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OPTIMAL SIZE OF GOVERNMENT AND ECONOMIC GROWTH IN EU-27

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ABSTRACT: *Using time-series techniques and panels data, the paper analyses for the EU countries in the period 1970-2009 the existence and shape of the "BARS curve" (Barro, Armey, Rahn, and Scully), connecting the size of Government (measured by the share of public expenditure on GDP) to the rate of economic growth. Individual countries research has been conducted for 12 countries for whom enough time series were available, while panel analysis has been performed both for EU-27 and for subgroups, distinguished by their different socio-economic and monetary structures, and per capita GDP. BARS curves were generally found, and the shares of actual public expenditures generally exceed substantially those related to the maximization of GDP growth. However, great differences do emerge. For the 12 countries examined by time-series techniques, the difference between the actual level and the peak of the BARS curve ranges from 5.7 points for Germany and 18.1 points for Belgium. Panel data analysis for EU-27 shows a peak of the BARS curve at 37%, while the actual level is about 47%. While, panel data disaggregation shows a similar situation for the Western Continental Countries, with a smaller gap for Anglo-Saxon countries. For low per capita GDP countries the peak is higher than for the mature economies. So, further research may prove useful to show light on the disparities emerging in the empirical analysis of individual countries and of the panel sub-groups. However, the present research provides enough evidence that high GDP countries of EU have overcome the level of government size compatible with GDP growth rate maximization.*

KEYWORDS: *Government size; economic growth; BARS curve; public expenditure; EU-27.*

JEL Codes: *C22; C23; E62; H60; O40.*

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1. – Introduction

Growth theory has a central role in modern macroeconomics. However for a long time studies on growth haven been based on SOLOW's (1956) neo-classical approach, which focuses on the importance of two factors related to long-term growth, i.e. exogenous technological changes and convergence of per capita income. If one assumes that all the determinants of growth are exogenous, it is clear how economic policies are not susceptible of influencing the growth process – unless temporarily during the transitional phase of an economy towards its stationary state. As a consequence, the role of Government in the growth process in this approach has been neglected.

The models on growth developed by ROMER (1986), LUCAS (1988), BARRO (1989; 1990) and REBELO (1991) devise a new (endogenous) theory of growth, with a role of Government in the growth process. Indeed according to this new approach, both the growth rates in the transitional phase and those associated to the stationary condition are endogenous, thus implying that the growth rates of long-term economic activities are endogenous. And in the endogenous approach to growth the positive and negative influence of Government on the growth process, cannot be overlooked. These factors as BROS, DE GROOT, and NIJKAMP (1999) showed, are both direct and indirect. In this perspective long-term growth rates can differ among the various countries, and the convergence of per capita incomes is not necessary. Thus, for instance, DAR and AMIRKHALKHALI (2002) pointed out how the three main instruments of budget policy (taxation, public expenditure and overall balance) can influence the long-term growth process through the efficient use of resources, factorial accumulation rate and dynamics of technological process.

Obviously Governments, at the various level, provide both intermediate public goods that can be considered as factors of production and as factors for the private consumption, and goods for final consumption or/and redistribution purposes. While public expenditure, in a general meaning, is necessary to have a functioning market economy and to promote GDP growth, its expansion cannot necessarily be consistent with the maximization of the long-term rate of GDP growth. Indeed, if size of the Government grows then free market economy goes down. An equilibrium among them has to be found. This does not mean that this equilibrium should be that where the GDP growth rate is maximized. An high growth with an unbalanced society may not be consistent with the welfare maximization in any of the various meaning of this complex concept. Nevertheless to know whether there is a point beyond which the increase size of the public expenditure as it exists, and financed in given countries reduces the growth rate is extremely important. It helps in choosing among the different objectives of the public policy and in looking to the possibility of reconciling them, as far as possible, by improving the quality of the public sector and that of the growth process. A recent approach to the effects of Government size on economic growth is centred on the "BARS curve", which relates the rate of economic activity to public expenditure, considered as a peculiar proxy of Government size (ARMEY (1995); RAHN and FOX (1996); CHAO and GRUBEL (1998); VEDDER and GALLAWAY (1998); TANZI and SCHUKNECHT (1998a; 1998b; 2007); SCULLY (1998; 2000; 2002; 2004); PEVCIN (2003; 2004; 2008)). As stated in OSBAND and RIJCKEGHEN (2000), a low value of public deficit/GDP ratio and public expenditure/GDP ratio are two key-factors ("fundamentals") to prevent a financial crisis, as well as to guarantee a safety environment for net capital inflows. Moreover, some recent studies tend to shed light on themes very close to the BARS curve, such as the relationship between budget deficit and GDP growth (ALESINA and ARDAGNA (2009)), or the effects of public debt on economic activity (REINHART and ROGOFF (2010)). While, FEDELI and FORTE (2010) show that high public debt/GDP ratio in the long run causes high unemployment rates.

The paper is divided into five sections. Section 2 provides a survey of economic literature on this issue. Section 3 presents an overview of the applied empirical methodology and a brief discussion of the data used. Section 4 discusses the empirical results, either for time-series analysis or panel-data models. Section 5 contains our concluding remarks and policy implications.

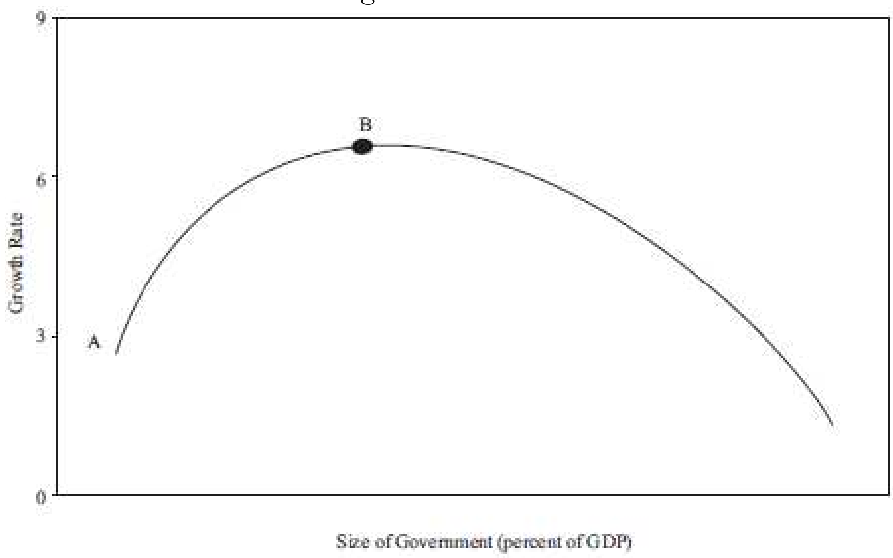
2. – The Optimal Size of Government and the "BARS curve" in literature

The concept of "optimal size of Government" was formulated by ARMEY (1995), who proposed in 1979 the homonymous curve. Similar to the "LAFFER curve"[1] – representing the relationship between tax flows and the average tax rate through an "upside-down U"-shaped graph – the "ARMEY curve" shows instead the relationship between public expenditure (defined as a share of the domestic product) and the variation of the general welfare

[1] See: LAFFER A.B., SEYMOUR J.P., *The Economics of the Tax Revolt: A Reader*, Harcourt Brace Jovanovich, New York, 1979.

of the country *à la* PIGOU (defined as the growth rate of aggregate production), showing the same "upside-down U" shape. The idea beneath ARMEY's work is that very low levels of public expenditure would not allow the State to guarantee the respect of contracts and the protection of property rights, and thus a positive growth rate. On the other hand, very high rates of public expenditure would not entice citizens to invest and produce, as fiscal pressure would be huge, and in this case, too, growth would suffer. Moreover, given that by nature the productivity of public enterprises grows less compared to the market one, the higher the public share of resources, the more probable the decrease of total productivity. As a consequence, higher expenditures together with low levels of public intervention in the economy give a strong impulse to economic activity; while fiscal expansions, linked with high levels of expenditure, trigger a slowdown of the economic activity, taking the place of a more efficient alternative use of the same resources on behalf of the private sector. Thus, there is an optimal level in the relationship between public expenditure and GDP so to maximize the aggregate income growth. In particular, according to CHAO and GRUBEL (1998), this level appears to be lower than the one maximizing fiscal revenue (or the point of maximum revenue in the "LAFFER curve"). In their opinion, some expenditure budgets would generate discouraging effects, reducing the risk components in the various agents' economic life, and changing the economical behaviour of the individuals, thus reducing the effective labour supply and free enterprise. A reduction of the economic growth rate would result.

Figure 1 – BARS curve.



Source: GWARTNEY, LAWSON, and HOLCOMBE (1998).

In the field of endogenous growth models, BARRO (1989; 1990) pointed out that a raise in taxation reduces the growth rate through triggering discouraging effects. At the same time, however, the increase in public expenditure causes the rise of marginal productivity of capital, – and thus – it has a positive effect on growth. The second measure prevails when the dimensions of the public sector are smaller, while the first one when the public sector is very wide. Thus, the effect of Government expenditure on economic growth is non-monotonic. In this way the "BARRO Rule" is formulated, and according to it public services are provided at an optimal level when their marginal product is unitary. Graphically, then, the relation between the growth rate of economy and the variation rate of public expenditure follows an upside-down U-shaped curve.

Analyzing the relation among tax rates, public revenue and economic growth in 103 countries, SCULLY (1994; 1998; 2000; 2002; 2003) found out that economic growth rates are maximized when public expenditure is approximately equal to the fifth part of the aggregate income, as excessive increases in the expenditure have a substantially depressive effect on economic growth.

RAHN and FOX (1996) carried out an empirical analysis reaffirming the existence of an optimal size of Government, graphically represented through an upside-down U-shaped curve. These first studies on the topic suggested to some scholars to name such curve differently, i.e. BARS (due to BARRO, ARMEY, RAHN, and SCULLY contributions).

VEDDER and GALLAWAY (1998) moved from the recognition that in the history of mankind there has never been any society who experienced widespread wealth without providing a public apparatus: otherwise, economic activity and welfare would be penalized by complete anarchy. For this reason, the first functions bestowed to the state entity – guaranteeing order and the rule of law, and defending the property right –, in line with classical economic thought, have a strong impact on economic development. The presence of the State thus becomes a necessary but insufficient condition for prosperity. On the other side, collectivistic societies with planned economy failed because of the centralization and monopolization of the allocation of resources and decisions in the economic field. As a result, the expansion of the public sphere beyond a certain limit is subjected to the "law of diminishing marginal productivity", which would grant positive profits because of the checks to public expenditure in the economies with a wide public intervention.

