FISCAL POLICIES ENHANCING GROWTH IN EUROPE: CAN WE APPLY COMMON REMEDIES TO DIFFERENT COUNTRIES?

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We provide evidence of heterogeneous reactions of the growth rates in the European Union countries to changes in taxes and public expenditure, when the governments' budget constraint is taken into account. Direct taxation exerts a much more damaging effect on the growth rate of the European emerging countries than on the most industrialized countries'. Indirect taxes are not inconsistent with growth in the latter, while they are harmful in the former. Increases in human capital expenditure stimulate growth in the low-growth countries, while welfare and sovereign spending are efficient for growth in the economies that grow rapidly.

1 Introduction

There is a widespread view in the European economic policy circles that in order to get out of the current economic depression while respecting at the same time the sustainability of their public finances, the European Union countries should implement common fiscal policies. Some people even suggest a fiscal federalism, by comparison with the United States, where a federal budget can be operated to conduct countercyclical policies. This paper argues against such a view. We provide evidence of great heterogeneities among the EU countries regarding the fiscal/growth relationship. We conclude that similar policies cannot work in a similar way in countries that are still experiencing a catch-up dynamics and which experienced the highest growth rates over the last 10 years (the most recent members of the Central and Eastern Europe and some countries such as Spain, Portugal and Ireland) and in countries whose growth rates have been lower (the older members). This conclusion is valid whether or not we consider demographic differences between the countries. For example, welfare and social spending, usually considered in the literature as non-productive, stimulate growth in countries with fast growth, but are harmful on the growth rates of low-growth countries. Tax cuts have stronger positive effects on the growth rate of the emerging economies than on the growth rate of the most industrialized countries. Increases in social security contributions inhibit the growth rates of the low-growth countries, but stimulate the growth rate of countries that are growing fast.

Such differences would not necessarily appear if we tried to link growth to fiscal variables by using aggregate indicators of spending and taxation, for instance, the ratio of total spending out of GDP, or the ratio of total taxes over GDP. Differences among the countries appear once we consider that the European countries face the joint problem of attempting to boost growth while simultaneously tracking a sustainable level of their public finance. This double choice is motivated by the fact that the fiscal policies are coordinated through the implementation of a Stability and Growth Pact which imposes restrictions on the levels of debt and deficits. Therefore, the fiscal/growth link rests on the structure of spending and taxes. For instance, suppose that governments decide to increase welfare spending to conduct countercyclical policies. To guard control on the sustainability of public deficits, they may decide to finance this increase by higher direct or indirect taxes, or to offset the increase in welfare expenditure by a decrease in other spending. In this case, the impact on growth will be different, as compared with a situation in

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which the structure of other spending and taxes are left unchanged, which would mean that higher welfare expenditure would result into a higher deficit. The argument that is put forward in this paper is that the effects of similar fiscal policies can differ across countries, because the economic growths react not only to the amounts of expenditure and revenue, but also to the structure of expenditure and revenue when a budgetary measure is adopted.

In previous papers of the literature, some authors relate the growth rate of the European countries to the structure of taxes and public spending, but they assume that the links are the same across countries. Afonso and Furceri (2010) find that a rise the following components of taxes and expenditures negatively affect growth: indirect taxes, social contributions, subsidies. An important contribution of their paper is the finding that the disaggregated components impact growth when changes occur in both their size and volatility. Nikos (2009) examines whether a reallocation of the components of public spending and revenues in 14 EU countries have enhanced their economic growth between 1990 and 2006. He concludes that government outlays on education, social protection and defense, as well as public expenditures on infrastructures, are growth-enhancing, while distorsionary[1] taxes depress growth. Furceri and Karras (2009) show that increases in social security contributions and in taxes on goods and services have had a larger negative effect on growth in the European countries between 1965 and 2003, than increases in income taxes.[2]

In contrast to these studies, we take in consideration the issue of heterogeneity. Quantile regression analysis provides a useful empirical framework within which we explore the idea of heterogeneous reactions of growth to fiscal policies in the European Union. In such a framework, it is possible to justify that the impact of changes in public spending and taxes varies across the conditional distribution of growth. This is an alternative methodology to the usual ones, either focusing on mean effects, or treating the issue of fiscal/growth heterogeneity by splitting the data into separated groups of countries.[3] Our approach differs from the previous empirical papers in two ways.

The first difference concerns the empirical methodology. Although there is a considerable literature on the fiscal policy/growth relationship, a relatively small amount of this literature is concerned with heterogeneous reactions in terms of growth to the same fiscal policies.[4] To our knowledge, three exceptions are Bassanini and Scapetta (2001), Arnold (2011) and Gemmel *et al.* (2011). These authors use the pooled mean group (PMG) and mean group (MG) estimators introduced by Pesaran *et al*. (1999). Although these estimators are useful in accounting for different slopes across the countries of a panel, the cost of using them is a reduction of the degrees of freedom. Indeed, they are based on an average of the estimates from individual countries regressions. We instead use an estimator that keeps the pooled dimension of the panel while allowing at the same time to deal with the diversity of reactions across the countries: a quantile regression estimator. One advantage is to consider the entire panel and to distinguish the countries by their location in the conditional distribution of growth. Instead of estimating models for conditional means functions, we consider a full range of other conditional quantile functions.

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1 Following the definition given by Kneller *et al.* (1999), distortionary taxes are those which affect the investment decisions of agents (with respect to physical and / or human capital), creating tax wedges and hence distorting the steady-state rate of growth. Non-distortionary taxation does not affect the saving / investment decisions because of the assumed nature of the preference function, and hence has no effect on the rate of growth.

2 There are other examples of papers linking growth to the composition of expenditure and tax structure in other industrialized countries, among which Lee and Gordon (2005), Angelopoulos *et al*. (2007), Gemmel *et al*. (2011).

3 See, for instance Angelopoulos *et al*. (2007), Arnold (2008), Arnold and Schwellnus (2008), Bleany *et al*. (2001), Gemmel *et al*. (2011), Lee and Gordon (2005), Peretto (2003, 2007), Vartia (2008).

4 In a survey of the growth empirics, Eberhart and Teal (2011) note that the possibility of heterogeneous parameters is ignored by a vast majority of studies.

Secondly, unlike many previous studies, we do not only consider estimates of fiscal/growth regressions based on the growth rate of the GDP per capita, but also the growth rate of the real GDP itself in a context where the European governments search to avoid a rise in the burden of public debt. Our approach is motivated as follows. Fiscal policy usually has several objectives. The first is equity. Taxation and expenditure are considered in terms of their ability to impact fairly personal incomes. In this case, using the growth rate of GDP per capita (or a multidimensional welfare indicator) as the endogenous variable is convenient. Previous papers examining the impact of fiscal measures on per capita growth implicitly assume that a higher growth of the real GDP translates into a higher standard of living within and across individuals, on average (but this is an assumption that would need to be proved, since average effects mask potential changes in income distribution). A second concern of fiscal policy is efficiency. This can be defined as the way in which expenditure and taxes "deliver" in terms of the growth rate of the real GDP. For instance, finding a negative elasticity of the latter with respect to welfare expenditure, or direct taxation, might be interpreted as the existence of waste in the public sector inducing inefficiencies in the global activity (the channels yielding such inefficiencies are for instance a lower productivity of the labor supply, a higher wage reservation level, a reduced competitiveness of firms, etc). In this paper, we adopt the interpretation in terms of both efficiency and equity. We thereby consider both the growth rate of the real GDP and the growth rate of per capita GDP.

The remainder of the paper is structured as follows. Section 2 describes the theoretical underpinnings, while section 3 presents the empirical methodology and data. Section 4 contains our estimation results and our comments. Finally, Section 5 concludes.

2 Theoretical underpinnings

In this section, we briefly explain the theoretical framework underlying our empirical equations. Although, we do not present the theoretical models formally, this is important to motivate the choice of our variables as well as some restrictions imposed on some coefficients of our equations. Our empirical framework relies upon two different strands of the theoretical literature on the fiscal/growth link. One is the correlation between growth and the composition of public spending and taxes. The second concerns the effects of fiscal policy on growth with respect to how a public spending or deficit is financed.

