding system in the UK property tax, where the top band can encompass moderately expensive properties up to multi-million pound properties, and charge both the same amount.

Figure 8

Evolution of the Expected User Cost of Capital with Fully-adaptive Expectations, Scenario (i), 2006-2013



4.5 *Sensitivity analysis: Impact of house price expectations*

The above simulations assumed that the rise in house prices, which is an important component in the user cost of housing, remains constant at the average growth rate between 1989 and 2013. The actual movements in house prices are shown in Figure 11 in the Appendix. In this simulation, we investigate the impact on the user cost of housing if households adapt, or partially adapt, their expectations based on the recent past.

We employ a simple weighted average of the long-term trend and the recent past:

$$\{E(\pi)\}_t = a \,.\, \pi_{ST} + (1 - a) \,.\, \pi_{LT}$$

where π_{ST} refers to the rise in house prices over the recent past (short-term), specifically the past year, and π_{LT} refers to the geometric mean rise in house prices over the long term, since 1989. The parameter '*a*' is the weight that the household gives to each piece of information, so an '*a*' of 1 implies that expectations are fully adaptive, and the trend over the past year is expected to continue indefinitely. An '*a*' of 0 implies that only the long-term trend is considered.

We look at how the user cost of housing evolves over time. The simulations run from 2006 to 2013 and also make incorporate variations in property taxes and subsidies and the 10-year bond rate. The three scenarios shown offer various degrees of adjustment of house price expectations: Figure 8 shows the results where '*a*' equals 0.9, near-fully adaptive expectations, Figure 9 where '*a*' equals 0.5, somewhat adaptive expectations, and Figure 10 'a' equals 0.1, nearly only long-term expectations.

Figure 9

Evolution of the Expected User Cost of Capital Somewhat Adaptive Expectations, Scenario (ii), 2006-2013

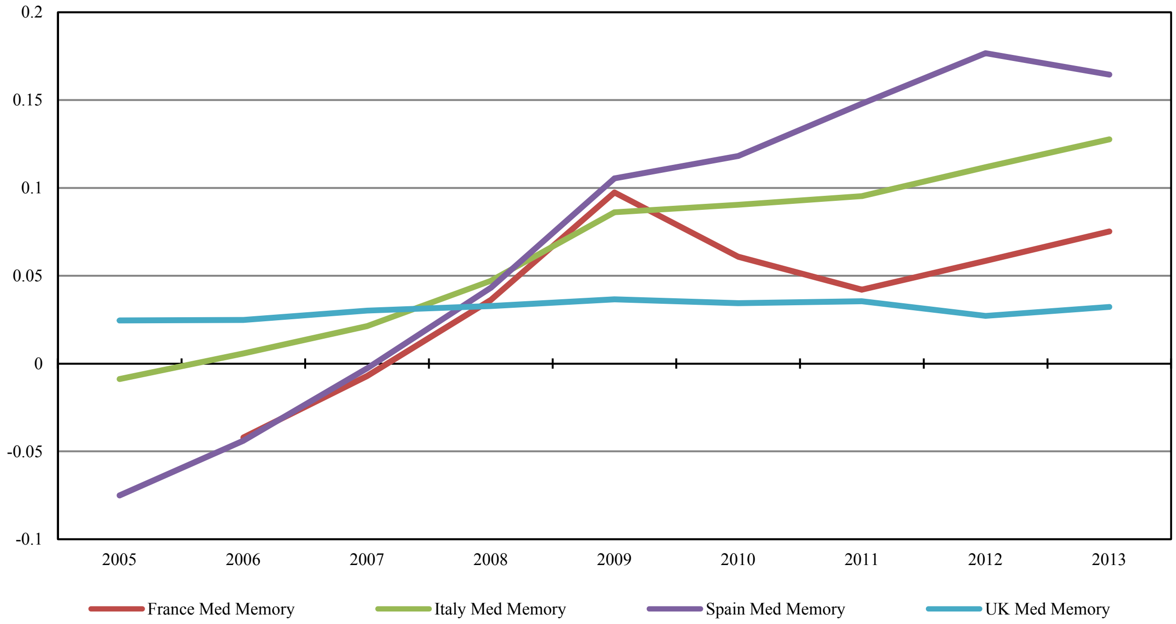
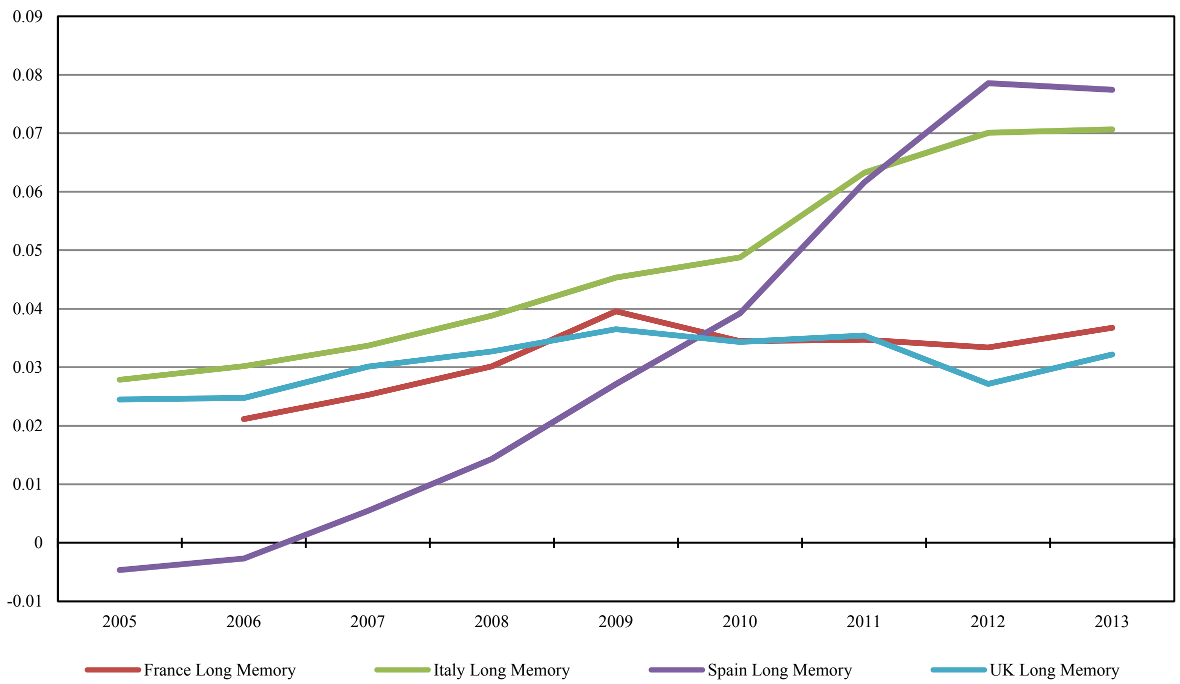


Figure 10

Evolution of the Expected User Cost of Capital Near-Only Long-term Expectations, Scenario (iii), 2006-2013



We consider Figure 8 interesting as an extreme scenario where house owners (or prospective owners) naïvely expect prices to continue to move as they have done in the past year. One sees that were house owners in Spain to adapt their expectations to this extent, their expected user cost of housing would range from minus 0.06, as the housing market was booming, to 0.21 as prices were falling most steeply. Indeed for all countries, large movements are seen under this extreme assumption. Figure 10 is considered more plausible, in that homeowners mostly rely on the long-term trend, with a small adjustment for the recent past. Therefore, if house prices are rising (or falling) steeply, there is a weak sense that this will continue. Though the changes in the user cost are much less, they still demonstrate that house price expectations can dominate the investment decision. This is seen most clearly in the case of Spain, where the user cost in 2005 and 2006 is below zero, meaning that the costs of holding capital are slightly more than compensated by the expected gain from price rises. As the housing bubble bursts in 2007, the expected user cost rises to nearly 0.08. Italy also shows a large difference over this period (approximately from 0.03 to 0.07), while France and the UK are relatively stable, reflecting the relative stability of the overall housing market during the period. Nevertheless, even in these countries fluctuations from 0.021 to 0.040 (France) and from 0.024 to 0.036 (UK) are still significant. Further disaggregation has been carried out by decile for long memory scenario, with the results show in the Appendix as Figures 12-15.

This analysis emphasises why booms and busts in the housing market can be self-sustaining. The user cost of housing fluctuates markedly based on the movement of house prices. When considering a purchase decision, the expected user cost facing the prospective buyer forms is hugely dependent on the expected house price changes. Any prospective buyer who bases their expectation on past price movements in the way suggested above would expect a lower user cost as prices rise, and so would be more inclined to buy, which sends the price even higher, fuelling the housing boom (especially as the housing market typically features an inelastic supply). Conversely, falling house prices raise the user cost, and deepen the housing bust.

5 Conclusions and policy implications

We have used the user cost of housing to investigate the impact of taxes and subsidies on the home ownership decision. The results demonstrate the mixed distributional consequences of the current tax and subsidy schemes. In particular, the mortgage interest relief (in France, Italy and Spain only) and property taxes tend to be regressive, with higher income deciles able to benefit more as measured by the impact on the user cost of housing.

The paper has argued that a tax on imputed rent is reasonable from a tax neutrality perspective. In particular, we analyse the differences emerging from a counterfactual experiment where the existing recurrent housing is replaced by an imputed rent tax. Interestingly, the existing taxes in Italy and Spain have fairly similar implications for the user cost as would an imputed rent tax. The deviations are large for the UK, especially for the richest decile, reflecting the relatively low tax rate on high value properties. In France, an imputed rent tax would be less progressive than the existing recurrent property tax.

One important element of the user cost of capital is the expected price change of the asset. When house prices move dramatically, this can dominate other considerations about the user cost. This even occurs when prospective homeowners incorporate a long-term view of the housing market.

APPENDIX 1
CALCULATING A REVENUE-NEUTRAL TAX REFORM

In order to set the rate of imputed rent tax so as to exactly match the lost revenue from removing the existing property tax, the following calculation was made. First, we calculate the total property tax revenue, ptaxrev:

$$ptaxrev = \sum_{decile=1}^{10} (propertytax\_rate_{decile} \times housevalue_{decile})$$

where "propertytax_e" is the average rate of property tax for each and "housevalue" is to the total value of housing owned by each decile (including weights to represent the whole population).

The same calculation is done for the imputed rent charged at the standard VAT rate (see Table 8 and Table 9).

$$irtaxrev = \sum_{decile=1}^{10} (irtax\_rate_{decile} \times housevalue_{decile})$$

This allows us to calculate the revenue-neutral imputed tax rate, irtaxneu_rate, by simply scaling the existing imputed rent tax rate:

$$irtaxneu\_rate = \frac{ptaxrev}{irtaxrev} \times irtax\_rate$$

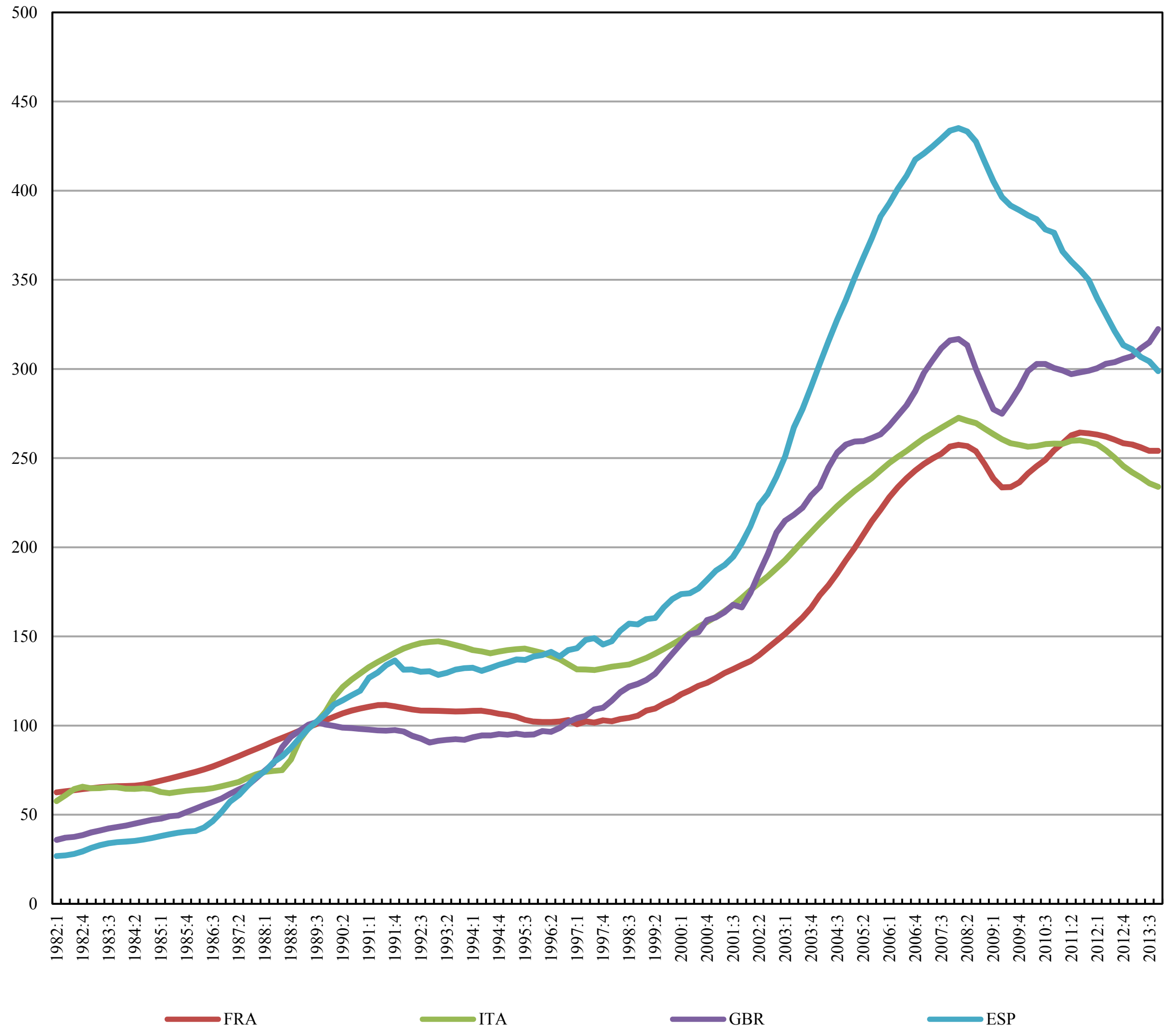
Note that irtaxneu_rate may be greater or less than the imputed rent charged at the standard VAT rate.

APPENDIX 2
ADDITIONAL FIGURES

Figure 11 shows the evolution of house prices indexed to 100 in 1989, which is an element of all calculations, and is especially relevant to the simulations in Section 4.5 where the house price expectations are allowed to vary.

Figure 11

House Price Index – OECD
(1989=100; 1982-2013)



Figures 7 to 10 show the user cost of capital over time, based on a long memory of house prices split by income decile. See Section 4.5 for further explanation.

Figure 12

France – User Cost of Capital, Long Memory of House Prices by Income Decile, 2006-2013

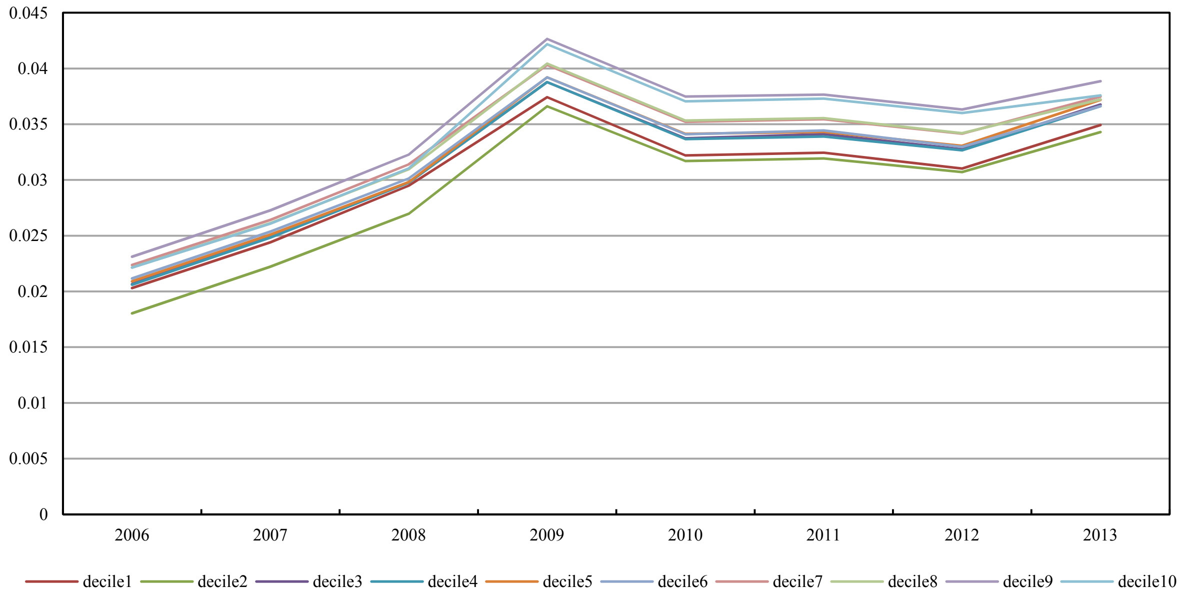


Figure 13

Italy – User Cost of Capital, Long Memory of House Prices by Income Decile, 2006-2013

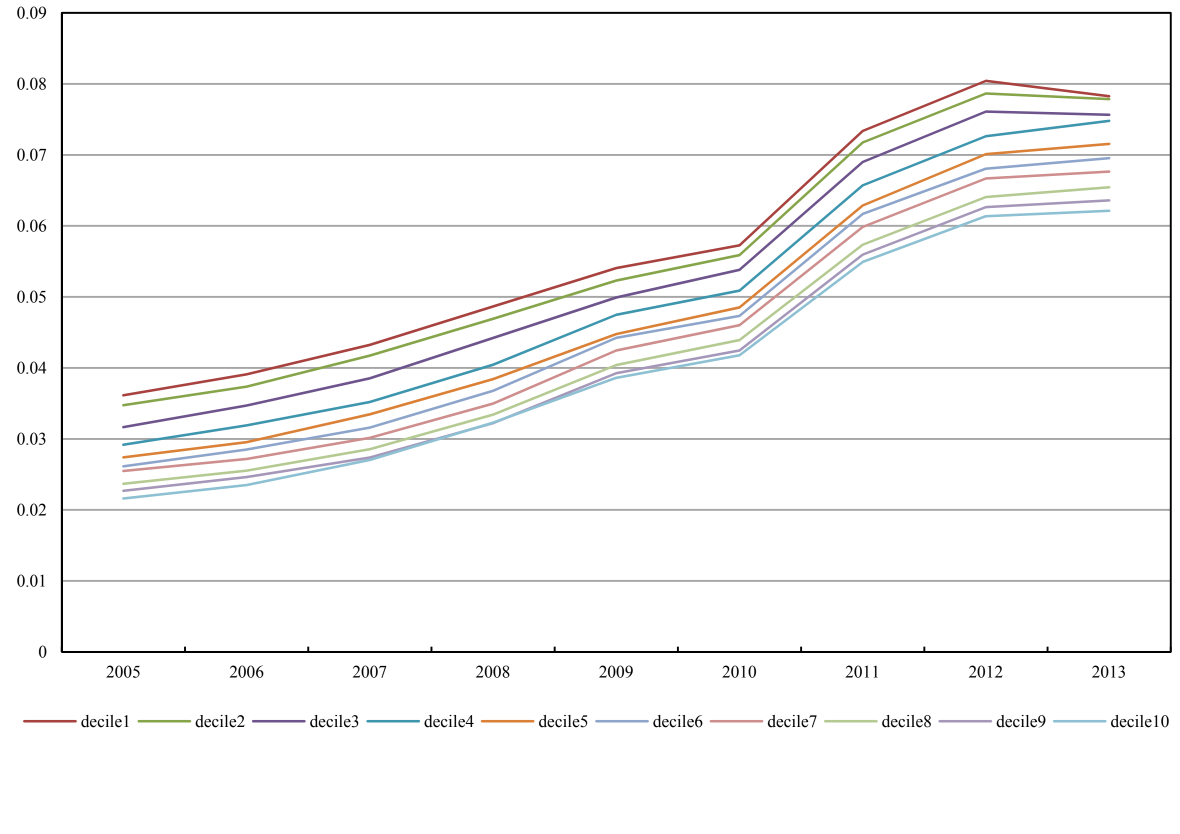


Figure 14

Spain – User Cost of Capital, Long Memory of House Prices by Income Decile, 2005-2013

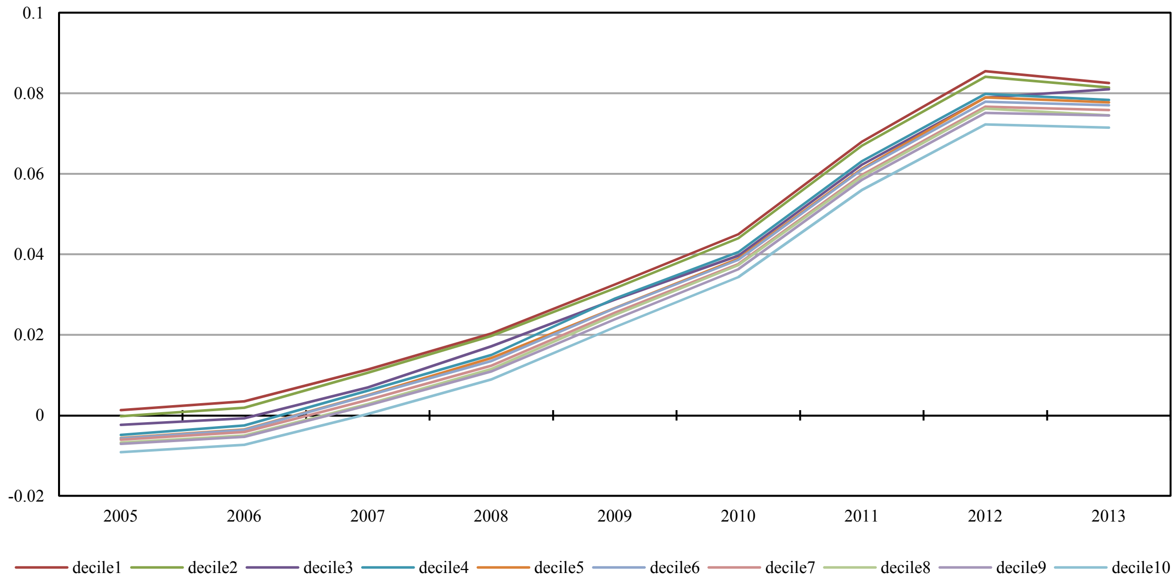
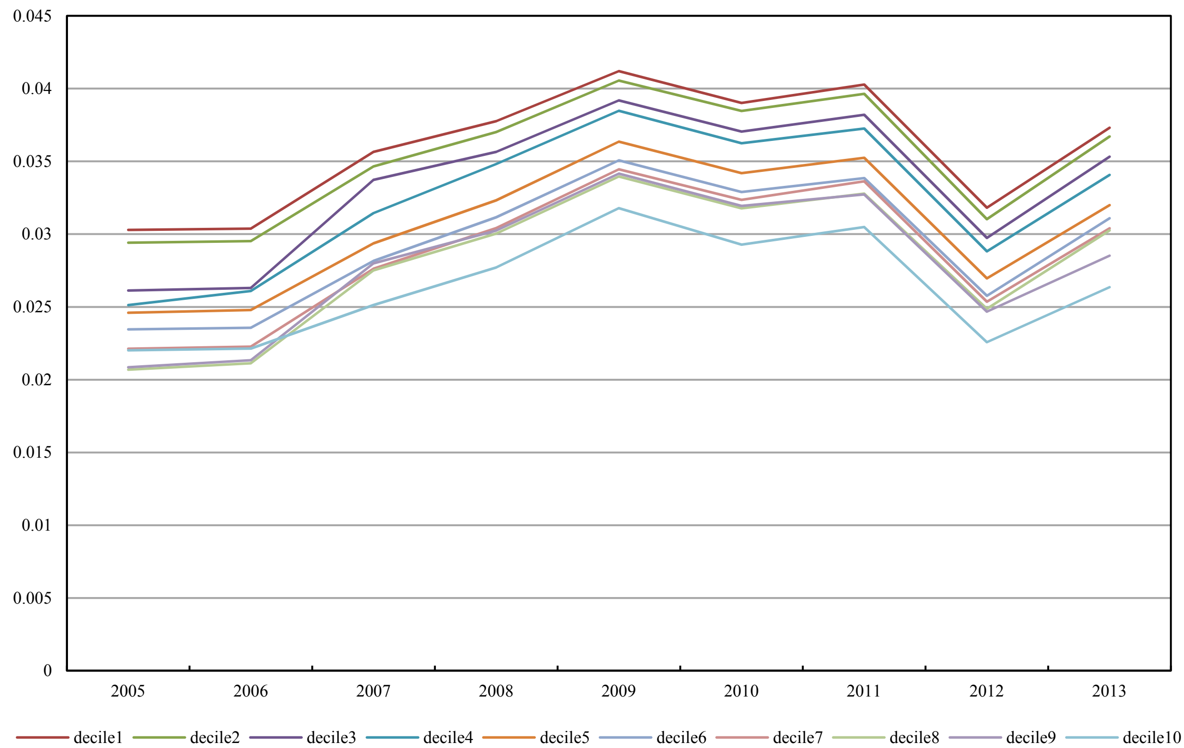


Figure 15

UK – User Cost of Capital, Long Memory of House Prices by Income Decile, 2005-2013



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COMMENT TO
"PROPERTY TAX REFORM
AND THE USER COST OF OWNER-OCCUPIED HOUSING IN THE EU"
BY SALVADOR BARRIOS, SERENA FATICA AND JONATHAN PYCROFT

Pietro Tommasino[*]

1 Short summary of the paper

The paper computes the "marginal cost of homeownership" (MCH) for four EU Countries (France, Italy, Spain and the UK).

This measure, well-established in the empirical literature, is given by the following formula:

$$MCH = i + t_p + \beta + m + \delta - \pi_H,$$

where i is the prevailing interest rate, t_p is the recurrent property tax rate, β is a risk premium associated with housing investment, δ is the depreciation rate, m represents maintenance unit costs and π_H is the rate of increase of house prices.

Obviously, the higher the marginal cost of homeownership, the lower the incentive to invest in housing.[1]

Tax policy affects this measure in several ways, besides recurrent real estate taxes. In particular, the MCH is reduced by two elements. First, the fraction of the house which is debt-financed (call it λ) benefits from tax relief for mortgage interest payments. Second, the remaining fraction $(1-\lambda)$ of the house, which is financed by own funds, is bought with funds which would have been invested in financial assets, and therefore taxed accordingly. Therefore, if we call t_{cap_inc} the tax rate applied to capital income and EMTR the effective marginal personal income tax rate, the marginal cost of homeownership becomes:[2]

$$\text{MCH} = i - \lambda EMTR - (1-\lambda)t_{cap\_inc} + t_p + \beta + m + \delta - \pi_H$$

The *EMTR* – and therefore the *MCH* – differ across different taxpayers.

The main contribution of the paper is to compute individual-specific EMTRs and MCHs for a representative sample of individuals for each of the four countries. To do this, the authors use the simulation model EUROMOD (which is in turn based on EU-SILC data for France Italy and Spain, and on FRS data for the UK).

The main results are summarized in their Table 3, which I report here for convenience. From the table emerges that Italy has the highest MCH (about 5 per cent) while UK has the lowest MCH (about 2 per cent). The other important finding is that for all countries except France the MCH decreases as a function of income (in France it is basically constant across income deciles).

2 Some comments about how the index is computed

The paper sheds light on a very interesting and hotly-debated topic, using appropriate and theory-driven tools. It is also very clear and (perhaps too) concise.

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[*] Bank of Italy.

[1] In equilibrium, it should be equal to the rent-to-price ratio.

[2] For simplicity's sake, I omit other terms included in the original contribution but not relevant for the present discussion.

Country	User Cost of Housing		By Income Decile									
	Average	**CoV**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
France	0.0309	4.25%	0.0291	0.0285	0.0309	0.0308	0.0313	0.0308	0.0317	0.0314	0.0330	0.0317
Italy	0.0486	2.14%	0.0562	0.0558	0.0536	0.0527	0.0495	0.0475	0.0456	0.0434	0.0415	0.0401
Spain	0.0424	8.31%	0.0475	0.0464	0.0459	0.0433	0.0427	0.0420	0.0407	0.0394	0.0394	0.0364
UK	0.0236	5.21%	0.0287	0.0281	0.0267	0.0254	0.0234	0.0224	0.0218	0.0216	0.0199	0.0177

2.1 Relaxing the assumptions

I would like to discuss some assumptions made by the authors in their calculations. While I understand that they are necessary to simplify things, they might be relaxed in future versions of the paper (alternatively, they might be discussed qualitatively, and the authors could explain to what extent, and in what direction, they drive the results).

The authors assume that the borrowing and lending rates coincide, and that they are the same for all individuals. The latter hypothesis appears unrealistic for two reasons: first, given the existence of transaction costs, typically the poor have access to worse investment opportunities (for example, they don't invest in stocks); second, given their worse credit standing, they are typically charged higher borrowing rates.

The same is true for the rate of appreciation of houses. My intuition is that typically (except perhaps during housing booms) the rich own houses in city centers and in other zones in which supply is generally fixed, so these houses tend to appreciate more.

2.2 Explain results more at length

Apart from relaxing some restrictive assumptions, I think the authors could give some more information about their computations.

It seems that what drives the regressivity of the MCH is the regressivity of the property tax and of the mortgage interest relief. But what features of the four tax systems should be blamed for this?

Furthermore, in some countries (e.g. in Italy) capital income is excluded from the personal income tax base, in others it may be included, so that *EMTR* and t_{cap_inc} coincide. I don't know what are the rules in the remaining three countries, but the authors should tell us, and say whether this is relevant for their results.

3 Some comments about the index

Let me conclude with some thoughts concerning the MHC index itself.

First, one is left wondering whether the MCH is relevant from the positive point of view. Do cross-country differences in the index explain differences in households' choices and housing prices? I think the authors can check whether, everything else equal, households with lower MCHs are more likely to own a house (and/or to own larger houses). Furthermore, it would be interesting to extend the analysis to at least another point in time, to see whether reductions (resp. increases) of the MCH induce an increase in homeownership or in house prices (this would also increase the robustness of the results, as the authors' data come from a very peculiar period of subdued house price dynamics and pronounced economic downturn).

A related concern is about the use of the index for policy exercises. Indeed, the MCH is computed for given (expected) price dynamics. However, clearly the MCH and its tax components are itself drivers of house prices; doesn't this represent a classical example of the Lucas critique, and therefore limits the policy usefulness of the index?

From a normative viewpoint, I wonder what are the normative foundations of the MCH index. Said differently: should public policies target the MCH? Is it a sufficient statistics of a country's housing policy? Related to this, I would suggest the authors to look at some contributions in the fields of urban economics and local public finance[3], which argue that homeownership can be seen as a policy goal in itself as homeowners tend to behave as better citizens. In some countries, cultural preferences could drive the policy choices.

Finally, what is left unexplained is the MCH regressivity. While we all know that the degree of progressivity should be seen as an attribute of the tax-benefit system as a whole, studying the political economy reasons behind the political power of rich homeowners could be a very interesting topic for further research.

[3] See, e.g., Fischel, W.A. (2001), *The Homevoter Hypothesis*, Harvard University Press, Cambridge (MA).

Session 2

PUBLIC INVESTMENT

PUBLIC CAPITAL IN THE 21ST CENTURY: AS PRODUCTIVE AS EVER?

Jasper De Jong,[*] *Marien Ferdinandusse*[**] *and Josip Funda*[***]

The global financial crisis and the euro area sovereign debt crisis that followed induced a rapid deterioration in the fiscal positions of many European countries. In the ensuing fiscal adjustment process, public investments were severely reduced. How harmful is this for growth perspectives? Our main objective is to find out whether the importance of public capital for long run output growth has changed in recent years. We also aim to provide insights on differences between countries and on international spill-overs. To this end, we expand time series on public capital stocks for 20 OECD countries as constructed by Kamps (2006) and estimate country-specific recursive VARs. Results show that the effect of public capital stocks on economic growth has not increased in general, leaving little ground to conclude the current low level of public investments forms an immediate threat to potential output.

1 Introduction

The global financial crisis and the euro area sovereign debt crisis that followed induced a rapid deterioration in the fiscal positions of many advanced economies. Governments reacted to this by increasing tax revenues and implementing expenditure cuts. In the process of expenditure adjustment, public investment had a large share, in particular in countries under market pressure. General government gross fixed capital formation as percent of GDP in the EU28 was in 2013 almost 25 per cent below its peak level in 2009, with the decline in for example Spain amounting to more than 60 per cent.

The cuts in public investments in the aftermath of the crisis may be caused by economic or political factors. In an environment of low growth, the number of viable projects could well be low. Moreover, financial market pressure or European fiscal rules urged countries to deliver budget balance improvements in the short run. In doing so, planned investment projects may be more easily terminated or postponed than most types of current spending.

Cuts in public investments might come at a significant cost. Public investments, or public capital, have been shown to contribute to economic growth both in the short and the long run (see, e.g., IMF, 2014; Pereira and Andraz, 2013; Romp and de Haan, 2007), although the effect varies greatly across regions, industries and types of investment (Bom and Ligthart, 2014b). Furthermore, due to international spillovers, investment cuts may harm the growth prospects in neighbouring countries.

Despite the presumable positive effect of public capital on economic potential, the growth of public capital stocks in many countries already started slowing down during the eighties. As a percentage of GDP, public capital stocks are generally either flat or falling. This means governments spend too little on investments to sustain the existing capital stock. The question now is: is this something to worry about, do governments miss out on the opportunity to benefit from

[*] De Nederlandsche Bank.

[**] European Central Bank.

[***] Hrvatska Narodna Banka.

The views expressed in this paper are those of the authors and not necessarily the views of the European Central Bank (ECB). This paper was written while Jasper de Jong and Josip Funda were seconded to ECB. We thank Jakob de Haan, Cristophe Kamps, Vaclav Zdarek and national representatives in the Working Group on Public Finance (WGPF) for valuable comments and suggestions. We are furthermore grateful to members of the WGPF for providing us with national data on public capital stocks.

high marginal returns to investments? And has the recent strong decline in public investments aggravated the situation? This need not be the case. Jong-a Pin and de Haan (2008) show that the effect of a public capital shock on output has decreased over time, suggesting that marginal benefits of public capital have not increased. However, their sample ends in 2001 and hence sheds no light on developments in the beginning of the 21st century.

We contribute to the literature in a number of ways. First of all, we expand existing series on public capital stocks for 20 OECD economies, as constructed by Kamps (2004), applying a common methodology. This provides us with data for the years 1960-2013. Secondly, we estimate recursive VAR-models – starting from the period 1960-1995, then expanding the sample period by one year at the time – to obtain some idea of the potentially changing relationship between public capital and other model variables, most notable economic growth. Lastly, by comparing the impulse responses from a VAR for the euro area as a whole to the weighted impulse responses of VARs for individual euro area countries, we scrutinize the importance of spillovers between European countries.

Our results show that the effect of public capital on GDP growth differs widely between countries. The effect of public capital shocks on economic growth has not increased in general, leaving little ground to conclude the current low level of public investments forms an immediate threat to potential output. Of course, if low investment levels are sustained for a long time, this could change. Furthermore, we provide some tentative evidence of the existence of positive spillovers of public capital between European countries.

In this paper, when we use the term “public investment”, this refers to general government gross fixed capital formation. However relevant, this does not include investment spending by public, but non-government organisations; expenditures on regular maintainance; or current expenditures which might actually have some characteristics of an investment, e.g., current spending on education.

2 Related literature

Transport infrastructure, communication services, electricity and water are used in the production process of almost every sector (Romp and de Haan, 2007). In many countries, the capital stock providing these services is largely in public hands. Public capital thus represents the wheels – if not the engine – of economic activity, in the words of the World Bank (1994).

But how exactly does public capital impact on output growth? In the short run, an increase in public investments creates positive demand effects. At the same time, public capital arguably enhances the economy’s supply side. But additional public expenditures have to be financed, with potential detrimental consequences for output. This section gives a brief overview of empirical research on the relationship between public capital and output.

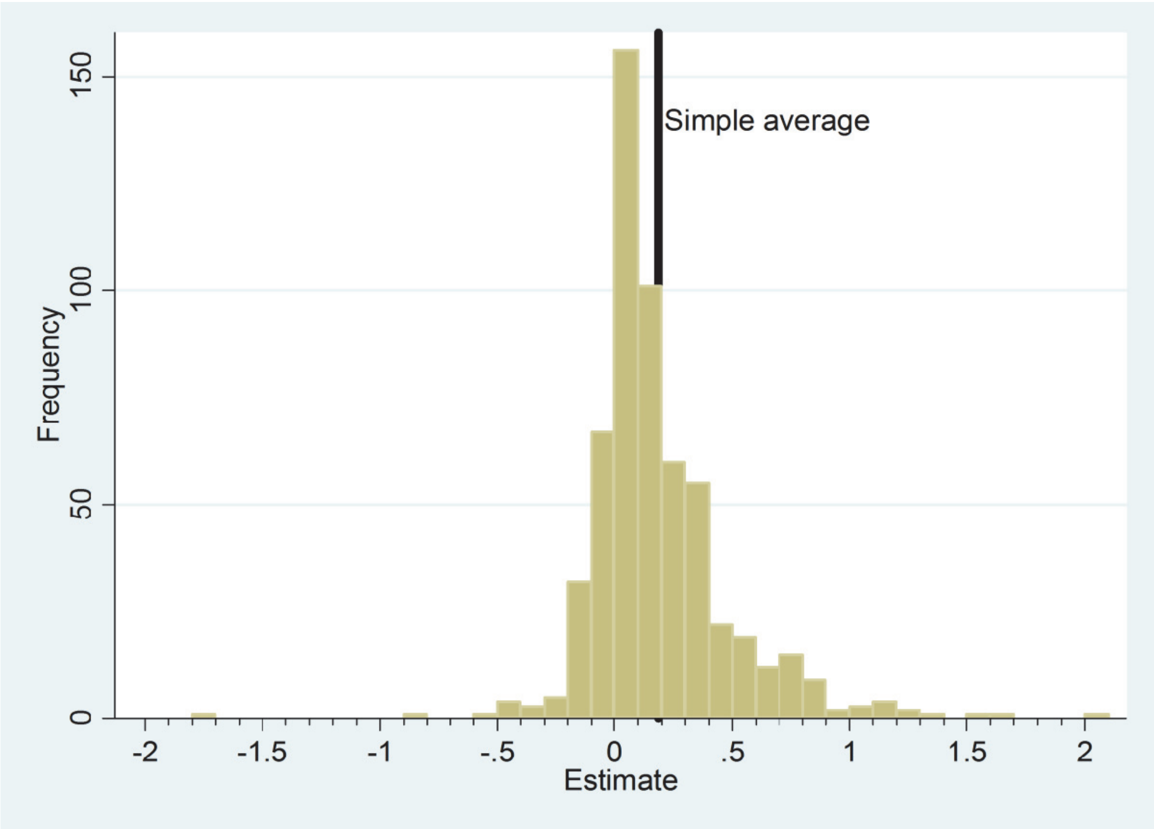
2.1 Partial equilibrium effects

There is a substantial, largely empirical literature aiming to quantify the economic importance of public capital (see Pereira and Andraz (2013), EC (2014) and Romp and de Haan (2007) for extensive reviews of the empirical literature on public capital and growth).

One major branch focuses on partial effects of public capital, in particular on the contribution of public capital or investments to private sector output production. The empirical literature in this branch set off with the work of Aschauer (1989). Estimating a production function including public capital for the US, the author found strong positive effects of the public capital

Figure 1

Estimated Output Elasticities of Public Capital



Data are from Bom and Ligthart (2014b). Histogram shows published estimates of output elasticities; no correction for publication bias.

stock, and of core infrastructure in particular. The so-called production function approach, describing the technical relationship between production factors and output, was applied by many empiricists since (e.g., Kamps, 2006; Cadot *et al.*, 2006; Creel and Poilon, 2008).

Bom and Ligthart (2014b) summarize the empirical literature on production function estimates by carrying out a meta-analysis. Overall, it is difficult to draw strong conclusions on the economic importance of public capital. This is illustrated by Figure 1.[1] Figure 1 shows published estimates of public capital output elasticities, taken from 68 papers published between 1983 and 2008 (data are from Bom and Ligthart (2014b).[2] Values run from a negative –1.7 for New Zealand (Kamps, 2006) to 2.04 for Australia (Otto and Voss, 1994), with the average output elasticity of public capital after correcting for publication bias at 0.106. Estimates vary considerably over time, location, level of aggregation, measure of public capital or estimation method.

Nevertheless, some lessons can be learned. The general picture emerging is that public capital supports the potential output level. Core infrastructure (roads, railways, telecommunications, etc.) seems to be relatively more important compared to other investments in physical capital (see also Figure 2, lhs).

1 We greatly thank Pedro Bom (University of Vienna) for sharing the data.

2 Caution is warranted in interpreting the data in Figures 1-3, since data are not adjusted for publication bias.

2.2 General equilibrium effects

The production and cost function approaches provide useful information on the macroeconomic production process and firm behaviour, but only highlight the benefits of public investment or public capital. More is always better, as more public capital will increase output and lower costs, ceteris paribus. However, a government facing the decision whether to invest more or not has to trade off these extra investments against lower consumptive expenditures, higher taxes or an increase in the debt level.

The second major branch of the literature therefore aims to provide a broader picture by taking into account feedback effects from higher public capital or investments on the rest of the economy. For example, if an increase in public investments is financed by raising tax rates, beneficial effects of extra public investments will be mitigated. Two common methods for incorporating feedback effects are estimation of VAR-models and the use of calibrated general equilibrium models.

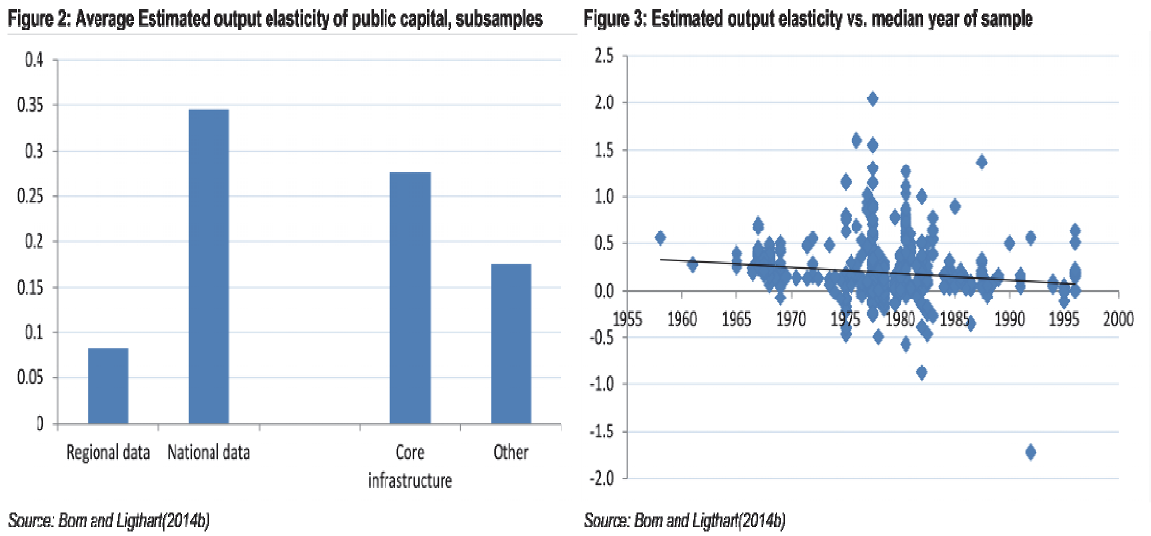
Calibrated or estimated macro-models provide the economist with a clear economic story, but at the cost of imposing restrictions on the data. A common way for incorporating public capital into a model is as a third production factor in a Cobb-Douglas production function, with constant or increasing returns to scale on private production factors (Leeper *et al.*, 2010; Bom and Ligthart, 2014a; Baxter and King, 1993). Elekdag and Muir (2014) generalise the model of Leeper *et al.* (2010), employing a multi-region DSGE model and allowing for liquidity-constrained households and accommodative monetary policy. They confirm findings by Leeper *et al.* (2010) that implementation delays in investment result in muted positive or potentially even negative responses in output and labour in the short run, but show that accommodative monetary policy can overturn the short run contractionary effects from an increase in public investments.

VAR-models, while lacking an explicit economic story, provide direct (reduced form) estimates of the dynamic relations between public capital and output growth. Moreover, they address some econometric objections to the structural approaches. A point of criticism towards the production function and cost function approaches outlined in the previous paragraph is that they impose causal relationships between the variables. However, causality might well run in multiple directions. For example, next to finding that infrastructure positively affects income growth, it could be envisaged that with income the demand for adequate infrastructure rises. VAR models do not impose causal relationships between variables a priori, and allow for testing for the existence of causal relationships in either direction. VAR models have other advantages as well. They allow for indirect links between the variables in the model. In the VAR approach, the long-run output effect of a change in public capital results from the interaction of all the variables in the model. Thirdly, VARs offer more flexibility concerning the number of long-run relationships in the model; they do not assume there is at most one such relationship (Kamps, 2004). On the downside, a clear economic framework providing guidance in interpreting the outcomes is lacking (at least in an unrestricted VAR). Furthermore, data limitations often imply the number of regressors should be kept relatively small.

Kamps (2004) estimates VARs or VECMs for 22 OECD countries. An essential ingredient to this research is the database on public capital stocks as constructed by Kamps (2006). Next to the net public capital stock, Kamps (2004) includes the net private capital stock, the number of employed persons and real GDP (in that order). Overall, an increase in public capital seems to contribute to economic growth, but less so than often found in production function estimates. This hints at the importance of taking into account feedback effects from output to public capital. Furthermore, public and private capital are found to be long-run complements in the majority of countries.

Figure 2

Output Elasticities: Sub-samples and Variation Over Time



Results found in the empirical VAR-literature remain mixed though. Jong-a Pin and de Haan (2008) extend the analysis by Kamps (2004), only partially confirming his findings. Using hours worked as a measure for labour input they find a positive effect of public capital on output in some, but by no means all countries. Sometimes the effect is even negative. Broyer and Gareis (2013) on the other hand, using data for 1995-2011, find very strong positive effects for infrastructure expenditures in the four largest euro area countries. IMF (2014), directly estimating the relationship between public investments and output growth in a panel setting, also find strong positive effects (studying 17 advanced OECD economies, 1985-2013). Effects are particularly strong during periods of low growth and for debt-financed shocks, but are not significantly different from zero if carried out during periods of high growth or for budget-neutral investment shocks.

2.3 Has the impact changed over time?

An interesting question is whether the impact of public investments is constant over time. In many developed countries the public capital stock (as percentage of GDP) has been on a downward trend for a while. The question is: is this something to worry about, do governments miss out on the opportunity to benefit from high marginal returns to public capital?

This need not necessarily be the case, as Bom and Ligthart (2014b) in their meta-analysis find that estimated output elasticities of public capital are lower when more recent sample periods are used (see also Figure 2, rhs). This could support the idea that with the maturing of infrastructure networks in most developed countries, gains from additional roads, railway connections or power lines should be smaller than in the past. An alternative explanation is that early empirical studies sometimes ignored endogeneity or non-stationarity of the data, biasing estimates upwards, although Bom and Ligthart (2014b) in principle control for such issues. In the second part of their paper, Jong-a Pin and de Haan (2008) estimate a rolling-window panel-VECM. The results indicate that between 1960 and 2001, the long-run impact of a shock in public capital to output declined in a number of countries, which was correlated with a declining public capital stock.

2.4 Cross country spill-overs of public investment?

The effects of public capital are generally found to be lower for regions within countries than for countries as a whole, suggesting the presence of spill-overs. Given the network characteristics of for example road and telecommunications infrastructure, positive spill-overs between regions could emerge. Bom and Ligthart (2014b) in their meta-analysis find that using regional rather than national data generally results in lower estimates of the output elasticities of public capital, hinting at the importance of spill-overs. Amongst many others, studies find evidence for spill-overs between U.S. states of public investments in infrastructure (Cohen and Paul, 2004) or infrastructure maintenance spending (Kalyvitis and Vellai, 2012); of public capital formation between Spanish regions (Pereira and Roca-Sagalés, 2003; Roca-Sagalés and Lorda, 2006) and of public transport infrastructure between Italian regions (Di Giacinto *et al.*, 2013).

However, the evidence from regional studies on the existence of spill-overs is far from uniform and the available evidence should be interpreted with caution. Some authors have pointed to the possibility of aggregation bias that results in high estimates when using aggregate data or did not find evidence for spill-overs (see Creel and Poilon (2008) for an overview). De la Fuente (2010) in a survey finds that public capital variables are almost always significant in panel data specifications for the Spanish regions, and often insignificant in similar exercises conducted with US data, which could possibly be related to the difference in maturity of infrastructure networks in both countries.

3 Data

Data on public and private investments, as well as real GDP series, are obtained from OECD. Total hours worked per annum are taken from the Total Economy Database.[3] We have data for 1960 and later years.

3.1 Construction of the data

We use the perpetual inventory method to construct government and private capital stocks. Here we provide a brief overview of the methodology. For a full description, see Kamps (2004) and references therein.

Assuming geometric depreciation, the net public capital stock evolves as follows:

$$K_{i,t+1} = (1 - \delta_t)K_{i,t} + I_t \tag{1}$$

where K measures the capital stock at the beginning of the period, δ_t is the time-varying rate of depreciation and I denotes gross public investments.

From this, the public capital stock can be calculated as:

$$K_{t+1} = (1 - \delta_t)^t K_1 + \sum_{i=0}^{t-1} (1 - \delta_t)^i I_{t-i} \tag{2}$$

with K_1 denoting the initial capital stock. Data on investments are readily available, but one still has to determine the initial capital stock, as well as the depreciation rate to apply.

3 The Conference Board Total Economy Database™, January 2014, http://www.conference-board.org/data/economydatabase/

There is no official information on the magnitude of the initial capital stock for any country except the United States. Therefore, following Kamps (2004) (who in turn borrows the method from Jacob *et al.* (1997)) an artificial investment series for the period 1860-1959 is constructed. For each country, we assume that investment grew by 3.2 percent a year (the 1960-2013 average) during this period, finally reaching its observed level in 1960.

The depreciation rates used are time-varying. In fact, they increase over time. This reflects findings from a detailed analysis by the U.S. Bureau of Economic Analysis (BEA, 2001). The increase could follow from both a shift in composition of the capital stock towards assets with a higher depreciation rate, as well as a decrease in asset lives. Expanding the formula used in Kamps (2004), depreciation rates develop as follows:

$$\delta_t = \delta_{min} \left(\left(\frac{\delta_{max}}{\delta_{min}} \right)^{1/54} \right)^{t-2014+54} \tag{3}$$

with δ_{min} fixed at 2.5 per cent and δ_{max} equal to 4.8 per cent. The underlying assumption of increasing depreciation rates of the total public capital stock is mirrored in national estimates of the public capital stock.

Regarding private capital stock, we assume constant depreciation of rate 1.5 per cent for residential capital and time-varying depreciation rate going from 4.25 per cent in 1960 to 11 per cent in 2013 for non-residential capital stock. Differences in the composition of the capital stock are ignored due to lack of data.

Figure 3 presents the estimates of public capital stock for a sample of countries included in the analysis. The government capital stock data are constructed by applying a perpetual inventory method, described above.[4]

Two observations stand out. First, despite still considerable cross-country differences, capital stocks seem to have converged in size internationally. In 2013, all countries shown had estimated public capital stocks between 25 and 60 per cent GDP. Japan is a notable exception with the public capital stock of 80 per cent of GDP. There is no apparent relation between the size of the public capital and GDP per capita.

Secondly, in a number of countries public capital stocks have declined (as percent of GDP) over the last two or three decades including the most recent period of global financial crises and its aftermath. Compared to 1980, the largest fall in public capital stock was estimated for Denmark, Ireland, UK and New Zealand, in all cases above 20 per cent. US, Sweden and Netherlands all recorded a drop of more than 10 per cent.

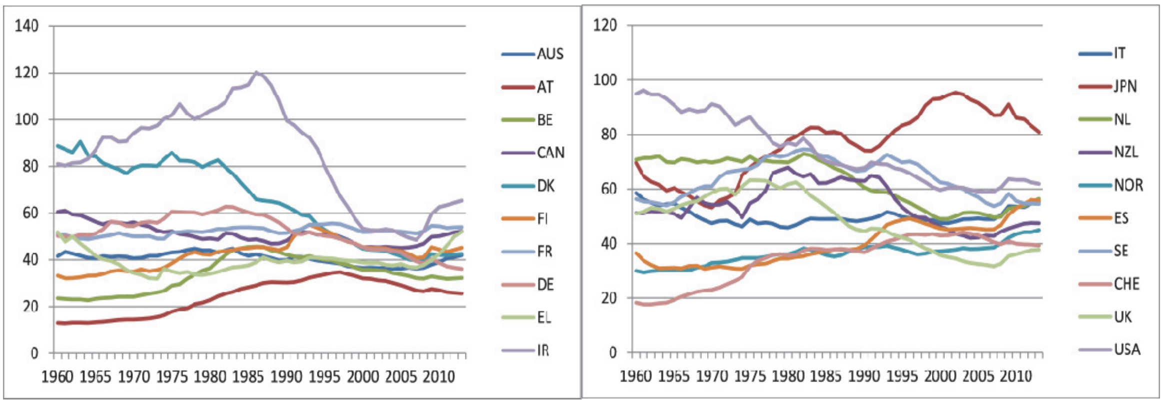
Such developments are reflecting a lower public investment rates than in the past. General government gross fixed capital formation as a percent of GDP has declined substantially over the recent period in some countries (Figure 4). The largest reductions in public investment ratios took place in countries with high initial public investment ratios, such as Japan and Ireland as well as in countries that came under market pressure (e.g., Spain, Greece, Italy).

Furthermore, a fall in public capital stock ratios can to some extent also be the result of privatisations in the eighties and nineties, as well as a matter of valuation. Capital is valued at production costs, with its value subsequently adjusted for depreciation and price increases. Its true economic value however also depends on real income developments, but these are not accounted for. Therefore, assuming positive real GDP growth and constant production costs in percent of

[4] As the ESA2010 data on government investment are available only from 1995 or later, for this purpose ESA95 data with a reference year 2005 were used. In this way we also avoid including the military equipment in the investment which are assumed not to be important for the production process.

Figure 3

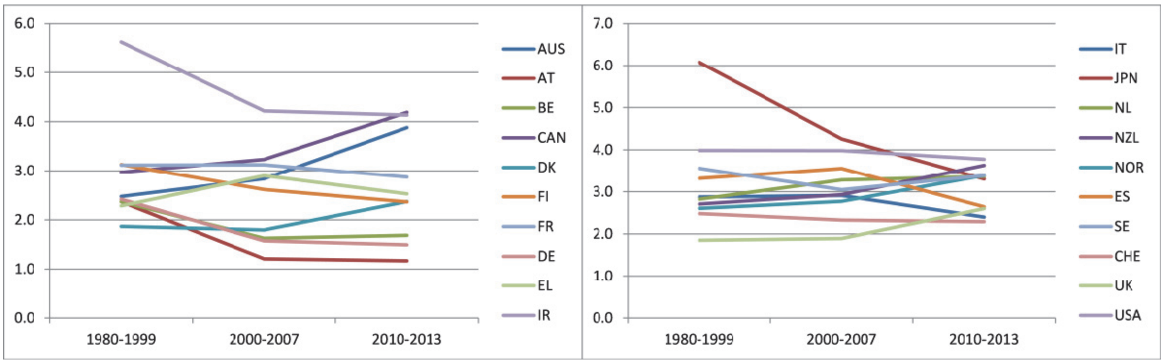
Public Capital Stock, 1960-2013
(percent of GDP, volume data)



Source: authors' calculations.

Figure 4

General Government Gross Fixed Capital Formation
(percent of GDP)



Source: OECD.

GDP, a road constructed in 1960 will be valued less today than a road constructed in 2000, even if maintenance spending actually prevented depreciation. In any case, it should be clear that these public capital stock measures are necessarily only proxies for the true public capital stock.

For an overview of the resulting public and private capital stocks, see Figures 9-15.

3.2 Statistical properties of the series:

First, we check for the order of integration of individual series. Out of many available testing procedures, we apply two of the most commonly used tests: the ADF-test and the KPSS-test. These tests have different null hypotheses. The ADF-test has a unit root as its null, while the KPSS starts from the premise of stationary series. The relevant test-statistics and outcomes are presented in Table 1.

Series for GDP and total hours worked generally turn out to be integrated of order one and we therefore maintain this as our working assumption. The same can not be said for capital stock data. Formal tests for the order of integration of capital stocks show mixed results. In many cases, the ADF and KPSS-tests point in different directions, with capital stocks supposedly integrated of either order one or of order two. In some cases, both tests point in the direction of $I(2)$. Both results, $I(1)$ and $I(2)$-ness of capital stocks, are actually found in the empirical literature (e.g., Jong-a Pin and de Haan (2008) conclude capital stocks are $I(1)$, Everaert (2003) and Kamps (2004) find evidence for $I(2)$ capital stock series).

However, from equation 1 we know that the capital stock in a year consists of two elements, namely last years' capital stock minus depreciation and the investment series. By construction, the first part has a root very close to, but surely below one. This part of the capital stock series is therefore $I(0)$. The investment series turn out to be $I(1)$ in many/all countries. In theory this means capital stocks must be $I(1)$ as well.

So, how should we interpret the $I(2)$ findings? It is well known that unit root tests (such as ADF) have low power to distinguish between unit root and near unit root processes (Enders, 1995), *i.e.*, a false null hypothesis is relatively unlikely to be rejected. The problem is furthermore aggrevated in case of small samples. As Mahadeva and Robinson (2004) state, practically speaking it is often close to impossible to differentiate difference stationary series from a highly autoregressive one. Clearly, slowly depreciating capital stocks are by nature highly autoregressive.

However, before jumping to conclusions, we investigate another potential cause of our $I(2)$ results. A look at the data in Figure 9 suggests there may be structural breaks in the capital stock series. Perron (1989) showed that failure to account for a structural break leads to a reduction in the ability to reject a false unit root null hypothesis. Therefore, we perform Zivot-Andrews and Philips-Perron testing allowing for a break in the intercept and the deterministic trend where appropriate (results not shown).[5] Still, the evidence remains inconclusive.

Since allowing for structural breaks does not change overall results and since by deduction we concluded that capital stocks must be $I(1)$, we interpret the outcomes of the unit roots tests mainly as evidence for the low power of these tests for near unit root processes. In the empirical sections below, we assume capital stocks are $I(1)$.

4 Empirical approach and results

Both the production function and the cost function approach impose quite strong restrictions on the data, by assuming a causal relationships between the variables. However, causality might well run in multiple directions. For example, next to finding that infrastructure positively affects income growth, it could be envisaged that with income the demand for adequate infrastructure rises.

VAR-models form an attractive alternative to structural models. VAR-models do not impose causal relationships between variables a priori, and allow for testing for the existence of causal relationships in whatever direction. VARs furthermore allow for indirect links between the variables in the model. In a VAR-approach, the long-run output effect of a change in public capital results from the interaction of all the variables in the model. Thirdly, VARs offer more flexibility concerning the number of long-run relationships in the model; they do not assume there is at most one such relationship as is the case in the production function approach (Kamps, 2004). For these reasons, we estimate country-specific VAR-models.

5 In both cases, we set the trimming parameter to 0.10.

4.1 Econometric approach

A k-th order VAR can be written as:

$$X_t = A_1 X_{t-1} + \ldots + A_k X_{t-k} + \theta D_t + E_t \tag{4}$$

D_t captures any deterministic elements. Since our sample size is limited, we aim to estimate parsimonious models and keep the number of deterministic elements as low as possible.

A cointegration model can be written as:

$$\Delta X_t = \Pi X_t + \Phi_1 \Delta X_{t-1} + \ldots + \Phi_k \Delta X_{t-k} + \theta D_t + E_t \tag{5}$$

Since we are mainly interested is on the long run effects of public capital, we estimate an unrestricted VAR in levels as a first step. As Sims *et al.* (1990) show, the OLS estimator for the autoregressive coefficients in such a model is consistent and asymptotically normally distributed, even in the case where some variables are integrated or cointegrated. Therefore, a VAR in levels can be used to investigate the properties of the data and construct a valid empirical model. Our aim is to estimate a model as parsimonious as possible while preserving proper diagnostics, *i.e.* with normally distributed, homoskedastic residuals which are not serially correlated. However, the consistency of estimates for the autoregressive coefficients does not carry over to impulse response functions (IRFs) obtained from unrestricted VARs in levels. IRFs are inconsistent at long horizons if non-stationary variables are included (Phillips, 1998).

As we are primarily interested in the IRFs, a second step is needed beyond estimating VARs in levels. To this end, we continue from the benchmark empirical model provided in the first step and investigate whether series are cointegrated. If there is cointegration, we revert to VECM estimation, further improving our model along the lines sketched above. If series are not cointegrated, we estimate a VAR in first differences. We thus end up with either a VECM, or a VAR in first differences for each country.

4.2 VAR models

4.2.1 Selected models

Table 1 provides an overview of the selected empirical models, as well as some diagnostic checks on these models. As at least cointegration relation among variables is confirmed for all countries, we estimate VEC-models. In principle we include a trend in the cointegration relation, as well as a constant in both the cointegration relation and the VAR.

In most models, we included some deterministic elements. We often have to allow for breaks in trends or to correct for observations in specific years (see also Figures 9-15) to account for specific events. These specific events include, for example, moving some entities from the general government to the private sector in Austria from 1998 onwards, the reunification of Germany in 1990 and the economic crisis of 2009 and later years.

The number of lags is chosen with an economic use of degrees of freedom in mind. Usually we choose the model with the lowest number of lags that is not suffering from too strong autocorrelation.

The number of cointegration relations is a priori unknown (Kamps, 2004). Economic theory suggests constancy of the great ratios. Therefore, public capital to output and private capital to output could well form cointegrating relations. Furthermore, if technology behaves as a trend-stationary process, the macro-economic production function describes another cointegrating relation. With potentially up to three cointegrating relations, which is the maximum in our

Table 1

Selected Models

Country	Sample period	Model type	# lags	# Cointegr. Rel.	Johansen model type	Deterministic terms	Test-statistics Trace	Test-statistics Max. Eigenval	Diagnostics J-Bera	Diagnostics 1st order ac
AUS	1962-2013	VECM	1	2	4	-	2	2	8.53	8.54
AT	1963-2013	VECM	2	2	4	dummy 75-13, dummy 98-13	2	3	5.00	20.78
BE	1962-2013	VECM	1	1	4	dummy 66, dummy 1972	1	1	10.24	12.33
CAN	1962-2013	VECM	2	2	3	dummy 82	2	2	7.44	25.47*
DK	1962-2013	VECM	1	1	3	dummy 90, dummy 81-13, dummy 2009-13	1	1	30.55***	8.38
FI	1964-2013	VECM	3	1	3	dummy 90-93, dummy 09, dummy 93-13	1	1	6.86	13.38
FR	1962-2013	VECM	1	2	4	dummy 73, dummy 75, dummy 84-13	2	1	4.18	19.80
DE	1963-2013	VECM	2	2	4	dummy 90-13, dummy 09-13	2	2	17.67	7.59
EL	1962-2013	VECM	1	2	4	dummy 74-13, dummy 09-13	2	2	3.69	22.79
IR	1965-2013	VECM	1	1	4	dummy 94-13, dummy 08-13	1	1	13.58*	25.93*
IT	1963-2013	VECM	2	1	4	dummy 68, dummy 69, dummy 09	1	1	4.18	20.52
JPN	1963-2013	VECM	2	1	5	dummy 91-13, dummy 09	1	1	12.84	16.12
NL	1962-2013	VECM	1	1	4	dummy 09	1	0	4.43	7.61
NZL	1963-2013	VECM	2	1	4	-	2	0	5.40	15.81
NOR	1962-2013	VECM	1	2	4	dummy 09-13	2	0	7.23	19.99
ES	1964-2013	VECM	3	2	3	dummy 09	2	2	4.97	22.36
SE	1962-2013	VECM	1	2	4	dummy 91-93, dummy 09	2	3	8.27	23.33
CHE	1962-2013	VECM	1	1	4	dummy 75	1	0	13.00	17.50
UK	1962-2013	VECM	2	1	4	dummy 73, dummy 09-13	1	1	12.81	24.55*
USA	1962-2013	VECM	1	1	3	-	1	1	14.32*	17.18

*Johansen model types refer to: 3 = model with intercept in cointegration relation and in VAR; 4 = intercept and trend in cointegration relation, intercept in VAR. Dummies with a single number are equal to 1 in the year mentioned, 0 otherwise. Dummies with two numbers added are 1 from the first year mentioned onwards, 0 before. Columns Trace' and 'Max. Eigenval.' show selected number of cointegration relations from Johansen cointegration tests, either according to the trace statistic or the maximum eigenvalue statistic. The Jarque-Bera statistic tests for normality of residuals, with as null hypothesis that residuals are multivariate normal, 8 degrees of freedom. The serial correlation LM statistic tests for first order autocorrelation, with a null of no autocorrelation. * significant at 10%, ** significant at 5%, *** significant at 1%.*

four-variable framework anyway, we need to resort to formal testing. We apply Johansens cointegration test, Table 1 shows the test results. In about half of the cases, the trace and maximum eigenvalue statistics agree on the number of contegration relations. For countries where both tests return different results, we generally follow the outcomes of the trace test as this test is more robust to nonnormality (Cheung and Lai, 1993).

The residuals of the selected models are well-behaved. Normality of residuals cannot be rejected in nearly all cases with Denmark being a notable exception. Furthermore, there is no strong evidence for first order autocorrelation or heteroskedasticity in the residuals of any model.

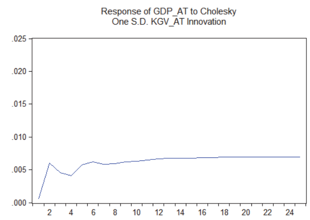
4.2.2 Results

Figures 5 and 6 plot the impulse response functions for GDP to a shock in the net real public capital stock. To orthogonalize shocks, a Cholesky decomposition of the residual covariance matrix is applied. The variables are ordered as follows: net real public capital, net real private capital, total hours worked and real GDP. This particular ordering implies that we assume that public capital contemporaneously influences other variables, but is not contemporaneously influenced by the others. Government investment is largely considered to be unrelated to current changes in the business cycle as there are considerable implementation time lags related to capital projects in the public sector. Similar reasoning holds for private capital, although we assume the private sector is

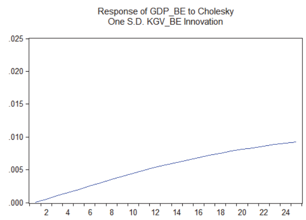
Figure 5

Impulse Responses of GDP to a one s.d. Public Capital Shock, Euro Area

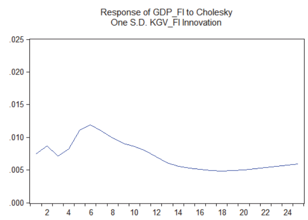
(a) Austria



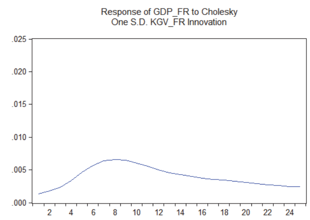
(b) Belgium



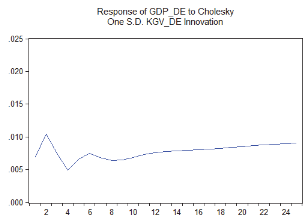
(c) Finland



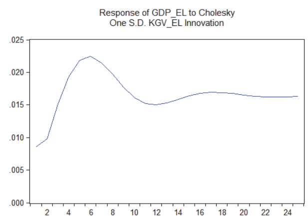
(d) France



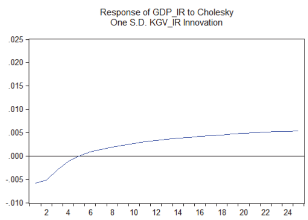
(e) Germany



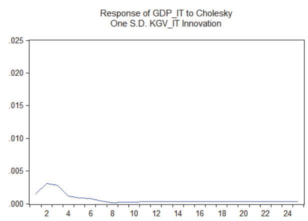
(f) Greece



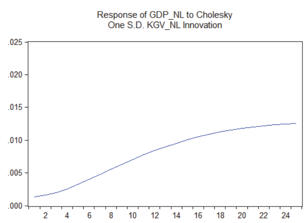
(g) Ireland



(h) Italy



(i) Netherlands



(j) Spain

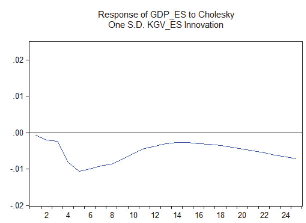
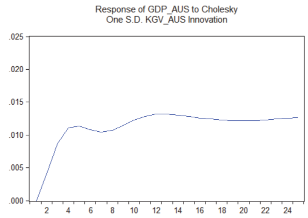


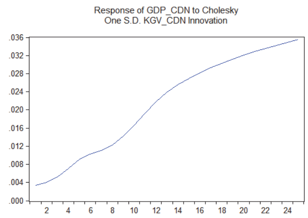
Figure 6

Impulse Responses of GDP to a one s.d. Public Capital Shock, Non-Euro Area

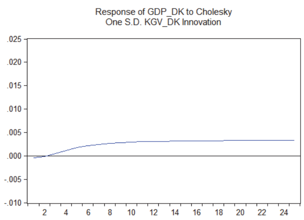
(a) Australia



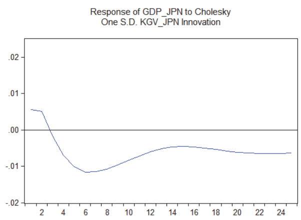
(b) Canada



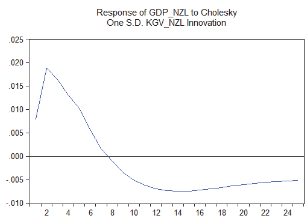
(c) Denmark



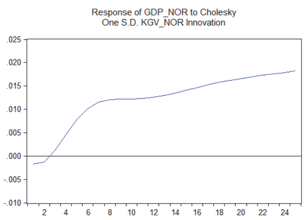
(d) Japan



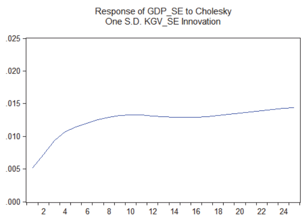
(e) New Zealand



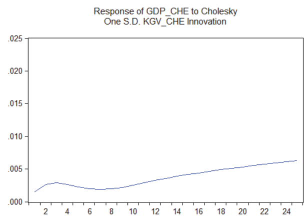
(f) Norway



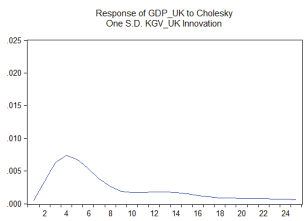
(g) Sweden



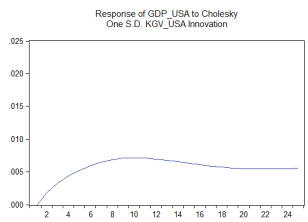
(h) Switzerland



(i) United Kingdom



(j) United States



in general able to react quicker. While labour market developments are found to be highly pro-cyclical they tend to lag output developments. Therefore, employment is ordered third, and real GDP is ordered last in our specification.[6]

Overall, similar to Kamps (2004), public capital seems to be productive for most of the countries included in the sample as the long run impact of a one standard deviation shock in public capital on GDP seems to be positive. A notable exception is Spain where, similar to Jong-a Pin and de Haan (2008), the effect is found to be negative for all periods while for Japan and New Zealand the initial positive impact is followed by negative effects. The results for Japan might be seen as expected since Japan has by far the highest level of public capital among the countries in the sample so after initial positive demand effect this additional capital has an adverse impact on output. In the case of Ireland (second largest capital stock in the sample) and Norway an initial negative effect turns positive after several periods. In general, we do find a small negative correlation between the response of GDP to the shock to public capital and the level of the public capital itself, especially in the long run.

