# FISCAL POLICY AND ECONOMIC GROWTH:

# EMPIRICAL EVIDENCE FROM EU COUNTRIES

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Abstract: This paper decomposes public spending and revenues into various sub-categories and estimates the impact of each of them on economic growth. The results provide some support for theoretical models of endogenous growth. Specifically, the main findings are: a) public expenditures on infrastructure (economic affairs and general public services) exert a positive impact on growth; b) government outlays on property rights protection (defense, public order-safety) have a positive effect on per capita growth; c) distortionary taxation depresses growth; d) government expenditures on human capital enhancing activities (education, health, housing-community amenities, environment protection, recreation-culture-religion) and social protection do not have a significant effect on per capita growth. These findings are robust to changes in specification and estimation methodology.

**Keywords**: Panel Data. Fiscal Policy. Taxation. Government Expenditures.

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## 1. INTRODUCTION

Endogenous growth models are widely used in macroeconomics mainly because they are consistent with the fact that the growth rate of output, the capital-output ratio, the real interest rate etc. are constant over time (see Kongsamut et al., 2001). This literature also stresses the role of economic policy in the long-run growth process. Different authors have focused on different types of policy as engines of balanced growth (see Section 2 for details).

Much empirical work has been done to test the predictions of theoretical models, but the results differ greatly between various studies. Levine-Renelt (1992) have emphasized the sensitivity of the findings to changes in the set of control variables. The same point was made by Agell et al. (1997) using data for 23 OECD countries for 1970-1990. A problem with most studies is that they do not test the effects of fiscal policy taking into account the structure of both taxation and expenditure, i.e. they focus on the one side of government activity ignoring, at least partially, the other. A notable exception is Kneller-Bleaney-Gemmell (1999, 2001) (KBG from now on), who showed that any study, which does not take into account both sides of the budget, suffers from substantial biases of the coefficient estimates.

In this paper, we contribute to the literature in various ways. First, we include a richer menu of policy effects and sub-categories of spending-taxes than most previous studies as potential determinants of growth. Second, regarding the misspecification of the growth equation related to the government budget constraint, we conduct our estimations from a general to specific specification by omitting variables with statistically insignificant growth effects. Third, we test for lagged effects on growth of variables for which theory and intuition would suggest so and allow the data to determine the appropriate number of lags in static and dynamic panel data models. In this context, we employ different lag structures as a check of robustness of our results. Fourth, we employ alternative estimation methods appropriate for panel data of satisfactory quality, as a check of robustness of our results. In this framework, we apply GMM estimation techniques, not simply IV estimation used in most of the literature, to deal with potential endogeneity problems.

So, we find that some types of government expenditures and taxation matter for growth. Specifically, public expenditures on infrastructure (economic affairs and general public services) exert a positive impact on growth. Moreover, government outlays on property rights protection (defense, public order-safety) have a positive effect on per capita growth. Also, distortionary taxation depresses growth. Finally, government expenditures on human capital enhancing activities (education, health, housing-community amenities, environment protection, recreation-culture-religion) and social protection do not have a significant effect on per capita growth.

The rest of the paper proceeds as follows. Section 2 outlines the basic implications of the endogenous growth models for fiscal policy and of the government budget constraint for empirical testing. Section 3 summarizes the existing empirical work on fiscal policy and growth. Section 4 presents our data and econometric methodology, while section 5 comments on our results. Section 6 concludes the paper.

## 2. PREDICTIONS OF GROWTH MODELS WITH FISCAL POLICY

Neoclassical growth models imply that government policy can affect only the output level but not the growth rate (Judd, 1985). However, endogenous growth models incorporate channels through which fiscal policy can affect long-run growth (Barro 1990, Barro-Sala-i-Martin 1992, 2004).

The latter models classify generally the fiscal policy instruments into: a) distortionary taxation, which weakens the incentives to invest in physical/human capital, hence reducing growth; b) non-distortionary taxation which does not affect the above incentives, therefore growth, due to the nature of the utility function assumed for the private agents; c) productive expenditures that influence the marginal product of private capital, henceforth boost growth; d) unproductive expenditures that do not affect the private marginal product of capital, consequently growth.

The endogenous growth models predict that an increase in productive spending financed by non-distortionary taxes will increase growth, whilst the effect is ambiguous if distortionary taxation is used. In the latter case, there is a growth-maximizing level of productive expenditure, which may or may not be Pareto efficient (Irmen-Kuehnel, 2008). Also, an increase in non-productive spending financed by non-distortionary taxes will be neutral for growth, while if distortionary taxes are used the impact on growth will be negative.

Various extensions of the basic endogenous growth models have been worked out, allowing publicly-provided goods to be productive in stock and/or flow form (e.g. Futagami-Morita-Sibata, 1993, Cashin 1995, Turnovsky 1997a, Tsoukis-Miller, 2003, Ghosh-Roy, 2004), different forms of expenditure to be productive (e.g. Devarajan et al. 1996, Sala-i-Martin 1997, Glomm-Ravikumar 1997, Kaganovich-Zilcha 1999, Zagler-Durnecker, 2003, Gomez, 2007), various forms of taxation (Ortigueira, 1998) and asymmetric equilibria ex-post (e.g. Glomm-Ravikumar 1992, Chang 1998). Also, there is research on models with adjustment costs (Hayashi, 1982, Turnovsky, 1996a), congestion effects (Glomm-Ravikumar, 1994, Eicher-Turnovsky, 2000, Ott-Turnovsky, 2006, Ott-Soretz, 2007), utility-enhancing public consumption (Cazzavillan, 1996, Turnovsky, 1996c) and endogenous labour supply (Turnovsky, 2000a, Raurich, 2003). Finally, work has been done on small open economies (Turnovsky, 1999a), public capital maintenance (Rioja, 2003, Kalaitzidakis-Kalyvitis, 2004), stochastic environments (Turnovsky, 1999c), increasing social returns (Abe, 1995, Zhang, 2000) and non-scale growth (Eicher-Turnovsky, 2000, Pintea-Turnovky, 2006).