2.1 Linking growth to the structure of taxes and the composition of expenditure

The Lisbon strategy puts an emphasis on the efficiency of fiscal policy on the European countries' growth rate. Indeed, the EU member States agreed on improving the contribution of public spending to growth by directing public expenditure towards growth-enhancing investment in both physical and human capital.[5] Besides, in a report published in 2011, the European Commission points to several challenges of tax policy, among which the potential to make the tax structure more growth friendly.[6]

These issues cannot be examined within the first-generation endogenous growth models linking fiscal policy to growth. Indeed, as pointed by Agell *et al.* (2007) and Myles (2000), when the growth effects are apprehended by considering aggregate measures of tax burden and public expenditure, these models only capture the role of government size. In the second-generation

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[5] Wierts (2005) discusses some aspects of redirecting public expenditure under the Lisbon experience.

[6] The report published on October 2011 was entitled "Tax reform in EU member States 201: tax policy challenges for economic growth and fiscal sustainability".

models of endogenous growth the share of different categories of public expenditure and taxes is explicitly taken into account. A fairly simple approach consists in separating public spending between productive and non-productive components and distinguishing between distortionary and non-distortionary taxes. An important conclusion of the papers is that different spend-tax combinations yield different effects on growth. For instance, productive expenditure financed by non-distortionary taxes have a higher effect on growth than when they are financed by distortionary taxes. Another approach, widely used in the growth literature to identify the effects of fiscal policy, is to consider a fine disaggregation of public spending and taxes. On the spending side, it is usual to consider a functional disaggregation of government expenditure: spending on health, education infrastructure, defense, recreation, social protection, etc. On the revenue side, the decomposition of taxes is generally between personal income taxes, corporate income taxes, direct and indirect taxes, taxation of capital gains, etc. A motivation for doing this is that determining the direction of the response of growth to changes in the fiscal variables requires somewhat careful judgment on the transmission channels, for instance through their influence on private production, human capital accumulation, on productivity, or through the diffusion of innovations and network externalities.[7]

There are several findings in the theoretical literature regarding the direction of the different fiscal components on growth. Recommendations for tax policy and government spending from the view of endogenous growth models do not lead to consensual conclusions. In general, the conclusion of the endogenous growth models is that the mechanisms through which the different components of taxes and spending influence growth are diverse, thereby implying that the question of composition of government spending and tax structure on growth remains an open question. For instance, some models support the idea that income taxes are detrimental for growth through the decline of the rate of capital accumulation (see, for instance, Lucas 1990), Easterly and Rebelo 1993). This leads to the policy recommendation that reducing taxes on capital income could lead to increases in growth. However, in some other models, a positive impact on long-run growth of changes in income tax is shown to exist when these taxes are used to finance public services (see Rivas 2003). Another example, government consumption spending has been shown to affect growth alternatively negatively or positively depending upon whether public goods and services enter the households' utility function or whether they enter as inputs in the production function (see Barro 1990, Turnovsky and Fisher 1995, Dhont and Heylen 2008). Myles (2000) provides a literature review of the diversity of theoretical models analyzing tax incidence and its influence on growth. The channels through which taxation can affect growth are many: the elasticity of substitution between capital and labor in production, households' preferences over consumption in different periods of life over the life-cycle, the relationship between capital and the non-taxable factors, the share of physical capital in human capital, the way in which taxes affect risky assets, the proportion of wealth invested in foreign assets, etc.

Given the great variety of theoretical models, the diversity of their predictions regarding the effects of fiscal variable changes on growth, it is unlikely that the same model would illustrate the case of all the EU countries. Further, the balance between the various items of taxes and expenditure vary in each country and across time depending upon the juncture and their priorities. Our aim here is not to test a particular theory. The above brief review of the theoretical literature is useful to shed some light on the fact that, given the wide range of predictions from the theoretical models, imposing a priori common parameters across countries would be restrictive and may result in non robust conclusions.

When the purpose is to test the fiscal policy/growth relationship from the view of the endogenous growth model, whichever the theoretical apparatus, the empirical relationship is very

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[7] See, among others, Zeng and Zhang (2002), Zagler and Durnecker (2003), Blankenau and Simpson (2004), Linneman and schabert (2003), Greiner *et al.* (2005), Agenor and Yilmaz (2011), Peretto (2003, 2007), Semmler *et al.* (2007), Gosh and Gregoriou (2008).

often a linear equation between the growth rate of GDP per capita and the different items of taxes and public spending, for given control variables describing the economic environment. We modify the standard equation by taking into account the distributional heterogeneity of fiscal policy effects on growth. The specific form employed in this paper is the following:

$$\gamma_{it}(\theta) = \sum_{j=1}^{J} \alpha_{1j}(\theta)\Delta\gamma_{it-j} + \sum_{k=1}^{K} \alpha_2(\theta)\Delta F_{it-k} + \sum_{l=1}^{L} \alpha_3(\theta)\Delta X_{it-l} + \upsilon_{it}(\theta) \quad (1)$$

where i indicates a country, t is year, γ is the growth rate of real GDP, F is a vector of fiscal variables, X is a vector of control variables, $\beta_1(\theta)$, $\beta_2(\theta)$, $\alpha_1(\theta)$, $\alpha_2(\theta)$ are vectors of coefficients to be estimated, $\alpha_{1j}(\theta)$, is a lagged coefficient and υ_{it} is an error term.

Equation (1) provides a useful way to deal with the issues discussed above and to confront the predictions of the theoretical models with the experience of the European countries by considering the percentiles of the conditional distribution of the growth rates. The θ^{th} percentile is assumed to vary between 0 and 100 per cent. The idea is to obtain the value of the estimate of the parameter vectors which best fits the impact of the fiscal variables at various points along the conditional distribution of growth. This approach permits a flexibility to capture heterogeneity. Indeed, since we are considering a pooled panel, the percentiles do not only refer to countries but also allow time variation and therefore possible non-monotonic effects of the components of taxes and expenditure on growth. Finally, finding different coefficients according to the percentiles is a way of showing that fiscal changes in the European countries may result in multiple equilibriums both in terms of transitional growth and long-run growth.

2.2 Deficit financing and growth

Given the importance of the government budget constraint in the theoretical models, the influence of a given component of public spending on growth depends on how an increase in this component is financed. A government considering new spending programs must decide on how to raise the necessary revenue. A financing of productive public spending by higher direct taxes will not necessarily results in a positive impact on long-run growth, because of the negative effect of the taxes on the returns of capital. Also, as far as we consider the structure of taxes and the composition of public spending, the final decision is the result of different trade-offs. For instance, cuts in labor income or capital tax might be compensated by increases in indirect taxes; or a government can search to balance an increase in productive expenditure by a decrease in non-productive expenditure. Another example is that any change in a given spending or tax can be decided by maintaining a continuously balance budget, by keeping a constant share of expenditure and taxes in GDP, or alternatively by allowing a higher or lower fiscal balance. Taxes and public policies are thus restricted by the budget constraint.

The implication is that, different financing methods have different effects on the economic growth. In his seminal papers, Harberger (1964a, 1964b) showed that the mix of direct and indirect taxes in a growth-accounting framework has a negligible effect on growth. Mendoza *et al.* (1997) show that this conjecture can be supported within the framework of an endogenous growth model. In standard endogenous growth models, expansionary fiscal spending stimulates economic growth provided that they are financed by lump-sum taxes or by non-distorsionary taxes (see, Devereux and Love 1995, Palivos and Yip 1995). This finding is, however, challenged by Pelloni and Waldman (2000). The authors find that a small amount of capital taxation can increase the growth rate. Barro (1990), Blankeneau and Simpson (2004) show that spending funded by distortionary taxes such as taxes on capital or labor income has a non-monotonic effects: increases in productive spending is growth-enhancing in the short-run, but growth-depressing in the long-run. There are conflicting views in the theoretical literature about the growth implications of a financing of public

spending by public debt. Some authors conclude that the effect is unambiguously positive (for instance Greiner and Semmler 2000). Others reject this finding (Minea and Villieu 2010).

As pointed by Easterly *et al.* (2007), irrespective of the theoretical framework, it is likely that the combination of fiscal variables needed to obtain a positive impact on growth vary across countries and across time depending on a number of structural factors: the initial level of debt, the composition of revenues and taxes, fiscal institutions, different public finance constraints, etc. Again, the issue of heterogeneity is at stake.