Regarding the response of other endogenous variables included in the analysis (see Figures 13 and 14), private and public capital are found to be complements (positive response of private capital to a shock in public capital) in Austria, Belgium, Greece, Finland, France, Netherlands, Norway, New Zealand and Sweden, already in the short run. In the case of Australia, Canada and Germany complementarity holds only in the long run while in the short to medium run public capital shock has a negative effect on the private capital. As Baxter and King (1993) suggest, there are two forces determining the response of the private capital stock to a shock in public capital. First, a crowding out effect of additional government investment (that results in an increase in public capital stock) leading to a reduction in the resources available for financing private sector projects. Second, a public capital shock could increase the marginal productivity of private capital leading to an increase in private investment. One might expect the first one to dominate in the short run while in the long run the second one should dominate, albeit probably only up to a certain level of public capital stock.

The reaction of total hours worked as a measure of the labour input is in most cases negative in the long run suggesting that additional public capital wouldn't be beneficial for employment. While there are several European countries where this effect is positive even in the long run it is always very close to zero and statistically insignificant. Exceptions are Greece, and Canada and New Zealand (in the short and medium run) where the shock to public capital leads to a rather sizable increase in employment. As Kamps (2004) suggests, the reaction of labour might depend on the way the new public investment are financed (distortionary versus non-distortionary taxes). The small sample size makes it difficult to include additional variables in our models though.

The response of GDP and other variables to a public capital shock endogenously causes public capital to change over time itself. Therefore, the IRF of GDP cannot be interpreted as an estimate of the public capital multiplier. To obtain this multiplier, additional calculations are needed. The period n multiplier of public capital can be calculated as:

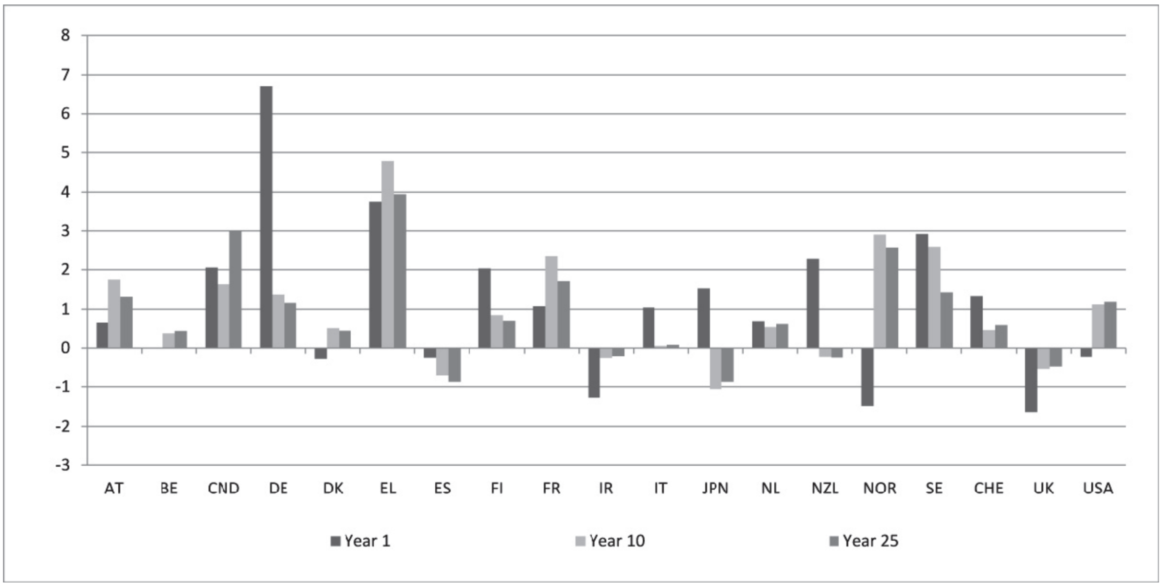
$$M_n^{KGV} = \frac{\Delta GDP}{\Delta KGV} / \frac{KGV}{GDP} \qquad (6)$$

In words, a 1 percent of GDP shock in public capital results in an M_n^{KGV} percent increase in GDP in period *n*.

6 Of course, these are quite strong assumptions. We therefore performed a robustness check with different ordering of the variables but this does not affect results much. The impulse response functions for different ordering of the variables are available on request.

Figure 7

General Government Capital Multipliers at Different Horizons



Source: Authors' calculations

Figure 7 shows the estimates of the general government capital multipliers for different time horizons.[7] The highest multiplier is found for Greece where the strong reaction of GDP to a public capital shock is supported by the complementarity of private and public capital as well as a positive reaction of total hours works to this shock. Large long-run multipliers (around 3) are also found for Canada and Norway. Surprisingly, the medium and long run the public capital multiplier is found to be negative for the UK, Ireland, Japan and Spain. For all other countries the multipliers are positive and fall in the long run (after 25 periods) roughly in the range between 0.5 and 2.

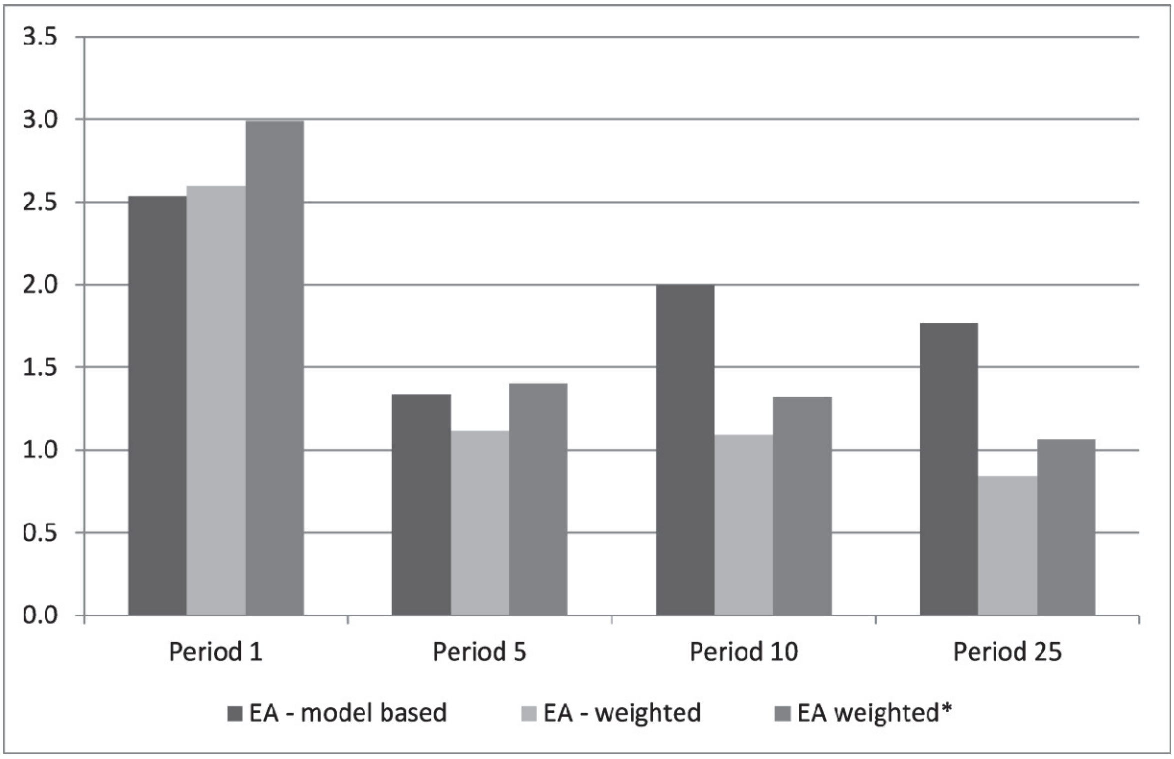
4.2.3 Spillovers

This section investigates further the issue of potential spillover effects across euro area countries included in the sample. Both theoretical and empirical literature has shown that policy actions in one country may have a significant effect on economic outcomes of other countries (Auerbach and Gorodnichenko, 2012). The literature on fiscal spillovers identifies several channels for the transmission of fiscal shocks among countries. For example, the trade channel captures the extent to which increase in public spending (including investment spending) in one country has a positive output effects in other countries either through direct purchase of foreign products by the government (usually found to be small) or/and by stimulating the domestic economy which in turn increases imports from other countries (Giuliodori and Beetsma, 2004). The latter cause is found to be more important, but depends on the size of domestic multipliers and trade linkages among countries. The interest rate channel and the exchange rate channel are also potentially relevant. However, in a monetary union a fiscal stimulus in one country should not, in theory, affect the

[7] The very high impact multiplier for Germany should be interpreted with caution as it reflects a very small reaction of public capital to its on shock and already after two periods it takes the value much closer to those found for other countries.

Figure 8

Fiscal Multipliers at Different Horizons Compared



Note: Euro area* includes only countries where a positive multiplier was found in the country model Source: Authors' calculation.

short-term interest rate at the union level. Yet, if the country engaging in expansionary fiscal policy is sufficiently large, upward pressure on area-wide inflation might appear, leading to a monetary policy tightening with adverse effects on other countries in the union (Hebous and Zimmermann, 2013). Increases in the short-term interest rate may also result in upward pressure on long-term interest rates, thereby crowding out private investment. Finally, in the context of public investment, the long-term effects on output might be larger than just the country which undertakes the investment, e.g., in the case of cross country infrastructure networks. Accordingly, studies that focus on small(er) geographical areas might not be able to capture the full pay-off of public investment.

We address the issue of spillovers among countries in our sample that share a common currency (euro area)[8] in two ways.

First, we calculate a weighted multiplier for the euro area where shares in the aggregate output are used as weights (see Figure 8). These individual country multipliers ignore spillovers to other countries. We compare this weighted multiplier to a multiplier calculated from a model estimated for the euro area leve as a whole. This euro area aggregate model should in principle incorporates positive spillovers. The impact multiplier (period 1) is similar for all estimates which is in line with the literature conclusions that direct purchases of foreign products by the domestic government are usually insignificant and their effects on foreign outputs are negligible. After three

[8] Our sample includes Austria, Belgium, Finland, France, Germany, Greece, Ireland, Italy, Netherlands and Spain. These countries account for more than 95 per cent of the overall euro area output.

Table 2

Long-run GDP Response to a Shock in Public Capital

	'60-'00	'60-'01	'60-'02	'60-'03	'60-'04	'60-'05	'60-'06	'60-'07	'60-'08	'60-'09	'60-'10	'60-'11	'60-'12	'60-'13
Austria	0.0	0.3	0.5	0.4	0.4	0.2	0.3	0.3	0.4	0.6	0.6	0.6	0.7	0.7
Belgium	0.0	0.9	0.4	1.1	0.5	0.5	0.4	0.3	0.5	1.5	1.3	1.3	1.3	1.3
Finland	-0.1	-0.3	-0.2	-0.3	-0.2	-0.1	-0.1	-0.3	0.0	0.0	0.0	0.4	0.4	0.6
France	3.0	2.8	0.6	0.3	0.4	0.4	0.6	0.5	0.4	0.3	0.4	0.3	0.3	0.3
Germany	0.9	0.9	0.9	0.9	0.9	0.9	1.2	1.2	1.1	1.1	1.6	1.3	1.3	1.1
Greece	1.4	1.6	1.6	1.7	1.8	1.8	1.8	1.7	1.6	1.6	1.6	1.6	1.7	1.6
Ireland	-1.1	-0.5	-0.2	0.1	0.6	0.7	0.8	0.8	0.8	0.8	0.8	1.0	0.8	0.6
Italy	-0.6	-0.5	-0.4	-0.3	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.2	-0.1	0.0
Netherlands	5.0	4.6	4.6	4.3	4.2	2.5	2.1	2.3	2.3	2.3	1.9	1.5	1.2	1.2
Spain	0.5	1.9	2.2	-0.6	-0.9	-1.0	-1.2	-1.2	-1.1	-1.1	-0.8	-0.9	-1.1	-1.1
Australia	2.2	1.9	1.9	1.9	2.0	2.0	2.0	1.9	1.9	2.3	2.1	2.5	1.5	1.3
Canada	3.0	4.2	4.1	4.8	4.9	4.6	4.7	4.7	4.4	4.4	3.7	3.7	5.1	5.7
Denmark	1.0	1.1	1.1	1.3	1.3	1.2	1.2	0.7	0.6	0.6	0.7	0.5	0.4	0.3
Japan	-0.7	-0.7	-0.7	-0.6	-0.5	-0.6	-0.8	-0.8	-0.8	-0.8	-0.8	-0.6	-0.6	-0.6
New Zealand	-0.2	-0.4	-0.3	-0.2	-0.2	-0.2	-0.3	-0.3	-0.3	-0.3	-0.5	-0.5	-0.6	-0.5
Norway	1.5	1.1	1.2	2.8	0.5	2.2	3.5	3.2	4.0	4.0	2.7	1.9	2.0	2.3
Sweden	3.0	2.9	2.8	2.7	2.8	2.7	2.7	2.5	2.0	2.0	2.2	2.2	2.0	1.5
Switzerland	3.2	5.4	6.5	6.2	3.8	5.1	3.2	1.9	1.8	3.5	2.0	1.0	1.6	1.1
United Kingdom	0.6	0.9	0.8	0.9	0.8	0.7	0.5	0.6	-0.3	-0.3	0.2	0.0	0.0	0.0
USA	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.4	1.2	0.8	0.9	0.8	0.7	0.6

Numbers denote the long-run (period 100) response of GDP to a Cholesky one standard deviation innovation in public capital.

years a positive differential appears which further increases in the long run. This could point to the existence of positive spillovers within the euro area. These results should however be interpreted with caution – and for more precise estimates of the size of the spillover effects more detailed modeling of trade-linkages would be necessary.

Recently, calls have emerged for Germany to increase its public spending, claiming this would have a beneficial effects also for the other countries in the euro area. Germany is the largest economy in the euro area and arguably has the fiscal space to increase spending. Therefore, we additionally re-estimate the model for Germany, but now also include GDP of one other European country at the time. This allows us to test whether a public capital shock in Germany exerts a positive effect on the output of the other country. Figure 15 gives impulse response functions. Positive effects of a shock in German public capital were found for Italy and (marginally) for Spain. Surprisingly, no significant effect was found for Germany's neighbouring countries France, Austria or Netherlands, despite significant trade linkages. These results suggest that international spill-overs from an increase in German investment spending would be rather limited.

4.3 Recursive VARs

We are interested in the development of the relationship between public capital and economic growth over time. To this end, we estimate models starting from the sample 1960-2000 up to 1960-2013, each time adding one year to the estimation period. For each subsample, we impose the country-specific model for the whole period as specified in the previous section. That is, the number of cointegration relations and the number of lags is as depicted in Table 1.

Table 3

Long-run Multiplier, Different Subsamples

	'60-'00	'60-'01	'60-'02	'60-'03	'60-'04	'60-'05	'60-'06	'60-'07	'60-'08	'60-'09	'60-'10	'60-'11	'60-'12	'60-'13
Austria	-0.2	0.5	0.6	0.5	0.6	0.4	0.4	0.5	0.7	0.9	0.9	1.0	1.2	1.2
Belgium	0.0	0.2	0.1	0.3	0.2	0.2	0.2	0.1	0.2	0.4	0.4	0.4	0.4	0.4
Finland	-1.0	-0.9	-0.4	-0.4	-0.5	-0.1	-0.1	-0.4	0.0	0.0	0.0	0.5	0.5	0.8
France	2.4	2.4	2.4	1.8	1.6	1.6	1.9	1.9	1.9	1.9	1.9	1.8	1.9	1.9
Germany	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Greece	3.8	3.5	3.6	3.6	3.3	3.1	3.7	3.6	3.3	3.3	3.3	3.3	3.7	4.0
Ireland	0.1	0.1	0.0	0.0	-0.1	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	-0.4	-0.3	-0.2
Italy	-1.0	-1.0	-0.7	-0.7	-0.8	-0.8	-0.9	-1.0	-1.0	-1.0	-0.8	-0.6	-0.2	0.1
Netherlands	0.8	0.8	0.8	0.8	0.8	0.8	0.7	0.7	0.7	0.7	0.7	0.6	0.6	0.6
Spain	0.4	1.0	1.1	-0.6	-0.9	-1.0	-1.3	-1.4	-1.2	-1.2	-0.9	-1.1	-1.4	-1.4
Australia	1.2	1.2	1.2	1.3	1.3	1.3	1.3	1.3	1.3	1.2	1.1	1.0	0.9	0.9
Canada	1.6	1.7	1.9	2.0	2.2	2.4	2.9	3.3	3.2	3.2	3.1	3.1	3.3	3.4
Denmark	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.6	0.6	0.6	0.6	0.6	0.5	0.4
Japan	-0.8	-1.2	-1.0	-0.9	-0.8	-0.9	-1.9	-2.3	-1.5	-1.5	-2.0	-0.9	-0.8	-0.8
New Zealand	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.2	-0.3	-0.3	-0.3	-0.2
Norway	0.9	0.6	0.8	1.2	0.6	1.4	1.7	1.9	2.2	2.2	2.2	2.1	2.1	2.1
Sweden	1.1	1.1	1.0	1.0	1.1	1.1	1.1	1.1	1.2	1.2	1.1	1.1	1.1	1.1
Switzerland	1.3	1.3	1.3	1.3	1.2	1.1	1.0	0.7	0.7	0.9	0.7	0.6	0.7	0.6
United Kingdom	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	-0.3	-0.3	0.1	0.0	0.0	0.0
USA	1.4	1.4	1.4	1.4	1.3	1.4	1.4	1.4	1.5	1.3	1.3	1.2	1.2	1.2

Numbers denote the long-run (period 100) public capital multiplier as defined in equation 6.

From Table 2 a rather diffuse picture emerges. The long-run GDP response (here we simply take the value from period t=100) to a one standard deviation innovation in public capital increases over time in a number of, mainly euro area, countries. To take into account the fact that public capital itself also responds to a shock in public capital, Table 3 also shows the "public capital multiplier" as defined in equation 6 above. Our conclusions do not change much. Experiences differ by country, there is no general tendency for public capital to become more, or less, productive over time.

5 Concluding remarks

The recent cuts in public investment in many advanced economies as part of the budgetary corrections following the financial crisis have raised the question if there is public underinvestment, which through its effect on the public capital stock will harm long-term growth prospects. The public capital-to-GDP ratio has been on a long-term downward trend in many countries, for which various explanations have been offered in the literature. The first relates the evolution of the public capital stock to changing economic needs, such as less importance of physical capital in more service oriented economies and saturation effects once infrastructure networks have been built. The second puts more emphasis on political considerations during consolidation episodes, with public investment considered to be among the easier to cut public expenditures.

This paper examines whether the relationship between public capital and output has changed on the basis VAR/VECM estimates of an expanded data series of public capital stocks for 20

OECD economies for the years 1960-2013. We find that public capital seems to be productive for most of the countries in our sample, but that these results are heterogeneous across countries, as in earlier studies. We also find a small negative correlation between the effect of public capital on output and the level of public output in the long run. However, we do not find that the effect is much larger than in previous studies.

We also estimate recursive VAR-models – starting from the period 1960-2000, then expanding the sample period by one year at the time – to see if the relationship between public capital and economic growth has changed in recent years. We do not find systematic evidence that this has been the case. Our results do not suggest that there is general lack of public investment or that its marginal use has increased in recent years. Of course, the need for public investment should be considered carefully on case-by-case basis, in which other consideration, such as the expected interest rates relevant for investment decisions, can play an important role.

Finally, we compare the impulse responses from a VAR for the euro area as a whole to the weighted impulse responses of VARs for individual euro area countries and include the GDP growth of other euro area countries in the VAR for Germany as a tentative way to consider the importance of investment spill-overs in Europe. The first approach yields some evidence for the relevance of spill-overs, evidence from the latter is not conclusive.

Figure 9

Log Real Net Government Capital Stocks, 1960-2013

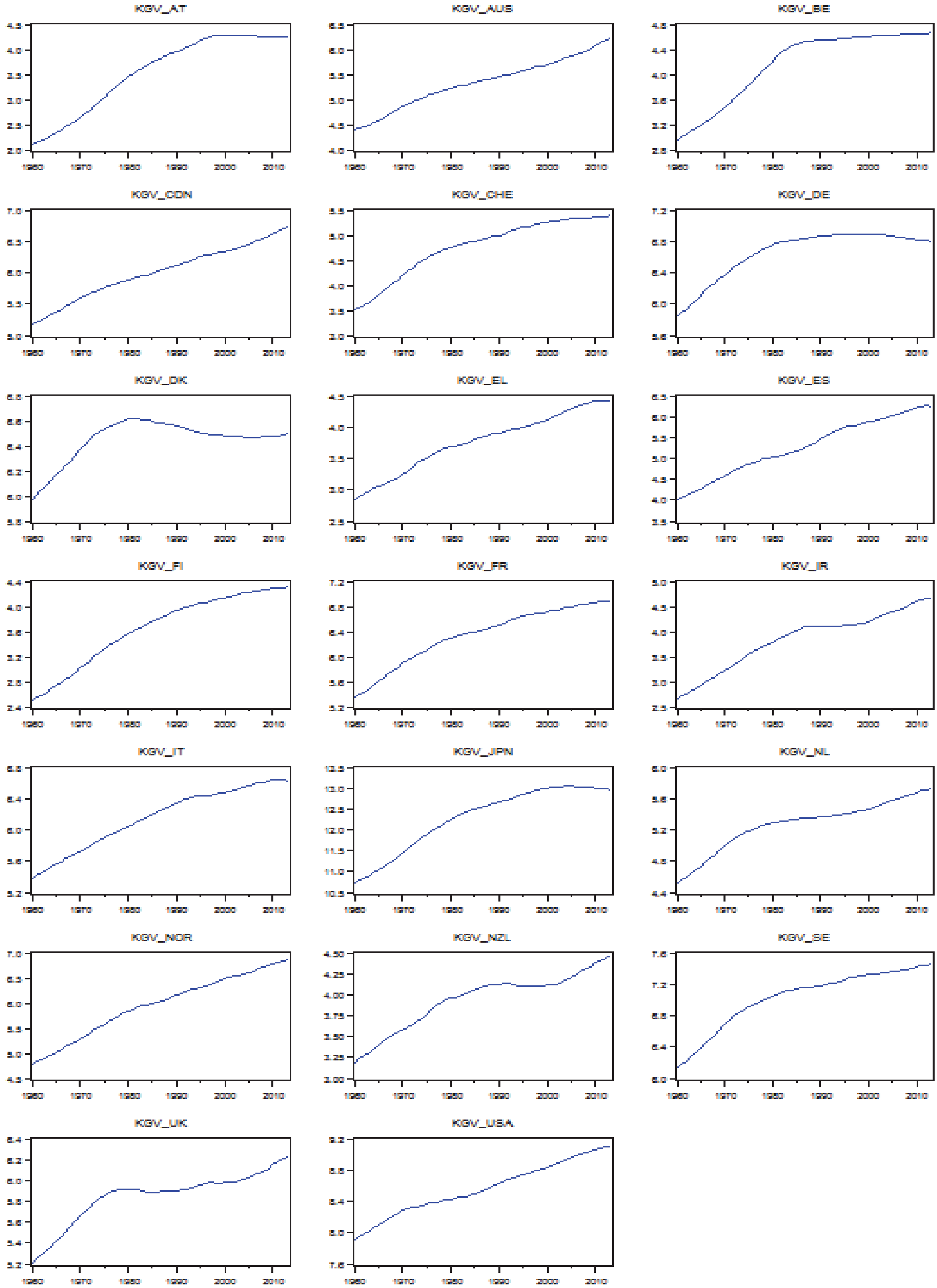


Figure 10

Log Real Net Private Sector Capital Stocks, 1960-2013

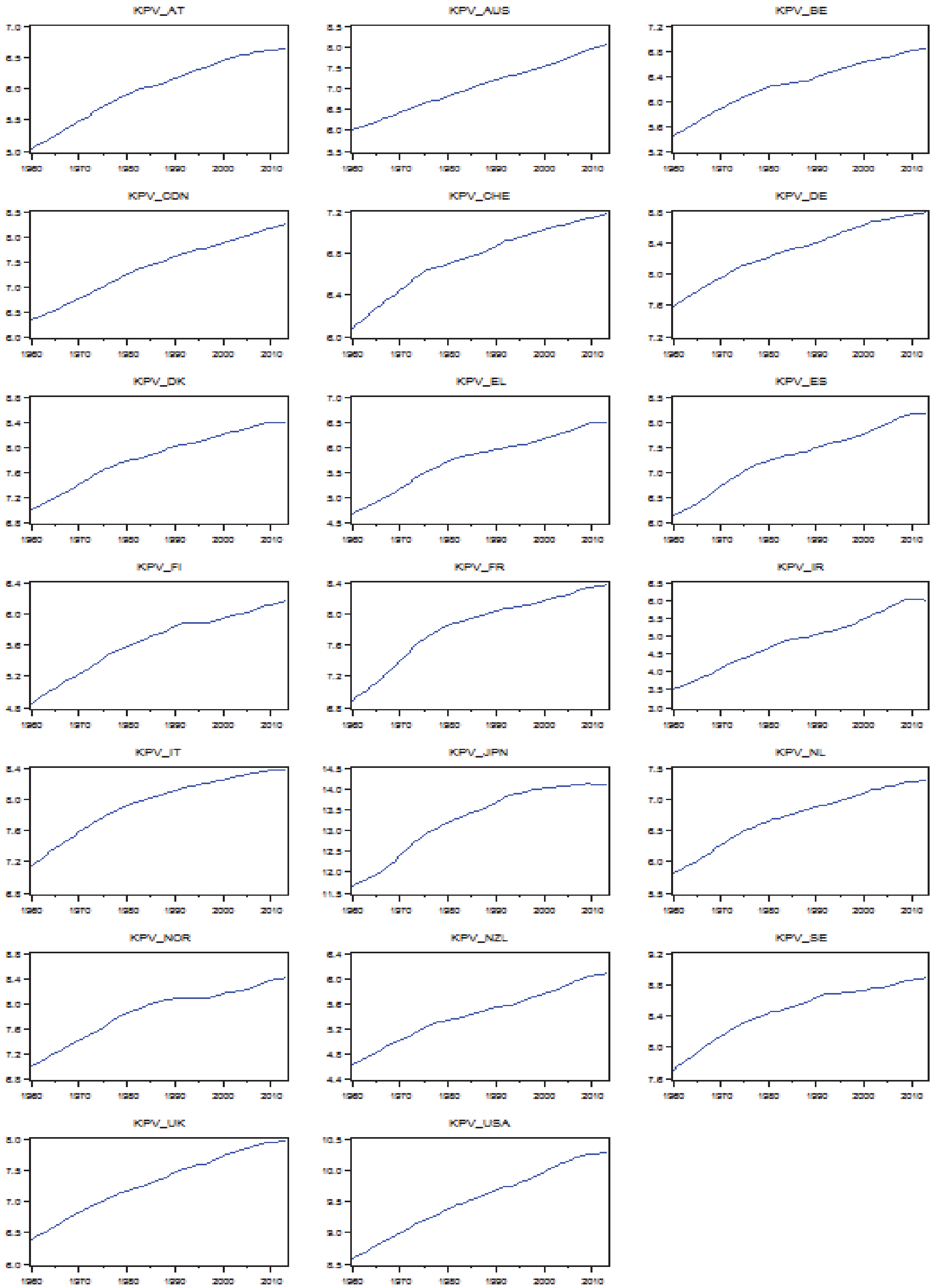


Figure 11

Log Total Hours Worked, 1960-2013

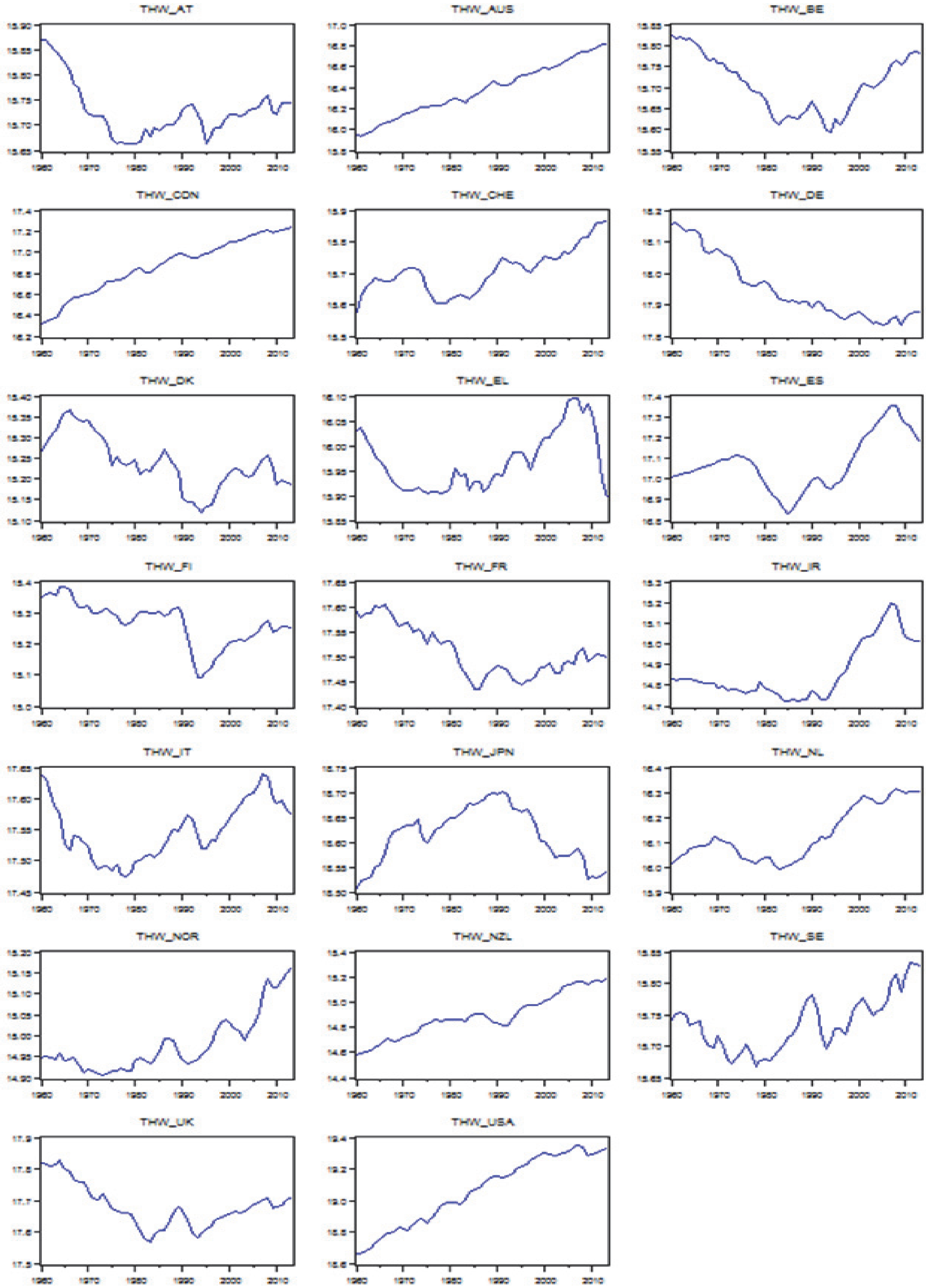


Figure 12

Log Real GDP, 1960-2013

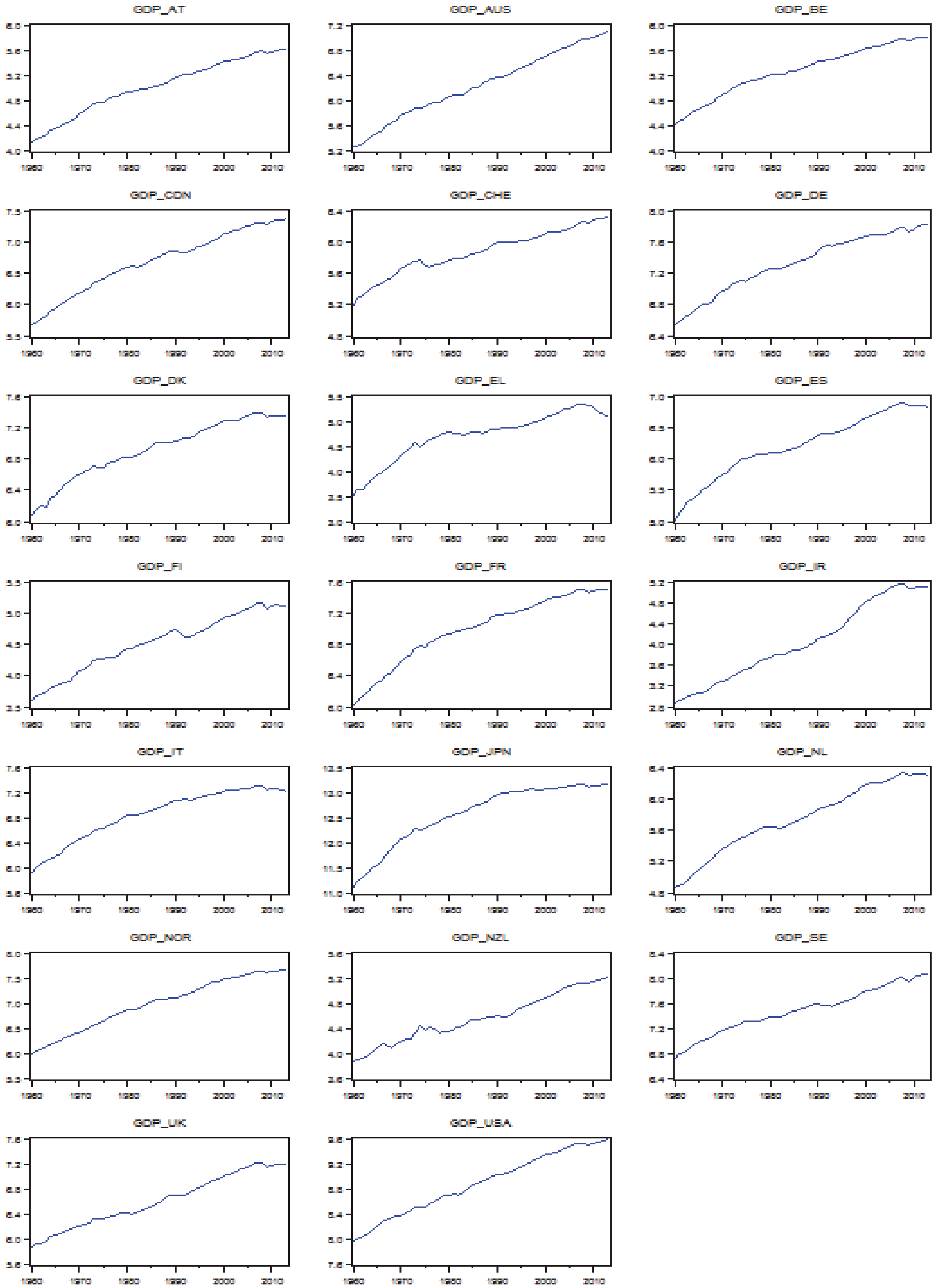
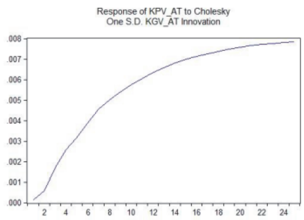


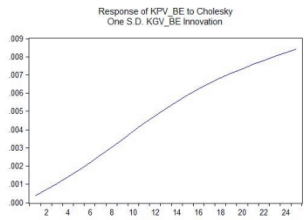
Figure 13

Impulse Responses of the Net Real Private Capital Stock to a one s.d. Public Capital Shock, Euro Area

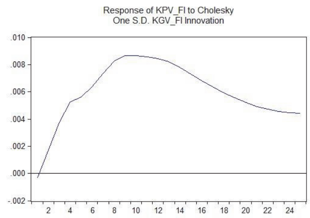
(a) Austria



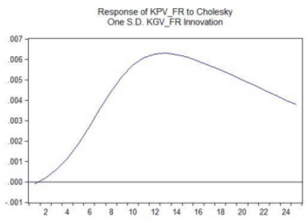
(b) Belgium



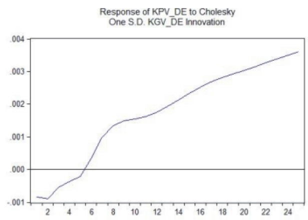
(c) Finland



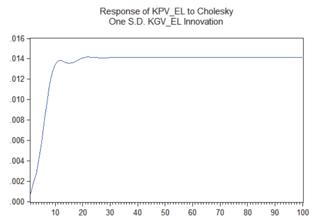
(d) France



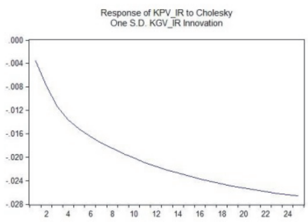
(e) Germany



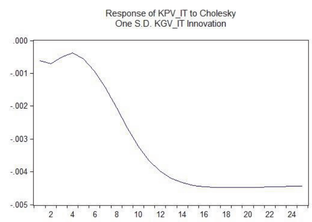
(f) Greece



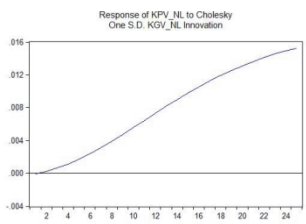
(g) Ireland



(h) Italy



(i) Netherlands



(j) Spain

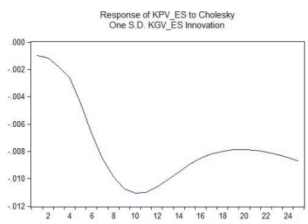
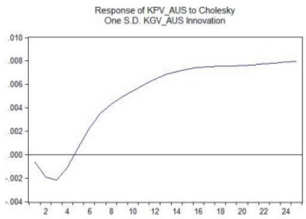


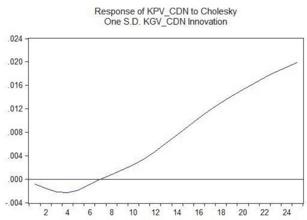
Figure 14

Impulse Responses of the Net Real Private Capital Stock to a one s.d. Public Capital Shock, Non-Euro Area

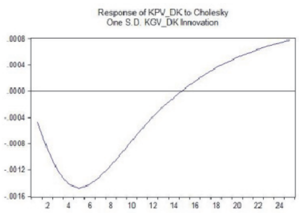
(a) Australia



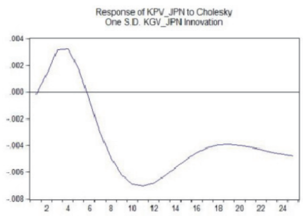
(b) Canada



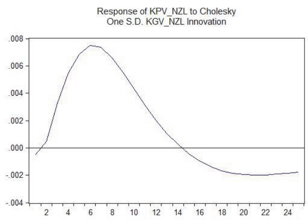
(c) Denmark



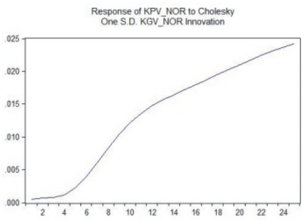
(d) Japan



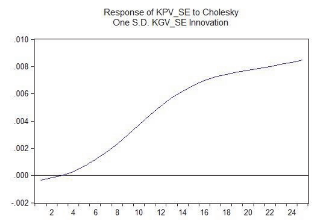
(e) New Zealand



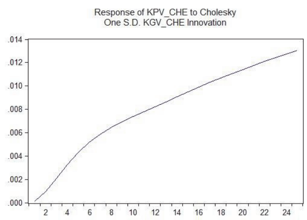
(f) Norway



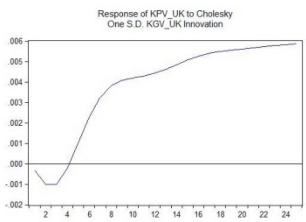
(g) Sweden



(h) Switzerland



(i) United Kingdom



(j) United States

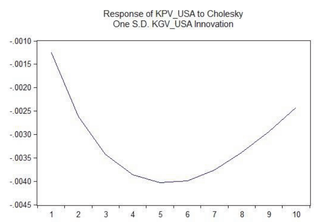
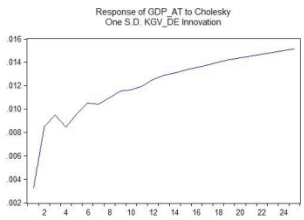


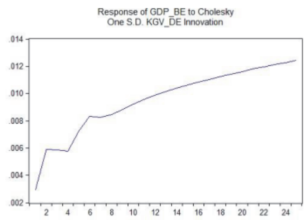
Figure 15

Impulse Responses of Real GDP to a Shock to General Government Capital Stock in Germany

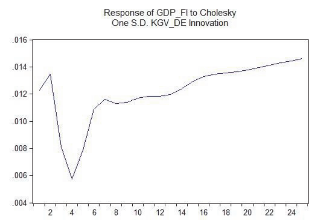
(a) Austria



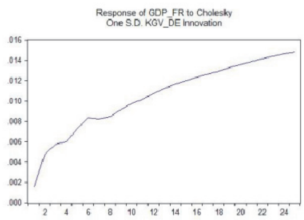
(b) Belgium



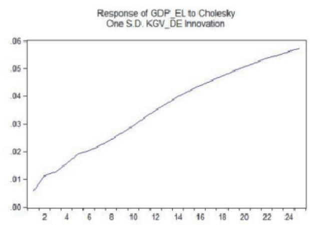
(c) Finland



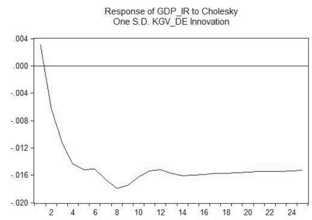
(d) France



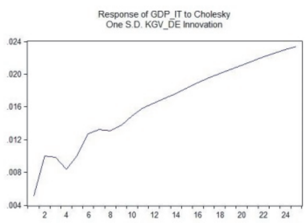
(e) Greece



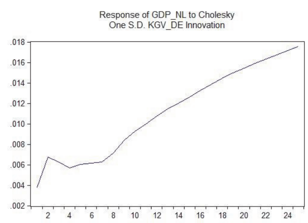
(f) Ireland



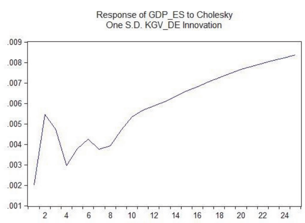
(g) Italy



(h) Netherlands



(i) Spain



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COMMENT TO
"PUBLIC CAPITAL IN THE 21TH CENTURY: AS PRODUCTIVE AS EVER?"
BY JASPER DE JONG, MARIEN FERDINANDUSSE AND JOSIP FUNDA

Luiz de Mello[*]

Introduction

The recovery of investment, both public and private, since the crisis has been particularly slow in most advanced economies. A growing empirical literature has therefore emerged to revisit earlier evidence on the links between output growth and investment, on the one hand, and between public and private investment, on the other. To contribute to this literature, Jasper de Jong, Marien Ferdinadusse and Josip Funda focus on public investment (measured in terms of general government gross fixed capital formation) and GDP growth in a set of 20 OECD countries during 1973-2013. They set out to identify changes in the growth-investment nexus over time in individual countries and computed impulse responses for the euro area countries. The paper's main finding is that impulse responses vary across countries but have not increased over time, despite falling government investment and, in some cases, public capital stocks.

The broader context of how business and public investment have recovered since the crisis in the OECD area provides a backdrop to the paper. Comparison with the pre-crisis period suggests that there is an investment shortfall in most OECD countries: current-price investment-to-GDP ratios remain considerably below pre-crisis levels, especially in those countries that were severely hit by the crisis (see chart below). The weakness in business investment has been due essentially to weak demand, higher user cost of capital, overall policy uncertainty, and high corporate leverage before the crisis. In turn, public investment has been held down by fiscal consolidation following the withdrawal of stimulus after the crisis, with a particularly sharp contraction at the subnational level, which accounts for close to two-thirds of public investment on average among OECD countries. Current investment is also estimated to be below long-term trends and steady-state levels (OECD, 2014).

The empirical analysis and other considerations

The findings reported in the paper are by and large in line with recent empirical literature, which shows mixed results but in general falling output elasticities over time. Some discussion is nevertheless warranted on the empirical analysis reported in the paper, especially on the computation of impulse response functions, which may provide directions for future work. In addition, there are more general, conceptual issues that need to be taken in to account when assessing longer-term investment trends.

A key difficulty in the empirical assessment of linkages between GDP growth and investment is the identification of exogenous shocks to investment or the capital stock, which are needed for the computation of impulse responses. Dealing with reverse causality has indeed motivated a growing empirical literature since the onset of the global crisis, including on the sign and magnitude of fiscal multipliers (see de Mello, 2014, for a review of the literature). Recent contributions to this literature include alternative identification strategies that supersede on both analytical and statistical grounds the more conventional one pursued by the authors, which is based on the ordering of the variables in an unrestricted VECM. Among these alternative options is the

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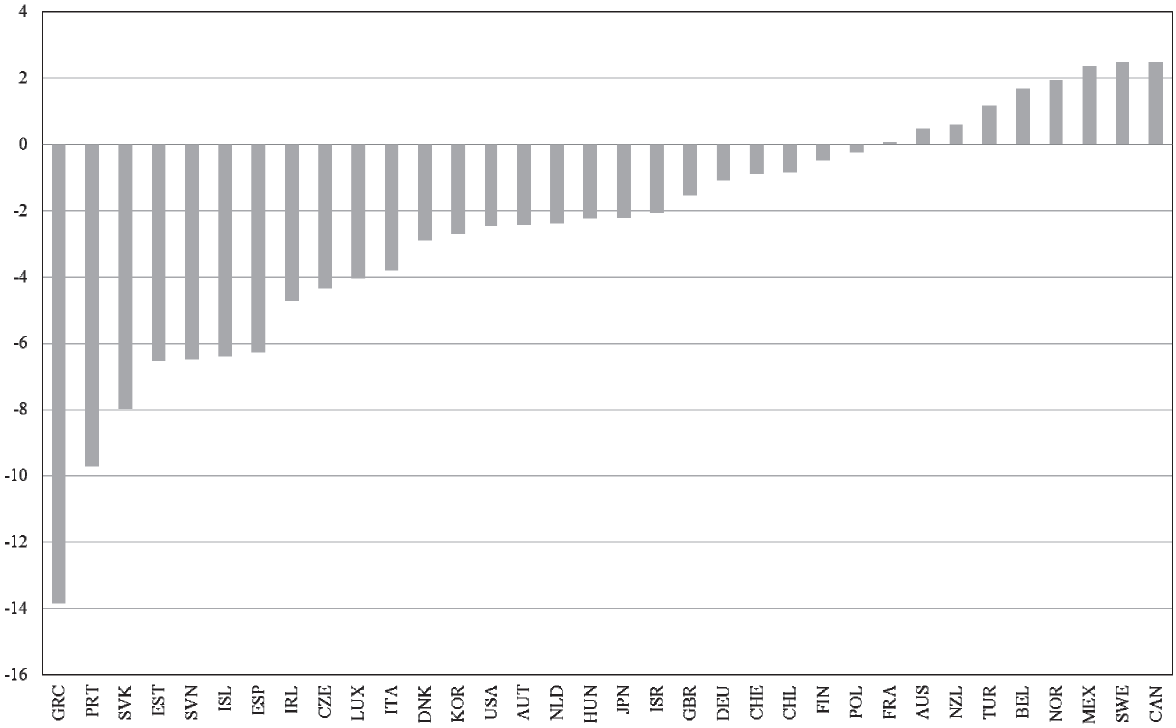
Figure 1

Investment Gap, 2015
(percent of GDP)



Note: Investment gap is defined as total investment as a percentage of GDP in 2015 minus the 1996-2007 average.
Source: OECD Economic Outlook database.

estimation of SVARs, which allow for greater refinement in the identification of exogenous shocks on the basis of hypotheses about the temporal linkages among the variable of interest. Narrative-based strategies have also been proposed more recently, building on a chronology of policy announcements that can be used as identification devices (see, for example, Blanchard and Perotti, 2002; Auerbach and Gorodnichenko, 2012; Alesina *et al*., 2012).

Indeed, the crisis and the policy responses it brought about provide interesting narrative-based identification options that the authors could use in their analysis. Policy activism in the immediate aftermath of the crisis included the announcement of stimulus packages that in some cases delivered sharp rises in public investment, often at the subnational levels of government. These announcements and the timing of implementation of stimulus measures, which are well documented for OECD countries (see OECD, 2015, for recent policy announcements), could therefore be used to identify exogenous shocks and the computation of impulse responses. Moreover, the authors could also report the confidence intervals around the impulse responses to demonstrate the strength of the responses reported in the paper and discuss in greater detail their motivation for introducing a time trend in the cointegrating vector.

More fundamentally, and going beyond empirical considerations, the investment shortfall since the crisis brings a number of questions to the fore. One is whether or not the weakness of the recovery of investment is due essentially to a lack of attractive investment opportunities. This question is related to the nature of innovation and technological change over the last decade or so, and the opportunities they create for business investment. In particular, the range of applicability of innovation (for example, steam engine versus electricity) determines the extent of adaptation required to technological change and the associated investment needs. Innovation and technological change also have a bearing on the extent of complementarity (or substitution) that exists between public and private investment, which, in turn, affects the growth elasticity of investment.

Another consideration is related to demographics and changes in the price of capital goods. In particular, population ageing could bring down the rate of return on investment and the investment rate altogether, although there could be offsetting effects on saving behaviour that would need to be taken on board. Moreover, the post-crisis investment shortfall could be related to changes in the price of capital goods: if prices fall, then the same amount of investment requires less spending in relation to GDP, which in turn affects the estimated elasticities (see IMF, 2014, for evidence for advanced economies, and Eichengren, 2014, for a more general discussion on investment trends).

All in all, while a better understanding of the empirical linkages between growth and investment remains important, there is much room for broadening the analysis in future work to include longer-term determinants of investment, including not least these related to innovation and changes in demographics and the price of capital goods.

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AN EMPIRICAL ANALYSIS OF THE LINK BETWEEN PUBLIC AND PRIVATE INVESTMENT IN FOUR OECD COUNTRIES

Jérôme Creel,[*] *Paul Hubert*[**] *and Francesco Saraceno*[***]

We investigate the relationship between public investment and investment decisions by firms. In theory, public investment may have contradictory effects on private investment, either crowding-out or crowding-in effects. We disentangle these effects in different agnostic linear models, in which we assess, for four OECD countries, the existence and the sign of relationship between public and private investment, including a VAR model in which private investment, GDP growth, and interest rates interact and are affected by public investment and debt among other determinants. We further look at the possibly time-varying sign of the relationship between public and private investment and its state-contingence. In a third stage, we assess the possible international spillovers of public investment. This allows producing evidence on the impact of public investment on the economy, both in the short and in the long run, taking into account different types of interaction. We find a crowding-in effect in France, a weak crowding-out effect in the US, and no robust effect in the UK and Germany.

1 Introduction

The persisting weakness of the Eurozone economy is challenging European policy makers and putting pressure on the single currency. The year 2014 has seen a slow but inexorable slide of the Eurozone towards deflation that prompted a new consensus on the causes of the crisis. Mario Draghi's speech at Jackson Hole, in August 2014, marks a turning point, and puts forward a new diagnosis:

- the Eurozone crisis is a crisis of insufficient demand;
- insufficient demand can be ascribed to low consumption and, more importantly, to subdued investment;
- the impact of a prolonged recession on potential growth is large and calls for bold action;
- last, but not least, fiscal policy has a role to play in supporting growth.

While the emphasis remains on structural reforms as the primary means for fostering growth, the importance of public investment is now widely recognized, as witnessed by chapter 3 of the IMF World Economic Outlook of October 2014. In fact, investment is today seen as both a Keynesian short-term stabilization tool and as a means to restore sound levels of public (and private) capital in the long run so as to boost potential output.

In spite of this new emphasis and investment agendas for the EU, stemming from the Juncker Plan and former discussions in Germany about the requirement of boosting public investment to reduce the "investment gap" (Bach *et al.*, 2013), the management of the European

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debt crisis may have had a negative impact on public investment. Balassone and Franco (2000) discuss the composition effect of fiscal austerity: in order to match the deficit and debt criteria before entering in the Euro area, governments decided to reduce public investment more than current expenditures. Likewise Mehrotra and Välilä (2006), while arguing that the Euro *per se* is not a determinant to the downward trend in public investment of pre-enlargement member states, show that either fiscal sustainability concerns or budgetary consolidation are significant determinants of public investment.

In this paper we shed light on the impact of public investment on growth, by investigating its impact on investment decisions by firms. In theory, public investment may have contradictory effects on private investment. On one side, it may compete with private funds for limited resources, thus crowding out private investment. This is an effect that we expect to be strong in normal times, when the economy is at (or close to) potential, but also in the short-run when financing opportunities are scarce. On the other, it may crowd-in investment. This may happen in the short run, because through Keynesian business cycle stabilization it improves the state of the economy and therefore expectations; but it can also happen in the long run, if public and private capitals are complementary in the production function, so that private investment productivity is enhanced by appropriate stocks of public capital.

In a first stage, we disentangle these effects in different agnostic linear models, in which we assess, for four OECD countries, the existence and the sign of the relationship between public and private investment. We include public and private investment in a more general model, namely a small structural VAR model in which private investment, GDP growth, and interest rates interact and are affected by public investment among other things. This allows us to gather evidence on the impact of public investment on the economy, both in the short and in the long run, taking into account debt sustainability and interaction with monetary policy. In a second stage, we look at the possibly time-varying sign of the relationship between public and private investment and its state-contingence. In a third stage, we assess the possible international spillovers of public investment. The four countries we model are France, Germany, the United Kingdom (UK) and the United States (US). They testify for the possible specific situation of Eurozone countries (France, Germany), compared with a non-Eurozone though EU country (the UK) and with a non-European country (the US).

Our analysis is subject to a number of pitfalls and biases that need to be kept in mind to assess the potential, but also the limits of the exercise. First, the relationship between public and private investment may not be constant over time, and its sign may change from period to period. This lack of stability may be explained by a number of factors, for example the business cycle, the state of public finances, and so on. To counter this limit, we estimate a time-varying correlation index, and try to isolate its determinants. Second, the relationship between public and private investment, and their determinants, may be non-linear. One could easily imagine, for example, that the positive spillovers linked to infrastructure spending have a peak beyond which their impact on private productivity is declining and may even become negative. Other problems may arise from the different time horizons of public and private investment projects that impose a consideration of leads and lags, and from the difficulty of establishing causation. In the following pages we will try to tackle these issues, but the reader should bear in mind that our proposed solutions will only partially address them.

The one limit that this paper will not deal with is the obstacle that all research dealing with public investment faces, namely that not all investment was created equal. The exact same spending, in different periods or in different countries, may have a very different macroeconomic impact. Even more problematic is the necessarily narrow definition of public investment, that includes items whose productivity may be dubious, while some forms of current expenditure (for example in education or in health care) have an impact on the potential growth rate of the economy.

Our macroeconomic data do not allow developing this subject, of paramount importance, that would require microeconomic data and case studies. In this respect, reported results may underestimate the actual impact of public investment.

The rest of the paper is organized as follows. Section 2 briefly reviews the literature about the relationships between public capital (or investment) and GDP (or economic growth). Section 3 sketches the model of complementarity between public and private investment. Section 4 presents the data. Section 5 reports statistical insights in the relationship between public and private investment. These insights are incorporated in a more general VAR model, and in an analysis of dynamic conditional correlations, including the investigation of their determinants. Section 5 also investigates the impact of public investment on private investment in a single-regression model. Section 6 concludes.

2 Public capital (or investment) and growth: A brief survey of the literature

The starting point of the empirical literature devoted to the relationship between fiscal policy and economic growth is Ratner (1983) who finds that US output elasticity with respect to public capital is positive but smaller than private capital (close to 6%, whereas the output elasticity with respect to private capital was 22%).[1] The literature on the effects of public capital on output and growth then accelerated after a series of contributions by Aschauer (1989a, b, c). Aschauer (1989a) finds a large elasticity of total factor productivity to public capital (around 0.4) and Aschauer (1989b) shows that public investment crowds out private investment, but that this effect is counterbalanced by the positive impact of public capital on the return to private capital. Whereas his two former empirical contributions focus on US data, Aschauer (1989c) extends his analysis to G7 countries and highlights the positive impact of public investment on labor productivity. Since then, many surveys have been dedicated to the impact of public capital and/or investment on economic growth or productivity.

The most recent survey, albeit limited mostly to infrastructure spending, is provided by Pereira and Andraz (2013). Broadly speaking, the literature on public capital and growth can be divided into four main categories: first, papers based on the production function approach, which treat public capital as an input of the aggregate production function, and estimate its effects on output, as in Ratner and Aschauer. Second, papers based on the cost function approach, that are admittedly less demanding than the previous ones regarding the restrictions (for example on the degree of substitutability among factors) that they impose. Third, papers based on cross section growth regressions à la Barro (1991), which include public capital among other explanatory variables. The fourth is the group of contributions that use VAR (or VECM) models including public capital; the advantage of this latter approach is that, by explicitly taking into account the dynamic links among variables, it allows to disentangle possible reverse causation (i.e. from output to capital/investment) and to differentiate the short run and long run relationships between public investment and GDP or public investment and private investment.

Romp and de Haan (2007) survey the literature on public capital and growth, explaining in detail each of the methodologies enumerated above, and reach a number of general conclusions. First, the majority of works surveyed, especially the most recent ones, conclude for a positive effect of public capital (or investment) on growth or on output. These effects are nevertheless considerably smaller than originally suggested by Aschauer. Such a positive but mild effect also emerges from the meta-analysis carried out by Bom and Lightart (2014) on a sample of 68 papers

[1] Drawing on a meta-analysis performed 20 years after Ratner's seminal contribution, Nijkamp and Poot (2004) broadly confirm his findings that the evidence of an impact of fiscal policy on economic growth is weak. Not surprisingly, they find nevertheless that composition matters: education and infrastructure have a stronger impact.

published between 1983 and 2008. Second, a number of papers (e.g., Batina, 1998) suggest that reverse causation, from output to capital, is also significant and positive. Finally, and quite unsurprisingly, Romp and de Haan notice that the effects of public capital on growth differ across countries, regions and sectors.[2]

While the first two methodologies naturally limit the effect of public capital to the impact on the private sector production or cost functions, both growth regressions and VAR models do not have this limitation, and can capture macroeconomic effects of public expenditure beyond those linked to the production side of the economy. The multivariate VAR approach is certainly the most relevant in this respect and for the scope of the present paper. Furthermore, as Pereira and Andraz (2013) notice, it is less subject than the production function approach to reverse causation issues.

Among the papers using a VAR approach, Pereira (2000) estimates an annual model in first differences for the US. He identifies the model assuming a Cholesky decomposition identification where innovations in public investment lead the other variables. He then finds permanent (long run) output level effects of a temporary increase in the growth rate of public investment or, which amounts to the same, a permanent increase in the level of investment. Afonso and St Aubyn (2009) estimate VARs for 17 developed countries and show that crowding-in effects go in both directions, from public to private investment and the other way round. The former effect varies across countries whereas the latter is more homogeneous across countries.

A regular feature of papers using the VAR approach is the use of yearly data. However, a few contributions have made use of quarterly data. Voss (2002) studies the impact of public investment on private investment in the US and Canada, and (weakly) concludes for crowding out effect. Otto and Voss (1996) estimate a model in hours worked, GDP, public capital and private capital for the US and Canada. They find weak evidence of a positive cointegration between private and public capital. They find a positive lagged effect on private capital (crowding in), but no significant effect on output. Mittnik and Neumann (2001) estimate a quarterly VAR model in levels with long run cointegration restrictions (their results are not significantly different when they do not impose restrictions). Their model, estimated for six OECD countries, includes private investment and current government spending, and generally finds long run, positive (but weak) effects of public investment on growth and on private investment (only for West Germany, does the long run effect seem to be significant). The UK is the only country for which the effect is not significant even in the short run. Perotti (2004) estimates a structural VAR in levels for 5 countries (Australia, Canada, West Germany, the UK, and the US). His model contains 6 variables: government current and investment spending, GDP, net taxes, interest rate and inflation. He uses institutional features to set some cross-instantaneous-elasticities at zero and estimates some others. The conclusions of Perotti are not only that investment seems to have limited effects on GDP; but also that these effects are smaller than those of current spending. A possible explanation that Perotti offers for these puzzling findings is that the level of public capital is so large in the countries considered, that public investment is not productive enough. The crowding out of private investment hence more than compensates the direct effect on aggregate demand.

[2] We do not discuss papers dealing exclusively with developing countries. Kahn and Kumar (1997) showed that that the impact of public investment on economic growth was positive but smaller than the impact of private capital. Ghali (1998) applies a vector error-correction model to Tunisia and reports crowding-out effects and a negative long-run impact of public investment on economic growth. Haque and Kneller (2015) argue that the ineffectiveness of public investment in raising economic growth can be related to the quality of institutions. Cavallo and Daude (2011) include another determinant: the lack of openness to international trade and financial flows.

3 A conceptual framework

The recent reference for work on the complementarity of public and private investment is Leeper *et al.*, 2010, who present a standard DSGE model incorporating several real frictions. The most notable for our purpose is investment adjustment costs that introduce slow response of capital accumulation to policy shocks.

The firms' production function embeds the aggregate public capital stock K_{t-1}^G:

$$y_t = u_t^a (v_t k_{t-1})^{\alpha} l_t^{1-\alpha} \left(K_{t-1}^G\right)^{\alpha^G}$$

α^G is the elasticity of output with respect to public capital. Leeper *et al.* assume that the production function exhibits increasing returns with respect to public capital. u_t^a is total factor productivity, v_t denotes the utilization rate, k_{t-1} and l_t are private capital and labour respectively. The law of motion of capital is:

$$k_t = [1 - \delta(v_t)]k_{t-1} + [1 - s]i_t$$

where depreciation δ depends on the rate of capacity utilization v_t and investment i_t is subject to an investment shock. Public capital evolves following a standard law of motion:

$$K_{t-1}^G = (1 - \delta_G)K_{t-2}^G + A_{t-N}$$

where A denotes the sum of actual spending in period t-1, for the investment decisions taken for each year since t-N. In other words, this formulation includes a time to build of public capital, whose value can be calibrated. Public capital enters the production function as a "productivity enhancer", analytically equivalent to a technology shock.[3] Public investment, and the corresponding accumulation of public capital, therefore makes expected returns of private capital and hence its level increase. This crowding-in effect may be compensated by the financing of public investment, through taxes and/ or debt, that competes with private capital for available savings and hence crowds it out.

Our purpose is to investigate these hypotheses in some detail. We will first take an agnostic approach regarding causation, and focus on correlation. Then, we will try to assess the link more in depth, developing a VAR model, and regressing private investment against public investment and standard macroeconomic variables, including some non-linearities.

4 Data

We carry on our empirical exercise for 4 countries, the US, France, Germany, and the United Kingdom. We build our dataset mostly from the OECD Economic Outlook. We use quarterly data from 1966Q1 to 2014Q4 (for obvious reasons, the starting date for Germany is 1991Q1). Our proxy for the cost of capital is borrowing rates, provided by Oxford Economics. A complete list of variables and their sources and names is available in Table 1, while Table 2 provides descriptive statistics for investment variables. The country with highest private (resp. public) investment growth over the sample is the US (resp. the UK). The average growth rate of private investment across the four countries is close to 3%, hence almost twice the average growth rate of public investment. The highest variance in the growth rates of public and private investment is found in the UK.

[3] The analogy is not complete. A technology shock is permanent while a public investment shock, however persistent, is temporary because of depreciation. With standard depreciation rates (between 5% and 10%) the rate of decay of capital is nevertheless slow enough to make the difference little more than a theoretical curiosum.

Table 1

Variables Description

Name	Description	Source	Notes
invg	Government gross fixed capital formation	OECD	y/y variation
invpnr	Private non-residential gross fixed capital formation	OECD	y/y variation
debt	Public debt	OECD	%of GDP
gov_bal	Public net lending	OECD	%of GDP
rateg	10y gov. bond interest rates	OECD	%
ratep	Corporate borrowing costs	Oxford Economics	%
cpi	CPI	OECD	y/y variation
gdp	GDP	OECD	y/y variation

Table 2

Descriptive Statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
us_invpnr	196	4.49	7.13	-17.75	20.62
us_invg	196	1.94	5.95	-13.36	18.88
uk_invpnr	192	2.83	7.94	-20.55	23.72
uk_invg	196	3.49	20.39	-42.72	79.96
f_invpnr	196	3.09	5.61	-15.50	26.28
f_invg	196	1.55	5.19	-12.36	15.85
g_invpnr	92	1.32	6.59	-19.08	13.28
g_invg	92	-0.44	7.86	-17.55	28.65

Following national accounting standards, the OECD defines Gross fixed capital formation as "the acquisition (including purchases of new or second-hand assets) and creation of assets by producers for their own use, minus disposals of produced fixed assets. The relevant assets relate to products that are intended for use in the production of other goods and services for a period of more than a year". We made no correction to the data except for treating an abnormal peak in investment for the UK in 2005Q2 due to the reclassification of British Nuclear Fuels (BNFL).[4]

[4] For more information, see Section 3 of the background notes of the Business Investment Statistical Release at http://www.ons.gov.uk/ons/rel/bus-invest/business-investment/index.html.

Table 3

Granger Causality Test

Country	***H0***	χ^2	**Prob >** χ^2
Germany	g_invpnr does not cause g_invg	0.673	0.714
	g_invg does not cause g_invpnr	0.279	0.869
France	f_invpnr does not cause f_invg	16.42	0.000
	f_invg does not cause f_invpnr	6.361	0.042
UK	UK_invpnr does not cause UK_invg	8.522	0.014
	UK_invg does not cause UK_invpnr	4.404	0.111
US	US_invpnr does not cause US_invg	0.888	0.641
	US_invg does not cause US_invpnr	1.677	0.432

The output gap stands as a crucial variable, because it can be used as a proxy for the capacity utilization rate. In order to have comparable and above all sufficiently long time series, we chose to compute the output gap as an HP filtered GDP series. Existing data on the output gap, including from the OECD, do not extend sufficiently back in time.

5 A Multi-Dimensional Analysis of the Link between Public and Private Investment

In this section we focus on public and private gross capital formation, trying to ascertain whether for the countries we study, a pattern of correlation appears. We do not focus on causality (except in the broad temporal sense represented by Granger causality or in terms of exogenous shocks obtained from a Cholesky decomposition). Figure 1 shows the time series we use for our analysis. All variables are expressed in year-on-year percentage changes. This means that our focus is not on investment levels, but on the correlation between changes in the investment behavior of the public and of the private sector.

5.1 Correlation

Our first exercise is to analyse contemporaneous correlation between public and private investment. Figure 2 reports simple correlations between private and public investment for the four countries considered, together with a linear fit and confidence intervals. The figure shows that correlation is not significantly different from zero for Germany, the UK and the US, while it is slightly positive (the slope coefficient is 0.27) and statistically significant for France.[5]

In order to add a time dimension, we made Granger causality tests for the four countries. Results are reported in Table 3. It is well known that Granger causality has very low power because it neglects the impact of expectations, and suffers by construction of an omitted variables bias. It constitutes nevertheless, especially if it yields conclusive results, a useful first glance at the temporal relationship between the variables.

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[5] Plotting the correlograms one can observe that for France and the US public investment leads private investment (in both cases the peak is at seven quarters), while it lags private investment in Germany (the peak being at eleven quarters). No relationship emerges for the UK. The figures are available upon request.

