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

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[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.

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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 $k\leq 1$ ($k=1$ 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}.

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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.

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[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,

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[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:

$$FD(\pi) = T_{wt_{t-1}} * \left(\varepsilon_{wt_t} - 1\right) * \left(\frac{Def_t}{Def_{t\ 1}} - 1\right)$$

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]

$$b_t^{TOT} = b_t^S + b_t^{NS} = \frac{1+i}{1+g} b_{t-1}^S + \frac{1+i^*}{1+g} b_{t-1}^{NS} - pb_t \quad (1)$$

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:

$$d_t^{tot} = \frac{1+r}{1+n} d_{t-1} + \frac{(1+r^*)(1+\pi_t^{exp})}{(1+n)(1+\pi_t)} d_{t-1}^* - a_t \quad (2)$$

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

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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:

$$\frac{\partial inp}{\partial \pi} \approx \frac{1}{(1+n+\pi)^2}\left[(1+n-r)\frac{d_{t-1}}{d^{tot}_{t-1}} - (r^* + \pi^{\exp})\frac{d^*_{t-1}}{d^{tot}_{t-1}}\right] d^{tot}_{t-1} \quad ,$$

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, π_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

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[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.

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[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

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[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

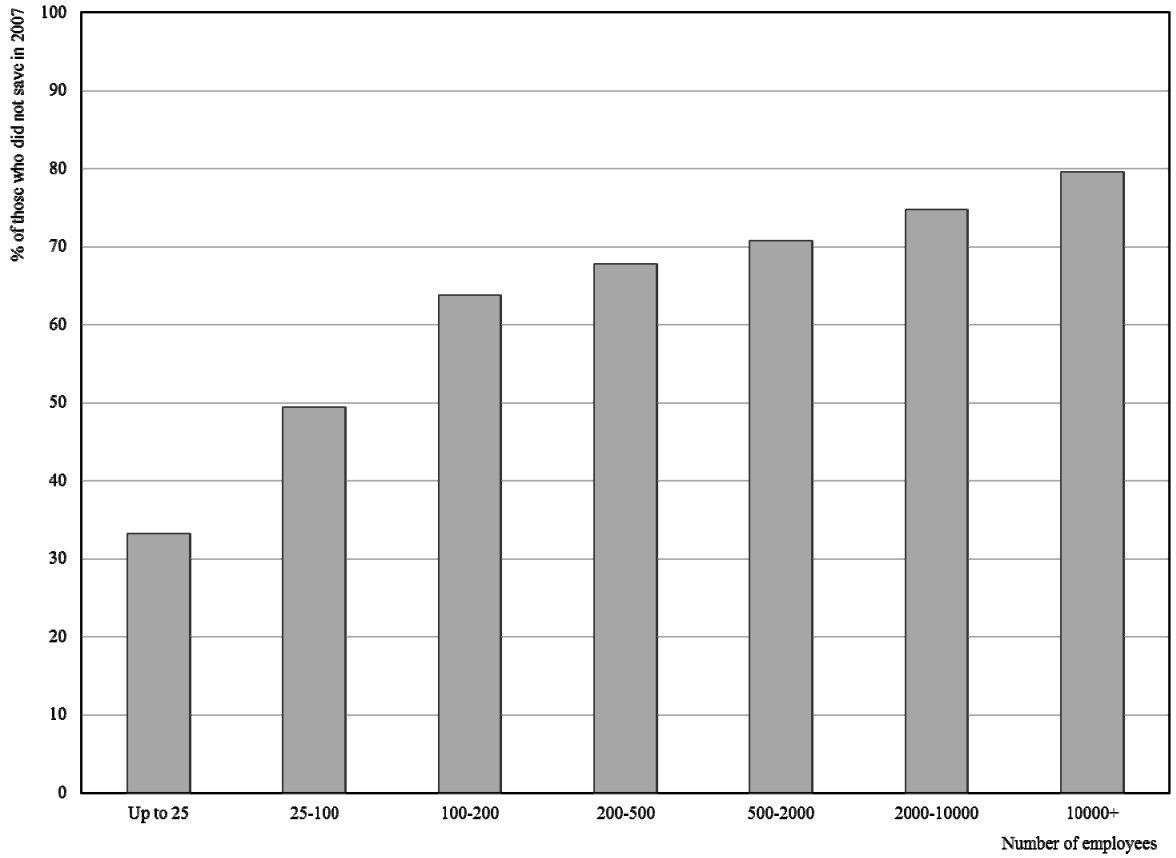
[29] Since in 2008 the arrangement applied only to workers who had been employed for at least nine months with the same employer, those who started to work after March 2008 were still exempt, even if they were employed for the whole period by the same employer.

[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

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[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

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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

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[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.

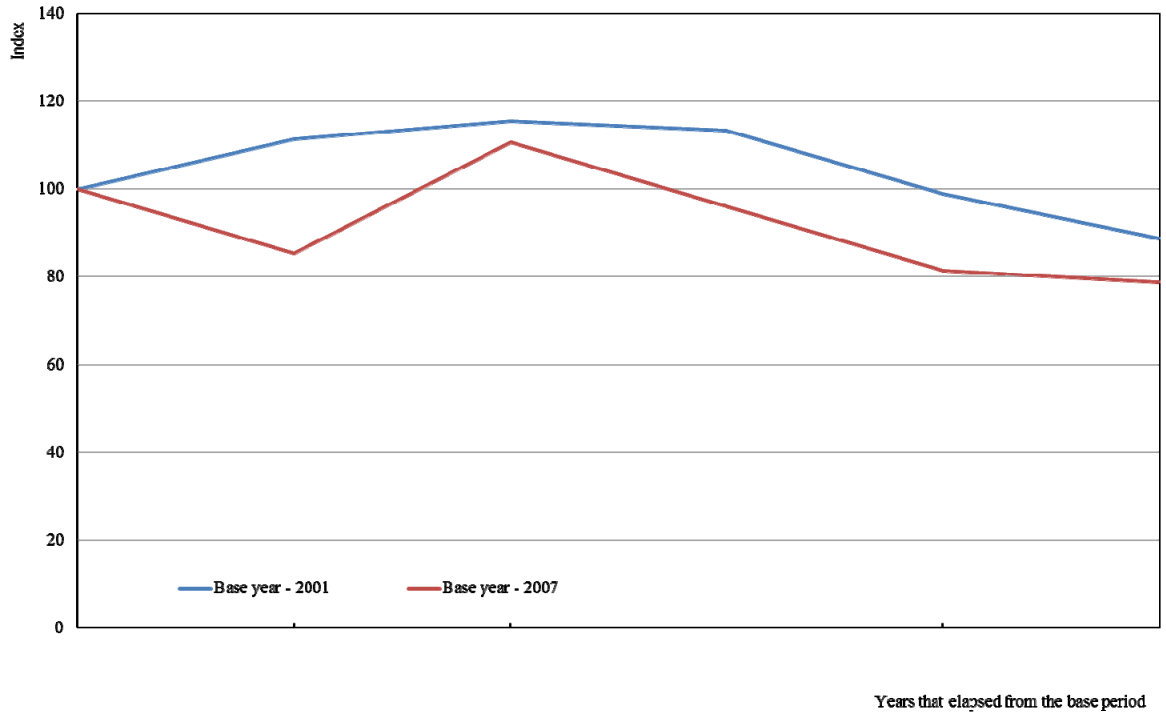
[46] The employer's contributions are not included in the reported (gross) wages.

[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

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[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

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[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

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[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.

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[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

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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.