What this implies in our case is the following. The government budget constraint can be written by considering the various components of the vector of fiscal variable F as follows:

$$\sum_{n=1}^{N} rev_{it}^{\ n} - \sum_{m=1}^{M} \exp_{it}^{\ m} + b_{it} = 0, \quad i=1,..,I \text{ and } t=1,...,T \tag{2}$$

where *exp* means expenditure and *rev* stands for revenue. We consider M components of public spending and N components of fiscal taxes. b is the budget surplus. As shown in a paper by Bleany *et al.* (1995), not taking into account this constraint when examining the fiscal policy/growth link yields strong biases in growth equations. Further, since the different components of the fiscal vector are linked through the budget constraint, considering all them in equation (1) yield inefficient estimates due to co-linearity between the variables. Some of them must be omitted. The omitted variables are interpreted as the financing instruments. To show this, consider for instance that we separate the taxes into distorsionary (*DIST*) and lump-sum (*LUMP*) taxes and that spending are categorized as productive (*PROD*) and non productive (*NPROD*). Equation (2) can be rewritten as follows:

$$DIST_{it} + LUMP_{it} - PROD_{it} - NPROD_{it} + b_{it} = 0 \tag{3a}$$

Assume that the omitted variable is the distorsionary tax. Then (3a) implies that:

$$[(DIST_{it} = -(LUMP_{it} - PROD)]_{it} - NPROD_{it} + b_{it}) \tag{3b}$$

In the general case, we decompose the vector F into two sub-vectors vectors F_1 and F_2 containing respectively the omitted and non-omitted variables. The constraint (3b) implies that $F_1 = -F_2$. Equation (1) can thus be rewritten as follows:

$$\blacksquare(\gamma_1 it\ (\theta) = \Sigma_{\downarrow}(j=1)^{\uparrow} J \boxplus [\alpha_1 1\ (\theta)\Delta]\ \gamma_{\downarrow}(it-j) + \Sigma_1(k=1)^{\uparrow} K \boxplus [\{\alpha_1 22\ (\theta) - \alpha_1 21\ (\theta)\}_1\ [\Delta F]\ _{\downarrow}(2it-k) +] \quad @$$

$$\Sigma_{\downarrow}(l=1)^{\uparrow} L \boxplus [\alpha_1 3\ (\theta)\Delta]\ X_1(it-l) + v_1 t \tag{4}$$

Therefore, the coefficients of the fiscal variables are interpreted as follows. They indicate how changes in given fiscal variables, offset by changes in omitted fiscal variables, affect the economic growth. Equation (4) is retained as our benchmark equation for testing the fiscal policy/growth link.

3 The econometric methodology and data

3.1 Quantile regressions

Equation (4) can be rewritten in matrix form as follows:

$$Y_{it}(\theta) = X'_{it}\beta(\theta) + \upsilon_{it}(\theta), \qquad i = 1, \ldots, N \text{ and } t = 1, \ldots, T \tag{5}$$

where X is the vector of explanatory variables, $\beta(\theta)$ is the vector of coefficients and Y is the endogenous variable. We apply a double-quantile regression to equation (5).

Before turning to the estimation, some discussion about the methodology of quantile regression is warranted. The idea is to model the percentiles of the conditional distribution of the growth rate as functions of the explanatory variables. In a situation of heterogeneous responses of the endogenous variable to changes in the explanatory variables the standard linear estimators (OLS, GLS, GMM, etc.) are not suited. Indeed, those methodologies focus on the estimation of a conditional mean function and conditional dispersion of the endogenous variable around its mean. So doing, one assumes that the conditional mean summarizes the behavior of all the observations in the endogenous variables. This approach is good as far as we consider that the fluctuations of Y_{it} around its conditional mean are erratic or "accidental". However, when the reaction of the endogenous variables to its covariates are assumed to vary across the sample, the standard methodologies do not fully account of the diversity of reaction across the distribution of Y_{it}. In this case, we need alternative estimators.

In panel data methodologies, a now widely used approach consists in using estimators but that allow slope variations across individuals and/or time. In a recent paper, Gemmel *et al.* (2011) use Pesaran *et al.* (1999)'s pooled mean group (PMG) and mean group (MG) estimators to study the impact of fiscal policy on growth using a panel of 17 OECD countries from 1970 to 2004. Although these estimators are useful to account for different slopes across the countries of a panel, the cost of using them is a reduction of the degrees of freedom. Indeed, they are based on an average of the estimates from individual country regressions either for the short or for the long-run coefficients. Quantile estimators avoid this caveat since growth estimators conditional on fiscal policy variables, for given control variables, are obtained by considering the entire sample and by distinguishing the countries and the years according to their location in the conditional distributional of growth. Quantile estimator allows a greater flexibility by allowing all the parameters in a regression to vary across the distribution.

Let $F(y)$ be the probability distribution function of Y. The θ^{th} percentile of Y is defined as the smallest y satisfying $F(y) \geq \theta$. In a regression context, it can be shown that the finding of θ amounts to estimating β such that:

$$\hat{\beta}(\theta) = \arg\min\left\{\sum_{i=1}^{T} H(\theta, \upsilon_t)\right\}, \qquad H(\theta, \upsilon_t) = \theta\upsilon_t^{+} + (1-\theta)\upsilon_t^{-} \tag{6}$$

where v_t^+ is the vector of residuals with positive value and 0 otherwise, v_t^- is the vector of negative residuals and 0 otherwise. We thus have as many estimators of β as values of $\theta \in (0,1)$. Therefore, a quantile regression leads to estimate β by changing the "representative" individual. The latter can be the "mean" (as in OLS), the median ($\theta = 0.5$) or any other percentile.

Basset and Koenker (1978) derive the asymptotic normality results for the quantile regression and show that:

$$\sqrt{T}\left(\hat{\beta}_\theta - \beta_\theta\right) \approx N\left(0, \theta(1-\theta)s(\theta)^2 J^{-1}\right) \tag{7}$$

$$J = \lim_{T\to\infty}\left(X' X / T\right) \tag{8}$$

$$s(\theta) = 1/f(F^{-1}(\theta)) \tag{9}$$

While the estimation of β is quite simple and requires the use of simplex algorithms (see Koenker and d'Orey, 1987), the estimate of the standard error of the estimated parameters is more complicated since it requires the estimation of the unknown probability distribution function of the endogenous variable and its derivative. The latter are required in order to estimate the quantile

density function $s(\theta)$, also called sparsity function. Here, the coefficient covariance matrix is computed using bootstrap resampling and the sparsity function is estimated by using a kernel density estimator as proposed by Powell (1984) and Buschinsky (1994).

All the variables in the right-hand side of equation (4) are purged from reverse causality (endogeneity) by using the double-stage quantile regression proposed by Kim and Muller (2004). They show that the double-quantile estimator is consistent for finite samples.[8] In order to obtain efficient estimates, we however depart from these authors by bootstrapping the standard errors of our estimated coefficients at the second step. Indeed, we are working with the EU countries and our data are contaminated by country cross-correlation. In order to avoid problem of inefficient estimation, we prefer a direct method of estimating the covariance matrix of the estimates by employing a bootstrapping technique (residual bootstrap).

Possible effects running from growth to control and fiscal variables are taken into account in the first step by instrumenting as fully as possible for those variables. We use the logarithm of per capita GDP, the lags of the growth rates of per capita GDP, the difference between the long and short-term interest rate, the ratio of labor force to population as well as lags of the explanatory variables themselves. In addition, endogenous relationships are avoided by not considering the contemporaneous effects of the fiscal variables.

Finally, in each regression, unobserved heterogeneity is taken into account through country fixed effects.