Turning to the specification issue mentioned in the introduction of the paper, we refer shortly to the analysis by KBG (1999)[1]. They basically concluded that the equation being estimated typically by the researchers who investigate the effect of fiscal policy on growth takes the form $G_{it} = a + \sum_{i=1}^{k} b_i E_{it} + \sum_{j=1}^{l-1} \left(c_j - c_l\right) F_{jt} + u_{it}$ (1)

In (1), $G_{it}$ is the growth rate of country $i$ at time $t$, which is a function of non-fiscal variables, $E_{it}$ , and fiscal variables, $F_{jt}$. Additionally, $a$ and $b_i$ represent the constant term and the slope coefficient of the non-fiscal variable $i$ (there are $k$ such variables) respectively. Also, $c_j$ is the coefficient of the growth impact of the variable $F_{jt}$, one of $l-1$ fiscal variables, and $c_l$ measures the effect on growth of the $lth$ fiscal variable, which finances the change in one of the $l-1$ fiscal policy instruments.

From equation (1), we see that the hypothesis test of zero coefficients for $F_{jt}$ usually conducted in empirical studies, tests the hypothesis that $c_j - c_l = 0$, and not $c_j = 0$, as implicitly assumed. So, we actually estimate the impact of a change in one

[1] For details see pp. 174-175 of their paper.

fiscal variable when there is an offsetting change in the omitted $lth$ fiscal variable, which implicitly finances the variation in the variable of interest. If the omitted category is modified, the coefficient of $F_{jt}$ will be different. This implies that the researcher has either to omit a fiscal instrument with negligible effect on growth, i.e. one for which $c_l = 0$, or to omit two fiscal variables for which the hypothesis that $c_j = c_l$ can not be rejected. So, it is necessary to test down from the full-fledged specification to less complete specifications omitting only variables with negligible growth effects.

## 3. EMPIRICAL LITERATURE REVIEW

Many studies of the relationship between fiscal policy and growth were conducted before the relevant endogenous growth models were developed, i.e. from the early 1980s. For example, Landau (1983) using cross-sectional data from 104 countries found a negative relation between public consumption as share of GDP and growth per capita using Summers-Heston data, while Kormendi-Meguire (1985) using cross-section/time-series data for 47 countries found no statistically significant relation of the same variables for the post-World War II period. Barro (1989), with data from 98 countries in the post-World War II period, found that government consumption decreases per capita growth, while public investment does not affect growth. Levine-Renelt (1992) found that most results from earlier studies on the relationship between long-run growth and fiscal policy indicators are fragile to small changes in the conditioning set.

In the next generation of studies, Easterly-Rebello (1993) (ER from now on) used cross-section data for 100 countries for 1970-1988 and panel data for 28 countries for 1870-1988. They found that public transportation, communication and educational investment are positively correlated with growth per capita and aggregate public investment is negatively correlated with growth per capita, although they admitted that many fiscal policy variables are highly correlated with initial income levels and fiscal variables are potentially endogenous. Cashin (1995) estimated a positive relationship between government transfers, public investment and growth and a negative one between distortionary taxes and growth from panel data for 23 developed countries between 1971 and 1988. Devarajan et al (1996) showed that public current expenditures increase growth, whilst government capital spending decreases growth in 43 developing countries over 1970-1990. Kneller et al. (1999, 2001) showed that the biases related to the incomplete specification of the government budget constraint present in previous studies (see section 2 above) are significant and after taking them into account, they found for a panel of 22 OECD countries for 1970-1995 that: (1) distortionary taxation hampers growth, while non-distortionary taxes do not; (2) productive government expenditure increases growth, while non-productive expenditure does not; (3) long-run effects of fiscal policy are not fully captured by five-year averages commonly used in empirical studies. Poot (2000) in a survey of published articles in 1983-1998 did not find conclusive evidence for the relationship between government consumption and growth, while he found empirical support for the negative effect of taxes on growth. Also, he reported a positive link between growth and education spending, while the evidence on the negative growth impact of defense spending is moderately strong. Finally, Poot presented evidence of a robust positive association of infrastructure spending and growth. Easterly (2005) found a significant growth effect of budget balance, which disappeared when extreme observations were excluded from the analysis.

It therefore seems that there is widespread non-robustness of coefficient signs and statistical significance even within similar specifications for similar variables. There are some possible explanations for these differences. The most important, in our opinion, is the absence of a generally accepted theoretical framework to guide the empirical research (Galor, 2005). This framework would pin down the most important determinants of growth, being fiscal policy variables or not. If such a framework were available, we could test the statistical significance of the postulated fiscal and non-fiscal determinants of growth and avoid the omitted variable bias that empirical results possibly suffer. Another issue is the inappropriate classification of some expenditure types as productive/unproductive, a question over which there is some debate in theoretical literature (KBG, 1999). Another problem of most empirical studies of growth and fiscal policy concerns the misspecification of the growth equation in relation to the government budget constraint (for details refer to Section 2 of the paper).