FRATIANNI and SPINNELLI (1982) found a strong empirical evidence that the Italian public sector has grown more than the rest of the economy, both in relative and absolute terms. There is also strong evidence regarding the acceleration of the growth rates of public sector. Moreover, they show how the redistributive model is more suited to explain the evolution of the size of Italian Government (from 1861 to 1979) compared to the model with public goods and the hypothesis of sector-based interests.

GROSSMAN (1987) described positively the State contributions to general economic growth soon after the birth of the State, advising however that public decision-making process would bring to continuous increases in expenses, ending up in insufficient volumes of public goods.

Making a distinction between two alternative visions in the domain of the economic analysis of Government theory – the Pigouvian one, which looks at the Government as a benevolent actor, trying to rectify lacks and excesses of a market without rules[2]; and the one typical of the "Public Choice School", which on the contrary depicts the Government as a Leviathan, instrument of special groups of interests, and generating distortions – GROSSMAN developed a model in which all the expenditures of the Government constitute inputs for production in the private sector, thus searching the optimal size of Government able to maximize private output[3]. The estimate results show that in 1983 US public expenditure exceeded by 87%

[2] See: PIGOU A.C., *Public Finance*, Macmillan, London, 1947.

[3] See: MUELLER D.C., *Public Choice III*, Cambridge University Press, Cambridge – New York, 2003.

the value that would maximize private production.

GRIER and TULLOCK (1989) completed an empirical work on OCSE countries between 1951 and 1980 noting that growth in the State size in countries having already a strongly interventionist Government has a significantly negative effect on economic growth.

TANZI and SCHUKNECHT (1997a; 1997b; 1998a; 1998b; 2007) analyzed the long-term dynamics of expenditure in industrialized countries. They came to the conclusion that countries with "small governments" do not usually show worse socio-economic and welfare indicators than those having "big governments". The first ones, providing just the essential services and a minimum of security and social protection to the needy, avoid running into the negative effects originated by the high taxation levels needed to guarantee a large-scale redistribution. They found out that in the cases in which public expenditure absorbs half the national income social progresses are not materially more consistent than anywhere else.

YAVAS (1998) showed that an increase in the size of public sector rises the output level if the economy is characterized by a low level of aggregate per capita income, while reduces it when the economy produces a high level of per capita income.

In developing countries a significant share of public expenditure is usually destined to the construction of infrastructures, thus stimulating the private sector production. On the contrary, in mature economies the main share in the expenditure budget is destined to social services.

GHALI (1998) and ANAMAN (2004) showed, by empirical research, that the public size can have a positive effect on economic activity due to positive external effects, the development of a favourable economic, administrative and legal framework and the intervention in the case of market failures.

On the contrary, BAJO-RUBIO (2000) pinpointed that the Government size has negative effects on economic growth, mainly because of bureaucratic inefficiency, excessive fiscal burden, distortion in the incentives system and public intervention on the market.

An analysis taking into account the different aims of public expenditure has been carried out by HEITGER (2001). He pointed out that governmental expenditures for "central" public goods (the Nozickian ones of *minimal State*: rule of law, security from external aggression, internal order) have a positive impact on economic growth[4]; while production and public supply

[4] See also: BRUMM H.J., *Military Spending, Government Disarray, and Economic Growth: A Cross-Country Empirical Analysis*, in "Journal of Macroeconomics", 19(4), 1997, pp. 827-838; KENNEDY P., *The Rise and Fall of the Great Powers*, Random House, New York, 1987.

of private goods have negative outcomes. Moreover, HEITGER remembered – as SMITH, RICARDO and MALTHUS[5] had already done –, that the soundness of public accounts forces the financing of massive public expenditures through more and more "oppressive" taxation levels, thus reducing incentives to work, investment and innovation.

FOLSTER and HENREKSON (2001) examined the effects of expenditure and fiscal withdrawal measures on growth rate in rich countries between 1970 and 1995, finding a strong negative relation between public expenditure and economic growth.

ILLARIONOV and PIVAROVA (2002) studied the optimal size of Government in OECD countries in the period 1960-2000, coming to the conclusion that the rise of one percentage point in the share of public expenditure on GDP has come with a 0.1% reduction of the average growth rates of economic activity. Moreover, the two scholars subdivided their sample in several sub-samples in order to take into account individual heterogeneity (due to the presence of very different countries in the initial sample), using as proxy of public size two different criteria: the share of total public incomes as regards GDP and the share of total public expenditure on GDP. The set of independent variables included 46 potential regressors, classified according to their characteristics (geographical, climatic, demographic, administrative, economic). The results showed that for both the dependent variables, the only relevant regressors were the per capita GDP (carrying a positive sign, thus confirming the "WAGNER's Law") and the annual average of population (carrying a negative sign). Grouping the various units in three more homogeneous groups, they noticed that the average share of public incomes on GDP for group 1 amounted to 37.5%, less than group 3, while the growth rates average in group 1 was more than thrice and a half the one in group 3. Finally, the two scholars calculated a "necessary level of public size" equal to 20.9% of the public expenditure share on GDP for less developed, highly populated countries (more than one million inhabitants). When such indicator reached ratios between 21% and 36%, the fiscal burden was described as "irrational", while over 36% it was described as "excessive".

AFONSO, SCHUKNECHT, and TANZI (2003), on the basis of ARMEY's contribution, suggested that the general Government expenditure exceeding the ratio of 30% of the national income reduces economic growth and does not trigger, in practice, any improvement in social welfare.

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[5] See: ROMAGNOLI G.C., *Le funzioni economiche dello stato in Italia*, in ACOCELLA N., REY G.M., TIBERI M. (eds.), *Saggi di politica economica in onore di Federico Caffè*, vol. III, FrancoAngeli, Milan, 1999, pp. 171-200.

PEVCIN (2003; 2004; 2008) analyzed the presence of a "BARS curve" in twelve European countries with regard to the period 1950-1996, using – like VEDDER and GALLAWAY – the relationship between total public expenditure and domestic product as a proxy of the Government size. The results show the evidence of a decreasing marginal productivity of public expenditure.

KUSTEPELI (2005) analyzed the size of Government in the twelve new countries that adhered to the EU and the two candidate ones[6], referring to the period 1994-2001. The sample was initially subdivided into three groups, according to the average expenditure share on the GDP: low (26-33%): Lithuania, Latvia, Estonia, Czech Republic, Turkey and Romania; medium (34-40%): Slovakia, Cyprus, Poland, Bulgaria and Slovenia; high (41-47%): Malta, Hungary and Croatia. The results of the panel-type econometric analysis show that a smaller size of Government positively influences the economy's growth rates. On the contrary, in relation to average ratios of this indicator, there is a diminution in the economic growth.

In a recent essay, HILL (2008) criticized the model used by SCULLY (1996; 2003), through which the scholar determined the optimal taxation level for the United States of America in the thirty-year period 1960-1990 equal to 19.3%. HILL's critiques mainly concerned the peculiar form of the production function – to which SIEPER (1997) and KENNEDY (2000) had already objected – which includes the scarcely plausible assumption that all capital goods are completely consumed every year. Correcting this mistake, HILL found out that the size of Government able to maximize economic growth oscillates between 16% and 28%.

MAGAZZINO (2008) estimated the "BARS curve" for Italy in two different periods: in the first instance, using time-series which refer to the years between 1862 and 1998, the Government size maximizing the Italian economic growth is given by a ratio between public expenditure and GDP equal to 23.06% (g^* in Figure 1). The estimated value is in line with the one calculated by VEDDER and GALLAWAY (1998), equal to 22.23%. On the other hand, limiting the analysis to just the post-World War II period (1950-1998), the public size associated to the maximum GDP growth rate results equal to 32.83%. This value is not noticeably different from the estimate of 37.09% indicated in PEVCIN (2008).

CHOBANOV and MLADENOVA (2009) examined the optimal size of Government (defined as the share of the total public expenditure on GDP) able to maximize economic growth for a set of 28 countries adhering to the

[6] They are Bulgaria, Croatia, Cyprus, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Malta, Poland, Romania, Slovakia, Slovenia, and Turkey.

OECD in the period 1970-2007. The empirical results showed that the ratio between public expenditure and optimal GDP equals to 25%. Moreover, all the countries in the sample were situated in the right descending part of the curve.

MAGAZZINO (2009; 2010a; 2010b) pointed out how, in the framework of 13 OECD countries examined, a country with a ratio between public expenditure and GDP higher than 10% registers, on average, a reduction of its own GDP growth equal to 0.74%. Moreover, an increase in the variation of public expenditure equal to one percentage point corresponds approximately to a reduction in the acceleration rate of economic activity equal to 0.31%. These results are particularly relevant in countries with a strong presence of the State in their economy, such as, in Europe, Belgium, Denmark, Finland, France, Greece, Hungary, Italy, the Netherlands, Portugal, Sweden and the United Kingdom, taking into account that the average share of public expenditure on GDP in 2008 was equal to 46.8% both for EU-16 and EU-27, and that the main international institutes – given the current severe economic and financial crisis and the consequent interventions launched by the various governments to support real economy – expect that in 2009 both groups of countries will exceed 50%.

Others researchers focused on fiscal policies and the relationship between public revenue and expenditure. BENSON and JOHNSON (1986) observed the impact of taxation on the future formation of capital in various countries. They came to the conclusion that upward movements of relative tax shares bring about a reduction in the relative amount of investments; i.e., high taxation would trigger a low formation of capital. For this reason, as classical thought had already envisaged, excessive taxation can negatively influence economic activity, depressing demand.

While investigating the effects of regional differences in the United States taxation, BESCI (1996) came to the conclusion that marginal rates of taxation show a statistically relevant negative relationship with economic growth.

FELDTSEIN (1997), considering the US experience, pointed out how the appropriate size and role of Government depend, first of all, on the burden of fund transfers from the private sector. The size of this burden depends on the increases in fiscal shares and the welfare losses for the community on the whole due to higher fiscal shares. In conclusion, the central question of public finance is detected in the appropriate level of public expenditure and, consequently, taxation, particularly in those countries with a high public debt/GDP ratio. The suitability of further increases in expenditure depends on the comparison between its gains and total costs, including losses caused by a rising revenue. Moreover, FELDSTEIN pinpointed the necessity to investigate more deeply the importance of the expectations mechanism on changes in the taxation shares, and the resulting effects on revenue. Finally, the lack in welfare associated to taxation reflects changes both in labour supply and taxable base. Thus, he concluded that financing a further public expenditure of one dollar would require an increase in taxation of more than two dollars.

Besides, FRIEDMAN (1997) had already noticed the essential role of the State as an actor of economic policy in the framework of a free open society. However, he signalled that increasing the expenditure share on national income from 15% to 50% – and, thus, the share of withdrawal, in order to guarantee the budget balance – would be undoubtedly negative for the income produced, generating a Paretian worsening.