Figure 1

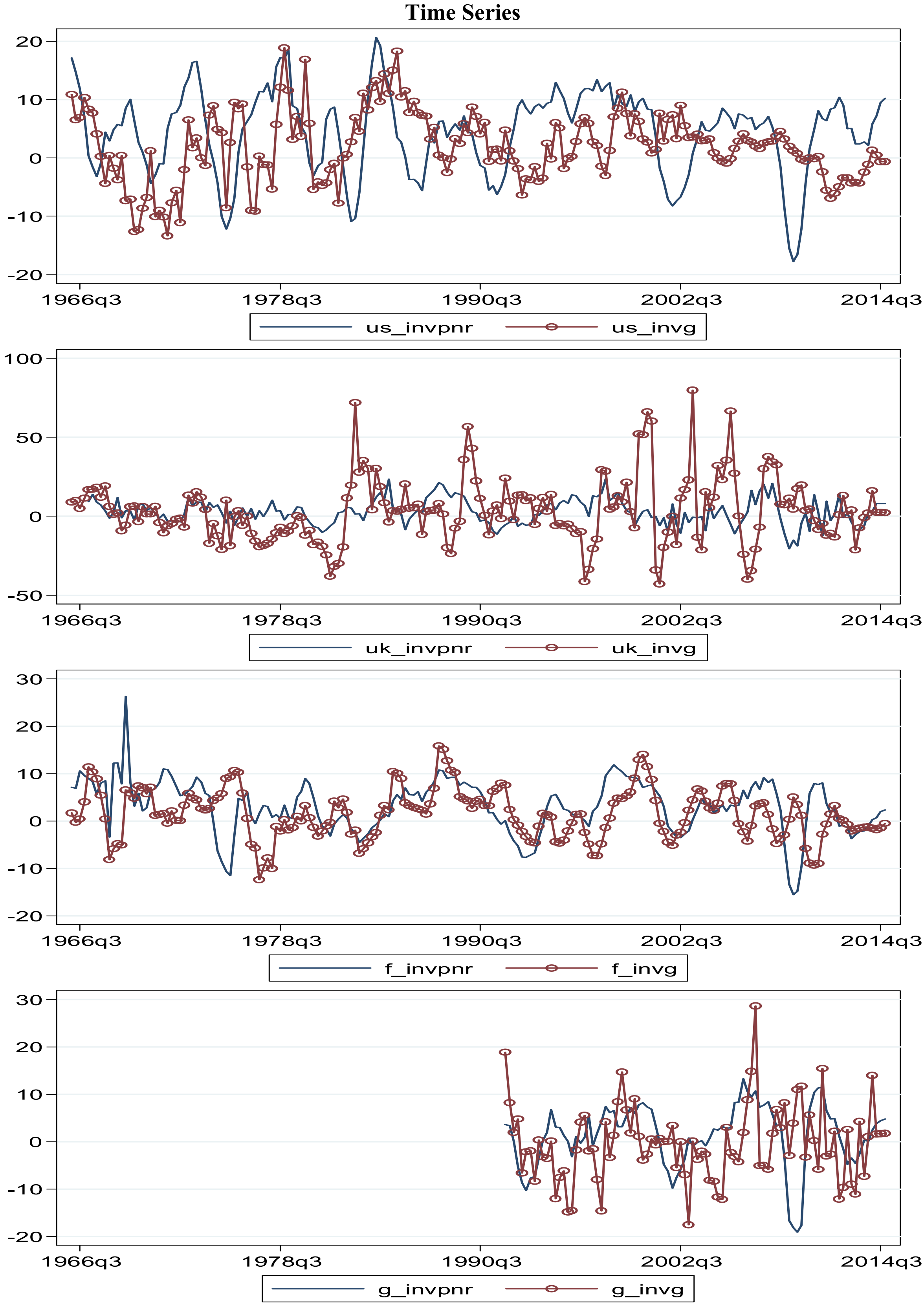
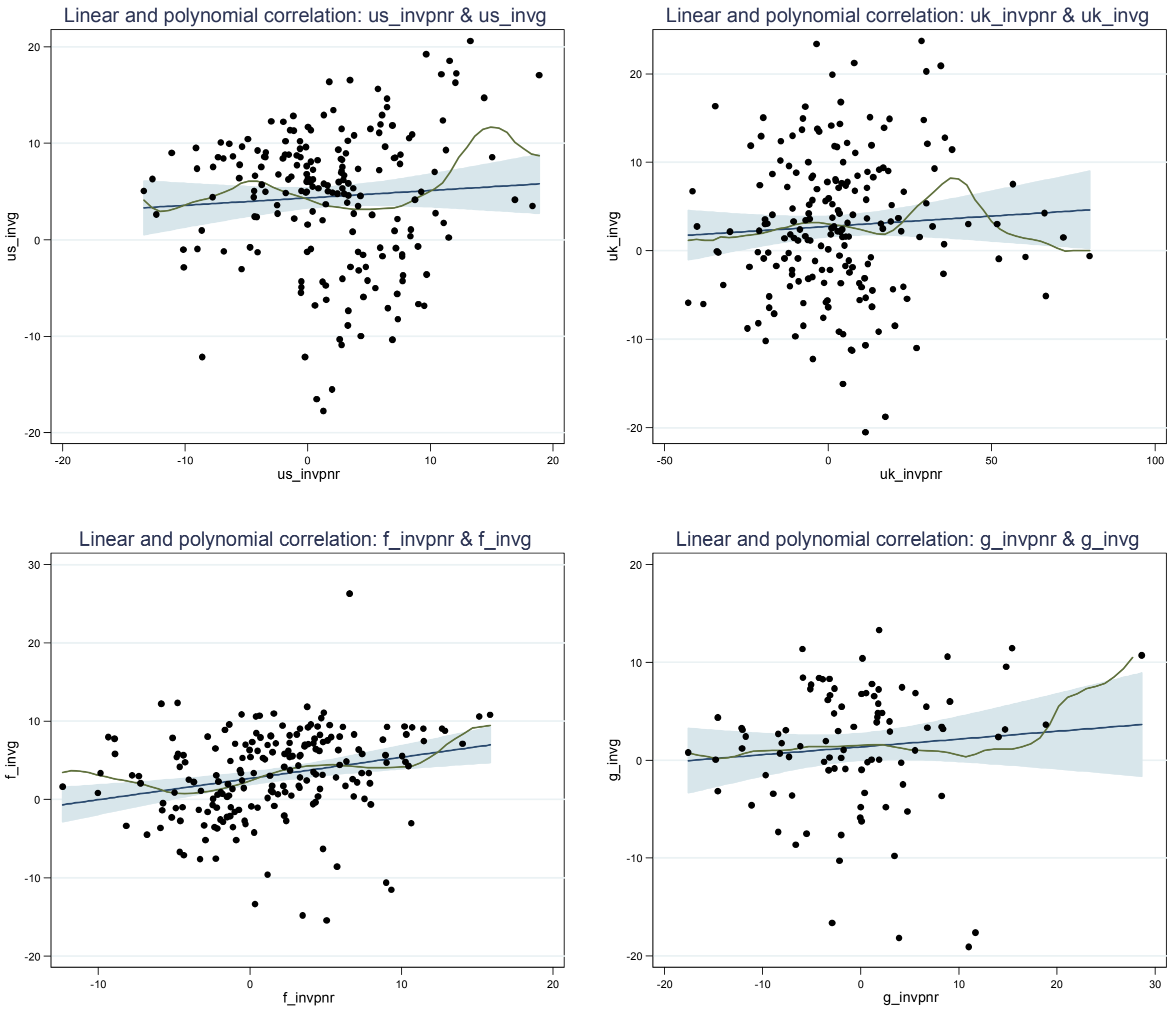

Time Series
20
10
0
-10
-20
1966q3
1978q3
1990q3
2002q3
2014q3
us_invpnr
us_invg
100
50
0
-50
1966q3
1978q3
1990q3
2002q3
2014q3
uk_invpnr
uk_invg
30
20
10
0
-10
-20
1966q3
1978q3
1990q3
2002q3
2014q3
f_invpnr
f_invg
30
20
10
0
-10
-20
1966q3
1978q3
1990q3
2002q3
2014q3
g_invpnr
g_invg

Figure 2

Simple Correlations



In our case the test is not conclusive, and we do not observe strong Granger causality. This is coherent with the previous results, as for France there seems to be evidence of Granger causation in both directions, while for the other countries nothing appears (with the exception of the UK where private investment Granger causes public investment).

The overall picture that emerges from correlation and Granger-test analyses does not show a clear link between contemporaneous private and public investment in the countries considered. The exception seems to be France, where the two magnitudes seem to have a positive relationship.

5.2 VAR analysis

We continue our investigation by means of a VAR analysis including a large set of macroeconomic variables which proxy the macroeconomic environment and include key macro determinants of investment: outlets (output gap), prices (CPI) and the costs of capital (sovereign interest rates and borrowing rates). While remaining to a large extent agnostic from a theoretical point of view, the VAR model allows highlighting causal relationships, if any, and their dynamics over time. For each country, we start with a eight-variable model including the output gap, inflation, public debt, government budget balance, borrowing costs for public and private sector respectively, and both public and private investment.

$$X_t = [og\ \ cpi\ \ debt\ \ gov\_bal\ \ rateg\ \ ratep\ \ invg\ \ invpnr]$$

We estimate the model with 4 lags, and we impose a standard Cholesky decomposition to identify exogenous shocks. We take a very conservative stance by putting the two variables of interest last in the X_t vector, so that these structural shocks are cleaned from the contribution of all other shocks. In other words, the IRF computed with the ordering we chose can be seen as the lowest bound of the estimation, and different orderings tend to give larger results in absolute terms (results are available upon request). All the eigenvalues lie inside the unit circle, so our VAR model satisfies the stability condition.

The results of this exploration are reported in Figure 4. For the US, the UK and Germany, the VAR delivers evidence of a negative impact of public investment on private investment. On the contrary, private investment shocks have a positive impact on public investment, except in the UK where the effect is very short-lived.

France stands out once more, as the impulse response functions are significantly positive for both investments: A shock to public investment has a positive impact on private investment, and vice-versa. This seems to point out to some positive feedback (a crowding-in effect) for France, as opposed to a crowding out effect for the three other countries.

Changing the order of public and private investment in the Cholesky decomposition does not change the impulse response to public investment (it has a positive impact on private investment for France, and a negative one for the other countries). The positive impact of private investment on public investment is not robust to a change in the ordering of the Cholesky decomposition, and as such it can be considered non robust.

The VAR estimation therefore delivers two messages: the first is that causation runs from public to private investment (the opposite link is not robust to changes in the ordering); the second is that crowding-out dominates for three countries (Germany, the UK, the US), while crowding-in dominates in France. On average for Germany, the UK and the US, the crowding-out lasts one year, whereas the crowding-in effect works one year and a half in France.

5.3 Dynamic conditional correlations

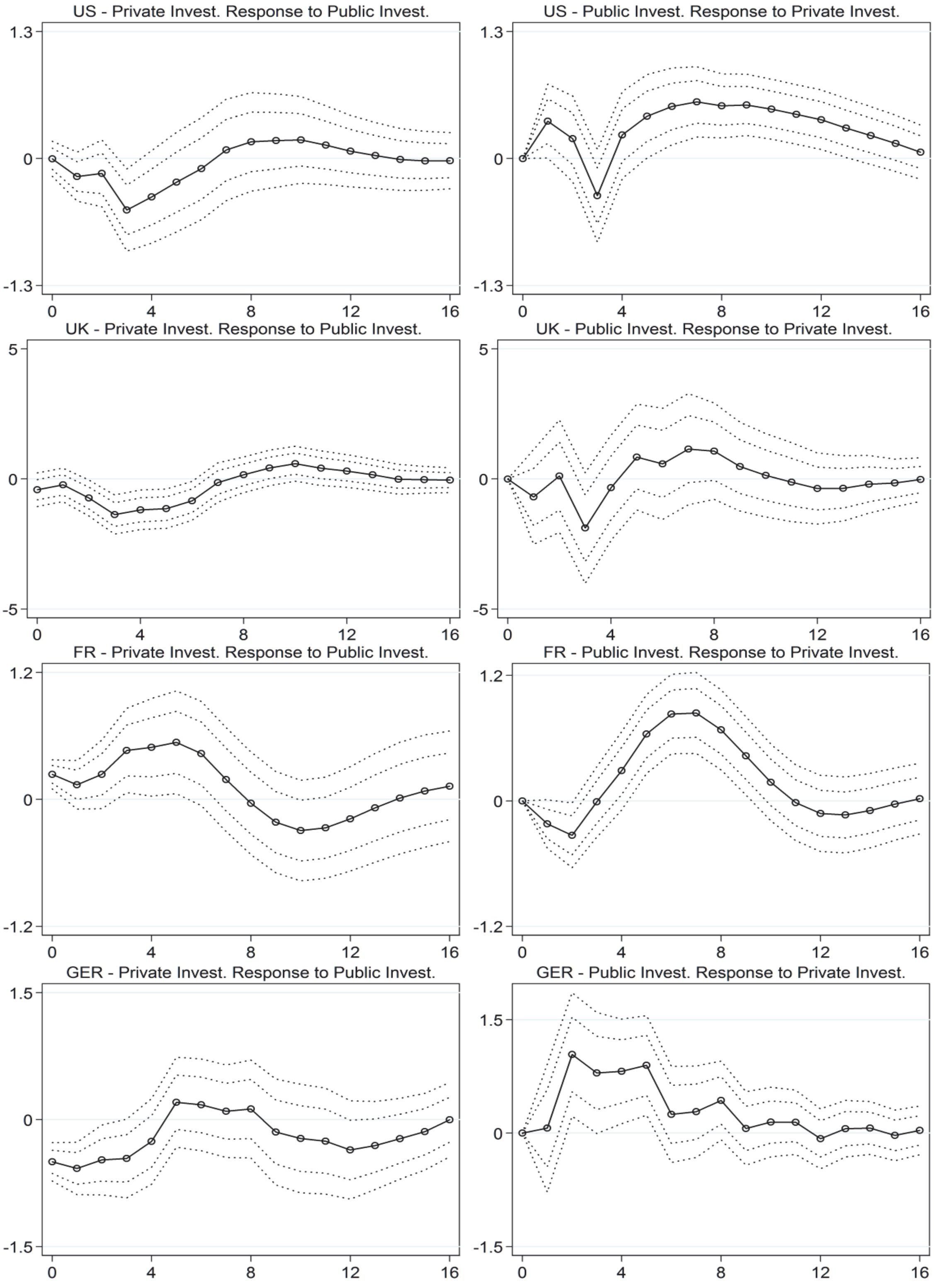
The length of the time span that we considered (almost five decades for the United States, France and the United Kingdom, more than two for Germany) may be responsible for the lack of a clear correlation between public and private investment over the period. Indeed, the existence of structural breaks could affect the results. Therefore, it is certainly worth resorting to a time-varying analysis of correlation to assess whether there have been sub-periods over which the two variables exhibit some degree of correlation. To identify the possibly time-varying relationship between public and private investment, we estimate a time-varying measure of correlations based on the dynamic conditional correlation (DCC) model of Engle (2002), in which the conditional correlation follows a GARCH(1,1) process.

The GARCH model is a specification of both the conditional mean and the conditional variance, where the variance is a function of prior unanticipated innovations ε_t^2 and prior conditional variances σ_t^2.

$$y_t = \beta Y + \varepsilon_t, \text{with } \varepsilon_t \sim (0, \sigma_t^2)$$

Figure 4

VAR Model: Impulse Response Functions



Note: The dotted lines represent the 68 and 90% confidence intervals.

$$\sigma_t^2 = y_0 + y_1\sigma_{t-1}^2 + y_2\varepsilon_t^2$$

A DCC-GARCH model (see Engle, 2002) can be viewed as a multivariate representation of a univariate GARCH process from which dynamic covariance is computed from conditional variance. The procedure involves 2 steps: first, estimating the conditional volatility of each individual series and, second, capturing dynamics in the covariance of the standardized residuals from the first stage procedure and using them as inputs to estimate a time-varying correlation matrix.

The vector *Y* includes a constant and a number of lags between 1 and 4 lags (depending on the country and on the convergence properties of the iterative process) of the output gap to control for capacity utilization. We also include into the *Y* vector 1 to 3 lags of total investment, to improve the fit and capture the inertia of both public and private investment.

The resulting time series, capturing the changing correlation of the two variables over time, has been filtered with an HP filter to obtain a smoother series. Figure 5 shows the dynamic correlation between private and public investment for the four countries (we include the original and the filtered series). The country that stands out in this case is the UK, where the correlation is low, unstable with very frequent sign changes. For the other countries, in particular France and the US, we observe rather long periods of relatively stable (positive or negative) correlations. In the US, the 1970s and the most recent years witness a positive correlation, whereas the 1980s show a strong negative correlation. The rising interest rates and public deficits under the Reagan administration were to some extent detrimental to private investment, despite investment incentives (Modigliani, 1988). The negative correlation remained, though at a lower level, until 2013. The timing of correlations for France is opposite to the US': correlation was negative in the late 1960s and 1970s; and it has started being positive in the 1980s when French public deficits were high and the financial system was under liberalization. It remained positive until the global financial crisis. In Germany, the correlation has been low, in comparison with the US and France, and mainly positive over the entire (though short) time span.

These patterns suggest that the relative strength of the crowding-out and crowding-in effects changes over time, and needs to be further investigated.

To conclude, our various exercises of correlation analysis suggest that for 3 countries, the UK, Germany and the US, there is no robust correlation between public and private gross capital formation. France gives a slightly more structured picture, as the two variables seem to have an overall positive relationship. France is also the only country for which there is evidence of crowding in[6], while for the UK and the US estimations point to crowding out (if anything). Dynamic correlation analysis shows that the relationship is unstable, alternating phases of positive and negative correlation. This is true for Germany, France and the US, while for the UK correlation seems erratic, as variance statistics already pointed out, confirming the weakness of the link across all the methods we used.

Nevertheless, the amount of information that can be extracted from simple correlations is limited by the existence of well-known biases. The more important one may be the existence of omitted variables, which may yield spurious correlation, or on the contrary hide actual significant relationships between variables. Other biases may be non-linearity between public and private investment, or non-linearity of the relationship with respect to the business cycle, the existence of lags, and of variability. Even dynamic correlation is not enough to eliminate these biases.

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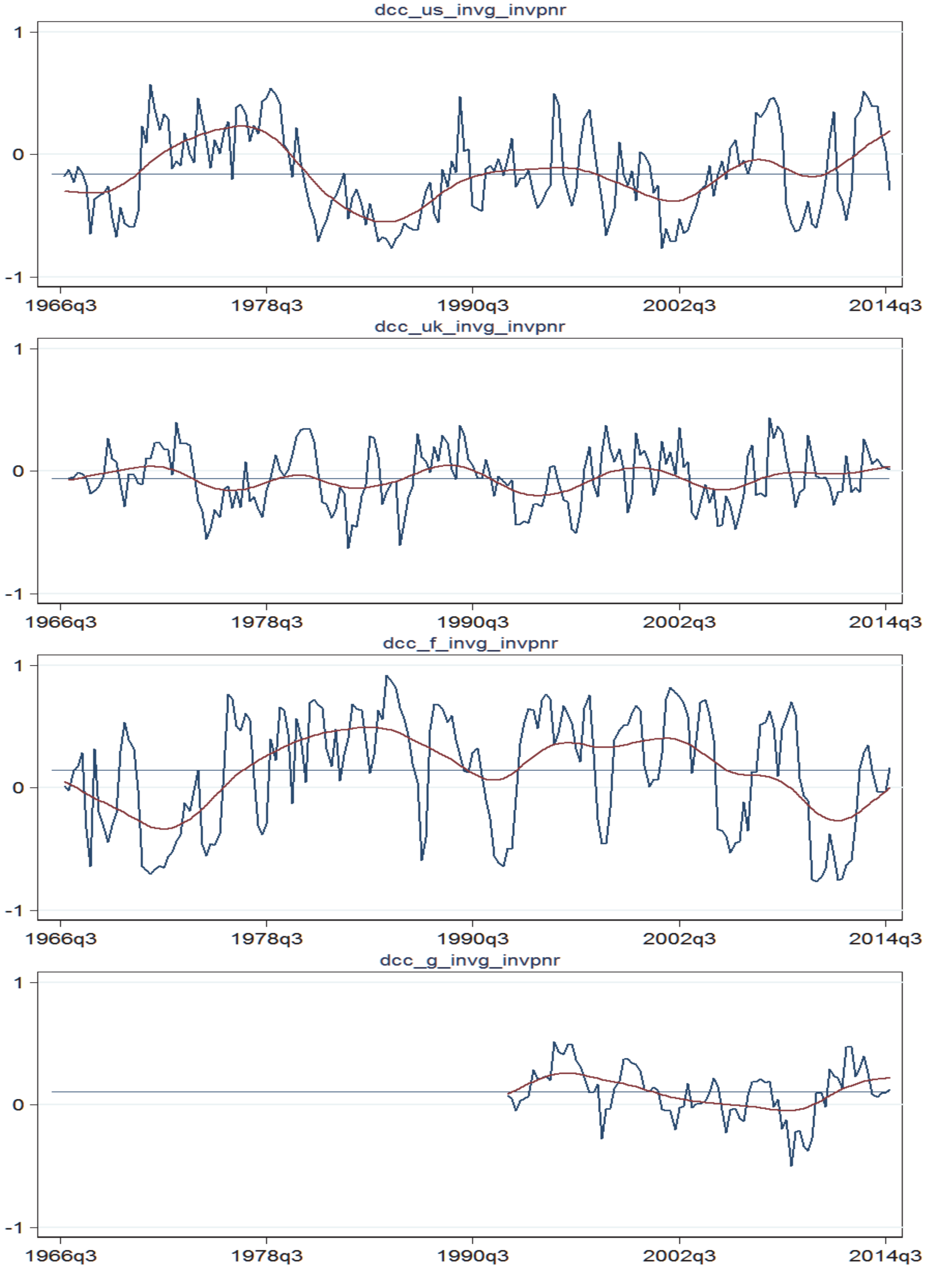
[6] DCC correlations for Germany give only a small crowding-in effect.

Figure 5

Dynamic Conditional Correlations



Note: The most volatile (blue) line is the DCC, the less volatile (red) line is the HP-trend of the DCC, and the flat line is the mean of the DCC over the sample.

5.4 Explaining the time-varying link

Next, we investigate whether the macro variables used in the VAR can help explain the variation in time of the correlation between private and public investment. We regress the DCC time series (plotted in Figure 5) on the macro variables used in the VAR. To avoid multi-collinearity issues, we eliminate from the regressions public and private rates, and government balance; all these variables exhibit a strong correlation with government debt, which therefore captures all the impact of public finances on the correlation.

Overall, as Table 4 shows, there is heterogeneous evidence of an impact of macroeconomic variables on correlation across the four countries. There is also little evidence of an impact of interactions, except for France, when we try to capture nonlinearities. Coefficients of determination for the UK and Germany are very low and empirical results must be taken with caution. On the contrary, results for France may be considered as rather robust. Results are now discussed in more details.

Private investment has an impact on the correlation only in France, where a positive correlation is associated with higher levels of private investment. We interpret this impact as a requirement for a positive business climate to emerge prior to the unfolding of crowding-in effects in France.

Public investment has a negative impact on the correlation in the US, a direct indication of crowding-out effects. This effect is also present, although much less significantly, for France, except in the model of column 14 which shows that the interaction with public debt is positive. In this latter case, the sum of estimated coefficients of public investment and its interaction with debt is positive, hence a (weak) indication of crowding-in effect.

Inflation impacts the link between private and public investment, maybe through a portfolio effect: higher inflation may push reallocation from financial to real activities. This reallocation concerns private and public investment only in the US, and very weakly in France.

Public debt has differentiated effects on the correlation across sub-groups of countries. It has a negative impact in France and Germany: the correlation between public and private investment is lower if debt is higher, and public and private investments tend to crowd-out one another. On the contrary, for the US and the UK, both investment variables co-move when debt is large. Does this difference relate to fiscal rules: France and Germany, under the Stability and Growth Pact, would reduce public investment when debt grows, all else equal, whereas the US without a federal fiscal rule would not undergo a change in public investment when debt varies? The situation depicted for France and Germany would fit the main conclusion of Mehrotra and Välilä (2006). Notwithstanding the existence of fiscal rules, the difference in the reaction of the correlation between public and private investment to debt between the UK and the UK, on the one hand, and Germany and France, on the other, matches Reicher (2014)'s results. She shows that public debt has no significant impact on government gross investment in the former and a (weakly significant) positive impact in the latter (her Table 4, model 2, p.192).

Finally, the correlation between public and private investment is contingent to the business cycle. The output gap has a strongly significant negative impact on the correlation in France and is less significant in the UK. During booms the possibility of crowding out in both countries would tend to increase. At the opposite, the correlation is instead pro-cyclical for the US, though statistically less significant than in France.

Table 4

Explaining DCC

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	US	**US**	**US**	**US**	**UK**	**UK**	**UK**	**UK**
	DCC	DCC	DCC	DCC	DCC	DCC	DCC	DCC
invg	-0.008***	-0.007***	-0.008**	-0.010	0	0	0	0
	[0.00]	[0.00]	[0.00]	[0.01]	[0.00]	[0.00]	[0.00]	[0.00]
invpnr	0.002	0.002	0.002	0.002	0.001	0.001	0.001	0.001
	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]
output gap	0.016**	0.016**	0.016*	0.016**	-0.007**	-0.008**	-0.007*	-0.007**
	[0.01]	[0.01]	[0.01]	[0.01]	[0.00]	[0.00]	[0.00]	[0.00]
cpi	0.044***	0.044***	0.044***	0.045***	0.002	0.002	0.002	0.002
	[0.01]	[0.01]	[0.01]	[0.01]	[0.00]	[0.00]	[0.00]	[0.00]
debt	0.424***	0.398***	0.424***	0.438***	0.174***	0.185***	0.176***	0.175***
	[0.08]	[0.08]	[0.08]	[0.09]	[0.04]	[0.04]	[0.04]	[0.04]
invg * invg		0				0		
		[0.00]				[0.00]		
invg * output gap			0				0	
			[0.00]				[0.00]	
invg * debt				0.006				-0.001
				[0.02]				[0.00]
const	-0.523***	-0.501***	-0.523***	-0.533***	-0.177***	-0.187***	-0.179***	-0.177***
	[0.07]	[0.07]	[0.07]	[0.08]	[0.03]	[0.03]	[0.03]	[0.03]
N	193	193	193	193	137	137	137	137
R^2	0.35	0.36	0.35	0.35	0.12	0.14	0.12	0.12
	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)
	FR	**FR**	**FR**	**FR**	**GER**	**GER**	**GER**	**GER**
	DCC	DCC	DCC	DCC	DCC	DCC	DCC	DCC
invg	-0.004	-0.005*	0.006	-0.033***	-0.002*	-0.002	-0.002	-0.008
	[0.00]	[0.00]	[0.00]	[0.01]	[0.00]	[0.00]	[0.00]	[0.01]
invpnr	0.014***	0.014***	0.015***	0.016***	0.002	0.002	0.002	0.002
	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]
output gap	-0.070***	-0.071***	-0.068***	-0.060***	-0.002	-0.002	-0.002	-0.002
	[0.01]	[0.01]	[0.01]	[0.01]	[0.01]	[0.01]	[0.01]	[0.01]
cpi	0.010*	0.010*	0.009	0.007	-0.018	-0.018	-0.018	-0.017
	[0.01]	[0.01]	[0.01]	[0.01]	[0.01]	[0.01]	[0.01]	[0.01]
debt	-0.479***	-0.473***	-0.470***	-0.558***	-0.348***	-0.347***	-0.350***	-0.334***
	[0.10]	[0.10]	[0.09]	[0.09]	[0.11]	[0.11]	[0.11]	[0.11]
invg * invg		0				0		
		[0.00]				[0.00]		
invg * output gap			0.007***				0	
			[0.00]				[0.00]	
invg * debt				0.056***				0.008
				[0.01]				[0.01]
const	0.289***	0.278***	0.296***	0.367***	0.352***	0.353***	0.355***	0.341***
	[0.08]	[0.08]	[0.08]	[0.08]	[0.09]	[0.09]	[0.09]	[0.09]
N	137	137	137	137	90	90	90	90
R^2	0.64	0.64	0.67	0.69	0.15	0.15	0.15	0.15
invg coefficient when:								
high interacted variable	-	-	0.003	0.009**	-	-	-	-
			[0.00]	[0.00]				
low interacted variable	-	-	-0.024***	-0.015***	-	-	-	-
			[0.01]	[0.00]				

Standard errors in brackets. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

5.5 A state-contingent analysis of the link between private and public investment

We now investigate the direct instantaneous impact of public investment and six other macroeconomic variables on private investment; and include a nonlinear impact of public investment (with a squared term), and interaction terms between public investment and the output gap, public deficit and debt. The specification is close to Furceri and de Sousa (2011), without lags, including a few more interaction terms (public deficit and debt), and testing for the impact of public investment rather than government consumption' on private investment.

Table 5 shows the results. Columns (1), (5), (11), and (15) report the baseline regressions for each of the 4 countries. In this case, Germany has the higher R^2. The output gap has the expected sign (positive) and is significant for all the countries. Prices do not have an impact on private investment except for France and Germany for which it is strongly negative. Reading this result together with Table 4, shows that contrary to the intuition the portfolio reallocation effect mostly happens through public investment. Public debt has a negative impact for France, and no impact for the other countries.

Coming to public investment, it has generally no impact on private investment, except for France, where there is evidence of crowding-in effect. Nonlinearities play no role at all.

Overall, these results confirm the ones we found above: The only country for which there is evidence of crowding-in effect is France. France therefore seems to fit the Leeper *et al.* (2010) theoretical framework discussed in Section 3. No significant or robust result appears for the UK and Germany. For the US there is moderate evidence of crowding out.

Our results are partially at odds with Furceri and Sousa (2011), who run estimations on 145 countries, including the four we focus on. They test crowding-in versus crowding-out effects *via* the effect of government *consumption* on either private consumption or investment. They show that in Germany, the UK and the US, higher government consumption produces a significant decrease in private investment, whereas no significant effect can be found in France. For the US these results can be read in comparison with Blackley (2014), who finds that US government purchases have a significant negative impact on private investment (crowding-out). He also shows that composition matters: public investment positively impinges on private investment (crowding-in), whereas public consumption and military purchases reduce private investment (crowding-out). Our analysis shows that the sign and intensity of the relationship depends to some extent on other variables (in particular public finances).

5.6 Spillovers

Our final exercise is to test for the existence of possible spillovers from foreign public investment on domestic private investment. The most direct effect would be *via* increased growth and imports that in turn boost growth and investment in partner countries. For countries with very strict ties as for example the Eurozone countries, an interest channel could also play: with integrated financial markets, public investment may drive up interest rates across the border, with a negative effect on the partner country private investment level (for more details, the reader is referred to Auerbach and Gorodnichenko, 2012).

We regress private investment on the same variables as those appearing in Table 5, adding for each regression public investment in the three other countries among the exogenous variables. Table 6 displays some spillover effects. As rough as they are, the results are broadly in line with what could be expected. In France and in Germany, private investment is positively affected by public investment in the largest economy, the US. The German economy, traditionally reliant on

Table 5

Explaining Private Investment

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	US	**US**	**US**	**US**	**UK**	**UK**	**UK**	**UK**
	invpnr	invpnr	invpnr	invpnr	invpnr	invpnr	invpnr	invpnr
invg	0.065	0.012	0.18	0.356	-0.015	0.003	-0.011	-0.145
	[0.07]	[0.08]	[0.13]	[0.24]	[0.03]	[0.04]	[0.06]	[0.19]
output gap	2.121***	2.087***	2.011***	2.069***	1.149**	1.184**	1.137**	1.185**
	[0.23]	[0.23]	[0.25]	[0.23]	[0.45]	[0.45]	[0.47]	[0.45]
cpi	0.118	0.118	0.1	0.015	-0.479	-0.469	-0.479	-0.445
	[0.19]	[0.19]	[0.20]	[0.21]	[0.29]	[0.29]	[0.29]	[0.30]
debt	-4.591	-3.19	-4.184	-6.203*	-8.662	-9.504*	-8.569	-8.930*
	[2.89]	[2.99]	[2.92]	[3.16]	[5.36]	[5.46]	[5.49]	[5.39]
invg * invg		0.015*				-0.001		
		[0.01]				[0.00]		
invg * output gap			0.038				0.002	
			[0.04]				[0.02]	
invg * debt				-0.699				0.294
				[0.56]				[0.41]
const	12.523***	11.186***	12.068***	13.693***	11.793***	12.596***	11.709***	11.951***
	[2.39]	[2.50]	[2.43]	[2.56]	[3.70]	[3.82]	[3.84]	[3.71]
N	196	196	196	196	137	137	137	137
R^2	0.31	0.32	0.32	0.32	0.07	0.08	0.07	0.07
	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)
	FR	**FR**	**FR**	**FR**	**GER**	**GER**	**GER**	**GER**
	invpnr	invpnr	invpnr	invpnr	invpnr	invpnr	invpnr	invpnr
invg	0.310***	0.251***	0.153	0.610***	-0.035	-0.048	0.006	0.427
	[0.08]	[0.09]	[0.13]	[0.22]	[0.05]	[0.05]	[0.06]	[0.31]
output gap	2.351***	2.274***	2.273***	2.208***	3.014***	3.006***	2.916***	3.031***
	[0.31]	[0.32]	[0.31]	[0.33]	[0.23]	[0.23]	[0.24]	[0.23]
cpi	-0.660***	-0.639***	-0.631***	-0.620***	-1.343***	-1.358***	-1.488***	-1.561***
	[0.16]	[0.16]	[0.16]	[0.16]	[0.45]	[0.45]	[0.46]	[0.47]
debt	-13.219***	-12.762***	-13.113***	-12.185***	-0.599	-0.698	-1.094	-1.803
	[2.81]	[2.83]	[2.80]	[2.89]	[4.47]	[4.47]	[4.45]	[4.50]
invg * invg		0.012				0.003		
		[0.01]				[0.00]		
invg * output gap			-0.100				0.038	
			[0.06]				[0.03]	
invg * debt				-0.597				-0.72
				[0.42]				[0.47]
const	15.039***	14.345***	14.658***	13.986***	8.134**	8.009**	8.501**	9.354**
	[2.23]	[2.30]	[2.23]	[2.34]	[3.51]	[3.52]	[3.50]	[3.58]
N	137	137	137	137	92	92	92	92
R^2	0.42	0.43	0.43	0.43	0.68	0.68	0.69	0.69

Standard errors in brackets. * p < 0.10, ** p < 0.05, *** p < 0.01.

exports, also benefits from larger levels of public investment in France. The contrary does not hold, and a public investment push in Germany seems to have a negative impact on French private investment. Somewhat surprisingly, private investment in the traditional partner of the US, the UK, is unaffected by what happens in the other countries.

It is noteworthy that the introduction of spillover effects in the regression of French private investment does not modify the crowding-in effect, which is still statistically significant at the 5% threshold. On the contrary, CPI and debt are no longer significant.

Table 6

Spillovers

	(1) US invpnr	(2) UK invpnr	(3) FR invpnr	(4) GER invpnr
us_invg	-0.170	0.383	0.782***	0.292**
	[0.22]	[0.33]	[0.12]	[0.13]
uk_invg	-0.037	-0.016	-0.007	-0.003
	[0.03]	[0.05]	[0.02]	[0.02]
f_invg	0.135	-0.126	0.254**	0.287***
	[0.16]	[0.24]	[0.10]	[0.10]
g_invg	-0.112	-0.155	-0.117**	-0.091*
	[0.09]	[0.13]	[0.06]	[0.05]
output gap	0.551	1.416**	3.239***	2.983***
	[0.51]	[0.55]	[0.34]	[0.21]
cpi	2.714***	-1.028	-0.776	-0.373
	[0.76]	[1.03]	[0.65]	[0.51]
debt	0.44	-3.106	-6.455*	8.880*
	[6.13]	[6.35]	[3.45]	[5.07]
const	-0.317	8.672*	10.880***	-0.304
	[6.24]	[5.06]	[3.17]	[4.19]
N	92	92	92	92
R^2	0.269	0.107	0.603	0.732

Standard errors in brackets. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

6 Conclusion

This paper contributes to the literature on the impact of public investment in the economy, by focusing on the direct link between private and public investment. Our contribution is original in that we perform a number of exercises trying to assess the robustness of the link, and to determine whether crowding in or crowding out dominates. As the correlation analyses show, raw data do not allow to determine a clear relationship.

Our analysis gives a few results. First, thanks to the VAR estimation we determine that causation, if any, runs from public to private investment. When trying to assess the sign of this causation, then, we conclude that for France there is reasonable evidence of textbook-like effects: increases of public investment generally trigger increases of private investment, unless the economy is overheating and/or public finances are in dire conditions. For the United States instead, the link is in general weaker, and tends to point to prevailing crowding out effects, except for very low levels of public debt. The same can be said for Germany, where nevertheless the relationship is even weaker than for the US. The UK stands out as the country for which the results are more inconclusive. In fact, this was somehow to be expected, as the descriptive statistics of Table 1 show much larger variability than for the other countries. Moreover, the sequence of institutional changes certainly blurred the impact of public investment in the UK: the Code for Fiscal Stability was adopted in 1998 and paved the way for an impetus of public investment, but it was finally abandoned on the onset of the global financial crisis. Thus, noise is likely to have hidden the possible relationship between both public and private investment. Our policy recommendation is therefore only directed towards France for which a stimulus plan centered on public investment would have a chance of lifting private investment from its current low levels.

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ASSESSING POLICY OPTIONS FOR THE EU COHESION POLICY 2014-2020

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In this paper, we estimate the impact on GDP of Cohesion Policy 2014-2020 for 267 EU regions running a set of simulations with RHOMOLO, a spatial CGE model tailored for economic analysis at the subnational level. We do so by treating the different parts of Cohesion Policy as exogenous and independent shocks, which are first considered separately and then combined to estimate an overall effect. Our simulation suggests that European regions display significant heterogeneity in their deviations from the baseline due to Cohesion Policy, both in absolute terms and relative to the amounts received.

1 Introduction

In this paper we present the expected impact of the Cohesion Policy 2014-2020 on EU regions based on simulations using RHOMOLO, a spatial Computable General Equilibrium (CGE) model designed to provide ex-ante policy impact assessment at the regional level (see Brandsma *et al*, 2015). The different budget lines of Cohesion Policy are implemented as exogenous shocks. First separately and then combined into an overall effect. The paper has been organised as follows. First, Section 2 gives a short description of what Cohesion Policy is, to get an idea of its importance and magnitude. Section 3 provides a technical description of RHOMOLO, touching upon its' structure, characteristics and dynamics. Section 4 describes in detail the design of the four main scenarios that have been simulated (Human Capital, R&D, Non-R&D and Infrastructure investments) and Section 5 presents the outcomes of these simulations with respect to the non-policy baseline. Finally, Section 6 concludes.

2 Background information on Cohesion Policy

The EU Cohesion Policy, also known as Regional Policy, is one of the oldest and most important policy instruments of the European Union, absorbing roughly one third of the entire EU budget and involving every region of each Member State. It is designed as an investment policy which is expected to kick-start growth, employment, competitiveness and development on a sustainable basis.

The commitment to develop a common regional policy for development dates back to the Treaty of Rome, which instituted the European Economic Community in 1957, but its actual operationalization evolved substantially over time, following institutional changes and the EU enlargement. Currently, the Cohesion Policy is structured as the combination of three instruments (European Regional Development Fund, European Social Fund and Cohesion Fund) aimed at achieving three main objectives following the strategic guidelines inspired by the Europe 2020 growth strategy: convergence, competitiveness and territorial cooperation.

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Each instrument is designed to address a different set of objectives and target different stakeholders:

- The Cohesion Fund is aimed at Member States with a Gross National Income (GNI) per capita of less than 90 per cent of the EU average and supports actions in the framework of the convergence objective. The main activities concerned include trans-European transport networks and environmental sustainability, notably in the fields of energy or transport (e.g., supporting energy efficiency, the use of renewables, public transport, intermodality and so on);
- The ESF (European Social Fund) is meant to support Member States in their labour market policies in the framework of the convergence and competitiveness objectives. The areas covered by the ESF include policies aimed at fostering lifelong learning schemes, reducing search and matching costs in the labour market, promoting social integration, combating discrimination and strengthening human capital by reforming education systems;
- The ERDF (European Regional Development Fund) aims to support Regions in order to strengthen economic and social cohesion and correct imbalances. It deals with the three objectives of Cohesion Policy (convergence, competitiveness and territorial cooperation) by directly financing private investments policies; physical infrastructures (linked to R&D, telecommunications, environment, energy or transport); financial instruments to support regional and local development and cooperation; technical assistance measures.

Cohesion Policy Funds are provided taking into account the principles of additionality, concentration, programming and partnership. Additionality requires that contributions from the Structural Funds must not replace public or equivalent structural expenditure by a Member State in the regions concerned by this principle. Concentration refers to local concentration (the majority of the funds will be located in the poorer regions), concentration in objectives (growth and jobs) and concentration in time (must be spent three years after allocation). Programming means that the funds are used for multi-annual national programmes aligned on EU objectives and priorities. Finally, partnership aims at development through a collective process involving authorities at European, regional and local level, social partners and organisations from civil society.[1]

To give an idea of the potential impact of Cohesion Policy, the combination of the Structural Funds (ESF and ERDF) and the Cohesion Fund amounted to roughly €347 billion or 0.3 per cent of the EU27 GDP in the last programming period 2007-2013, although this can go up to 4 to 5 per cent of GDP due to the principle of concentration in certain targeted countries and regions.

2.1 Cohesion Policy 2014-2020: Overall envelope

The European Commission has adopted a draft package of the Cohesion Policy for 20142020. The new proposals are focused on the "Europe 2020" objectives mainly targeting growth and jobs. For an ex-ante assessment of its impact, the planned regional investments are introduced into RHOMOLO. Section 4 will explain in detail the design of the simulations and Section 4.4 presents the results. See Table 1 for basic descriptive data on expenditures per type of region and expenditure category.

The total amount of Cohesion Policy is divided over 86 categories of expenditure (see Annex 2) that have been merged into five main budget lines for being able to toggle the adequate parameters in the model. The policies under these headers are quite diverse and, as a consequence, the assumptions as to which exogenous parameters of the model are affected and how, are necessarily quite strong.

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1 See http://ec.europa.eu/regional_policy/index_en.cfm for more detailed information about Regional Policy.

Table 1

Details on Cohesion Policy Expenditures
The Four French Regions that Are Not in RHOMOLO Are Not Taken into Account
(millions of euros)

Region Type[2]	#	GDP 2007	RTDI	Aid to Private Sector	Infra-structure	Human Capital	Technical Assistance	Total	%
Less Developed Regions	65	1,147,683	25,250	27,127	129,128	38,408	12,162	232,075	68%
Transition Regions	51	1,407,194	5,772	6,218	14,339	10,201	1,585	38,115	11%
More Developed Regions	151	9,120,647	10,916	9,101	24,167	24,196	2,954	71,335	21%
Total	267[3]	11,675,524	41,938	42,447	167,634	72,805	16,701	341,525	100%
percent of total CP			12%	12%	49%	21%	5%	100%	

Funds designated to *Human Capital* aim at bringing improvements to the labour markets by investing in training and education of employees. As can be seen, the vast majority (68 per cent) of the funds is destined to the Less Developed Regions. The joint human capital expenditures are assumed to translate into an improvement of labour productivity in the model. The full setup of the simulation is discussed in Section 4.1.

Funding for *Research, Technical Development and Innovation* (RTDI) is aimed at supporting firms of in the process from basic research to actual implementation of innovations. The RTDI related expenditures are assumed to affect the research and development capacity of the economy, which is translated into changes in the total factor productivity (TFP) parameter of the model. Section 4.2 discusses these simulations in detail.

The category *Aid to Private Sectors* aims at supporting non-R&D activities, which play an important role in the economic development of countries and regions by positively affecting their TFP growth. These non-R&D innovation activities consist e.g. of technology and know-how acquisitions, such as machinery and other equipment patents, trademarks, designs, etc. In Europe, about 40-60 per cent of the industrial value-added and 50 per cent of all industrial employees are engaged in the non-R&D intensive sector (Som, 2012). Moreover, more than half of all innovating firms in the EU are non-R&D performers (Arundel *et al.*, 2008). Therefore, considering the high shares of funding devoted to the non-R&D activities and the importance of these activities in the promotion of innovation and TFP growth in Europe, it is important to evaluate the ex-ante short and long term effects of the planned regional non-R&D investments across EU regions. More details are provided in Section 4.3.

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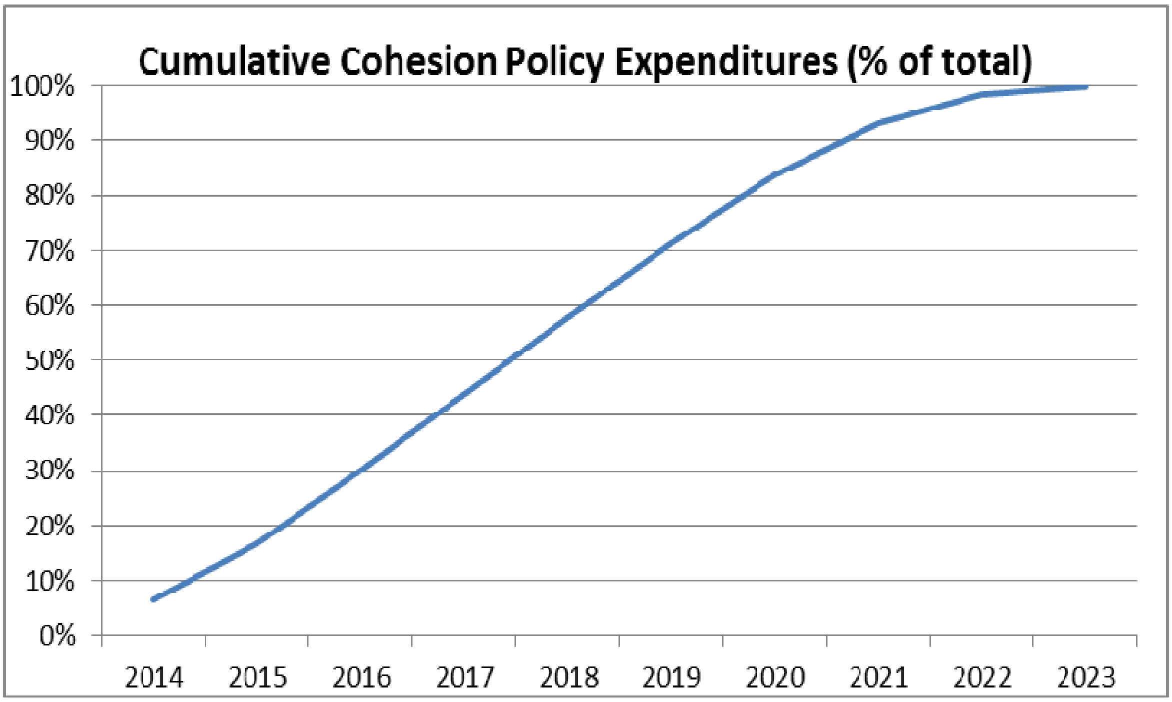
2 Less Developed Regions are defined as having a GDP per capita that is less than 75 per cent of the EU27 average. The GDP per capita of the Transition Regions is between 75 and 90 per cent of the EU27 average and for the More Developed Regions this is above 90 per cent.

3 The EU27 has a total of 271 NUTS2 regions, but 4 French regions were left out because of their very particular characteristics: Guadalupe, Martinique, Guyana and Réunion. Croatia recently joined the EU, but has not yet been introduced into the model.

Figure 1

Time Profile of Cohesion Policy Expenditures



Cohesion Policy funds aimed at *Infrastructure* mainly support regions in improving connectivity within the region and between other regions, focussing on railways, motorways and airports, as well as environmental and social infrastructure. These policies in general will decrease transport costs, as well as the general cost of firms for doing business with other regions such as communication costs, be it for selling final goods or sourcing intermediates. These investments will be modelled as decreasing the transport costs. The setup is discussed more in detail in Section 4.4.[4]

2.2 *Cohesion Policy 2014-2020: Time profile*

Based on experience from passed Framework Programmes, the *expenditure* period for the funds is from 2014 to 2023, taking into account the N+3 rule.[5] The time profile is shown in Figure 1.

3 Technical description

The RHOMOLO model is calibrated to the regionalised Social Accounting Matrices (SAMs) of the EU member states that were extracted from the World Input-Output Database (WIOD). SAMs for the NUTS2 regions were constructed using the data of regional production by sector,

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[4] Notice that, given its size in the overall budget and the difficulty to model it in a consistent way, the category Technical Assistance has not been modelled. It mostly concerns technical support given to regions or other local authorities in streamlining bureaucratic procedures and public programming and auditing.

[5] If the funding in question has not been spent by 2020, the Commission can 'decommit' future budget allocations.

bilateral trade flows among the NUTS2 regions and trade with the rest of the world (ROW), as described by Potters *et al.* (2013). The version of the model used for this paper includes 6 NACE[6] Rev. 1.1 industries: Agriculture (AB), Manufacturing (CDE), Construction (F), Transport (GHI), Financial Services (JK) and Non-market Services (LMNOP). An illustration of the SAMs used for RHOMOLO is shown in Annex 1.

EU regions are modelled as small open economies that accept EU and non-EU prices as given, which is consistent with the regional scope of the model. In this perspective, EU external relations involve only one non-EU trading partner that is represented by the ROW aggregate.

Interregional trade flows are estimated based on prior information derived from the Dutch PBL dataset (see Thissen *et al.*, 2013). Data on bilateral transport costs per sector are provided externally by the TRANSTOOLS model,[7] a model covering freight and passenger movements around Europe. The costs of different shipments are calculated in terms of share of the value shipped, based on the time needed to reach the destination using alternative modes of transport. Transport costs thus differ by type of good and depend on the distance between the regions and the variety and characteristics of modes of transport connecting them, which also means that they can be asymmetric. The representation of trade and transport flows among the NUTS2 regions gives the model a spatial dimension, indicating that EU regions differ not only in their stocks of production factors but also in geographic location.

Mobility of capital and labour is assumed to occur within regions, but international or intra-regional migration of production factors is not considered in the core model version.

Because of the models' large dimensionality (268 of NUTS2 regions, 6 sectors, 10+ years modelling horizon), a rather simple approach to introduce dynamics has been applied that rests on the assumptions of exogenous growth, which is in line with Solow's model (Solow, 1956). The main advantage is that this type of dynamics does not require a time index in the core equations. All agents of the model have myopic expectations and cannot anticipate future changes in relative prices or make choice between consumption and savings depending on the interest rate. Using a perpetual inventory method (OECD, 2001), the sum of interest rate and depreciation rate are employed to estimate the regions' capital stocks from the value of their operating surplus, as available in the SAMs. The interest rate is set at the level of 5 per cent and the capital depreciation rate at 6 per cent per annum. In order to keep the model baseline "clean" of trade spillovers that change relative prices and induce sectorial changes, we apply a uniform 2 per cent annual growth rate to all regions.

The model solves for the sequence of equilibrium states when all time periods are connected with the equation of capital accumulation: each year in each region a portion of capital stock depreciates and gets augmented by the previous year investments, so that capital stock and investments grow at the same rate with the rest of economy. Values of inventory changes and investments in each region are adjusted in order to achieve consistency among the observed investments, the estimated capital stock and the required replenishment of the capital stock. Therefore, there are no changes in regions' economic structures over the steady-state baseline period. All prices remain constant; only the quantities grow at the same constant rate. As such, we get clearer insights by comparing the after-shock results with the baseline values.

The core model equations are specified in a calibrated share format proposed by Rutherford (1999), programmed in GAMS as a mixed complementarity problem (Mathiesen, 1985) and solved using a PATH solver.

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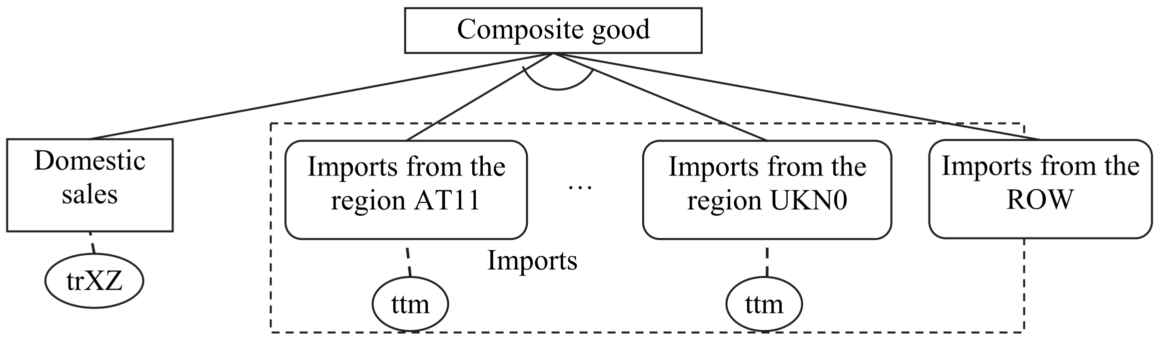
6 See http://epp.eurostat.ec.europa.eu/statistics_explained/index.php/Glossary:NACE

7 See Burgess *et al.* (2008) or visit http://energy.jrc.ec.europa.eu/TRANS-TOOLS/TT_model.html

Figure 2

Composite of Domestically-produced and Imported Varieties of the Same Good



3.1 Market equilibrium

3.1.1 Composite of domestic and imported varieties

Domestically produced and imported varieties are combined to form a composite good. Trade and transport margins are applied to imports from other NUTS2 regions (*ttm*) and to domestic sales (*trXZ*). Following this specification, the structure of this good is depicted in Figure 2.

Composite goods are consumed by industries, households, government and the investment sector.

3.1.2 Industries' nested cost function

The lower level of the sector's production function features a combination of labour and capital services, which are then combined with intermediate inputs. Coefficients of factor productivity improvements are assigned to labour (*fpl*) and capital (*fpk*).

With this specification, producers can maintain the same levels of output using less production factors. The same structure of nested production functions is adopted for all sectors (see Figure 3).

3.1.3 Household and Public utility

The top level of nested household utility function combines the consumption of final goods and savings (see Figure 4). Zero substitutability between consumption and savings is assumed. On the second level of nesting, final goods were combined with the Cobb-Douglas function.

The structure of public utility is identical to that of households and is described in Figure 4.

3.1.4 Investment sector

The investment sector combines in fixed proportions the final goods, transfers and inventory changes (see Figure 5). Transfers between investment sector, the EU and ROW are expressed on a net basis. The tax rate on output of regional investment good is defined as a lump-sum transfer to the government.

Figure 3

Sector's Nested Production Function

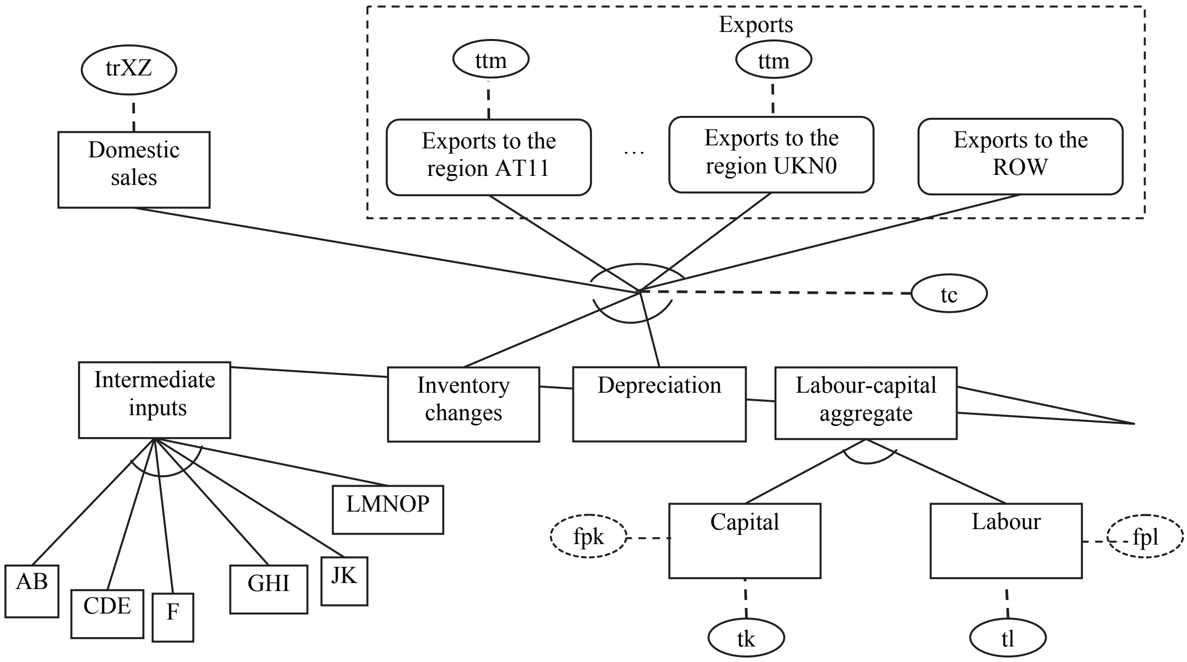
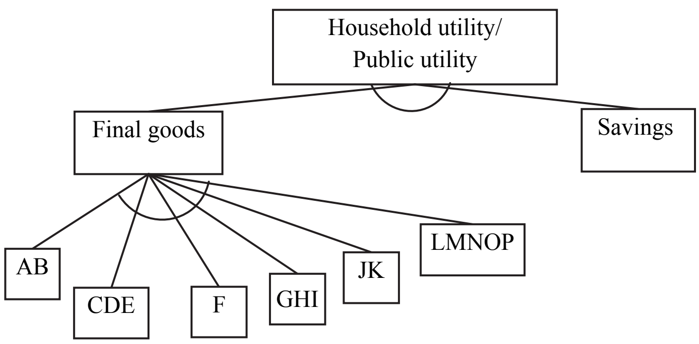


Figure 4

Structure of Regional Household Expenditures and Public Expenditures



3.1.5 Inventory changes

Inventory changes combine final goods and transfers (see Figure 6**).** This entity pays taxes on output, which is defined as lump-sum transfer to the government. Transfers between regional inventory changes, the EU and ROW are expressed on a net basis.

Figure 5

Structure of Regional Investment Demand

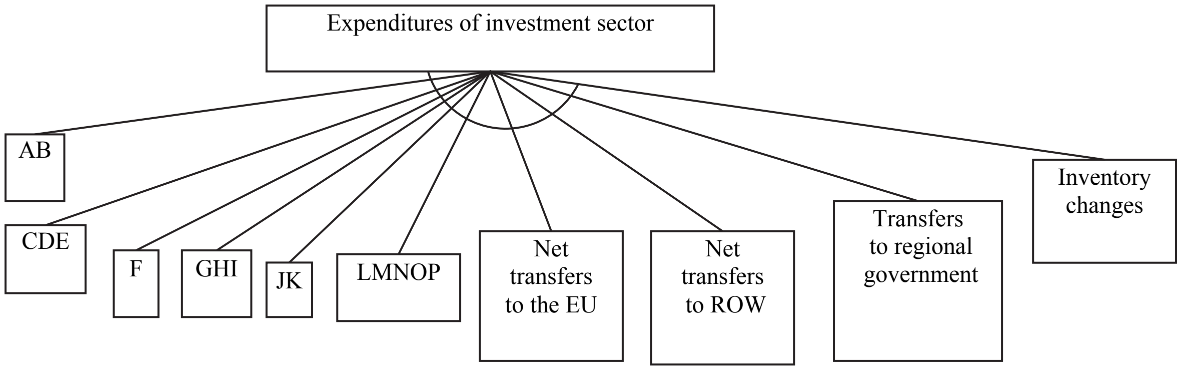
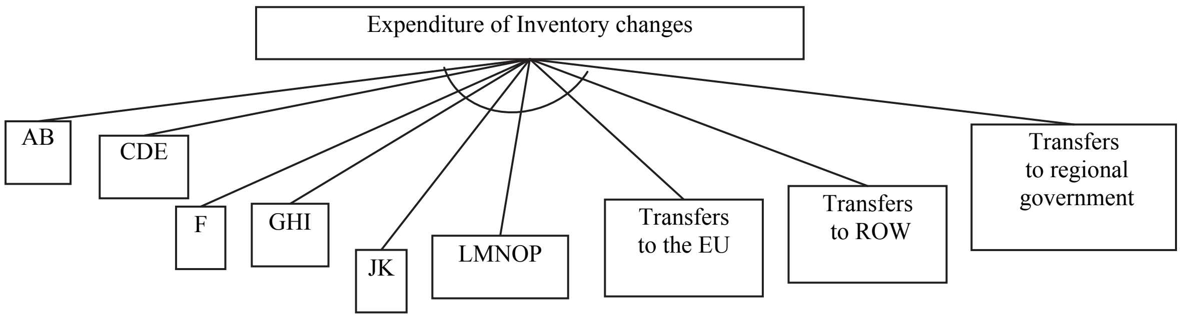


Figure 6

Structure of Regional Demand of Inventory Changes



3.2 *Market clearing conditions*

In order to specify the market clearance conditions, we derived the supply and demand functions of the primary factors, intermediate inputs or final goods by differentiating the profit or cost function by the price of that good (Hotelling's and Shephard's lemmas).

3.2.1 *ROW closure*

Following a common approach, the ROW closure was specified as equality between the sum of regional exports to the ROW, the sum of regional imports to the ROW plus the balancing constraint. We fix the exchange rate and use the producer price index as *model numéraire*.

3.3 *Budget balance*

3.3.1 *Households*

According to the information provided in the regional SAMs, households supply labour and capital services, pay taxes from their endowment of labour and capital, receive net transfers from the public sector and also net transfers from abroad. In the current model version, taxes on labour and capital endowment are modelled as lump-sum transfers from the households to the regional government. Disposable income of regional households is fully spent on their consumption of final goods and savings.

3.3.2 Public sector

According to the SAMs, income of regional government consists of taxes on sectors' output, sectors' consumption of labour, capital services, taxes on regional investment good and inventory changes, net transfers abroad and net transfers from regional households. Disposable income of regional governments is fully spent on their consumption of final goods and savings.

4 Scenario construction

4.1 Human capital related policies

The budget line Human Capital of the Cohesion Policy program combines a wide variety of measures. Some measures aim at fostering re-integration of long-run unemployed on the labour market, while others pertain to improving life-long learning or on the job training. To simulate the effects of cohesion expenditure on human capital in RHOMOLO, this wide variety of measures has to be translated into an exogenous change to the model by assuming that these expenditures lead to an increasing regional labour productivity (the *fpl* parameter), at the cost of a temporary decrease in the local labour supply.

Next, a choice is required as to how efficient the policy is to improve regional labour productivity. For this, we assumed that the relative human capital stock increase in a region induced by Cohesion Policy equals the relative size of the cohesion expenditure with respect to the local expenditure on education, taken from EU KLEMS (Timmer *et al.*, 2007). Next, we turned to the general literature, where it is found broadly that increasing the stock of human capital by 1 per cent leads to an increase of 0.3 per cent in output per worker (Sianesi and Van Reenen, 2003).

In the initial years of the policy implementation, labour supply simultaneously is assumed to decrease and remains subdued during the programming period. After the programming period, labour supply recovers to its original level.

Future work will focus on the stark assumptions made for these simulations. Firstly, the homogeneity of the labour productivity increase between countries for a given percentage increase relative to local education expenditure will be relaxed, as it seems likely that not all countries and regions would benefit equally from an increase in the human capital stock. Secondly, policies will be separated out which may be expected to operate not through increasing labour productivity, but rather e.g. through improving labour market efficiency.

4.2 R&D investments[8]

In the 2014-2023 period, €42 billion have been allocated to lines of expenditure[9] related to the support to RTDI. This is 12 per cent of the grand total of Cohesion Policy funds; 60 per cent of this goes to the less developed regions, a lower percentage than the 70 per cent across all budget lines.

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8 Notice that, in the next versions of RHOMOLO, the regional R&D sector modelled in this paper will be replaced with a national R&D sector with positive externalities at the regional level.

9 These lines are 01-09, 11-15 and 74, see Annex 2.

The current version of RHOMOLO uses the TFP to channel the support to RTDI. There is considerable empirical evidence of the effect of R&D on TFP, very well elaborated in Hall *et al.* (2009). The Cohesion Policy investment is first expressed as an increase in R&D intensity compared to the baseline and subsequently a TFP equation is used to model the increase in TFP resulting from R&D. This is the most standard formulation derived in Hall *et al.* (2009) which is reproduced here in a distributed lag format, reflecting that it takes time for an investment in R&D to be turned into innovation and consequently a productivity improvement. The TFP equation is as follows:

$$\mathrm{TFP}_{reg} = \gamma * \mathrm{TFP}(-1) + (1-\gamma) * \left(b_0 + b_1 * \frac{\mathrm{RTDI}_{reg,sec}}{\mathrm{GDP}_{reg}} + b_2 * \frac{\mathrm{RTDI}_{reg,sec}}{\mathrm{GDP}_{reg}} * \mathrm{TFPgap}_{reg,reg*} + b_3 * \mathrm{TFPelsewhere}\right) + \varepsilon \tag{1}$$

where TFP_{reg} represents the level of regional TFP at a given point of time that subsequently has an impact on the total output. The term $\frac{\mathrm{RTDI}_{reg,sec}}{\mathrm{GDP}_{reg}}$ is the R&D intensity for each sector in each region. The second explanatory variable is the combined interaction between the average R&D and the gap in TFP with the leading region.

The third term between brackets represents the possible spillovers from TFP increases in other regions and sectors ($\mathrm{TFPelsewhere}$). These spillovers are the key reason why the social return on R&D exceeds the private return and thereby would justify public investment and support to R&D in the private sector. This is a topic of empirical research taken up by Belderbos and Mohnen (2013), who propose a patent citation-based indicator to measure the presence of intra- and inter-sectoral knowledge spillovers, nationally as well as cross-border. This could possibly at a future stage be transformed into a spatial structure for the spillovers between regions but for the moment b3 is set to zero.

Kancs and Siliverstovs (2015) conclude that R&D rates of return in developed economies are strongly positive and may be as high as 75 per cent, although they are more likely to be in the 20 to 30 per cent range. This estimate is introduced in the model by setting a rate of return. This is close to the estimate used in QUEST III (McMorrow and Röger, 2009).

The empirical evidence on the spillover effect and catching-up is not as strong, but it is likely that the farther away from the technology frontier the greater the potential for catching up, conditional on the ratio of R&D to GDP. This is introduced in the model by a multiplicative term expressing that the higher the R&D intensity the greater the part of the TFP gap that is closed every year. An increase in RTDI expenditure compared to the baseline will set in motion this process, which is assumed to operate with the same distributed time lag and coefficient as the R&D effect on its own. This would approximate a doubling of the rate of return on RTDI for regions which are at $\mathrm{TFP} = 1$ compared to the technology frontier ($\mathrm{TFP} = 2$).[10] The estimates behind this specification are confirmed by the econometric research of Kancs and Siliverstovs (2015).

4.3 Non-R&D subsidies

Innovation can take place through activities which do not require R&D such as the purchase of advanced machinery, patents and licenses, training related to the introduction of new products or processes, etc. These forms of acquiring knowledge and technology are referred to as non-R&D

[10] Luxembourg, Brussels and Greater London are excluded from the frontier, because they are financial centres with a very high TFP in the data.

(NR&D) innovation activities. From the policy point of view it is important to analyse the impact of NR&D subsidies since the European Commission devotes an important portion of their budgets to finance them. In the Cohesion Policy 2014–2020, around €41 billion are devoted to NR&D activities. The current version of RHOMOLO analyses its impact considering that the main channel of influence of these activities is through their impact on TFP. We employed the our previous estimations of TFP elasticity with respect to the NR&D investments $(\gamma_3 + \gamma_1 \overline{Ird})$[11]. Mathematically, the following expressions have been used to estimate the shifts on TFP due to Non-R&D funds:

$$gTFP_{reg,t} = (\gamma_3 + \gamma_1 \overline{Ird})\left(\frac{NR\&D_{t-1,reg}}{GDPbau_{t-1,reg}}\right) \quad (2)$$

$$TFP_{reg,t} = gTFPbau_{reg,t} + gTFP_{reg,t\ 3}) \quad (3)$$

where $gTFP_{reg,t}$ is the annual regional growth rate in TFP in region reg in year t due to NR&D innovation expenditures; $\gamma_3 + \gamma_1 Ird$ is the elasticity of TFP improvements wrt. NR&D investments, $NR\&D_{t-1,reg}$ is the amount of NR&D innovation expenditures assigned in the year $t-1$; $GDPbau_{t-1,reg}$ is the forecasted GDP region reg in the year $t-1;$ $gTFPbau_{reg,t}$ is the baseline annual regional TFP growth in the region reg during the year t; $TFP_{reg,t}$is the growth rate induced by the NR&D investments.

DG REGIO provided us not only with the values of allocated funds but also with the planned annual absorption of non-R&D investments for each region during the compliance period of 2014–2023. It should be mentioned, that regional NR&D investments were not distributed homogenously within the period of 2014–2023, but allowed for quite high spikes from one year to the next. Given that the model baseline was projected assuming a steady-state 2 per cent annual growth rate, region's values of TFP growth can double or triple from one year to another.

4.4 *Infrastructure investments*

In a first step, an aggregate measure of the total Cohesion Policy expenditure on transport infrastructure is derived for each region. For this purpose, all policy instruments directly affecting transport infrastructure are aggregated in one category, INF. We use the aggregation scheme provided by DG REGIO.[12]

In a second step, we attempt to impute the spatial dimension of the transport infrastructure funds based on region-specific expenditures as calculated in the first step by estimating how region-specific expenditure translates into region-pair-specific expenditure. The spatial dimension is important, because transport infrastructure improvement affects not only the region, where the money is spent, but also all other regions with which it trades. We follow the literature and use the following formula to impute a spatial matrix of bilateral transport investments, $ECP^{INF}_{reg,regg}$:

$$ECP^{INF}_{reg,regg} = \phi_{reg,regg}\left(\frac{ECP^{INF}_{reg} + ECP^{INF}_{regg}}{2R}\right) \quad (4)$$

[11] This expression takes values in the range [0.15-0.18].