In addition, existing empirical studies on fiscal policy and growth differ in terms of countries included in the sample, period/method of estimation and measures of public sector activity. Data quality is also a problem since, for example, various countries have different conventions for the measurement of public sector size and there are limited data at the required level of disaggregation, implying measurement errors. Also, the dynamic effects of fiscal policy are either ignored completely or not modeled carefully in existing empirical work, i.e. not sufficient attention is paid on distinguishing the transitional from the long-run effects of fiscal policy. Moreover, even if there is correlation between explanatory variables and the rate of growth, the direction of causation is not clear (Wagner's law). Besides these, there might be correlation of fiscal variables with initial GDP (Easterly-Rebello, 1993). Furthermore, the linear structure imposed on most empirical models is convenient but not necessarily realistic and consistent with the underlying theory (Liu-Stengos, 1999, Kalaitzidakis, 2001). In addition, examination of the sample searching for outliers as well as testing for parameter heterogeneity is not conducted in most studies. Other potential problems include serial correlation in the error terms.

In our work, we take some of the above problems into account and refine existing research, disaggregating government spending and revenue, searching for evidence that is robust to changes in specification and estimation method.

## 4. DATA AND ECONOMETRIC METHODOLOGY

As mentioned in Section 2, endogenous growth models assume a classification of fiscal instruments into four types, i.e. productive/unproductive expenditures and distortionary/non-distortionary taxation. However, regarding government spending, the theoretical literature is not very clear about the classification of the various functional categories, so we simply mention them leaving the estimation results to determine whether these categories are productive or unproductive. As a result, we aggregate the various types of revenues using the functional classification of the EU into these categories (Table 1).

Table 1. Theoretical/Functional classification of fiscal policy instruments

| Theoretical classification | Functional classification |
|---|---|
| Distortionary taxation | Current taxes on income, wealth |
| | Capital taxes |
| | Actual social contributions |
| Non-distortionary taxation | Taxes on production and imports |
| Productive/unproductive government expenditures | Expenditure on education |
| | Expenditure on health |
| | Expenditure on housing-community amenities |
| | Expenditure on environment protection |
| | Expenditure on social protection |
| | Expenditure on economic affairs |
| | Expenditure on general public services |
| | Expenditure on public order-safety |
| | Expenditure on defense |
| | Expenditure on recreation-culture-religion |

Note: functional classifications refer to the classifications given in the data sources.

We use an unbalanced panel data set covering 14 EU countries. The number of countries was limited by the requirement of at least 10 observations per country imposed by us, so that we can study long-run growth. The observations are annual, cover the period 1990-2006 and are obtained from Eurostat[2].

Table A1 displays the basic descriptive statistics for the variables used in the estimations (for variables' definitions see A1 in Appendix). We see that per capita income of the countries in our sample grew at about 2.2% per annum. Public spending on education (*GEDY*) and health (*GHEAY*) was about the same, approximately 5.5% and 5.8% of GDP respectively. Government expenditures on housing-community amenities (*GHOCOY*) and environment protection *(GENPRY)* were equal to 0.9% and 0.6% respectively, while spending on recreation-culture-religion *(GRRY)* was 1%. Social spending (*GSPROY*) was the largest component of public spending with about 18.4%,

[2] The classification of public expenditure changed in 2001 and there are no data before 1990.

while expenditure on economic affairs (*GEAFY*) was around 4.6% of GDP. Besides these, government spending on public-order safety (*GPUBSY*) and defense (*GDEFY*) amounted to 1.5% and 1.7% of GDP respectively. These expenditures were financed mainly by taxes on income and wealth (*TIWY*), taxes on production and imports (*TPRIMY*) and social security contributions (*ACSY*), which amounted to 14.7%, 13.7% and 11.9% of GDP respectively. Capital taxes (*CAPTY*) accounted for only 0.2% of GDP. The budgets (*DEDPY*) were on deficit of 2%. Here, we should note that for most variables there is large variation across countries and time, as is evident from the last three columns of Table A1. For example, growth ranges from –7% to 13.3%, spending on education was as low as 2.5% and as high as 8.2% of GDP and health expenditures are between 0.9% and 7.7%. Also, social spending ranges from 7.8% to 28.4% of GDP. Furthermore, taxes on income and wealth are from 6.4% to 31.2% and we observe deficit equal to 9.5% and surplus of 6.9% of GDP.

As far as the non-fiscal variables are concerned, the percentage of the population aged 20-24 with at least upper secondary education (*UPSEC*) was 73.9%, while the percentage of active population who has completed tertiary education and is employed in S&T occupations (*HRSTCOR*) was 15%. Employment growth (*EMPGR*) was 1% per year, private investment (*PRIY*) was around 17.5% of GDP, exports (*XY*) and imports (*MY*) accounted for 48.6% and 45.1%, respectively. In all cases there is large variation in the values of the variables in both the time and country dimensions.

Turning to the specification of our econometric model, we want to test the predictions of endogenous growth models about the relationship of the structure of public spending/taxation and economic growth. So, we proceed in the spirit of KBG (1999, 2001), but refine their work in several ways. First, in the equation to be estimated, we include all the elements of the government budget constraint and decompose government expenditures and revenues. Specifically, we classify the various categories of expenditures and revenues into groups in order to reduce the number of explanatory variables and increase the efficiency of our estimates, since we do not have a very large number of observations. So, we incorporate public spending on education, health, housing-community amenities, environment protection and recreation-culture-religion in the variable *GHY*, which includes the types of expenditures that enhance human capital accumulation. The new variable represents 14% of GDP on average, but ranges from