3.2 Data

Our dataset cover 22 countries of the European Union from 2000 to 2010.[9] Our motivation for considering the recent ten years is the following. The current members of the EU are composed of three groups of countries regarding the date of adhesion. 15 were members before the 2000s, 10 countries entered the Union in the early 2000's (in 2004) and 2 in 2007. We consider as many countries as possible and not limit our attention to EU 15. With the exception of Romania and Bulgaria whose adhesion is very recent, we therefore consider the other countries. Luxembourg has a very high GDP therefore may appear as an "outlier". To avoid a strong influence on our results, we drop it from the panel. We also do not include Cyprus and Malta for problem of data availability. This leaves us with 22 countries. Regarding the choice of the time period, we restrict years from 2000 to 2010. We begin after the introduction of the euro, since after 1999, a new institutional framework for fiscal policy was set up (Stability Growth Pact, multilateral surveillance) intended to reinforce the coordination of national fiscal policies. For the countries which joined the EU in 2004, they also had to change the conduct of their fiscal policy at least 4 to 5 years before their adhesion (the Maastricht conditions were entry requirements). Therefore, our aim is to see whether, the adoption of a common fiscal framework makes taxation and expenditure measures become growth-enhancing or growth-reducing in a similar way across countries, or whether their impact on growth have still been different across countries.

In our pooled data, an individual observation describes a country and a year, which we call "an episode" of growth rate of real GDP. Our fiscal variables are taken from the functional

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[8] Other methodologies have been proposed in the literature to deal with endogeneity bias in quantile regressions. For instance, Chernozukov and Hansen (2006, 2008) have suggested an instrumental variable quantile regression estimator. However, the latter is computationally demanding when applied to our case since it is based on a grid search procedure on the coefficients of all the variables which are suspected to be endogenous. Their method is well suited to models where there are few endogenous variables among the explanatory variables of a regression.

[9] The countries are the following: Austria, Belgium, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, the Netherlands, Norway, Poland, Portugal, Slovenia, Spain, Slovak Republic, Sweden and the United Kingdom.

classification of public administration expenditure (COFOG) as set by the OECD and by considering the disaggregated taxes. This yields the fiscal categories described in Table 1. The set of endogenous and conditioning variables includes those described in Section 2.2. The GDP, the long-run and short-run interest rates, as well as the inflation and unemployment rates are from the OECD statistics. Private investment is measured by the gross capital formation of corporations and comes from the European Commission AMECO dataset. Data on labor markets were obtained from the OECD: employment, working-age population, population, hours worked per employee, labor force (the latter are used as instruments in our regressions).

All the variables in the regressions are in logarithm, except the budget surplus, the inflation rate and the interest rate term structure defined as the long-run minus the short-run interest rates. The fiscal variables are measured as share of GDP.

4 The results

4.1 The conditional distribution of growth episodes

We consider both measures of the growth rate: the simple growth rate of the real GDP and the growth rate of per capita GDP. The policy recommendations regarding the design of tax structure and composition of expenditure in the EU are usually made by considering the real GDP growth (not deflated by the population size). The second indicator, the growth rate of the real GDP per capita, is helpful for evaluating how economic growth feeds into welfare (a rough measure of income distribution).

In order to contrast the different growth episodes with each others, we first examined how the countries and years are shared across the main percentiles of the conditional distribution of the growth rate of the real GDP. In this view, we ran different regressions corresponding to different percentiles from the 10^{th} to 90^{th} percentiles (each percentile estimate is obtained using the pooled panel). Then, we examined the regressions for which the coefficients measuring the impact of the fiscal variables on growth were quite similar. We computed the fitted value of growth and consider that two fitted values belonged to the same group if they were obtained from regressions in which the coefficients of the fiscal variables were quite similar in magnitude. Again, we stress that this classification is made *after* running quantile regressions with the pooled data. In terms of the growth impact of changes in taxation and expenditure, we observed that the estimated coefficients of the explanatory variables were rather similar for four "subgroups" of percentiles as described in Table 2a.

At the left-hand side of the distribution, below the 40th percentile, the real GDP growth rate is less than or equal to 2.6 per cent. This corresponds to times of crisis. Indeed, the intervals up to the 40th percentiles contain the data for all the countries corresponding to the years 2008 and 2009. In addition, these intervals also include the growth episodes of the most ancient members of the EU corresponding to the years 2002, 2003 and 2010. The percentiles up to the 40th are therefore refereed as low growth episodes in times of crisis. At the higher end of the distribution, above the 70th percentile, the real GDP growth is driven by a catch-up dynamics. Indeed, the group of years and countries is made of the new member states between 2002 and 2007 (Central and Eastern Europe) and some former member countries belonging geographically to the periphery of Europe, for instance Ireland, Portugal, Spain in the earlier 2000's. Their growth rate is greater than 4.3 per cent per annum. There is a broad consensus in the literature that these countries' very fast growth was an illustration of a catch-up dynamics to the standard of living of the richest members of the EU from 2000 onwards. We therefore consider the percentiles above the 70th as illustrating transitional growth rate. Then we have medium growth episodes, between 2.6 and 3.3 per cent (from the 40th to the 50th percentile) and high growth not corresponding to transitional growth, between 3.3 and 4.3 per cent, (from the 50th to the 70th percentiles).

Table 1

Classification of Fiscal Variables

Theoretical Classification	Classification in the Data Source
Taxes	
Direct taxation	Direct taxes on business
	Direct taxes on households
Payroll taxes	Social security contributions received by governments
Indirect taxation	Taxes on production and imports
Other government revenues	General Government total receipts minus direct and indirect taxation
Expenditure	
Sovereign expenditure	Defence expenditure
	Security expenditure
	Economic affairs
	General public service expenditure
Human capital	Education expenditure
	Health expenditure
	Social security expenditure
	Recreation and culture
	Environment
Other expenditure	General government total disbursements minus productive and unproductive expenditure
Budget surplus	Government total revenues minus Government total disbursements

Table 2a

Classification of Countries According to the Results of Quantile Regressions
(real GDP growth)

Low-growth episodes: <2.6% [0^{th}-40^{th}]	All countries Most ancient members	Crisis episodes (2008-09) Years: 2002, 2003, 2010
Medium low growth episodes: 2.6%-3.3% Medium high growth episodes: 3.3%-4.3% [50^{th}-70^{th}]	Most ancient members Most ancient members New members	2000, 2001 and 2004 to 2007 2000, 2001 and 2004 to 2007 2000, 2001, 2010
High-growth episodes: >4.3% [70^{th}-100^{th}]	New member states Periphery	Period 2002 to 2007 (catch-up growth) Early 2000's

An interesting feature of the data is that the more industrialized members of the EU move in the distribution over different years (all the intervals of the different percentiles are "visited"), which is not the case of the Central and Eastern emerging countries. For the latter we indeed have few observations between the 40^{th} and 70^{th} percentiles, which could be explained by the fact that they are still converging to the other countries and therefore they experience a higher growth rate (catch-up dynamics).

Comparing the cases of two leading economies of the EU, France and Germany, we observe an unhooking of the former with regard to the latter from 2006 onwards. Indeed, from Table 2b, it is seen that France's growth rates systematically lies in lower percentile intervals.

For purpose of comparison, a classification was also done by considering the regressions with the growth rate of per capita GDP. The conditional distribution of per capita GDP growth led us to classify the growth episodes in three intervals. The first group was composed of countries and years for which the conditional growth rate is below 3.2 per cent (which correspond to the following interval of percentiles: [0^{th} – 40^{th}]), the second group for countries and years for which the growth rate lies between 3.2 and 5 per cent (the interval of percentiles is [40^{th} – 70^{th}]) and finally the third group consisted of countries and years characterized by a growth rate above 5 per cent in the interval [70^{th} – 100^{th}].

4.2 Tax and expenditure effects on real GDP growth across percentiles

Tables 3 till 5 report the estimation results of equation (4). The reported coefficients are cumulative sums over the two years following the initial changes in taxation and expenditure. We report the cumulative sum of the coefficients over the two years. This corresponds to the length of time usually required for changes in investment to fully affect growth in Europe. Further, we

assume that the implementation of fiscal policy requires a delay before impacting the economy and that short-run effect are completely dissipates after two years.