GWARTNEY, LAWSON, and HOLCOMBE (1998) considering a sample of 23 OECD member countries, from 1960 to 1996, argued that the expansion of Government beyond its core functions has a negative influence on economic growth for three reasons: a) the discouraging effects of high taxation and the crowding effect of public investments if compared to private ones; b) the diminution in profits coming from governmental intrusion in activities not appropriate to the public sector; c) the interference in the wealth-generating process.

Moreover, several studies has been centred on public expenditure productivity and its efficiency levels. PEDEN and BRADLEY (1989) tried and measure the effect of public size on economic production and productivity in the United States of America between 1949 and 1985. They came to the conclusion that the level of Government activity in economy has a negative effect both at the level of aggregate production and growth rates; moreover, they found out that continuous increases in the shares of domestic product destined to the public sphere bring about a significant erosion of productivity.

GUPTA *et al.* (2001) pointed out that the Government aim and size are optimal when the marginal social cost of public resources is equal to their marginal social benefit. However, they noticed that difficulties in the enactment of such rule remain, turning it in an intellectually stimulating challenge for Costs-Benefits Analysis.

Likewise, DAR and AMIRKHALKHALI (2002) came to the conclusion that the weaker the growth in the total factors and in capital productivity, the bigger is the size of the public apparatus. Studying 19 OCSE countries between 1971 and 1999, they found out that where the "small government" prevails, the efficiency degree, market discipline and use of resources are superior, further to noticing the absence of crowding-out effects weakening the incentives in the investment of capital goods.

ALESINA *et al.* (2002) analyzed the effects on investments of vast changes in fiscal policy. They found out that an increase in public expenditure – and, thus, in the size of the State apparatus – provokes an increase in labour costs in the private sector. Moreover, they found out that an increase in taxation reduces profits and investments, though an increase in public expenditure would reduce them more. Thus, the conclusion they draw is that fiscal stabilizations able to promote economic growth are mainly associated to cuts in expenditures and not to tax burdens.

POULSON and KAPLAN (2008) investigated the impact of tax policy on economic growth inside an endogenous growth model, where differences in policies can trigger different paths of long-term equilibrium growth. In line with the "LAFFER curve", the analysis reveals that higher marginal shares have a negative impact on the various countries' economy. Besides, a minor progressiveness of the taxation system has a positive impact on growth. States maintaining the rate of revenue increase under the rate of income increase reach higher rates of economic growth.

Recently, ALESINA and ARDAGNA (2009) examined the relationship between public deficit and economic growth, shedding light on episodes of large stances in fiscal policy, both in cases of fiscal stimuli and in that of fiscal adjustments in OECD countries from 1970 to 2007. Fiscal stimuli based upon tax cuts are more likely to increase growth than those based upon spending increases. As for fiscal adjustments those based upon spending cuts and no tax increases are more likely to reduce deficits and debt over GDP ratios than those based upon tax increases. In addition, adjustments on the spending side rather than on the tax side are less likely to create recessions.

While, REINHART and ROGOFF (2010) study economic growth and inflation at different levels of government and external debt. Their more relevant findings include the fact that the relationship between government debt and real GDP growth is weak for debt/GDP ratios below a threshold of 90 percent of GDP; emerging markets face lower thresholds for external debt (public and private); there is no apparent contemporaneous link between inflation and public debt levels for the advanced countries as a group.

3. – Econometric modelling and data

The estimate methods used in this research are typical of the time-series and panel type econometric analysis.

Concerning the time-series analyses, the ARIMAX (*AutoRegressive Integrated Moving Average with Exogenous Variables*)[7] models were used, together with NEWEY and WEST's correction regarding heteroscedasticity[8] and KALMAN's filter for data filtering[9].

Panel-type analyses, instead, were conducted through FE (*Fixed Effects*), BE (*Between Effects*), RE (*Random Effects*), FEMAR (*Fixed Effect Models with an AR(1) Disturbances*), REMAR (*Random Effect Models with an AR(1) Disturbances*), PFGLS (*Panel Feasible Generalized Least Squares*), PCSE (*Panel PRAIS-WINSTEN Regression*), and PGEE (*Population-Averaged Panel-data Models*) models[10].

The data used in this work were provided by AMECO[11] database and *Total Economy Database*[12], freely consultable on the internet.

In Table 1 variables of the model are summed up.

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[7] For a detailed analysis of the time-series modelling used see, among others: LÜTKEPOHL H., *New Introduction to Multiple Time Series Analysis*, Springer-Verlag, Milan, 2005; DAGUM B.E., *Analisi delle serie storiche: modellistica, previsione e scomposizione*, Springer-Verlag, Milan, 2002; ENGLE R.F. (ed.), *ARCH. Selected Readings*, Oxford University Press, Oxford, 1995; HAMILTON J.D., *Time Series Analysis*, Princeton University Press, Princeton, 1994.

[8] See: NEWEY W.K., WEST K.D. (1987), *A simple, positive semi-definite, heteroskedasticity and autocorrelation consistent covariance matrix*, in "Econometrica", Vol. 55, pp. 703-708; WHITE H., *A heteroskedasticity-consistent covariance matrix estimator and a direct test for heteroskedasticity*, in "Econometrica", 48, 1980, pp. 817-838.

[9] See: KALMAN R.E., *A new approach to linear filtering and prediction problems*, in "Journal of Basic Engineering", Transactions of the ASME, Series D, 82, 1960, pp. 35-45.

[10] For a detailed analysis of the panel modelling used see, among others: BALTAGI B.H., *Econometric Analysis of Panel Data*, Wiley, New York, 2005; HSIAO C., *Analysis of Panel Data*, Cambridge University Press, New York, 2003; WOOLDRIDGE J.M., *Econometric Analysis of Cross Section and Panel Data*, MIT Press, Cambridge, 2002; BALTAGI B.H., WU P. X., *Unequally spaced panel data regressions with AR(1) disturbances*, in "Econometric Theory", 15, 1999, pp. 814-823; MUNDLAK Y., *On the pooling of time series and cross section data*, in "Econometrica", 46, 1978, pp. 69-85.

[11] See the website: http://ec.europa.eu/economy_finance/ameco/user/serie/.

[12] See the website:http://www.conference-board.org/economics/database.cfm.

Table 1 – List of variables.

Variable	*Explanation*
TGDPGK	Total GDP, in millions of 1990 US$ (converted at Geary-Khamis PPPs)
CATEGG	Cyclically adjusted total expenditure of general government, % GDP

Sources: AMECO and TED database.

In Table 2 some preliminary descriptive statistics are shown.

Table 2 – Exploratory data analysis.

Variable	*Mean*	*Median*	*Standard Deviation*	*Skewness*	*Kurtosis*	*Range*
TGDPGK	258006.5	96097	369505.5	1.9304	5.7864	1716872.9
CATEGG	46.1405	45.6866	6.9494	0.1881	2.7092	41.5205

Sources: our calculations.

In Table A (in *Appendix*) we report results of stationarity tests carried on these two time-series, while in Table B correlation coefficients between real GDP and the share of public expenditure is shown. In general, both variables are non-stationary at levels, but they become stationary at first differences; so we can conclude that real GDP and public expenditure are I(1) processes.

4. – The estimates

First we examine the relationship between economic growth and public expenditure following the analyses carried out in ILLARIONOV and PIVAROVA (2002), SCULLY (2004), PEVCIN (2004) and CHOBANOV and MLADENOVA (2005), estimating three fundamental relationships. The first one investigates the relation between the growth rate of the aggregate product and the expenditure share as regards the GDP. The estimated equation belongs to the type:

$$d(TGDPGK)_{i,t} = \alpha + \beta_1\, CATEGG_{i,t} + u_{i,t} \qquad [1]$$

The dependent variable (*TGDPGK*) represents the GDP growth rate at constant prices (converted in GEARY-KHAMIS P.P.P.), while the explanatory (*CATEGG*) consists in the total public expenditure of the general Government, corrected according to the trend of the economic cycle. We expect that an excessive size of the Government trigger negative effects on economic growth.

The second relationship we studied concerns the link between the growth rate of the aggregate product, the expenditure share as regards the GDP and the variation of public expenditure. The estimated equation belongs to the type:

$$d(TGDPGK)_{i,t} = \alpha + \beta_1\, CATEGG_{i,t} + \beta_2\, d(CATEGG_{i,t}) + u_{i,t} \qquad [2]$$

In this case, we expect that, given the excessive size of the Government, further increase in public expenditure triggers new negative effects on economic growth.

The third relationship analyzes the link between the variation rate of economic growth and the variation of the expenditure share as regards the GDP. The estimated equation is:

$$d2(CATEGG)_{i,t} = \alpha + \beta_1\, d(CATEGG_{i,t}) + u_{i,t} \qquad [3]$$

In this case, too, an increase in public expenditure can trigger a check to the economic growth dynamics.

We then estimate the relationships between economic growth rate and public expenditure according to the specification suggested by VEDDER and GALLAWAY (1998), PEVCIN (2004), CHOBANOV and MLADENOVA (2005) and DAVIES (2008). It assumes that the growth rate of aggregate income is the positive function of the public expenditure share on domestic product and the negative function of the square of the public expenditure share; initially we estimate the following model:

$$d(TGDPGK)_{i,t} = \alpha + \beta_1\, CATEGG_{t} + \beta_2\, CATEGG^2_{i,t} + u_{i,t} \qquad [4]$$

with the i index standing for the country (i=Austria, …), while the t one referring to the period (t=1970,…, 2009). The dependent variable is the real GDP growth rate corrected according to the impact of the factors of commerce (measured at constant prices), *TGDPGK*, while the independent variables are the public expenditure share corrected according to the economic cycle trend on real GDP, *CATEGG*, and its square value, $CATEGG^2$. For every series the logarithmic transformed counts were calculated.

We expect that the linear term, *CATEGG* carry a positive sign and show the positive effects of public expenditure on economic growth; on the contrary, the square term $CATEGG^2$ should take a negative sign, as it measures the negative effects associated to the enlargement of public sector. In other words, this second degree term should stand for the decreasing marginal productivity of public expenditure.

The government expenditure as a share of GDP that maximizes economic growth from the quadratic function above is found to be the following after differentiating the *TGDPGK* with respect to *CATEGG*:

$$CATEGG^* = -b/2c \qquad [5]$$

BALTAGI[13] lists several benefits from using panel data. These include the following:

1) Controlling for individual heterogeneity, panel data suggests that countries are heterogeneous. Panel data are able to control for these state- and time-invariant variables whereas a time-series study or a cross-section study cannot.
2) Panel data give more informative data, more variability, less collinearity among the variables, more degrees of freedom and more efficiency.
3) Panel data are better able to study the dynamics of adjustment.
4) Panel data are better able to identify and measure effects that are simply not detectable in pure cross-section or pure time-series data.