4.8% to 18.3%. Furthermore, we construct the variable *GINFY,* which comprises public spending on economic affairs and general public services that improve infrastructure, since they concern among others transportation, communication etc. These expenditures correspond to 13% of GDP being between 7% and 25.1%. Also, we define *GPRY* to be government expenditure on property rights protection, because it includes outlays on defense and public order-safety. These types of spending absorb 3.2% of GDP on average ranging from 1.2% to 6.5%. We leave spending on social protection (*GSPROY*) as a separate category and include budget balance (*DEDPY*) as an additional variable. Furthermore, we create *DTY* for distortionary taxation, which contains taxes on income-wealth, capital taxes and social security contributions. These taxes are 26.8% of GDP on average, but vary from 16% to 35.8%. We assume that non-distortionary taxes are the implicit financing elements of a change in the rest of the fiscal variables, therefore we omit them from the regressions.[3]

Regarding non-fiscal variables, we incorporate initial GDP per capita *(Y0)* and lagged per capita growth to isolate possible convergence effects. We also include investment as a proportion of GDP (*PRIY)* and employment growth (*EMPGR)* in our equation, since capital and labour are the main factors of production in growth models. Besides that, *EMPGR* controls for business cycle effects on growth. Futhermore, we incorporate the percentage of the population aged 20 to 24 having completed at least upper secondary education (*UPSEC)* and alternatively, persons who have completed tertiary education and are employed in S&T occupations as percentage of active population (*HRSTCOR).* These variables were included in order to take into account the growth effects of human capital in our economies. Finally, we use the sum of imports and exports as a proportion of GDP (*OPEN)*, accounting for external effects on the economies, which equals on average 93.7% of GDP.

Finally, since empirical evidence suggests that there are lagged effects of fiscal policy on growth, in order to distinguish the effects of policy during transition from those on the steady state, we use sums of contemporaneous and lagged values of the relevant variables in our models.

[3] Additionally, we included in our model public debt as a percentage of GDP to examine potential effects of the level of indebtness on growth. However, it was not found statistically significant, so the respective estimations are not presented in the paper, but are available upon request.

As a result, we estimate the following model:

$$YG = a_0 + a_1 C + a_2 \sum_{b=0}^{c} GHY(-b) + a_3 \sum_{b=0}^{c} GINFY(-b) + a_4 \sum_{b=0}^{c} GPRY(-b) + a_5 \sum_{b=0}^{c} GSPROY(-b) +$$
$$+ a_6 \sum_{b=0}^{c} DTY(-b) + a_7 \sum_{b=0}^{c} DEDPY(-b) + a_8 \sum_{b=0}^{c} H(-e) + a_9 \sum_{b=0}^{c} EMPGR(-b) + a_{10} PRIY +$$
$$+ a_{11} OPEN \quad (2)$$

[4]

Regarding estimation methodology, empirical panel data studies on growth are usually carried out for periods of around 30 years, with five-year averaged observations to isolate business cycle influences on growth. However, first, this implies loss of information and second, the lack of synchronicity in country business cycles does not purge five-year averages from cyclical effects (Bassanini, et al, 2001). Hence, we use annual observations.

Also, we apply OLS and panel econometric techniques.[5] OLS assume that the error in each time period is uncorrelated with the explanatory variables in the same period. Panel data analysis offers several advantages over time series and cross-section techniques. It allows for more efficient parameter estimates,[6] uncovers dynamic relations[7] and identifies otherwise unidentified models.[8]

So, we initially estimate our models by OLS and select the appropriate model specification using the Akaike Information and Schwartz Bayesian Information Criteria as selection criteria.[9] However, a primary motivation for using panel data is to solve the problem of omitted variables, which are effectively part of the error term and cause bias in the coefficient estimates. In light of that, we assume that there is a time-constant unobserved effect, which may represent country-specific technology, tastes, historical and cultural factors and proceed with fixed effects estimation.[10]

However, although the main premise informing the present work is the effect of

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[4] C stands for the variables representing convergence, which correspond to initial income per capita and lagged per capita growth, while *H* represents *UPSEC* and *HRSTCOR* depending on the specification.

[5] We do not conduct explicit econometric testing of the cross-equation overidentifying restrictions implied by any particular model. Also, we do not work in the RBC tradition in order to reproduce the main moments of the data.

[6] See Hsiao, Mountain & Ho-Illman, 1995.

[7] See Pakes & Griliches, 1984.

[8] See Biorn, 1992; Griliches & Hausman, 1986.

[9] It is hard to derive adequate selection criteria for the conditioning variables, see e.g. Bellettini et al, 2000.

[10] Depending on the assumption about the correlation between the unobserved effect and the explanatory variables, two different estimation methods can be followed: either the random or the fixed effect one. The

fiscal variables on GDP per capita growth, the association does not mean that causality runs exclusively in one direction. If this is not taken into consideration, biased and inconsistent estimates will be obtained. To account for this problem, we employ a GMM estimator developed by Arellano and Bond (1991).[11] This requires first differencing and lags of the dependent and explanatory variables as instruments (Caselli et al., 1996). First differencing removes country-specific effects, which are a potential source of omitted variable bias and deals with series non-stationarity.

In addition, we apply the enhanced Arellano and Bover (1995) - Blundell and Bond (1998) estimator. Blundell-Bond (1998) showed that the lagged level instruments in the Arellano-Bond (1991) estimator become weak as the autoregressive process becomes too persistent or the ratio of the variance of the panel-effects to the variance of the idiosyncratic error becomes too large. So, building on Arellano-Bover (1995), Blundell-Bond (1998) proposed a system GMM estimator that uses moment conditions in which lagged differences are used as instruments for the level equation, in addition to the moment conditions of lagged levels as instruments for the differenced equation. This estimator produces more accurate and efficient estimates compared with the Arellano-Bond (1991) estimator. As a result, we are more confident about the two GMM estimators compared with FE/OLS estimators and emphasize the former. At the same time, if the findings are similar, this is a signal of robustness.