[12] Note that no weights are applied at this stage of aggregation, although, according to the theoretical literature (European Commission, 2011), the aggregation of different policy measures should account for differences in their expected impact. This will be introduced in future simulations.

where ECP_{reg}^{INF} and ECP_{regg}^{INF} are ECP transport infrastructure expenditures in regions reg and $regg$, respectively and $\phi_{reg,regg} \equiv \tau_{reg,regg}^{1-\sigma}$ is the freeness of trade, which ranges from zero, when trade is perfectly un-free (bilateral trade costs are prohibitive between reg and $regg$), to unity, when trade is perfectly free and bilateral trade costs are zero (Baldwin *et al.*, 2005). $\tau_{reg,regg}^{1-\sigma}$ denotes bilateral trade costs between pairs of regions as measured by TRANSTOOLS.

The bilateral measure of transport infrastructure investments (4) accounts for both the intensity of the Cohesion Policy expenditure in the regions and for the proximity of the regions. The second term on the RHS in equation (4) calculates the average transport investment for every pair of regions. The first term on the right-hand side introduces a spatial structure (economic geography) in the bilateral measure of transport infrastructure investment by weighting the proximity (integration) of regions. The farther away the trading regions are (trade is more costly), the less weight will be attributed to the transport infrastructure improvements between the two regions. The weighting implies that the further away are the two regions, the lower impact will have a fixed amount of expenditure (1 km of road can be improved much better than 10 km of road with the same amount of funds).

In a third step, we transform $ECP_{reg,regg}^{INF}$, which is a bilateral measure of expenditures, into changes in bilateral trade costs between regions, which are measured as a share of trade value. This is done by pre-multiplying the bilateral measure of transport infrastructure investments ($ECP_{reg,regg}^{INF}$) by an elasticity that measures the effectiveness of transport infrastructure investments. This elasticity of trade costs with respect to the quality of infrastructure is retrieved from studies on TEN-T infrastructure (European Commission, 2009), since no comparable elasticities are available for Cohesion Policy investments in transport infrastructure. As a result, we obtain a transport infrastructure scenario that can be readily implemented in the model.

5 Simulation results

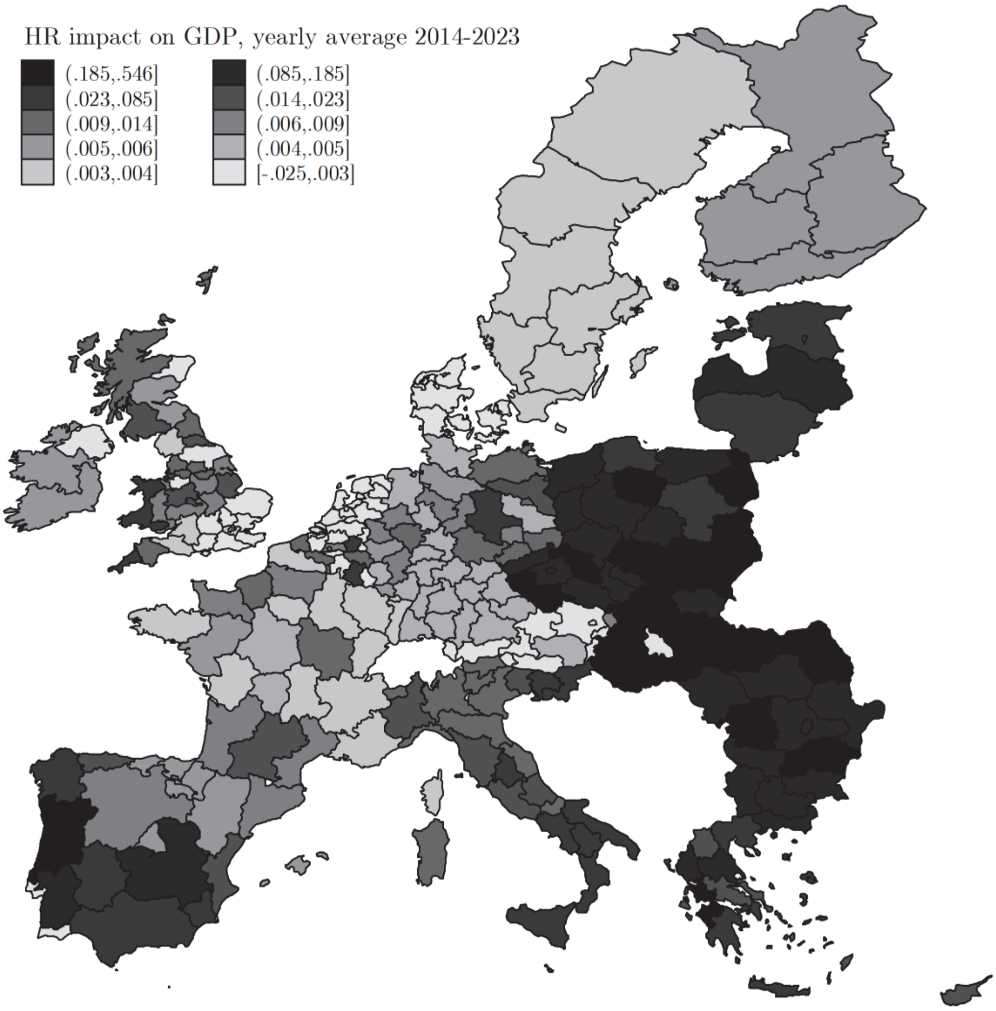
Given the high number of interactions and spillovers in RHOMOLO, regional shocks due to Cohesion Policy propagate quickly beyond regional borders. In fact, EU regions are highly interconnected through a dense network of trade in goods and services, flows of physical capital and technology that make the model and the interpretation of its results rather complex. Therefore, in order to fully capture the effects of each expenditure item and the role played by interconnections, we show the simulated impact of each measure in isolation and then their combination. Following the order proposed in the scenario construction (Section 4), we present first human-capital related policies, then R&D investments, followed by non-R&D subsidies and infrastructure investments. Finally, we show the overall impact of Cohesion Policy is obtained by combining the simulations and show the extent of spatial interrelations.

5.1 Interventions in the field of human capital

Cohesion Policy expenditures on human capital encompasses a wide variety of measures. It is projected to account for about 20 per cent of total Cohesion Policy expenditures for the 2014-2020 period. To simulate the effects on human capital in RHOMOLO, the Human Capital expenditures are assumed to lead to an increase in labour productivity, however at the cost of a temporal decrease in the regional labour supply. Formally, an expenditure on human capital of

Map 1

Impact of Interventions in the Field of Human Resources on NUTS 2 Regions GDP, 2014-2023
(yearly average)



1 per cent relative to local education expenditures is assumed to increase local labour productivity by 0.3 per cent.[13]

Increase in regional labour productivity implies an increase in regional GDP but also an increase in labour demand and wages, which, in the long run, will attract new migrants. The following map displays the impact expected by 2030 of investment in human resources under Cohesion Policy 2014-2020.

As Map 1 suggests, the overall effect of investment in human resources is clearly positive, especially in most of the Central and Eastern European Member States. This reflects the distribution of Cohesion Policy support which is much higher for less developed regions compared to the transition and more developed regions.

[13] This elasticity is taken from the literature (Sianesi and Van Reenen 2003).

However, the difference in regional impact also stems from other factors. First, investment in human resources is likely to produce a larger impact on GDP in regions where the level of local expenditure on education is low. These are indeed places where Cohesion Policy support will significantly change the level of public support provided to human resources. Second, RHOMOLO includes six industrial sectors which are more or less intensive in labour. Regions where the industrial fabric incorporates a larger proportion of labour intensive industries (such as for instance manufacturing) are likely to benefit more from an increase in labour productivity.

Finally, investment in human resources also generates spatial spillovers. As for infrastructure investments, the increase of GDP in the regions receiving support also benefits other regions because of the interregional trade links.

5.2 Interventions in the field of R&D

R&D is another key sector of intervention for Cohesion Policy and accounts for approximately 12 per cent of the total Cohesion Policy budget (or €42 billion) that is to be allocated to lines of expenditure associated with support to research, technological development and innovation (RTDI) during the 2014-2020 programing period. More than 60 per cent of this should be allocated to the less developed regions.

As discussed in Section 4.2, in RHOMOLO, support to RTDI is assumed to increase TFP. An increase in R&D affects GDP in several ways. First, GDP increases due to the fact that, as mentioned above, R&D leads to an increase in factor productivity. This also implies a reduction in the prices of intermediate inputs and hence of production costs which also contributes to increase GDP. Finally, the price of consumption goods also decreases which encourages demand and hence the level of economic activity. As for other fields of intervention, other regions benefit from a rise in GDP due to increased demand from the regions receiving RTDI support.

The model also accounts for spatial spillovers specific to R&D. Formally, it is assumed that the farther away a region from the technology frontier, the greater the potential for absorption and imitation of technological progress produced elsewhere. This not only implies that lagging regions are catching up on more advanced ones in terms of technology but also that an increase in R&D produces a bigger impact on factor productivity in regions where the level of technology is originally low.

The results of the simulation show positive effects in all regions, with very few exceptions due to the intensification of competition from catching-up regions (see Map 2). Czech, Hungarian, Polish and Portuguese regions benefit the most, with impacts on regional GDP of 1-2 per cent above the baseline in 2020. The impact on GDP in the less developed regions on average is somewhat higher than 1.2 per cent in 2020, after which it levels off to 0.2 per cent of the baseline in 2030. A renewed/continued increase in RTDI would be needed to keep the regional economies on a higher growth path.

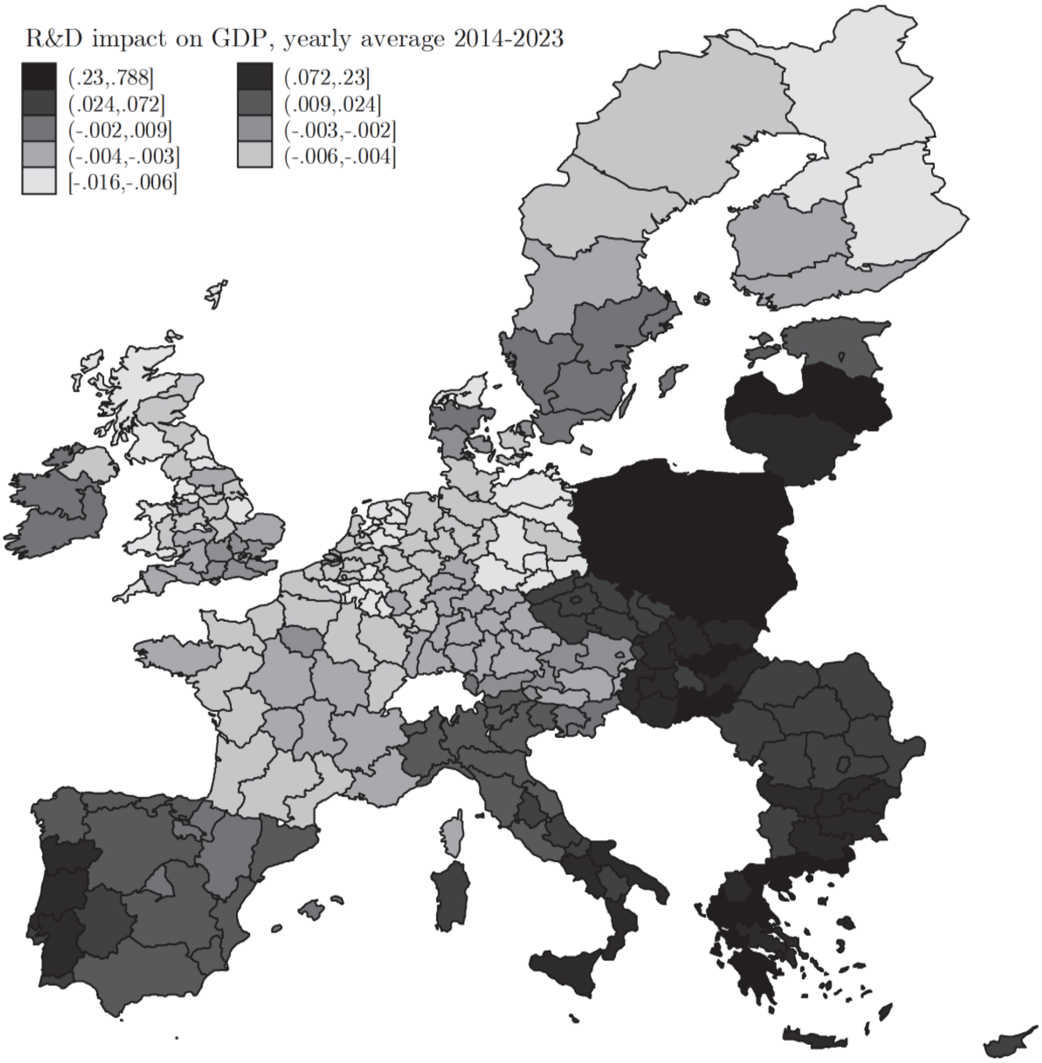
In general, the impact is higher in less developed regions than in transition regions. This is explained by the fact that less developed regions receive more support from Cohesion Policy than the two other groups and that R&D investment has a higher impact on TFP in lagging regions in terms of technology.

5.3 Interventions in the field of non-R&D subsidies

As explained in Section 4.3 and described at length in Diukanova and Lopez-Rodriguez (2014), non-R&D subsidies are another key component of the overall Cohesion Policy. Map 3

Map 2

Impact of Interventions in the Field of R&D on NUTS 2 Regions GDP, 2014-2023
(yearly average)



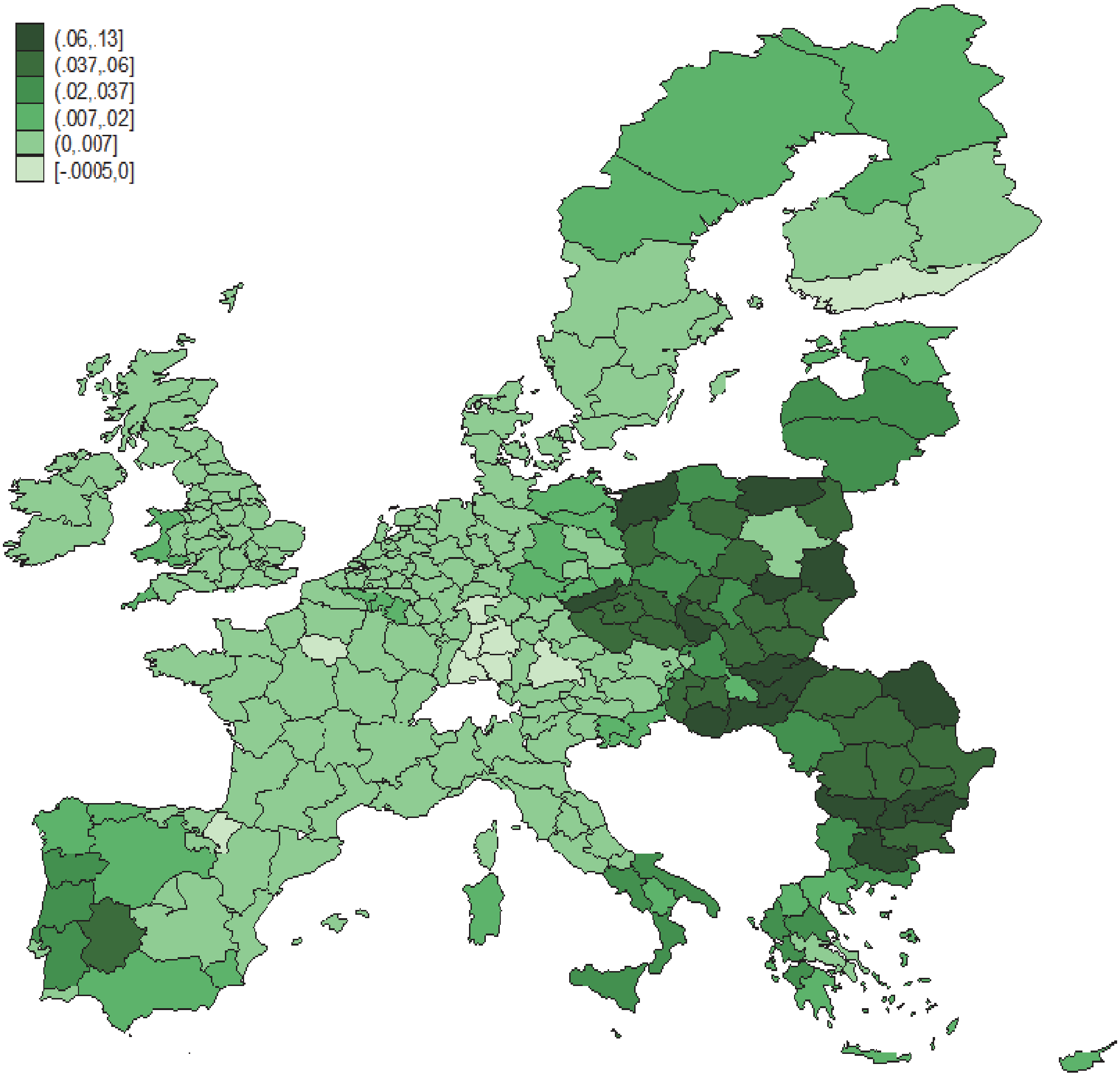
shows the impact of non-R&D subsidies on GDP across the NUTS2 regions in EU27. The impact on non-R&D subsidies is positive in all regions although their magnitude varies considerably between different types of regions. The most benefited regions are those located in the Eastern parts of Europe and the Southern European periphery (Greece, south of Italy Spain and Portugal). Central European regions only mildly benefit. The results of the simulations are highly correlated with the amount of non-R&D funds received.

5.4 *Interventions in the field of infrastructure*

Finally, investment in infrastructure represents an important part of Cohesion Policy funding. For the 2014-2020 period, it is projected that investments in infrastructure will be around €168 billion, about half of all funds available.

Map 3

Impact of Interventions in the Field of Non-R&D on NUTS 2 Regions GDP, 2014-2023
(yearly average)

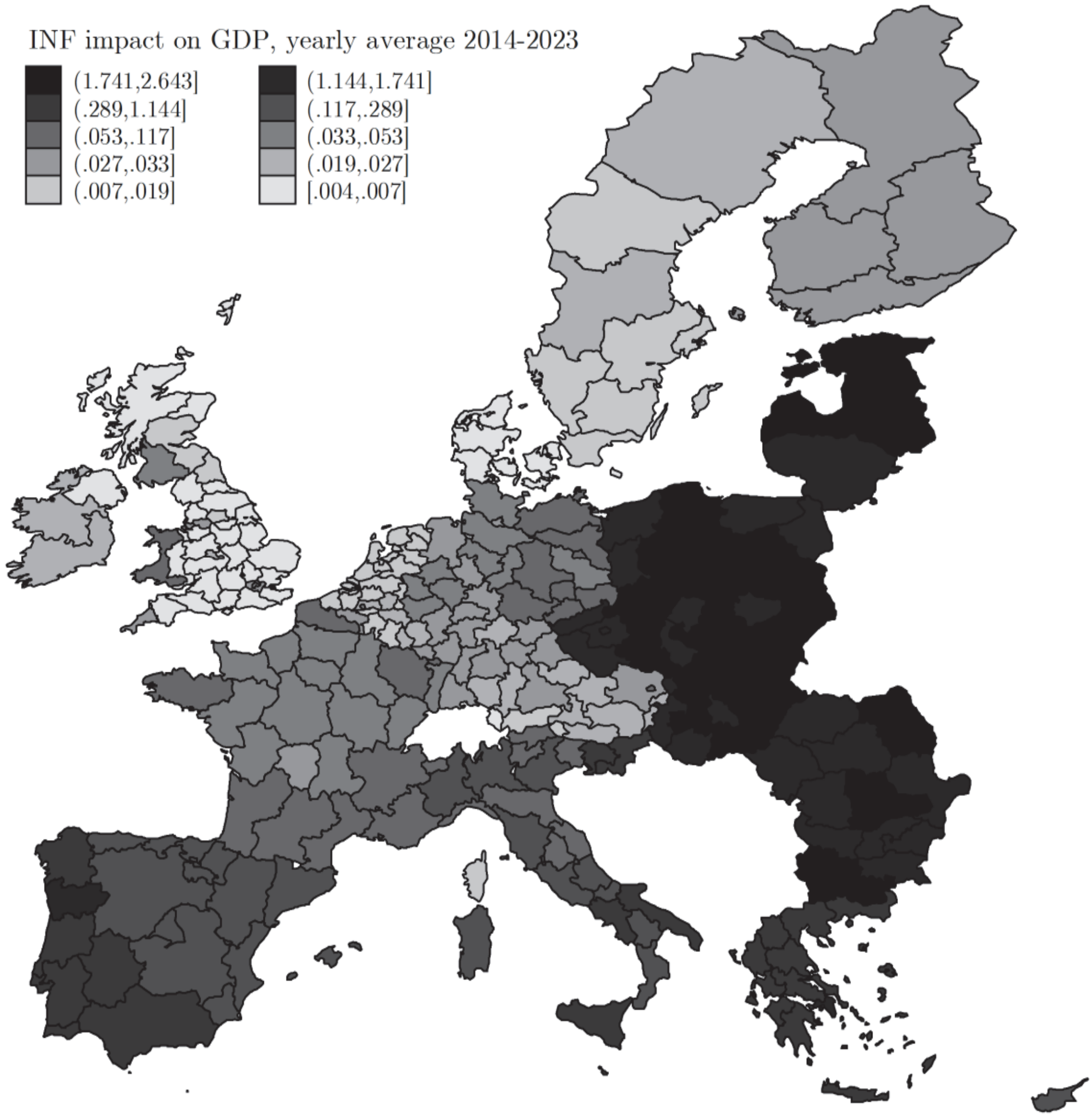


However, there are large differences between regions concerning Cohesion Policy expenditure on infrastructure. Indeed, larger amounts are allocated to less developed regions. In addition, the share of infrastructure in the allocation is also higher than in more developed regions. Accordingly, Cohesion Policy expenditures on infrastructure are considerably higher in less developed regions compared to transition and more developed regions.

In order to simulate the impact of Cohesion Policy investment in the field of infrastructure, the corresponding expenditure (in euros) needs to be 'translated' into changes in some of the model's parameters. Infrastructure investments are assumed to reduce transport costs between regions and the parameters representing transport costs are adjusted accordingly. Bilateral transport costs can be used to calculate an indicator of each region's accessibility. There are significant

Map 4

Impact of Interventions in the Field of Infrastructure on NUTS 2 Regions GDP, 2014-2023
(yearly average)

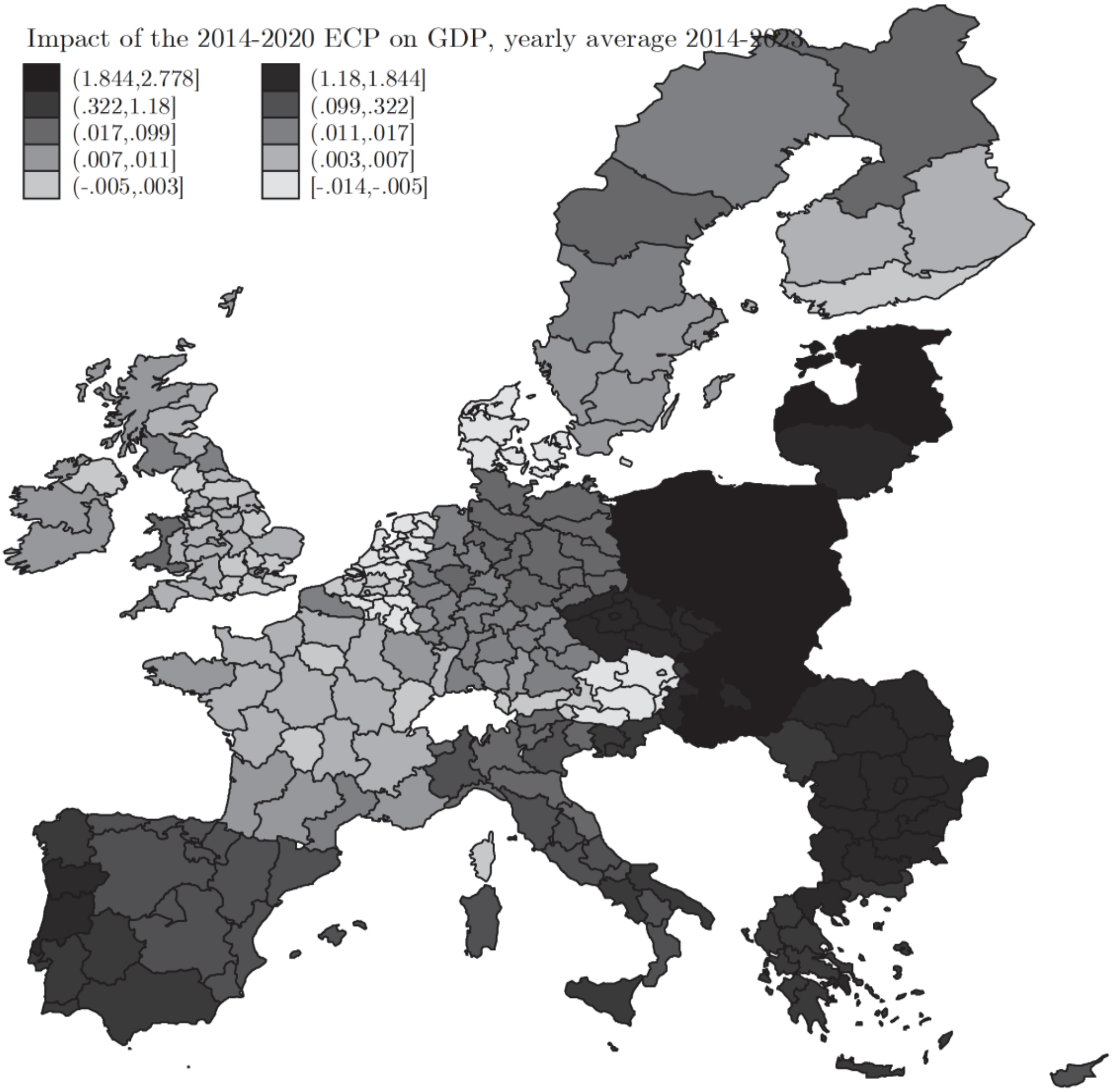


differences in transport cost reductions between regions and the largest improvements in accessibility take place in the less developed regions which reflects the expenditure pattern of Cohesion Policy.

Improvement in transport infrastructure means that regions have a better access to the EU markets which increases their exports and hence boosts the level of economic activity. Enhanced accessibility also implies a reduction in the price of imported intermediate goods and of consumption which contributes to reduce firms' production costs and increase real income of households. All these effects lead to an increase in regional GDP as shown in Map 4.

Map 5

Impact of the 2014-2020 Cohesion Policy Programmes on NUTS 2 Regions GDP, 2014-2023
(yearly average)



The largest returns of investment for improving accessibility are found in the less developed regions of the EU, due to the fact that it is in these regions where transport infrastructure is lacking and where improvement in accessibility investment makes thus the biggest difference.

The impact of investment in the field of infrastructure does not only materialise in the regions where the investment takes place. A region benefiting from enhanced accessibility increases its imports of goods from the other regions which in turn also experience an increase in their exports and hence their GDP. The impact of local intervention therefore has a tendency to progressively disseminate in space through the numerous trade links existing between the EU regions.

5.5 Simulating Cohesion Policy 2014-2020

We now turn to the simulation of the full Cohesion Policy package for the period 2014-2020. As mentioned above, RHOMOLO has been calibrated so as to follow the results of QUEST at the national level for each year and each Member State. This amounts to use RHOMOLO to disaggregate the results obtained with QUEST at the NUTS2 level. Map 5 shows the average annual impact for the implementation period (2014-2023). This can be considered as the short run as it corresponds to the period during which both demand side and supply side effects of the interventions are supposed to play.

The impact is particularly large for regions located in Eastern and Central Europe. It is the highest in the Polish regions of Śląskie, Podkarpackie, Małopolskie and Lubelskie as well as in Východné Slovensko (Slovakia) where, compared to the baseline scenario with no policy interventions, Cohesion Policy is expected to increase GDP by more than 3 per cent per year on average between 2014 and 2023. A number of regions in Southern Europe also benefit from a large positive impact of Cohesion Policy on their GDP. For instance, between 2014 and 2023 GDP is expected to increase on average by 1.7 per cent per year in Norte (Portugal) and by 1.5 per cent per year in Kentriki Makedonia (Greece).

This mainly reflects the fact that these regions are the main beneficiaries of Cohesion Policy. As resources allocated to these regions are generally high, one can expect to also observe a higher impact in terms of GDP. Such regions are also generally lagging behind in terms of infrastructure and hence are in a situation where investment in this field is likely to produce a particularly large impact. In addition, Cohesion Policy support in the fields of human resources adds much more to the total amounts dedicated to education in these regions than in regions of more developed Member States. Finally, they are in general relatively more specialised in labour intensive industries, which implies that they particularly benefit from investment in human capital and the increase in labour productivity that follows.

Even if regions located in more developed Member States benefit less from Cohesion Policy interventions, the impact of the policy still remains significant in a number of more developed regions. For instance, GDP is expected to increase on average by 0.11 per cent per year in Lazio (Italy) or by 0.12 per cent per year in West Wales and The Valleys (UK) during the implementation period. The impact is obviously smaller in these regions where the allocation of cohesion funds is more modest and which are already largely endowed in infrastructure and human capital and technology. However, these regions still benefit from their own Cohesion Policy programmes but also from those implemented in other regions, in particular the less developed regions.

6 Conclusions

This paper presented RHOMOLO, the European Commission's spatial CGE model used for ex-ante impact policy assessment of the EUs 267 NUTS2 regions at the 6 NACE Rev. 1.1 industry level, through a simulation of the planned Cohesion Policy for the years 2014-2020. The Cohesion Policy expenditures were grouped into four main categories, covering Research, Technical Development and Innovation (RTDI). Infrastructure, Human Capital and Aid to Private Sector. These expenditures are assumed to affect a set of parameters including factor productivity and transport costs that determine the model outcome.

A spatial CGE model such as RHOMOLO is essential for capturing the effects of Cohesion Policy but has its limitations. The Cohesion Policy expenditures were grouped into four main categories, covering "Research, Technical Development and Innovation", investment in Infrastructure, investment in human capital and "Aid to private sector". These expenditures are assumed to affect a set of parameters including factor productivity and transport costs, which determine the model outcome.

The main dynamics in RHOMOLO are the long-term effects of capital accumulation that continue even after the funding has ended. As inter-temporal optimisation and forward-looking expectations are not currently included, inter-temporal dynamics of the simulations are not always reliable. Therefore, RHOMOLO has been calibrated to the European Commission's QUEST III model to obtain consistent results for each year and each Member State. What can also be done is to filter the input of the simulations through a module which incorporates more sophisticated dynamics than what we use currently in the model.

ANNEX 1
THE REGIONAL SOCIAL ACCOUNTING MATRIX

	Commodities	**Industries**	**Value Added Inputs**	**Final Demand Sectors**	
Commodities		Intermediate Demand		Final Demand	Exports
Industries	Output				
Value Added Inputs	Taxes less Subsidies on Products	Value Added and Taxes			
Final Demand Sectors			Sources of Value Added		Incoming Transfers
	Imports			Outgoing Transfers	
	Trade & Transport Margins				

ANNEX 2
CATEGORIES OF COHESION POLICY EXPENDITURES

Categories of Expenditure 2007-'13	
Research and technological development (R&TD), innovation and entrepreneurship	
1	R&TD activities in research centres
2	R&TD infrastructure (including physical plant, instrumentation and high-speed computer networks linking research centres) and centres of competence in a specific technology
3	Technology transfer and improvement of cooperation networks between small and medium-sized businesses (SMEs), between these and other businesses and universities, post-secondary education establishments of all kinds, regional authorities, research centres and scientific and technological poles (scientific /technological parks, technopoles, etc.)
4	Assistance to R&TD, particularly in SMEs (including access to R&TD services in research centres)
5	Advanced support services for firms and groups of firms
6	Assistance to SMEs for the promotion of environmentally-friendly products and production processes (introduction of effective environment managing system, adoption and use of pollution prevention technologies, integration of clean technologies into firm production)
7	Investment in firms directly linked to research and innovation (innovative technologies, establishment of new firms by universities, existing R&TD centres and firms, etc.)
8	Other investment in firms
9	Other measures to stimulate research and innovation and entrepreneurship in SMEs
Information society	
10	Telephone infrastructures (including broadband networks)
11	Information and communication technologies (access, security, interoperability, risk-prevention, research, innovation, e-content, etc.)
12	Information and communication technologies (TEN-ICT)
13	Services and applications for the citizen (e-health, e-government, e-learning, e-inclusion, etc.)
14	Services and applications for SMEs (e-commerce, education and training, networking, etc.)
15	Other measures for improving access to and efficient use of ICT by SMEs
Transport	
16	Railways
17	Railways (TEN-T)
20	Motorways
21	Motorways (TEN-T)
26	Multimodal transport
27	Multimodal transport (TEN-T)
28	Intelligent transport systems
29	Airports
30	Ports
32	Inland waterways (TEN-T)

Energy	
34	Electricity (TEN-E)
36	Natural gas (TEN-E)
38	Petroleum products (TEN-E)
39	Renewable energy: wind
40	Renewable energy: solar
41	Renewable energy: biomass
42	Renewable energy: hydroelectric, geothermal and other
43	Energy efficiency, co-generation, energy management
Environmental protection and risk prevention	
52	Promotion of clean urban transport
Increasing the adaptability of workers and firms, enterprises and entrepreneurs	
62	Develop life-long learning systems and strategies in firms Training and services for employees to step up adaptability to change Promoting entrepreneurship and innovation
63	Design and dissemination of innovative and more productive ways of organising work
64	Development of specific services for employment, training and support in connection with restructuring of sectors and firms and development of systems for anticipating economic changes and future requirements in terms of jobs and skills
Improving access to employment and sustainability	
65	Modernisation and strengthening of labour market institutions
66	Implementing active and preventive measures on the labour market
67	Measures encouraging active ageing and prolonging working lives
68	Support for self-employment and business start-up
69	Measures to improve access to employment and increase sustainable participation and progress of women in employment to reduce gender-based segregation in the labour market and to reconcile work and private life, such as facilitating access to childcare and care for dependent persons
70	Specific action to increase participation of migrants in employment and thereby strengthen their social Integration Improving the social inclusion of less-favoured persons
71	Pathways to integration and re-entry into employment for disadvantaged people; combating discrimination in accessing and progressing in the labour market and promoting acceptance of diversity at the workplace
Improving human capital	
72	Design, introduction
73	Measures to increase participation in education and training throughout the life-cycle, including through action to achieve a reduction in early school leaving, gender-based segregation of subjects and increased access to and quality of initial vocational and tertiary education and training
74	Developing human potential in the field of research and innovation, in particular through post-graduate studies and training of researchers and networking activities between universities, research centres and businesses’

Non-Lisbon	
10	Telephone infrastructures (including broadband networks)
44	Management of household and industrial waste
45	Management and distribution of water (drink water)
46	Water treatment (waste water)
50	Rehabilitation of industrial sites and contaminated ¡and
53	Risk prevention (...)
61	Integrated projects for urban and rural regeneration
75	Education infrastructure
77	Childcare infrastructure
18	Mobile rail assets
19	Mobile rail assets (TEN-T)
22	National roads
23	Regional/local roads
24	Cycle tracks
25	Urban transport
31	Inland waterways (regional and local)
33	Electricity
35	Natural gas
37	Petroleum products
44	Management of household and industrial waste
45	Management and distribution of water (drinking water)
46	Water treatment (waste water)
47	Air quality
48	Integrated prevention and pollution control
49	Mitigation and adaption to climate change
50	Rehabilitation of industrial sites and contaminated land
51	Promotion of biodiversity and nature protection (including Natura 2000)
53	Risk prevention.
54	Other measures to preserve the environment and prevent risks
55	Promotion of natural assets
56	Protection and development of natural heritage
57	Other assistance to improve tourist services
58	Protection and preservation of the cultural heritage
59	Development of cultural infrastructure
60	Other assistance to improve cultural services
61	Integrated projects for urban and rural regeneration
75	Education infrastructure
76	Health infrastructure
77	Child care infrastructure
78	Housing infrastructure
79	Other social• infrastructure
80	Promoting the partnerships, pacts and initiatives through the networking of relevant stakeholders
81	Mechanisms for improving good policy and programme design, monitoring and evaluation
82	Compensation of any additional costs due to accessibility deficit and territorial fragmentation
83	Specific action addressed to compensate additional costs due to size market factors
84	Support to compensate additional costs due to climate conditions and relief difficulties
85	Preparation, implementation, monitoring and inspection
86	Evaluation and studies; information and communication

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COMMENT TO
"ASSESSING POLICY OPTIONS FOR THE EU COHESION POLICY 2014-2020" BY ANDRIES BRANDSMA, FRANCESCO DI COMITE, OLGA DIUKANOVA, D'ARTIS KANCS, JESUS LÓPEZ RODRÍGUEZ, DAMIAAN PERSYN AND LESLEY POTTERS

Teresa Ter-Minassian[*]

I appreciate the opportunity to comment on this interesting paper on assessing policy options for the EU Cohesion policy 2014-2020. This policy is an important part of the EU's institutional architecture, accounting for about one third of the EU's budget. It has acquired increased importance in recent years, as many EU countries have been forced by the crisis to cut back public investments. The policy has evolved over time, reflecting the expansion of EU membership, and its changing development needs, in particular gaps in infrastructure and human capital.

Not surprisingly, there has been a spate of cross-country, cross-region, and national studies that have attempted to assess the effectiveness of the policy.[1] The evidence from the studies is mixed, but on balance it suggests that the policy has been more effective in promoting convergence in national growth rates within the EU than in reducing within-countries regional disparities.

Recent spatial economics literature highlights the advantages of agglomeration and the consequent policy challenges in promoting economic convergence of relatively isolated and backwards regions with faster-growing metropolitan areas. A number of studies have emphasized the obstacles to convergence posed by weaknesses in institutions (e.g., corruption, legal uncertainties, and poor administrative capacities).

The reformulated Cohesion Policy for 2014-20 aims to address some of these issues. Specifically, it aims to combine the regional convergence objective with those of the Europe 2020 strategy, namely: innovation; increased competitiveness; employment growth; environmental sustainability; and social inclusion. This new approach is reflected in an increased focus on: investments in R&D; SMEs; the environment; access to high speed internet; and labor market programs.

The main instruments of the Cohesion Policy for 2014-2020 are: five structural funds (ESIFs), with common streamlined rules; and partnerships with national governments, with levels of support and co-financing varying depending on the level of the country's development. A key feature is an increased focus on strengthening governance, including at the sub-national levels of government. National strategies supported by the Cohesion Policy must be broadly consistent with structural reform priorities identified in the European Semester.

The paper by the EC's Regional Economic Modelling Team represents a useful attempt to evaluate ex-ante the expected impact of the Cohesion Policy for 2014-20. It presents the methodology and results of a simulation of the growth impact of the budgeted expenditures under 4 main lines of the policy (Human capital, R&D, Aid to Private Sector, and Infrastructure) on 267 EU regions. The simulation uses a spatial CGE model (RHOMOLO), supplemented by other analytical tools as needed (SAMs, and the TRANSTOOL model to analyze the impact of the policy on transport costs). The paper does not attempt to model the effects of Cohesion spending on capacity-building.

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[*] Formerly IMF.

[1] See Shankar and Shaw, 2009 for a comprehensive literature review.

The paper's key assumptions can be briefly summarized as follows:

- Cohesion expenditures on human capital (21 per cent of the total) are assumed to reduce labor supply and increase workers' productivity in a ratio of 0.3 to 1;
- The expenditures on R&D (12 per cent of total) are modeled as increasing (with a distributed lag) total factor productivity (TFP). The impact is assumed to be greater the farther away is the region from the technology frontier;
- Subsidies to non-RD&D private innovation activities (12 per cent of total) are also assumed to boost TFP with an elasticity of 0.15-0.18;
- The impact of infrastructure investments (49 per cent of total) on bilateral trade costs is modeled with a three-step procedure.

The different policy interventions are simulated first separately and then jointly. The distribution of the effects of the different components of the policy varies across regions, partly reflecting differences in initial conditions (skills and infrastructure gaps). The combined impact of the policy is estimated to boost the average EU GDP by 0.4 per cent, that of the newer members (EU13) by 2.6 per cent, and that of the EU15 by 0.2 per cent. Much of the difference in the effects reflects differences in the allocation of the funding. However, differences in initial gaps and in production structures also play a role.

In my view, the paper provides a valuable and carefully constructed analysis of a very relevant policy question, using state- of-the-art analytical tools. As for any analysis based on a CGE model, its results depend heavily on the assumptions underlying its specification and main parameters. The relevant literature shows significant variance in the available empirical estimates of the parameters.

For this reason, it would be desirable to test the robustness of these assumptions through a range of sensitivity analyses, in particular regarding the elasticities of labor and total factor productivity to positive spending shocks. It may also be desirable to analyze to what extent differences in labor productivity among the six sectors included in the model affect the estimated impact of industry-specific interventions.

I think that a significant limitation of the analysis is the fact that the quality of institutions does not influence in the model the effectiveness of the Cohesion Policy funds. This limitation largely explains why the impact of the funds is found to mostly mirror their projected geographic distribution. Yet, as found by some of the studies mentioned above, capacity constraints can affect the rate of absorption of the funds, and leakages due to inefficiencies and corruption can and do impact adversely their growth and employment stimulation potential.

A formal incorporation of this important dimension in the model may be prevented by a lack of comparable regional indices of the quality of institutions in the EU. However, it may be possible to supplement the model-based analysis with more detailed qualitative case studies of a few regions projected to be especially successful (or unsuccessful) in utilizing the Cohesion Policy funds (as measured by the projected ratio of impact to funds allocation). Such case studies should attempt to identify potential institutional obstacles to the effectiveness of the funds, and suggest possible remedial actions.

Session 3

OTHER FISCAL POLICY ISSUES

THE EFFECT OF LOW INFLATION ON PUBLIC FINANCES

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The paper analyses the impact of an unanticipated disinflation shock and finds evidence of an adverse impact on fiscal balances given rigidities in nominal government spending, which limit the downward adjustment to lower inflation, whereas revenues tend to decline much faster. Moreover, the impact on the debt-to-GDP ratio tends to be stronger and more persistent given the adverse implications of the denominator effect. Country specific features are found to play an important role, whereas second round, though important, effects coming from the impact of low inflation on real GDP growth are not fully taken into account given the lack of available evidence for euro-area countries.

Given the gradual decline in inflation rates in the euro area and the weak growth performance in several member countries, this paper aims to analyse the direct transmission mechanisms of inflation developments on public finances by taking into account country-specific features.

The paper provides evidence that an unanticipated disinflation shock has an adverse impact on fiscal balances given rigidities in nominal government spending, which limit the downward adjustment to lower inflation, whereas revenues tend to decline much faster. Moreover, the impact on the debt-to-GDP ratio tends to be stronger and more persistent given the adverse implications of the denominator effect. Country specific features are found to play an important role, whereas second round, though important, effects coming from the impact of low inflation on real GDP growth are not fully taken into account given the lack of available evidence for euro-area countries.

This is one of the few papers providing a comprehensive analysis of the fiscal effects of low inflation. It focuses on the case of Germany, France, Italy, Austria and Greece and looks into the transmission channels of low inflation on the main fiscal aggregates in two steps.

First, by using the fiscal forecast model of each National Central Bank, the paper presents model based simulations where country-specific features regarding the dynamics of expenditures and receipts are documented in detail and taken into account for a deeper understanding of how price shock translates to government balances in the simulations displayed. In particular, the paper finds that in response to an unexpected (temporary) disinflation shock of −1p.p. the primary balance deteriorates on average by 0.15p.p. of GDP in the first year. This is attributed to the

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finding that total nominal revenues decline more than nominal primary expenditures which, at least initially, display some rigidity. The size and duration of the deterioration in the primary balance tends to be country specific. Moreover, if lower inflation feeds through to lower market interest rates (i.e., via lower inflation expectations), the impact on the headline budget balance would be cushioned by the reduction in interest payments on newly issued debt. The effects tend to be stronger in case the growth rate of the GDP deflator turns negative.

Second, using the findings of the simulations on the effect on the primary balance, the paper looks at the effects of an inflation shock on debt sustainability. The effect on the debt-to-GDP ratio tends to be more sizeable, due to the denominator effect. Moreover, the larger the initial debt-to-GDP ratio, the more vulnerable a country is to unexpected negative shocks to inflation. This debt sustainability analysis shows that a permanent low inflation shock leads to an average increase in the debt ratio of 11p.p. of GDP over ten years, which implies heightened debt sustainability risks for some countries. The note finds that in case inflation would turn negative, the adverse impact on the fiscal variables would be larger.

1 Introduction

While it is crucial that monetary and fiscal policy authorities are clearly separated in terms of objectives and instruments, it has to be acknowledged that there are strong interdependencies between monetary and fiscal developments.[1] Indeed, both monetary and fiscal policy impact similar key macroeconomic variables (e.g., aggregate demand, real interest rates and risk premia) (Sargent & Wallace 1980, Aiyagari & Gertler 1985, Sims 1988, Walsh 2010). These interdependencies are particularly challenging in the current low inflation and low growth environment. Since 2011 inflation rates across the euro area have fallen gradually on account of a number of factors, and remain below the ESCB's medium-term objective, while the conventional monetary policy instruments have reached the zero lower bound. At the same time, euro-area countries' fiscal positions remain weak following the unsound policies of the past, but also the effect of the financial and economic crisis and the still weak recovery. In most countries, the need for further consolidation remains and there is a risk that persistently low or negative inflation further aggravate the weak fiscal position of euro area sovereigns.

Economic analysis suggests that, *coeteris paribus*, a disinflation shock worsens both the headline and the primary budget balance and increases the debt-to-GDP ratio. The first effect is modest and short-lived, but the second is larger and more persistent.

In the present paper, after reviewing the main channels through which inflation influences public finances, we will shed more light on these effects by looking on a subsample of euro-area countries (Germany, France, Italy, Austria and Greece).

Based on the fiscal forecast models of individual central banks, we find that a 1p.p. temporarily lower inflation rate worsens the primary balance on average by 0.15p.p. of GDP on impact. Furthermore, to the extent that lower inflation passes through to market interest rates (via lower inflation expectations), the ensuing decline in interest payments would have a cushioning effect on the headline balance, which, on average, would deteriorate by about 0.05p.p. of GDP on impact. The effect on the fiscal balances tends to be transitory and to fade away by the end of the third year. Country specific circumstances (e.g., a temporary suspension of indexation mechanisms) may heighten the sensitivity of the fiscal balances to inflation developments and imply a more persistent deterioration. A high debt-to-GDP ratio is another important vulnerability

[1] The separation is needed to avoid that fiscal authorities force central banks into accommodating their policies while disregarding price stability objectives.

factor. Illustrative simulations of the effects of a negative inflation shock are also presented for the case of France.

Low/negative inflation has also implications for debt sustainability. The DSA presented in section 5 finds sizeable effects from low inflation on the debt-to-GDP ratio, especially for countries starting from a high debt-to-GDP ratio. The average increase in the debt-to-GDP ratio is about 11p.p. for a permanent low inflation shock.

A disinflation shock is not a major hindrance to comply with SGP requirements. Given the limited effects of low inflation on public finances, section 6 argues that these are too small to obstruct compliance with SGP requirements. While there is no specific definition in the SGP of a severe economic downturn, should tail risks and deflation materialise, an application of the general escape clause might need to be considered. However, if negative inflation materialises in the absence of a severe economic downturn, the general escape clause will likely not apply.

The effects on public finances are likely to be exacerbated if inflation turns negative. On the fiscal side proper, negative inflation would possibly lead to a more pronounced impact from the downward rigidity of some government spending (e.g., social payments and compensation of employees), hence a stronger deterioration of the fiscal position. However, a full understanding of the effects of negative inflation on public finances is beyond the scope of this note given the uncertainty surrounding its macroeconomic effects. The latter depend, in the first place, on the nature of the inflation shock. If negative inflation reflects a supply-side shock (e.g., a positive technology shock or cost competitiveness improvements) that is not monetarily accommodated, the effect on public finances is positive as the decline in the price level is accompanied by an increase in the actual and natural level of output (Bordo *et al.* (2004)). If negative inflation originates from a collapse in aggregate demand, output and employment would decline given the downward rigidity of nominal input prices, including wages, which reduce firms' margins. Moreover, to the extent that the monetary policy is constrained by the zero lower bound, real interest rates would increase thus further hitting the real economy.[2] In these circumstances, negative cyclical developments are likely to weight significantly on public finances.

The rest of the paper is as follows. In section 2, we discuss in general terms the impact of inflation on public finances, reviewing both the analytics and the available empirical evidence; we highlight three different channels of transmission of the inflation shock to the debt-to-GDP ratio. We then try to measure this impact both separately for each channel (section 3) and globally (section 4) for a subset of European countries. the effects on debt sustainability are also looked at (section 5). In section 6 we draw some policy implications. Section 7 concludes.

2 The effects of inflation on fiscal policy: an overview

According to the empirical literature, changes in the price level may have significant effects on debt dynamics. Aizenman & Marion (2011, 538) find that an unanticipated inflation shock of the order of 6 per cent could reduce the debt/GDP ratio by up to 20 per cent within 4 years. Investigating the impact of inflation on the public debt in the G7 countries, Akitoby *et al.* (2014) find that if "inflation were to fall to zero for five years, the average net debt-to-GDP ratio would increase by about 5 percentage points over the next 5 years".[3] Hall & Sargent (2010) decompose

2 In this context, inflation expectations are crucial. If deflation becomes anticipated, than the expectation of a further decline in prices may reinforce the negative output effects. This occurs, for example, when in anticipation of further declines in prices, firms and households postpone investment and consumption choices respectively, this causing a further fall in aggregate demand and a prolonged economic slump. This vicious circle triggers a "deflationary spiral", which however, is not explicitly considered in this note.

3 The paper simulates the effect of inflation on base money creation (seigniorage) and the erosion the real value of the debt.

the post-war debt reduction in the US into contributions from negative real returns on government bonds, primary surpluses, and growing real income. They find that higher inflation accounted for only 20 per cent of the 85 per cent decline in the debt-to-GDP ratio achieved over the period 1946-1974.

Theoretically, inflation affects fiscal outcomes through a number of channels (Tanzi *et al.*, 1987; Abbas *et al.*, 2013), in particular via: (1) the real debt stock; (2) market interest rates; (3) primary public expenditures and tax revenues.[4]

To illustrate the first channel, one could start from the well-known dynamic debt accumulation equation:

$$\Delta b_t = \frac{i_t - g_t}{1 + g_t} b_{t-1} - pb_t \tag{1}$$

where b_t is the debt-to-GDP ratio, i_t is the average nominal (effective) interest rate, g_t is the nominal GDP growth rate, pb_t is the primary balance-to-GDP ratio at time t.

Indeed, equation (1) can be reformulated by expressing the total debt-to-GDP ratio as the sum of b_t^S the portion of debt that is sensitive to inflation (*i.e.,* short-term debt, foreign-currency denominated debt, long-term variable-interest or inflation-indexed debt) and b_t^{NS} the portion which includes only domestic-currency denominated, long-term, non-indexed debt:[5]

$$b_t^{TOT} = b_t^S + b_t^{NS} = \frac{1+i}{1+g} b_{t-1}^S + \frac{1+i^*}{1+g} b_{t-1}^{NS} - pb_t \tag{2}$$

where i is the interest rate on b_t^S, i^* is the interest rate on b_t^{NS}; g is the growth rate of nominal GDP and pb_t is the primary balance.[6] Equation (2) can be further rearranged and expressed as (see Annex 2):

$$b_t^{TOT} = \frac{1+r}{1+n} b_{t-1}^S + \frac{(1+r^*)(1+\pi_t^{\exp})}{(1+n)(1+\pi_t)} b_{t-1}^{NS} - pb_t, \tag{3}$$

where n is the real growth rate, r and r^* are respectively the real exchange rate required by investors in period t–1 on the b^S and the b^{NS} portion of the debt, and π_t^{exp} is the rate of inflation in period t expected by investors in period t–1. The first term on the right hand side of equation (3) captures the contribution to the debt-to-GDP dynamics of the component of debt whose cost is inflation-sensitive. This term does not depend on inflation as it is the sum of the debt outstanding from the previous period, which depends negatively on inflation, and interest payments, which depend positively on inflation. These two opposing effects on the debt-to-GDP ratio cancel out.

To the extent that period t inflation is unexpected, the second term in equation (3), clearly does depend negatively on inflation.

[4] This note abstracts from seignorage revenues. Governments typically receive revenues from the operating profits of the central bank. For the euro area, the "Protocol on the Statute of the European Central Bank" states that ECB profits are distributed in accordance with paid-up shares of member countries in European Central Bank capital. Operating profits broadly originate from the change in the monetary base (seigniorage) as well as interest income (Buiter 2007). Government seigniorage revenues are thus often understood as an inflation tax, *i.e.*, the financial loss of value suffered by holders of currency (e.g., Fischer, 1982). However, seigniorage accounts for a very small percentage of government revenues in industrialised countries (Hilscher *et al*., forthcoming).

[5] A more detailed version of this equation is discussed in Akitoby *et al.* (2013).

[6] For ease of exposition, we did not take into account that the various components of b_t^{NS} might have different interest rates, and we disregard time sub-indices. The equation also assumes a full Fisher effect. This will be relaxed below.

Moreover, it is worth noting that the real interest rate (r*) may decrease if inflation increases – this is the second channel mentioned at the beginning of this section.

Indeed, the sensitivity of the debt-to-GDP-ratio to the inflation rate is a function not only of the size and the structure of debt, but also on the pass-through from low inflation to nominal interest rates. In particular, when the pass through from low inflation to the nominal interest rate is 1 (so-called full Fisher effect) the formula for the elasticity of debt to inflation is:[7]

$$\varepsilon_{b_t^{TOT},\pi_t} = -\left(\frac{\pi}{1+\pi}\right)\left(\frac{b_t^{NS}}{b_t^{TOT}}\right). \tag{4}$$

But when the pass-through is less than one, the elasticity is:

$$\varepsilon_{b_t^{TOT},\pi_t} = -(1-k)\left(\frac{\pi}{1+\pi}\right)\left(\frac{b_t^{S}}{b_t^{TOT}}\right)-\left(\frac{\pi}{1+\pi}\right)\left(\frac{b_t^{NS}}{b_t^{TOT}}\right). \tag{4'}$$

where we have defined $(1+i)=(1+r)(1+k\pi_t)$, where $k\leq1$ (k=1 in the full Fisher effect). Equation (4’) differs from equation (4) for the first terms on the right hand side. The intuition behind this term is straightforward. With k=1 inflation reduces the debt-to-GDP ratio only via b_t^{NS}. With k<1 also b_t^{S} contributes, because the outstanding-debt effect on b_t^{S} is only partially counterbalanced by the increased interest payments effect. This happens because also the real interest rate r due on b_t^{S} is reduced by inflation, as now the nominal interest rate (i) reacts less than 1-to-1 to π.

Empirical evidence suggest that the pass-through could be lower than one. Several studies (Feldstein & Summers 1978, Ardagna *et al.* 2007, Laubach 2009) find that a 1 percentage point increase in expected inflation leads to an increase in bond yields in the range of 0.1 and 0.3 percentage points. Caporale & Williams (2002), find that inflation expectations play a greater role for interest rates in countries with a history of volatile inflation than in those with a history of low and stable inflation. Similarly, Arslanalp and Poghosyan (2014) argue that for advanced economies the smaller impact of inflation on interest rates could be explained by the relatively low and well anchored inflation expectations in these countries thus diminishing their importance for long-term investors.

To assess the degree to which the Fisher effect is valid for today’s Europe, we regressed daily changes in the 10-year overnight index swap (OIS) on daily changes in inflation expectations measured by inflation swap rates at 10-year maturity: the estimated coefficient over the daily period 1 April 2005-25 August 2014 amounts to 0.61, is highly statistical significant and rather stable.

We also performed a more formal multivariate analysis, using a panel regression with country fixed effects and controlling for the level of government debt, expected real GDP growth 1-year ahead, the sovereign bid-ask spread, and a proxy of the redenomination risk premium (the USD/EUR option price at 1-year maturity). We found in this case a pass-through from the 10-yr OIS rate to the 10-yr sovereign yield is close to 1 (estimated for a cross-section of the largest 10 euro-area countries over the period Oct 2003 to July 2014, monthly frequency; the results are supported by a Pedroni residual cointegration test, which suggests that the residuals of the panel regression are stationary).

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7 For ease of exposition we assume here that the primary balance does not react to unexpected inflation shock. This effect will be discussed in more detail in the following sections.

All in all, our results[8] suggest that the short-term pass-through from long-term expected inflation to long-term nominal sovereign yields is quite high, and the Fisher hypothesis can be considered –at monthly frequencies – a good approximation of reality

Concerning the third channel (primary balance), the overall negative effect on the primary balance can be considered limited and transitory. On the spending side, a decrease in the prices of goods and services reduces nominal intermediate consumption and government investment. It also reduces spending on compensation of public employees, pensions and other transfers, as long as those payments are indexed to price developments. Barro (1979) and Dwyer (1982) argue that in order to maintain the same anticipated real amount of spending, governments adjust their deficit to unanticipated inflation rate changes. However, in practice public expenditures are unlikely to adjust to inflation automatically. Expenditures, including discretionary spending, are decided in a discretionary manner every year by government entities in the context of the budgetary process. Public wages and transfers are usually fixed for even longer periods, and indexation rules may apply with a lag. Unanticipated lower inflation may thus cause expenditures to increase as a ratio to GDP, at least in the short term.

Inflation can affect tax revenues on account of (nominal) fiscal drag (Kremer, 2006; Creedy and Gemmell, 2007; Lee, 2011). Progressive income taxes imply that increases in wages in line with inflation increase government real tax revenues by pushing nominal incomes into higher tax brackets ("bracket creep"). A deceleration in the rate of inflation mitigates this effect. Negative inflation can lead to a reversal of the fiscal drag and may – where nominal wages start falling – imply a fall in real tax revenues. Heinemann (2001, 543) finds that in many OECD countries with strongly progressive tax systems, inflation is "helpful in increasing revenues from individual income taxes and social security contributions" on account of the fiscal drag. Immervoll (2005) in a study of the tax systems in Germany, the Netherlands and the U.K. finds that the bracket creep has a substantial effect on individual tax burdens in the absence of automatic inflation adjustment mechanisms. At the same time, inflation has a negative effect on real revenues for taxes with a significant collection lag. Inflation automatically reduces real revenues for taxes with a considerable lag between the taxable event and the moment the tax is actually paid (Escolano 2010).

3 Public finances in a low (negative) inflation environment: a look at selected euro-aurea countries

The effect of an unexpected disinflation shock on public finances depends on the structure of government spending, the tax system and the structure/size of government debt. This section focuses on selected euro-area countries (Germany, France, Italy, Austria and Greece) for which detailed information on key fiscal aggregates (*i.e.,* primary expenditures, revenues, interest payments and the debt stock) and how they are likely affected by inflation developments is available.[9] After summarising the key transmission channels, a model-based simulation of the impact of low inflation on public finances is obtained using the fiscal forecast models of the NCBs. Finally, an illustrative quantification of the effects of negative inflation for the case of France is provided.[10]

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[8] Results are available from the authors upon request.

[9] This information has been collected by the working team on the basis of a detailed questionnaire prepared and filled in by the NCBs experts participating in the working team.

[10] The model based analysis presented in this section, however, is a partial analysis as it is not based on a fully consistent macroeconomic scenario.

3.1 The Primary balance channel (1): primary expenditure

Indexation of government spending is common to all countries under consideration and CPI inflation is the most commonly used index (see Table 1). The share of total spending which is indexed ranges from 29 per cent (13.3 per cent of GDP) in Germany, to 60.8 per cent (31.9 per cent of GDP) in Italy. In Germany, however, less than 5 per cent of total spending is directly indexed to inflation. Since 2009-2010, however, indexation mechanisms have been suspended either entirely or partly in both Italy and France in the context of the ongoing consolidation efforts of the respective governments. As a result, the effective indexation is smaller (for Italy it falls to 21 per cent of GDP). In Greece all indexation mechanisms operating before the country entered the economic adjustment programme have been suspended.

Discretionary spending, (e.g., intermediate consumption and public investment) is usually budgeted in nominal terms at the beginning of the budgetary process. Budgeting is done in a top-down manner (*i.e.,* spending envelopes across entities are decided centrally by the Minister of Finance) in France, Italy and Germany, and bottom-up (*i.e.,* based on consultation with various entities) in Austria and Greece. Spending envelopes are usually set in nominal terms and in France, Germany and [Italy], they are based on expected inflation developments, whereas in Austria a medium-term path is set for the period t+4 which, however, is not linked to inflation developments. Unexpected changes in inflation usually transmit to this type of spending with a time lag, because most of these expenditures are controlled by lower levels of government. They usually adjust their spending behaviour only in the medium-term, while relying on budget-deficits in the short-term.

3.2 The Primary balance channel (2): Tax revenues

Personal income taxes are levied progressively in all countries under consideration, though only France legally indexes the tax brackets of its personal income tax to inflation (of year t–1) thus limiting the fiscal drag to real component (see Table 2) . However, such indexation has been suspended for 2012 and 2013 for consolidation reasons, whereas for the remaining countries in our sample, both a nominal and real fiscal drag effect is at work. The overall fiscal drag typically amounts to revenues of up to 0.2 per cent of GDP annually over the last 15 years.

Corporate income taxes are progressive only in Greece and France but no bracket indexation is foreseen. For these two countries the nominal fiscal drag has been small over the recent past. This is due to the limited number of tax brackets foreseen by law in both countries(two). Inflation plays a role in corporate taxation even if corporate profits are taxed proportionally. In all countries considered here, depreciation allowances are based on historic costs; thus inflation reduces the real value of depreciation allowances and increases the effective tax rate on corporations indirectly.

Social security contributions, which share the same tax bases as personal income taxes, are typically levied proportionally. With the exception of Greece, in all countries there are caps on the maximum amount of social security contributions to be paid. As inflation would push more and more people over the cap limits, *i.e.,* exempting them from contributions, all countries in our sample legally index the caps to inflation developments.[11] These adjustments allow for stability of real social security contributions.

Indirect taxes, such as VAT, are usually levied proportionally on prices (*ad valorem* method of taxation). Excise duties, are levied proportionally on quantities (except for tobacco taxes which

[11] While Germany and Austria adjust the caps (and also minimum contribution levels) to wage increases in t–2, France adjusts according to wage increase in t–1 and Italy takes price increases in t–1 into account. Hence, Italy implicitly spares real wages from higher social security contributions.

Table 1

Indexation Structure of Main Government Spending
(percent)

Expenditure Items	Share in Total Expenditures (2013 data, percent)	(percent of 2013 GDP)	Indexation Mechanism (Y/N)	Index Used for Indexation	Is Mechanism Working at Present?
Pensions					
Germany	24.4	11.2	Y	Per capita wage increase in t–1	
France	***24***	**14.1**	***Y***	***Forecasted CPI excl. tobacco***	***Basic pensions frozen in 2015; supplementary pensions progress less than inflation***
Italy	***35***	**18.3**	***Y***	***Forecasted CPI excl. tobacco***	***Partial indexation for pensions > 3000 EUR/month***
Austria	***28***	**14.7**	***Y***	***Realised CPI***	
Greece	**26**	**15.2**	**Y**	**Forecasted CPI**	**Suspended since 2009**
Social benefits					
Germany	4.6	2.1	Y	Private sector wage growth and past CPI	
France	***11***	**6.5**	***Y***	***Forecasted CPI (excl. tobacco)***	
Italy	***5.3***	**2.8**	***Y***	***Wages and CPI***	
Austria	***2.8***	**1.5**	***Y***	***Wages, CPI***	
Greece	**2.00**	**1.18**	**Y**	**Forecasted CPI**	**Suspended since 2009**
Compensation of employees					
Germany	17.5	8.0	N		
France	23	13.5	Y	Index point not automatically related to inflation	Yes, until 2017 will be frozen
Italy	***20.5***	**10.7**	***Y***	***Government CPI inflation target***	***Yes, until 2015 will be frozen***
Austria	18.3	9.6	N		
Greece	**20.4**	**11.9**	**Y**	**Forecasted CPI**	**Suspended since 2009**

Source: authors' elaboration based on ESA1995 data. Note: figures in bold represent those items which are directly indexed to inflation.

Table 2

Main Taxes and Indexation of Tax Brackets in Selected Euro-area Countries

Type of Taxes and Indexation of Tax Brakets				
	PIT	Corporate	SSC	Excise duty
EL	progressive /NO	progressive/NO	proportional	proportional on quantity
DE	progressive /NO	proportional/NO	proportional/indexation of caps	proportional on quantity
FR	progressive/yes	progressive/NO	proportional (progressive)/indexation of caps	proportional on quantity
IT	progressive /NO	proportional/NO	proportional/indexation of caps	proportional on quantity
AT	progressive /NO	proportional/NO	proportional/indexation of caps	proportional on quantity

Source: authors' elaboration.

incorporate also a price component). Thus, assuming no behavioral changes, price developments should not affect nominal excise tax revenues. In real terms, however, and in percent of GDP these tax revenues are gradually eroding over time without any discretionary adjustment. For the countries in the sample, these represent approximately 5 per cent of overall tax revenues, which are not legally linked to any price developments. Moreover, the same phenomenon concerns recurring real estate taxation, in instances where it is based on cadastral values, as opposed to market values. This is the case for Italy, Austria, France and Germany.

Table 3 quantifies the nominal fiscal drag for the wage tax and excise duties[12] and shows that for 2013 it is overall very limited. For the purpose of this analysis, the focus is only on the nominal revenue effects of fiscal drag on wage tax for 2013[13] and on excise duties. The underlying method used to calculate the nominal fiscal drag is detailed in the Annex 2[14] and the reference price index used is the private consumption deflator. The nominal fiscal drag from the wage tax in 2013 was positive for all countries that experienced an increase in the price deflator and was comprised between 0.07 and 0.14 per cent of GDP, whereas it was negative, though small in Greece owing to the fall in the price deflator. Differences in the change in the price deflator, largely explain the observed cross country differences in the fiscal drag.

The fiscal drag from excise taxes was small across countries but the sign of the fiscal drag goes in opposite direction to the change in the price deflator. Since excise taxes are levied on quantities, the calculation of the nominal fiscal drag assumes that the tax base is linked to real private consumption and not to nominal private consumption. The elasticity of revenues from excise taxes to changes in real private consumption is assumed to be smaller than 1. As a result, in

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[12] The WGPF provides information on fiscal drag using the disaggregated approach for income tax. However, this source only allows quantifying the combined effect of real and nominal changes on fiscal drag. If, however, the aim is to examine the impact of low inflation on public finances, quantifying the general fiscal drag is a relatively ineffective approach.

[13] This analysis takes no account of a further important effect of inflation on the size of the real tax burden, for where taxation is determined in line with nominal investment income, higher inflation generally results in the tax levied on the real return being well above the nominal tax rate. In this regard, the degree of divergence between the nominal rate and the effective real tax burden depends on the ratio of the nominal interest rate to the real interest rate, although other factors (in particular, depreciation allowances) also exert an influence. The following example illustrates the effect in question: If, say, the tax rate is 50 per cent, the nominal interest rate is 2 per cent and inflation stands at 0 per cent, this leaves a nominal and real return after tax of 1 per cent while tax revenue also amounts to 1 per cent. By contrast, if the nominal interest rate is set at 5 per cent, with inflation at 3 per cent (the real interest rate remaining unchanged at 2 per cent), the nominal return after tax amounts to 2.5 per cent whereas the real return after tax is –0.5 per cent and tax receipts stand at 2.5 per cent. This effect, which impacts on the progressive tax regime but also on proportional tax rates, can be quite considerable. Moreover, it can lead to severe distortions in the economy that are a drag on potential growth. However, it is not taken into consideration here when calculating fiscal drag.

[14] The calculation of the fiscal drag is based on the implicit assumption that a change in inflation induces an equally large percentage change in nominal wages. In addition, the relative significance of the price effect for income tax (relative to a proportional tax regime) depends on the choice of price index.

Table 3

Fiscal Drag that Is Due to Changes in the GDP Deflator (2013)

	Fiscal Drag on Wage Tax			Fiscal Drag on Excise Taxes			Overall Fiscal Drag			Change in Pric Deflator
Country	bn EUR	%GDP	Sensitivity to 1p.p. change in deflator	bn EUR	%GDP	Sensitivity to 1p.p. change in deflator	bn EUR	%GDP	Sensitivity to 1p.p. change in deflator	%
AT	0.42	0.14	0.06	-0.15	-0.05	-0.02	0.27	0.09	0.04	2.20
DE	1.93	0.07	0.06	-0.86	-0.03	-0.02	1.07	0.04	0.03	1.25
FR										
GR	-0.10	-0.05	0.03	0.1	0.05	-0.03	0	0	0.00	-1.5
IT	1.63	0.10	0.08	-0.58	-0.04	-0.03	1.05	0.07	0.05	1.32

Source: authors' elaboration.

2013, the fiscal drag from excise taxes due to a change in the deflator was negative in all countries, except Greece where the fiscal drag was positive due to a fall in the deflator.[15]

3.3 *The debt ratio and the interest-rate channels*

As illustrated in section 2, an unexpected increase in inflation reduces the debt-to-GDP ratio via the impact on the outstanding stock of debt and the cost of servicing this debt in addition to its effect via the primary balance (see equation 1, Section 2).[16] The share of the debt which is not sensitive to inflation developments differs significantly across countries (see Annex 2 and Table 8 for more details) thus leading to different degree of sensitivity of the debt ratio to inflation shocks.