We use time-series regressions and we use dummy variables to take into account specific country and time effects, but also robust standard errors to control for heteroscedasticity or serial correlation.

4.1 – Time-series analysis of the relationship between economic growth and size of Government

In order to study the relationship between public expenditure and economic growth, we used a dataset for 27 countries members of the European Union (Austria, Belgium, Bulgaria, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, the Netherlands, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, and UK) from 1970 to 2009. First we conducted an econometric analysis for time-series data of the countries with enough yearly data.

The negative relationship between economic growth rate and public ex-

[13] See: BALTAGI B.H., *Econometric Analysis of Panel Data, …, cit.*

penditure is clearly evident from Table 3. The coefficient of the explanatory variable is statistically relevant for every country but Denmark, and it has a negative sign. Regarding the determination coefficient, public expenditure alone explains from 19% (United Kingdom) to 86% (Greece) of the ratio of growth rate variability. Residuals are never correlated, and for each country they are White Noise (W.N.).

GRANGER causality tests show that we have a bi-directional causality for three countries (Belgium, France, and Ireland). Instead, GDP Granger-causes public expenditure for Belgium, France, Germany, Ireland, and Italy. On the contrary, for Belgium, Denmark, France and Ireland empirical results support the opposite hypothesis, since the direction of causality moves from public expenditure to aggregate income. The inverse causality found for Italy may have an explanation in the fact that social public expenditures were planned structurally assuming a rate of GDP growth that actually did not came out. On the other hand, the reason for the lack of econometric evidence for a causal relation between the expansion of public spending and the reduction of the growth rate might be that expansion was largely financed through public debt, and that a share of it, for a period, was absorbed by the central bank. Only later, when the burden of the high debt did appear in the budget via high expenditures for interest and high tax burden became necessary, the negative effect of big Government on the rate of GDP growth emerged.

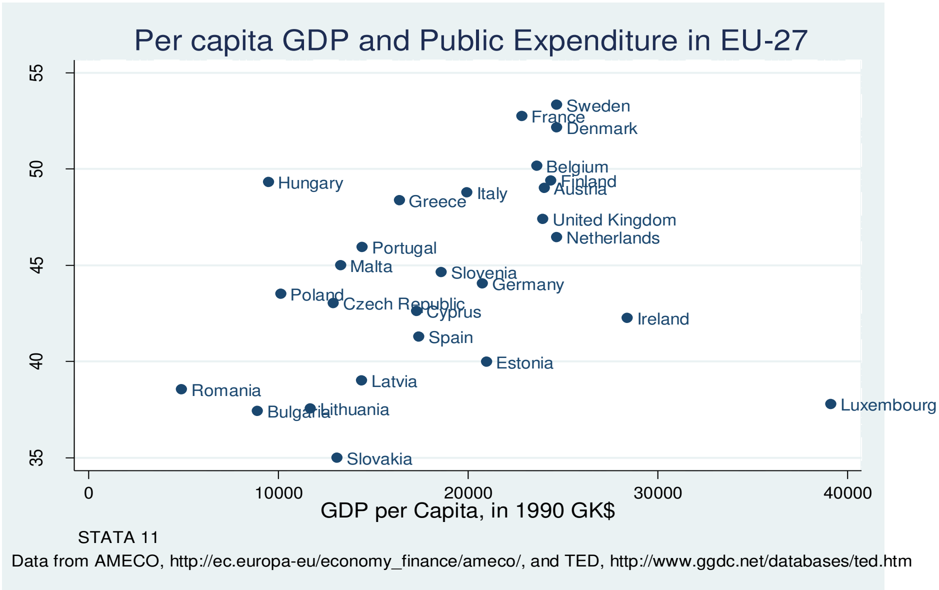
Regarding Table 4, the growth rate is estimated as a function of the public expenditure share on GDP and its series in first differences. The results previously shown are confirmed; in fact, public expenditure still has a negative sign in almost all countries (just Greece is the exception). The series to first differences, carry a negative sign and a strong statistical significance (everywhere). The R^2 fluctuates between 40% (Germany) and 89% (France). Just in the cases of France and Germany residuals do not follow a Gaussian trend, while for every country they are serially uncorrelated, thus being a W.N.

In Table 5, conversely, we regress the variation in the GDP growth rate, i.e. the acceleration or deceleration of aggregate growth (*d2TGDPGK*) on the difference of the public expenditure share on GDP. Again, there is a negative relationship between economic growth and public expenditure. The independent variable has the expected negative sign and is statistically relevant in twelve out of thirteen countries (the only exception being Denmark, as before). The coefficient of determination fluctuates from a minimum of 19% (United Kingdom) to a maximum of 80% (Italy) of the growth rate variability. Regression' residuals seem to be normally distributed (except for Germany). Finally, in every case the residuals appear serially uncorrelated.

The time-series analysis show that the optimal size of public expenditure in relation to the GDP growth rate maximization (*G**) differs from country to country: from 35.4% from Belgium to 44.5% for Ireland (Table 6).

As shown in Table 7, for all the countries here considered the maximum of the BARS curve are situated in the right part of them. The peak of the BARS curve varies among the considered countries with a difference of 9 points between the lowest level (35.39) and the highest level (44.47). In the lowest range we find Belgium and The Netherlands; in the highest range there are Ireland and UK. The former is the country with the minimum deviation from its ratio of public expenditure on GDP that maximizes GDP growth: only 2.27%. It is followed by Luxembourg with 2.30 points. Ireland, together with Luxembourg, it is also the country with the highest ratio of public spending consistent with its growth maximization. The difference between the actual level of public expenditure and the level consistent with maximization of GDP growth rate, with the exception of these two cases, ranges between 5.7 points for Germany and 18.1 points for Belgium.

Figure 2 – Relation between per capita GDP and public expenditure, (EU-27, 2009).



Source: our elaborations on AMECO and TED data.

Table 3 – Relations between economic growth rate and public expenditure in some countries adhering to EU-27 (1970-2009).

Indipendent Variables	**Dependent Variable: d(TGDPGK)**											
	AUT	**BEL**	**DNK**	**FIN**	**FRA**	**GER**	**GRE**	**IRL**	**ITA**	**PBS**	**POR**	**UK**
Constant	.0749 ** (.0332)	.0772 *** (.0171)	.0163 (.0265)	.1563 *** (.0424)	.0487 * (.0262)	.1296 *** (.0450)	.1695 ** (.0703)	.0994 *** (.0165)	.1269 *** (.0336)	.0634 *** (.0218)	.0790 *** (.0237)	.0655 ** (.0266)
CATEGG	-.0230 ** (.0108)	-.0239 *** (.0056)	-.0040 (.0086)	-.0501 *** (.0136)	-.0150 * (.0086)	-.0426 *** (.0151)	-.0557 ** (.0238)	-.0302 *** (.0054)	-.0422 *** (.0120)	-.0193 *** (.0072)	-.0259 *** (.0083)	-.0215 ** (.0093)
Log-likelihood	151.199	158.552	161.501	124.988	157.182	164.638	81.160	96.957	144.037	184.960	139.740	161.911
Wald χ^2	4.54	18.23	31.64	59.53	8.61	117.18	9.85	546.49	58.65	13.20	56.44	6.89
R^2	0.5082	0.4594	0.3757	0.5215	0.7578	0.3170	0.8590	0.4168	-	0.5658	0.7633	0.1880
ARIMA ARCH Corrections	-	MA(1)	AR(1) MA(1)	AR(1)	MA(1)	AR(1) MA(1)	AR(1)	AR(1) MA(1)	AR(1) ARCH(1)	MA(1)	MA(1)	AR(1)
BIC	291.908	302.450	304.813	235.870	300.629	310.959	150.143	280.400	271.238	355.164	265.617	309.167
SW W Test	(0.5241)	(0.3828)	(0.5034)	(0.5884)	(0.7445)	(0.0500)	(0.4487)	(0.0286)	(0.8900)	(0.9593)	(0.4804)	(0.0931)
LB Q Test	(0.9252)	(0.5923)	(0.4508)	(0.4075)	(0.3360)	(0.8710)	(0.4963)	(0.3402)	(0.0973)	(0.8884)	(0.5494)	(0.2946)
Granger-causality	-	→ ←	←	-	→ ←	→	-	→ ←	→	-	-	-

N.B.: Newey-West HAC estimator and Kalman filter applied. Significance levels: * 10%, ** 5%, *** 1%. Robust Standard Errors in brackets. → Granger causality exists only from the dependent towards the independent variable. ← Granger causality exists only from the independent towards the dependent variable.

Source: our calculations on AMECO and TED data.

Table 4 – Relationships among economic growth rate, public expenditure and first differences in expenditure in some countries adhering to EU-27 (1970-2009).

Indipendent Variables	Dependent Variable: d(TGDPGK)											
	AUT	**BEL**	**DNK**	**FIN**	**FRA**	**GER**	**GRE**	**IRL**	**ITA**	**PBS**	**POR**	**UK**
Constant	.0321	.0904 ***	.0198	.0446 ***	.0646 ***	.1405 ***	-.0755	.0663 ***	.0262	.0676 **	.0442	.0314 **
	(.0348)	(.0183)	(.0242)	(.0094)	(.0145)	(.0526)	(.0886)	(.0129)	(.0268)	(.0289)	(.0349)	(.0152)
CATEGG	-.0090	-.0275 ***	-.0051	-.0126 ***	-.0200 ***	-.0462 ***	.0277	-.0197 ***	-.0078	-.0207 **	-.0137	-.0095 *
	(.0113)	(.0061)	(.0078)	(.0031)	(.0047)	(.0176)	(.0303)	(.0045)	(.0089)	(.0095)	(.0121)	(.0052)
d(CATEGG)	-.0535 ***	-.0582 ***	-.0799 ***	-.1261 ***	-.0883 ***	-.0735 ***	-.0459 **	-.0902 ***	-.0341 ***	-.0476 **	-.0252 *	-.0482 ***
	(.0215)	(.0201)	(.0155)	(.0091)	(.0111)	(.0279)	(.0188)	(.0177)	(.0085)	(.0185)	(.0143)	(.0146)
Log-likelihood	150.028	178.984	162.571	21298.80	164.370	163.023	73.218	80.275	143.433	184.224	136.637	181.939
R^2	0.6027	0.6658	0.5310	-	0.8930	0.4037	0.8000	0.5420	0.8749	0.6443	0.7819	0.4879
ARIMA ARCH Corrections	-	AR(1) MA(1)	-	AR(1) MA(1) ARCH(1)	-	AR(1) MA(1)	MA(1)	AR(1)	MA(1)	AR(1)	MA(1)	AR(1) MA(1)
BIC	286.194	336.142	310.698	283.945	315.135	304.221	131.457	144.872	270.205	350.129	256.104	342.052
SW W Test	(0.7536)	(0.8233)	(0.0428)	(0.5881)	(0.3107)	(0.0000)	(0.4201)	(0.3406)	(0.7518)	(0.7971)	(0.9645)	(0.0157)
LB Q Test	(0.9958)	(0.7022)	(0.9232)	(0.7091)	(0.7835)	(0.9336)	(0.2604)	(0.8864)	(0.6059)	(0.9929)	(0.3579)	(0.8614)

N.B.: Newey-West HAC estimator and Kalman filter applied. Significance levels: * 10%, ** 5%, *** 1%. Robust Standard Errors in brackets.