## 5. EMPIRICAL RESULTS

We try models with up to three lags to account for the cumulative impact of our model's variables on growth, in order to maintain a sufficient number of observations, which is necessary to derive reliable conclusions. As mentioned before, we assume that non-distortionary taxes are the implicit financing elements of changes in the other fiscal variables, so we omit them from the regressions.

The preferred models according to the information criteria are those involving mostly three lags. The relatively large number of right hand-side variables and lags imply that the number of countries involved in the estimations is fourteen (see the Appendix for

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Hausman (1978) specification test is employed in order to examine the significance of the above correlation and shows that the Fixed Effects (FE) estimator is appropriate.

[11] For further details see Bond (2002) and Baltagi (2002).

a list of countries). We report the estimation results for the preferred static and dynamic panel models in Table A3 using the four estimators analyzed in the previous section. The coefficients reported are those of the summation operators in (2).

*Public expenditures on human capital*

We begin the discussion with policies, which affect human capital accumulation, i.e. the quantity and quality of human capital, by noting that government spending on human capital enhancing activities (*GHY*) does not seem to affect growth in a statistically significant way. This apparently surprising result may be due to various factors. First, the variable used here is the sum of public spending on education, health, housing-community amenities, environment protection and recreation-culture-religion, since we do not have enough observations so as to include each of these elements separately in the equations estimated. So, if some elements have a significant growth effect and others do not, the aggregate effect we estimate may be insignificant.

Another possibility is that the effects of public expenditure on human capital are non-linear, e.g. quadratic, in which case it may be that actual public spending is close to the growth-maximizing level (Capolupo, 2000). If this is true, the effect of a change in spending on growth will be insignificant. As we do not have enough observations, we can not examine if this is the case, by e.g. including quadratic terms in the regressions (Benos, 2005, Karras 1996, Kalaitzidakis et al, 2001 for evidence on non-linear effects of spending on education, health and housing). Finally, the 3 year-horizon may not be enough for capturing the long-run growth effects of public spending on human capital formation (KBG, 1999, 2001).

However, the above results are consistent with the difficulty of Devarajan-Swaroop-Zou (1996, DSZ from now on) to get statistically significant estimates for health and education spending. Additionally, Hanushek-Kimko (2000) found that although labour-force quality is important for growth and quality differences are related to schooling, these differences are not due to the resources devoted to schooling (see also Bils-Klenow, 2000).

*Public expenditures on infrastructure*

Public spending on infrastructure (*GINFY*) has a positive impact on growth. For example, an increase of such expenditure as a proportion of GDP by one standard deviation (3.5%) has a positive growth effect of 1.6%. This is expected, since it includes among others outlays on transportation, communication and energy. These types of spending imply positive externalities to private producers, raise their productivity, therefore enhance economic growth according to theoretical growth models (Barro, 1990). Our results are also consistent with evidence from ER, Kneller-Bleaney-Gemmel (1999) who found a positive correlation of this kind of expenditure with growth.

*Spending on property rights protection*

We include expenditure on public order-safety and defense (*GPRY*) in our estimated equations as an attempt to test the view expressed in some growth models that these types of spending contribute to the protection of property rights increasing the probability that the citizens retain these rights to their goods and services (see e.g. BS).[12] Therefore, such models argue, the higher spending on public order-safety and defense are, the stronger the incentive agents have to accumulate human/physical capital and this enhances growth.

Our empirical results are equally encouraging, since we are able to detect a statistically significant positive impact of expenditure on property rights protection on growth. So, a one-standard deviation (1% of GDP) rise in spending on property rights protection will increase per capita growth on average by 3.7%. This is in line with findings of Bleaney-Gemmel-Kneller (2001). Here, we should note that Poot (2000) and DFZ reported insignificant or negative influence of defense spending on growth.

*Social Spending*

The evidence regarding social spending (*GSPROY*) suggests a non significant influence on growth. This is consistent with the mixed conclusions of both theoretical and empirical work on the subject. Specifically, many growth models predict that redistributive policies have a depressing effect on physical capital accumulation and

[12] Defense expenditures are considered to contribute towards protection of property rights of a country's citizens as a whole.

growth (Feldstein, 1974), while others imply that social security expenditure may positively influence savings, the level and productivity of physical and human capital investment, employment, international competitiveness and growth (Cashin 1995, Bellettini-Ceroni, 2000, BC from now on, Lau et al., 2001 and Van Der Ploeg, 2003). Also, Atkinson (1999) in a survey of the literature concluded that the evidence on the relationship between the size of the welfare state and growth is mixed and KBG (2001) including social expenditure in unproductive spending estimated an insignificant growth effect. Finally, it may be that the high correlation of social spending and distortionary taxation (0.79)[13] makes it impossible to estimate accurately the growth effect of the former variable.

*Government revenues*

Looking at the revenue side of the budget, we see that distortionary taxes (*DTY*) have a statistically significant negative impact on growth in most cases. Specifically, a one standard deviation reduction in distortionary taxes as a percentage of GDP (4.6%) implies a 3.5% rise in growth on average. This is in accordance with the predictions of theoretical growth models (Barro, 1990, Millesi-Ferreti and Roubini, 1998a, Jones-Manuelli-Rossi, 1993, Turnovsky, 2000). It is also in line with empirical evidence, when both sides of the budget are taken into account (Kneller-Bleaney-Gemmel, 1999, Bleaney-Gemmel-Kneller, 2001).