Table 4 below illustrates the results of applying the formula derived in section 2 to individual countries. Italy is the country with the largest sensitivity to changes in inflation (0.9p.p. of GDP), owing to the high debt ratio. Greece, on the other hand, records the lowest impact on the debt ratio (0.3p.p.) owing to the very low elasticity, which in turn depends on the very low share of debt which is not sensitive to the inflation rate. For the other countries the effect is in between these two extremes (Table 5).

This sensitivity becomes larger under the assumption of a partial pass-through from inflation to interest rates. Applying the formula in (4') and assuming a value for k=0.6 (see section 2) we obtain the new values for the elasticity and the impact of lower inflation on the debt ratio. As expected, the sensitivity of the debt-to-GDP ratio to the same decline in inflation is larger than in the k=1 case. However, it turns out that the effects are not quantitatively very different. The debt-to-GDP ratio increases by 1.1 percentage points of GDP in Italy, 0.8p.p. in France, 0.6p.p. in Austria and 0.6p.p. in Germany. The only exception is Greece, where the increase in debt is now 0.9 percentage points (as opposed to 0.3 percentage points in the full-Fisher scenario). This is due to the fact that Greece is the only country in which b_t^S is much bigger than b_t^{NS}.

15 Finally, the so-called Tanzi effect (Tanzi 1977), which refers to the inflation-induced reduction in real tax income due to collection lags is likely to be not significant in ESA terms. In most countries tax-prepayments should avoid collection lags and moreover both ESA 95 and ESA 2010 follow the accrual principle.

16 As in the rest of the paper, we do not consider here the seigniorage channel.

Table 4

Effects of a Decrease of EA Inflation from 1.3 to 0.3 per cent

FULL FISHER EFFECT (k=1)	**GERMANY**	**FRANCE**	**ITALY**	**AUSTRIA**	**GREECE**
Debt-to-GDP ratio (%) (d_{tot})	78.4	93.5	132.6	74.0	175.1
share of long-term, non-maturing debt (b_t^{NS}/b_t^{TOT})	0.66	0.75	0.68	0.88	0.19
Inflation in 2015	1.3%	1.3%	1.3%	1.3%	1.3%
Elasticity	-0.008	-0.010	-0.009	-0.011	-0.002
Debt-to-GDP ratio with 1p.p. lower inflation	78.9	94.2	133.5	74.6	175.4
Change in debt	***0.5***	***0.7***	***0.9***	***0.6***	***0.3***
PARTIAL FISHER EFFECT (k=0.6)					
share of short-term, variable interest rate debt (b_t^S/b_t^{TOT})	0.34	0.25	0.32	0.12	0.81
second elasticity	-0.002	-0.001	-0.002	-0.001	-0.004
Elasticity	-0.010	-0.011	-0.010	-0.012	-0.007
Debt to GDP ratio	79.0	94.3	133.7	74.7	176.0
Change in debt	***0.6***	***0.8***	***1.1***	***0.7***	***0.9***

4 Country specific simulations on The effect of inflation on the primary balance

This section aims at providing a stylised assessment of the transmission mechanisms from inflation to revenues and expenditures using the fiscal forecast models of individual central banks. First, the results for a low inflation shock are presented, (*i.e.,* –1p.p. lower inflation vs. baseline). Second, the analysis looks at the effects on public finances in the case of a negative inflation rate (i.e., GDP deflator growth rate of –1 per cent). The main assumptions these simulations are in Annex 4.

4.1 A disinflationary shock

The effects of a –1p.p. temporary shock to the GDP deflator on the primary balance and the headline balance are illustrated in Table 5. This corresponds to a permanent shock to the level of the deflator, whereas it is assumed that the growth rate reverts to the baseline already in year t+1. The main transmission channels of the low inflation shock are country specific depending on the assumptions on the transmission of the shock to wages and salaries, the timing of indexation and the possibility that in some countries existing indexation mechanisms are temporarily frozen as discussed in section 4.1.

The average deterioration in the primary balance is 0.15p.p. of GDP on impact though there are important differences across countries (*i.e.,* 0.3p.p. in Italy vs. 0.1 per cent of GDP in Germany and Greece). These effects are in line with the findings from a panel regression for a sample of EU countries based on the fiscal reaction function literature (see Box 3). The deterioration is due to total revenues declining, in nominal terms, more than nominal primary expenditures. Both discretionary and non-discretionary spending adjust with a lag to the lower inflation environment, thus causing the primary expenditure-to-GDP ratio to increase on impact. The reduction in primary spending in the first year is influenced by assumptions regarding the pass-through of inflation developments to public and private wages. In Austria, for example, both private and public sector wages adjust with a lag to lower inflation, as wages are usually agreed in year t–1 for the following period. In France, Italy and Greece, public wages do not adjust to lower inflation as existing indexation mechanisms are currently suspended. This introduces an element of downward rigidity, whereby a lower realised inflation rate results in lower realised budgetary savings compared to a baseline scenario with higher expected inflation rates, hence higher savings thanks to the wage freeze. Other spending categories also adjust with a lag, though by different degrees. In Germany, Italy and Greece the pass-through from lower inflation to intermediate consumption is higher than in Austria and France. On the revenue side, direct taxes tend to decline in line with GDP in Germany and Austria, and more than in other countries, whereas the reaction of indirect taxes is more subdued. In the case of Austria this reflects the fact that indirect taxes depend only partially from private consumption. In Italy, France and Greece indirect taxes decline more in line with GDP. Finally, social security contributions are relatively less affected by lower inflation in the first year in all countries reflecting the partial pass-through from low inflation to total wages.

In Germany and Austria the primary balance returns to the pre-shock baseline by the end of the three-year simulation horizon. In Italy the gap to the baseline declines progressively, whereas it takes longer to converge in France and Greece. In Austria both revenues and primary expenditures fully adjust downward by the end of the horizon. In Germany, revenues and primary spending in nominal terms decline in proportion by a similar amount, so that the impact on the primary balance is almost zero. In Italy, the primary balance in the first year deteriorates more than in the other countries, owing mostly to the fact that pension expenditures[17] adjust with a lag to lower inflation. The gap to the baseline shrinks in the second year and widens slightly by the end of the projection horizon due to a more pronounced decline in direct taxes and social security contributions. In Greece and France, the end of period deterioration in the primary balance is higher than the one recorded on impact (0.2p.p. of GDP and 0.1p.p. of GDP respectively). This owes to a more rigid structure of primary spending given that in addition to wages and salaries, also social transfers are assumed not to react to the low inflation shock. As a result, the freezing of the indexation mechanisms introduced in the context of the recent consolidation efforts, introduces an element of downward rigidity in government spending (at unchanged policy), which has persistent effects on the primary balance in presence of a disinflation shock.

If lower inflation feeds through into lower interest rates on newly issued debt, it has a cushioning effect on the headline budget balance, which deteriorates on impact by 0.05p.p. on impact. If lower inflation passes-through to lower interest rates, via lower inflation expectations, this will reduce the cost of newly issued debt, thus cushioning the adverse effects of lower inflation on the primary balance. This beneficial effect depends on the degree of pass-through from low inflation to interest rates (higher in the case of full pass-through) and the maturity structure of debt. In the case of Germany, the savings related to lower interest payments more than offset the deterioration in the primary balance, thus leading to an improvement of the budget balance of 0.1p.p. In the outer years, this effect fades away since interest rates go back to the pre-shock level given the temporary nature of the inflation shock. For the other countries, the offsetting effect is less strong, but still positive. Overall the dynamics of the headline budget balance are similar to what described above for individual countries. However, it has to be noted, that to the extent that the shock to inflation is only temporary and inflation expectations are not affected, this beneficial impact from lower interest payments is likely not to materialise, or to materialise to a smaller extent.

4.2 A negative inflation shock

A negative inflation shock has more adverse consequences for public finances essentially via the negative effect on economic growth and a higher rigidity in government spending. Simulating

[17] In 2013 pension expenditures in Italy amounted to 35 per cent of total spending.

Table 5

Effects of –1p.p. Lower Inflation on Main Fiscal Variables

Deviations from baseline	Germany			France			Italy			Austria			Greece		
	t	t+1	t+2	t	t+1	t+2	t	t+1	t+2	t	t+1	t+2	t	t+1	t+2
	p.p. of GDP														
Budget balance	0.08	0.02	0.02	-0.04	-0.13	-0.15	-0.11	-0.02	-0.11	-0.14	-0.10	-0.03	-0.05	-0.17	-0.16
Primary balance	**-0.05**	**-0.02**	**-0.02**	**-0.15**	**-0.17**	**-0.19**	**-0.27**	**-0.13**	**-0.16**	**-0.17**	**-0.14**	**-0.06**	**-0.08**	**-0.12**	**-0.11**
Total expenditures	0.14	0.18	0.16	0.31	0.32	0.31	0.22	0.05	0.10	0.39	0.11	0.00	0.27	0.32	0.31
Primary expenditures	0.27	0.23	0.20	0.41	0.36	0.36	0.38	0.16	0.15	0.42	0.15	0.03	0.30	0.27	0.26
Total receipts	0.22	0.20	0.18	0.26	0.19	0.16	0.11	0.03	-0.01	0.25	0.01	-0.03	0.22	0.16	0.15
	% deviations from baseline level														
Total receipts	**-0.62**	**-0.65**	**-0.71**	**-0.50**	**-0.64**	**-0.69**	**-0.76**	**-0.94**	**-1.00**	**-0.50**	**-0.98**	**-1.06**	**-0.53**	**-0.65**	**-0.66**
o.w.: Direct taxes	-1.09	-1.04	-1.08	-0.27	-0.80	-0.90	-0.20	-0.56	-0.65	-1.01	-1.47	-1.61	-0.14	-0.59	-0.64
Indirect taxes	-0.71	-0.75	-0.77	-0.98	-0.97	-0.97	-0.98	-0.97	-0.97	-0.54	-0.74	-0.78	-1.00	-1.00	-1.00
Social contributions	-0.13	-0.23	-0.35	-0.30	-0.36	-0.42	-0.26	-0.33	-0.39	0.00	-0.90	-1.03	0.00	0.00	0.00
Total expenditures	**-0.68**	**-0.59**	**-0.65**	**-0.46**	**-0.43**	**-0.44**	**-0.60**	**-0.90**	**-0.78**	**-0.24**	**-0.78**	**-1.00**	**-0.43**	**-0.30**	**-0.31**
o.w.: Compensation of employ	-0.13	-0.24	-0.37	-0.01	-0.01	-0.01	0.00	0.00	0.00	0.00	-0.80	-1.00	0.00	0.00	0.00
Intermediate consumptio	-0.75	-1.00	-1.00	-0.50	-1.00	-1.00	-1.00	-1.00	-0.99	-0.50	-1.00	-1.00	-1.04	-1.06	-1.06
Social transfers in kind	-0.42	-0.49	-0.58	0.00	0.00	0.00	-0.50	-0.50	-0.50	-0.30	-0.80	-1.00	0.00	0.00	0.00
Social benefits	-0.43	-0.47	-0.53	-0.11	-0.11	-0.11	0.00	-1.00	-1.00	0.00	-0.44	-0.89	-0.27	-0.27	-0.27
Interest payments	-5.63	-1.20	-1.30	-5.53	-2.87	-3.11	-4.20	-3.20	-2.00	-2.41	-2.48	-2.19	-1.60	0.00	0.00
Public Investment	-0.50	-1.00	-1.00	-0.50	-1.03	-1.06	-0.40	-1.00	-1.00	-0.50	-1.00	-1.00	-0.43	-1.12	-1.04
Nominal GDP growth	***-1.00***	***0.00***	***0.00***	***-1.00***	***0.00***	***0.00***	***-1.00***	***0.00***	***0.00***	***-1.00***	***0.00***	***0.00***	***-1.00***	***0.00***	***0.00***
Nominal GDP	***-1.00***	***-1.00***	***-1.00***	***-1.00***	***-1.00***	***-1.00***	***-1.00***	***-1.00***	***-1.00***	***-1.00***	***-1.00***	***-1.00***	***-1.01***	***-1.01***	***-1.01***

Source: authors'elaboration.

the effects on public finances when the GDP deflator growth rate turns negative is particularly challenging given the uncertainty surrounding the macroeconomic effects of negative inflation and the possibility that threshold effects governing the reaction of the main macroeconomic variables operate. Nonetheless, some tentative assumptions can be made in order to illustrate how a negative inflation rate would transmit to public finances.

When inflation turns negative for a protracted period, real economic activity is adversely affected owing to the (likely) downward rigidity of input prices and the (likely) decline in real private consumption. These factors would lead to a decline in firms' gross operating surplus, hence the major tax bases. In presence of negative inflation, it is plausible to assume that private sector wages are downward rigid and that the negative inflation does not pass-through to nominal interest rates,[18] thus causing an increase in the real interest rate. Moreover, it is also plausible to assume that real private consumption falls in response to negative inflation essentially because consumers observing negative inflation postpone their consumption choices to the future. The rigidity of input prices, the fall in private consumption and the contraction in economic activity that follows leads to a decline in firms' gross operating surplus. As a result, the main tax bases start to contract with negative consequences for tax revenues. Moreover, spending for compensation of employees and other social spending, including unemployment benefits, are also unlikely to fall in line with negative inflation, thus leading to a further worsening of the budget balance. Nominal interest payments are unchanged as there is no effect on nominal interest rate, including those on inflation indexed bonds (the payments on the returns is not diminished when inflation realizations are negative; inflation indexed bonds are set in a way that prevent bonds holder's against the risk of deflation).

Against this background, this section presents some illustrative simulations for the case of France taking as a starting point the low inflation scenario discussed above. It is assumed that an additional shock of –1p.p. to the GDP deflator growth rate occurs, such that the growth rate of the GDP deflator is –1 per cent (as the GDP deflator growth in the pre-low inflation shock (*i.e.,* baseline was 1 per cent). The simulations presented in this section aim at illustrating the transmission mechanisms of negative inflation to public finances. For this purpose it is assumed that the macroeconomic effects of negative inflation are as described above, though it may be argued that in presence of a temporary shock such effects could be less pronounced. Table 6 illustrates the results of the incremental effect on the fiscal balances (compared to the low shock scenario discussed above) when the growth rate of the GDP deflator turns negative.

In this scenario, revenues will decrease as the result of the lower tax bases due to fall in prices but also to the contraction of economic activity. Indeed, unlike in the low inflation scenario, in this case it is assumed that negative inflation has consequences for the real economy via a fall in private consumption will of 0.2 per cent, which translates into a decline in real GDP of 0.1 per cent. The fall in direct taxes reflects essentially the decrease of corporates' taxes, due to the fall of their profits. In year $t+2$, the primary balance (as percent of GDP) will be lower by –0.22pp compared to low inflation shock as a result of lower revenues (compared to low inflation, primary expenditures will be slightly affected by an increase of unemployment starting in year $t+1$). The decrease of social security contributions is limited due to the assumed downward rigidity of wages. The budget balance deteriorates more than in the case of "low inflation" as interest payments are not affected by the decline in the rate of inflation and the additional financing needs related to the higher budget deficit as well as the maturing debt are financed at unchanged interest rates.

[18] On the other hand, it could be assumed that wages could be lowered via cutting extra payments and allowances and by increasing working time. Regarding interest rates, it the real interest rate is sufficiently positive, nominal interest rate could still be reduced even if inflation is negative. Both these factors would mitigate the negative effect on the fiscal balances. However, these effects are not explicitly taken into consideration in this note.

Table 6

Additional Impact on the Budget Balance when GDP Deflator Growth Rate is –1 per cent

Deviation from Low Inflation Scenario	**FRANCE**		
	T	**T+1**	**T+2**
Budget balance (p.p. of GDP) *	–0.17	–0.24	–0.25
Primary balance (p.p. of GDP)	**–0.15**	**–0.21**	**–0.22**
Total expenditures (p.p. of GDP)*	0.53	0.50	0.50
Primary expenditures (p.p. of GDP)	0.51	0.48	0.47
Total receipts (p.p. of GDP)*	0.36	0.26	0.25
Total receipts (percentage change from low inflation level)	–0.52%	–0.70%	–0.72%
Of which: Direct taxes	–0.29%	–0.94%	–1.00%
Indirect taxes	–1.17%	–1.16%	–1.15%
Social contributions	–0.15%	–0.25%	–0.25%
Total expenditures (percentage change from low inflation level)	–0.26%	–0.30%	–0.30%
Primary expenditures	–0.27%	–0.32%	–0.32%
Of which: Compensation of employees	–0.01%	0.00%	0.00%
Intermediate consumption	–0.50%	–1.00%	–1.00%
Social transfers in kind	0.00%	0.00%	0.00%
Social benefits	–0.11%	–0.02%	–0.02%
Interest payments	0.00%	0.14%	0.35%
Public Investment	–0.50%	–1.03%	–1.06%
Nominal GDP growth	–1.10%	0.00%	0.00%
Nominal GDP	–1.10%	–1.10%	–1.10%

Overall, a negative growth rate of the GDP deflator is likely to induce an additional deterioration of about 0.2p.p. of GDP of both the headline and the primary balance at end-period. If taken together with the low inflation scenario, the decline in the GDP deflator by 2p.p. and the non-linearities associated to the fact that its growth rate turns negative, would cause a deterioration of the budget balance of about 0.4p.p. of GDP by the end of the third year compared to the baseline, with a similar time profile as discussed previously.

5 Debt sustainability analysis

The DSA simulations take as a starting point the benchmark scenario as per the 2014 Public Finance Report and quantify the debt impact of three types of inflation shocks:

1) **A permanent shock of 1p.p. lower GDP deflator growth** (compared to the path embedded in the benchmark) over the entire simulation horizon starting with 2015. The inflation shock is considered to fully surprise economic agents and governments the first years (unanticipated shocks). Thereafter, it is gradually, over a period of three years, feeding-through expectations.
2) **A temporary shock of 1p.p. lower GDP deflator growth for 3 years (2015-2017),** followed by gradual linear convergence over 5 years (2018-2022) to the path in the benchmark (reaching the GDP deflator growth of the benchmark in 2022).
3) **A deflationary shock**: country-specific shocks calibrated to obtain a negative GDP deflator growth of −1 per cent for 3 years (2015-2017), thereafter convergence to the benchmark path in 5 years.

In all the above scenarios, the price level is permanently lower.

It is assumed that fiscal authorities do not implement any discretionary policy measures in reaction to the adverse environment. This allows isolating the impact of inflation shocks on the debt dynamics. The results are derived taking into account a partial reaction of fiscal, macro and financial variables to the inflation shocks in line with the findings of the current note. In this respect, three main channels[19] are captured:

First, a drop in the rate of inflation increases the **real value of government debt** directly by reducing nominal GDP (the so-called denominator effect, *i.e.,* the debt-to-GDP ratio increases ceteris paribus).

Second, the slowdown in inflation may adversely affect the **primary balance** to the extent that nominal government spending is downwardly rigid and via lower fiscal drag (*i.e.,* nominal revenues increase as higher inflation pushes incomes into higher tax brackets). For the purpose of the current simulations, the results of the empirical analysis, *i.e.,* an adverse impact of lower inflation on primary balance of 0.1p.p. per year (see Box 3) is considered as a starting point.

Third, the slowdown in inflation is likely to be reflected in a gradual adjustment of **nominal interest rates** beyond what implied by the credit risk premia. For a given level of spreads between government bond yields, a reduction in nominal interest rates is more likely to occur if the low inflation shocks occur throughout the euro area, as this is likely to be associated with the expectation of a lower path of current and future central bank interest rates. The assumptions for the pass-through of an inflation shock to the marginal interest rate (for new government debt) are in line with the empirical finding of Box 2. For the current simulations and in line with the practise in the PFR, the deterioration in fiscal fundamentals resulting from a lower inflation environment is translated into higher sovereign bond spreads (25 bp, and respectively 4 b.p. for every 1p.p. increase in the deficit and the debt-to-GDP ratios). For the three DSA shock scenarios, the assumptions above are translated as follows:

1) Permanent shock scenario:
    - Primary balance-to-GDP: deteriorates through the structural component (exogenous variable) by 0.1p.p. per year for three years (period during which the shock is unanticipated). Thereafter, no reaction is considered beyond the denominator effect.

[19] The slowdown in inflation may also affect potential output growth, with the sign of this effect being, however, unclear a priori and thus not taken into account in the simulations. Hence, on the one hand, a slowdown in inflation may lead to an increase in output growth in countries undergoing rebalancing through an improvement in competitiveness (rebalancing effect). Moreover, other things equal, lower inflation reduces the allocative distortions caused by (nominal) taxation of interest income. Therefore, savings, the capital stock and potential growth could be higher. On the other hand, in presence of low inflation, downward rigidities (especially in wages) can become binding, reducing employment and real activity, which through hysteresis could be transmitted to potential GDP. Moreover, a euro-area wide low inflation environment would make more difficult for countries with external imbalances to regain price and wage competitiveness, especially in the presence of downward rigidities.

- Marginal Interest rates: A pass-through to interest rate of 0.6p.p. is considered for the first year of the shock (2015) across the whole yield curve (an alternative is to have different pass-through effects, *i.e.,* starting at 1 for very short-term debt and converging to 0.6 for 10-year maturities and above). Thereafter, a full pass-through is ensured by the end of the simulation period (2024) through a gradual linear convergence. Marginal interest rates remain somewhat above the benchmark at the end of the simulation horizon due to the higher risk premia.

2) Temporary shock scenario:
   - Primary balance-to-GDP: deteriorates through the structural component (exogenous variable) by 0.1p.p. per year for three years (2015-2017). Thereafter, a symmetric improvement of the structural balance is ensured over the next 3 years (2018-2020).
   - Marginal Interest rates: A pass-through to interest rate of 0.6p.p. is considered for the first year of the shock (2015) across the whole yield curve. Thereafter, a full pass-through is ensured by the end of the simulation period (2024) through a gradual linear convergence. Marginal interest rates remain somewhat above the benchmark at the end of the simulation horizon due to the higher risk premia.
3) Deflationary shock:
   - Primary balance-to-GDP: Given the likely higher pressure from downward expenditure rigidities, the primary balance-to-GDP deteriorates through the structural component (exogenous variable) by the specific share of expenditure subject to inflation indexation (wage bill and social transfers). As above, the impact is maintained only for a period of 3 years.
   - Marginal Interest rates: A pass-through to interest rate of 0.6p.p. is considered for the first year of the shock (2015) across the whole yield curve and then it gradually converges until the marginal interest rates hit the lower bound. Marginal interest rates remain more significantly above the benchmark at the end of the simulation horizon due to the higher risk premia.

Table 7 illustrates the DSA simulations for the five countries considered in this note.

The effects on the debt-to-GDP ratio to the 2024 horizon are sizeable especially for the countries that start with a high debt-to-GDP ratio. In all scenarios, in the absence of discretionary measures in response to the shock, the average headline budget balance deteriorates somewhat over the simulation horizon compared to the baseline. In the lower inflation shock, the decline in the debt servicing costs is not sufficient to compensate for the assumed deterioration of the primary balance, as the permanent decline in the marginal interest rates is offset, at least partly, by the increase in the stock of debt which feeds into higher risk premia. For the temporary shock the deterioration in the headline budget balance is larger than for the permanent shock. This owes essentially to the fact that interest payments savings on account of permanently lower inflation do not materialise, whereas the increase in the debt stock weighs on debt servicing costs. In the case of Greece, the debt service costs increase due to confidence effects related to the relatively higher-than-benchmark debt level. Though the size of shocks is not comparable, in relative terms, the debt increasing effect is the largest in the case of a deflationary shock due mainly to the size of the shock but also to the assumed rigidities on the expenditure side in line with what described in the previous section.[20]

[20] In all countries the size of the shock is larger in the negative inflation scenario: ranging between –2.5 pp in 2015 and –2.8 pp in 2017 for AT, –2.8 and –3.3 for DE, –2.3 and –2.5 for FR, –1.3 and –2.0 for GR and –2.5 and –2.7 for IT. In Greece, which is currently in deflation (but expected to revert to positive inflation in the projections), the size of the shock is smaller compared to the other countries. Moreover, being temporary, the negative inflation shock implies a much faster recovery of the GDP deflator in positive territory over the long term.

Table 7

Impact of Adverse Inflation Shocks on the Debt-to-GDP Ratio in 2024 and on the Average Budget Balance Over 2014-24
(percent of GDP, deviation from baseline)

	Low Inflation Shock				**Country-Specific Negative Inflation Shock***	
	Permanent Shock		**Temporary Shock**			
	Debt Effect (2024)	**Average Impact on Budget Balance (2014-24)**	**Debt Effect (2024)**	**Average Impact on Budget Balance (2014-24)**	**Debt Effect (2024)**	**Average Impact on Budget balance (2014-24)**
Austria	8.1%	–0.2% [0.0]	5.7%	–0.3%	11.3%	–0.3%
Germany	6.6%	–0.1% [–0.1]	4.9%	–0.2%	11.4%	–0.2%
France	8.7%	–0.1% [–0.2]	5.8%	–0.2%	13.4%	–0.4%
Greece	18.6%	–0.5% [0.3]	11.8%	–0.6%	15.5%	–0.3%
Italy	11.5%	–0.1% [–0.1]	7.9%	–0.3%	23.2%	–0.9%
Average	**10.7%**	**–0.2%** [0.0]	**7.2%**	**–0.3%**	**15.0%**	**–0.4%**

Sources: authors' elaboration.
* The size of the shock is country specific and as a result, the resulting effects on the debt stock are not directly comparable across countries. For the permanent shock scenario, the value in square brackets illustrates the average deviation of effective interest rates compared to the baseline.

6 Policy implications

The adverse impact of unfavourable inflation developments on public finances raises the issue of whether this may hinder compliance with the requirements under the SGP. To briefly recap, the main indicators for the assessment of compliance with the SGP (both under its preventive and the corrective arm) are the *nominal budget balance* and the *structural budget balance.* Under the corrective arm, the so-called *effective action* procedure foresees that if a country fails to comply with either the nominal balance or the structural effort targets, a *careful analysis* is undertaken. The careful analysis relies on the *adjusted structural balance* (*i.e.,* corrected for revenue windfalls and changes in potential growth) and the so-called (bottom-up) *fiscal effort*. The latter sums up the budgetary impact of individual measures on the revenue side; on the expenditure side it assesses measures as improvements compared to the nominal expenditure path as included in the EDP recommendation. Finally, the six-pack reform has operationalised the debt rule.[21] For the countries that in November 2011 were under an EDP, a three-year transition period has been introduced. During the transition period a country needs to make sufficient progress with its structural adjustment to ensure that it complies with the debt rule after the end of the transition period. Sufficient progress is measured with reference to the minimum linear structural adjustment (MLSA) which is the least stringent adjustment in the structural balance required for compliance with one of the three specifications of the debt rule (backward looking, forward looking and adjusted for the cycle).

[21] This rule requires countries whose debt-to-GDP ratio is in excess of 60 per cent, to reduce it by 1/20 of the excess over 60 per cent in each year.

Inflation may then affect the assessment of countries' compliance with the SGP requirements as it affects the nominal and the structural budget balances, their change and the fiscal effort. As shown in this note, a 1p.p. unanticipated decline in the rate of inflation (or GDP deflator) would translate into a deterioration of the budget balance ranging from about 0.04p.p. of GDP on impact in the case of France and Greece to 0.11p.p. of GDP for Italy and Austria. Depending on the country specific circumstances, the effect can become stronger over time (e.g., France) or fade progressively away (e.g., Austria) or be very limited altogether (e.g., Germany). Therefore, a deceleration in the growth rate of inflation could cause both the nominal balance and the structural balance[22] to deteriorate to different degrees across countries.

As regards the impact of inflation on the size of the (bottom-up) fiscal effort, the implications of lower than expected inflation crucially depend on the behaviour of expenditures. If spending adjusts downwards in line with inflation developments, than lower inflation leads to an increase of the expenditure savings *vis-à-vis* the benchmark of the nominal expenditure path included in the EDP recommendation. Inflation effects on the spending side therefore could make compliance with the fiscal effort recommendation under the EDP easier. However, in case spending does not adjust, as seen in section 4, then compliance with the fiscal effort would be hindered.

The implications of lower inflation are more significant in the case of the debt rule. The size of the MLSA, which is defined in terms of a requested improvement of the structural balance, is affected, among other factors, by the gap between the debt-to-GDP ratio and the 60 per cent reference value. As shown in section 4.2, for a very high debt-to-GDP ratio a 1p.p. lower inflation leads to an almost equivalent increase in the debt ratio. Moreover, the DSA has shown that a persistent shock to inflation determines an increase in the debt ratio of up to 19p.p. in the case of Greece, thus jeopardizing debt sustainability. Therefore, unexpectedly lower inflation has negative effects on countries' capacity to comply with the debt rule via both the negative impact on the debt ratio (*i.e.,* leading to a widening of the gap vs. the 60 per cent) and via a lowering of the realised structural adjustment vis-à-vis the requirement under the MLSA. Finally, as we have seen, the implications for compliance with the SGP rules tend to be more severe in the case of a negative inflation shock. Nonetheless, and as stressed various times in this note, to the extent that lower inflation translates into lower interest payments via lower inflation expectations, the resulting savings in interest payments, although initially limited, would partially offset the negative impact of inflation on budget balance. This partially counterbalancing effect would not, however, materialize in the current circumstances, given that the euro area economy is at the zero lower bound.

The SGP does not include specific reference to adverse inflation developments among the circumstances under which derogation to the rules can be granted. Under the recently amended method to assess effective action under the corrective arm of the Pact, it was conjectured that the impact of inflation may be considered in the careful analysis in cases in which the change in the adjusted structural effort and the bottom-up fiscal effort point in different directions. This has so far not been applied. At the same time, under the corrective arm of the Pact, a so-called general escape clause exists, which refers to periods of a severe economic downturn for the euro area or the Union as a whole. It provides for revisions in EDP recommendations if this does not endanger fiscal sustainability. While there is no specific definition in the SGP of a severe economic downturn, in case tail risks of negative growth and deflation materialise, an application of such a clause might need to be considered. The case for doing so would be stronger if deflation affects core components of HICP and GDP deflator as risks for the economy and public finances are more severe. However,

[22] We assume that a deterioration in the headline balance, which is due to lower inflation, is entirely of a structural nature as the cyclical component, which is based on the output gap, is not affected.

it needs to be recalled that if deflation materialises in the absence of a severe economic downturn (*i.e.,* in the presence of positive or mildly negative real output growth and output gap), then the general escape clause will likely not apply.

In the context of the debt rule there is no specific provision for low or negative inflation developments as a factor justifying lack of compliance with the rule. In particular, in case a significant deviation from the MLSA is diagnosed, which triggers the preparation of a report under Art.126(3) TFEU, the Commission in deciding whether an excessive deficit exists in the sense of the debt rule shall take into account all relevant factors as indicated in article 2(3/4) of regulation 1467/2011. Such factors include consideration of: i) developments in the medium-term economic position[23] ii) the developments in the medium-term budgetary positions;[24] iii) the developments in the medium-term government debt position.[25] Moreover, the Commission shall give due and express consideration to any other factors which, in the opinion of the Member State concerned, are relevant in order to comprehensively assess compliance with deficit and debt criteria and which the Member State has put forward to the Council and the Commission. Although also in the case of the debt rule adverse inflation developments are not explicitly mentioned as a factor justifying a deviation from the rules, a country can still ask the Commission to consider adverse inflation developments among the other factors relevant for the assessment of compliance with the debt rule.[26]

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[23] This includes potential growth, including the various contributions provided by labour, capital accumulation and total factor productivity, cyclical developments, and the private sector net savings position.

[24] This includes, in particular, the record of adjustment towards the medium-term budgetary objective, the level of the primary balance and developments in primary expenditure, both current and capital, the implementation of policies in the context of the prevention and correction of excessive macroeconomic imbalances, the implementation of policies in the context of the common growth strategy of the Union, and the overall quality of public finances, in particular the effectiveness of national budgetary frameworks.

[25] This includes debt dynamics and sustainability, including, in particular, risk factors including the maturity structure and currency denomination of the debt, stock-flow adjustment and its composition, accumulated reserves and other financial assets, guarantees, in particular those linked to the financial sector, and any implicit liabilities related to ageing and private debt, to the extent that it may represent a contingent implicit liability for the government.

[26] However, internal ECB analysis for the case of Italy shows that even taking into account currently low inflation as a relevant factor, compliance with the MLSA would not be ensured and the size of deviation from the required adjustment would remain significant in the sense of the debt rule in both 2014 and 2015 in the absence of additional measures.

ANNEX 1
THE CALCULATION OF THE FISCAL DRAG

The following calculations concerning the nominal effects of fiscal drag are based on the private consumption deflator. In the case of income tax revenue, the price effect of fiscal drag can be calculated as follows:

$$FD(\pi) = T_{wt_{t-1}} * (\varepsilon_{wt_t} - 1) * \left(\frac{Def_t}{Def_{t\;1}} - 1\right)$$

where $T_{wt_{t-1}}$ is the tax revenue from wage tax (excluding minor occupations) in t–1. While ε_{wt_t} is the elasticity of wage tax with respect to changes in per capita wages and salaries, *Def* is the price deflator for private consumption in t and t–1, respectively.

The nominal effect of fiscal drag can also be calculated for excise taxes. However, unlike income tax, excise taxes are computed on a quantitative basis. When calculating the nominal effect of fiscal drag on excise taxes, we assume that the assessment base for gauging the inflation effect is linked to real private consumption and not to nominal private consumption. It is also assumed that the elasticity of tax revenue from excise taxes in terms of changes to real private consumption is smaller than 1. This being the case, the nominal part of fiscal drag on excise taxes is calculated as follows

$$FD(\pi) = T_{ET_{t-1}} * \begin{pmatrix} PV_{real_t} & PV_{nominal_t} \\ PV_{real_{t-1}} & PV_{nominal_{t-1}} \end{pmatrix}$$

where $T_{ET_{t-1}}$ is tax revenue from excise taxes in the last period, PV_{real_t} denotes real private consumption (data taken from the national accounts) and $PV_{nominal_t}$ refers to nominal private consumption.

ANNEX 2
EFFECTS OF INFLATION ON THE STOCK OF DEBT

To better understand the effect of inflation on the stock of outstanding debt and the interest payments to GDP, equation (2) reformulates the standard debt accumulation equation by expressing the total debt-to- GDP ratio as the sum of b_t^S the portion of debt that is sensitive to inflation (*i.e.,* short-term debt, foreign-currency denominated debt, long-term variable-interest or inflation-indexed debt) and b_t^{NS} the portion which includes only domestic-currency denominated, long-term, non-indexed debt:[27]

$$b_t^{TOT} = b_t^S + b_t^{NS} = \frac{1+i}{1+g} b_{t-1}^S + \frac{1+i^*}{1+g} b_{t-1}^{NS} - pb_t \tag{1}$$

i is the interest rate on b_t^S, i^* is the interest rate on b_t^{NS}; g is the growth rate of nominal GDP and pb_t is the primary balance.[28] Equation (2) can be further rearranged and expressed as: The right hand-side of equation (1) can be further rearranged as the sum of debt outstanding from the previous period ($\frac{1}{1+g} d_{t-1} + \frac{1}{1+g} d_{t-1}^*$) and the interest payments due on such debt:

$$\frac{i}{1+g} d_{t-1} + \frac{i^*}{1+g} d_{t-1}^*.$$

Furthermore, if we define r and r^* as the market real interest rate on d_t and d^*_t respectively, n as the real growth rate of GDP, π_t and π_t^{exp} as the realised and expected inflation for period t, and noting that $(1+i)=(1+r)(1+\pi_t)$, $(1+i^*)=(1+r^*)(1+\pi_t^{exp})$ and $(1+g)=(1+n)(1+\pi_t)$, equation (1) can be written as:

$$d_t^{tot} = \frac{1+r}{1+n} d_{t-1} + \frac{(1+r^*)(1+\pi_t^{exp})}{(1+n)(1+\pi_t)} d_{t-1}^* - a_t \tag{2}$$

The first term on the right hand side of equation (2) captures the contribution to the debt-to-GDP dynamics of the component of debt whose cost is inflation-sensitive. This term does not depend on inflation. It is the sum of two parts: debt outstanding from the previous period ($\frac{1}{(1+n)(1+\pi)} d_{t-1}$), which depends negatively on inflation, and interest payments ($\frac{i}{(1+n)(1+\pi)} d_{t-1} = \frac{(1+r)(1+\pi)-1}{(1+n)(1+\pi)} d_{t-1}$), which depend positively on inflation, with the two opposing effects cancelling out.

The second term in equation (2), depends negatively on actual inflation. Indeed, its "debt outstanding" part is given by $\frac{1}{(1+n)(1+\pi)} d_{t-1}^*$ and its interest payment part is given by: $\frac{(1+r^*)(1+\pi_t^{exp})-1}{(1+n)(1+\pi)} d_{t-1}^*$, both being unambiguously decreasing with respect to π. This effect is quantitatively small, given that the ratio of interest payments to GDP is typically much less than one. However, it is worth noting that to the extent that higher (lower) inflation leads to a change in

[27] A more detailed version of this equation is discussed in Akitoby et al. (2013).

[28] For ease of exposition, we did not take into account that the various components of d* might have different interest rates, and we disregard time sub-indices. The equation also assumes a full Fisher effect. This will be relaxed below.

Table 8

The Structure of Debt

Debt structure	Germany	France	Italy	Austria (1)	Greece
	(in % of total debt)				
1. Debt denominated in euros	97%	97%	100%	100%	96%
2. Debt denominated in other currencies	3%	3%	0%	0%	4%
3. Debt with residual maturity up to 1 year	25%	22%	25%	10%	10%
4. Debt with residual maturity over 1 year	75%	78%	75%	90%	90%
5. Of which: variable interest rate	*6%*	*0%*	*7%*	*1%*	*67%*
6. Share of debt sensitive to unexpected changes in inflation (d^*/d_{tot}) **(4-5-2)/7**	*66%*	*75%*	*68%*	*88%*	*19%*
7. Share of debt not sensitive to unexpected changes in inflation (d/d_{tot}) **(8-6)/8**	*34%*	*25%*	*32%*	*12%*	*81%*
Memorandum items	EUR bn, years				
8. Gross consolidated debt	2,147,028	1,925,300	2,069,216	227,173	318,703
9. Nominal GDP	2,737,600	2,059,852	1,560,024	307,003	182,054
10. Average residual maturity of debt	6.1	7.0	6.9	8.1	16.0

(1) 2012 data.

inflation expectations, hence a higher nominal interest rate required by the market, the second term in equation (2) does not depend on inflation either (to the extent that the real interest rate remains constant and that a full Fisher effect is at work).

Overall, the elasticity of the debt-to-GDP-ratio to the inflation rate is a function of $\frac{d_t^*}{d_t^{tot}}$, the share of **the long-run, domestic-currency-denominated, fixed-rate part of the debt.** In particular, when the pass through from low inflation to the nominal interest rate is one-to-one the formula for the elasticity is:

$$\varepsilon_{d_t^{tot},\pi} = -\left(\frac{\pi}{1+\pi}\right)\left(\frac{d_t^*}{d_t^{tot}}\right). \tag{3}$$

On the other hand, when the pass-through is less than one, the elasticity is:

$$\varepsilon_{d_t^{tot},\pi} = -(1-k)\left(\frac{\pi}{1+\pi}\right)\left(\frac{d_t}{d_t^{tot}}\right) - \left(\frac{\pi}{1+\pi}\right)\left(\frac{d_t^*}{d_t^{tot}}\right). \tag{3'}$$

In this case we assume that in equation (1) $(1+i)=(1+r)(1+k\pi_t)$, where $k \leq 1$ ($k=1$ in the full Fisher effect).

Equation (3') differs from equation (3) for the term: $-(1-k)\left(\frac{\pi}{1+\pi}\right)\left(\frac{d_t}{d_t^{tot}}\right)$. The intuition behind this term is straightforward. With $k=1$ inflation reduces the debt-to-GDP ratio only via d^*. With $k<1$ also d contributes, because the outstanding-debt effect on d is only partially counterbalanced by the increased interest payments effect. This happens because also the real interest rate r due on d is reduced by inflation, as now the nominal interest rate (i) reacts less than 1-to-1 to π.

Finally, as regards the sensitivity of interest payments to inflation, it is worth noting that **total interest payments may or may not increase with inflation**. Indeed, they are given by:

$$(Int.paym./GDP)_t \approx \frac{r+\pi}{1+n+\pi} d_{t-1} + \frac{r^* + \pi_t^{exp}}{1+n+\pi} \, d_{t-1}^*$$

so that:

$$\frac{\partial inp}{\partial \pi} \approx \frac{1}{(1+n+\pi)^2}\left[(1+n-r)\frac{d_{t-1}}{d_{t-1}^{tot}} - \left(r^* + \pi^{\exp}\right)\frac{d_{t-1}^*}{d_{t-1}^{tot}}\right] d_{t-1}^{tot} \quad ,$$

where the term in square brackets is of ambiguous sign.

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COMMENT TO "THE EFFECT OF LOW INFLATION ON PUBLIC FINANCES" BY MARIA GRAZIA ATTINASI, VLADIMIR BORGY, OTHMAN BOUABDALLAH, CRISTINA CHECHERITA-WESTPHAL, MAXIMILIAN FREIER, GEORGE PALAIODIMOS, DORIS PRAMMER, PIETRO TOMMASINO AND JOCHEN ZIMMER

Ernesto Rezk[*]

1 The context for the paper

As known, almost all 20 century's economic crises – particularly as of the seventies – originated in developing and emerging countries due to their weak macroeconomic fundamentals and mainly included the following ones:

- Energy crises in the seventies (Δ in oil prices due to wars in the Middle East)
- Debt crisis in the eighties
- The Asian crises
- The Russian crisis
- The Real crisis in Brazil
- The Argentine default following the exit of convertibility (year 2002).

In most of the episodes mentioned above, public sectors were held responsible for irresponsible or unsound fiscal policies, paving the road for financial crises whose negative impacts were in turn internationally transmitted as international organisms (in particular the IMF) were forced to take responsibilities as lenders of last resort.

Conversely to what has so far being mentioned, developed countries' crises of years 2007-09 revealed three specific and worth emphasizing features:

- For the first time, emerging and developing countries were not to be blamed nor they shared responsibility for the events and they rather suffered the negative consequences via the reduction of their exports to developed countries.
- Developed countries' public sectors were not held responsible for the crises, unless the hypothesis is upheld that they failed in their regulatory role and responsibilities.
- Clearly, the financial sector was held responsible for the bubble, whose origin must be sought at the unsound credit policies towards borrowers (in the case of mortgages) and the toxic assets that thereafter spread up throughout financial and insurance institutions' balance sheets.

Needless to say, the 2007-09 international crises brought about disadvantageous consequences for many developed countries in America and Europe as, in the first place, the resulting dwindled private demand deepened the contractive phase of the cycle; likewise, international crises impaired their growth possibilities and increased unemployment rates and, finally and due to the recession and the lack of economic growth, the burden of debt went up placing countries in a difficult situation as far as sustainability was concerned. In this context, developed economies subject to pronounced deflationary pressures (both for low or negative inflation shocks) faced to opposing scenarios: a) to aim at fiscal consolidation, based on fiscal discipline and public reductions, and b) to resort to counteracting discretionary fiscal policies in

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order to check the effects of recession (mainly upon consumption) and seeking also to boost growth, should a lower and sustainable relative debt burden was to be obtained.

Let it be mentioned that the quoted Dilemma was extensively discussed by Cherif and Hasanov[1] in this same workshop 2014 when, after acknowledging that low inflation shocks worsened Debt/GDP ratios (denominator effect), these authors wondered whether grounds existed to believe that – in dealing with the impact of low or negative inflation shocks – the story could only partially told if fiscal consolidation and growth considerations were not both included into the analysis. Cherif and Hasanov's suggestion seems to be applicable as the paper here being commented also dealt with Debt Sustainability Analysis.

2 The paper's objectives and content

As the authors pointed it out, the paper intended to assess the impact of unanticipated disinflation shocks upon Fiscal Balances and the Debt to GDP ratio. In pursuing the mentioned objectives, a thorough revision was carried out of the standing literature related to the channels through which unanticipated disinflation shocks affected fiscal outcomes (that is, primary public spending, tax revenues, market interest rates and real debt stock). They conceptual framework developed was next used to assess the performance and policy implications in five Euro countries: Germany, Italy, France, Austria and Greece, for what three transmission channels (primary balance-primary expenditures and tax revenues and interest-rate channels) were resorted to for the carried out country-specific simulations on the effects of disinflationary and negative inflation shocks that accompanied a debt sustainability analysis.

With reference to the analytical content of the paper the authors, after quoting different empirical evidences of the impact of unanticipated inflation shocks upon the debt/GDP ratio, resorted to the known theoretical background in order to recall channels through which inflation affected fiscal outcomes, as for instance the real debt stock; market interest rates or primary public expenditures and tax revenues and particularly focused in the first one.

The ensuing interesting analytical development departed from the well known dynamic debt accumulation equation split as shown below in order to represent the total debt to GDP ratio as the sum of b^S and b^{NS} ratios which respectively expressed the portion of debt sensitive/non sensitive to inflation:[2]

$$b_t^{TOT} = b^S{}_t + b^{NS}{}_t$$

After rearrangement by the authors, the dynamic debt accumulation equation changed into the following expression:

$$b_t^{TOT} = [(1 + r)/(1 + n)]b^S{}_{t-1} + [(1 + r^*)(1 + \pi_t^{exp})/(1 + n)(1 + \pi_t)]\, b^{NS}{}_{t-1} - pb_t$$

in which n stands for the real growth rate, r and r^* are the real exchange rates respectively expected by investors on b^S and b^{NS} portions of the total debt, $\pi_t{}^{exp}$ indicates the rate of inflation in period t expected by investors in period t–1 and pb_t is the primary balance to GDP ratio at period t.

The new presentation goes beyond a simple rearrangement of components of the debt accumulation equation, in particular as it permits now to highlight interesting features regarding the paper's objectives. Let it be noticed that the first term on the right hand side reflects the portion of the total debt "whose cost is inflation-sensitive" and that, by being the sum of the outstanding debt

[1] Cherif, R. and F. Hasanov (2014), "Public Debt Dynamics: The effects of Austerity, inflation, and growth effects", International Monetary Fund, Washington (D.C.).

[2] As illustrated in the paper, b^S included short term debt, foreign-currency denominated debt, long-term variable-interest or inflation-indexed debt whereas b^{NS} only stood for domestic currency-denominated, long-term, non-indexed debt.

from the previous period, it depends negatively on inflation and also on interest payments which depend in turn positively on inflation; these two opposing effects upon the debt-to-GDP ratio cancel out.

Furthermore, the second term depends negatively on inflation when the period t inflation is unexpected, whereas the real interest rate r^* may decrease if inflation increases (in line with the second channel whereby inflation affects fiscal outcomes). In sum, the sensitivity of the debt ratio to the rate of inflation is a function of the debt's size and structure but depends also on the pass-through from low inflation to nominal interest rates.[3]

3 Some interesting conclusions from the paper

- Although disinflation tends to worsen fiscal balances due to spending rigidities and indexation, accompanied by a greater fall in tax revenues, the impact on the public finances of countries analyzed seems to be rather limited. Particularly due to the overall positive fiscal drag. Nevertheless, the authors showed that country specific features matter.
- Conversely, the impact of a negative inflation shock upon public finance is more pronounced due a higher rigidity in government spending and the contraction of GDP (negative growth rates).
- On the other side, the relative debt of burden, via the denominator effect, can increase, which can be partially compensated if low inflation shocks reduce the interest rate which will be applicable to newly issued debt.

Likewise, the performed Debt Sustainability Analysis presents interesting conclusions on the impact of shocks upon the GDP deflator growth, primary balances to GDP and marginal interest rates, on the basis of scenarios for a permanent shock of 1 per cent, a temporary shock of 1 per cent and a deflationary shock.

4 A final comment

The paper discussed has neatly been written and the adequate depth and equilibrium between the analytical and empirical sections contributed to strengthen the policy implications of achieved results; that being said, the point must be mentioned that multivariate analysis was resorted to by the authors, using panel regression and country fixed effect in order to assess the impact of low inflation according to the different mentioned channels. In this connection, and mainly intending to contribute to the discussion, the point deserves being mentioned that it is not evident from the text whether the multivariate analysis was used only for evaluating the sensitivity of the debt to GDP ratio to the inflation rate (pass through < 1 or = 1 from low inflation to nominal interest rates) and if panel regressions were also carried out in the case of fiscal variables.

Finally, it would have been interesting to count with the regressions results that assumedly backed figures presented in the various tables.

[3] An interesting point proven by the authors was that the value of the elasticity of debt to inflation was in turn influenced by the value reached by the pass through.

**THE WELFARE AND LABOR MARKET EFFECTS
OF MANDATORY PENSION SAVINGS:
EVIDENCE FROM THE ISRAELI CASE**

Adi Brender[*]

Many studies show that workers make poor decisions about pension savings. Policy responses to these failures include social security retirement arrangements, tax benefits for pension savings and, in some countries, also mandatory private savings towards retirement. This study examines the response of Israeli employees to the introduction of mandatory pension contributions, and the medium-term labor market effects of the arrangement, using a randomly selected panel of 300,000 employees. The first year of the arrangement, when enforcement was lax and compliance partial, provides an opportunity to identify employee preferences, before compliance became almost universal. We find that in this year both the probability of beginning to save and the tendency to contribute at rates above the required minimum were positively correlated with how (un)beneficial the required pension savings were for the employee. We also show that 5 years after the arrangement was initiated wages of its target population were reduced by nearly the full amount of the increase in employers' contributions. These outcomes indicate a rational and informed response of the employees and that such arrangements require careful and detailed examination of their consequences for the affected population.

1 Introduction

Following Kotlikoff (1987), the economic literature provides a number of justifications for government intervention in retirement savings and for imposing mandatory pensions (see Section 2 below): (a) shortsightedness of workers, who fail to understand the need to save for retirement or err in the calculation of their required level of savings: (b) high transaction costs in joining a pension savings plan and deciding on its size, which lead to workers' passivity even when they understand the need to save; (c) abuse of government income support systems, which guarantee workers a reasonable level of retirement income and lead to reduced pension savings. On the basis of these claims, two main types of government intervention are common in developed economies: (a) national insurance systems that collect mandatory payments from workers in exchange for pensions and typically include a significant component of progressive redistribution of income; (b) imposition of mandatory pension saving on workers, carried out through non-government savings institutions. In both systems it is common to split the contributions between employees and their employers. Systems of the first type exist in almost all OECD countries while the latter exist in eleven.[1] In addition, pension savings is the default in the UK and New Zealand where uninterested workers must actively ask to stop contributing.

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[1] Australia, Chile, Denmark, Estonia, Iceland, Israel, Mexico, Norway, the Slovak Republic, Sweden and Switzerland (OECD, 2009 and recent updates). The Netherlands has as system of quasi-mandatory pension with an almost universal coverage.

Table 1

Contribution Rates According to the Mandatory Pension Arrangement

Beginning from	Employer Contributions	Severance Pay Insurance	Employee Contributions	Total Contribution
1.1.2008	0.83	0.84	0.83	2.50
1.1.2009	1.66	1.68	1.66	5.00
1.1.2010	2.50	2.50	2.50	7.50
1.1.2011	3.33	3.34	3.33	10.00
1.1.2012	4.16	4.18	4.16	12.50
1.1.2013	5.00	5.00	5.00	15.00
1.1.2014	6.00	6.00	5.50	17.50

Israel introduced a mandatory pension arrangement at the beginning of 2008. It requires every worker to contribute 17.5 per cent of wages to pension savings, which are designated for the payment of a monthly pension upon retirement. The arrangement had been implemented gradually (Table 1), such that the full contribution rates came into effect from 2014. The obligation to contribute to pension savings applies to wages up to the level of the average wage in the economy and since about 70 per cent of workers earn less than the average, for them the obligation to contribute applies to the entire wage. One-third of the contribution to pension savings is deducted from the worker's wage; one third is paid directly by the employer and one third substitutes the employers' legal obligation for severance pay insurance.[2]

While there are many justifications for government intervention in individuals' lifetime income allocation, such interventions also raise non-trivial theoretical and empirical issues, especially when governments choose to intervene through a variety of policy instruments (Scholtz *et al.*, 2006). It is therefore critical that such interventions are measured and account for the particular circumstances and needs of the most affected populations. Otherwise such a policy may end-up hurting more workers than it helps (Martin and Whitehouse, 2008).

In the case of Israel, Brender (2010) found that, given the existing government intervention through the National Insurance Institute (NII) and tax benefits, the mandatory pension arrangement may adversely affect a large proportion of low-earning workers. This is because the lifetime wage profiles of many low-earning employees are flat, and the NII pensions provide them a reasonable replacement rate. Accordingly, additional pension savings reduce their incomes in years when their

[2] Employers are legally obliged to pay laid-off employees the equivalent of one month's salary per year of employment (based on the last salaries). Employers could – even before the mandatory pension arrangement – deposit 8.33 per cent of the annual salary in a special fund and protect themselves from the potential increase in employee wages. In return, the funds would belong to the employee when employment is terminated – regardless of whether the employee resigned or was fired. The mandatory pension arrangement states that the 6 per cent contribution would substitute 72 per cent of the severance pay obligation. Accordingly, it is not clear that the share of pension contributions replacing the severance pay imposed an additional burden on employers (see further discussion below).

family's disposable income (per standard individual) is relatively low and increases it in periods when it is high. The degree to which working years' income is reduced depends on the magnitude in which employer's contributions translate into a decline in wages. In addition, the arrangement reduces the total lifetime benefits provided by the State for retirement savings to large groups of low-earning workers relative to both higher-income earners and individuals who do not work at all. Since the pension saving rate required by the arrangement is non-trivial it has the potential to significantly reduce the welfare of low-earning workers as well as their employment.

One argument in favor of the mandatory pension arrangement is that most of the contribution is borne by employers. This argument is based upon three components: 1) the legal requirement that about two thirds of the total cost shall be paid by the employer; 2) the notion that many of the employees affected by the arrangement earn low wages, so their employers may not shift the tax (contribution) incidence to them due to the legal minimum wage; 3) that employment at the low end of the labor market is not very sensitive to wages and labor cost in Israel (Brender and Strawczynski, 2006) and in general (Schmitt, 2013; Neumark *et al.*, 2014). However, the effectiveness of minimum wage enforcement in Israel is questionable, especially due to the complexities of its calculation, so the actual split of the contribution incidence merits an empirical examination.

The current research examines how workers and employers reacted when the arrangement went into effect. Using administrative panel data from the Tax Authority for a representative sample of 10 per cent of the employees in the economy it examines the degree of compliance with the mandatory pension arrangement during its first year, among employees who had worked in both 2007 and 2008 and had not contributed to pension savings in 2007. This was done to determine whether compliance with the arrangement is correlated with the desirability of pension savings for the worker and in order to "exploit" the period in which enforcement was still lax so the "tastes" of savers and their employers can be identified,[3] before compliance became almost full.[4]

While compliance may be associated with the characteristics that make pension savings more desirable to the employee, it may be argued that these characteristics are associated with a general tendency for law obedience rather than a response to the mandatory pension. To account for that possibility we examine the savings rates for those who began saving only after the arrangement went into effect. If the relevant characteristics reflect obedience to laws, they are likely to be associated with a tendency to contribute at the legally required rate. If they reflect potentially larger benefits from contributing by employees that were led "to do the right thing" – after avoiding savings due to, e.g., high transaction costs and passivity - they should be associated with a greater tendency to contribute at above-minimum rates.

The main results of the paper are that in 2008 there was a large degree of heterogeneity both in compliance and in saving rates; both are positively correlated with the characteristics which determine whether pension savings are worthwhile for the employee. This behavior indicates that the mandatory pension arrangement is perceived as a burden for large groups of workers - those that the a-priori analysis identified as the potential losers from it. We also find that in 2012 – 5 years after the arrangement went into effect – the relative wages of the affected employees were reduced by the full amount of the required employer contribution. Hence, the full contribution incidence was borne by the employees.

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3 The enforcement mechanism of the arrangement was not specified when it was introduced. The perception was that employees will have to sue in the labor courts when employers fail to comply, but little attention was given to the possibility of employee non-compliance. Later procedures accorded a greater supervisory role to the Labor Ministry.

4 By 2012, 84 per cent of the employees that did not contribute in 2007 began contributing – an equal proportion to that among the employees that did contribute in 2007. The remaining proportion of non-contributors predominantly includes exempt employees.

Section 2 presents arguments used to justify government intervention to require pension contributions and potential effects on employee behavior of the introduction of the mandatory arrangement in Israel. Section 3 describes the legal and institutional framework of retirement saving in Israel and Section 4 presents the methodology and database. Section 5 examines the characteristics of the workers who did not contribute to pension savings prior to the arrangement, the rates of compliance with the arrangement and the characteristics of workers and employers that did not comply. Section 6 analyzes the pension saving rates for those who began saving following the introduction of the arrangement and examines the connection between these rates and whether saving towards a pension is beneficial for these employees. Section 7 examines the effects of the arrangement on the medium-term labor market outcomes of the target population and Section 8 concludes.

2 Justifications for mandatory pension savings and their potential effects in Israel

The common way to accumulate sufficient saving towards retirement in developed economies is pension arrangements based on the workers' income and/or savings during their working years. These arrangements allow individuals to smooth lifetime consumption while insuring the post-retirement income against changes in life expectancy.[5] The first layer of the pension system typically consists of a social insurance system that ensures a minimal income for the elderly, alongside the right to basic government-provided health and welfare services. Nonetheless, in many countries, including Israel, some of these rights are conditional on the individual not having sufficient income from independent sources, creating an incentive for low income earners to avoid saving in order not to lose their eligibility for benefits (Hubbard *et al.*, 1995). At the same time, governments provide tax benefits on pension savings during the working years to encourage the accumulation of independent sources of income and mitigate market failures.

Choosing the desired level and path of savings from the point of view of utility and consumption smoothing, while accounting for the structure of retirement and tax benefits provided by the State, creates a complex set of considerations. A significant component in the funds available to retirees consists of the yields accumulated on their savings, which depend on how early savings begin; therefore there is an advantage in initiating pension deductions at a young age. On the other hand, pension savings are intended to "smooth income and consumption" over the individual's lifetime and if the worker's income rises over his lifetime then he should contribute less in his younger years and save more later, when income is higher. In addition, there are periods in which a worker has a greater need for current income, such as during the childrearing years or when a mortgage has to be repaid.[6] Tax benefits for pension savings also constitute an important consideration in the timing of contributions. Thus, it is worthwhile to avoid pension-savings when the worker does not have any tax liability and to increase the saving rate when tax benefits can be exploited. All these factors are of course subordinate to the question of the optimal size of retirement savings beyond the pension promised by the State. Therefore, the answer to the questions of whether and how much to save towards a pension in each period depends on the parameters of the tax and social insurance systems in each country[7] and on the worker's income trajectory, family status and other parameters.

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5 Insuring life expectancy and its pricing are among the main factors that determine the value of pension benefits and a source of possible failures in the pension market (Finkelstein and Poterba, 2002, 2004).

6 Without tax benefits, it is not usually worthwhile for the worker to save for a defined contribution pension and at the same time borrow to finance current consumption.

7 Diamond (2009) points to the need to take into account the interactions between the tax and pension systems.

In view of the complexity of the calculations, it has been claimed (Kotlikoff, 1987) that workers may not save enough for retirement due to shortsightedness regarding their needs during retirement, which is likely to reflect "erroneous" discount rates or a lack of information regarding future needs.[8] A similar claim is that young workers are passive with respect to their pension savings and their behavior is characterized by inertia (see, for example, Beshears *et al.*, 2006 and Choi *et al.*, 2004), even if they are aware of the need to save for retirement. According to this claim, their passivity is a result of both behavioral considerations[9] and the fact that pension saving schemes are complex products whose "transaction costs" for entering and exiting over one's working life are high (Lusardi, 2000). Consequently, workers discover only at a relatively late stage in their lives that they have not saved enough for retirement; at this late stage it is difficult to correct the error since accumulating sufficient savings starting from that stage in life implies a significant reduction in their current standard of living. Based on these claims, a government intervention requiring saving for retirement will improve welfare. This claim is supported by the findings that pension savings are particularly low when the head of a household has a low level of schooling (Bernheim and Scholz, 1993) and that the drop in consumption after retirement is particularly large among households that did not save for this period (Bernheim *et al.*, 2001). Another claim is that workers intentionally save less for their pensions in order to exploit government benefits on retirement and therefore government intervention is justified in order to prevent abuse of this type.[10]

In contrast to these arguments, mandatory savings may also lead to "too much" savings by various types of employees and to sub-optimal lifetime distribution of disposable income (e.g., with respect to balancing pension savings with child upbringing costs or mortgage payments), especially if individuals are rational and possess the required information (Martin and Whitehouse, 2008). One of the indications for rationality and pro-activity is whether employees respond to changes in incentives in the expected directions. Additionally, if mandated savings are intended to prevent employees from exploiting the income support system upon retirement, this decision should be based on an examination of the combined effects of the pension tax benefits and the social security system on the lifetime income distribution among individuals. Although the desired level of intervention in income distribution is primarily a matter of social and political preferences, it is important to examine whether the utilization of the income support system by low-income employees results in them receiving overall larger retirement benefits than other workers.

Brender (2010) examined the incentives for pension saving in Israel based on the characteristics of workers and their families. He found that between one-quarter and one-third of Israeli employees are characterized by a low starting wage, a wage profile that does not converge to the average wage during their working years, as well as by having a spouse that does not work for most of his/her lifetime. For ***these*** workers pension savings result in a financial loss, since the amount of the pension is offset with the income supplement for which they are eligible. It was also found that saving for retirement will hamper their ability to smooth income over their lifetime, primarily because the old age social security pensions are similar in size to their net wage prior to

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8 Hamermesh (1984) found that the consumption of white couples at the beginning of the retirement period is 14 per cent higher than their income. Banks *et al.* (1998) reported a drop in consumption following retirement in contrast to what is expected according to the consumption-smoothing approach. They attribute this drop to insufficient saving.

9 For example, Lusardi (2000) found that retirement was perceived as an unpleasant future event and therefore workers prefer to ignore it.

10 The findings in the US regarding the effect of income-dependent savings programs on the savings of target populations are mixed. Gruber and Yelowitz (1999) found that health insurance has a significant negative effect on saving while Hurst and Ziliak (2006) found only a small effect for the food stamp and AFDC programs.

retirement, while during much of the period in which they save their family income per standard individual is much lower than it would be after retirement.[11]

The differences between workers who saved for retirement and those who did not were consistent with the incentives identified in simulations (as in the findings of Scholz *et al.*, 2006 for the US) and it was found that workers reacted as expected to changes in the pension system during the last decade, given the structure of incentives. These findings cast doubt on the need for mandatory pension savings (beyond the mandatory payments to the NII) and raise the concern that such an obligation will hurt low-earning workers which constitute more than 70 per cent of the non-saving employees – the target group for the arrangement.[12] This is especially the case if these employees would eventually have to pay the full cost of the increased contributions since their wages will be reduced by the cost to their employers. Nonetheless, these prospective analyses need to be tested in order to determine whether the behavior of workers following the introduction of the arrangement was consistent with these evaluations.

3 The legal and institutional background in Israel and its implications for private pension saving incentives

Starting from the mid-90s, the pension system in Israel went through a series of major reforms.[13] The terms offered by veteran pension funds were downgraded for existing savers and they were closed to new members (this was a precondition for the provision of government grants to cover the funds actuarial deficits). The terms of new pension funds were gradually downgraded, so that the pensions they offer are derived directly from the savings accumulated in the fund and the yield on them ("defined contribution"). In addition, public sector employees are directed now to the new pension funds. As a result of these changes, pension savings no longer provide an excess return to workers who are not members of the veteran funds or who are not eligible for a budget-funded pension, relative to an individual who does not save towards a pension.[14]

Even though the financial institutions no longer offer high subsidized yields, the tax benefits provided for pension savings essentially produce such yields. The benefits include three components: (a) Deposits by employers into a pension fund or credit to a budget-funded pension, up to an amount of 7.5 per cent of the insured wage, are exempt from taxation for the worker and are exempt from NII contributions. This exemption applies to wages of up to four times the average wage (a wage level exceeded by less than 5 per cent of all employees). (b) Employee contributions from the part of their wage for which the employer also contributed provide the worker with a tax credit of 35 per cent. This credit is paid for deposits of up to 7 per cent of the insured wage, up to the level of the average wage.[15] (c) Upon retirement, the pension is taxed as regular wage income and an additional exemption was applicable in the amount of 35 per cent of the pension payment,

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[11] The pension system in Israel also penalizes employees severely for withdrawing money from their pension funds before the retirement age, hence making pension saving not useful for smoothing income during periods of unemployment.

[12] The benefits that low-earning workers receive through the National Insurance system when they do not save for retirement are similar in size to those received by higher-earning workers saving for retirement, through the tax system. This conclusion is reached even though the positive correlation between the level of income during the working years and life expectancy (Cutler *et al.*, 2006), which increases the value of pensions to high-earning workers in comparison to lower-earning ones, is ignored. Accordingly, mandatory pension savings, that reduce the government lifetime benefits for low-income employees, would result in these employees receiving lower benefits than other groups.

[13] Achdut and Spivak (2010) present a detailed survey of the structure of the pension system in Israel and the reforms it has undergone.

[14] Pension funds still receive designated government bonds that pay an annual real return of 4.8 per cent to cover 30 per cent of their assets; however, taking into consideration administrative costs, the yields to a fund member do not exceed on average the long-term risk-adjusted yields in the capital market. The provident funds, where much of retirement savings are managed, do not receive designated bonds.

[15] Similar regulations existed for workers whose employers do not contribute to pension savings.

up to a level (of the exemption, not of the pension payment) of about 30 per cent of the average wage.[16] Pensioners are also eligible for an additional credit point (NIS 215 per month) if their spouse is not working and has no pension. However, the benefits at the time of the contribution are relevant only for workers whose wage exceeds the tax threshold (about 45 per cent of employees earn less than the tax threshold).[17] The benefits when drawing a pension are relevant to only about one-fifth of the workers, whose wage was particularly high during their working years. As noted above, a significant portion of low-earning workers experience limited upward wage mobility (relative to the national average wage) throughout their working life.[18] In the wage and tax dataset used in the current study (see the description below) about two-thirds of the workers that earned below the tax threshold in 2000 and were working in 2010 did not reach the tax threshold in 2010 either. When account is taken of those who did not work at all in 2010, about three-fourths of the workers who did not pay taxes in 2000 were not able to utilize the tax benefits in 2010 either.

Individuals who do not gain from a subsidy on savings or tax benefits may still wish to save for a pension in order to smooth their lifetime income. One common measure of this is the ratio of retirement income to the individual's wage during his late working years ("the replacement rate"). Since every citizen is eligible for an old age pension from the NII, additional pension savings by low-earning workers is needed only if the size of the state old age pensions does not allow them to maintain a level of income in retirement that is similar to what they earned during their working years. The state old age pension consists of three components:

- The basic grant: a fixed monthly sum of about 17.5 per cent of the average wage in the economy for a single individual and 26.3 per cent for a couple.
- An addition of 2 per cent for every year in which a worker contributed to NII, beyond the first ten years, up to 50 per cent of the basic grant. Two working spouses are eligible for an old age pension on the basis of the sum of their rights as individuals, which is larger than their eligibility as a couple.
- The income supplement program, which is means-tested, provides a minimum income equal to 32 per cent of the average wage for individuals and 48 per cent for couples. Eligibility is not affected by pensions that total up to 13 per cent of the average wage for individuals and 20.5 per cent for couples.[19] For recipients of higher pensions the state old age pension is offset against the pension at a rate of 60 per cent, until it is reduced to the level of the basic grant, including the addition for years of contribution.[20] The amount of the basic grant and the addition for years of contribution in the case of couples where both spouses worked for most of their adult life – regardless of their wage level and whether they worked part-time or fulltime – exceeds the income ceiling for the income supplement payment and therefore they are not subject to the offset of their occupational pension against the old age pension. The NII old age pension is also not considered as income in the calculation of tax liability and therefore does not affect the marginal tax rate imposed on the pension payment.

The full old age pension exceeds the wage of low-earning workers in the economy (which, as noted above, remains flat over time for a large number of employees). For example, the size of the old age pension for a couple, including the income supplement, is higher than the minimum

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16 New legislation from 2011 gradually increases this exemption up to 67 per cent of the pension payment by 2025, including an initial increase to 43.5 per cent beginning in 2012.

17 In addition, there is a 25 per cent tax exemption on interest and capital gains for pension savings in the case of indexed assets (on the real yields) and 15 per cent on non-indexed assets (on the nominal yield). The value of this exemption is much smaller than the value of the tax benefits for pension contributions.

18 The gross minimum wage for a full-time employee is fixed at 47.5 per cent of the average wage.

19 Individuals over the age of 80 receive an addition both to their basic old age pension and to the income supplement.

20 Hubbard *et al.* (1995) showed that offsetting the social benefits of workers against the wealth they have accumulated can have a significant negative effect on the accumulation of wealth.

Table 2

Personal Characteristics Affecting the Decision to Begin to Contribute

Characteristic	Cause for Behavioral Effect	Effect
Low wage	Sufficient replacement rate through old-age allowances	(-)
	No tax benefits on withdrawal	(-)
Wage below the tax threshold	No tax benefits at the time of contribution	(-)
Married woman	Insufficient replacement rate through old-age allowances as spouse is likely to work, even if he does not work currently.	(+)
Working spouse	Insufficient replacement rate through old-age allowances. No offset of allowances against pension.	(+)
Spouse contributing to pension	Additional contribution is unlikely to be offset against the old-age income supplement	(+)
Female	Even if currently unmarried, expected to have a working spouse later in her career.	(+)
Children	Consumption smoothing` liquidity.	(-)
Older age	Insufficient accumulation to overcome the pension offset against the old-age income supplement	(-)
Arab	Unlikely to have a working spouse, especially if currently single or has a non-working spouse	(-)

wage.[21] Therefore, an individual who is the sole income earner and earns a low wage more or less maintains his standard of living upon retirement and has no significant advantage in saving towards a pension. Furthermore, accounting for the fact that during some of his working years he also had to support his children (90 per cent of Israeli employees have children during their working years), it is likely that the standardized household income during those years was significantly lower than on retirement. In addition, workers whose wages are below the tax threshold and who save for their pension over a significant period may be “fined”, as mentioned above, by having their income supplement reduced. On the other hand, for high-earning workers, particularly those who are above the tax threshold, pension savings are desirable since otherwise their income during retirement will be significantly less than during their working years and also because they will thus enjoy the tax benefits. For two working spouses saving is worthwhile, even if both earn less than the tax threshold, in order to avoid a drop in their income after retirement. In this case, their state old age pension will also not be offset against their pension since the offset is not carried out against the basic grant or the addition for years of contribution.