Table 2b

Classification of Growth Episodes Across Quantile Intervals for France and Germany
(real GDP growth)

France		Germany	
2000	70^{th}-80^{th}	2000	50^{th}-60^{th}
2001	30^{th}-40^{th}	2001	30^{th}-40^{th}
2002	20^{th}-30^{th}	2002	10^{th}-20^{th}
2003	40^{th}-50^{th}	2003	20^{th}-30^{th}
2004	40^{th}-50^{th}	2004	30^{th}-40^{th}
2005	30^{th}-40^{th}	2005	20^{th}-30^{th}
2006	50^{th}-60^{th}	2006	70^{th}-80^{th}
2007	40^{th}-50^{th}	2007	60^{th}-70^{th}
2008	10^{th}-20^{th}	2008	20^{th}-30^{th}
2009	0^{th}-10^{th}	2009	0^{th}-10^{th}
2010	20^{th}-30^{th}	2010	60^{th}-70^{th}

The different coefficients must be interpreted in light of our discussion in Section 2.2. In Table 3, first regression, the coefficients indicate the effect on growth of changes in the different variables (two years after the initial change) when these changes are accompanied by changes of similar amount in welfare expenditure. For instance the estimate –0.05 of direct taxation says that a 1 per cent increase in direct taxation, used to finance a 1 per cent increase in welfare expenditure, reduces growth by 0.05 per cent two years after the initial change in direct taxation. In Table 4, second regression, the coefficients measure the impact of changes in the variables on growth, when there are changes of equal amount in the budget surplus. For instance, the coefficient –0.09 of social security contributions says that a 1 per cent increase in social security spending, entirely reflected in the budget balance (which means that neither other spending, nor taxes are modified) reduces growth by 0.09 per cent, two years after the initial change. All the regressions in Tables 3 till 6 must be interpreted in a similar way.

We report the results of the regressions based on the 40^{th}, 50^{th}, 60^{th} and 70^{th} percentiles. The reader must keep in mind that for the different choices of percentiles, we do not split the data into different sub-samples. We use the whole pooled observations. The difference with the classical "mean-based" estimations is that, instead of the conditional mean, the representative observation to which the others are compared is the reported percentile.

Instead of commenting on all the estimated coefficients, we focus on the variables related to the ongoing debate in Europe on the fiscal tools that are viewed as growth-enhancing instruments: the improvement of competitiveness on the labor cost which may imply a reform of the social security systems, optimal taxation and in particular the trade-off between direct and indirect taxes, the rationalization of public expenditure by reducing unproductive public spending, fiscal devaluation.

Table 3

Growth Equation. Two-stage Quantile Regression with Bootstrapped Standard Errors

(t-ratios in parentheses)

Omitted Variable	Welfare Expenditure				Direct Taxation			
	0.4	0.5	0.6	0.7	0.4	0.5	0.6	0.7
Constant	–2.61*** *(–4.51)*	–2.87*** *(–5.04)*	–0.60*** *(–5.58)*	–0.45** *(–2.49)*	–4.74*** *(–4.70)*	–3.17*** *(–4.57)*	–2.96*** *(–5.61)*	–1.30*** *(–3.58)*
Business investment	0.04** *(2.34)*	0.04** *(2.13)*	–0.007 *(–0.26)*	0.07*** *(2.99)*	0.09*** *(4.94)*	0.005 *(0.185)*	–0.025 *(–0.84)*	0.008 *(0.39)*
Employment growth	–0.15 *(–1.51)*	0.14 *(1.51)*	0.04 *(0.55)*	0.003 *(0.03)*	–0.009 *(–0.108)*	–0.09 *(–0.97)*	0.03 *(0.39)*	0.004 *(0.053)*
Hum. capital expenditure	–0.02 *(–0.44)*	–0.04 *(–1.06)*	–0.003 *(–0.09)*	–0.148*** *(–4.60)*	–0.005 *(–0.54)*	–0.07 *(–0.73)*	–0.28*** *(–4.06)*	–0.32*** *(–3.41)*
Welfare expenditure	-	-	-	-	–0.02 *(–0.42)*	0.074 *(1.27)*	0.11* *(2.20)*	0.102 *(1.58)*
Sovereign expenditure	–0.08 *(–0.37)*	–0.004 *(–0.02)*	0.36* *(1.88)*	0.24 *(1.08)*	–0.04 *(–0.66)*	–0.001 *(–0.02)*	0.16** *(2.55)*	0.122*** *(2.10)*
Direct taxation	–0.05*** *(–3.20)*	–0.08*** *(–4.66)*	–0.27*** *(–6.16)*	–0.11 *(–1.50)*	-	-	-	-
Soc. Sec. contributions	0.22 *(1.08)*	–1.66*** *(–3.56)*	0.08 *(0.53)*	–0.04 *(–0.176)*	–0.69* *(–1.87)*	–1.51*** *(–4.16)*	0.05 *(0.28)*	0.06 *(0.21)*
Indirect taxation	–1.22*** *(–4.34)*	0.34 *(0.70)*	0.16 *(1.09)*	–0.11 *(–0.51)*	–1.59*** *(–4.84)*	0.297 *(1.17)*	–1.31*** *(–5.15)*	–0.45*** *(–2.33)*
Other taxes	–0.03 *(0.35)*	0.05 *(0.29)*	–0.19 *(–1.25)*	–0.46*** *(–2.64)*	–0.16 *(–0.96)*	0.04 *(0.18)*	–0.12 *(–0.70)*	–0.18 *(–0.96)*
Budget surplus	0.03 *(0.35)*	–0.01 *(–0.22)*	–0.20*** *(–3.73)*	–0.407*** *(–4.98)*	–0.03 *(–0.36)*	–0.19** *(–1.99)*	–0.19*** *(–2.92)*	–0.32*** *(–3.63)*
Pseudo R^2	0.62	0.61	0.66	0.56	0.63	0.58	0.65	0.58

Note: *, **, *** mean statistical significance at 10, 5 and 1 per cent respectively.

Table 4

Growth Equation. Two-stage Quantile Regression with Bootstrapped Standard Errors
(t-ratios in parentheses)

Omitted Variable	Indirect Taxes				Budget Surplus			
	0.4	0.5	0.6	0.7	0.4	0.5	0.6	0.7
Constant	–2.59*** *(–3.38)*	–3.90*** *(–5.00)*	–0.54*** *(–5.48)*	–0.75*** *(–4.94)*	–2.87*** *(–4.35)*	–3.85*** *(–5.43)*	–0.57*** *(–4.82)*	–1.00*** *(–6.29)*
Business investment	0.09*** *(4.94)*	0.05** *(2.29)*	–0.025 *(–0.842)*	0.008 *(0.39)*	0.08*** *(4.15)*	0.04 *(1.59)*	–0.004 *(–0.15)*	–0.02 *(–1.19)*
Employment growth	–0.009 *(–0.108)*	0.06 *(0.70)*	0.03 *(0.39)*	0.004 *(0.05)*	–0.02 *(–0.28)*	–0.009 *(–0.11)*	–0.003 *(–0.04)*	–0.06 *(–0.64)*
Hum. capital expenditure	0.22* *(1.91)*	0.38*** *(2.97)*	–0.001 *(–0.014)*	–0.38*** *(–4.56)*	0.27*** *(2.64)*	0.34*** *(3.25)*	–0.05 *(–0.58)*	–0.24*** *(–2.78)*
Welfare expenditure	–0.21*** *(–2.84)*	–0.24*** *(–3.39)*	–0.03 *(–0.51)*	0.13** *(2.05)*	–0.24*** *(–3.49)*	–0.21*** *(–3.62)*	–0.07 *(–0.83)*	–0.15* *(–1.86)*
Sovereign expenditure	–0.07 *(–1.29)*	–0.15* *(–1.81)*	0.05 *(0.84)*	0.15*** *(2.77)*	–0.07 *(–1.24)*	–0.11 *(–1.60)*	0.138** *(2.41)*	0.31*** *(6.09)*
Direct taxation	–0.09*** *(–4.84)*	–0.10*** *(–5.28)*	–0.26*** *(–5.15)*	–0.14** *(–2.33)*	–0.09*** *(–4.96)*	–0.09*** *(–5.03)*	–0.24*** *(–4.63)*	–0.19*** *(–3.53)*
Soc. Sec. contributions	–1.31*** *(–3.29)*	–2.06*** *(–4.88)*	0.05 *(0.28)*	–0.31 *(–1.36)*	–1.45*** *(–4.24)*	–2.01*** *(–5.25)*	0.51** *(2.03)*	0.63** *(2.28)*
Indirect taxation	-	-	-	-	0.14 *(0.60)*	0.17 *(0.74)*	0.33 *(1.52)*	1.05*** *(4.10)*
Other taxes	–0.165 *(–0.96)*	0.01 *(0.05)*	–0.12 *(–0.71)*	–0.06 *(–0.31)*	–0.02 *(–0.12)*	0.05 *(0.28)*	0.02 *(0.09)*	0.28 *(1.34)*
Budget surplus	–0.03 *(–0.36)*	–0.02 *(–0.21)*	–0.195*** *(–2.93)*	–0.32*** *(–3.63)*	-	-	-	-
Pseudo R^2	0.63	0.61	0.65	0.58	0.62	0.62	0.65	0.58

Note: *, **, *** mean statistical significance at 10, 5 and 1 per cent respectively.