A related item is budget deficit (*DEDPY*), which exerts an ambiguous impact on growth. Specifically, the evidence is divided equally between positive, negative and insignificant growth effects. So, our results cast doubt on the Ricardian Equivalence proposition, which argues that since a current surplus will finance future deficits through cuts in distortionary taxation or increases in productive spending, it causes an increase in the expected returns to current investment, therefore growth (KBG, 1999). However, there is theoretical literature suggesting that turnover in the population and failure of the permanent income hypothesis of consumption may lead to failure of the Ricardian equivalence (Romer, 2006). Also, our results are in line with Easterly (2005).

[13] See Table A2 for correlation of the models' variables.

*Non fiscal policy variables*

The relationship between per capita growth and initial income per capita/ lagged GDP growth (*C*) is negative implying conditional convergence between the countries of our sample. This is consistent with neoclassical growth models and recent empirical studies on convergence (see Casseli-Esquivel-Lefort 1996, Kalaitzidakis et. al, 2001, Doppelhofer-Miller-Sala-i-Martin, 2004).

Regarding human capital, we assess its role on growth by including two alternative measures of it in our model. The basic measure (*UPSEC)* is the percentage of the population aged 20 to 24 having completed at least upper secondary education, since this is the minimum education level for which there is enough variation in our sample, so as to be able to estimate possible growth effects. Also, it is used for reasons of comparability with earlier studies. Furthermore, we allow *UPSEC* to have lagged effects on growth. This variable has statistically insignificant growth impact in most cases, which is similar to results of other research (Pritchett, 2001; Sianesi-Van Reenen, 2003, Barro & Sala-i-Martin, 2004). This implausible finding theoretically (Lucas, 1988, Romer, 1990, Grossman-Helpman, 1991) can be explained in several ways. Human capital presents serious measurement problems (Krueger-Lindhal, 2000). Specifically, it embraces complex characteristics that are difficult to quantify accurately. Also, the observations on which human capital measures are based are relatively few to be a sensible basis for panel estimation. Furthermore, educational measures are not often compatible across countries due to differences in schooling quality. Moreover, returns to education tend to be higher in countries with a better-educated labour force, as predicted by some growth models (Azariadis & Drazen, 1990). Also, the acquisition of educational skills is not linked with productivity in some cases – that is, education is not only an investment but also a consumption good for some individuals. In light of such problems, we use an alternative measure of human capital, i.e. the percentage of active population having completed tertiary education and employed in S&T occupations (*HRSTCOR*), because we think that it is a more accurate measure of productive human capital in developed countries like those in our sample. The latter has a statistically significant positive growth impact, i.e. a one standard deviation rise (4.4% of active population) implies a 1.1% increase in per capita growth.

As far as employment growth (*EMPGR*) is concerned, it has a positive association with per capita growth. This is expected, since labour is a factor of production in most growth models. Also, employment controls for business cycle effects on growth, so we can be reasonably confident, that the estimated growth effects of the rest of the variables included in our model are not contaminated by short-run factors.

Moreover, private investment (*PRIY*) is estimated to have a positive effect on growth. This is in line with both growth theory (McGrattan, 1998) and empirics (Levine-Renelt, 1992, Cooley-Ohanian, 1997, Dinopoulos-Thomson, 2000, Bond-Leblecioglu-Schiantarelli, 2004).

Furthermore, openness (*OPEN*), affects growth mostly positively or in a non-statistically significant way. The positive effect can be explained by international knowledge spillovers of R&D driven by trade (Coe-Helpman, 1995, Lichtenberg-Van Pottelsberghe de la Potterie, 1998, Coe-Helpman-Hoffmeister, 1997). Also, an economy can grow more rapidly if its comparative advantage at the time of opening to trade is in industries with faster learning-by-doing (Lucas, 1988).

## 6. CONCLUSIONS

The composition of both sides of the government budget, spending and revenues, matters for balanced growth according to endogenous growth models. This paper takes into account explicitly both sides of the government budget, since the policy variables in our growth regressions include both revenues and expenditures. We also extend past work by disaggregating government expenditures in a more detailed way. We find that some types of public spending and taxation affect growth. Specifically, government outlays on infrastructure (economic affairs and general public services) and property rights protection (defense, public order-safety) exert a positive impact on per capita growth. On the contrary, government expenditures on human capital enhancing activities (education, health, housing-community amenities, environment protection, recreation-culture-religion) and social protection do not have a significant effect on growth. Finally, distortionary taxation depresses growth. However, the growth impact of budget deficit is ambiguous. These findings are robust to changes in specification and estimation methodology.

We close with future extensions. We could update our data set including more recent data and more countries. Afterwards, we could further disaggregate government spending in order to explore the growth impact of each spending category in detail. We could also apply additional estimation methods, e.g. panel cointegration to distinguish better the short and long run growth effects of the various categories of public spending and revenues. We leave these for future research.