The characteristics of employment and the range of wages in Israel, together with the tax incentives and the structure of the NII pensions, create a spectrum of pension saving behaviors that vary according to the characteristics of each individual and household (Table 2). The analysis shows that low-earning employees will tend to avoid saving for retirement, both due the inertia of

[21] About 80 per cent of workers are married when they reach the age of retirement.

their wage and – if their wage is temporarily low – because they will prefer to defer their contributions to years in which it will exceed the tax threshold and they will have higher disposable income. On the other hand, workers at an intermediate wage level or above will prefer to save for retirement. Married workers, in particular those whose spouses also work, are expected to save more than singles and those whose spouse does not work. Parents of young children are expected to save less than those without children. In addition, there may be differences in the rate of pension contributions also among those who save for their pensions. In particular, workers at intermediate/low wage levels are likely to prefer saving at lower rates than those required by the mandatory pension arrangement since the retirement savings at those rates together with the NII pensions will provide them with a reasonable replacement rate on retirement. The characteristics that influence the preference to save for a pension are discussed further in Sections 5 and 6 below.

4 Methodology and the database

According to the mandatory pension arrangement, which went into effect at the beginning of 2008, employees who worked for the same employer at least nine months should have begun to contribute from their wage towards a pension. This means that individuals who worked in 2007 and did not switch employer in 2008 were required to contribute. This also applies to individuals who worked for the same employer for a period of nine months or more in 2008, even if this is not the same employer they worked for in 2007. The required contribution rate was still quite low in 2008: 0.83 per cent from the worker and another 1.67 per cent directly from the employer.

The fact that the arrangement was applied uniformly to all workers who did not save towards a pension in 2007 makes it possible to test whether the response of workers to the introduction of the arrangement was consistent with the of incentives created by the institutional structure of retirement savings, NII pensions and tax benefits. In particular, since the arrangement is likely to adversely affect low-earning workers, we want to examine whether these workers behaved accordingly or whether the arrangement motivated them to begin saving towards retirement, as would be expected if their lack of pension saving was due to passivity and shortsightedness.

The behavior of workers is examined in two stages: The first attempts to determine whether as a result of the introduction of the arrangement workers who had not saved toward their pension in 2007 began to do so in 2008 and whether the differences between workers in the tendency to begin saving were consistent with the nature of the incentives, as related to their characteristics. The examination is based on probit regressions in which the binary dependent variable is "whether workers who did not contribute to their pension in 2007 and continued to work in 2008 started to contribute in 2008" (Logit estimation yielded very similar results). Since the mandatory pension contribution also applied to the employer, the decision whether to contribute is also dependent on the employer's willingness to cooperate with the workers in non-compliance, a decision that will likely vary according to the employer's characteristics. Accordingly, the analysis also controls for these characteristics.[22]

The second question is whether workers that started to contribute in 2008 did so at the minimal rates specified in the arrangement or at the higher rates to which the arrangement will converge in coming years. Since the arrangement made pension contributions mandatory, it is likely that many workers who were not interested in this level of saving, but who nevertheless decided to comply with the arrangement, contributed according to the minimal rates in order to minimize the

[22] In line with the relatively low contribution rate in 2008, we do not observe in the data a significant change in the proportion of workers who switched employers between 2007 and 2008. As noted above, in later years, when enforcement became clearer, the vast majority of employees and employers began to contribute.

"damage", particularly at lower income levels.[23] On the other hand, the theories that attribute the lack of pension saving to passivity and high transaction costs, predict that those who start saving will do so at rates that are compatible with the long term needs. This is particularly the case since the fees charged by the pension funds are negatively correlated with the size of the savings. As in the examination of the decision to begin saving, the study looks at whether initial low saving rates are correlated with the characteristics that lead to pension saving being less desirable.

The link between the pension saving rate and workers' characteristics, which determine whether pension saving is worthwhile for them, were tested using a probit regression in which the dependent binary variable is "whether the worker that began to contribute contributed not more than 0.83 per cent of his wage". This test directly determines who among the workers that began saving following the introduction of the arrangement did so at the minimal rates specified by the law and highlights the correlation between the tendency to contribute at such low rates and the characteristics that make saving less desirable.[24]

The statistical and econometric analyses are based on a random sample of 10 per cent of the employees in Israel, *i.e.* about 300,000 individuals. The database includes employers' reports to the Tax Authority regarding the salaries of their workers, the various deductions made, credit points, the number of months worked, etc. The file is in the form of a panel for the years 2000-12 and includes the worker's employer (for years in which the worker had several employers the data on each employer appears separately and they have been consolidated), such that it is possible to know whether the worker switched employer during the year or between years.[25] Using data from the Tax Authority and the Population Registry, the spouses of all the married workers were identified and their full tax returns were also obtained in order to determine whether they were working, the level of their income and whether they contributed to their pension. In addition, the Population Registry was used to identify the ages of a worker's children and his place of residence, a variable that makes it possible to identify the vast majority of Arab workers.

5 Compliance with the requirement to contribute toward pension savings

In 2007, about 950 thousand employees (about 38 per cent of the total) did not contribute to pension savings from their wages.[26] There are major differences in the characteristics of employees who contributed and those who did not and they are consistent with what is predicted by the analysis of pension saving incentives (Table 2).[27] Eighty five per cent of those who did not save for pension earned less than the median wage (Table 3) and about 70 per cent did not reach the tax threshold. In contrast, only about 2 per cent belonged to the top quintile. The table shows that employment without a pension arrangement was to a large extent a phenomenon of the private sector, particularly among small employers. A more in-depth examination of the data shows that among workers below the tax threshold, the wages of the minority who contributed to pension savings were also much higher than those of workers who did not.[28]

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[23] This is because for these workers saving is not desirable even if their pension payments increase to a level above the point where they fully offset the National Insurance income supplement.

[24] Similar OLS equations, in which the dependent variable was the contribution rate, yielded qualitatively similar results.

[25] The identification of the employers is accomplished through the deduction file number. There are a small per centage of cases in which the deduction file number changed from one year to the next, without an actual change in employer, and they are counted as a change in employer.

[26] Men aged 22-67 and women aged 21-62 who worked for at least four months.

Throughout the article, workers are defined as having contributed to pension savings whether they contributed directly or alongside their employer.

[28] The database does not contain information on hours worked.

Table 3

Characteristics of Workers Who Did Not Contribute to Pension Savings in 2007

	Contributed to Pension Savings	**Did Not Contribute to Pensions Savings**
	(percent of the group in the column)[1]	
Income below the median	28.8	85.2
Belongs to the top Quintile	31.0	1.8
Private sector	65.8	92.2
Married	72.1	49.2
Spouse contributes to a pension arrangement	41.7	17.1
Under the age of 30	17.8	41.2
Not liable for tax	28.4	70.8
Employer with less than 100 employees	29.2	67.5
Lives in an Arab town or village	6.6	13.6

[1] Relates to men aged 22-67 and women aged 21-62 who have worked for at least 4 months.

Among workers that did not contribute in 2007, about 815 thousand also worked in 2008; they constituted the main target population of the arrangement.[29] Of them, 51 per cent began to contribute, which is much higher than in previous years. For example, only 18 per cent of the 930 thousand workers that had not contributed in 2006 started to contribute in 2007. In addition, the percentage of workers with the same employer who stopped contributing declined, though by a small magnitude: from 4 per cent in 2007 to 3 per cent in 2008. The increase in the proportion that began contributing is evidence of the major effect that the mandatory pension arrangement had on saving patterns. Still, a large percentage of workers did not comply. Of the workers that did not begin contributing, only one-third switched employer in 2008 and worked less than nine months with the new employer, which would potentially provide a legal reason for them not starting to contribute.[30]

There is a clear relationship between a worker's income level and the tendency to comply with the arrangement. The compliance rate among workers in the lowest quintile who did not contribute in 2007 was 38 per cent, while in the fourth quintile it reached 68 per cent.[31] The low rate of compliance among small employers and their workers is evident in Figure 1, as is the monotonic increase in the rate of compliance according to size of employer. This compliance may be the result of intermediate and large-sized employers having maintained active pension arrangements for some of their workers prior to the mandatory pension arrangement going into effect and therefore they were not required for any major organizational effort to bring in additional

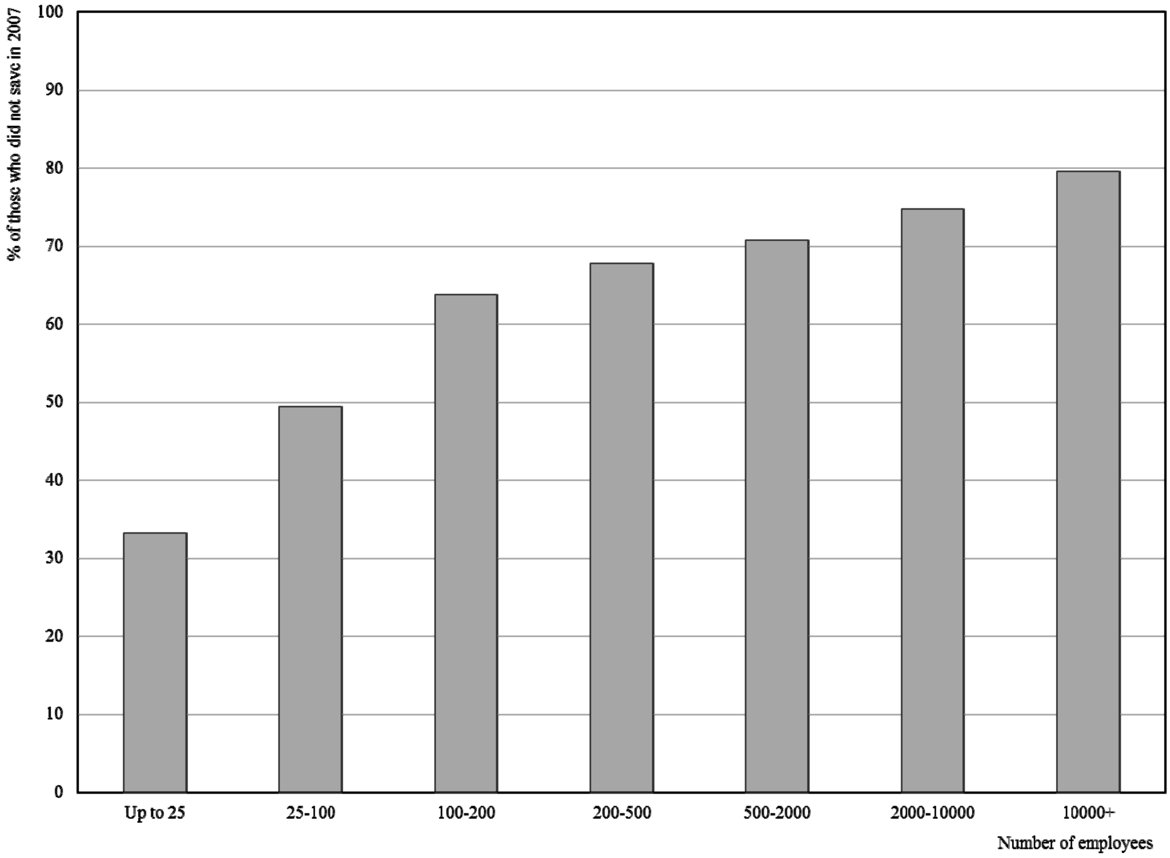
[29] Since in 2008 the arrangement applied only to workers who had been employed for at least nine months with the same employer, those who started to work after March 2008 were still exempt, even if they were employed for the whole period by the same employer.

[30] Since this relates to continuously employed workers, the requirement to contribute also applied to some of those individuals who worked less than nine months or that switched employer between the years.

[31] As shown in Table 3, only a negligible number of workers in the top quintile did not contribute in 2007. Apparently some of them had alternative pension arrangements as self-employed.

Figure 1

Distribution of Workers Beginning to Save Towards a Pension in 2008 by Size of Employer



workers.[32] Compliance is likely to also reflect their ability and that of their workers' union, to attain better pension arrangements, as well as their potentially higher risk in not complying.[33] Accordingly, the empirical analysis of the tendency to begin to contribute needs to control for employer size. This is true in particular since employer size is also correlated with the wage level and other characteristics that determine whether saving is worthwhile for the worker.

Table 4 presents the differences in the proportions of workers that started to save according to several additional characteristics. The data emphasize the difference between the public and private sectors, between the Jewish and Arab populations and between men and women. The direction of the differences between the groups for all these characteristics is similar to that of the differences in the proportion of savers among all workers prior to the arrangement. Nonetheless, since there is a high correlation between the various characteristics, it is necessary to analyze the differences using equations that identify the separate effects of each characteristic on the probability of a worker starting to contribute to pension savings.

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32 In 2007 about 30 per cent of all mid-sized and large employers employed both a significant proportion of employees that contributed to pension (20-80 per cent) and a significant proportion that did not. The dataset does not allow identifying this proportion for small employers.

33 The legislation did not differentiate between employers, but it was reasonable to assume at the time that enforcement would begin with the larger employers due to their higher visibility.

Table 4

Workers Who Started to Contribute in 2008 According to Various Characteristics

(percent of the workers in the category that did not contribute to pension savings in 2007)	
Men	44.0
Women	59.5
Public sector	74.5
Private sector	49.3
Resides in an Arab town	33.8
Resides in a Jewish town	54.0
Immigrated after 1989	60.8
Native Israeli	48.6
Spouse contributes to pension savings*	62.3
Spouse does not contribute to pension savings*	54.3

* Of those who have a working spouse.

Table 5 presents the results of a probit equation which examines the probability of a worker who had not contributed in 2007 (and continued to work in 2008) starting to do so in 2008. The equation was estimated for 78,618 employees included in the sample that had worked in both years, were below the retirement age and had worked for at least 4 months with non-negligible earnings. The dependent variable in these equations is a binary variable that takes the value 1 if the worker started to contribute in 2008. The reported coefficients are the marginal effect of each variable.

The characteristics associated with a legal exemption from the pension saving requirement had a negative (as expected) and large effect on the probability of starting to save.[34] The chance that a worker who switched employer between the years would start contributing is lower by 24 percentage points than that of a parallel worker that did not switch employer. The probability declined by another four percentage points if such a worker also worked less than nine months in 2008. In addition, there is a strong positive correlation between the decision to begin contributing in 2008 and the number of months worked during the year and a negative correlation with the worker’s number of employers in 2008. The negative effect of switching employer on the probability of starting to save declines with the workers age and increases with salary. Nonetheless, very few workers who did not save for their pension in 2007 had a sufficiently high wage in order to switch the sign of the overall effect of “switching employer” to positive.[35]

The demographic characteristics of workers who began contributing in 2008 differ significantly from those of workers who continued not to contribute and are consistent with the incentives highlighted in Table 2. The probability of women to begin contributing to their pension

[34] In the relevant population, *i.e.* workers that did not contribute to pension savings, switching employer was a common occurrence; more than one-third of these workers switched employer between 2007 and 2008 (which is nearly identical to the per centage who switched between 2006 and 2007). Nonetheless, we also estimated equations without employer characteristics; the coefficients of the other variables were not significantly affected by this omission.

[35] The effect is equal to the sum of the coefficient of the variable “switching employer” and the product of the coefficient of the interaction of “switching employer multiplied by annual wage” and the worker’s annual wage.

Table 5

Factors Correlated with the Decision to Start Contributing to Pension Savings, 2007/8 compared to 2006/7[1]

	Marginal Effect Between 2007 and 2008	z		Marginal Effect Between 2006 and 2007	z	
Individual characteristics:						
Gender (0 – men, 1 – women)	0.1159	18.40	*	0.0120	2.99	*
Resides in an Arab town (binary variable)	-0.1333	-21.44	*	-0.0487	-11.71	*
Age	0.0128	8.08	*	0.0031	2.95	*
Age squared	-0.0002	-9.58	*	-0.0001	-5.12	*
Married man (binary variable)	-0.0097	-1.25		-0.0078	-1.56	
Married woman (binary variable)	0.0719	8.90	*	0.0242	4.47	*
Divorced/widowed man (binary variable)	-0.0113	-0.89		0.0118	1.39	
Divorced/widowed woman (binary variable)	0.0555	5.21	*	0.0049	0.70	
Number of children aged 0-3	-0.0162	-4.02	*	-0.0091	-3.36	*
Number of children aged 4-8	-0.0211	-6.04	*	-0.0135	-5.72	*
Number of children aged 9-18	-0.0195	-7.79	*	-0.0093	-5.34	*
Number of children aged 19-25	-0.0096	-2.60	**	-0.0036	-1.40	
Immigrated to Israel after 1989 (binary variable)	0.1579	7.80	*	-0.0104	-0.81	
Immigrated to Israel after 1989*potential working years	-0.0033	-6.30	*	0.0001	0.23	
Income and employment characteristics:						
Annual income (in 10,000s of NIS)	0.0046	6.10	*	0.0188	34.83	*
Annual income squared (in 10,000s of NIS)	-0.0001	-11.63	*	-0.0002	-30.20	*
Annual income >48,000 (binary variable)	0.1254	21.59	*	0.0777	19.63	*
Exceeds the tax threshold (binary variable)	0.0223	4.23	*	0.0070	2.03	**
Number of jobs during the year	-0.0346	-17.29	*	0.0080	6.55	*
Number of months worked during the year	0.0485	36.48	*	0.0071	6.94	*
Spouse characteristics:						
Age of spouse	-0.0025	-11.00	*	-0.0018	-13.16	*
Does spouse work? (binary variable)	0.1032	13.56	*	0.0851	19.20	*
Does spouse contribute to pension savings? (binary variable)	0.0996	13.80	*	0.0409	8.73	*
Annual income of spouse (in 10,000 of NIS)	-0.0027	-7.10	*	0.0001	0.43	
Employer characteristics:						
Size of employer (number of employees)	0.0001	13.44	*	0.0000	19.50	*
Up to 15 workers (binary variable)	-0.3692	-73.44	*	-0.1325	-43.10	*
15-30 workers (binary variable)	-0.2903	-47.93	*	-0.1043	-30.26	*
30-50 workers (binary variable)	-0.2039	-36.60	*	-0.0799	-25.15	*
Switched employer between the two years (binary variable)	-0.2419	-16.60	*	-0.0172	-1.83	***
Switched employer*worked less than 9 months (binary variable)	-0.0426	-3.91	*	0.0272	3.49	**
Switched employer*age	0.0008	2.06	*	0.0006	2.29	**
Employed in the public sector (binary var.)	0.1234	15.04	*	0.0590	12.08	*
Switched employer*annual wage (in 10,000s NIS)	0.0175	18.16	*	0.0009	14.00	*
Constant (the equation coefficient)	-1.1825	-13.90	*	-1.6112	-15.27	*
Number of observations	78,618			78,801		
Pseudo R squared	0.2022			0.1730		

[1] A panel of workers who worked at least 4 months in 2008. Men aged 22-66 and women aged 22-61 in 2008, with annual income of at least NIS 3,000 who did not contribute to pension savings in 2007. The probability of workers who did work and did not contribute in 2006 and worked in 2007 was estimated in a similar way.
(*) significant at the 1 per cent level; (**) significant at the 5 per cent level; and (***) significant at the 10 per cent level.

is higher by 12 percentage points than that of men. In addition, women tend to prefer working for employers that comply with the labor laws, since these laws, such as those related to maternity benefits, may be more important for women. These employers are likely to also comply with the rules for pension contributions.[36] As expected, the difference between the genders is even more pronounced when we look at the effect of an individual being married on whether he/she starts contributing. Among married women this effect is seven percentage points higher than for single women and among divorced and widowed women the difference is six percentage points. In contrast, the marital status of men has no effect on compliance, if the wife does not work. The number of children in a family has a negative influence on the tendency to start contributing – without any significant difference between fathers and mothers.

The age of a worker has a relatively large though not monotonic effect. Up to age 35, the age effect is positive, but it changes sign at higher ages. For example, the probability that a 55-year old worker who did not save for his pension in 2007 will start doing so in 2008 was 7 percentage points lower than the corresponding probability for a 35-year old. This difference reflects the decline in the likelihood of accumulating significant pension savings with the age at which the worker starts to save. In addition, it is likely that older workers who have not yet saved for their pension have a low expectation that their future wage will increase significantly (which would make pension saving potentially worthwhile) in comparison to young workers. Among the Arab population, the probability of starting to contribute to pension savings was 13 percentage points lower than among the Jewish population, reflecting the lower probabilities for both a future rise in salary (see Table 7 below) and for having a working spouse.

The employee's income level had a significant influence on the probability of starting to save in 2008. The effect of income on its own is positive and statistically significant at all the relevant levels, although its magnitude is not large. For example, the probability of a worker whose monthly income is NIS 7,000 to begin contributing is higher by 0.75 percentage point than for a worker whose monthly income is NIS 5,000. In contrast, there is a large effect of the wage being above the tax threshold: it raises the probability of complying with the arrangement by 15 percentage points (the sum of the coefficients of "income above NIS 48,000" and "above the tax threshold"). This result reflects the major importance of tax benefits in determining whether saving for a pension is beneficial and their corresponding effect on the behavior of workers. The fact that workers below the tax threshold tended not to save towards a pension also demonstrates the willingness of many employers to cooperate with the worker for their mutual benefit.[37]

The spouse's employment status has a large effect on determining whether contributing to pension savings is desirable. Working spouses, particularly those continuously employed, will be eligible for the full tenure supplement to the NII old age pensions and therefore their private pension will not be offset from their state old-age pension. In addition, the NII pensions do not fully substitute the income of a household in which both spouses work so such a couple needs to save towards their pension in order to achieve a reasonable replacement rate. The data confirm these considerations: the tendency of a worker with a working spouse to start contributing was 10 percentage points larger than if his spouse did not work and it increased with the spouse's income. In addition, the tendency of a worker to start contributing was 10 percentage points larger when the spouse was also contributing to pension savings.

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36 This is in addition to the effects of the employer's number of workers and being in the private or public sectors, which are observable and controlled for in the equation.

37 Even when workers are not liable for income tax, reporting pension contributions - if they are paid - is beneficial for them and their employers; otherwise, the employer's contributions will be liable for NII contributions. An employer that does not report pension contributions to the tax authority will not be able to deduct them as an expense and therefore it is preferable for him to fully report them.

Since the obligation to contribute applies both to the worker and the employer, the worker can avoid doing so only with the employer's cooperation. The employer has a clear interest in avoiding the costs of the arrangement; thereby also satisfying the worker's preference not to contribute (regardless of the division of the arrangement's overall cost between employer and employee). However, the employer is exposed to legal risks for not complying with the arrangement and therefore it is unclear that he will agree to cooperate with the employee or that he himself would initiate non-compliance. The analysis shows a clear difference between employers. Thus, in the public sector – where in any case there are only a few workers without a pension arrangement – the probability of workers without a pension arrangement to start saving is 12 percentage points higher than the corresponding probability in the private sector.[38] In addition, there are significant (and non-linear) differences between employers according to size. The tendency not to start contributing is particularly large among workers employed by small employers. There is a gap of 37 percentage points between employers of up to 15 workers and employers of 100 workers.[39] In contrast, the difference between employers of 100 workers and employers of 200 workers is only 0.6 percentage points. In other words, non-compliance with the arrangement was particularly common among small employers and their workers.

The right side of Table 5 presents the results of a parallel equation for the characteristics of workers who did not save towards a pension in 2006 and started to do so in 2007, before the arrangement went into effect. The results indicate that most of the personal characteristics that determine whether saving is desirable also had a significant effect on the decision to save in 2007. However, the marginal effect of most of the relevant characteristics increased substantially in 2008, indicating greater selectivity. It appears that while in the past there was variation in the behavior of workers for whom saving towards a pension was only marginally beneficial, the arrangement induced these individuals to begin saving. In contrast, individuals for whom saving towards a pension was clearly not desirable tended not to save in 2008.

The largest differences in the behavior of workers and employers between 2007 and 2008 are reflected in the variables that may capture differences in the tendency to comply – gender and employer size. While in 2007, the probability of women to start saving was higher than that of men by one percentage point, the difference in 2008 was 12 percentage points. There was also a large change in the effect of working for a small employer. The magnitude of the negative effect of this characteristic grew threefold in every category up to 50 employees. The difference is also large in the variables that are related to the legal requirements of the arrangement. Thus, number of jobs had a positive effect in 2007, which became negative in 2008; the positive effect of number of months worked grew sevenfold; and the effect of switching employer, which was not statistically significant in 2007, became particularly important in 2008. All these differences in the size of the coefficients are statistically significant.

Beyond the effects of the variables that may be associated with compliance and with the legal exemptions of the arrangement, the coefficients of the variables that are associated with contributions' desirability have also increased by an order of magnitude. The effect of a woman being married grew from 2 to 7 percentage points (in addition to the general gender gap). The difference between Jews and Arabs grew from 5 to 13 percentage points and the effects of age, income, spousal income and spousal pension contribution all grew significantly.[40]

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[38] This difference is not necessarily related to the mandatory pension arrangement but also to the accepted rules in the public sector according to which workers that have reached a particular tenure threshold in the public sector start to contribute to pension savings.

[39] The sum of the coefficient of "up to 15 workers" and the product of the coefficient of "size of employer" and the difference in number of workers.

[40] The t statistic for the difference between the coefficients of these variables in the 2007-8 and 2006-7 equations (Clogg *et al.*, 1995) were 11.3 for the Arabs variable and 5.1, 15.3, 6.3 and 6.8 for the other variables, respectively.

Another way of examining the changes in the effect of the various characteristics on the decision of workers to begin contributing is by constructing a variable to capture the probability of starting to save in 2008 on the basis of the coefficients calculated for 2007. This variable was constructed using the coefficients of the probit equation that appears on the *right side* of Table 3 in order to predict the probability of starting to save in 2008 for each of the workers in the target group. This variable was added to the equation appearing on the *left side* of Table 3 and it was found that despite its large and statistically significant effect, (a marginal effect of 45 percentage points) all the other variables remained significant.

The large differences between groups of workers in compliance with the mandatory pension arrangement and their correlation with workers' characteristics that are related to whether saving for a pension is beneficial indicate that mandatory pensions are not desirable for a large number of workers. The behavior of these workers indicates that when the requirement to save was later enforced, their welfare was reduced. In addition, it is likely that many other workers began contributing in order to comply with the arrangement or because their employers refused to cooperate in non-compliance. However, it may be argued that the decisions to comply only reflected a tendency for law obedience – which is correlated with the characteristics that make pension savings desirable - rather than the desirability of savings. To examine this possibility we analyze in the next section the contribution rates of those who began saving.

6 Pension contribution rates

If many of the workers who began saving for pension in 2008 did so only to comply with the arrangement, even though such savings were not beneficial for them, it can be expected that these workers will contribute at the minimum required rate. On the other hand, if the arrangement led workers to correct past "calculation errors", and since someone who is contributing to pension already bears the fixed "search and transaction costs" of the pension arrangement, it can be expected that those who began saving will do so at rates that are consistent with long-term pension planning. Moreover, if the dominant party in determining the contribution rate is the employer, the rate should not be correlated with individual characteristics such as spousal income and contribution rates, and the number of children. To study this issue, we examine the pension saving rates among workers who did not contribute in 2007 and started to do so in 2008. Specifically we examine whether the characteristics that were found to make pension savings undesirable (e.g., those mentioned in Brender, 2010, or in Table 2) and with a low tendency to begin saving in 2008 are associated with contribution at the mandated rate or above. The former would indicate a dominant role of obedience in the contribution decisions and the latter pension desirability.

The average saving rate among workers who began contributing in 2008 was 1.5 per cent of wages, in comparison to 2.6 per cent among those who began contributing in 2007 and 4.3 per cent among those who contributed in both 2007 and 2008. The employer's contribution gap for new savers was even larger: 2.8 per cent on average for those who began contributing in 2008 as opposed to 7.2 per cent for those who began in 2007. Moreover, there was low variation among those who started saving in 2007 between workers with different income levels and different characteristics. In contrast, the pension saving rates among workers who began to contribute in 2008 showed a large variation, which is correlated with the characteristics that determine whether saving for a pension is beneficial.

The findings with respect to the contribution rates are consistent with the idea that workers that started to contribute in 2008 can be divided into two groups: 1) those who would have started to save in any case, whether or not the mandatory pension arrangement had been introduced, and did so at rates similar to the average for the entire population (according to the data for previous years, they make up about one-sixth of the target group); and 2) workers who started to save only due to the arrangement and therefore tended to do so at low rates. This group includes about one-third of the target group. The weighted average of the saving rate that can be expected in the case of an individual who starts saving voluntarily (2.6 per cent)[41] and the minimum saving rate required by the arrangement (0.83 per cent) is close to 1.5 per cent.

Table 6 presents an analysis of the characteristics that are associated with an individual beginning to contribute at the rate mandated by the arrangement. Among workers that did not contribute in 2007 and started to do so in 2008, about 60 per cent saved at a rate of up to 0.83 per cent of their income – the minimum required by the arrangement.[42] Among workers that started saving in 2008 and who are below the tax threshold, 65 per cent saved up to 0.83 per cent in contrast to 18 per cent of the corresponding group of savers in 2007. In other words, a large proportion of those starting to save towards their pension, and in particular among the lowest-earning groups, did so at the minimum required rates. Furthermore, the proportion of those who saved at minimum rates among all those who started to save in 2008 is very similar to the estimated "addition" of savers due to the arrangement (which, as discussed above, is about two-thirds of those who started to save in 2008).

The probit equation presented in Table 6 tests the probability that a worker who started to contribute in 2008 will contribute more than 0.83 per cent of his wage. In this analysis, belonging to a group that can legally avoid the requirement to save has a major positive effect. The probability that a worker who switched employer between the two years and worked less than nine months in 2008 will start to contribute at a rate of more than 0.83 per cent is higher by about 25 percentage points than that for workers who did not switch employer and worked throughout the year.[43] This is a large difference in view of the fact that only 40 per cent of the workers who started contributing in 2008 did so at a rate above 0.83 per cent; it indicates that workers who willingly started to contribute did so in general at rates above the minimum required by the arrangement. In the public sector, where pension savings after a certain period of employment were the rule even before the arrangement, employees had a higher probability to start saving at above-minimum rates than workers in the private sector.

The results show that the variables which are related to whether pension savings are beneficial, *i.e.* level of income, being above the tax threshold, a working spouse the spouse's income and the number of children, have the expected signs. In addition, the probability that older workers, for whom it is doubtful that starting to save towards a pension is worthwhile, will save at above minimum rates is lower than for younger workers (the difference between a worker aged 60 and a worker aged 35 is 9 percentage points). We also find that, compared to its large effect on the probability to comply, employer size has only a small (although statistically significant) positive effect on the probability to contribute at above-minimum rates, implying a greater role for individual employee characteristics.[44] Still, employees who worked for the smallest employers – those with up to 50 employees – contributed less – possibly reflecting the less beneficial terms these employers receive from the pension insurers. These results indicate that beginning to

41 The average contribution rate for those who started to save in 2007.

42 Since parts of the wage are regarded as non-pensionable, the actual contribution rates may be somewhat lower than 0.83 per cent and still comply with the arrangement. The results are robust to changes of the benchmark rate to 1 per cent or 1.25 per cent.

43 The sum of the coefficients of "switched employer between the two years", its interaction with "worked less than nine months" and "months worked during the year" multiplied by 3 (the difference between 9 and 12 months). In 2007, the effect of this variable on the pension saving rates was not statistically significant and its coefficient was positive.

The positive effect of the linear "employer size" variable, which may become economically significant for very large employers is consistent with the parallel coefficient in the right column of Table 4 which reflects the common practice that employees of these employers began to contribute (at "usual" rates) after a short tenure period even before the arrangement went into effect.

Table 6

Factors Affecting the Probability of Workers Starting to Save in 2008[1] to Contribute at Above-minimum Rates

	Marginal effect between 2007 and 2008	z	
Individual characteristics:			
Gender (0 – men, 1 – women)	-0.0515	-6.27	*
Age	0.0118	5.74	*
Age squared	-0.0002	-6.56	*
Married man (binary variable)	0.0312	3.31	*
Married woman (binary variable)	0.0294	3.13	*
Divorced/widowed man (binary variable)	0.0448	2.54	*
Divorced/widowed woman (binary variable)	-0.0007	-0.05	
Number of children aged 0-3	-0.0172	-3.76	*
Number of children aged 4-8	-0.0088	-2.71	*
Number of children aged 9-18	-0.0088	-1.85	***
Income and employment characteristics:			
Annual income (in 10,000s NIS)	0.0462	27.76	*
Annual income squared (in 10,000s NIS)	-0.0003	-18.46	*
Annual income >48,000 (binary variable)	0.0715	9.43	*
Wage in 2007 (in 10,000s NIS)	0.0191-	-15.88	*
Number of jobs during the year	0.0105-	-3.88	*
Number of months worked during the year	0.0247-	11.87-	*
Spouse characteristics:			
Age of spouse	0.0017	6.49	*
Does spouse work? (binary variable)	0.0757	8.75	*
Annual income of spouse (in 10,000s NIS)	0.0026	5.46	*
Employer characteristics:			
Size of employer (number of employees)	0.0001	17.07	*
Up to 15 employees (binary variable)	0.0430-	-5.73	*
15-30 employees (binary variable)	-0.0469	-6.39	*
30-50 employees (binary variable)	-0.0391	-4.05	*
Switched employer between the two years (binary variable)	0.0551	4.80	*
Switched employer*worked less than 9 months (binary variable)	0.1223	6.29	*
Employed in the public sector (binary variable)	0.0820	9.43	*
Switched employer*annual wage (in 10,000s NIS)	0.0095	5.76	*
Constant (the equation coefficient)	-0.4312	-3.66	*
Number of observations	40,800		
Pseudo R squared	0.0929		

[1] A panel of workers who worked for at least 4 months in 2008. Men aged 22-66 and women aged 22-61 in 2008, with annual income of at least NIS 3,000, who did not contribute to pension savings in 2007 and started to do so in 2008.
(*) significant at the 1 per cent level; (**) significant at the 5 per cent level. (***); significant at the 10 per cent level.

contribute reflected employee preferences and yield considerations rather than a tendency to obey the law.

The gender coefficient, that had a positive effect on the probability to begin contributing, has a negative sign in the contribution rate equation, This effect seems to be inconsistent with the incentives of women to save, and may reflect women's self-selection of employers that leads to a higher tendency to comply with employment laws.

7 The labor market effects of mandatory pension savings

One of the arguments in favor of the mandatory pension arrangement is that even though employees may prefer not to save, most of the contribution burden is carried by employers anyway (Table 1), so the negative effect on employees' disposable income is not large. Moreover, it is claimed that since the earnings of many of the relevant employees are close to the legal minimum wage their employers cannot reduce their wages even in the medium-term. In contrast, if the enforcement of minimum wage rules in Israel is, as often argued, scant at best and, given the complexities of minimum wage calculations in Israel, it may not be relevant to the affected population. Moreover, Brender and Strawczynski (2006) estimate low labor supply elasticity (0.05-0.10) for the bottom part of the wage distribution in the Israeli labor force – suggesting that if the minimum wage is not binding, most of the pension cost burden will be borne by employees. Since the effect of the arrangement on labor cost (17.5 per cent, or 11.5 per cent excluding the severance pay, of which 6 per cent are paid by the employer) is significant, an empirical examination of the labor market outcomes of the arrangement is warranted.

The estimation of the arrangement's effect on wages and employment is based on the tax records panel. We start by constructing a binary variable for each employee in the business sector in 2007, indicating whether he or she contributed to pension (the control group) or not (the treatment group).[45] Then we construct two outcome variables: 1) the percentage change in the employee's real wage[46] between 2007 and 2012 (the latest year for which we have full data),[47] provided that the employee worked in 2007 and 2012; 2) a binary variable indicating whether the employee was still working in 2012. We estimate an OLS equation for the first variable and a Probit one for the second (Table 7), controlling for individual and initial employer characteristics,[48] in order to estimate the differential effect of belonging to the treatment group, as reflected in the associated binary variable. These variables include demographic characteristics, pre-arrangement wage, and spouse's employment and income. The sample consists of all employees that were above the military duty age in 2007, did not reach the retirement age in 2012, and earned at least half the monthly minimum wage for a full time employee and no more than the average wage.

The set of control variables we use is not sufficient, however, to fully account for the differences between employees that contributed in 2007 and those who did not. Not contributing to

[45] We focus on the business sector since our expectation is that wage adjustment mechanisms with respect to labor cost will be more relevant there. Also, as noted above, only few employees in the public sector did not have pension contributions, largely as a temporary stage in the beginning of their employment; these employees were 5 per cent of those who did not save in 2007. Robustness tests including public sector employees find slightly *larger* effects than those based only on the business sector.

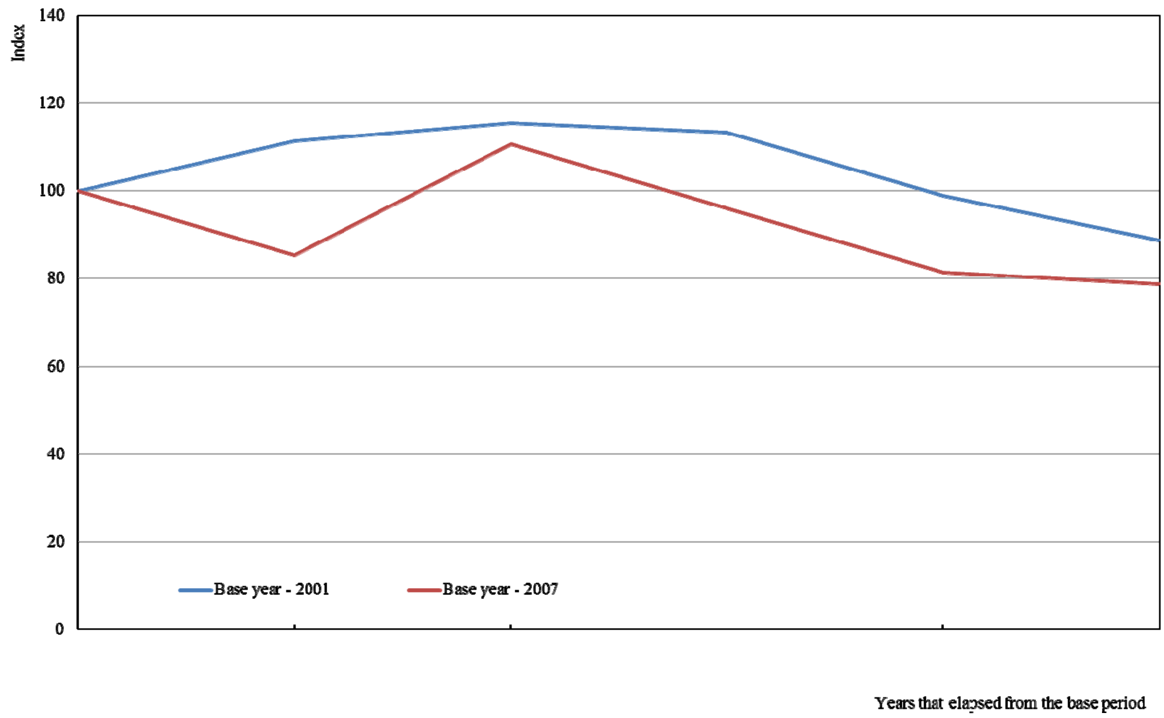
[46] The employer's contributions are not included in the reported (gross) wages.

[47] The analysis relates to a five-year period because there is no reason to assume that the arrangement would affect wage in the same manner over the years. Although it is a permanent arrangement in which most components were determined immediately upon implementation, institutional rigidities in the labor market may inhibit the adjustment.

[48] Among those who had made no pension contribution in 2001 and continued to work in 2006, 75 per cent switched employers by 2006, and among those who did not make contributions in 2007, 72 per cent switched employers by 2012. Among workers who contributed, the rates were 60 per cent and 56 per cent, respectively. The detection of switching is prone to error in cases where employers changed their file numbers with the Israel Tax Authority, but a sample check found that the bias in question is small.

Figure 2

**Unemployment Trends* Among 25-64 Aged Workers –
Comparison Between 2001-2006 and 2007-2012**



* For each period the unemployment rate in the base year is fixed at 100.

pension may reflect the employee's labor market prospects, beyond those that are indicated by the observable characteristics. This may be particularly relevant with respect to employment when the cyclical position of the economy changes, as those that are not contributing (as well as their employers) are likely to also be those that are less protected from layoffs. To account for this possibility we re-estimated the equations for the period 2001-2006, when the pattern of unemployment in the economy was similar to 2007-2012 (Figure 2), and regard only the difference in the coefficients between the periods as the treatment effect.[49] Additionally, a control variable was included in the equations: it receives the value of one if the employee changed employers between the two years and the value of zero if he or she did not.[50]

In 2001-12, the entire period investigated here, the rates of wage taxation changed in a way that reduced the tax burden on employees whose wages exceeded the tax threshold, and it did so in a differential manner. Although the rates of decrease between 2001 and 2006 were similar to those between 2007 and 2012 in the relevant income range, to avoid potential biases in the residual discrepancy, we used three variables in the equations to control for employees' wage: employee's monthly wage, wage squared (to take account of the possibility of a non-linear effect on wage), and

[49] The slightly larger decline in unemployment in 2007-2012 would tend to increase wages more during this period than in 2001-2006, thus reducing the calculated negative difference that we report.

[50] Since, as stated, there is a high rate of job-switching among members of the relevant group, it may be inferred that the decisions of the specific employer for whom someone worked at the beginning of the period are less relevant for the same employee's situation at the end of the period.

a dummy variable for employees whose wages exceeded the tax threshold.[51] If the change in tax rates between the periods affected the wages of workers who were over the tax threshold differently than the effect on those below it, these variables should reflect the difference. In addition, we put the results through robustness tests that excluded workers whose wages exceeded the tax threshold, and the results did not change qualitatively.

Another factor that may affect workers' wage trajectory is the development of the minimum wage. Changes in this parameter may have a stronger effect on low-wage workers. Since workers who did not save for pension before the arrangement congregated at these income levels, changes in the minimum wage may have affected their wages more strongly than they would those of workers who did contribute. The real minimum wage decreased relative to the national average wage during the investigation period (2007-2012) but not during the baseline period (2001-2006). Therefore, we included – in addition to the other wage variables – a dummy variable for workers whose wages in the baseline period were below or around the minimum (approximately NIS 4,000 per month in 2007 prices). If the relevant workers' wages did decrease, in relative terms, as a result of the decline in the minimum wage, this variable should account for the effect. We also performed a sensitivity test on the results by excluding workers whose monthly wage was smaller than NIS 4,000, and the results were unchanged.

Age is yet another variable that may correlate with pre-arrangement pension contributions and the wage trajectory. The proportion of pension savers is lower among young workers than among older ones, and the rate of increase in their wage is higher and may change between the periods. To account for the fact that wages change in different ways at different ages, we included control variables for age and controlled separately for the effect of age among the Arab population. We also included, as a sensitivity check, dummy variables for young workers in various age ranges.

The results indicate a statistically significant and economically large effect of the mandatory pension arrangement, suggesting that all the employer costs were reflected in wage reduction making the pension contribution incidence fully borne by the employees (Table 7). The coefficient of the binary variable "did not contribute to pension in the base year" in equation 1 indicates that the wages of the employees who did not contribute to pension in 2007 increased by 7.5 per cent *less* than those of the employees who did. Between 2001 and 2006 (equation 2) the parallel difference was only 3.0 per cent, so the effect associated with the pension arrangement is 4.4 per cent. The t statistic for the difference between the coefficients is 5.0 – indicating a statistically significant difference at the 1 per cent significance level. Comparing this figure to the employer contribution rate in 2012 – 4.16 per cent (Table 1) – indicates that the full incidence of the employers' contributions was borne by the employees, augmenting the direct employee contribution of 4.16 per cent. This result is somewhat above the range reported by Gonzales-Páramo and Melguizo (2009) in their meta-analysis of social security contributions' incidence (0.5-0.85) by Fuchs *et al.* (1998), and by Coenen *et al.* (2007). It is also consistent with the labor supply elasticities for the relevant employees reported by Brender and Strawczynski (2006).[52] The larger wage effect reported here probably reflects the high concentration of low wage employees in the studied population.[53]

The tax records do not contain data on the industry to which each employer belongs and on employee occupation. Hence we cannot control directly for the possibility that the changes in

[51] Different groups of workers have different tax thresholds. Men and women, for example, have different thresholds, and among women the threshold varies in accordance with the number of children. In the equations, we controlled for number of children and employee's gender; we also estimated the effect on men and on women separately (Table 8 below).

[52] Brender and Politzer (2014) report a tax incidence of 50 per cent for Israeli income tax rate changes, but these relate predominantly to employees with above median salaries.

[53] As noted below, narrowing the examined salary range brings the calculated differences closer to the upper range estimated by Gonzales-Paramo and Melguizo (2009).

Table 7

Factors Affecting the Change of Individuals' Wages and the Probability of Leaving Employment, 2007-2012 Compared to 2001-2006, Business Sector

(percent)

	Change (in percent) of individuals' wages						Change in the probability of leaving employment					
	coefficient between 2007 and 2012	t		coefficient between 2001 and 2006	t		Probit Coef. between 2007 and 2012	z		Probit Coef. between 2001 and 2006	z	
Individual characteristics:												
Didn't save for pension in base year	-7.516	-13.58	**	-3.068	-4.44	**	0.227	18.26	**	0.206	17.16	**
Gender (0 – men, 1 – women)	-20.784	-26.23	**	-19.395	-18.28	**	-0.038	-2.2	*	0.013	0.68	
Age	0.193	0.76		-1.327	-3.87	**	0.042	7.68	**	0.018	3.07	**
Age squared	-0.014	-5.02	**	0.005	1.34		-0.0004	5.95	**	-0.00007	-1.12	**
Resides in an Arab town (binary variable)	-63.535	-4.58	**	-109.955	-5.47	**	0.585	2.16	*	0.754	2.42	*
Resides in an Arab town*Age	1.327	1.93		3.392	3.36	**	-0.036	-2.73	**	-0.043	-2.8	**
Resides in an Arab town*Age squared	-0.007	-0.85		-0.029	-2.36	*	0.001	3.58	**	0.001	3.43	**
Married man (binary variable)	-6.897	-6.31	**	-11.406	-8.19	**	0.108	4.59	**	0.161	6.6	**
Married woman (binary variable)	-6.996	-5.95	**	-11.776	-7.95	**	0.046	1.8		0.116	4.48	**
Divorced/widowed man (binary variable)	-7.176	-4.63	**	-8.131	-3.83	**	0.094	3.06	**	0.182	5.43	**
Divorced/widowed woman (binary variable)	-2.921	-2.34	*	-1.534	-0.86		-0.127	-4.68	**	-0.108	-3.44	**
Number of children aged 0-3	-2.137	-4.64	**	-2.894	-6.08	**	0.022	2.3	*	-0.011	-1.06	
Number of children aged 4-8	-3.164	-8.03	**	-2.945	-5.55	**	-0.016	-1.91		-0.025	-2.67	**
Number of children aged 9-18	-1.727	-6.06	**	-0.842	-2.14	*	-0.038	-6.29	**	-0.048	-7.12	**
Number of children aged 19-25	-0.741	-1.67		-1.669	-2.9	**	-0.029	-3.12	**	-0.028	-2.91	
Immigrated to Israel after 1989 (binary variable)	-7.432	-13.16	**	-5.655	-7.74	**	0.001	-0.11		-0.074	-5.71	**
Income and employment characteristics:												
Annual income (in 1,000s of NIS)	-5.339	-71.77	**	-4.981	-51.92	**	-0.004	-2.94	**	-0.005	-3.24	**
Annual income (in 1,000s of NIS) squared	0.031	62.38	**	0.030	46.16	**	0.0000047	-0.46		0.0000038	0.35	
Annual income < 48,000 (binary variable)	8.515	9.52	**	9.579	8.36	**	-0.079	-4.2	**	-0.064	-3.31	**
Exceeds the tax threshold (binary variable)	6.234	10.31	**	3.029	3.77	**	0.001	0.08		-0.041	-2.95	**
Number of jobs during the year	1.798	7.47	**	1.533	4.67	**	-0.059	-10.89	**	-0.044	-7.42	**
Number of months worked during the year	9.98	57.3	**	9.278	42.75	**	-0.059	-17.55	**	-0.047	-13.47	**
Spouse characteristics:												
Age of spouse	-0.041	-1.57		-0.131	-2.98	**	-0.003	-4.86	**	-0.002	-2.52	*
Does the spouse work? (binary variable)	3.772	4.44	**	14.974	9.53	**	-0.103	-5.37	**	-0.118	-4.38	**
Does spouse contribute to pension savings? (binary variable)	0.455	-0.58		2.460	2.48	*	-0.105	-5.96	**	-0.108	-6.18	**
Annual income of spouse (in 1,000 of NIS)	0.056	12.16	**	0.021	5.59	**	0.001	7.54	**	0.0002	3.26	**
Employer characteristics:												
Number of employees (100s)	0.704	6.59	**	0.701	4.97	**	0.0002	-8.3	**	-0.00008	-2.83	**
Up to 10 workers (binary variable)	1.468	2.1	*	-1.156	-1.26		0.147	10.23	**	0.108	7.07	**
10-30 workers (binary variable)	2.052	3.15	**	-0.911	-1.08		0.118	8.61	**	0.036	2.48	*
30-50 workers (binary variable)	1.468	1.78		1.423	1.33		0.082	4.65	**	0.05	2.71	**
Constant (the equation coefficient)	134.708	24.7	**	147.983	20.43	**	-1.254	-10.84	**	-0.633	-5.14	**
Number of observations	88,612			67,756			103,738			83,789		
Pseudo R squared							0.0565			0.0540		
R squared	0.18			0.13								

The sample includes men that were at the age-range 22-60 in the base years (2001 and 2007) and women that were at the age-range of 21-55. All the employees worked at least 4 months in both the base year and the last year of the sample period (2006 and 2012, respectively) and earned at least NIS 2,000 per-month and no more than NIS 9,000 (in 2012 prices). Includes only employees that worked in the business sector in the base year.

*, ** and *** indicate statistical significance at the 1 per cent, 5 per cent and 10 per cent levels, respectively.

employee salaries reflect differential developments in their respective industries and occupations. To account for this possibility indirectly we used the Social Survey published annually by the Israeli Central Bureau of Statistics (CBS) which included in the years 2002, 2007 and 2012 questions about pension contributions, occupation and the industry in which the employee was employed. Based on these data we calculated a weighted average change in wages between 2001 and 2006 and between 2007 and 2012, allowing different weights for occupations and industries based on the distribution of the employees that contributed to pension or not. The calculated differences between the two means were minimal and in alternating directions.

Given the low contribution incidence for employers and the small supply elasticities found in the literature, we do not expect the arrangement to have a substantial negative employment effect. Taking the full 8.3 per cent contribution rate in 2012 (excluding the severance pay insurance) and applying to it the supply elasticity of 0.05-0.12 one would expect a decline in employment of the treated population by 0.4-1.0 per cent. Equations 3 and 4 in Table 7 indicate this order of magnitude of the effect, but given its small size it is not statistically discernible between the two periods (the *t* statistic for the difference between the coefficients is 1.3).

To examine the robustness of the results, we estimated various alternative specifications of the equations. Table 8 compares the outcomes, presenting the coefficients that reflect how non-saving for pension in the baseline year impacts on the change in wage. In all cases, the spreads between the estimated coefficients between 2007 and 2012 are significantly larger than those estimated for the period preceding mandatory saving, and the size of the difference resembles that shown in Table 7. Thus, for example, when the results for 2007-12 are compared with those estimated for 2000-05 or 2002-07, they are not qualitatively affected.[54] When Arab employees are removed from the sample (due to the political and security situation at the beginning of the previous decade, which impaired their wages in 2001-06), the estimated effect of pension savings increased a little. When the equation was estimated for men and women separately, no meaningful difference in the size of the estimated effect was found. When employees whose wages in the baseline year were at the low or the high end of the distribution were expunged from the equation, the difference narrowed slightly. Similarly, the results are not sensitive to the removal of the youngest and/or the oldest workers and the addition of a dummy variable for young workers, whose wages rise more quickly than those of older workers.[55] Furthermore, when the first two years of each period are investigated – 2001-03 and 2007-09, sub-periods in which the unemployment rates rose (Figure 1) – the difference in the *average* annual rate of increase in wage resembles that found in estimations for the entire period.[56]

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[54] As noted above, the period 2001–06 was chosen because it resembles the 2007-12 period in terms of the path of the business cycle. In addition to this rationale, there are other reasons to find the years 2000 and 2007 less suitable for the comparison: the 2000 data relating to pension saving do not totally correspond to the data for the other years and the 2007 data may have been affected already by the mandatory pension arrangement, because the decision to implement the arrangement was discussed and adopted that year.

[55] The dummy variable shows that the wages of young workers – before and after the arrangement – rise more quickly than those of the older workers. However, its effect on the main variable is negligible because the equations included, ab initio, control variables for age and age squared, as well as variables for the interaction between age and age squared and living in an Arab locality. The results do not change when we include dummy variables for age 30 and below or age 35 and below.

[56] It is not correct to perform a comparison for ensuing years in the 2001-2006 period because rapid economic recovery ensued in 2003, making the state of the business cycle different in those years than in 2007-2009. Similarly, it is improper to compare the years following 2003 with those following 2009 because most employees who had not made pension contributions before the arrangement began to contribute from 2009 onward; therefore, the group comprising those who had not yet begun to contribute is not representative of the population affected by the arrangement.

Table 8

The Effects of Non-saving for Pension on Wage Changes – Alternative Specifications[57]

Specification	Coefficient for 2007-2012	Coefficient for 2001-2006	Difference
Baseline estimation	-7.52	-3.07	-4.65
Comparison with 2000-2005	-7.52	-2.51	-5.01
Comparison with 2002-2007	-7.52	-3.12	-4.40
Excl. residents of Arab municipalities	-7.41	-2.51	-4.90
Men	-5.38	-1.11	-4.27
Women	-9.90	-5.43	-4.47
Monthly wage: NIS 4,000–NIS 9,000	-4.31	-0.79	-3.52
Monthly wage: NIS 2,000–NIS 7,000	-7.48	-3.58	-3.90
Monthly wage: NIS 3,500–NIS 6,000	-5.55	-2.14	-3.41
Monthly wage: NIS 3,000–NIS 6,000	-6.28	-2.68	-3.60
Excluding the young (<23 in baseline year)	-7.17	-2.42	-4.75
Plus: excl. men over age 57 and women over age 52	-7.49	-2.44	-5.05
With dummy variable for those aged 21-26 in baseline year	-7.62	-2.99	-4.63
Comparison of 2001-03 with 2007-09[1]	-4.75	-3.03	-1.72

[1] The comparison relates to a two-year period only. The t-statistic for the difference between the coefficients is 3.09 (significant at the 1 per cent level).

8 Conclusion

The mandatory pension arrangement in Israel significantly increased the number of workers contributing to pension savings: about one-half of the workers who did not contribute in 2007 started to do so in 2008, as compared to only one-sixth in previous years. By 2012, 80 per cent of those who did not contribute in 2007 did contribute. This study focuses on the arrangement's initial implementation phase in 2008, when enforcement was lax and unspecified, to learn about employee preferences with respect to the mandated savings. We find a clear connection between how beneficial pension savings are for the worker and compliance with the arrangement. In addition, workers in small firms tended to comply with the arrangement much less than other workers. It appears that closer employer-employee relations in the smallest firms facilitated collusion in non-compliance which may have also been due to, inter alia, the limited ability of small employers to obtain reasonable terms for their employees from pension insurance institutions. Most of the employees who started saving in 2008 did so at the minimum rates required by the arrangement and the tendency not to contribute more is also correlated with how advantageous pension savings are for the employee.

[57] The equations estimated were identical to those in Table 7; the differences pertain to the population for which they are estimated.

That some employees wanted to avoid contributing is not evidence per-se that the arrangement is not beneficial. The arguments raised in the literature in favor of government intervention show that individuals may not save even if it is in their benefit. More relevant is the finding that avoidance and saving at the minimum rate are correlated with the *ex ante* analytical assessment of how desirable savings are. This indicates that most of those who did not start saving did so rationally.

Among the main variables that affect the tendency to comply with the arrangement and to save at above minimum rates are the level of income, employment of the spouse and whether the spouse saves for a pension. These characteristics are consistent with the analysis of Brender (2010) which found that the mandatory pension arrangement has a particular negative effect on workers whose income is below the tax threshold and those whose spouses do not work. There is a large group of workers whose income remains low for most of their working lives and their spouses do not work. Since the NII pensions provide a reasonable solution for these workers during retirement, saving for retirement is not desirable for them.[58] These workers are the vast majority of the mandatory pension's target group. Also, for workers who are temporarily under the tax threshold, saving for retirement is not beneficial in many cases until their wage rises sufficiently so that they can utilize the tax benefits. This study indicates that *these* workers view the mandatory pension as a burden that they would like to avoid.[59] For most of the target group the findings do not support the arguments that attribute low pension savings to a lack of retirement planning or the desire to avoid "transaction costs" that are incurred in the choice of a specific pension scheme and in the management of pension contributions. If this were the cause of low (and insufficient) pension savings, it is likely that the introduction of the arrangement would have led to saving at the full rates (those that became mandatory only in 2014), already from the start. Saving at higher rates would also allow savers to receive better terms from pension saving institutions, an important factor in determining the long-term yield on savings (Whitehouse, 2000 and 2001).

An arguably mitigating factor for the arrangement's undesirability to employees is that most of the contribution is made by the employers. However, when we estimated the effect of the arrangement on the target group's wage growth during the 5 years since the arrangement's initiation we found that the employer costs were shifted to the employees, on top of the direct employee contributions. Evaluations of the perceived "lost income" due to excessive pension savings based on the framework of Card and Ransom (2011), suggest that the negative effect of the arrangement on the permanent income of *workers for whom it is not desirable* is between one-third and 40 per cent of the size of the pension contribution – namely 4-5 per cent of the employees' income (excluding the severance pay insurance).[60]

When comparing the findings about the effect of the arrangement on wages with the added direct cost to the employer, the question arises of how much consideration should also be given to the effect of the severance-pay contribution that was transferred to pension saving. In our judgment, severance pay has no meaningful implications for the current analysis for several reasons. First, the Severance Pay Law preceded the mandatory pension saving arrangement by years and both groups of workers – those whose employers contributed to their pensions and those who did not – were eligible for severance pay. In other words, even if the depositing of severance

[58] Although, formally, first pillar pensions in Israel are indexed to the CPI, in practice they are adjusted discretionally once in every few years to keep pace with wages.

[59] We find that the saving rate of households in which the primary wage earner had an average monthly salary of 2,000-4,000 NIS – the income range most affected by the arrangement, and just below the tax threshold – decreased between 2007 and 2012 by 3 per centage points (from 7 to 4 per cent). while the saving rates of all other income groups – where the arrangement was less relevant – did not change. This may also be a reflection of the undesirability of the mandated pension savings.

[60] According to the analysis of Chety *et al.* (2009), this is an underestimate of the subjective reduction in the welfare of a worker who is forced to save for retirement since the worker is far more aware of the undesired mandatory pension contribution than the future benefits from the savings.

pay in a pension-savings plan affects wage, it does not have differential effects on employees who saved for pension before the arrangement and those who did not. Therefore, severance pay should not affect the econometric comparison of the groups of employees. Second, when employers deposit the contribution to an employee's severance pay in a pension saving vehicle, they "insure" themselves against an increase in the employee's wage: whereas severance pay is paid out commensurate with the employee's most recent wage, pension contributions accumulate gradually on the basis of the employee's current wage. The up-front contribution reduces the employer's future liabilities at a rate that resembles the prevailing interest rates. Finally, the authorities have not made it clear, thus far, who is entitled to severance-pay funds in the event that an employee resigns; in many cases, this allows employers to withdraw these proceeds.[61] For this reason, the decrease in the wages of employees who are affected by mandatory pension saving should be compared only with the component of the employer's pension contributions that does not substitute for a severance-pay contribution.

This study does not claim that pension savings are not desirable, nor does it provide evidence that mandatory savings for retirement lower welfare in general. The claim made here is that *given* the existing system of old age pensions and tax benefits in Israel and in light of the existing employment and demographic characteristics, there is a large group of workers for whom additional saving is not desirable, especially when they carry the full burden of the contributions. Because a large majority of the workers for whom saving towards a pension is desirable already saved in the past, the mandatory pension saving required by the arrangement is effective predominantly for groups that are in fact adversely affected by it.[62]

Since mandatory saving toward retirement through a combination of national insurance and obligatory contribution towards a private pension is used by a large and growing number of countries, the results of this study may extend well beyond the Israeli experience. In particular they indicate a need to carefully examine the consequences of such policies on the population *specifically affected* by them. Such examinations may show that policies tailored to tackle insufficient savings by certain groups may end-up forcing excessive savings by much larger segments of the population.

[61] Longstanding vagueness surrounds the legal entitlement to severance-pay proceeds in the often-encountered event that an employee resigns and withdraws his or her pension savings. Since the entities in charge of the arrangement – the Ministry of Economy and the Commissioner of Capital Markets at the Ministry of Finance – have not clarified the legal situation, many employers take back the funds that they contributed. Furthermore, even when employees resign and do not withdraw their savings, employers often exploit the employees' ignorance of their rights and withdraw the severance-pay funds.

[62] Discussions of the long-term fiscal effects of the arrangement and its equity consequences appear in Bank of Israel (2011) and Brender (2010), respectively.

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COMMENT TO "THE WELFARE AND LABOR MARKET EFFECTS OF MANDATORY PENSION SAVINGS: EVIDENCE FROM THE ISRAELI CASE" BY ADI BRENDER

Martino Tasso[*]

Summary of the paper

This very interesting paper studies the effects of a major mandatory pension savings reform introduced in 2008 in Israel with respect to both the heterogeneous response of employees in terms of saving behavior and the tax incidence of the contributions to the pension funds. Adi looks at this issue from an empirical point of view, using a random panel with administrative information on about 300,000 employees.

The reform, gradually implemented in 2008-14, consisted in the introduction of a new mandatory pension arrangement targeted towards those without prior pension savings, which complemented (but not substituted) the existing national insurance pension system. The new, and mostly tax deductible, contribution increased over time from 2.5 to 17.5 percent of the gross wage. As Adi shows in his work, not all employees had the same incentive to participate in this scheme. Indeed, even though the program was mandatory for some portions of the Israeli population, its enforcement was lax at the beginning (i.e., in 2008). This feature provides the author with a way to check whether agents rationally reacted to the incentives generated by the program. Through a probit analysis, Adi shows that this seems to be the case. In particular, poorer workers did not participate as much because they could reasonably expect to exploit the income floor guaranteed by the national insurance pension system (after their retirement) and because they had fewer chances to take advantage of the tax deductibility of the contribution (during their working years). Moreover, the author shows that, among workers who choose to participate at first, the majority stuck with the minimal contribution rates, that is, just enough to be compliant with the law. Therefore, it seems that the program sub-optimally forced low-income workers to save too much, early in their working lives.

The second part of Adi's work looks into the issue of the incidence of the new contribution. According to the law, employees are responsible for paying only one third of the new contribution; clearly, the economic incidence does not simply follow the legal apportionment of a tax, but depends on the relative elasticity of demand and supply. Indeed, since the contribution to the new pension fund created a wedge between gross labor costs and net wage, it is interesting to study who bears the burden. The author answers this question by looking at wage dynamics in the five years following the implementation of the reform and finds that wages were reduced by nearly the full amount of the increase in employers' contributions.

The author concludes that this program, which was originally meant to stimulate savings among poorer individuals, turned out to be both inefficient (in terms of life-cycle allocation of consumption) and costly (in terms of net earnings) for many of them, given its interaction with the tax-and-benefit system in place.

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Comments

I found the first part of the work particularly convincing: my comments are, therefore, mainly calls for future research on the topic.

This study is about the effects of economic incentives on the participation to a pension savings program, which, as Adi pointed out, benefited of several tax advantages. Thus, an important question from the policy perspective is whether the program induced an overall saving increase or it simply encouraged a shift from one saving vehicle to another. In my opinion, this is a question worth answering, maybe using some additional data on households' savings allocation.

Moreover, since many scholars in this strand of literature attach a great importance to *financial literacy* in explaining households' saving patterns, it would be interesting to check whether the correlation between income and saving behavior, found in the paper, is robust to the inclusion of the education level as a control.

Finally, in some countries, workers are allowed to draw from their retirement accounts early in some specific cases of need. In those countries, a mandatory savings program thus works as an insurance program too. I believe that this feature matters when evaluating the "optimality" of the program. My understanding is that this characteristic is of limited importance in Israel; nevertheless, as the lessons learned thanks to this paper could be easily extended to other countries, I believe a clarification about the nature of the saving program should be made.

In the second part of the paper, in order to evaluate the incidence of the program, Adi compares the wage dynamics in 2007-12 of two distinct groups of employees: those who did not have pension savings in 2007 e were therefore forced into the mandatory savings program (treatment group) and those who did (control). One could worry that control and treatment group differ substantially in some unobserved characteristics (in fact, the former saved, while the latter did not). Adi compares the 2007-12 period to the 2001-06 one, which experienced a similar labor market dynamics, to account for this possibility. In my opinion, one alternative way to address this concern would be to check whether the so called *parallel trend assumption* holds, i.e. whether wage dynamics of the two groups before 2007 are similar. It could also be interesting to verify that placebo policies generate differences in wage dynamics which are not statistically different from zero. Perhaps, as an additional robustness test, focusing on new young workers (first time employees) in 2007 and 2008 respectively could reduce the severity of the problem of comparability of treatment and control group: one could argue that these workers face different institutional arrangements in an almost random fashion.

Finally, I think that the text should clarify the exact definition of the dependent variable in most of the analysis, that is, whether individual wages include the employee's and/or the employer's contributions.

Conclusions

I found Adi's paper very interesting, thanks to both its focus on a highly relevant issue from the point of view of economic policy and the care of the analysis. I really enjoyed reading it and I thank Adi for the opportunity of sharing my thoughts about this piece of research with him. Indeed, since other countries may face similar problems, this work could teach important lessons which could be usefully applied even outside Israel. In general, this paper reminds us of the great importance of the linkages of different economic policies. Because of them, even the most well-intended policies could unfortunately generate unplanned outcomes.

Session 4

NEW RULES FOR EMU?

GORDIAN KNOT OR ARIADNE'S BALL OF THREAD? SEARCHING FOR A WAY OUT OF THE EUROPEAN FISCAL LABYRINTH

Ľudovít Ódor[*] *and Gábor P. Kiss*[**]

A proper fiscal framework should ensure long-term sustainability while avoiding pro-cyclicality of fiscal policy. As a prerequisite, fiscal rules should be based on numerical indicators that are conducive to both of these basic objectives and rest on best practices. In this paper, we discuss problems that the existing European fiscal architecture fails to address, even as it becomes increasingly more complex and rule-based. In our view, a decentralised framework would be better suited to fight against the deficit bias in Europe. Accordingly, we propose that the first line of defence against irresponsible fiscal policy be provided by national, country-specific rules, with active monitoring of local fiscal councils using more robust fiscal indicators. This solution can help to design much better long-term fiscal anchors and by greater involvement of independent institutions it can also ensure the much needed medium-term flexibility. In this model, the community level would be responsible for checking compliance with minimum standards defined for local fiscal frameworks, enforcing strict programs for countries over pre-agreed limits and ensuring counter-cyclicality of EU budgets. No yearly fine-tuning of national budgets would be necessary.

1 Introduction

Fiscal policy remains an area where there continue to be substantial gaps between theory and practice. Although significant progress has been made since the crisis, the European fiscal framework itself has become overly complicated, non-transparent and almost unenforceable over the years. As Ódor (2014a) points out, comparing the end result with a well-known set of criteria (Kopits and Symansky, 1998) the European fiscal architecture scores relatively low on simplicity, consistency, definition and enforceability. The latter weakness has been demonstrated also by the current application of the new fiscal legislation: granting arbitrary number of years for correction of excessive deficits (instead of "one year as a rule"), introducing the "investment clause" and defining more space for flexibility in the application of the Stability and Growth Pact (SGP). Especially worrisome is the treatment of structural reform *plans*. *Ex ante* proposals can qualify for extension of deadlines (European Commission, 2015).

We argue that the theoretical sub-optimality and low practical enforceability can easily create another crisis of the SGP in the future. Fine-tuning the already complex system is not a viable alternative; one has to design a fundamentally new institutional set-up. Burocratic processes under political influence should be eliminated and international best practices implemented as far as fiscal indicators are concerned.

This article proposes a framework that is not only better aligned with theory, but also benefits more from synergies between fiscal rules and independent fiscal institutions (both at the European and national level). In addition, it offers a more efficient division of labour between the community and the national level with regards to fiscal responsibility. The new structure will achieve its objectives only if it takes into account country-specific conditions and is based on better

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fiscal indicators. This article therefore focuses on issues of methodology, theory and institutional set-up that must be resolved in order to design an efficiently functioning fiscal architecture in Europe.

Depending on the time horizon available for reform, strength of resolution mechanisms and potential legal obstacles, we see two possible strategies to pursue. The first is a “quick-and-dirty” approach, when radical action is necessary to cut the complex Gordian knot. In that solution, clearly defined and very limited bail-out options would be implemented at the level of the sovereign.[1] In exchange for it, big part of the current list of European fiscal rules would be simply eliminated and/or replaced by minimum standards for local fiscal frameworks. In this scenario also the definition of minimum standards would be relatively loose. The second approach is a more gradual one. Instead of cutting the problem right away,[2] lengthy discussions would be necessary to define detailed requirements for local fiscal frameworks based on best international practices. Moreover, the sovereignty principle should be substantially curbed down. It is like using Ariadne´s thread to find the way out of the labyrinth. However it should be noted that whichever strategy we choose, a fundamental redefinition of accountability between the centre and national authorities would be necessary in any case.