Table 5

Growth Equation. Two-stage Quantile Regression with Bootstrapped Standard Errors
*(*t*-ratios in parentheses)*

Omitted Variable	**Sovereign Expenditure**			
	0.4	0.5	0.6	0.7
Constant	–3.37***	–3.05***	–0.76	–0.53***
	(–4.74)	*(–5.53)*	*(–1.60)*	*(–3.08)*
Business investment	0.05**	0.05**	–0.01	0.06***
	(2.54)	*(2.24)*	*(–0.43)*	*(3.01)*
Employment growth	–0.07	0.06	0.09	0.002
	(–0.76)	*(0.65)*	*(1.26)*	*(0.02)*
Hum. capital expenditure	0.10	–0.09	0.07	–0.15*
	(1.27)	*(–0.52)*	*(0.97)*	*(–1.80)*
Welfare expenditure	–0.134*	0.03	–0.06	0.03
	(–1.98)	*(0.24)*	*(–0.77)*	*(0.37)*
Sovereign expenditure	-	-	-	-
Direct taxation	–0.077***	–0.10***	–0.29*	–0.15**
	(–3.90)	*(–5.31)*	*(–1.74)*	*(–2.34)*
Soc. Sec. contributions	0.35	–1.97*	0.28	0.16
	(1.54)	*(–1.82)*	*(0.99)*	*(0.67)*
Indirect taxation	–1.59***	0.61	0.40*	–0.04
	(–4.51)	*(0.49)*	*(1.70)*	*(–0.17)*
Other taxes	0.12	0.01	–0.03	–0.55***
	(0.65)	*(0.05)*	*(–0.16)*	*(–2.81)*
Budget surplus	–0.03	–0.017	–0.18**	–0.32***
	(–0.40)	*(–0.21)*	*(–2.50)*	*(–3.65)*
Pseudo R^2	0.63	0.61	0.66	0.57

Note: *, **, *** mean statistical significance at 10, 5 and 1 per cent respectively.

4.2.1 Social security contributions

Social security contributions have the strongest influence among the different fiscal variables (greatest coefficients) but their effect on growth varies across percentiles. Their expected total effect is ambiguous. Indeed, on the one side, they have a negative impact on growth (due to higher labor costs). On the other side, they may have a positive impact due to second round demand effects (in Europe, higher income transfers are usually the counterpart of higher social security spending). From the tables, we see that augmenting social security taxes had the potential for reducing growth during medium low growth episodes. Indeed, we recall from Table 2a, that the 40th and 50th percentiles correspond to medium low growth episodes (growth rates between 2.6 and 3.3 per cent). In Tables 3 till 5 it is seen that we obtain a negative and statistically significant coefficient of social security contributions for these two percentiles. Therefore, in the European economies that have been growing moderately (with a real growth rate between 2.6 and 3.3 per cent), increases in social security contributions have been detrimental for growth. This

happened when the increases in social security contributions were not followed by any changes in public spending or taxes (we obtain negative coefficients in Table 4, when the budget surplus is the omitted variable), or when the governments decided to compensate the increase in social security contributions by lower direct or indirect taxes (see the negative coefficients in Table 3, when the omitted variable is direct taxation and in Table 4, when indirect taxation is omitted from the regressions).

In countries with a fast growth rate, we find that the total impact on growth of an increase in social security contribution has been positive (always for the 60th percentile and sometimes for the 70th percentile), though they are not found to be significantly related to growth, except when the omitted variable is the budget surplus (Table 4). Therefore, the estimates suggest that in the European emerging countries (whose growth episodes are located in the percentiles above the 60th), the negative growth effects of social security revenues are cancelled out by their positive demand effects.

Therefore, from these results, we can conjecture that a reduction in the employers and employees' contribution to social security would have no effect in the fast growing countries (Southern and Eastern European countries) , while they may be growth-enhancing in those countries experiencing a moderate growth (the industrialized countries). For instance, if the governments in Hungary, Poland, or Spain would like to raise growth by improving the competitiveness on labor costs and decide to reduce the social contribution revenues, this policy would be ineffective on growth. But, it would work in countries like Sweden, Germany or UK. One reason may be that in the latter countries social security contributions account for a high proportion of the total labor costs. Another reason is that in these countries, the supply effects of a reduction in social security contribution more than outweigh the negative demand effects (since the contribution finances unemployment benefits). In the eastern European countries social benefits are rather financed by taxes.

4.2.2 Direct and indirect taxation

We first consider the growth impact of a mix between direct and indirect taxation, looking at the respective coefficients of these variables in Tables 3 and 4 when the other variable is omitted from the regression. In Table 3, the coefficients corresponding to the line "indirect taxation" and columns 6 till 9 measure the impact on growth of a shift from indirect to direct taxation. In Table 4, the coefficients in the line labeled "direct taxation" and columns 1 till 4 indicate the impact on growth of a shift from direct to indirect taxation. Indirect taxes can be considered as taxes on consumption, while direct taxes are taxes on production (labor and capital revenues). It is seen that a shift from direct to indirect taxes (Table 4), that is a fall of the former followed by an increase in the latter, is growth-augmenting. Indeed the estimated coefficients are negative, thereby indicating that growth moves in the opposite direction of direct taxes. Table 3 yields a similar conclusion if one considers instead a shift from indirect to direct taxation (higher direct taxes substituted for lower indirect taxes). However, the impact of direct taxation in Table 4 is much smaller than the impact of indirect taxation in Table 3 (compare the coefficients for the different percentiles). This suggests that a reduction of direct taxes compensated by higher indirect taxes is more efficient for growth than a decrease in indirect taxes followed by an increase in direct taxes. One reason may be that direct taxation is more distortionary than indirect taxation.

Now, what happens if the governments rely on either one or the other form of taxation (when none of them is considered as an omitted variable)? Higher indirect taxes reduce growth mainly in times of crises or during low-growth episodes (in Tables 3,4,5, we find a statistically significant coefficient for the 40th percentile, while the coefficient is often non-significant for the other percentiles). Recall that, in Table 2a, the 40th percentile refers growth rates less than 2.6 per cent

and includes years of crisis. Higher direct taxes significantly reduce growth in all the countries. But the negative effect is stronger in the fastest growth countries (compare the coefficients in Tables 3 till 5 between the 40^{th}, 50^{th} percentiles and the 60^{th}, 70^{th} percentiles). Therefore, increases in direct taxation have been more detrimental for the economies which were experiencing a catching-up dynamics.

4.2.3 The impact of public spending

On the expenditure side, our results point to different effects of sovereign and welfare expenditure across the percentiles and the way in which they affect growth depends upon the financing variables in the government budget constraint. When an increase in welfare or sovereign expenditure is financed by an equivalent increase in taxes (direct or indirect), these expenditures boost growth in the countries that are growing fast (the coefficients for the 60^{th} and/or 70^{th} percentiles are positive and statistically significant in Tables 3 and 4), but they are be neutral or even detrimental in the countries with a low growth rate (we obtain negative coefficients for the 40^{th} and 50^{th} percentiles in Tables 3 and 4). The coefficients of welfare expenditure are statistically significant when higher welfare spending is financed by higher indirect taxes). The reported coefficients capture the influence on growth of recreation, culture, and environment spending, social security benefits, sovereign spending. Our results suggest the following interpretation. Although the literature usually classifies these spending as unproductive, they may have a demand effect on growth that cancel out the negative effects of the accompanying tax increases, specifically in the European emerging countries that experience a catch-up growth.

Table 5 also suggests that welfare expenditures have usually no significant impact on growth, if a trade-off is made with other spending items, for instance sovereign expenditure. Finally, if a government raises welfare expenditures and maintain the other spending and taxes at their current level, the increase results in a negative impact irrespective in all countries (in Table 4, when the omitted variable is budget surplus, the coefficients of welfare expenditure is negative for all the percentiles and statistically significant in most cases). In the same context (no changes in the structure of taxes and spending), sovereign expenditures appear to have significant positive effects on growth only in those countries growing fast (the estimated coefficient are statistically significant for the 60^{th} and 70^{th} percentiles).