Source: our calculations on AMECO and TED data.

Table 5 – Relationships between variation of economic growth rate and first differences in public expenditure in some countries adhering to EU-27 (1970-2009).

Indipendent Variables	**Dependent Variable: d2(TGDPGK)**											
	AUT	**BEL**	**DNK**	**FIN**	**FRA**	**GER**	**GRE**	**IRL**	**ITA**	**PBS**	**POR**	**UK**
Constant	-.0001	.0000	-.0001	.0003	.0001	.0001	.0003	-.0008	.0000	-.0001	.0002	.0000
	(.0002)	(.0003)	(.0005)	(.0008)	(.0003)	(.0005)	(.0003)	(.0006)	(.0004)	(.0003)	(.0007)	(.0005)
d(CATEGG)	-.0452 *	-.0638 **	-.0293	-.0642 ***	-.0510 ***	-.0889 ***	-.0544 ***	-.0633 ***	-.0605 ***	-.0592 ***	-.0476 *	-.0430 *
	(.0257)	(.0322)	(.0259)	(.0250)	(.0188)	(.0265)	(.0179)	(.0174)	(.0156)	(.0160)	(.0271)	(.0228)
Log-likelihood	142.823	148.475	133.114	135.37	132.688	153.183	94.942	91.220	138.806	180.063	131.327	167.596
Wald χ^2	24.31	96.29	49.29	42.48	12.45	23.90	32.02	28.23	40.41	33.99	46.49	25.11
R^2	0.5380	0.4536	0.3692	0.4713	0.5257	0.3230	0.8874	0.4354	0.8023	0.5912	0.7177	0.1861
ARIMA ARCH Corrections	AR(2)	AR(1) MA(1)	AR(1) MA(1)	AR(1) MA(1)	AR(1)	AR(1)	AR(2)	AR(1)	AR(1) MA(1)	AR(1)	AR(1) MA(1)	AR(1) MA(1)
BIC	268.318	278.763	248.174	253.251	251.770	291.815	174.906	169.899	260.952	345.471	245.485	317.003
SW W Test	(0.2714)	(0.0733)	(0.0214)	(0.5664)	(0.5192)	(0.0600)	(0.5711)	(0.2207)	(0.2219)	(0.0145)	(0.0105)	(0.0439)
LB Q Test	(0.9150)	(0.3805)	(0.2225)	(0.5966)	(0.3641)	(0.7068)	(0.8033)	(0.4613)	(0.3749)	(0.9375)	(0.4108)	(0.5501)

N.B.: Newey-West HAC estimator and Kalman filter applied. Significance levels: * 10%, ** 5%, *** 1%. Robust Standard Errors in brackets.

Source: our calculations on AMECO and TED data.

Table 6 – "BARS curve" in some countries adhering to EU-27 (1970-2009).

Indipendent Variables	**Dependent Variable: d(TGDPGK)**											
	AUT	**BEL**	**DNK**	**FIN**	**FRA**	**GER**	**GRE**	**IRL**	**ITA**	**PBS**	**POR**	**UK**
Constant	5.0870 *** (.0554)	.6598 *** (.0000)	2.2004 *** (.1971)	-.9094 *** (.0000)	-3.1221 *** (.0000)	-1.8816 *** (.0000)	4.3571 *** (.0000)	-.7677 ** (.3208)	.9400 ** (.3896)	1.0941 (.0009)	-2.0833 *** (.3797)	-.3547 *** (.0000)
CATEGG	1.8006 *** (.0184)	.1951 *** (.0085)	.7993 *** (.0755)	.3718 *** (.0255)	1.2007 *** (.0165)	.8490 *** (.0299)	1.6564 *** (.0322)	.4118 *** (.1363)	.3215 ** (.1502)	.3272 *** (.0152)	-.9568 *** (.1527)	.1857 *** (.0177)
CATEGG^2	-2.3563 *** (.0216)	-.2756 *** (.0065)	-1.0346 *** (.0954)	-.4604 *** (.0193)	-1.5202 *** (.0125)	1.0109 *** (.0226)	-2.1060 *** (.0238)	-.4630 *** (.1652)	-.4266 ** (.1896)	-.4605 *** (.0114)	-1.1315 *** (.1892)	-.2134 *** (.0134)
N	34	40	39	35	32	39	22	25	30	41	33	40
Log-likelihood	152.365	176.540	163.332	142.685	158.389	164.918	98.645	100.176	143.544	189.399	110.492	179.847
R^2	0.5418	0.5180	-	0.5803	0.7756	0.3278	0.8787	0.5522	0.8231	-	0.8029	0.2710
ARIMA ARCH Corrections	AR(1) MA(1)	AR(1) MA(1)	AR(1) MA(1) ARCH(1)	MA(1)	MA(1)	AR(1) MA(1)	AR(1) MA(1)	MA(1)	MA(1)	AR(1) MA(1) ARCH(1)	MA(1)	MA(1)
BIC	283.750	334.762	301.201	271.264	303.042	311.517	182.066	178.106	270.252	356.664	203.6543	345.040
SW W Test	(0.5241)	(0.382)	(0.9875)	(0.4829)	(0.7445)	(0.0000)	(0.4541)	(0.2431)	(0.9057)	(0.8938)	(0.2504)	(0.0225)
LB Q Test	(0.9252)	(0.5923)	(0.5198)	(0.4255)	(0.3360)	(0.9277)	(0.1653)	(0.9507)	(0.5805)	(0.7964)	(0.0692)	(0.7114)
Curve peak	38.21%	35.39%	38.63%	40.38%	39.49%	41.99%	39.33%	44.47%	37.68%	35.52%	42.28%	43.50%

N.B.: Newey-West HAC estimator and Kalman filter applied. Significance levels: * 10%, ** 5%, *** 1%. Robust Standard Errors in brackets.

Source: our calculations on AMECO and TED data.

Table 7 – Possible margins for public expenditure reduction in some countries of EU-27.

Country	Size of government (% of GDP, 2009)	"BARS curve" optimum (% of GDP)	Percentage change in spending as a share of GDP
Austria	52.24	38.21	-14.03
Belgium	53.48	35.39	-18.09
Denmark	55.41	38.63	-16.78
Finland	54.07	40.38	-13.69
France	55.15	39.49	-15.66
Germany	46.02	41.99	-5.65
Greece	49.97	39.33	-10.64
Ireland	46.74	44.47	-2.27
Italy	51.52	37.68	-13.84
Luxembourg	42.08	39.78	-2.31
The Netherlands	49.01	35.52	-13.49
Portugal	51.54	42.28	-9.26
UK	51.17	43.50	-7.67

Source: our calculations on AMECO and TED data.

The marked differences in the peaks of the BARS curves of these countries may depend from several factors, ranging from the different composition of the public expenditures; to the different degrees of efficiency of the public spending process; and from the way of financing them to the different degrees of tax evasion which increases the burden of those who do not evade. Different economic structures and institutions and different levels of per capita GDP might affect the capability of growth. A panel analysis may help the goal more in detail, while broadening the number of the states under consideration.

4.2 – Panel Analysis of the relationship between economic growth and Government size

The estimates of regression models for panel data essentially depend on hypotheses regarding the intercept, coefficients and error terms.

The first and more simple approach consists in analyzing the relationship between economic growth rate and public expenditure (measured as aggregate income share) and its first differences. Following the works of VEDDER and GALLAWAY (1998), ILLARIONOV and PIVAVORA (2002), PEVCIN (2004), DAVIES (2008), CHOBANOV and MLADENOVA (2009) the GLS-RE approach was used, with AR(1)-type disturbances. As it is pointed out in Table 8, the coefficient of the explanatory variable *CATEGG* in the first column indicates that a country having a 10% higher public expenditure records a decrease in its GDP growth equal to 2.1%. Public expenditure alone can explain more than 22% of the differences in growth rate among the 27 countries considered, during the reference period.

Moreover, economic growth is negatively correlated with the variation in public expenditure, thus reinforcing the negative effect that the increase in Government size can trigger on economic growth. The empirical evidence found suggests that big Governments impose big penalties upon their people, in the form of more limited GDP growth rates. Thus, reductions in the growth rate of economic activity are more accentuated in countries showing a strong public intervention in their economies. In fact, the results in the third column of Table 6 show that an increase of one percentage point in the public expenditure variation corresponds approximately to a reduction of 0.04% in the acceleration rate of economic growth.

Table 8 – Relationships between public expenditure and GDP growth, GLS-RE approach (EU-27, 1970-2009).

Indipendent variable	**Dependent variable**		
	d(TGDPGK)		**d2(TGDPGK)**
Constant	.0677*** (.0069)	.0589*** (.0069)	-.0003 (.0003)
CATEGG	-.0208*** (.0023)	-.0178*** (.0024)	-
d(CATEGG)	-	-.0335*** (.0044)	-.0402*** (.0056)
Number of obs.	593	569	566
Number of groups	27	27	27
$R^2_{overall}$	0.2259	0.3071	0.0839
Wald χ^2	78.8103 (0.0000)	138.3321 (0.0000)	51.0725 (0.0000)
ARIMA Correction	AR(1)	AR(1)	AR(1)
$\rho^{estimated}$	.2914	.2771	-.1985
$(\Sigma_u; \Sigma_e)$	(.0016; .0041)	(.0015; .0038)	(0; .0050)
$(\theta_{min}; \theta_{max})$	(.2683; 0.4903)	(.2807; .5210)	(0; 0)
Baltagi-Wu LBI test	1.4561	1.4904	2.3594
Bhargava *et al.* DW M test	1.2352	1.2642	2.1412

N.B.: Correzione di White per l'eteroschedasticità – Procedura di stima a 2 stadi per la correlazione. Livelli di significatività: * 10%, ** 5%, *** 1%.