Our motivation is threefold. First, in our view it is necessary to better align theory and actual design of fiscal rules and institutions. The fundamental conflict between using one-size-fits-all approaches and at the same taking into account country specificities has often led to reliance on escape clauses, special regimes and “other factors”. As a result, Europe ended up with a complex web of sometimes contradicting rules and procedures (Ódor, 2014a). Paradoxically the system is relying on so many rules that the final verdict is in fact a discretionary decision of the European Commission/Council in many cases. Second, the division of labour between the community and national level is blurred. There is no clear separation of accountability and responsibility. The European framework mixes together a non-credible no bail-out principle, sovereignty of Member States in budgetary issues, the SGP and resolution mechanism like the ESM or EFSF. It is necessary in our view to define when and under what conditions the intervention from the centre is warranted. Moreover, current discussions about a stronger fiscal union will add another layer of challenges, namely, the question of a proper design of fiscal rules and institutions at the community level. It is also important to limit political influence in applying rules and procedures as much as possible. Third, fiscal indicators allow fiscal gimmickry, and real time evaluation of structural budget balances is too important part of the system given the huge uncertainty surrounding the estimates. More appropriate methodological tools are available, but their application is hampered by the current institutional set-up (Ódor, L. and G.P. Kiss, 2014).

The solution to these three fundamental problems we propose in this paper is the following. The first line of defence against irresponsible fiscal policy behaviour should be at the local level, using home-grown fiscal rules and independent fiscal institutions. Their design however should fulfil commonly agreed minimum standards. If a Member State operates with no significant fiscal risks and if spill-over effects are unlikely, no yearly intervention from the community level would be needed. These institutions should in our view focus more on avoiding pro-cyclicality at level of the whole union and managing countries breaching European limits. As far as the choice of appropriate indicators is concerned, the definition of minimum standards for local fiscal rules should prescribe a wider use of stock indicators covering the whole public sector, not just the level of general government. It should be noted that the definition of minimum standards will heavily depend on the strength of resolution mechanisms.

[1] Introduction of several facilities by the ECB (*i.e.*, OMT) can make the original idea of limited or no bail-out more credible, since spill-over effects can be mitigated.

[2] For example if far-reaching changes to Treaty are not realistic in a short time horizon.

Table 1

Deficit Decomposition

	Permanent	Temporary
Exogenous	part of structural deficit (P1)	medium-term cyclical component (T1) revenue windfall/shortfall (T2) surprise inflation/disinflation (T3) volatility of yields + lagged effects on interest expenditure (T4) long-term volatility (T5)
Endogenous (discretionary)	part of structural deficit (P2)	creative accounting and one-offs (T6) deviations from necessary investment level (T7)

The paper is organised as follows. The second section looks at possible improvements of fiscal indicators based on international best practices. The third part contains our proposed solution for a more transparent and efficient European fiscal framework. The last section concludes and discusses possible avenues for further research.

2 Better fiscal indicators

For fiscal policy to operate properly, it needs to rely on a fiscal framework that keeps debt on an optimal path and at the same time avoids fiscal policy that is pro-cyclical (*i.e.*, intensifies economic volatility). A fiscal framework is comprised of numerical fiscal rules, fiscal councils, and the planning, procedural and accounting rules of the budget. In this section we look at fiscal indicators, basic building blocks of efficient local fiscal frameworks.

We argue that improvements in 3 areas are necessary to place fiscal architectures on a more solid ground. First, a numerical fiscal rule will function properly and be enforceable only if it covers the full scope of discretionary fiscal policy. Second, a numerical rule should exclude impacts of all exogenous factors. As we will see, there is potential for significant methodological progress in this respect as well, although the uncertainty surrounding the potential GDP level and growth rate will nevertheless persist. Third, countries should put more emphasis also on optimal composition of public debt, cash flow and other medium-run solvency indicators. Independent fiscal institutions might play a very important role in all three areas.

In international practice a large number of fiscal indicators are used for setting targets, monitor compliance and analyse developments. They are created for different purposes and their definitions reflect the differences in questions they are intended to answer. It is important to make distinction between permanent and temporary components of the deficit. Similarly, the impacts of discretionary fiscal policy and exogenous factors should be separated. This is demonstrated in Table 1.

The table appears relatively simple, yet it raises difficult questions. First, what time horizon is consistent with the definition of the "permanent" component? For instance, cyclical adjustment considers the economic cycle to be temporary, and thus it does not eliminate the "volatility" experienced on longer time horizons (T_5). As a result, convergence periods, absorption cycles, financial cycles and demographic volatility are partly included in the permanent component. In practice, cyclical adjustment captures only part (T_1) of medium-term volatility, since revenue windfall/shortfall unexplained by the cycle (T_2), effects of the surprise inflation (or disinflation) on the primary deficit (T_3) and volatility of interest expenditure (T_4) are not included in the cyclical component.

The second question is how are temporary measures defined? It is possible to find here a deliberate confusion of one-off and individual items, the alternative to which would be addressing this issue at the most aggregated level (level of the budget balance). Practically, only self-reversing measures may be considered temporary (*i.e.*, the average of the actual balances and the (structural) balances, excluding temporary impacts, will be equal). The time horizon of self-reversal may be very long (a typical example is the outsourcing of government investments under PPP arrangements, the impact of which is reversed through repayments over decades). Self-reversing measures are often referred to as creative accounting (T_6), since they temporarily improve statistical indicators at the costs of the future deterioration. Deficit can be temporarily adjusted by delaying investment spending and reducing the fixed capital stock, even if maintaining its level is necessary (T_7). This measure is not automatically reversed; lower fixed capital stock can be maintained over a longer horizon.

Now we turn to a more detailed discussion of stock and flow indicators. We argue that one needs a comprehensive analysis of stock, flow and cash-flow data in order to achieve complete understanding of fiscal trends.

2.1 Stock indicators

The most used (by far) stock indicator is the level of gross public debt. A conceptual problem however is that it represents only one component of the balance sheet of the government. Net debt is a key indicator for assessing medium-term solvency, but longer term debt trajectories cannot be determined independently of the desirable level of other items in the balance sheet of the sovereign (*i.e.*, capital stock). Therefore changes to the inter-temporal net worth of the public sector might play an important role in aligning theory and practice in fiscal policy.

A practical problem is, however, that non-debt components of the balance sheet cannot be easily measured. Valuation difficulties are well known in this respect, since most of the assets and liabilities are, with the exception of quoted shares, not marketable:

- The value of a public company will be properly measured only when it is sold, generating privatisation revenue; this is not irrespective of how the government regulates the prices of services provided by these companies.
- It is also difficult to measure the value of loans and guarantees granted by the government; the simple cash-flow accounting employed the practical solution of considering both to be zero (Wattleworth, 1993). Consequently, lending for policy purpose is an item that increases debt and deficit, whereas guarantees are recognised only when called.
- The stock of government arrears is easier to measure, but was nevertheless omitted from the debt statistics, making it possible to rely on arrears to manipulate both the debt and the corresponding cash-flow financing requirement (Diamond and Schiller, 1993).
- Valuing the stock of public real assets is more difficult, since they are not marketable: have no secondary market or market value.[3] In the absence of such information, their stock can be calculated through estimates of their service life and by using various methodologies to calculate depreciation (e.g. linear or geometric depreciation assumptions) (Boskin et al., 1987). The stock of the fixed capital is not comparable across countries and their desirable level is also difficult to measure.

[3] There may, of course, exist country-specific differences; a common example, however, is a road network that is not marketable, due to which which the government will be the only potential buyer in the event of bankruptcy of a road built in a PPP contract.

- Augmenting the statistical indicator of the net worth, the net present value of future taxes and expenditure can be also measured in order to capture the impact of aging (Buiter, 1993). In spite of its theoretical advantages, this has a number of methodological issues that hinder its practical application. For example, the horizon for projecting revenues and expenditures may be subject to debate. Another question concerns realistic ways of considering parameters that limit expenditure growth (e.g. pension indexation, caps on entitlements). These may contribute to deficit and debt improvements, while the real value of certain expenditures may gradually diverge from economic performance and the distribution of this divergence at the level of individuals may be considerable.

As we have seen, the projection of net worth raises a large number of measurement and methodological questions. First initiatives have appeared in this area (Ódor, 2011 and 2014c), but introduction across all the EU Member States is not possible for the time being. Nevertheless, many of these criteria can be considered when setting the medium-term balance objectives (MTOs). As an additional country-specific criterion, the outstanding stock and the projection of financial and non-financial assets may be used. Admittedly, this would represent a deviation from the current weight of one third for the different factors; this question also requires further deliberation. FCs[4] could be relied on extensively in this respect, particularly as their independence and country-specific knowledge may be coupled with an interest in designing meaningful indicators, since they are in charge of checking that the objectives are set and delivered.

The market may of course consider that the desired level of debt would not be financeable. There are significant differences between countries in terms of the extent to which the markets are ready to finance them. Experience shows that sudden financing problems may lead to serious liquidity crises. One method of prevention is fiscal discipline, and another is transparency. Maturing debts and planned issuance should be continuously monitored to avoid surprises (more in 2.2.1), and it is also very important to constantly analyse contingent liabilities (including government bailouts in the financial system). For example, European Commission (2014) estimates potential bank bail-out costs to be covered by tax-payers of individual countries.

Our last point is that when legislating optimal debt trajectories, one has to consider also the political economy aspects of the problem. It is much better strategy to work together with all relevant political players than to impose fiscal rules from the centre. Intensive public discussions are also necessary to design long-lasting and strong domestic fiscal rules.

2.2 Flow indicators

2.2.1 Cash-flow financing requirement

Like in the case of private companies, basic stock and flow indicators are not sufficient to gain a complete picture of financial health. Cash-flow financing requirement and financing conditions can be used as starting point for identifying and managing fiscal risks. Basic cash data, debt redemption profiles or interest expenditure sensitivities can reveal information not available through gross debt figures or structural budget balances. Ódor (2014d) includes regular analysis of these variables in the risk assessment framework of the Council for Budget Responsibility. The new European fiscal framework goes in this direction when asking Member States to provide detailed debt issuance calendars.

Recent research at the intersection of macroeconomics and finance has brought a lot of dynamism into the analysis of the term structure of interest rates. Following Diebold and Li (2006)

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4 In this paper we use the expressions "independent fiscal institutions" (IFIs) and "fiscal councils" (FCs) somewhat interchangeably.

it is relatively straightforward to link small scale yield factors model with parsimonious macroeconomic models. These approaches might be also helpful in analysing permanent and temporary components of interest expenditures consistent with equilibrium path of macroeconomic variables. For example independent fiscal institutions could develop these relatively simple tools. It is especially important in periods of "abnormally" low market interest rates or in situations, when creditors has agreed to grant grace periods or accepted terms and conditions much below the market level.

2.2.2 *Statistical deficit*

The System of National Accounts (SNA93, ESA95, SNA2008, and ESA2010) records stocks and flows within a consistent framework. Consequently, it defines a deficit (b_{ESA}) as equal to the change in the stock of financial assets and liabilities, excluding effects from revaluation. Thus, the proceeds of privatisation and the government's acquisitions of financial assets are financing items, excluded from the calculation of the deficit. On the other hand it includes all the temporary components shown in Table 1.

$$b_{ESA} = P_1+P_2+T_1+T_2+T_3+T_4+T_5+T_6+T_7$$

The first important step in designing better measures of the deficit would be to filter out creative accounting (T_6) in order to eliminate bad incentives in the conduct of fiscal policy.

2.2.3 *Adjusted headline deficit*

There are two possible solutions to replace the statistical approach, which is ineffective against creative accounting. One would be adoption of international public sector accounting standards (IPSAS Board).[5] The other would be the use of practical analytical indicators, such as those generated in the past by the Congressional Budget Office (CBO) in the United States.

A potential direction would be for the flow indicators calculated by independent institutions to eliminate creative accounting by identifying them from the stock side. The CBO's methodology defines creative accounting as "operations without significant economic impact" (Congressional Budget Office, 2002). The practical approach to this is a "standardisation" of the budget deficit. A Hungarian body of experts (KESZT, 2010) has proposed a similar solution. In essence, the proposal is to generate with - simple adjustments - a "normalised" cash-flow indicator that excludes any creative accounting.[6] This involves expanding the coverage of public finances to include public companies[7] (T_{6a}) and investments to include PPP projects as if the private partners in those projects were involved merely as the financing partner (T_{6b}), and spreading over time the capital revenues from sources other than the disposal of fixed assets, e.g., over the whole concession period (T_{6c}). It should be noted here that Magyar Nemzeti Bank has regularly published such an analytical

5 The advantages of the accounting approach include the fact that it is a harmonised methodology, it is compiled by an independent institution, and the principle of substance over legal form may be an efficient tool against creative accounting, which seeks to take advantage of regulatory loopholes (partly successfully in the case of statistics). This raises the problem, however, that a focus on substance may not be altogether simple in practice, as it can take forms that might appear arbitrary. It has a further advantage in that it would be possible to turn to the international accounting standards to adopt their solutions to the creative accounting methods imported from the corporate sector, to which the standards react relatively quickly.

6 Cash-based accounting will provide sufficient information on the budgetary situation if: 1) the spending on public functions is included in the budget (there is no quasi-fiscal section); 2) the capital expenditures and revenues are related solely to fixed assets (there are no early lump-sum receipts of concession income); 3) expenditure and tax-reimbursement scheduling is adjusted to the customary deadlines (no delays); and 4) the real cost of state loans and guarantees is booked (as provisions raised) when they are granted.

7 Quasi-fiscal activities are not recorded in deficit and debt figures; but they settled as capital transfers subsequently (much later, when the government assume the debt of the public company) (Stella, 1993).

indicator since 1998 (P. Kiss, 2011). This approach requires significantly fewer data and imposes fewer methodological requirements than the previous solution and therefore it would be more practical and more transparent for some of the countries.[8]

While it may not be optimal in terms of accuracy of the indicator, the approach has an advantage in its balance between robustness/stability and simplicity. There are clear trade-offs between accuracy and subsequent revisions (revealing skeletons in the closet.) This approach can be successful only if it employs "quick and dirty" solutions. If all PPP-investment appears in the deficit in real time and the deficit covers the financing need of the total public sector (PSBR), including state-owned companies, the room for creative accounting is limited. However, this simple measure cannot indicate and exclude the temporary savings related to insufficiently low levels of public investment, which should be done at the level of the underlying deficit (T_7).

$$b_{ADJ1} = P_1+P_2+T_1+T_2+T_3+T_4+T_5+T_7$$

An alternative approach coincides with the OECD definition of creative accounting, which states that these operations have no effect on the net worth of the government (Koen & Van den Noord, 2005). As seen above, the projection of net worth has appeared among the proposals (Ódor, 2011) and in the practice of the Council for Budget Responsibility. It has the advantage of being comprehensive: besides eliminating distortions that result from creative accounting, it is also able to identify the effects of changes in parameters affecting long-term expenditures (T_5), such as increasing retirement age. However, it may also have disadvantages, specifically the aforementioned valuation problem and the absence of the definition of a desired level of financial and non-financial assets. For this reason, it is unclear how capital spending should relate to the depreciation of the stock of fixed assets (T_7).[9] It may be useful to redefine boundaries of sectors, since some of the financial assets consist of assets of corporations providing public services, underlying which there may be public fixed assets or, just as likely, quasi-fiscal debt.

$$b_{ADJ2} - P_1+P_2+T_1+T_2+T_3+T_4+T_7$$

It should be noted that while b_{ADJ1} is a cash-based concept, b_{ADJ2} rests on accrual data.

2.2.4 *Structural deficit – EU definition*

Structural budget balances are designed to filter out cyclical fluctuations and one-off and temporary measures.

In the EU approach, the impact of each temporary measure is eliminated one-by-one from the structural deficit on the basis of consensus between the particular Member State and the Commission, although there are practical guidelines (Larch and Turrini, 2009). One criterion is that of size: only measures impacting over 0.1 per cent of GDP may be filtered out. Another criterion concerns the time horizon: measures may apply to one year or a few years at most. A third one requires that the focus should be placed on current items rather than capital expenditures. Finally, for reasons of prudence, items that increase the deficit should be omitted from the filtering exercise, or else they will be classified as "temporary" by the Member States. Clearly, these practical considerations are not suitable for filtering out the self-reversing measures and do not fulfil the requirements of theoretically sound principles, and as a consequence confusion of individual (I) and one-off measures could not have been avoided. In principle, distortive effects of

[8] This method, however, does not filter out capital spending that falls short of the depreciation of fixed assets; that would be possible only at the structural deficit level.

[9] If the stock of fixed assets is at the desired level, then investments must be equal to depreciation. The latter estimate should be reliable, however.

creative accounting could have been corrected, but the criteria applied were only partly successful, if at all; the methodology does not treat quasi-fiscal activities properly, even though experience suggests that their impacts can be "outsourced" only temporarily. Some capital revenue, for example concession payments were filtered out from the deficit, but it was not spread over the whole concession period (T_{6c}).

$$sCOM = P_1 + P_2 + T_2 + T_3 + T_4 + T_5 + T_{6a} + T_{6b} + T_7 + I$$

An even more serious problem is that the cyclical component (T_1) is estimated with a weak and unstable methodology. The methodology to calculate structural budget balances - officially adopted on 12 July 2002 - remained unchanged as a production function-based output-gap approach (Denis, Mc Morrow and Roeger, 2002). Its components are:

- Cobb-Douglas production function,[10]
- NAIRU estimates based upon multivariate Kalman filter,
- total factor productivity estimated with a HP filter in the past and with Kalman filter currently.

The first step in the commonly agreed methodology is to estimate the output gap. A tendency observed here is that potential GDP estimates subsequently proved to be overly optimistic (Larch and Turrini, 2009). Most Member States experienced a high rate of growth in the late 1990s that was not sustainable, since it was partly linked to the dot-com bubble. The key problem is to separate the trend from the cycle in real time. As a result of the erroneous estimates, several countries followed fiscal policies between 1994 and 2006 that were intended to be counter-cyclical, but often proved to be pro-cyclical subsequently – after downward revisions of growth (Forni and Momigliano, 2004; Cimadomo, 2008). The 2007–2012 crisis, in part correlated with the housing market bubble, also led to a significant downward revision of GDP and potential output. The methodology for estimating the output gap has remained unchanged; therefore, the same scenario could easily happen in the future. As Ódor (2014a) show in many cases the uncertainty around the estimates of the change in structural balance in Europe is higher than 0.5 per cent of GDP, which is the benchmark against to which it should be evaluated. Moreover as we mentioned earlier, financial cycles, absorption cycles or for example commodity price cycles can all have important effects on budget balances over and above the impact of traditional business cycles.

The other pillar of the methodology – or, in Larch and Turrini's words, its other Achilles' heel – is the constant overall budgetary sensitivity. As early as 2000, the Commission identified that the elasticity between GDP and the tax bases was fundamentally determined by the nature of the shock in the economy, and it even prepared an estimate for this (European Commission, 2000). This was against a background of tax-rich economic growth in many countries in the late 1990s, with booming private consumption as an underlying factor.

Another problem is the inability of the commonly agreed methodology to filter out all exogenous effects. This even exists with the ECB method (Bouthevillain et al, 2001), which takes composition effects into account. If tax changes are adjusted to changes in discretionary measures as well as to the cyclical component estimated with the ECB method, there remains an unexplained (*windfall/shortfall*) component (T_2) (Morris et al., 2009). In Germany, Spain, France, Italy and the Netherlands, profit taxes proved volatile; this was attributable partly to the changes in revaluation profits and write-offs.[11] In Ireland and Spain, the housing market bubble resulted in fluctuations in indirect taxes, which were more volatile than the household consumption taken into account by the ECB for cyclical adjustments. Two proposals were put forward to resolve this, but neither was used in practice. One would have eliminated the "dividend" effect of inflation, which may have

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[10] Methodological problems and consequences on fiscal policy are discussed in Godin and Kinsella, 2013.

[11] All this generated tax windfalls in 1999-2000 and 2004-2007, as well as tax shortfalls in 2004-2007.

contributed to the fact that tax revenues differed from the forecasts (Buti and Van den Noord, 2003). This was computed as the difference between the officially projected rate of inflation and the rate of inflation that is consistent with normal capacity utilisation. This, however, would not have eliminated the effects of the housing market bubble nor would it have estimated the short-term impacts of surprise inflation (T_3). By contrast, the other proposal suggested adjusting the absorption cycle itself (T_5) (Lendvai et al., 2011). It used a somewhat arbitrary definition of absorption gap, although in theory it interpreted potential absorption as an indicator that is in line with potential output and the external position consistent with the fundamentals (the balance of payments). The disadvantage of this approach is that it determined the absorption gap as a deviation with respect to norms rather than deviations from trends, as a result of which the correction lacked a zero mean. Moreover, the norms are period- and country-specific (Langenus, 2013).

In spite of cyclical adjustment being considered one of the Achilles' heels of the framework, as seen above, the methodology was not modified. Instead of improvements to the indicators, the rules were changed. The "Six-pack", in effect since 2012, requires that the analysis of expenditure net of discretionary revenue measures be included in the assessments carried out by the preventive arm. Until the MTO is reached, the growth rate of primary expenditures must not exceed the medium-term reference rate of potential GDP growth.[12] The extent to which the growth rate of government expenditures must remain below the medium-term reference rate of potential GDP growth should be defined so that it can ensure sufficient progress towards the medium-term objective. Expenditure growth in excess of the rate thus defined must be offset by the discretionary increase in revenues, whereas discretionary revenue cuts must be compensated for with cuts in expenditures. Since the tax revenue changes are calculated "bottom up", this can be a complementary solution for cyclical adjustment shortcomings regarding the composition effect of tax bases and the volatility of taxes (windfall/shortfall). Nevertheless, the estimation of potential GDP remains an unsolvable problem in this framework as well.

2.2.5 Structural deficit – medium term orientation

We have seen above, how adjusted headline indicators are able to eliminate the effects of creative accounting. However, adjustments to other factors may be needed as well. Factors exogenous to fiscal policy include natural disasters and the budgetary effects of court rulings. A backward-looking moving average may be proposed here; it will filter out only genuinely significant impacts and will not deviate the structural deficit from the actual deficits across the period as a whole (Hoffmann and P. Kiss, 2010). However, a deliberate confusion of individual and one-off measures should be avoided. Below a certain level of aggregation, every item may be deemed arbitrarily as "individual", whereas in the more aggregated approach they may be mutually offsetting (Hoffmann and P. Kiss, 2010).

Cyclical adjustment has an inherent problem in that potential GDP is an unobservable variable, and its estimate may be revised at any time, in light of new GDP figures, due to endpoint uncertainty. The IMF methodology represents one kind of solution: it takes into consideration the historical correlation between short-term GDP revisions and long-term revisions in potential output to reduce the estimation error in potential GDP (Tereanu et al., 2014). Another possible solution is to find a method that minimises the joint uncertainty coming from the choice of model and from parameter updates with new data. Cheremukhin's (2013) method in the United States is an

[12] Eligible for deduction from the primary balance are expenditures on EU programmes that are fully offset by revenues from EU funds; furthermore, unemployment benefit expenditures exclude the non-discretionary changes (which are taken into account in cyclical adjustment). The assessment must consider the potentially very high variability of investments, especially in the case of small Member States.

example. Nevertheless, since the possibility of significant revisions cannot be fully excluded, this could be managed with an escape clause to the fiscal rule.

P. Kiss and Vadas (2006) proposed solutions for other problems of cyclical adjustment.

- Similar to the Commission's methodology, the starting point is the Cobb–Douglas production function. Since the aggregate output gap equals the weighted sum of income gaps from labour and capital, it can be disaggregated into tax bases related to capital and labour. A standard consumption function may then be used to connect wages and potential consumption values on a theoretical basis. The authors have proposed a multivariate HP filter to link the above equations, with an aggregation limit added. Besides the theoretical foundations, this is more advantageous than the ECB's HP-filtering because it does not rely on extending the time series to close the gaps. Instead it uses the information included in the output gap as regards the cyclical situation.
- However, the composition effect of different tax bases will have an automatic distortion effect as different deflators are used to generate the corresponding real variables. This composition effect is easy to adjust for with the price gap between the consumer price index (CPI) and the GDP deflator, which is applied to adjust labour and consumption-related revenues. The price gap can also partly removes fluctuations in taxes caused by surprise inflation or disinflation (T_3).
- The private and the government part of labour and consumption tax bases and revenues must be disaggregated. As in the ECB method, it is assumed that the indirect taxes and contributions paid by the government and the direct taxes and contributions paid by public employees have zero elasticity (just as these government expenditures consistently have); in other words, they are not dependent on the cycle. This considerably reduces the budgetary impact of the cycle.
- A number of biases in elasticity between taxes and tax bases are highlighted. Note, for example, the effect of the nominal parameters of the tax regime (minimum values, tier boundaries, caps) and regulations causing asymmetry (e.g. carry-forward losses). All this necessitates updating the calculation/estimation of the elasticities each year. It may also partly reduce the volatility of taxes (windfall/shortfall) still remaining after cyclical adjustment.[13]

$$s_{ALT} = P_1 + P_2 + T_5 + T_7$$

The Council for Budget Responsibility currently uses the methodology developed by Kiss and Vadas (2006) to cyclically adjust budgetary figures. The aggregate output gap used is a result of an "estimate combination" (Ódor, 2014d) utilising various methods and information sets. Robustness is very important when the final estimate can have substantial welfare implications (by triggering correction mechanisms).

Finally, some part of interest expenditures can also be regarded as temporary (T4). Especially after large shocks or regime changes. In order to estimate the transitory component, one can use the methodology mentioned in 2.2.1.

2.2.6 Underlying deficit – longer term approaches

The long-term orientation of the fiscal policy can use b_{ADJ2} indicator as a starting point, since it adjust the deficit with the future costs of ageing (T_5). However, long-term volatility cannot be properly filtered out by using any cyclical adjustment methods. Convergence periods, absorption and financial cycles should also be taken into account.

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[13] Since EU Member States have to calculate the tax revenue changes in a "bottom up" approach, this can be a complementary solution for reducing unexplained windfall or shortfall.

Table 2

Better Flow Indicators

	Current Methodology	**Alternative 1**	**Alternative 2**
Headline deficit	$b_{ESA}= P_1+P_2+T_1+T_2+T_3+T_4+T_5+T_6+T_7$	$b_{ADJ1}=b_{CASH}-T_6$	$b_{ADJ1}=$ $b_{ESA}-T_6-T_5$
Structural deficit	$s_{COM}= P_1+P_2+T_2+T_3+T_4+T_5+T_{6a}+T_{6b}+T_7+I$	$s_{ALT}=$ $P_1+P_2+T_5+T_7$	
Underlying deficit			$u_{ALT}=$ P_1+P_2

$$u_{ALT} = P_1 + P_2$$

The last temporary item unfiltered so far is the difference between actual and "desirable" optimal level of investment (T_7).[14] It is a difficult exercise, but international comparisons, analysis of amortisation or calculation of marginal products of capital might shed some light on this issue. A less ambitious approach would be to take into account only changes to the "usual" level of maintenance costs in the budget.

After proposing better fiscal indicators and methodologies, now we turn to the description of a more de-centralized system of fiscal responsibility in the euro area.

3 Proposal for a new fiscal framework

The current benchmark methodology to identify structural budget balances in the European Union have the following main shortcomings (Marčanová and Ódor, 2014):

- no role for financial or absorption cycles,
- output composition does not matter,
- no clear and consistent definition of one-offs; actually it is not possible to get detailed information about one-offs based on the methodology of the EC ,
- no time-varying budgetary elasticities (important if there are legislative changes),
- high sensitivity to data revisions, since are based on GDP data,
- no adjustments to interest expenditures (as indicated in 2.2.1),
- end-point problems of the HP filter.

Instead of introducing more and more new rules, suitable fiscal indicators should once again be defined; this can result in much simpler and more consistent rules. The following section offers an overview of a comprehensive set of indicators suitable for introduction and the role that the independent FCs could play at this juncture. After all, not even a decade and a half has been sufficient to find the right solutions for certain fundamental problems at the community level.

[14] Currently there are discussions at the EU level to exclude part of co-financing to European investments from the application of the SGP.

Table 3

Weaknesses of Currently Used Indicators

Main Problems	Possible Remedies
Partial coverage of discretionary action	- use of public sector balance sheets - international accounting standards (substance over form) - analytical indicators covering quasi-fiscal activities
Over-reliance on (extremely uncertain) real-time estimates of the output gap	- robust estimates: battery of methods - *ex ante* evaluation mainly or longer *ex post* horizons - disaggregated methodology for CAB - bottom-up crosschecks
Not consistent and transparent identification of one-off and temporary measures	- full disclosure of one-off items - consistent methodology (only self-reversing measures are considered)
No adequate focus on cash-flow figures	- more emphasis on medium-term solvency - sensitivity analysis of interest expenditures

3.1 Pillars of the new framework

This section presents a framework that is based on theoretical considerations, covers the whole scope of fiscal policy, and takes advantage of the synergies between fiscal rules and independent fiscal institutions both at the national and European level. Before presenting the main building blocks of the proposal, it is important to stress that country-specific rules are superior to one-size-fits-all approaches.

As far as the optimal theoretical level of public debt is concerned, the literature does not offer clear-cut recommendations for policy makers. It is however clear from theory that optimal sovereign debt trajectories are country-specific and depend on a complex array of variables. Higher public debt, on the one hand, can bring the economy to the optimal capital level and increase welfare. Further, it allows consumption smoothing by lifting liquidity constraints on some households, which are subject to idiosyncratic shocks. Another benefit from higher debt is the deepening of domestic capital markets by facilitating precautionary savings. Both short-run and long-run welfare effects of debt depends on the income inequality (Röhrs and Winter, 2014). On the other hand, increasing levels of government debt are obviously not without costs. Higher market interest rates can crowd out private investments, distortionary taxation used to finance debt is lowering welfare and lower wages in equilibrium can be also mentioned as a cost. As Vogel (2014) illustrates, wealth inequality can also be an important factor affecting optimal debt levels. It is thus not surprising, that optimal values of debt in strictly theoretical models vary between a substantial negative amount (accumulation of assets) and a large positive value, for instance, 60 per cent of GDP in Aiyagari and McGrattan (1998).

Another very important theoretical lesson is that after a shock to the debt level, it is not optimal to make immediate and complete adjustment. Instead, efforts should be made to achieve tax smoothing (Barro, 1979). Kirsanova et al. (2007) show that in many models, optimal fiscal policy would involve steady-state debt following a random walk in response to shocks. A prerequisite for this, however, is a benevolent policy maker and a pre-shock debt level that is not excessively high and market expectations that are well anchored even after the shock. Otherwise, a sudden increase in risk premia may easily lead to a loss of confidence in the government debt markets. In other words, designing optimal consolidation paths is also a difficult exercise, where strict fiscal rules are unlikely to help.

The International Monetary Fund has collected some evidence concerning "excessive" debt levels over the years. A debt-to-GDP ratio of 60 per cent is quite often noted as a prudential limit for developed countries. For developing and emerging economies, 40 per cent is the suggested debt-to-GDP ratio that should not be breached on a long-term basis. A strand of the literature also focuses more on debt sustainability and government defaults rather than on optimal debt levels. For example Bi and Leeper (2013) calculate "fiscal limits" as probabilistic distributions (instead of fixed debt-to-GDP ratios) dependent on Laffer curves and economic shocks.

From a purely practical point of view, we know that countries often have persistent deficits and rapidly increasing debt levels even in normal times. The literature calls this phenomenon as "deficit bias". There can be many reasons for such a behaviour (Calmfors and Wren-Lewis, 2011): myopia, informational asymmetries, impatience, electoral competition or for example common-pool theory. The important point here is that the most important reasons for "fiscal alcoholism" are often country specific or even time-varying. For example, different degree of credibility, forms of governance and political set-ups all require tailor-made solutions.

To sum up, both theoretical (optimal debt trajectories and speed of debt adjustments) and practical (source of deficit bias) considerations point toward a need for country-specific fiscal rules. One-size-fits-all solutions can easily be sub-optimal at individual country level. The discussion above illustrates that there can be significant synergies between fiscal rules more aligned with theory and independent fiscal institutions. Optimal debt trajectories, consolidation paths or elimination of information asymmetries are all areas, where fiscal councils can have high value added.

Believed to guarantee a better division of labour between the national and the community levels, our proposed framework has the following main components:

- country-specific "optimal" stock indicators as long-term targets,
- analytical flow indicators, consistent with the above, as medium-term objectives,
- expenditure rules as instruments to achieve those targets,
- independent national fiscal institutions as the first-line supervisors of these indicators and rules,
- second-line supervision at the community level,
- simple EU fiscal rules,
- independent European fiscal watchdog.

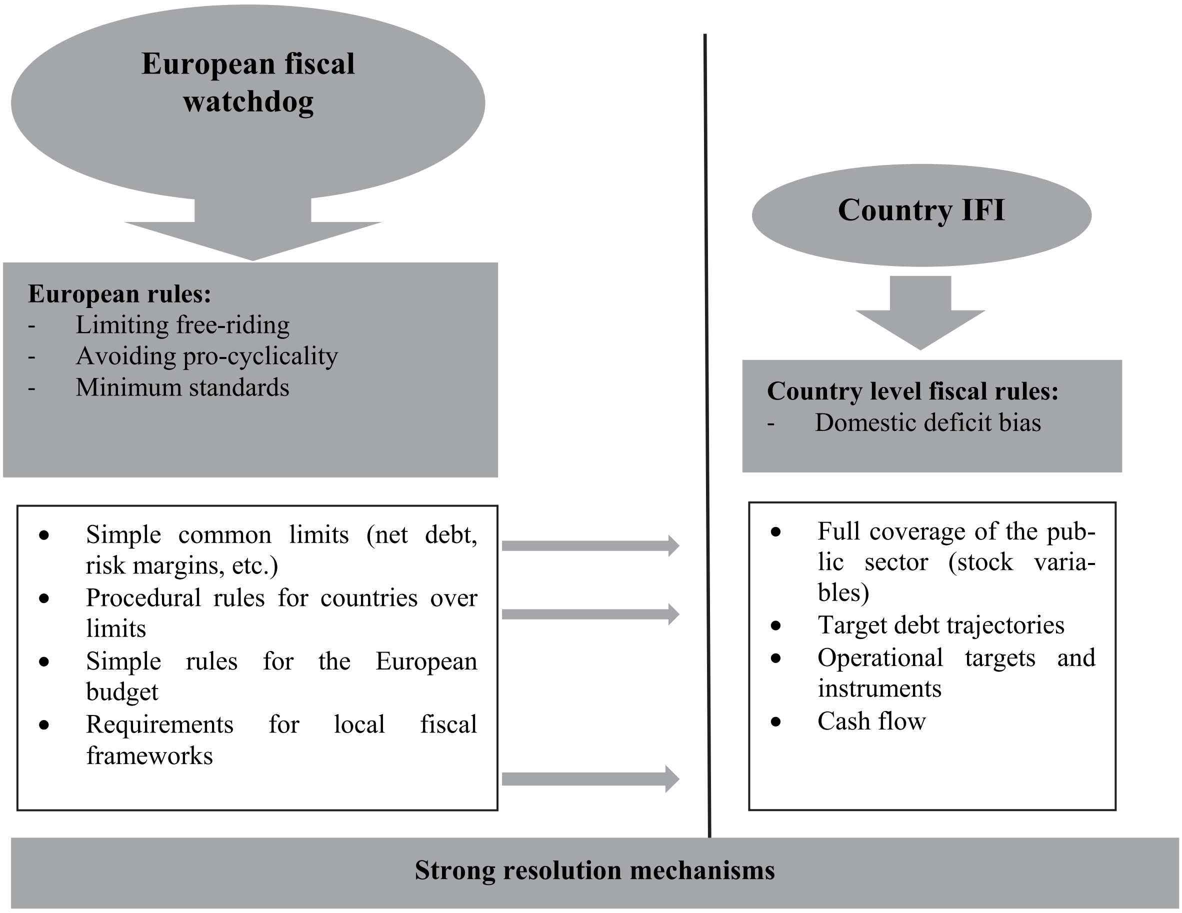
This framework avoids the community-level dilemma between international comparability and an economic policy tailored to a particular country, which frequently led to the unenforceability of the rules.

3.2 *Country-specific targets and instruments*

While the design of local fiscal frameworks depend very much on country-specific circumstances, including basic institutional characteristics and pre-defined politically-decided objectives, it might be useful to characterize the potential main building blocks. Here we describe three important elements in more details: long-term debt trajectories, medium-term objectives and yearly expenditure limits as instruments.

Figure 1

Alternative Fiscal Framework for the Euro Area



3.2.1 Debt trajectories

"Optimal" debt trajectories should be based on analytical work (with an active participation of FCs), but also have to take into account political economy considerations. It is far from easy to combine long-term stability (anchor) with medium-term flexibility to avoid sub-optimal fiscal policy.

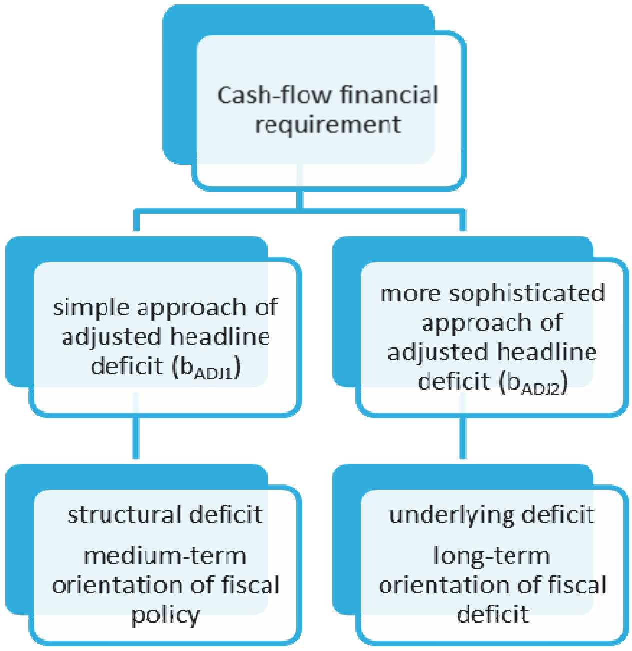
When designing fiscal rules with debt trajectories, the following seems to be necessary:

- analysis of the whole inter-temporal balance sheet of the public sector (including contingent liabilities),
- calculation of country-specific fiscal limits, sound debt levels,
- investment needs of the country,
- definition of escape clauses, automatic correction mechanisms, monitored by FCs,
- high legal power of the law.

The basic function of debt trajectories is to have a clear and commonly agreed long-term anchor for fiscal policy, written preferably in a constitutional law. To avoid medium-term pro-cyclicality, well-defined escape clauses are necessary, but with an active participation of independent fiscal institutions to ensure counter-cyclicality also in good times.

Figure 2

Selection of Country-level Fiscal Indicators



3.2.2 Medium-term objectives

The debt trajectories should *not* be used as medium-term operational targets for fiscal policy. They should be "translated" into the level of the structural/underlying deficit. Fiscal councils have to check to what extent are these objectives in line with debt trajectories embedded in higher level legislation.

However, while structural or underlying deficits are easy to construct *ex ante*, the *ex post* evaluation is problematic. It can be done only on a longer time horizon (at least a full business cycle), drawing conclusions in real-time is almost impossible. That is the reason, why we recommend using expenditure limits as operational instruments. In good times they limit over-spending, while in bad times allow deficit to increase. It is important to stress at the outset that expenditure ceilings should take into account discretionary revenue measures to avoid politicization of the concept. Of course, appropriate escape clause should be defined, again with a monitoring role of fiscal councils. To avoid unpleasant surprises, the best practice would be to include also non-allocated buffers in expenditure limits with a size of tenths of percent of GDP.

3.2.3 Expenditure rules

Expenditure rules should cover multiple years by regulating the annual rate of growth in primary expenditures (excluding interest expenditure) or setting a spending cap for every year (Ódor and P. Kiss, 2011).

If applied in a credible framework, the expenditure rule (Ódor and P. Kiss, 2011) may also eliminate the distortions originating from tax volatility, as it adjusts the expenditure growth rate, not with the change of cyclically adjusted revenue but the estimated effects of discretionary tax measures. The FCs may play an especially important role here, as they have appropriate information at their disposal to perform this task. As mentioned before, estimating potential GDP will also remain an unresolvable problem in this framework, even though it is the benchmark for expenditure growth. Its minor revisions may be solved with a spending reserve[15] and major revisions with an escape clause. Further investigations will be necessary to decide whether the rule should apply to the total primary expenditure or should handle intra-governmental transfers to municipalities and investments separately (Ódor and P. Kiss, 2011).

As has been seen, investments represent a special category, since they are closely related to a specific stock indicator and can be directly compared to the rate of depreciation. Savings in investments may be feasible on the short term, but this will not be acceptable for the purposes of either the structural deficit as a medium-term target indicator or the expenditure rule as instrument. If the objective is, for instance, to prevent the stock of fixed assets from decreasing, then a shortfall of investment spending compared to the level necessitated by depreciation may be interpreted as temporary, and cannot be used for increasing current expenditure.

The treatment of inflation may nevertheless pose a problem in the case of the expenditure rule. In principle, inflation volatility may affect the primary balance as well. An example is the so-called inflation dividend, which is the budget revenue impact of the "inflation gap", defined as the difference between the actual and the ECB target for the Eurozone countries (Buti and Van den Noord, 2003). An expected rise in inflation would, in fact, have an impact on the primary balance only if the government were to decide that it would not compensate for the loss in real value of expenditures from its extra revenues (P. Kiss, 2007). This, however, is not permitted under the expenditure rule, since it automatically increases the expenditure budget with the expected rate of inflation. The case of surprise inflation is different. The question here is whether the expenditure reserves are sufficient to offset the effect of the higher inflation and whether its compensation is obligatory. Another question is whether expenditures should be reduced in the event of, and consistently with, lower inflation, and thus the reserves increased.

3.3 The role of fiscal councils

Today it is recognised almost universally that independent central banks, simple rules and a high degree of transparency play an essential role in monetary policy. In spite of the fact that the crisis has engendered new problems in monetary policy as well, Ódor (2014b) considers it important that synergies between independent institutions and simple rules should have a stronger role also within fiscal policy. However, as fiscal policy has greater distribution effects than monetary policy, the scope of the role assigned to the independent FCs should be carefully considered. For example, it is not recommended to authorise an FC to legislate.

The following presents areas where independent fiscal institutions might help to reduce the deficit bias to a significant degree. One of the most important lessons from the recent years has been the recognition that the FCs are able to mitigate several of the trade-offs created when fiscal rules are defined. Three such trade-offs should be mentioned here. The first is the tension between flexibility and enforceability. If the rules are too flexible, they will never be enforced. If they are too inflexible, however, they may trigger a number of situations in which compliance with them would require pro-cyclical fiscal policy. Independent institutions acting as referees may provide a solution to this problem. The second trade-off lies between simplicity and electoral support. While simple rules are easy to circumvent, voters are unlikely to understand the complex ones. Fiscal council may have a role here as well: if adequate fiscal indicators are defined, no loopholes will be found, even if the rules are simple rather than complicated. Portes and Wren-Lewis (2014)

[15] Its size may be determined in a country-specific way, similarly to the estimated safety margin for the MTO.

emphasise a third trade-off, one between optimality and efficiency. As in the above, an independent institution will be able to mitigate this problem as well.

The FC's theoretical role is normally subdivided into three specific areas (Ódor, 2014b):

1) the interpretation and communication of fiscal policy,
2) the evaluation and monitoring of the fiscal rules,
3) an analytical (expert) role.

The model proposed in this article covers each of those three areas. The FC fills the first function by estimating public sector net worth and evaluating the escape clauses. It performs the second role as it carries out *ex ante* and *ex post* assessments of compliance with the proposed fiscal rules. And it fulfils the third function when it calculates the structural or underlying balance, estimates the effects of discretionary measures, or, as the case may be, defines the optimal debt path.

This issue become more complicated when we consider reforming the community level instead of the national level. Ódor (2014a) criticises the fiscal framework operated at the community level. One considerable problem is that the loss of credibility due to disregard of the "no bail-out" clause cannot be restored by creating an overly complex system with an increasing number of rules. Although independent fiscal institutions have been given a more important role, there remain a large number of country-specific issues where the focus is (more or less successfully) on comparability among countries rather than the provision of the best possible estimates.

3.4 Local vs community level

The problem of a deficit bias in currency unions can pop up both at the local level and the level of the whole area ("common-pool problem squared"). In our view the obvious approach would be to build a hierarchical system of responsibilities. When there is no sign of free-riding behaviour with a potential contagion effects, the national level should be responsible for fighting against the local deficit bias. In that case country-specific, tailor-made solution should be designed (also more in line with theory).

Area level rules and institutions should primarily focus on problems concerning common interest. High on this list is possible contagion, free-riding behaviour or for example counter-cyclical aggregate fiscal policy. In order to have an efficient division of accountability, one has to have a clear view on three important ingredients: i) resolution mechanisms, ii) area-wide fiscal rules and iii) fiscal institutions. In turn we discuss all three of them, including possible inter-linkages and synergic effects.

Resolution mechanisms, limiting moral hazard, are one of the most important cornerstones of a well-functioning currency union. The degree of central control varies considerably within existing federations. One extreme possibility is a reliance purely on market discipline, *i.e.*, having a credible no bail-out policy (like in the US). The other extreme is full solidarity between Member States, when bail-out is widely expected. It should be noted that the design of area-wide fiscal rules is heavily dependent on the approach chosen. In the former case almost no monitoring from the centre is necessary, while if one chooses the latter approach, very detailed rules and coordinated fiscal policy are necessary to avoid moral hazard. The current situation in the euro area is somewhere between these two extremes. Europe is balancing between the low credibility of the no bail-out clause in the Treaty and the need to avoid free-riding. As Ódor (2014a) argues, since the sovereignty principle is still in place, it would be a better strategy to move closer to a more de-centralised system through instituting bail-ins, clear resolution mechanisms and *ex ante* rules for sovereign debt restructuring. One should however note that strengthening the no bail-out clause is not possible without sound macro-prudential policies and an effective banking union. Even if it is unlikely to achieve full credibility of the no bail-out principle like in the US (at least in the medium-run), the more losses are absorbed by creditors, the easier is the design of fiscal rules at the community level.

In the case of a fully credible no bail-out clause, centrally imposed fiscal rules on Member States are not even necessary. If the euro area is successful in putting in place clear rules for burden sharing, banking union, debt restructuring with a strong backstop mechanism, the current trend of legislating more and more complex fiscal rules can be reversed. In our view, in that case it would be sufficient to operate with one or two simple rules. These rules should *not* target yearly balances in national budgets. Instead, they should fight against deficit bias occurring at the area level. One can imagine various possibilities suitable for this purpose: debt levels, sustainability indicators or, for example, sovereign risk indicators. It is important, however, to design rules not with a target level, but rather as a maximum value tolerated by the community. Countries operating below these thresholds would be free to conduct their fiscal policy if respecting minimum benchmarks (the universal 3 per cent deficit limit can be abolished). However, after breaching the limits, oversight from the centre should step in. The sovereignty principle should be significantly reduced above the agreed limits. This is a price Members States should pay for possible bail-outs.

In case of the institutional set-up, important changes are necessary to make the framework more credible. As it was indicated above, the failure of the one-size-fits-all approach in a currency union calls for a more de-centralised system of fiscal responsibility.

Under such potential division of labour, the community level would serve three important functions. One would be the supervision of national frameworks. Rather than analysing national budgets every year, this would involve the defining of minimum standards applicable to national fiscal frameworks. An EU-level process would be triggered only in the case of gross policy errors at the national level. Minimum standards should include:[16]

- rules for transparency,
- requirements to present indicators covering the whole public sector,
- basic remit of local IFIs, including long-term sustainability reports,
- professional requirements for IFI council members,
- independent financing of IFIs.

Second, the community level should have the power and the capacity to start a program for those countries breaching maximum limits set by the EU, *i.e.*, operating with gross policy errors. Here the sovereignty principle should be relaxed substantially.

Third, the community level would have an additional role if and when fiscal rules were to be extended to the EU budget in the course of further integration.

Last but not least, such a change would raise the question of who should exercise oversight over the supervisory institution. As mentioned before, one option is to involve the community level. Of course, there are other solutions as well: for instance, national parliaments or international networks (an organisation of FCs), or perhaps one of the EU institutions. The best solution would most likely entail an independent fiscal institution at the community level, one that is not subject to the sort of political pressure that the Commission is. This institution would monitor the national FCs and would itself report to a committee appointed by the European Parliament.

[16] The OECD Principles for Independent Fiscal Institutions (2014) can serve as an excellent starting point.

3.5 European fiscal rules

Depending on the strength of the resolution mechanisms and the future design of a fiscal union, the euro area needs two types of fiscal rules. The first set should tackle potential free-riding behaviour in a monetary union. The second set should ensure counter-cyclical policy of the common European budget.

The last changes to the European fiscal architecture have brought unnecessary complexity to the landscape of fiscal rules. Instead of focusing on gross policy errors (the initial objective of the SGP), the community level is now involved in fine-tuning national budgets. This is in our view not a sustainable solution. Rather, our proposal is to have a clear division of responsibilities between the centre and national authorities. The European level should focus on deficit-bias arising at the community level (free-riding), while the primary role of national fiscal frameworks should be fight against deficit-bias at local level.

The stronger and more efficient are the resolution mechanisms, the less need is to interfere with national budgets. The prime example is the US, where the strong and credible no bail-out rule eliminates free-riding, so there are no fiscal rules imposed at individual states from the federal level. However, it seems to us that this solution is not feasible in the medium-run in Europe, so we see some role for SGP-type of agreements with an aim to correct gross policy errors. On the other hand, the current overregulation with fiscal rules is clearly sub-optimal.

What kind of indicators can signal free-riding? We see three possible avenues. The first option is to use some kind of stock variable. The current limit on nominal gross debt is a good starting point. One can imagine various improvements by adding more assets and liabilities, however only if clear valuation principles and independent reporting are available. Various forms of net debt can serve this purpose relatively well. The main problem however is in the definition of "dangerous" limits. As we argued earlier, one-size-fits-all rules in a diverse monetary union are sub-optimal. On the other hand, the status quo with a 60 per cent ceiling for gross debt shows that from a political point of view, equal treatment is very important.

The second possibility we see is using sustainability gaps as limits. Since these are expressed in relative terms, the problem of different optimal thresholds for different countries is mitigated. On the other hand, calculating infinite horizon fiscal gaps is a tricky exercise. Fortunately there is an agreed methodology at the European level and countries are routinely evaluated based on this indicator. Its level is used with a 1/3 weight in the calculation of the medium-term objective (MTO).

The third possibility is a reliance on market valuation of debt instruments. It should be expressed as a margin over safe bonds, preferably European bonds issued by the central authority. It of course requires stronger integration – some form of fiscal union.

To sum up, with strong resolution schemes in place, European fiscal rules targeting free-riding behaviour can be radically simplified. All what is needed is a limit over which community level authorities step in to interfere with the national budgetary process. Below these thresholds, national parliaments are free to choose their fiscal targets; however above those limits national sovereignty should be substantially curbed. The European-wide limit should be set on some form of net debt, fiscal gap or risk margin on debt instruments.

Sustainability is just one goal of fiscal policy in a monetary union. One also needs counter-cyclical fiscal policy and risk sharing mechanisms. Currently there is an ongoing debate about delegating more fiscal power to the centre. The size of the European budget is small (1 per cent of GDP) and focuses mainly on structural issues and the common agricultural policy (CAP). The budget is always balanced. In order to allow for more risk-sharing between countries, one can imagine a stronger role for central redistribution of funds and use of European level automatic stabilizers or discretionary fiscal policy. According to Allard et al. (2013), a central budget with few percentage points of EU GDP would be capable of much better risk-sharing. The obvious candidates for central expenditures are: defence spending, R&D, infrastructure investment or for example common unemployment insurance or pension system. It would be financed by EU taxes.

If a stronger fiscal union is created, there will be room for counter-cyclical fiscal policy. Either via automatic stabilizers or discretionary policy action. The central authority would be able to issue debt against its revenues in bad times and pay it back in good times. One positive side-effect would be the creation of safe assets for the financial sector. One or two simple fiscal rules and an independent EU fiscal watchdog would be in our view enough to ensure sustainability and counter-cyclicality. Balanced budgets over the cycle or a low debt limit are the most obvious options to consider.

4 Conclusions

This paper offers three main conclusions. Firstly, a well-functioning currency area needs a clear separation of accountability. The complex set of hardly-enforceable rules and procedures and overlapping responsibilities of various institutions in Europe is far from optimal. One needs to eliminate path-dependency with a radical cut. It will be necessary to build – alongside with discussions about resolution mechanisms and a stronger fiscal union – a fiscal architecture, which is not only more in line with theory, but also maximizes synergies between fiscal rules and fiscal institutions. We argue for a decentralized fiscal framework with different objectives and instruments for the national and the community level.

Secondly, the importance of the one-size-fits-all approach should be significantly scaled down. Optimal debt trajectories, sources of local deficit bias are all country-specific and also time-varying. No single methodology can do justice in a diverse currency union.

The third point is that, in order to design more effective fiscal frameworks, we need to go back to the basic question of measuring fiscal performance. No fiscal rule can operate well without measuring the true fiscal position. The appropriately corrected headline indicators are expected to eliminate the effects of creative accounting, while more precise structural or underlying balances are necessary to filter out all exogenous factors. In both cases, independent fiscal institutions might play an important role. However, the estimation of potential output will still remain inherently uncertain, so the focus should be on employing methods which require fewer revisions or creating budgetary reserves to deal with the uncertainty.

This paper should be viewed only as a conceptual starting point for a more de-centralized fiscal framework in Europe. More work needs to be done to design a fully-fledged proposal. Obviously the solution will depend on a final agreement about resolution mechanism or risk sharing mechanisms through the European budget. Deeper analysis of the following elements will be also crucial in our view: i) designing a realistic transition phase from one regime to the other (including an analysis of potential legal obstacles), ii) empirical research on optimal debt levels and fiscal limits, iii) improvements in accounting standards and their actual implementation and iv) relaxation of the sovereignty principle in case of gross policy errors.

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REFORMING FISCAL GOVERNANCE IN THE EUROPEAN UNION

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The global financial crisis and its aftermath have tested the European Union's (EU) fiscal governance framework. The framework in place before the crisis had been useful to improve fiscal policymaking and coordination, but it ultimately did not prevent the buildup of fiscal imbalances. Public debt soared following the crisis in 2008 to an average of 95 per cent in 2014 – almost 30 percentage points above average precrisis levels. The experiences during the first decade of the European Economic and Monetary Union (EMU) and the euro area crisis led to major changes to the framework, including the 2005 reforms, the 2011 Six Pack, the 2012 Fiscal Compact, and the 2013 Two Pack. The successive reforms have helped to strengthen fiscal policy guidance, but they have also made the framework significantly more complex and difficult to operate, and concerns about compliance remain.

The purpose of this paper is to present options for simplifying the EU fiscal governance framework while enhancing its overall effectiveness. The current framework involves an intricate set of fiscal constraints. For example, both the preventive and corrective arms of the Stability and Growth Pact (SGP) constrain fiscal policies of EU member states through various targets, upper limits, and benchmarks. Fiscal policies are further constrained by the Fiscal Compact, which required countries to put in place national rules to ensure convergence toward medium-term objectives (MTOs). Overall, the framework has helped to strengthen policymaking and coordination, but compliance has remained weak, and the SGP's complexities have hampered effective monitoring and public communication.

The options presented in this paper would address these issues. In particular, they would:

- ***Simplify the overall fiscal governance framework design****. An ambitious approach would involve merging the preventive and corrective arms of the SGP, and replacing it with a simple two-step procedure based on a common set of rules; this may potentially require substantial legal changes, including treaty changes. A less ambitious approach would seek to enhance the consistency between the two arms across different targets, upper limits, and benchmarks.*
- ***Introduce a single fiscal anchor with a single operational rule****. The paper argues for moving to a two-pillar approach with a single fiscal anchor (the public debt-to-GDP ratio) and a single operational target (an expenditure growth rule, possibly with an explicit, that is, formal and deterministic, debt-correction mechanism) linked to the anchor. This approach would help to safeguard fiscal sustainability and macroeconomic stability, while also facilitating monitoring and public communication.*

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- ***Further bolster enforcement****. Several additional steps would improve implementation of the simpler fiscal framework and support compliance. These include: (1) greater automaticity in enforcement with a gradual step-up of monitoring and constraints; (2) a more credible set of sanctions that better reflect prevailing economic circumstances; and (3) a better coordination of fiscal policy monitoring between national fiscal councils and the Commission.*

Context

1 **Fiscal governance framework**: The centerpiece of the European Union (EU) fiscal governance framework is the 1997 Stability and Growth Pact (SGP). While it has evolved significantly over time, its origin dates back to the 1992 Maastricht Treaty and the inception of the European Economic and Monetary Union (EMU). The distinct structure of ongoing euro area integration – involving a common monetary policy and decentralized fiscal policies – called for mechanisms and rules to prevent national fiscal policies from imparting adverse spillovers to other countries and distorting the conduct of monetary policy (EC 2013).[1]

2 **Framework under pressure**: The global financial crisis has tested the EU fiscal governance framework and raised concerns about its effectiveness.

- Before the crisis, the existing fiscal governance provisions had not prevented the buildup of fiscal imbalances. For example, the public debt-to-GDP ratio increased steadily from an average level of below 60 per cent of GDP in 1991 to more than 70 per cent of GDP in the late 1990s, substantially above the level required by the 1992 Maastricht Treaty. Subsequently, a shallow reduction in the debt-to-GDP ratio during the 2000s reflected difficulties in building fiscal sufficient buffers in good times, as unsustainable domestic demand booms generated higher revenues that were mistakenly assumed to be permanent (Allard *et al*., 2013). The buildup of imbalances also reflected the framework's inherent asymmetries, where ceilings are set on deficits in bad times without requiring surpluses in good times.
- When the crisis hit in 2008, EU member countries were ill-prepared. A severe economic downturn and large private-sector imbalances, which in part turned into public-sector liabilities, led to dramatic surges in debt ratios: public debt soared to an average of 95 per cent in 2014 – almost 30 percentage points above average precrisis levels (Figure 1). This further strained fiscal rules, especially those that were set in nominal terms and did not foresee exceptional circumstances (IMF 2013). Failure to build sufficient buffers in good times led to the need to tighten fiscal policies in bad times (Figure 2).

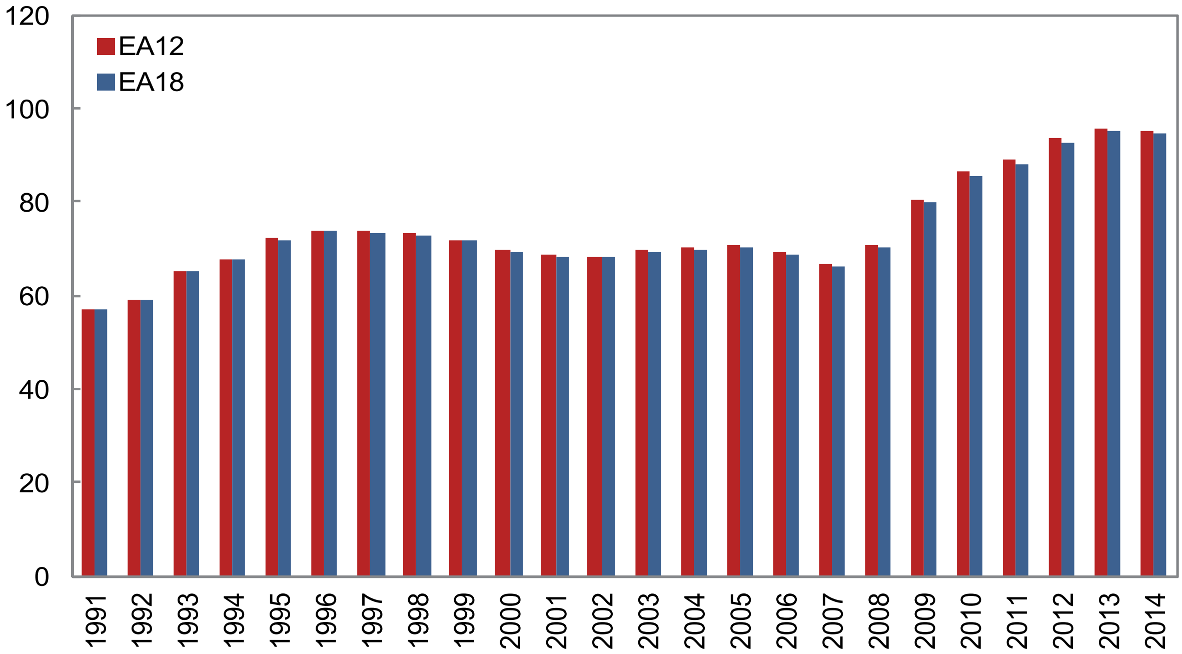
3 **Past reforms**: The experience during the first decade of the EMU and the euro area crisis has led to important changes to the fiscal governance framework—including the 2005 reforms, the 2011 Six Pack, the 2012 Fiscal Compact, and the 2013 Two Pack. The successive revisions pursued several objectives, such as providing stronger economic underpinnings of the rules-based system; better aligning fiscal targets with the final debt objective; providing more flexibility while also strengthening enforcement mechanisms; and bringing more specificity to the definition of the rules. As such, these reforms have enhanced fiscal governance.

4 **Views**: While successive reforms have brought many positive elements to the framework and support the conduct of fiscal policy, they have also increased its complexity. The current fiscal governance system involves an intricate set of constraints, which complicates effective monitoring and public communication, and creates risks of inconsistency and overlap between the different parts of the system. Also, compliance remains weak. This reflects the complexity of the framework, which has resulted in both unintended violations and the exploitation of loopholes, and has gone

[1] Throughout the note, we consider the terms targets, rules, constraints, ceilings, and upper limits as synonyms.

Figure 1

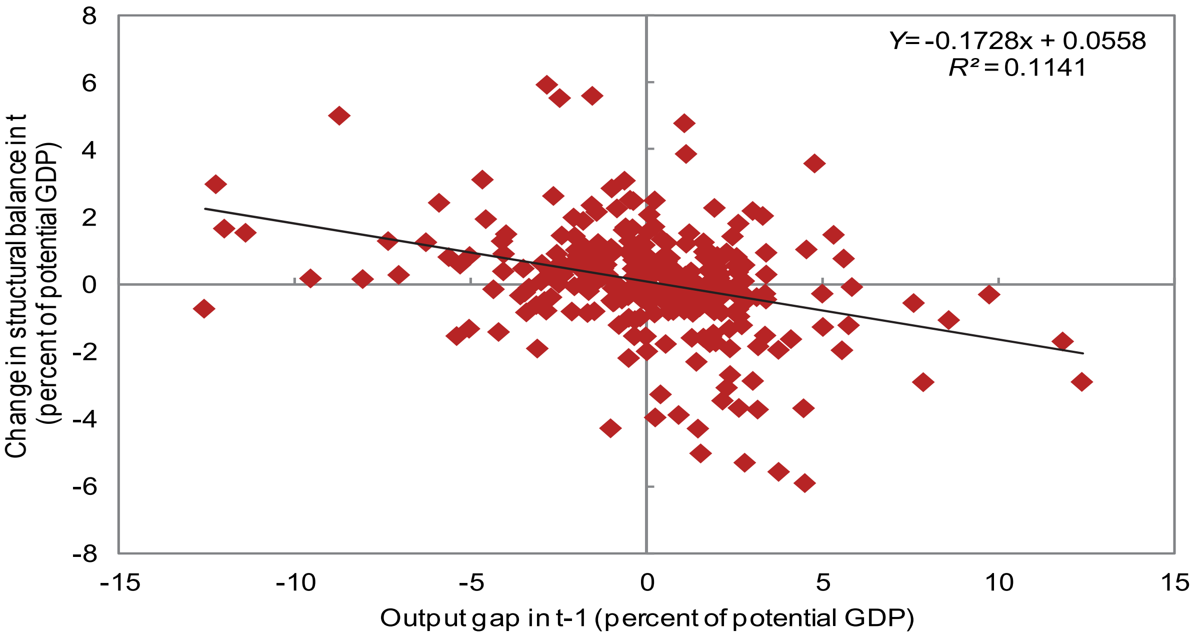
Average Public Debt Ratios of EU Member Countries
(percent of GDP)



Source: European Commission Annual Macroeconomic (AMECO) database.

Figure 2

Fiscal Consolidation and the Output Gap in the Euro Area*



Source: AMECO database.
* Sample is the EA-18 from 1999-2013 (May 2014 database vintage) and 2014 (May 2015 database vintage).

hand-in-hand with weak enforcement. It would seem appropriate to discuss how the fiscal governance framework can be simplified and enforcement strengthened.

5 **Scope:** This paper presents options, which could be pursued over the medium term, to make the fiscal governance framework simpler, more transparent, and more robust. Section II discusses the characteristics and potential shortcomings in the EU's current framework. Section III examines reform options for simplification and stronger compliance. Section IV concludes the paper. The annex provides details on model simulations for different types of fiscal rules. The paper focuses on reform options that can be pursued over the medium term, and refrains from commenting on near-term issues, such as the flexibility in the existing fiscal framework or the appropriate aggregate fiscal stance in the euro area.

The SGP: Past reforms and current issues[2]

6 **Overarching objectives**: The 1997 SGP provides a framework for governing national fiscal policies within the EU, aimed at safeguarding fiscal sustainability while also encouraging economic growth.[3] The SGP contains a preventive and a corrective arm, where the former seeks to monitor and prescribe actions to avoid the buildup of fiscal imbalances, and the latter seeks to monitor and prescribe actions to redress excessive fiscal imbalances in EU member states.

7 **Successive reforms**: The current framework reflects successive layers of reform to the original 1997 framework, including the 2005 reforms, the 2011 Six Pack (five regulations and one directive), and the 2013 Two Pack (two regulations), as well as the Treaty on Stability, Coordination, and Governance of 2012 (TCSG, with the relevant articles referred to as the Fiscal Compact).[4]

- The 1997 SGP included three EU-wide rules: ceilings of 3 per cent of GDP for the overall fiscal deficit and 60 per cent of GDP for public debt (corrective arm), and a requirement for medium-term budget positions to be "close to balance or in surplus" (preventive arm).
- The 2005 reform of the SGP aimed at enhancing the economic rationale underlying the rules and improving their flexibility by introducing country-specific medium-term objectives (MTOs) set in structural terms.
- The Six Pack reform in 2011 was designed to improve enforcement by adding an expenditure benchmark to the preventive arm and making the debt criterion in the corrective arm operational.
- The Fiscal Compact and Two Pack reforms of 2012 and 2013 reinforced monitoring and surveillance in the euro area and called for anchoring EU rules at the national level.
- In 2015, revised guidance on the implementation of the SGP increased its flexibility to encourage investment and structural reforms, and to account for the economic cycle.

8 **Complex system**: The current complexity of the framework (Figure 3) is rooted in this history of successive adjustments. Both the preventive and corrective arms of the SGP constrain fiscal policies of EU member states, including requiring them to converge towards the 60 per cent of GDP debt target at a sufficient pace (the debt benchmark criterion); prohibiting them from breaching the 3 per cent of GDP nominal deficit threshold; and mandating them to improve their

2 This paper draws extensively on the work done for the 2014 Euro Area Article IV Consultation; see Eyraud and Wu (2014, 2015).

3 The SGP refers to the set of secondary legislation passed to establish a fiscal rule-based framework to monitor and coordinate national fiscal policies in the EU, and, in some circumstances, the euro area. The underlying legal basis for the SGP is in Articles 121 and 126 of the Treaty on the Functioning of the EU, one of the EU's founding treaties.

4 The 2013 Two-Pack reforms apply only to euro area members.

structural balance-to-GDP ratio to a benchmark rate (see below) until they reach their country-specific MTOs, defined in structural terms. While increasing flexibility, the 2015 revised guidance on implementation of the SGP added another layer of complexity. The appropriate fiscal adjustment for member states in the preventive arm of the Pact will be defined using a matrix with five categories of economic conditions.[5] Furthermore, government spending (net of new revenue measures) is constrained to grow in line with trend GDP (the expenditure benchmark). When countries are under the corrective arm (excessive deficit procedure or EDP), they are also subject to specific nominal and structural balance targets. Beyond these EU-wide constraints, the Fiscal Compact required signatories to put in place national rules, which may differ across countries, to ensure convergence toward their MTOs.

9 **Related risks**: The elaborate set of fiscal constraints that make up the overall framework complicates effective monitoring, public communication, as well as national ownership and implementation. Implementation in particular is hampered by various overlaps, that may lead to inconsistencies or redundancies in the actions implied by the rules:

- First, the sheer number of rules poses an implementation burden on EU member states, hindering transparency. The EU imposes a larger set of constraints on member governments than most federations do; while the EU is not a federation, these are the closest comparators. For example, in a sample of 13 federations, Eyraud and Gomez (2014) find that the central government imposes, on average, two constraints on sub-central governments (states and sub-state entities), compared to five in the euro area.[6]
- Second, changes in underlying economic fundamentals have led to inconsistencies in the current configuration of numeric targets. For example, a 3 per cent deficit target is consistent with a 60 per cent debt level over the medium term only if nominal growth is slightly more than 5 per cent.[7] However, potential growth has been revised down since the crisis, with medium-term nominal growth now thought to be about 3 per cent in many euro area economies. This implies a 100 per cent of GDP debt level over the medium-term, resulting in an inconsistency between the existing debt and deficit targets; in other words, the action path implied by the deficit target diverges from that required by the debt target.
- Third, the existing structural rules, like the MTOs, tend to be more binding in theory than the nominal targets, weakening the relevance of the latter (abstracting from measurement issues and the distinction between the corrective and preventive arms). For example, a back-of-the-envelope calculation indicates that the output gap would need to fall below –5 per cent to make the nominal deficit target more relevant than the structural balance target for determining policy.[8] Moreover, in general the structural balance rule (if followed) pushes the medium-term debt level below 60 per cent of GDP at a pace at least as fast as that required by the debt-reduction criterion currently in place (see Eyraud and Wu 2015).[9]

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5 As highlighted in EC communications, the five categories are (1) good times (output gap above 1.5%); (2) normal times (output gap between –1.5% and +1.5%); (3) bad times (output gap between –3% and –1.5%); (4) very bad times (output gap between –4% and –3%); and (5) exceptionally bad times (negative real growth or output gap below –4%). Member states are required to make a smaller fiscal effort during difficult economic conditions and a larger fiscal effort during better times.