The empirical evidence regarding the growth effect of human capital spending (health and education expenditure) is mixed. These expenditures, when their coefficient is statistically significant, contribute positively to economic growth in times of crisis or during low-growth episodes in the richest European countries (see the coefficients in Table 4 for 40^{th} and 50^{th} percentiles). However, any increase in this category of spending reduces growth during high-growth episodes (see the coefficients, in Tables 3 till 5, for the 60^{th} and 70^{th} percentile). The positive sign is intuitive, since such expenditure is expected to enhance labor productivity. The negative sign reflects the fact that, in the European emerging economies, educational and health expenditure seem to have been inefficient in generating a positive growth rate, which could be explained by a weaker linkage between public education and wealth outlays. As reported in the literature, there may be several causes of ineffective human capital spending, among which the inefficient role of institutions and governance in mediating the nexus between social spending indicators and growth. Incorporating institutions indicators as additional control variables in the model would be interesting in assessing the negative link. We let this for a further study.

An important policy consequence of our findings is that we would be unable to draw recommendations regarding the composition of public expenditure in the EU countries in connection with growth, without considering two groups of countries, namely the most ancient members and the recent members that are still in a catch-up growth process. For instance, the usual

suggestion of reducing welfare expenditure would be a good thing for growth efficiency in the industrialized countries, but would have doubtful effects on growth in the emerging countries. A reallocation of welfare expenditure to sovereign expenditure (which mean reducing the former while increasing the latter) would be a good thing in the low-growth European countries, but would certainly not be a mean of enhancing growth in the countries with a fast growth rate (as is seen in Table5, the coefficient of welfare expenditure, when sovereign expenditure is the omitted variable, carries a statistically negative sign only for the 40^{th} percentile).

4.2.4 Fiscal devaluation

The principle of a fiscal devaluation is to reduce social security contributions (essentially payroll tax) and to increase in VAT. Such a policy is expected to work through both a demand channel and a supply channel by inciting firms to reduce their prices more or less in proportion to the decrease in unit labor costs. Our results lead mixed conclusions. The estimations suggest that such a policy could lead to a sizeable positive effect on growth, but only in the countries that experience a low growth rate (the most industrialized countries of Europe, like France, the UK, Germany, Finland, etc). Conversely, the impact would be neutral for growth in the emerging high-growth countries (see Table 4, the coefficients in the regressions where indirect taxation are the omitted variable. They are negative and statistically significant for the 40^{th} and 50^{th} percentiles, but non-significant for the 60^{th} and 70^{th} percentiles). Therefore, a transfer of fiscal revenues from payroll taxes to indirect taxes can either drive growth downwards or boost it. In the most industrialized countries (a majority of which have their growth episodes located below the median), one may expect the shift in the tax schedule to result in a higher growth. One reason may be that, in the EU, when growth is low, the price channel (domestic goods are sold at a reduced price) plays more intensively than the tax channel on domestic demand (the elasticity of domestic demand with respect to relative prices may be higher than the elasticity with respect to indirect taxes). Conversely, a reason why a measure like a fiscal devaluation would be neutral in the emerging EU countries facing a fast growth rate may be that the fall consumption fall following the rise in indirect taxation outweigh its increase due to higher real wage.

4.3 Impact of fiscal policy on per capita growth rate under alternative financing hypotheses

We now test the robustness of the above results to different changes in the specification. First, we consider the growth rate of per capita GDP as has been done in previous papers. We are no longer reasoning from a growth efficiency point of view, but we want to see whether different fiscal policies can raise or jeopardize the growth rate of the standard of livings across years and countries. As said before, working with per capita growth rate means that we assume that a shift in GDP modifies the average income per individuals.

We further add one additional lag to the explanatory variables since the annual macroeconomic programs transmitted by the countries to the EU Commission are evaluated over a period of three years. We also consider an alternative classification of spending. As shown in Table 6, we now consider three groups of expenditure: social spending, economic and sovereign expenditure, and, other public expenditure. Direct taxation now incorporates a third component, namely other government revenues. These include for instance taxes on property transactions. Another difference with the preceding section is that, instead of omitting variables from our specifications one by one, we also consider the case where several fiscal variables are omitted. Finally, we add inflation and the initial growth rate of per capita GDP to the list of control variables.

Tables 7a and 7b report the results for the 25th, 50th and 75th quantiles. The reported coefficients are cumulative sums over the three years following the initial changes in taxation and expenditure. Regression (1) assumes that changes in taxes and expenditure are fully reflected by changes in the budget surplus. In regression (2), it is assumed that changes in taxation and public spending are not entirely reflected in budget deficit/surplus, because the government modifies the structure of spending by modifying social expenditure. Similar interpretations apply to regressions (3) till (5).

Table 6

An Alternative Classification of Fiscal Variables

Theoretical Classification	Classification in the Data Source
Direct taxation	Direct taxes on business Direct taxes on households Other direct taxes (total direct taxes minus direct taxation on business and households)
Indirect taxation	Taxes on production and imports
Other government revenues	General Government total receipts minus direct and indirect taxation
Economic and sovereign expenditure	Defense expenditure Security expenditure Education expenditure Health expenditure General public service expenditure Economic affairs expenditure
Social expenditure	Expenditure on recreation and culture Social security and welfare expenditure
Other expenditure	General government total disbursements minus productive and unproductive expenditure
Budget surplus	Government total revenues minus Government total disbursements

Table 7a

Growth Equation (per capita). Two-stage Quantile Regression with Bootstrapped Standard Errors
(t-ratios in parentheses)

Regression No.	**(1)**			**(2)**			**(3)**		
Omitted Variable	**Budget Surplus**			**Budget Surplus and Social Expenditure**			**Budget Surplus, Indirect Taxes and Social Expenditure**		
	0.25	0.50	0.75	0.75	0.50	0.75	0.25	0.50	0.75
Constant	0.17 *(1.51)*	0.02 *(0.18)*	0.27** *(2.39)*	–0.009 *(–0.09)*	–0.09 *(–0.94)*	–0.11 *(–1.29)*	0.11 *(1.29)*	–0.08 *(–1.00)*	0.10 *(1.32)*
Growth (–1)	0.12 *(1.07)*	0.35*** *(3.34)*	0.20* *(1.94)*	0.28** *(2.84)*	–0.05 *(–0.66)*	0.05 *(0.62)*	0.23** *(2.24)*	0.24** *(2.60)*	0.07 *(0.90)*
Inflation	–1.48*** *(–4.63)*	–1.87*** *(–6.84)*	–1.39*** *(–4.35)*	–1.14*** *(–3.93)*	–1.13*** *(–4.88)*	–1.09*** *(–4.12)*	–1.69*** *(–5.72)*	–0.80*** *(–3.11)*	–0.87*** *(–3.83)*
Business investment	0.74*** *(3.56)*	0.45** *(2.14)*	0.71*** *(3.43)*	0.44** *(2.17)*	0.37** *(2.11)*	0.33** *(2.02)*	0.92*** *(4.58)*	0.29 *(1.48)*	0.29* *(1.70)*
Employment growth	0.58** *(2.51)*	0.54** *(2.32)*	0.51** *(2.07)*	0.72*** *(2.82)*	0.70*** *(3.26)*	0.62*** *(2.89)*	0.43* *(1.73)*	0.69** *(2.94)*	0.68*** *(3.26)*
Direct taxation	–0.39 *(–0.85)*	–0.15 *(–0.32)*	–0.66 *(–1.55)*	–0.19 *(–0.43)*	–0.84** *(–2.27)*	–0.79** *(–2.18)*	–1.21*** *(–2.71)*	–0.42 *(–0.99)*	–0.99** *(–2.58)*
Indirect taxation	–1.05 *(–1.54)*	–0.52 *(–0.76)*	–1.46** *(–2.34)*	–0.77 *(–1.21)*	1.28* *(2.24)*	1.37** *(2.51)*	-	-	-
Other taxation	0.10 *(0.24)*	0.30 *(0.94)*	–0.05 *(–0.14)*	0.21 *(0.55)*	–0.19 *(–0.63)*	0.11 *(0.34)*	0.11 *(0.28)*	0.33 *(0.92)*	–0.30 *(–0.93)*
Economic and sovereign expenditure	0.07 *(0.28)*	0.52** *(2.11)*	–0.26 *(–1.07)*	0.43* *(1.91)*	0.32* *(1.88)*	0.51** *(2.68)*	–0.26 *(–1.11)*	0.45** *(2.09)*	0.28 *(1.49)*
Social expenditure	–0.65 *(–0.65)*	–0.77* *(–1.89)*	–0.67** *(–2.20)*	-	-	-	-	-	-
Budget surplus	-	-	-	-	-	-	-	-	-
Pseudo R^2	0.53	0.38	0.53	0.39	0.45	0.45	0.66	0.57	0.45

Note: *, **, *** mean statistical significance at 10, 5 and 1 per cent respectively.