## APPENDIX

*A1. Variable definitions*

*Y*: GDP at market prices, Euro per inhabitant (at 1995 prices and exchange rates)
*YG*: growth rate of real GDP per capita equal to $\ln Y_t - \ln Y_{t-1}$
*Y0*: initial GDP at market prices, Euro per inhabitant (at 1995 prices and exchange rates
*GEDUY*: General government expenditure on Education (Percentage of GDP)
*GHEAY*: General government expenditure on Health (Percentage of GDP)
*GHOCOY*: General government expenditure on Housing and Community amenities (Percentage of GDP)
*GENPRY*: General government expenditure on Environment Protection (Percentage of GDP)
*GRRY*: General government expenditure on Recreation, Culture and Religion (Percentage of GDP)
*GSPROY*: General government expenditure on Social protection (Percentage of GDP)
*GEAFY*: General government expenditure on Economic Affairs (Percentage of GDP)
*GPUBSY*: General government expenditure on General Public Services (Percentage of GDP)
*GORSFY*: General government expenditure on Public Order and Safety (Percentage of GDP)
*GDEFY*: General government expenditure on Defence (Percentage of GDP)
*TIWY*: Current taxes on income, wealth (Percentage of GDP)
*CAPTY*: Capital taxes (Percentage of GDP)
*TPRIMY*: Taxes on production and imports (Percentage of GDP)
*ACSCY*: Actual social contributions (Percentage of GDP)
*DTY*: Distortionary taxation as share of GDP (*TIWY+ CAPTY+ ACSCY*)
*DEDPY*: Net lending (+)/Net borrowing (-) under the EDP (Excessive Deficit Procedure) (Percentage of GDP)
*GHY*: *GEDUY+GHEAY+GHOCOY+GENPRY+GRRY*, General government expenditure on human capital accumulation (Percentage of GDP)
*GINFY: GEAFY + GPUBSY,* General government expenditure on infrastructure (Percentage of GDP)
*GPRY: GDEFY+ GORSFY*, General government expenditure on property rights protection (Percentage of GDP)
*DTY: TIWY+ CAPTY+ ACSCY,* Distortionary taxation (Percentage of GDP)
*UPSEC*: Youth education attainment level - total - Percentage of the population aged 20 to 24 having completed at least upper secondary education
*HRSTCOR:* Human recourses in science and technology-core, i.e. persons who have completed tertiary education and are employed in S&T[14] occupations, percentage of active population
*EMPGR:* Employment growth - total - Annual percentage change in total employed population
*PRIY*: Business investment - Gross fixed capital formation by the private sector as a percentage of GDP
*XY*: Exports of goods and services (Percentage of GDP)
*MY*: Imports of goods and services (Percentage of GDP)

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[14] Science and technology occupations (professionals, technicians and associate professionals). See definitions in Eurostat web site for details.

*OPEN*: *XY+MY,* index of openness

*A2. List of countries*
The countries included in our sample are the following:
Belgium, Denmark, Germany, Ireland, Greece, France, Italy, Luxembourg, Netherlands, Austria, Portugal, Finland, Sweden, U.K.

*Table A1. Descriptive statistics*

| Variable | Mean | Std Deviation | Minimum | Maximum |
|---|---|---|---|---|
| *YG* | 2.191 | 2.236 | -6.968 | 13.280 |
| *Y0* | 18209.75 | 5976.567 | 8000 | 29800 |
| *GEDY* | 5.529 | 1.284 | 2.5 | 8.2 |
| *GHEAY* | 5.840 | 1.288 | 0.9 | 7.7 |
| *GHOCOY* | 0.933 | 0.584 | 0.1 | 6.3 |
| *GENPRY* | 0.629 | 0.288 | 0.1 | 1.5 |
| *GRRY* | 1.046 | 0.435 | 0.1 | 2.2 |
| *GSPROY* | 18.422 | 4.122 | 7.8 | 28.4 |
| *GEAFY* | 4.656 | 1.198 | 1.3 | 11.1 |
| *GPUBSY* | 8.4 | 3.188 | 3.7 | 21 |
| *GORSFY* | 1.476 | 0.495 | 0.001 | 2.8 |
| *GDEFY* | 1.729 | 0.938 | 0.3 | 6 |
| *GHY* | 13.977 | 2.735 | 4.8 | 18.3 |
| *GINFY* | 13.056 | 3.457 | 7 | 25.1 |
| *GPRY* | 3.204 | 1.005 | 1.2 | 6.5 |
| *TIWY* | 14.681 | 5.127 | 6.4 | 31.2 |
| *CAPTY* | 0.239 | 0.206 | 0.001 | 1.9 |
| *TPRIMY* | 13.653 | 1.782 | 10.4 | 18.2 |
| *ACSY* | 11.913 | 4.305 | 1.1 | 18.9 |
| *DTY* | 26.833 | 4.628 | 16 | 35.8 |
| *DEDPY* | -2.04 | 3.396 | -9.5 | 6.9 |
| *UPSEC* | 73.923 | 12.121 | 35 | 89.3 |
| *HRSTCOR* | 15.045 | 4.433 | 6.23 | 24.52 |
| *EMPGR* | 1.002 | 1.823 | -7.1 | 8.6 |
| *PRIY* | 17.49 | 2.333 | 11.3 | 24.5 |
| *XY* | 48.556 | 29.078 | 15.2 | 144.6 |
| *MY* | 45.143 | 23.315 | 19.4 | 118.3 |
| *OPEN* | 93.699 | 52.120 | 37.5 | 262.9 |

*Table A2. Correlations of models' variables*

| | *Y0* | *GHY* | *GINFY* | *GPRY* | *GSPROY* | *DTY* | *DEDPY* | *UPSEC* |
|---|---|---|---|---|---|---|---|---|
| *Y0* | 1.0000 | | | | | | | |
| *GHY* | 0.4016 | 1.0000 | | | | | | |
| *GINFY* | -0.1563 | -0.1545 | 1.0000 | | | | | |
| *GPRY* | -0.5703 | -0.1612 | 0.0600 | 1.0000 | | | | |
| *GSPROY* | 0.5505 | 0.3984 | 0.2574 | 0.0714 | 1.0000 | | | |
| *DTY* | 0.6692 | 0.5395 | 0.2941 | -0.1195 | 0.7899 | 1.0000 | | |
| *DEDPY* | 0.5074 | 0.2674 | -0.3836 | -0.4550 | 0.0124 | 0.3375 | 1.0000 | |
| *UPSEC* | 0.1682 | 0.0500 | 0.1012 | 0.0204 | 0.3338 | 0.3226 | 0.2522 | 1.0000 |
| *HRSTCOR* | 0.5074 | 0.2027 | -0.1493 | -0.1359 | 0.2702 | 0.4321 | 0.5552 | 0.4175 |
| *EMPGR* | 0.0497 | -0.1763 | -0.3211 | -0.3550 | -0.4844 | -0.2908 | 0.4740 | -0.0421 |
| *PRIY* | -0.1332 | 0.0341 | -0.0339 | -0.3094 | -0.3181 | -0.1880 | 0.0306 | -0.2385 |
| *OPEN* | 0.4082 | -0.0165 | -0.2946 | -0.6699 | -0.4442 | -0.1234 | 0.5345 | -0.0141 |