In parentesi, per le variabili, vengono riportati gli *Standard Errors* Robusti.

In Table 9, instead, the results of the "BARS curve" estimates for the

EU-27 countries are reported, in the specification of equation *[4]*. As we can see, using four different approaches (fixed effects models with an AR(1) factor, generalized estimate equations, PRAIS-WINSTEN for panel data and Generalized Least Squares for panel data) we reach a complete empirical evidence showing the existence of a "BARS curve" for this group of countries. The five models pinpoint a point of maximum of the curve between 35.6% and 37.3%, in any case much below both the average value (47.9%) and the median one(47.6%) registered for the group in 2009, thus in any case policy implications suggest an expenditure reduction.

Table 9 – "BARS curve" for EU-27 (1970-2009).

Dependent Variable: (d(TGDPGK)	***Fixed Effects with AR(1) Disturbances***	***GEE Population-Averaged***	***Prais-Winsten (PCSEs) Panel***	***C-S T-S FGLS***	***POLS Driscoll-Kraay SE***
Constant	.6042*** (.1395)	.6201** (.2542)	.7924*** (.1620)	.6068*** (.1407)	.6183*** (.1781)
CATEGG	.1946** (.0784)	.2015** (.0973)	.2634*** (.0615)	.1918*** (.0547)	.2033*** (.0688)
CATEGG²	-.2645*** (.0979)	-.2729** (.1233)	-.3537*** (.0782)	-.2629*** (.0689)	-.2738*** (.0868)
AR Correction	1	1	1	1	-
Number of obs.	593	593	593	593	593
Number of groups	27	27	27	27	27
Wald χ^2	23.1670 (a) (0.0000)	75.0533 (0.0000)	83.5109 (0.0000)	151.6166 (0.0207)	26.28 (a) (0.0000)
Log-likelihood	2338.3319	-	-	-	-
R^2	0.2519	-	0.3529	-	0.2467
BIC	-4657.648	-	-	-	-
AIC	-4670.664	-	-	-	-
$\rho^{estimated}$	.2920	-	.02713	-	-
Scale Parameter	-	.0000	-	-	-
Baltagi-Wu LBI test	1.4553	-	-	-	-
Bhargava *et al.* DW M test	1.2393	-	-	-	-
Curve peak	36.78%	36.92%	37.29%	35.62%	37.12%
Mean CATEGG (b)			47.90%		
Median CATEGG (b)			47.64%		

N.B.: White correction for heteroscedasticity; (a) F Stat.; (b) in 2009. Significance levels:* 10%, ** 5%, *** 1%. Robust Standard Errors in brackets.

Since EU-27 is not a homogeneous panel, we choose to estimate some sub-groups of countries, arranged on the basis of common history or Welfare State' similarities. Then, as in KUSTEPELI (2005) and HAKRO (2009), we break up the panel into different groups, homogeneous according to different characteristics; from the point of view of the welfare model: Anglo-Saxon countries, Eastern European, Central European, Scandinavian and Mediterranean; from the point of view of per capita income, determining four subgroups (or quartiles) in which the value of the per capita GDP is not too dissimilar; the Euro-area, in order to test the presence of a "BARS curve" for EMU countries.

Concerning the Anglo-Saxon countries, we find a clear empirical evidence in favour of the presence of the curve. Both the estimate methods used produce an optimal share of public expenditure between 3 to 6 p.p. lower than the 2009 one. The analysis of the cross-sectional dependence shows that the errors are not identically and independently distributed (ε~i.i.d.) for both variables (see Table 10)[14].

Table 10 – "BARS curve" for Anglo-Saxon countries (Ireland, Malta, and the United Kingdom, 1970-2009).

Dependent Variable: (d(TGDPGK)	***Between WLS with Bootstrap***	***GEE Population-Averaged***
Constant	9.1454***	-.4326*
	(3.4361)	(.2306)
CATEGG	4.1034**	.2378**
	(1.5152)	(.1032)
CATEGG²	-4.8892***	-.2654**
	(1.8155)	(.1233)
Number of observations	61	61
Number of groups	3	3
Wald χ²	7.46	5.31
	(0.0240)	(0.0212)
Log-likelihood	13.1751	-
R²	0.0388 (a)	-
Scale Parameter	-	.0000
Friedman C S I test	50.387 (0.0000) per TGDPGK 22.242 (0.0000) per CATEGG	
Curve peak	41.96%	44.80%
Mean CATEGG (b)	47.88%	
Median CATEGG (b)	46.74%	

N.B.: White's correction for heteroscedasticity; (a) $R^2_{overall}$; (b) in 2009. Significance levels: * 10%, ** 5%, *** 1%. Robust Standard Errors in brackets.

Also in the case of Eastern European countries we find the presence of

[14] See: SARAFIDIS V., DE HOYOS R.E., *On testing for cross sectional dependence in panel data models*, University of Cambridge, Mimeo, 2006; FREES E.W., *Longitudinal and Panel Data: Analysis and Applications in Social Sciences*, Cambridge University Press, Cambridge, 2004; PESARAN M.H., *General diagnostic tests for cross section dependence in panels*, in "Cambridge Working Papers in Economics", University of Cambridge, Faculty of Economics, No. 0435, 2004; FREES E.W., *Assessing cross-sectional correlations in panel data*, in "Journal of Econometrics", 69, 1995, pp. 393-414; FRIEDMAN M., *The use of ranks to avoid the assumption of normality implicit in the analysis of variance*, in "Journal of the American Statistical Association", 32, 1937, pp. 675-701.

the “BARS curve”, using five different estimate methods. Here, the optimal expenditure share equals to approximately 40%, more than 4 p.p. below the average of 2009. For these countries, as well, the two variables show the presence of cross-correlation (Table 11).

Table 11 – "BARS curve" for Eastern European countries (Bulgaria, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Romania, Slovakia, and Slovenia, 1970-2009).

Dependent Variable: (d(TGDPGK)	***Fixed Effects with AR(1) Disturbances***	***Random Effects with AR(1) Disturbances***	***Prais-Winsten (PCSEs) Panel***	***C-S T-S FGLS***	***GEE Population-Averaged***
Constant	2.5156*** (.5243)	1.8294*** (.5346)	1.8012*** (.5008)	1.4758*** (.3642)	1.7254*** (.6925)
CATEGG	.9936*** (.3019)	.7224*** (.2237)	.7113*** (.2033)	.5726*** (.1502)	.6786*** (.2767)
CATEGG²	-1.2428*** (.3681)	-.9031*** (.2738)	-.8892*** (.2518)	-.7204*** (.1848)	-.8497*** (.3448)
AR Correction	1	1	1	1	1
Number of obs.	127	137	137	137	137
Number of groups	10	10	10	10	10
Wald χ^2	11.28 (a) (0.0000)	21.85 (a) (0.0001)	15.37 (0.0005)	28.28 (0.0000)	6.51 (0.0385)
Log-likelihood	492.1495	-	-	-	-
R^2	0.1640 (b)	0.1627 (c)	0.1491	-	-
RMSE	-	-	.0053	-	-
BIC	-969.766	-	-	-	-
AIC	-978.299	-	-	-	-
$\rho^{estimated}$	.2664	.2664	.3722	-	-
(Σ_u; Σ_e)	(.0031; .0053)	(.0011; .0053)	-	-	-
(θ_{min}; θ_{max})	-	(.1219; .1465)	-	-	-
Scale Parameter	-	-	-	-	0.0000
Baltagi-Wu LBI test	1.5078	1.5078	-	-	-
Bhargava *et al.* DW M test	1.1936	1.1936	-	-	-
Friedman C S I test	65.586 (0.0000) per TGDPGK 23.935 (0.0044) per CATEGG				
Curve peak	39.98%	39.99%	40.00%	39.74%	39.94%
Mean CATEGG (b)	44.11%				
Median CATEGG (b)	44.43%				

N.B.: White's correction for heteroscedasticity; (a) F Stat.; (b) in 2009. Significance levels: * 10%, ** 5%, *** 1%. Robust Standard Errors in brackets.

Regarding Central European countries, we find once again a strong empirical evidence supporting the curve. Moreover, in this case, while the optimal expenditure curve is attested between 37% and 39%, the average in 2009 was equal to 47%, pointing out the need for a reduction of the expenditure share in the aggregate income almost equal to 10 p.p. The two variables show once again the presence of cross-dependence (Table 12).

Table 12 – "BARS curve" for Central European countries (Austria, Belgium, France, Germany, Italy, Luxembourg, and the Netherlands, 1970-2009).

Dependent Variable: (d(TGDPGK)	*Between WLS with Jackknife*	*Random Effects with AR(1) Disturbances*	*Prais-Winsten (PCSEs) Panel*	*C-S T-S FGLS*	*GEE Population-Averaged*
Constant	3.2934*** (.8116)	1.0322*** (.3768)	.7667** (.3834)	.7323** (.3235)	1.3096*** (.3577)
CATEGG	1.2489*** (.3226)	.3558** (.1469)	.2503* (.1429)	.2371* (.1242)	.4605*** (.1383)
$CATEGG^2$	1.5889*** (.4030)	-.4704** (.1850)	-.3385* (.1832)	-.3217** (.1573)	-.6039*** (.1747)
AR Correction	-	-	1	1	1
Number of obs.	226	226	226	226	226
Number of groups	7	7	7	7	7
Wald χ^2	119.61 (a) (0.0000)	137.58 (0.0000)	35.81 (0.0000)	57.37 (0.0000)	281.32 (0.0000)
Log-likelihood	44.1401	-	-	-	-
R^2	0.9366 (b)	0.2210 (c)	0.3180	-	-
RMSE	.0006	.0033	.0032	-	-
BIC	-72.019	-	-	-	-
AIC	-82.280	-	-	-	-
$\rho^{estimated}$	-	.00012	.1648	-	-
(Σ_u; Σ_e)	-	(.0001; .0032)	-	-	-
(θ_{min}; θ_{max})	-	(.0109; .0214)	-	-	-
Scale Parameter	-	-	-	-	0.0000
Friedman C S I test	159.724 (0.0000) per TGDPGK 53.289 (0.0000) per CATEGG				
Curve peak	39.30%	37.82%	36.98%	36.84%	38.12%
Mean CATEGG (d)	47.00%				
Median CATEGG (d)	48.79%				

N.B.: White's correction for heteroscedasticity; (a) F Stat.; (b) $R^2_{between}$; (c) $R^2_{overall}$; (d) in 2009. Significance levels: * 10%, ** 5%, *** 1%. Robust Standard Errors in brackets.