6 Given the complexity of the European framework, the numbering of rules is a matter of judgment. In our view, the framework has four main EU-wide rules—the 3 per cent deficit rule, the 60 per cent debt rule, an expenditure benchmark, and MTOs defined in structural terms. It also requires EU member countries to anchor a structural balance rule in national legislation.

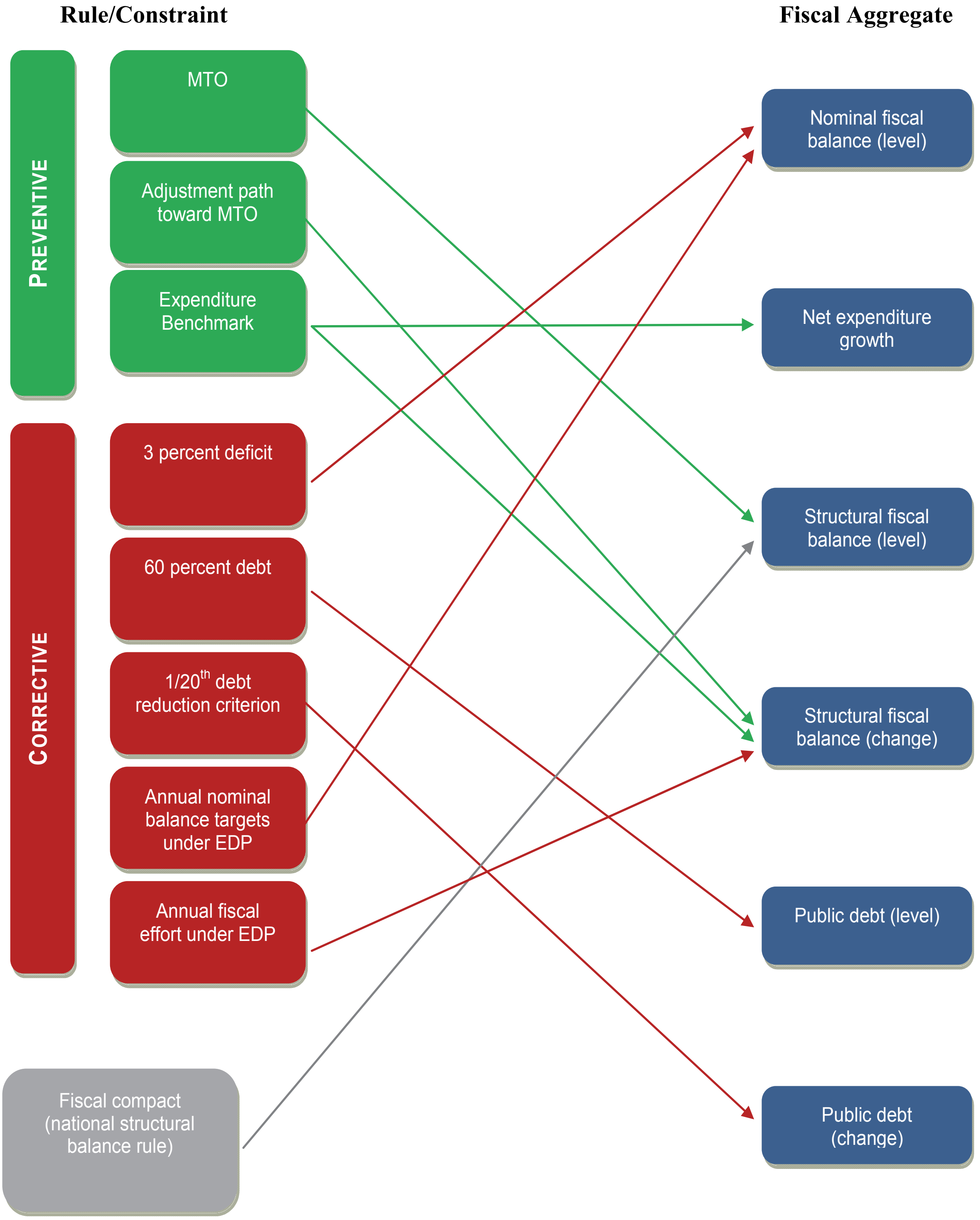
7 The nominal deficit-to-GDP associated with a stable debt-level (debt-stabilizing overall balance) is computed as $\left(\frac{Def}{GDP}\right)^* = \left(\frac{Debt}{GDP}\right)^* \left(\frac{g^*}{1+g^*}\right)$, in which the asterisk denotes steady-state values of the variables (Escolano 2010).

8 Assuming that a 1 percentage point drop in the output gap leads to a 0.5 percentage point deterioration of the nominal balance, a 3 per cent of GDP nominal deficit appears with a structural deficit of 0.5 per cent of potential GDP only if the output gap falls to –5 per cent: $(StructBal) + \epsilon_{NomBal,OUT}(OUTGAP) = (NomBal) \rightarrow -0.5 + 0.5(-5) = -3.$

9 This result would not hold if the initial debt level is significantly above target.

Figure 3

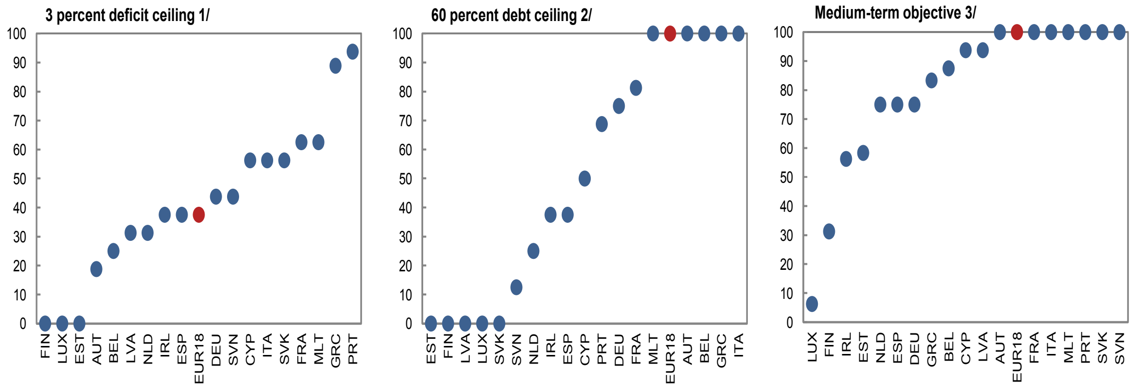
The EU Fiscal Framework
Multiple Rules and Various Aggregates
(as of mid-2014)



Note: EDP= excessive deficit procedure; MTO = medium-term objectives. The figure highlights key features; see EC 2013 for a fuller description.
Source: IMF staff.

Figure 4

Non-compliance with European Fiscal Rules



Source: AMECO database.
Note: The charts are not a formal evaluation of compliance because (1) they are based on ex post data; (2) targets are assumed to be similar across countries and time; and (3) they include all EA-18 countries, including those that joined EMU after 1999. Data labels in the figures use IOS country codes.
1/ Number of years with fiscal deficit above 3 per cent divided by total number of years.
2/ Number of years with debt above 60 per cent divided by total number of years.
3/ Number of years with structural deficit higher than 0.5 per cent divided by total number of years.

- Fourth, the national rules required by the Fiscal Compact are not required to be identical to the EU-wide rules. For example, Germany has put in place national structural rules that are stricter than the EU-wide rules, with ceilings on the structural deficits set at 0.35 per cent of GDP for the federal government from 2016 and at 0 per cent (balance) for its constituent states from 2020 onward.

10 Weak compliance: The complex SGP framework has faced compliance issues, also reflecting weak pressures for enforcement (Figure 4).

- Since 1999, about half of the countries have missed the 60 per cent target more than half of the time. Smaller countries have tended to be more compliant than larger countries. Moreover, the euro area as a whole has missed the target every year since 1999.
- Compliance has been better with the 3 per cent nominal deficit ceiling. Most countries complied with it during the precrisis period (1999–2007), while both Greece and Portugal have failed to keep their deficit below 3 per cent of GDP in most years since they joined the euro area.

Reform proposals

Simplifying the framework

11 Premise: The underlying premise of this paper is that simplifying the current SGP framework and improving its enforcement mechanisms will help achieve a higher degree of fiscal and macroeconomic sustainability.

12 Legal obstacles: Implementing some of the proposals described next may require legal changes, going beyond changes in interpretations of existing laws. The issue of legal obstacles is raised briefly in the conclusion, but is not the focus of this paper.

Consolidating the preventive and corrective arms

13 **Rationale:** To reduce complexities, the preventive and corrective arms of the SGP could be consolidated. Past revisions have already blurred the distinction between them. The preventive arm now includes many features of what would traditionally have been viewed as a corrective arm, including a structural balance target of no less than –0.5 per cent (or –1 per cent for countries below the 60 per cent of GDP public debt ceiling), a convergence path toward the target if there is a deviation, escape clauses, and even sanctions. In addition, there is little economic rationale to putting a country into the tighter constraints of the corrective arm triggered by having breached the 3 per cent nominal deficit limit, which only captures an annual flow.

14 **Ambitious versus less ambitious:** An ambitious approach, potentially requiring more substantial legal changes, would be to merge the two arms into a two-step procedure based on a common set of rules (Eyraud and Wu 2015). Minor slippages would trigger mild corrective actions, while cases of marked non-compliance could lead to enforcement of strong corrective actions and possibly sanctions. Along these lines, Debrun (2010) proposed to tie a country's exit from the corrective arm to meeting its MTO. A less ambitious reform would be to enhance consistency of the two arms across targets and benchmarks, similar to what was recently done to harmonize benchmarks for annual fiscal effort across the two arms.

Shifting to a single fiscal anchor with a single operational rule

15 **Two-pillar approach:** The dual objectives of safeguarding fiscal sustainability and maintaining simplicity suggest a two-pillar approach to the design of the fiscal framework, with *a single fiscal anchor* and *a single operational rule* that acts as the lever that moves the anchor. A feedback mechanism between the anchor and the operational rule can either be formal (explicit), for example, in the form of an automatic debt correction mechanism, or less formal (implicit), for example, based on periodic ad hoc adjustments to correct deviations from the anchor.

16 **Fiscal anchor**: The ultimate objective of the fiscal governance framework should be to ensure fiscal sustainability in the form of public debt sustainability. As a stock variable, the public debt-to-GDP ratio is considered a natural anchor for capturing repeated (cumulative) fiscal slippages that flow variables, like the budget deficit, would not capture. Yet, public debt is affected by many factors, including public-sector financing operations that are unrelated to budget deficits (for example, fiscal contingent liabilities that are realized or valuation effects). Also, it has proven difficult to pinpoint a clear sustainability threshold beyond which fiscal sustainability can no longer be taken for granted (a discussion that is beyond the scope of this paper). However, as public debt sustainability is largely synonymous with fiscal sustainability, there is no good alternative to using the public debt-to-GDP ratio as the fiscal anchor.

17 **Operational rule:** The framework should also include an operational rule. A good operational rule should support countercyclical fiscal policy (*economic stabilization*) and provide a strong link to the fiscal anchor. Moreover, the rule should provide *operational guidance* (by being under the control of policymakers and having a direct link to discretionary measures) and be *transparent* (that is, easy to communicate to the public).[10] There are three main types of operational

[10] The operational rule could be measured using either a "bottom-up" or "top-down" approach, or some average of the two. Bottom-up approaches assess the direct budgetary implications of discretionary policy measures, while top-down approaches take the headline overall balance and attempt to correct for the effects of the cycle, to recover the discretionary policy component of observed budgetary changes. The bottom-up approach is easier to communicate but harder to assess, while the top-down approach is easier to
(continues)

BOX 1
CANDIDATES FOR OPERATIONAL RULES

The main types of operational rules can be distinguished based on the type of budgetary aggregate that they seek to constrain; they have different advantages and disadvantages. The possible operational rules are the following:

Nominal budget balance rules. Budget balance rules constrain the variable that primarily influences the public debt ratio and can help ensure public debt sustainability. They are relatively easy to communicate to the public and largely under the control of policymakers. However, since they are specified in nominal terms, nominal budget balance rules do not have economic stabilization features and may lead to procyclical fiscal policies.

Structural balance rules. These are similar to nominal budget balance rules but explicitly take into account economic shocks and allow automatic stabilizers to operate. However, determining the required adjustment under a structural balance rule, typically also requires estimating an output gap, which makes it difficult to operate, communicate, and monitor the system. Structural balance rules can be supplemented with a debt correction mechanism ("debt brake") to correct for past deviations from the target, which adds further complexities.

Expenditure rules. Expenditure rules usually imply permanent limits on total, primary, or current spending in absolute terms, real growth rates (or real potential growth), or in percent of GDP.[1] These rules are generally transparent (directly constraining the budget). They inherit many of the macroeconomic stabilization properties of a structural balance rule, by allowing for automatic stabilizers on the revenue side to operate fully. In addition, adequate specification of these rules (for instance, in real growth terms rather than in percent of GDP) tend to further support macroeconomic stabilization. While they are not linked directly to the debt-sustainability objective (since they do not constrain the revenue side), they can trigger a required fiscal consolidation consistent with fiscal sustainability when they are accompanied by a debt brake. Yet the debt brake makes the system somewhat more complex to operate and more difficult to communicate to the public.

[1] For an in-depth discussion of design options for expenditure targets, see Ljungman (2008).

rules: revenue rules; expenditure rules, and budget balance rules (expressed either in nominal or structural terms, where the latter can be defined in levels or first differences or a combination of them). See Box 1 and IMF (2009).

18 Evaluating operational rules: We assess the ability of three operational rules—the overall (nominal) balance, the structural balance, and real expenditure growth—to deliver macroeconomic stabilization in the form of debt sustainability. This is done on the basis of stochastic simulations that are applied to a stylized model of a euro area economy, and allow us to evaluate how different operational rules perform over the course of the business cycle.[11] The simulations are based on the

assess but harder to communicate. There are pros and cons to each method; we do not address the exact measurement choice in this note.

[11] There are some differences between the expenditure benchmark in the SGP and the expenditure growth rule used in the simulations. While the simulations use a simple expenditure growth rule based on total expenditure, the SGP expenditure benchmark makes a number of adjustments to total expenditure. The expenditure benchmark in the SGP is based on real expenditures net of interest

(continues)

historical distribution of demand shocks over the past three decades, and show the counterfactual historical performance of these rules in terms of achieving debt sustainability for the stylized euro area economy.[12] In some cases, a debt correction mechanism is included to link the rule to the anchor explicitly and avoid permanent deviations from the anchor. A debt correction mechanism maps the current deviation of the debt from its target level to the policy action prescribed by a rule; for example, having debt above its target may imply an additional tightening over and above what the simplest rule might prescribe (see the annex for further details). In all cases, government spending is assumed to be the fiscal instrument that is adjusted to meet the rule (again, see the annex for some discussion regarding the results for fiscal adjustment via alternative fiscal instruments).

19 Model simulation results: Two main robust findings emerge from the simulations (Figure 5 and Table 1):

- *Economic stabilization*: The lowest variability of output is achieved by the expenditure growth rule, which ties down real expenditure growth to the economy's potential or trend growth rate, combined with a debt correction mechanism (to ensure convergence toward the fiscal anchor). Structural balance rules combined with a debt correction mechanism are a very close second (nearly identical). Nominal balance rules, which do not allow for a buildup of debt and deficits during the cycle, perform worst in terms of output variability.
- *Debt stabilization*: The lower volatility of output under the expenditure growth and structural balance rules comes at the cost of a more volatile debt-to-GDP ratio. This reflects the fact that both rules allow for the operation of automatic stabilizers (partially in the case of expenditure growth and fully in the case of the structural balance). By contrast, the nominal budget balance rule does well in terms of the volatility of the public debt-ratio. The debt correction mechanism is an important component for most fiscal governance frameworks, since it does not increase volatility of output by much and may significantly reduce the volatility of the debt ratio in the long-term. While our simulated debt correction mechanism is endogenous to the fiscal rule and automatically corrects deviations from the debt objective ("debt brake"), other debt correction mechanisms can also be considered. For instance, the expenditure rule could set spending growth below potential output growth (by a fixed margin) over a pre-defined period. This would also ensure convergence of debt toward a lower debt objective. An exogenous, pre-defined path of debt adjustment might however fail to be stabilizing if the economy is subject to larger than expected shocks.

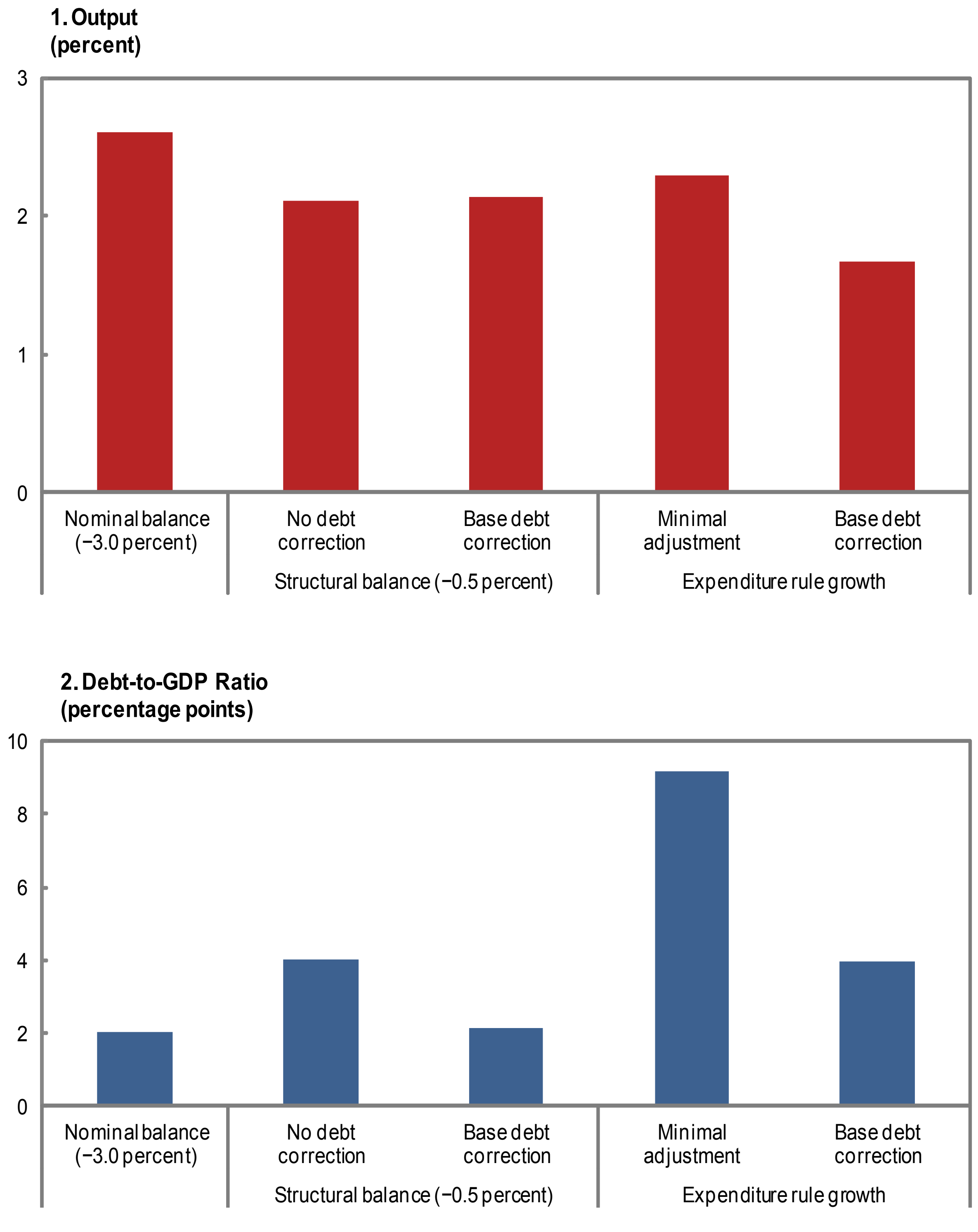
20 Additional considerations: The simulations suggest that expenditure rules and structural balance rules perform similarly well and clearly outperform nominal budget balance rules in stabilizing the economy. To decide between the two leading contenders, other considerations have to be taken into account.

payments, cyclical unemployment benefits, and discretionary revenue measures. Those adjustments allow for a greater degree of counter-cyclicality to the associated target than what we consider in the simulations. Moreover, to allow for countercyclical changes in public investment, the SGP expenditure benchmark uses smoothed capital expenditures instead of actual or expected capital expenditures.

[12] It is a global, three-region, general-equilibrium model (a variant of the IMF's Global Integrated Monetary and Fiscal (GIMF) model), with a euro area country (calibrated to Italy), an "other euro area country" aggregate, and the Rest of the World. The stochastic simulations are carried out around the steady-state, implying lower debt levels than those currently observed in many euro area economies. As the model does not feature strong nonlinearities, the results and ordering of various rules would not materially differ if carried out around the consolidation path, where the representative euro area economy would be converging from a higher debt level to its desired, steady-state debt level. The aggregate demand shocks are drawn from their estimated, historical distribution and used to build a history, which is then combined with the particular rules that are being simulated. The outturns from this exercise are then collected, and, building over multiple histories of shocks, provide a picture of the average behavior of economic variables of interest (like GDP growth and inflation) under each fiscal-rule option. Following general consensus (see, for example, Christiano, Motto, and Rostagno 2014), demand shocks are considered the primary drivers of business cycles. See the annex for further details.

Figure 5

Comparative Performance of Alternative Fiscal Rules
(variability around the steady-state; standard deviations)



Sources: IMF staff calculations.
Note: The "base debt correction" parametrization ensures convergence to the debt target within 15 years. The "minimal adjustment" parametrization corresponds to the smallest adjustment required by the model.

Table 1

Variability Around the Steady-State
(standard deviations)

Type of fiscal rule	Output (percent)	Output Growth (pp)	Debt-to-GDP (pp)
Nominal balance (-3 percent)	2.6	1.8	2.0
Nominal balance (0 percent)	2.4	1.6	0.0
Structural balance (-0.5 percent)	2.1	1.1	4.0
Structural balance (-3 percent)	2.3	1.2	5.6
Structural balance (-0.5 percent) w/ debt correction (base)	2.1	1.2	2.1
Structural balance (-0.5 percent) w/ debt correction (weak)	2.1	1.1	2.8
Expenditure growth rule w/ minimal adjustment	2.3	0.8	9.2
Expenditure growth rule w/ debt correction (base)	1.7	0.6	4.0

Source: IMF staff calculations.
Note: Simulations with three-region IMF GIMF model for aggregate demand shocks. See the main text and annex for additional details. pp= percentage points.

21 **Operational guidance and transparency:** Different considerations suggest that expenditure rules would better meet the dual objectives of providing operational guidance and achieving transparency than structural balance rules. First, expenditure rules are more directly related to the formulation of the annual budget, which sets legally binding spending appropriations, thereby providing clear operational guidance to policymakers. Second, expenditure rules are less complex and therefore easier to communicate and monitor.

22 **Recent literature:** The recent literature also gives strong support to using expenditure rules. For example, using a different simulation model and a simpler expenditure rule, Debrun, Epstein, and Symansky (2008) and Kinda (2015) show that an expenditure growth rule with a feedback mechanism from debt ensures a convergence toward the debt objective, while allowing greater flexibility in response to shocks. Petrova (2012) also demonstrates that an expenditure growth ceiling performs well against several criteria (stabilization, transparency, and fiscal discipline), when it is supplemented with a debt correction mechanism. More recently, Carnot (2014) shows that a rule targeting primary expenditure growth (adjusted for discretionary revenue measures) relative to trend output growth can strike a good balance between the objectives of long-term sustainability and short-term macroeconomic stabilization, while being tractable. Cordes and others (2015) also provide an in-depth discussion of expenditure rules and illustrate that compliance with them is generally better than with other fiscal rules because they are transparent and generally easy to monitor.

23 **Measurement uncertainty:** While our findings are in line with recent literature, a key shortcoming of the above model-based stochastic simulations is that they assume perfect measurement of the output gap. In practice, the levels of potential GDP and the output gap are difficult to measure, particularly in real-time, leading to large ex-post adjustments. This is true for both structural balance rules that rely on output gap measurements, as well as expenditure rules that are linked to potential growth. However, the use of potential growth – rather than the level of potential GDP or the output gap – makes expenditure rules more robust, as revisions to potential growth tend to be smaller (see below). To illustrate this, we use simple deterministic simulations and compare the performances of the expenditure and structural balance rules if they had been applied for Italy and France. In contrast to the model simulations above, these deterministic

simulations are backward looking and do not incorporate stochastic shocks.

24 Assumptions: To do so, real-time data are constructed such that the one-year ahead forecast of the October *World Economic Outlook* in year *t*–1 constitutes the information set available to policymakers when setting up budget plans for year *t*. The simulations assume that between 2001 and 2014 countries had followed either an expenditure or structural balance rule. The expenditure rule limits expenditure growth to a 10-year moving average of real GDP growth.[13] The structural fiscal balance (SFB) rule requires countries to be at their MTO (set at –1 and –0.5 per cent for France and Italy, respectively). We use a fiscal multiplier of 0.5 before 2008 and 0.75 after 2008 (both declining to zero in five years) to estimate the output effect of the implicit fiscal shock corresponding to the difference between spending in the baseline and in the fiscal rule scenarios.[14]

25 Illustration: The results show that the difference between real time and ex-post outcomes under the expenditure rule would have been significantly smaller than for the structural balance rule (Figure 6). For the expenditure rule, the difference in public debt between real-time and *ex post* data in 2014 is about 3 per cent for France and 4 per cent for Italy. For the structural balance rule, it is 14 per cent for France and 16 per cent for Italy. This is because measurement errors are much smaller for potential GDP growth (the expenditure rule) than for the output gap (the structural balance rule).

26 Specific parameters: The discussion here abstracts from the important issue of the exact parameterization of the rules, which can be calibrated to be more or less strict. There is a trade-off between the strictness of the rules and the need for discretionary flexibility through well-defined escape clauses. When the rules are very strict and hard to abide by when economic circumstances deteriorate, it may be helpful to have some flexibility in the framework. This will enable a better response to shocks and avoid pressures to abandon (or modify) the rules in an ad hoc manner.

27 Escape clauses: The current SGP already contains an area-wide escape clause for “exceptional circumstances,” such as natural disasters, periods of severe economic downturns, or large accumulated losses in output relative to potential. To further strengthen the flexibility of the proposed fiscal framework against stagnation risks, conditions to activate the symmetric escape clause could include a large accumulated loss of *nominal* output that may arise with a prolonged period of low inflation or deflation in the euro area (symmetric refers to the clause being equally applicable across all euro area economies when activated).[15]

28 Bottom line: We conclude that there is a good case for using public debt-to-GDP as the single fiscal anchor and an expenditure growth rule (possibly including an explicit debt correction mechanism) as the single operational target. Other indicators (such as the structural balance and its change) could provide supplementary evidence on the appropriateness of fiscal actions, while keeping the expenditure growth rule as the sole binding rule. That said, there are several assumptions and judgments used in the evaluation here that argue for approaching the conclusions with some degree of caution. For instance, different weights on the relative importance of the fiscal objectives may lead to a different selection.

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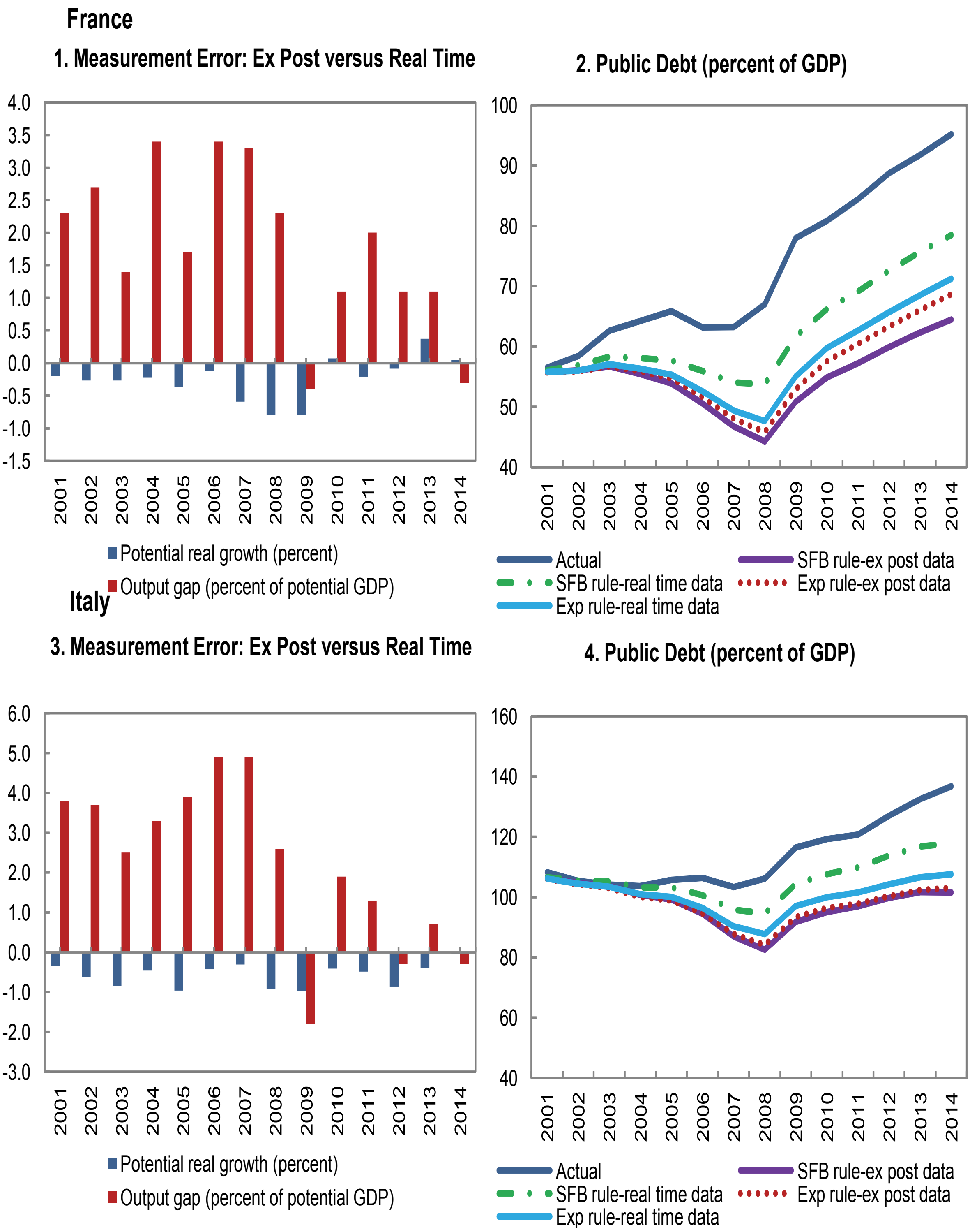
[13] The 10-year moving average in period *t* is constructed as the average of real GDP growth between *t*–5 and *t*+4 as a proxy for potential growth. The construction is analogous to that used in the EU expenditure benchmark. We do not exclude any items from expenditure.

[14] Empirical evidence shows that multipliers were higher during the crisis than in normal times (for a literature summary, see Batini, Eyraud and Weber, 2014). The simulations assume that under both the structural balance and expenditure rules, the adjustment to meet the target is made through spending. We compute the difference between historical expenditure (the baseline) and what spending would have been under the rules (both in real time and ex post). This measure of discretionary fiscal policy, together with the fiscal multiplier, is then used to adjust the baseline (historical) output level.

[15] IMF staff estimates suggest that the impact on public finances of low inflation can be quite pronounced. Simulations for five euro area economies (France, Ireland, Italy, Portugal, and Spain) suggest that a 1 per cent downward surprise in inflation would raise the public debt-to-GDP ratio by 1.4–1.7 per cent in the first year and 2.9–3.8 per cent in the second year (Tapsoba and Weber, 2014).

Figure 6

Measurement Errors and Public Debt Evolution with Real-time Data



Source: WEO and IMF staff calculations.
Note: Ex post data are from the October 2014 WEO, while the real-time data for year *t* are the projected values given in the year *t-1* October WEO. Measurement errors are taken to be the difference between the two.

Improving compliance

29 **Beyond design problems**: The reforms discussed above will address some of the shortcomings of the current framework by reducing its complexity and addressing underlying design and measurement issues. In particular, the reforms will reduce the number of numerical rules, address the problem of weak incentives to build sufficient buffers in good times, and do away with the need to estimate the level of potential output. However, simplification by itself will not resolve problems of weak compliance: even a simple framework can be circumvented. The unique surveillance and coordination procedures within the EMU pose challenges to enforcement mechanisms, which are not as strong as in federations. Although the relative "weakness" of the supranational level in the EU would call for stronger enforcement tools, sanctions and corrective actions are relatively mild in Europe (Eyraud and Gomez 2014). Beyond the technical dimensions, effective enforcement importantly requires a clear buy-in to the mechanisms by participating member states.

30 **Reform options**: To enhance enforcement and further improve compliance, a number of options could be considered:

- *Greater automaticity in enforcement*: More automaticity could be introduced in the gradual step-up of monitoring and constraints after a country is found to be in breach of the rules. However, the imposition of sanctions should remain a discretionary decision based on a sound economic judgment of their appropriateness, guided by the Commission.[16]
- *More credible sanctions*: The set of sanctions considered may also need to reflect economic circumstances; financial sanctions lack credibility in bad times, as they exacerbate the troubles of already distressed governments. Such sanctions might be more effective in good times, while non-pecuniary sanctions could be used in bad times. For example, administrative sanctions (such as constraints on new hiring by governments) might be considered.
- *Better coordination of fiscal policy monitoring:* Formal cooperation between national fiscal councils and the Commission could reduce the risk of conflicting assessments. Such cooperation can take place through regular meetings between fiscal councils and the EC in a multilateral setting—for instance in the context of the EU Network of Independent Fiscal Institutions (EUNIFI).

31 **Market discipline**: Complementary to formal enforcement mechanisms, market discipline could also improve compliance. However, market discipline was relatively ineffective before the crisis, reflecting the lack of credibility of the "no-bailout" provisions of the Treaties for a set of highly integrated economies in the face of a systemic crisis (Allard and others 2013). While important in bolstering fiscal moderation, enhancing market discipline is a long-term endeavor.

32 **A "center-based" approach**: In the absence of effective market discipline, better guidance to national fiscal decisions could take various forms. These include legal challenges at the national level, leverage to sanction with a larger central budget, and a veto power from the center. Many of these options would entail a permanent loss of fiscal sovereignty for euro area members (for instance, if a veto power of the center on national budgets was introduced). Of course, a larger role for the center raises difficult questions about political and democratic accountability for European and euro area decision bodies. See Allard and others (2013) for a fuller discussion and analysis of options for greater fiscal integration in the euro area.

[16] Although explicit sanctions are allowed in cases of non-compliance, they have not yet been used. The latest reforms, in particular the introduction of reverse qualified majority voting at the Council to overturn a decision by the Commission to impose sanctions, should help make enforcement more automatic and less subject to political interference by increasing the hurdle for objection.

Conclusions

33 **Lessons:** The global financial crisis and its aftermath have pointed to the need for strengthening the design and enforcement of the EU fiscal governance framework. Notwithstanding recent revisions, the EU fiscal governance framework remains complex, and compliance and enforcement fairly weak. With public debt at record highs, it would seem desirable to redesign the fiscal governance framework to prevent a further buildup of fiscal imbalances and better support fiscal and macroeconomic sustainability.

34 **Main Proposals:** A simplified fiscal framework centering on two main pillars: a single fiscal anchor (public debt-to-GDP) and a single operational rule (an expenditure growth rule, possibly with an explicit debt correction mechanism) linked to the anchor. Greater automaticity in enforcement, a more credible set of sanctions, and better coordination of fiscal policy monitoring could further support the implementation of the simplified framework.

35 **Reform hurdles:** The transition toward a new steady-state fiscal framework will take time. Some reforms may face legal obstacles, and wholesale treaty changes may be needed. However, working for a simpler and more robust fiscal framework may be the best response to recent skepticism about the European project.

ANNEX
SIMULATIONS DESIGN AND MODEL STRUCTURE

1 The model used for the stochastic simulations is a three-region version of the IMF's Global Integrated Monetary and Fiscal (GIMF) model; see Kumhof and others (2010) and Anderson and others (2013) for in-depth descriptions. It features a representative euro area country (in this case Italy), an aggregate of the rest of the euro area, and an aggregate of the rest of the world. There are two types of consuming households in the model: (1) Blanchard–Yaari type overlapping generations, intertemporally optimizing households, and (2) liquidity constrained, hand-to-mouth households. Both types of households supply their labor to firms in traded and non-traded goods sectors. Final and intermediate goods are produced using labor and capital goods, with varying capacity utilizations. The capital investment decision of firms is subject to financial frictions with an external financing premium that increases with the leverage of entrepreneurs (like the Bernanke-Gertler-Gilchrist vein of financial accelerator mechanisms).

2 Countries internationally trade both final and intermediate goods, as well in international euro-denominated nominal bonds. Monetary policy authorities in the euro area as a whole and in the aggregate of the rest of the world operate under inflation targeting regimes following a Taylor rule for nominal policy rate. The exchange rate between the euro area and rest of the world freely floats.

3 Household and firms pay labor and corporate taxes, and consumption is subject to value-added tax. Governments use their revenues to finance transfers to households, public consumption, and productive government investment, which has positive productivity spillovers to private producers. The government in the representative euro area country follows an explicitly specified fiscal rule that ensures the long-term sustainability of public debt. In each and every period the rule must assure that households and firms believe the government is intertemporally solvent.

4 The nominal and structural balance fiscal rules considered are nested in the following specification:

$$Def_t = Def^* - \alpha(OutputGap_t) - \beta(Debt_{t-1} - Debt^*),$$

in which the deficits and debt are relative to GDP, in percent, and the output gap is relative to the level of potential output, in percent as well. In the case of the structural balance rule $\alpha = 0.45$, while it is zero for the nominal balance rule. Further, β is the coefficient on the debt correction mechanism. The expenditure growth rule takes the form:

$$100 * \log(EXP_t) = 100 * \log(\alpha Y_t^*) - \delta(Debt_{t-1} - Debt^*),$$

in which δ drives the strength of a debt-brake. Expenditures growth follows the potential output growth, adjusted for debt stabilization.

5 The debt correction coefficient, β and δ are calibrated for each rule to achieve a debt-to-GDP ratio convergence within a specified number of years, with a given half-life. Structural balance rule with no debt correction implies debt convergence in more than 40 years after the initial shock, with a half-life of 15 years. In the case of weak debt correction, it takes up to 40 years for debt to reach its target after the shock, with the half-life of 13 years. With stronger debt correction it takes up to 15 years to converge, with the half-life of 7 years. In the case of the expenditure rule the "base" debt correction is parameterized to converge within 15 years, with the half-life of 6 years. The calibration of all fiscal rules is detailed in Table 2. The expenditure rule with "minimal" debt adjustment is a rule with the smallest value of the debt correction term that is feasible within the model.

Table 2

Fiscal Rule Parameterization

Fiscal Rule	Parameterization			
Nominal balance rule	α	0.00	β	0.00
Structural balance rule	α	0.45	β	0.00
Structural balance rule + debt corr. (base)	α	0.45	β	0.125
Structural balance rule + debt corr. (weak)	α	0.45	β	0.05
Expenditure rule: (minimal)	γ	0.00	δ	0.50
Expenditure rule: w/ debt corr.	γ	0.00	δ	0.95

Source: IMF staff calculations.

6 The rest of the model is calibrated for the three regions so that the steady-state matches their average stylized facts (such as the shares of consumption and investment in GDP), while the model's dynamic properties reflect those observed in the data (drawing upon the IMF's experience with this and other macro models) over the course of the business cycle. The representative euro area country amounts to about 16 per cent of the euro area. The euro area represents roughly 20 per cent of the world model economy. The calibration of the representative country broadly follows calibration of Italy, with the exception of the steady-state level of debt and deficit ratio to GDP. Further, it is assumed that there exists a debt-elastic sovereign premium in the euro area, which adds about 7 basis points for each increase of debt-to-GDP by 100 basis points.[17] See Table 3 for some essential calibration ratios and parameters and Anderson and others (2013) for more on GIMF model properties. Note that government transfers include, for example, pensions and social welfare payments, while government consumption includes, for example, the government wage bill.

7 As mentioned in the main text, the stochastic simulations focus on aggregate demand shocks drawn from their historical, estimated distribution, based on the variability of the annual output gaps in the last couple of decades.[18] To obtain those we have used an estimated output gap for Italy and rest of the euro zone and backed out the distribution of the shock needed to match the output gap dynamics. The shock distribution is then used to generate the stochastic simulations. An identical path of simulated shocks is used to evaluate all fiscal rules, hence there is no randomness involved in the comparison.

8 Table 4 then shows the long-run variability, unconditional, around the steady-state of each variable for the representative country, conditional on histories of aggregate demand shocks drawn from the estimated distribution. We believe this statistics captures well the idea that the goal is to evaluate the feasibility of fiscal rules over the course of multiple business cycles. As in the case of every model simulation exercise, it is rather a stylized one. It offers, however, a stock-flow consistent general-equilibrium environment to test various forms of fiscal rules, as compared to the often used partial equilibrium framework.

[17] The calibration of the debt-elastic sovereign premium is within the range of estimates seen in the literature and used by the OECD (for example, Haugh, Ollivaud, and Turner, 2009).

[18] Other shocks such as supply shocks, financial shocks, and monetary policy shocks can also be simulated. The analysis focuses on demand shocks as they dominate business cycle fluctuations and are fairly simple to simulate.

9 Some elementary robustness analysis was carried out. The main body of the text presents the fiscal rules that share a common instrument—government spending (consumption and investment). Other instruments were simulated, namely lump-sum transfers and labor and consumption tax rates. A robust finding is that all rules perform best when non-distortionary lump-sum transfers are used as an instrument, as one would expect based on economic theory. Also, no combinations of fiscal instruments for a given rule were presented in the main text. But one of the best-performing rules is when government spending responds to the output gap in a countercyclical way, while lump-sum transfers are the balancing instrument for long-term debt sustainability. The implied variance of all rules also changes in relation to the steady-state deficit-to-GDP ratio, be it 0 per cent, 0.5 per cent, or 3 per cent, respectively. When increasing the steady-state deficit the variance of the economy rises as more adjustment of fiscal instruments is needed to stabilize public finances.[19] The relative ordering, however, does not change. Table 4 illustrates a version of nominal and structural balance rules with lump-sum transfers as instruments and with differences in the steady-state deficit-to-GDP ratio.

10 The simulation focuses on a representative euro area country and the rest of the euro area. The calibration of the representative euro area country already implies a rather limited effect of the country on the area-wide inflation and interest rate. Larger countries would, however, affect the euro area total in a more substantive way. Relative variances do vary with the relative size of the country but the robust findings about the importance of the debt correction and instrument preference (transfers versus spending) are left unchanged. For idiosyncratic shocks the smaller is the country, the more important is the effect of the debt-elastic risk premium as it further diminishes the effects of area-wide monetary policy.

[19] Note that even with a 3 per cent deficit-to-GDP ratio the primary balance must be in surplus in the steady state, since the economy is efficient (real rates are higher than real growth).

Table 3

GIMF Calibration Essentials

Steady-State Shares	Units	EA Country	Rest of EA	RoW
GDP	% world GDP	3.2	16.6	80.2
Labor share	% GDP	60.0	60.0	60.0
Consumption	% GDP	60.3	59.3	60.0
Private investment	% GDP	17.4	16.6	20.0
Government spending	% GDP	22.3	24.1	20.0
Consumption	% GDP	20.4	21.7	17.0
Investment	% GDP	1.9	2.4	3.0
Exports	% GDP	22.8	26.2	5.6
Imports	% GDP	29.6	26.2	5.6
NFA/GDP	% GDP	0.0	0.0	0.0
Government Finances				
Government Deficit/GDP	% GDP	3.0	3.0	2.2
Government Spending				
Consumption	% GDP	20.4	21.7	17.0
Investment	% GDP	1.9	2.4	3.0
Transfers	% GDP	20.0	15.8	8.3
Government Revenue				
Labor tax	% GDP	24.9	23.0	22.5
Corporate	% GDP	2.2	2.4	16.0
Consumption	% GDP	12.3	10.1	15.0
Key Parameters				
Intertemporal EoS(1)		0.5	0.5	0.5
Habit persistence		0.4	0.4	0.4
EoS Home/Foreign goods		1.5	1.5	1.5
Home bias in consumption		0.8	0.8	0.8
Monetary policy rule				
Interest rate smoothing			0.3	0.3
Inflation gap			1.5	1.5
Output gap			0	0
Govt' debt-elastic premium	bp per100bp	7	7	7

Source: IMF staff calculations.

Note: EA = euro area; bp= basis point; EoS = elasticity of substitution; NFA = net foreign assets; RoW = rest of the world.

Table 4

Variance Around Steady-State, Detailed View

Type of fiscal rule	Instrument	Output (percent)	Output Growth (pp)	Debt-to-GDP (pp)	Surplus-to-GDP (pp)	Premium (pp)	Real Rate (pp)
Structural balance (-0.5 percent)	transfers	1.4	0.8	2.7	0.4	0.2	0.3
Structural balance (-3 percent)	transfers	1.5	0.8	3.8	0.5	0.2	0.3
Nominal balance (-3 percent)	transfers	1.3	0.8	1.2	0.0	0.1	0.3
Nominal balance (-3 percent)	spending	2.6	1.8	2.0	0.0	0.1	0.3
Nominal balance (0 percent)	spending	2.4	1.6	0.0	0.0	0.0	0.4
Structural balance (-0.5 percent)	spending	2.1	1.1	4.0	0.7	0.3	0.3
Structural balance (-3 percent)	spending	2.3	1.2	5.6	0.7	0.4	0.3
Structural balance (-0.5 percent) w/ debt corr. (base)	spending	2.1	1.2	2.1	0.6	0.1	0.3
Structural balance (-0.5 percent) w/ debt corr. (weak)	spending	2.1	1.1	2.8	0.6	0.2	0.3
Expenditure growth rule w/ minimal adjustment	spending	2.3	0.8	9.2	0.8	0.6	0.5
Expenditure growth rule w/ debt corr. (base)	spending	1.7	0.6	4.0	0.8	0.3	0.2

Source: IMF staff calculations.
Note: Simulations with three-region IMF GIMF model for aggregate demand shocks. See the main text and annex for additional details. pp= percentage points.

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PANEL DISCUSSION

SHORTCOMINGS OF EU FISCAL RULES AND INSTITUTIONS AND POSSIBLE WAYS FORWARD

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I will structure my discussion around three blocks:

1) The appropriate design of a fiscal rule, and how the Stability and Growth Pact (SGP) can be characterised against such ideal design. In this connection I will briefly discuss a possible alternative route the evolution of the European Union (EU) fiscal framework could have taken;
2) How fiscal rules should be applied to concrete cases and which form their enforcement should take. Taking the functioning of the SGP as a reference, I will relate its perceived shortcomings to a critical missing element, namely, a robust institutional set-up;
3) Possible ways forward to the development of an institution-based model to the steering of fiscal policy in Economic and Monetary Union (EMU), specially, examining how the fiscal council model could be adapted to the EU context.

1) Theory and experience converge to suggest that the appropriate design of a fiscal rule should combine the objective of debt sustainability with that of cyclical stabilisation. Concerning debt sustainability, while theory strictly requires a positive reaction of the primary surplus to increases in the debt ratio and remains inconclusive on the optimal debt objective, there seem to be strong reasons for having in place a mechanism inducing convergence to a prudent debt level. These reasons are probably stronger in the context of a monetary union, in the light of the externality created by each country in isolation facing in normal times a potentially flat demand curve for its debt, and hence an incentive to excessive indebtedness, while being potentially at risk of being shut out of the markets in times of crisis .There seems also to be a clear case for fiscal rules to include a counter-cyclical element, unless one believes in the absolute power of monetary policy to stabilise the economy (or the absolute impotence of fiscal stabilisation). Again, the case for fiscal policy stabilisation is probably stronger in a monetary union, as monetary policy is not available to offset country-specific shocks.

The resulting rule can thus be described as a fiscal reaction function, whereby the target fiscal variable reacts according to a debt feedback mechanism (ensuring that debt cannot permanently deviate from the adjustment path toward the "anchor" debt level) and to a measure of the cyclical conditions. Views can reasonably differ on the parameterization of the rule, specifically, the value of the "anchor" debt level; the speed of convergence toward it implicit in the feedback mechanism; and the form of the reaction function to the cyclical conditions. Carnot (2014) provides a neat formulation of such a "rule of thumb" for fiscal policy. Andrle *et al.* (2015) propose a similar approach. Both papers also argue for the superiority of an expenditure growth benchmark as the operational target of the fiscal rule, expenditure being the variable most directly connected with policy decisions (with adequate safeguards against offsetting measures on the revenue side): in this sense the ideal fiscal rule can be described as an expenditure rule.

How can the SGP be characterised against the fiscal rule model that has been outlined above? With a number of approximations, the Medium-Term Objective (MTO), which is the key concept of the SGP, can be described as a cyclically-adjusted "balance norm", inducing the convergence of debt to the 60 per cent of GDP Maastricht threshold. Cyclical stabilisation is not incorporated in the MTO as an independent objective but enters into consideration when measuring the gap between the "norm" and the actual balance, which countries are expected to steadily reduce. This has at least two practical implications: except in exceptional

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circumstances, the fiscal policy stance is expected to be restrictive until the debt convergence balance norm is achieved; conversely, once the norm is achieved, countries are dispensed from any other constraint on the conduct of fiscal policy, irrespective of cyclical conditions. It follows that the SGP is likely to envisage or allow pro-cyclical fiscal policies in a wider set of circumstances than it may be desirable. As to the operational variable, after its last reform, the SGP envisages a "two-pillar" approach, where the traditional metric for gauging the adjustment towards the MTO, namely, the change in the structural balance, has been flanked by the (deviation from the) expenditure benchmark, which effectively amounts to an expenditure rule (adjusted for net measures on the revenue side). This should be taken as a move in the right direction, although the co-existence of two operational targets is less than ideal from the point of view of transparency and communication.

One may recall at this point that the SGP, and in particular its so-called preventive arm introducing the concept of MTO, represents an innovation with respect to the original EMU fiscal framework envisaged by the Maastricht Treaty (1991). This introduced the numerical criteria for deficit and debt, and a step-wise procedure for their enforcement, but left considerable room for judgement at each stage, with Member States with deficit in excess of the 3 per cent of GDP threshold in practice receiving annual recommendations on how to reduce it. It was only in the run-up to the introduction of the single currency that the view prevailed that the excessive deficit procedure (EDP) should be made as "automatic" as possible, with Member States being given strict deadlines for the correction of the excessive deficits, under the threat of sanctions, and that moreover Member States should pursue a medium-term objective of close to balance or in surplus, with annual examination of the programmes for its achievement (van den Noord et al. 2008). It is tempting to imagine a different evolution of fiscal surveillance, where the Maastricht criteria would have served as potential flashpoints for identification of "gross errors" in fiscal policy, in the original spirit of the Treaty, while guidance for the normal conduct of fiscal policy could have evolved along the lines of the model outlined above; or, alternatively, it could have been devolved to national fiscal councils, under EU supervision, along the lines of the proposal of Odor and Kiss (2015). The recent set-up of fiscal councils under the impulsion of the intergovernmental Fiscal Compact and other pieces of EU legislation associated to the so-called Six-Pack (2011) and Two-Pack (2013) may eventually lead to a greater role for national independent bodies in prescribing fiscal behaviour. An immediate result of the Fiscal Compact, however, is that of effectively hampering any further evolution of the SGP in the sense of remedying the shortcomings that have been identified above, since it mandates the incorporation of a particularly restrictive version of the MTO in national constitutions or provisions of equally binding character.

2) The issue of the appropriate design of fiscal rules, while the most attractive from the economists' point of view, is arguably less important than that of the application of the rules to concrete cases and the manner of their enforcement. This is the area where the weaknesses of the EU fiscal framework are probably most apparent, but at the same time an insufficient appreciation of the true nature and causes of such weakness is pervasive. Complexity is probably the most frequent criticism of the EU fiscal framework, with multiple and overlapping rules affecting different fiscal aggregates the most cited illustration. Less widely appreciated is the role of the implementing and interpretative body that has grown around this elaborate set of rules: it is practically impossible to infer from the texts of the SGP how the rules will be applied to concrete cases without a detailed knowledge of the Code of Conduct on its implementation endorsed by the Council and the more comprehensive (and regularly revised) Commission's *Vademecum* (European Commission, 2013). As regards enforcement, the EU fiscal framework is characterised by the uneasy coexistence of two elements: an *ex ante* quasi-political peer pressure apparatus, implemented in the annual process of recommendation-setting known as the European Semester (followed by the assessment of national draft budgetary plans), and an *ex*

post quasi-judicial sanctioning mechanism, including the potential imposition of heavy fines on non-compliant Member States, which has however never been implemented in practice. It would be challenging to argue that the singular lack of implementation of the latter element owes to the unique effectiveness of the former.

What most critics of the SGP tend to miss is that both the complexity of the rules, and even more of their application, and the perceived lack of effectiveness of their enforcement, are not so much the result of exogenous policy choices, in terms of faulty design or biased implementation, as an endogenous feature of a system characterised by a lack of a central authority able to provide ultimate guidance and enforce the rules. Lack of central authority may be said to be a common feature of the EU governance, where the legal monopoly of initiative on the part of the Commission is balanced by the decision-making power of the Member States in the Council. It was therefore natural for the framers of the Maastricht Treaty to opt for a system of proscribing rules for fiscal policy, with the essential goal of protecting the central price-stability objective of the common monetary policy, while acknowledging the unwillingness of Member States to give up freedom of choice on matters of tax and expenditure, which are central to national sovereignty. A special recognition of the place of fiscal policy at the heart of sovereignty is to be found in the Treaty provision (Art. 126(10) TFEU) that, by way of exception to the normal functioning of the EU model of governance, excludes the right, on the part of the Commission or a Member State, to bring before the Court of Justice cases of Member State's failure to comply with its EDP obligations. Recognising the sensitivity of an issue is however not the same as finding a solution to it. In the case of fiscal policy, the absence of a common authority has been compounded by a lack of mutual trust among Member States and between the Member States and the Commission, which has probably deepened since the Great Recession and the different narratives that have emerged of it. Lack of mutual trust demands that every rule be either of a simplicity that makes it inadequate for the purpose or be complemented by endless specifications as to its application; in both cases, it makes highly contentious any attempt at its subsequent enforcement. Rather than as a sequence of mistaken views on the working of fiscal policy, as some of its academic critics would have it, the evolution of the SGP, from its initial attempt to put fiscal policies on "automatic pilot" to the current surfeit of "smart" rules, may suggest the conclusion that, in the absence of a robust institutional set-up, any fiscal framework may be condemned to oscillate between the Scylla of 'stupid rules' and the Charybdis of the "complete contract". In other words, the direction of causation between complexity and lack of ownership is not so much from the former to the latter as the other way round. Therefore aiming at dealing with the issue of complexity by proposing to streamline the rules without simultaneously addressing the institutional issue is equivalent to curing the symptoms while ignoring the root cause of the disease.

3) The need for a robust institutional set-up to sustain (or, in the view of some, replace) the working of fiscal rules has long been recognised by some academic critics: the natural parallel is that with monetary policy, where an early view stressing reliance on rules constraining the growth of monetary aggregates was replaced by a consensus on delegating the conduct of monetary policy to an independent central bank (Wyplosz 2002). A very significant recent development is that the call for a move from a system of "rules" to one of "institutions" has apparently become the line of the European Central Bank (Draghi 2015). The overall process and the concrete steps through which such a momentous change could take place are however left unspecified, producing the impression of discontinuity between the present unsatisfactory working of decentralized fiscal policies under far from ideal rules and a distant future of sovereignty sharing under common institutions. It is clear that the institutional model that has imposed itself for monetary policy would need strong modifications before its eventual adoption for fiscal policy: in a monetary union even more than in a national setting entrusting fiscal decision-making to an independent body does not seem readily feasible, or at least attuned with

democratic politics as we know it, even if it were possible to separate the distributional function of fiscal policy from its macroeconomic role. The growing literature on fiscal councils, while generally dismissive of the case for the delegating fiscal policy *powers*, highlights the *influence* that independent bodies can have on fiscal policy, essentially by raising the reputational costs for the government of running unsound fiscal policies (IMF 2013). However, the translation of the national model of fiscal council at European level is not straightforward. On the one hand, in the absence of a fiscal capacity at EU level, there is no EU equivalent of a national fiscal policy as the proper subject of influence on the part of an EU fiscal council. If, on the other hand, national fiscal policies were to be the subject, on which the EU fiscal council should pass judgment, then its field of action would be already potentially overcrowded by the presence of national fiscal councils and, not least, the European Commission in its role as "guardian of the Treaty" and, by extension, the EU fiscal framework. A viable division of labour would have to be found, bearing also in mind the "constitutional" constraints coming from the Treaty and Fiscal Compact.

It has been suggested above that in principle it would be possible, consistent with the Treaty provisions and arguably best in line with their original spirit, for the Commission and the Council to retreat from the day-to-day (micro-) management of fiscal surveillance and focus on the "gross errors" in fiscal policy. Already the evolution of the rules and even more of the practice of fiscal surveillance points in the direction of greater discretion on the part of the Commission and the Council. Further developments in this direction would demand the elimination of strictures in the corrective arm (e.g. the obligation to always open an EDP if certain conditions are not satisfied and the persisting obstacles to reviewing EDP recommendations in the light of changed economic circumstances); concerning the preventive arm, whose enforcement capacity remains relatively weak even after the recent reforms, it would be important to gain greater discretion in assessing the occurrence of a "significant deviation" from the MTO or the adjustment path towards it, particularly in the critical cases of apparent "overachievement" of the MTO owing to revenue windfalls (and hence consistent with imprudent policies on the spending side).

In the light of the shortcomings of the current situation analysed under 2) above, establishing the credibility of the Commission vis-à-vis Member States in the critical function of identifying "gross errors", with a wider margin of discretion than under the present rules, that the Commission itself be flanked by an independent body possessing the qualities – in particular, strict operational independence from politics, mandate restricted to fiscal surveillance – that are typically associated to a fiscal council. In turn this would raise the delicate institutional question of how to organise the co-existence of such a body with the decision-making power attributed by the Treaty to the Commission and the Council. A number of solutions may be envisaged: the fiscal council could provide advice on the balance of "relevant factors" underlying the case for a surveillance decisions (e.g. whether or not open an EDP or issue a new recommendation under the same procedure) before the Commission initiates it; alternatively, the fiscal council effectively prepare all surveillance decisions for endorsement by the Commission. It is interesting to note that the latter model has been effectively applied to allow for centralised banking supervision and resolution in the euro area context of the banking union: in particular, the creation of, and the attribution of extensive powers, to the Single Resolution Board, was made compatible with the preservation of the Commission powers that cannot be validly transferred to other bodies without changing the Treaty. For the fiscal council to perform an effective role it would be essential that the principle of "comply or explain" applies, in turn requiring that the Commission explains publicly the reasons for departing from the fiscal council advice, and that the fiscal council be involved with adequate resources upstream of the decision-making process.

A further question that the set-up of a fiscal council at EU level would raise concerns its relationship with the already (recently) established national fiscal council (technically, independent fiscal institutions (IFIs). Substantial disagreement between the EU-level and the national IFIs on the assessment of a country situation against the background of the commonly applicable fiscal framework would risk undermining the bodies' authority and that of the framework itself (although it has to be recognised that the risk already exists under the current set-up, especially with the tasks conferred to IFIs by the Fiscal Compact). A way forward could involve the creation of a European system of IFIs, with the EU-level IFI representing the "federal" interest, including providing the final advice to the Commission. The arrangements put in place for the banking union, in particular, the set-up of the Single Resolution Board, which works in close cooperation with the national resolution authorities, could provide *mutatis mutandis* a model for the working of the European system of IFIs compatible with the existing Treaty.

An eventual change of the Treaties would allow removing further shortcomings of the current model: in particular, replacing the distinction between "preventive" and "corrective arm" of the SGP, and the resulting plurality of rules and target aggregates, with the model of fiscal rule outlined under 1); and replacing the sanction-based model for the enforcement of fiscal rules, with greater *ex ante* intrusive powers on the part of the EU level (e.g. veto on national budgets) in case of serious and persistence failure to comply with the rules. The superior design of a fiscal rule effectively coupling the objective of debt sustainability with that of cyclical stabilisation should contribute to its acceptance, at least in terms of "output legitimacy". In turn, this should facilitate the shift from a "proscribing" to a "prescribing" approach to fiscal governance (although the extraction of sovereignty implied by such a move as a EU veto on national budgets would probably to remain reserved for behaviours endangering the sustainability objective). If the thrust of the analysis that has been presented is correct, however, it follows that, in terms of robust policy sequencing, it may be unwise to wait for an overall "constitutional" change before addressing the issue of the absence of an authoritative referee in the system and the corrosive effect that this absence is bound to have on the working of even the best-thought fiscal rule.

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RULES VS DISCRETION IN THE EUROPEAN FISCAL FRAMEWORK

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The Monetary Union, as designed by the Maastricht Treaty in 1991, rests on a rule-based approach. Except for a few commentators in favour of market mechanisms, this approach has been rarely questioned. Over the last quarter of century, a continuous debate concerned instead the most desirable design of the rules.

This situation has changed with the crisis. Many observers have questioned whether a purely rule-based governance is viable in the long run. The debate opened up to broader issues, including the end-point of the Union, the design of European institutions and how to achieve greater accountability and democratic legitimacy. At the end of 2012, the European Commission (with its *Blueprint*) and the four Presidents[1] contributed to the discussion. As you all know, some of their indications seem to have been somewhat side-stepped, but the quest for a better economic governance in the Euro Area is going on and a new Four Presidents' Report should be unveiled next June.

In what follows, I will not tackle these broader themes but I will largely focus on the issue of rules vs. discretion and its implications.

Given the nature of this workshop, I will stick to fiscal issues, but let me briefly mention another situation in which we find a conflict between rules and discretion, in the area of monetary policy. The prohibition of monetary financing imposed on the ESCB by the Treaty[2] had the rationale to protect the integrity of monetary policy, enhancing its autonomy. Its unintended effect, during the crisis, was to unduly constrain the actions of the ECB preventing a more effective and timely reaction to the risk of deflation.

The new framework induced by the crisis

As a reaction to the crisis, new fiscal rules have been introduced and exceptions and "relevant factors" have been added. **Together with its stringency, the complexity of the system has increased.** As we have just heard in this room (today, but the same message was conveyed by three distinguished panellists during last year's workshop), there is a widespread feeling that some streamlining is needed.

One of the reasons behind the proliferation of fiscal rules is probably the **insufficient trust** among member states, which may have been partly justified by the well-known episode of statistical misreporting. The revision of the rules was also a reaction to their failure to deliver sound public finances in every country.

At the same time, the introduction of exceptions and "relevant factors" was deemed necessary to **avoid that such a complex set of rules became a straightjacket** in bad times, also

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[1] The report "Toward a Genuine Economic and Monetary Union" was drafted by the President of the European Council in close collaboration with the President of the Commission, the President of the ECB and the President of the Eurogroup.

[2] "Overdraft facilities or any other type of credit facility with the European Central Bank or with the central banks of the Member States (hereinafter referred to as "national central banks") in favour of Union institutions, bodies, offices or agencies, central governments, regional, local or other public authorities, other bodies governed by public law, or public undertakings of Member States shall be prohibited, as shall the purchase directly from them by the European Central Bank or national central banks of debt instruments." Art. 123 of the Treaty on the Functioning of the European Union.

given the large uncertainty concerning the effects of fiscal policies, the wide margins of error in measuring the government structural budgetary position and the difficulties in defining in practical terms what fiscal sustainability is. Subsequent events suggest that it was a sensible decision.

Rather paradoxically, **discretion has also increased**. While before it depicted itself as just the "guardian" of the rules, the Commission has started to have an active role in interpreting them.

The system is now less transparent. The general public can understand the 3 per cent limit; with some imagination it may grasp the concept of a balanced budget in structural terms; but I believe it is at loss with the "minimum linear adjustment" required to satisfy the debt rule and similar subtleties.

Consequences of the current framework

More than in the past, **rules are under attack**, both from those who believe that they should be tightened and from those who think that they are too stringent.

A possible explanation of this discontent is the fact that the **rules may still be too pro-cyclical**, both in good and in bad times, notwithstanding the efforts to address this issue. In the current situation – the aftermath of a deep downturn in many economies – critics of the rules stress that they are too stringent and leading to pro-cyclical prescriptions. The critics on the opposite side are instead worried by the discretionary margins used in the interpretation of the rules by the European authorities (Commission as well as Council) in an effort to avoid their pro-cyclicality.

The problem cannot be easily solved modifying the rules by making them less pro-cyclical, because the current cyclical position is assessed with a large degree of uncertainty. When a signal is not accurate, it is not optimal to react fully to its indications.

Complexity and lack of transparency have **reduced the accountability of national politicians**.

Possible ways forward

We have gone probably too far in trying to draw up a "complete contract": a certain degree of discretion could be beneficial if the institutions and procedures are adequately designed and more discretion may also allow for simpler and more transparent rules. In what follows I will outline these themes.

Reconsidering institutions and procedures. - We all agree that the political dimension in the fiscal domain is unavoidable. Therefore, the final, political, decisions will still have to rest in the hands of the Council. My point is that, for the sake of transparency, its decision need to be based on a proposal formulated as much as possible on purely economic grounds, reflecting the rules as well as a wide range of elements.

I also believe that in the last, difficult years, the European Commission did a great job and that its technical skills, which have been progressively strengthened, match its tasks.

The issue I want to take up is the widespread perception that "political" elements played a role in the decision process already when the proposals of the Commission were defined. This contamination (or perception of it) may partly reflect the way Commissioners are appointed, *i.e.*, through a bargaining among member states. The recent emphasis given to electoral results, while justified on other grounds, probably increased this impression. A political balancing of national views seems also to underlie the current governance, featuring a supposedly lax Commissioner supervised by a supposedly hard-liner Vice-President.

Overall, in the current arrangement, instead of having a political decision based on a purely technical proposal (rule-based and economically sound), we have two decisions which rarely differ, because the political element is, at least partially, already included in the proposal.

How can we avoid this? One possibility is to **separate this task from the other activities of the Commission** creating a new institution with a specific mandate and therefore high accountability (in this respect, the ECB is the obvious model). This institution would represent a sort of European fiscal council, which would also oversee and coordinate the national ones. A similar idea was set forth by Karsten Wendorff last year at this conference and, more recently, by the Monthly Bulletin of the Bundesbank, though the details are still restricted to readers knowledgeable in German.

Evidently, separating the task of fiscal (and macroeconomic) surveillance from the many tasks carried out by the Commission would lead to greater transparency, but also to some duplication and additional costs.

While I find the paper presented by Odor and Kiss full of thought-provoking insights – I find problematic the suggestion to attribute large responsibilities to the National Fiscal Councils, leaving to the European institution a residual role, limited to exceptional circumstances. The reason of my reservations is that the externalities arising from participation in EMU imply limits that, in many cases, are more stringent than those which are optimal from a strictly national viewpoint. Such limits could be effectively overseen only by a supranational authority as we cannot expect national institutions to fully internalize in their decisions the interests of the other member states.

Reconsidering the rules

A simple but robust system could include the requirement to achieve and maintain a balanced budget in structural terms (or, alternatively, on the Medium Term Objective as currently defined) and the 3 per cent threshold as an upper bound for the deficit. In other terms, **we could go back to the state of the rules in 1997** (or, if we retain the MTO, to the pre-crisis framework), keeping however the various procedural improvements introduced since. I believe that no other rule is necessary. When there are no large and systematic stock-flows, the debt rule is redundant in normal times – as the respect of a balanced budget in nominal terms guarantees already a sizeable reaction of the debt ratio; the debt rule is instead binding in very bad times, but in this case its prescriptions would be damaging, as it would ask for a large pro-cyclical adjustment.

As for the expenditure rule – which is given a pivotal role in the excellent IMF paper just presented – I reckon it can be an important instrument at the national level, but its use seems problematic in a multilateral framework. As Daniele Franco argued last year in this conference, an expenditure growth ceiling would constrain social preferences, without directly targeting the fiscal variables which cause externalities. If citizens' preferences change in favour of increasing the size of the public budget, an expenditure growth ceiling may unduly hamper the adjustment.

Of course, the very incomplete contract I have outlined should be overseen by an accountable European authority enjoying a degree of discretion. In particular, this authority should make sure that the spirit of the covenant is respected; for example, overseeing the size and nature of stock-flows.

Summing up

Rules have carried us forward a long way, but it was naïve from the start to believe that they could be mechanically applied in all possible contingencies.

A certain degree of discretion must be accepted. This is also the opinion set forth by President Draghi in his recent speech when discussing the fiscal framework (Frankfurt, 16 March 2015): “Rules can only really be credible if they are applied with very little discretion. Otherwise as soon as they actually bind, countries will find reasons not to follow them. But having no discretion is also not optimal, as circumstances will always arise that the rules did not foresee. There is thus an inevitable trade-off between credibility and flexibility”.[3]

Accepting discretion may also allow us to **reconsider the rules**, making them simpler and more transparent.

But discretion should also be exercised through **well-designed institutions and procedures**. We have to ponder on whether the current arrangements are fully optimal in this respect. As stressed by President Draghi in the above mentioned speech: “We need to move from rules to institutions”.

3 https://www.ecb.europa.eu/press/key/date/2015/html/sp150316.en.html