| | *HRSTCOR* | *EMPGR* | *PRIY* | *OPEN* |
|---|---|---|---|---|
| *HRSTCOR* | 1.0000 | | | |
| *EMPGR* | 0.0892 | 1.0000 | | |
| *PRIY* | -0.3899 | 0.1867 | 1.0000 | |
| *OPEN* | 0.4141 | 0.5537 | 0.1050 | 1.0000 |

*Table A3. Estimation Results*

| Explanatory Variables | OLS Estimates[1] (1) | FE Estimates (2) | AB Estimates[2] (3) | AB Estimates[3] (4) | AB-BB Estimates[3] (5) | AB-BB Estimates[3] (6) |
|---|---|---|---|---|---|---|
| *C* | 0.0002<br>(0.93) | | -0.544***<br>(-3.52) | -1.111***<br>(-2.91) | -0.938***<br>(-2.69) | -0.932**<br>(-2.34) |
| *GHY* | 0.009<br>(0.51) | 0.168*<br>(1.93) | -1.597<br>(-1.55) | -2.216<br>(-1.37) | -0.132<br>(-0.31) | 0.220<br>(1.39) |
| *GINFY* | 0.082*<br>(1.96) | 0.154**<br>(2.00) | -1.083<br>(-1.07) | -1.664**<br>(-1.97) | 0.805***<br>(3.12) | 0.759***<br>(2.62) |
| *GPRY* | 0.184***<br>(3.01) | 0.024<br>(0.13) | 5.077*<br>(1.68) | 2.061*<br>(1.87) | 1.994**<br>(2.18) | 8.949*<br>(1.88) |
| *GSPROY* | 0.036<br>(1.11) | 0.151<br>(1.52) | 0.459<br>(0.95) | -0.407<br>(-0.84) | 0.515<br>(1.41) | -0.290<br>(-0.66) |
| *DTY* | -0.077**<br>(-2.01) | -0.096<br>(-1.20) | -0.901***<br>(-3.12) | 1.821<br>(1.46) | -0.544***[5]<br>(-2.85) | -1.516**<br>(-2.51) |
| *DEDPY* | 0.035<br>(1.17) | 0.091<br>(1.33) | -0.978*[4]<br>(-1.71) | -1.292**<br>(-2.03) | 0.381***<br>(2.57) | 0.585**<br>(2.37) |
| *UPSEC* | -0.0002<br>(-0.04) | -0.034***<br>(-2.76) | -0.556<br>(-1.60) | -0.083<br>(-1.63) | 0.033<br>(0.72) | |
| *HRSTCOR* | | | | | | 0.246***<br>(2.84) |
| *EMPGR* | 0.748***<br>(5.41) | 0.330*<br>(1.69) | 2.064*<br>(1.70) | 2.614**<br>(2.53) | 1.333**<br>(2.09) | 0.401***[6]<br>(3.29) |
| *PRIY* | -0.034<br>(-0.27) | 0.287*<br>(1.71) | 2.769***<br>(2.69) | 1.139**<br>(2.16) | 0.986***<br>(2.66) | 1.741*<br>(1.68) |
| *OPEN* | 0.003<br>(0.37) | 0.019<br>(0.90) | -0.040<br>(-0.23) | -0.157*<br>(-1.77) | 0.074**<br>(2.07) | 0.056*<br>(1.69) |
| Obs. | 111 | 111 | 94 | 94 | 113 | 127 |
| $R^2$ | 0.364 | 0.327 | | | | |
| Hausman test (p- value)[7] | | 0.017 | | | | |
| Sargan Test (p-value)[8] | | | 1.000 | 1.000 | 1.000 | 1.000 |
| Autocorrelation of 2nd order (p-value)[8] | | | 0.969 | 0.108 | 0.601 | 0.326 |

*Note:* Dependent variable GDP per capita growth in country i (i =1,…,14) in period t (t =1990,…,2006). t-statistics, z-statistics are reported in parentheses for OLS/FE and AB/AB-BB estimations respectively; *, **, *** denote 10%, 5% & 1% significance levels respectively. [1]OLS estimates heteroskedasticity consistent.[2] Dependent variable and explanatory variables lagged up to 14 periods were used as instruments. [3] Dependent variable lagged up to 14 periods was used as instrument. [4] *DEDPY* lagged up to 1 period used. [5] *DTY* lagged up to 2 periods used. [6]*EMPGR* lagged up to 2 periods used. [7]The Hausman statistic is distributed as a chi-square whose critical value with df=10 is 18.307 (p-value: 0.05) and the null hypothesis is that the difference in RE/FE coefficient estimates is not systematic. [8] The null hypothesis is that the instruments used are not correlated with the residuals.[9]The null hypothesis is that the errors in the first-differenced regression exhibit no second order serial correlation.

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