Regarding the Scandinavian countries, the empirical evidence found is contrary to the presence of the "BARS curve". In fact, even though the explanatory variables carry the expected sign, their statistical relevance is only attested around 20%. In any case, using the estimate coefficients, a share of optimal expenditure equal to 37.9% is obtained, neatly below the group average in 2009. For those countries as well, the two variables are affected by a cross-sectional type dependence (Table 13).

Table 13 – "BARS curve" for Scandinavian countries (Denmark, Finland, and Sweden, 1970-2009).

Dependent Variable: (d(TGDPGK)	***Fixed Effects with AR(1) Disturbances***
Constant	1.1206** (.4745)
CATEGG	.3883 (.3072)
$CATEGG^2$	-.5121 (.3953)
Number of observations	85
Number of groups	3
F	1.93 (0.1526)
RMSE	.0038
R^2_{within}	.0459
ρ	.0585
(Σ_u; Σ_e)	(.0010; .0039)
Baltagi-Wu LBI test	1.2638
Bhargava *et al.* DW M test	1.1739
Friedman C S I test	84.837 (0.0000) per TGDPGK 32.900 (0.0000) per CATEGG
Curve peak	37.91%
Mean CATEGG (a)	55.02%
Median CATEGG (a)	55.41%

N.B.: White's correction for heteroscedasticity; (a) in 2009. Significance levels: * 10%, ** 5%, *** 1%. Robust Standard Errors in brackets.

Finally, regarding the Mediterranean countries' group (Cyprus, Greece, Portugal and Spain) the empirical evidence is favourable, and while the optimal expenditure curve is attested on 43%, the average in 2009 was above 47%, evoking the need for a reduction of the expenditure share on aggregate income of 4.5%. The two variables show once again the presence of cross-dependence (Table 14).

Table 14 – "BARS curve" regarding Mediterranean countries (Cyprus, Greece, Portugal, and Spain, 1970-2009).

Dependent Variable: (d(TGDPGK)	***GEE Population-Averaged***
Constant	-2.0190*** (.4377)
CATEGG	.9911*** (.1958)
CATEGG^2	-1.1444*** (.2333)
Number of observations	81
Number of groups	4
Wald χ^2	49.10 (0.0000)
Scale Parameter	.0000
Friedman C S I test	65.130 (0.0000) per TGDPGK 13.088 (0.0045) per CATEGG
Curve peak	43.30%
Mean CATEGG (a)	47.79%
Median CATEGG (a)	47.59%

N.B.: White's correction for heteroscedasticity; (a) in 2009. Significance levels: * 10%, ** 5%, *** 1%. Robust Standard Errors in brackets.

Analyzing country aggregation according to the per capita income, for the group of "richer" countries (fourth quartile of our distribution) we obtain a strong empirical evidence supporting the curve, the peak of which is between 35% and 38%, some 13 to 16 p.p. below the average in 2009. For both variables problems related to the cross-sectional dependence remain (Table 15).

Table 15 – "BARS curve" regarding the countries of the fourth quartile (Austria, Denmark, Finland, Ireland, Luxembourg, the Netherlands, and Sweden, 1970-2009).

Dependent Variable: (d(TGDPGK)	***Between WLS with Jackknife***	***Random Effects with AR(1) Disturbances***	***Prais-Winsten (PCSEs) Panel***	***C-S T-S FGLS***	***GEE Population-Averaged***
Constant	1.1914** (.3791)	.4647** (.1967)	.5083** (.2467)	.5025** (.2556)	.4119*** (.1119)
CATEGG	.4187** (.1517)	.1399* (.0773)	.1545* (.0940)	.1527 (.0967)	.1177*** (.0439)
$CATEGG^2$	-.5490** (.1890)	-.1957** (.0969)	-.2153* (.1194)	-.2127* (.1231)	-.1685** (.0551)
AR Correction	-	-	1	1	1
Number of obs.	204	204	204	204	204
Number of groups	7	7	7	7	7
Wald χ^2	124.24 (a) (0.0000)	56.14 (0.0000)	43.76 (0.0000)	34.10 (0.0000)	131.44 (0.0000)
Log-likelihood	44.6202	-	-	-	-
R^2	0.9707 (b)	0.2660 (c)	0.2589	-	-
RMSE	.0005	.0042	.0038	-	-
BIC	73.28607	-	-	-	-
AIC	83.24043	-	-	-	-
$\rho^{estimated}$	-	0	-.0122	-	-
$(\Sigma_u; \Sigma_e)$	-	(0; .0042)	-	-	-
$(\theta_{min}; \theta_{max})$	-	(0; 0)	-	-	-
Scale Parameter	-	-	-	-	0.0000
Friedman C S I test	138.929 (0.0000) per TGDPGK 50.300 (0.0000) per CATEGG				
Curve peak	38.13%	35.74%	36.89%	35.88%	34.91%
Mean CATEGG (d)	50.91%				
Median CATEGG (d)	52.24%				

N.B.: White's correction for heteroscedasticity; (a) F Stat.; (b) $R^2_{between}$; (c) $R^2_{overall}$; (d) in 2009. Significance levels: * 10%, ** 5%, *** 1%. Robust Standard Errors in brackets.

Regarding the countries of the third quartile, too, the empirical evidence is favourable to the curve, showing the necessity of an expenditure reduction of approximately 15 p.p. Once again, the variables are affected by cross-dependence (Table 16).

Table 16 – "BARS curve" regarding the countries of the third quartile (Belgium, France, Germany, Italy, Slovenia, Spain, and United Kingdom, 1970-2009).

Dependent Variable: (d(TGDPGK)	***Prais-Winsten (PCSEs) Panel***
Constant	.4396** (.1913)
CATEGG	.1357* (.0734)
CATEGG^2	-.1879** (.0930)
Number of observations	189
Number of groups	7
Wald χ^2	55.48 (0.0000)
RMSE	.0028
R^2	0.2325
ρ	-.0347
Friedman C S I test	71.211 (0.0000) per TGDPGK 37.658 (0.0000) per CATEGG
Curve peak	36.12%
Mean CATEGG [(a)]	50.51%
Median CATEGG [(a)]	51.17%

N.B.: White's correction for heteroscedasticity; (a) in 2009. Significance levels: * 10%, ** 5%, *** 1%. Robust Standard Errors in brackets.

The second quartile countries, for which once again there exist a "BARS curve", show a need for public expenditure reduction lower than the third and fourth quartile ones. In fact, here the peak is attested between 38% and 39%, between 6 and 7 p.p. below the average of 2009. As in the former cases we find the presence of cross-sectional dependence (Table 17).

Table 17 – "BARS curve" regarding the second quartile countries (Cyprus, Estonia, Greece, Latvia, Malta, Portugal, and Slovakia, 1970-2009).

Dependent Variable: (d(TGDPGK)	***Fixed Effects with AR(1) Disturbances***	***Prais-Winsten (PCSEs) Panel***	***C-S T-S FGLS***
Constant	1.3459** (.5745)	1.0781** (.4660)	1.1224* (.6161)
CATEGG	.4987 (.3347)	.3776* (.1980)	.3948 (.2657)
CATEGG^2	-.6398 (.4066)	-.4959** (.2407)	-.5175 (.3213)
AR Correction	1	1	1
Number of obs.	116	116	116
Number of groups	7	7	7
Wald χ^2	9.40 (a) (0.0002)	28.56 (0.0000)	30.70 (0.0000)
Log-likelihood	454.2153	-	-
R^2	0.1495	0.2379	-
BIC	894.170	-	-
AIC	902.431	-	-
$\rho^{estimated}$	.2684	.4470	-
Scale Parameter	-	-	-
Baltagi-Wu LBI test	1.5135	-	-
Bhargava *et al.* DW M test	1.1617	-	-
Friedman C S I test	25.406 (0.0000) per TGDPGK 22.436 (0.0000) per CATEGG		
Curve peak	38.98%	38.08%	38.14%
Mean CATEGG (b)		45.37%	
Median CATEGG (b)		44.72%	

N.B.: White's correction for heteroscedasticity; (a) F Stat.; (b) in 2009. Significance levels: * 10%, ** 5%, *** 1%. Robust Standard Errors in brackets.

For "poorer" countries (belonging to the first quartile) in EU-27, a curve is marked out showing the need for a more limited expenditure, neatly lower than the reductions indicated for the other three quartiles. In this group, in fact, G^* is attested between 39 and 40.5%, just 4 or 5 p.p. lower than the average in 2009. The analysis of cross-sectional dependence shows that it exists for the aggregate income, while it can be excluded for public expenditure with a relevance level equal to 5% (but not 10%). Moreover, the variables seem to be cointegrated (Table 18).

Table 18 – "BARS curve" for the first quartile countries (Bulgaria, Czech Republic, Hungary, Lithuania, Poland, and Romania, 1970-2009).

Dependent Variable: (d(TGDPGK)	*Random Effects*	*Prais-Winsten (PCSEs) Panel*	*C-S T-S FGLS*	*Fixed Effects Driscoll-Kraay SE*
Constant	1.3304** (.6317)	.7716 (.4772)	.9248* (.4812)	1.541* (.6459)
CATEGG	.5365** (.2621)	.2887 (.1946)	.3558* (.1972)	.6305* (.2584)
$CATEGG^2$	-.6648** (.3217)	-.3679 (.2406)	-.4486* (.2433)	-.7770* (.3218)
AR Correction	-	1	1	-
Number of obs.	81	81	81	81
Number of groups	6	6	6	6
Wald χ^2	4.73 (0.0940)	5.83 (0.0541)	6.42 (0.0404)	3.19 (a) (0.1282)
RMSE	.0051	-	.0045	-
R^2	.0690	-	0.2804	0.0653 (b)
$\rho^{estimated}$	.1953	-	.5959	-
(Σ_u; Σ_e)	(.0025; .0052)	-	-	-
(θ_{min}; θ_{max})	(0.4780; 0.5231)	-	-	-
Friedman C S I test	38.830 (0.0000) per TGDPGK 10.109 (0.0722) per CATEGG			
Curve peak	40.35%	39.23%	39.65%	40.57%
Mean CATEGG (c)	44.30%			
Median CATEGG (c)	44.99%			

N.B. White's correction for heteroscedasticity; (a) F Stat.; (b) R^2_{within}; (c) in 2009. Significance levels: * 10%, ** 5%, *** 1%. Robust Standard Errors in brackets.

The last aggregation to be examined regards the countries that have the Euro as their national currency. The empirical evidence is favourable to the "BARS curve", and shows how a reduction of the expenditure share on the GDP of approximately 13% is desirable. In this case, too, effects of cross-dependence (for each variable, Table 19).