Table 7b

Growth Equation (per capita)
Two-stage Quantile Regression with Bootstrapped Standard Errors
*(*t*-ratios in parentheses)*

Regression No.	**(4)**			**(5)**		
Omitted Variable	**Budget Surplus and Indirect Taxes**			**Indirect Taxes, Other Taxes and Social Expenditure**		
	0.25	0.50	0.75	0.25	0.50	0.75
Constant	0.10 *(1.12)*	–0.08 *(–0.97)*	0.09 *(1.13)*	0.02 *(0.31)*	–0.03 *(–0.42)*	0.11 *(1.47)*
Growth (–1)	0.04 *(0.39)*	0.22** *(2.37)*	0.06 *(0.65)*	–0.09 *(–0.82)*	0.07 *(0.72)*	–0.07 *(–0.69)*
Inflation	–1.60*** *(–5.18)*	–1.34*** *(–5.04)*	–1.25*** *(–5.26)*	–1.79*** *(–5.30)*	–0.74** *(–2.32)*	–1.44*** *(–5.81)*
Business investment	0.96*** *(4.93)*	0.37* *(1.83)*	0.36** *(2.00)*	1.09*** *(5.19)*	0.31 *(1.49)*	0.51** *(2.53)*
Employment growth	0.76*** *(3.18)*	0.79*** *(3.25)*	0.62** *(2.87)*	0.62** *(2.56)*	1.01*** *(4.79)*	0.39* *(1.80)*
Direct taxation	–0.97** *(–2.19)*	–0.39 *(–0.87)*	–0.88** *(–2.29)*	–0.84* *(–1.77)*	–0.54 *(–1.19)*	–1.12** *(–2.50)*
Indirect taxation	-	-	-	-	-	-
Other taxation	0.04 *(0.12)*	0.46 *(1.16)*	–0.34 *(–1.02)*	-	-	-
Economic and sovereign expenditure	0.18 *(0.64)*	0.68** *(2.62)*	0.63*** *(2.85)*	–0.14 *(–0.55)*	0.37 *(1.59)*	0.24 *(1.18)*
Social expenditure	–0.94** *(–2.45)*	–0.62 *(1.63)*	–0.60* *(–1.89)*	-	-	-
Budget surplus	-	-	-	–0.04 *(–0.18)*	–0.04 *(–0.21)*	0.36* *(1.69)*
Pseudo R^2	0.54	0.40	0.44	0.54	0.41	0.46

Note: *, **, *** mean statistical significance at 10, 5 and 1 per cent respectively.

We begin with a brief comment of the results obtained for the conditioning variables (the variables other than the fiscal variables). Their coefficients have the expected signs. Both the business investment ratio and the employment growth enter the regressions with a positive sign and they are mostly statistically significant, irrespective of the quantiles. This seems better than in our previous regression where the ratio of business investment to GDP was positive and statistically significant for the low-growth countries only and the growth rate of the employment rate was rarely significant across the different regressions. Inflation negatively affects per capita GDP growth, which is not a surprised given that price stability has been set up as a prerequisite for sustainable growth in the EU.

Higher direct taxation significantly reduces growth if a country is experiencing either a low-growth or a high-growth rate (in Regressions 3 till 5) while the effect is statistically insignificant for middle-growth countries. Therefore, an increase in direct taxation financed by an equivalent decrease in indirect taxes, social expenditure, or which results in a higher budget surplus, is growth-reducing when growth is below 1.14 or above 3 per cent (these are the average growth rates in the intervals of percentiles shown in Table 2c). In Tables 3 till 5, we see that the coefficients of direct taxations are statistically negatively significant for the 25^{th} and 75^{th} quantiles. When indirect taxation is excluded from the list of omitted variables (regressions 1 and 2), higher direct taxes are growth-reducing only for the high-growth countries (with a growth rate above 3 per cent).

The regressions also report that sometimes, higher indirect taxes can have a negative growth effect in the low-growth economies but a positive effect in the high-growth countries (Regression 2). A reduction of public deficit by higher indirect taxes, or the financing of additional social spending by a higher indirect taxation has several theoretical effects. In principle, deficits and indirect taxes imply a shift in growth in opposite directions. The effect of the former is either positive or negative depending upon whether one observes strong or weak Keynesian multipliers (this depends upon crowding out effects, Barro-Ricardo effects, etc). Indirect taxes are expected to be growth-reducing. The total impact is thus either positive or negative depending upon the effects which is predominant. If we look at Regression 2, it seems that the taxation effect is larger in low-growth countries, while the negative effects of higher budget surpluses dominates in high-growth economies. Therefore, an indirect taxation used to finance social expenditure has the benefit of shifting growth upward if an economy evolves on its transition growth path to its long-run per capita GDP level. Otherwise, once the transition phase is achieved, indirect taxation is likely to result in a lower growth. This finding can be explained by our previous observation that social spending are growth-enhancing in the European emerging countries, but growth-reducing in the industrialized countries (see Section 4.2.4).

Interestingly, the results report a positive effect on growth of economic and sovereign expenditure in high-growth countries, while they are neutral for the group of low-growth countries. Indeed in Regressions 1, 2 and 4, we obtain statistically significant positive coefficients for the median and the 75^{th} quantile only. Economic and sovereign expenditure are therefore beneficial for per capita growth above 3 per cent, when the initial composition of taxes and spending remains unchanged (Regression 1), when their increase is substituted for social expenditure (Regression 2), or even if they are partially financed by higher indirect taxation (Regression 4).

Finally, we can see that social expenditure, when included in the list of explanatory variables, has a negative effect on growth irrespective of the quantile (Regression 4). This contrasts with our findings in the preceding section, since we saw that such spending had strong demand effects in the fast-growth countries.

5 Conclusion

Can we apply common fiscal policies in Europe to boost growth in Europe? The answer seems to be negative.

While using taxes and public spending to foster growth, the EU governments also use their fiscal policy to keep their finance sustainable. Our results cast some doubts on a widespread idea in the policy circles according to which a higher growth rate in the EU could be achieved with the same fiscal mix in all member countries. Against this view, the quantile estimates strongly illustrate heterogeneous reactions across the EU economies.

In light of our findings, we favor the idea of distinguishing among the ancient member countries and the recent emerging countries which adhered to the EU in the early 2000's. On the differences discussed in this paper, social security spending, direct taxation, welfare and sovereign expenditure and human capital expenditure have strikingly different effects on the growth rate of the real GDPs. Increases in human capital spending are growth-enhancing in the industrialized EU countries, while welfare and sovereign expenditure play a more important role in fostering growth in the emerging economies. Direct taxation exerts a much more detrimental impact in the countries that are growing rapidly than in those that experiment a slow growth. When the growth rate is considered in per capita terms, indirect taxes appear to exert an asymmetric effect on the EU economies: they are harmful in the low-growth countries, but not inconsistent with a stronger growth dynamics in the economies that grow rapidly. Direct taxation is growth-enhancing if an economy has either a slow or fast growth rate. Direct taxes are neutral at moderate growth rates.

One implication of the above results is that, in analyzing the fiscal policies which could act friendly to growth in the EU, using average fiscal multipliers could be of very little use. One needs to consider the different growth impacts in times of crises and normal times and to acknowledge the different ways in which the same policies can affect the growth rates in different countries. This rules out the use of a single fiscal/growth model for the EU economies.

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