Table 19 – "BARS curve" for the Euro-area (Austria, Belgium, Cyprus, France, Germany, Greece, Ireland, Italy, Luxembourg, Malta, the Netherlands, Portugal, Slovakia, Slovenia, and Spain, 1970-2009).

Dependent Variable: (d(TGDPGK)	***C-S T-S FGLS***	***Prais-Winsten (PCSEs) Panel***
Constant	.4652** (.1878)	.4732*** (.1558)
CATEGG	.1319* (.0732)	.1375** (.0608)
$CATEGG^2$	-.1898** (.0921)	-.1956*** (.0764)
Number of observations	377	377
Number of groups	15	15
Wald χ^2	115.03 (0.0000)	92.55 (0.0000)
RMSE	-	.0034
R^2	-	0.3552
ρ	-	.0874
Friedman C S I test	107.861 (0.0000) per TGDPGK 61.116 (0.0000) per CATEGG	
Curve peak	34.74%	35.14%
Mean CATEGG (a)	48.19%	
Median CATEGG (a)	49.01%	

N.B.: White's correction for heteroscedasticity; (a) in 2009. Significance levels:* 10%, ** 5%, *** 1%. Robust Standard Errors in brackets.

Finally, in Table 20, in order to recap and facilitate the comparisons, we sum up the panel estimates.

Table 20 – BARS curve peak, summary of estimates (1970-2009).

Panel	***Median G/Y (a)***	***Mean G/Y (a)***	***Curve peak***
EU-27	47.64%	47.90%	37.29%
Euroarea	49.01%	48.19%	35.14%
Anglo-Saxon	46.74%	47.88%	41.96%
Eastern European	44.43%	44.11%	39.74%
Western Continental European	48.79%	47.00%	36.84%
Mediterranean	47.59%	47.79%	43.30%
I Quartile	44.99%	44.30%	39.65%
II Quartile	44.72%	45.37%	38.14%
III Quartile	51.17%	50.51%	36.12%
IV Quartile	52.24%	50.91%	35.88%

N.B.: (a) in 2009.
Source: our calculations on AMECO and TED data.

As is shown above, only for Scandinavian countries does not emerge a

BARS curve. For the others sub-groups, the optimal size of Government – measured by curve peak – lies in the interval 36-43%. It is quite interesting to note that for the Western Continental European countries – that have a common tradition of welfare state and complex labour institutions – the peak of the BARS curve is at a much lower level than for the Anglo-Saxon countries, which, at least from Thatcher's reforms (MAGAZZINO (2010c)), have a much more flexible labour market.

It is also interesting to note that the level of the peak of the BARS curve, on balance, increases with the increase of the per capita GDP, confirming the theoretical thesis that for countries who are in the former stages of economic development, the ratio of public expenditure to GDP needs to be higher than for the countries with high per capita GDP, because of the presence of indivisibilities in the supply of public goods.

5. – Concluding remarks and policy implications

In the second half of the 20th century there has been a general growth in the size and aims of Government, due to the institution of modern Welfare State systems and to the intervention of the public economy in the economic process. The rates of economic growth in the EU countries have undergone a systematic reduction trough time. Several factors, including the aging of the population, the preference for leisure and low risk, the excesses of regulations of real economy together with lack of regulation in the monetary and financial sector may have been among the causes of the reduction of growth rates. However, there are reason to believe that an "excessive" increase of the ratio of public expenditure to GDP reduces the rate of its growth, because the costs for the market economy of its financing may exceed its marginal productivity, and because the productivity of the market economy which is exposed to the competitive pressure tends to grow more than that of the public sector, which is not exposed to these pressures.

As for the 27 EU member countries we considered, a country having a public expenditure/GDP ratio above 10% the peak, on average, suffers a diminution in the GDP growth rate of 2.1%. Moreover, an increase of 1 percentage point in the variation of public expenditure approximately corresponds to a 0.04% reduction in the acceleration rate of economic activity.

Moreover, we found statistically significant inverse relationships between the growth of the ratios of public expenditure to GDP and the GDP growth rate, and their variations. Thus we were able to construct statistically significant BARS curves, for the 12 countries for whom we have homogeneous data for the entire period and, by panel data methodology, for the 27 EU countries as a whole, and for nine sub-groups of "homogenous" countries. In all these cases, the considered EU countries are on the right side of the "BARS curve". For the EU-27 panel the peak of the BARS curve is attained for an expenditure of 37.29% of GDP, while the average ratio is 47.9%: i.e. 10 points more. For the 12 EU countries for whom an individual time-series analysis was meaningful (because of the availability of data), we found that the peak of the BARS curve ranges from 35.39 for Belgium and 35.52 for The Netherlands to 44.47 for Ireland and 43.50 for UK. The minimum deviation from the level of the public expenditure that coincides with the peak of the BARS curve is that of Ireland with only 2.27 points, followed by Luxemburg with 2.31%. UK is in the third place with 7.67 points in excess. The maximum deviation is that of Belgium of about 18%, followed by Denmark with a percentage of about 16.78%.

Considering the four groups of EU countries homogeneous from the point of view of their welfare and labour market institutions, for whom we found a BARS curve, it emerged that for the Mediterranean countries whose welfare state is relatively young and the labour market not extensively regulated, the peak of the BARS curve is reached by a public expenditure at the share of 43.30% of GDP: not much different from that found for Portugal. Also for the Anglo-Saxon countries the peak of the BARS curve coincides with a share of public expenditures higher than 40% of GDP (41.96%). In this case too the labour market (after the Thatcher's reforms) is flexible, but the welfare state is relatively big. Likely an important factor that allows to a size of the public expenditure greater than 40% of GDP, to be consistent with GDP growth maximization it is its efficiency. For Eastern European countries, whose welfare state features and labour market institutions are small, the share of public expenditure consistent with the peak of the BARS curve is close to 40%. On the other hand, for the Western Continental EU countries, that have an old tradition of welfare state and of labour market regulations, but also a mature economy, the share of public expenditure coinciding with the peak of the BARS curve is equal to 36.84%. For these countries the excess of the level of public expenditure on that coinciding with GDP maximization it is of about 10 points. For the Mediterranean countries and the Eastern European countries it is of about 4 and an half points, and for the Anglo-Saxon countries of about 6 points. The peak of the BARS curve it is inversely correlated with the per capita GDP of the EU countries. For the quartile with the highest per capita GDP the level of public expenditure corresponding to the peak of the BARS curve is around 36%, as for the III quartile. It goes up to about 38% for the II quartile, and rising to 40% for the I quartile. The excess of the size of public expenditure on the share of GDP maximization is of about 4.5 points for the countries with the lower per capita GDP. It rises to about 7 points for the countries of the next quartile, and it spatters to about 15 points for those in the third and fourth quartile. On balance, one may argue that the need of reducing the share of public expenditure to GDP to reach the level consistent with GDP growth maximization increase with their per capita GDP.

We do not argue that one should reduce the Government sizes by percentage that allows to have a maximum GDP growth rate. Obviously, distributive factors do matter. However, the cost of equity in terms of GDP growth has to be considered, together with the question of present versus future welfare. On the other hand, macroeconomics may be elusive: one cannot argue that any percentage reduction in the share of public expenditure on GDP would have the same effect as for the increase of GDP. The efficiency of public expenditure varies from country to country. The composition of the public expenditure and of its financing should be considered. Indeed, as we have seen, the different groups of countries have their peak at a different point. And this outcome suggest that one should consider not only the size but also the quality of the two sides of the public finances of the various countries. Further research may prove useful to show light on the disparities emerging in the empirical analysis of individual countries and of the sub groups of the panel. However, the present research provides enough evidence that high GDP countries of EU have overcome the level of government size compatible with GDP growth rate maximization.

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Appendix

Table A – Stationarity tests for some EU members (1970-2009).

Country	***Stationarity tests***					
	Variable	**Deterministic component**	**ADF**	**ERS**	**PP**	**KPSS**
Austria	TGDPGK	constant, trend	-2.778 (NS)	-1.652 (NS)	-1.961 (NS)	0.273 (NS)
	CATEGG	constant	-2.483 (NS)	-1.471 (NS)	-2.490 (NS)	0.340 (NS)
Belgium	TGDPGK	constant, trend	-2.746 (NS)	-1.090 (NS)	-2.712 (NS)	0.343 (NS)
	CATEGG	constant	-2.316 (NS)	-0.925 (NS)	-2.711 (NS)	0.268 (NS)
Denmark	TGDPGK	constant, trend	-3.177 (NS)	-1.050 (NS)	-3.181 (NS)	0.393 (NS)
	CATEGG	constant	-2.140 (NS)	-0.606 (NS)	-2.112 (NS)	0.971 (NS)
Finland	TGDPGK	constant, trend	-2.492 (NS)	-1.554 (NS)	-2.301 (NS)	0.275 (NS)
	CATEGG	constant	-1.447 (NS)	-0.904 (NS)	-1.704 (NS)	0.632 (NS)
France	TGDPGK	constant, trend	-3.123 (NS)	-0.719 (NS)	-3.452 (TS)	0.519 (NS)
	CATEGG	constant, trend	-2.823 (NS)	-0.155 (NS)	-2.509 (NS)	1.06 (NS)
Greece	TGDPGK	constant, trend	-2.622 (NS)	-1.580 (NS)	-2.877 (NS)	0.261 (NS)
	CATEGG	constant, trend	-2.604 (NS)	-0.779 (NS)	-2.554 (NS)	0.506 (NS)
Ireland	TGDPGK	constant, trend	-1.757 (NS)	-1.654 (NS)	-1.135 (NS)	0.458 (NS)
	CATEGG	constant	-1.803 (NS)	-1.236 (NS)	-1.626 (NS)S	0.825 (NS)
Italy	TGDPGK	constant, trend	-2.690 (TS)	-0.070 (NS)	-2.623 (TS)	0.576 (NS)
	CATEGG	constant, trend	-3.508 (LS)	-0.564 (NS)	-3.346 (TS)	0.270 (NS)
Netherlands	TGDPGK	constant, trend	-3.547 (TS)	-1.613 (NS)	-2.115 (TS)	0.352 (NS)
	CATEGG	constant	-1.774 (NS)	-1.051 (NS)	-1.806 (NS)	0.532 (NS)
Portugal	TGDPGK	constant	-1.686 (NS)	-0.857 (NS)	-1.387 (NS)	0.496 (NS)
	CATEGG	constant, trend	-1.945 (NS)	0.997 (NS)	-1.866 (NS)	1.11 (NS)
UK	TGDPGK	constant, trend	-3.083 (NS)	-3.058 (NS)	-2.313 (NS)	0.227 (NS)
	CATEGG	constant	-0.981 (NS)	-1.261 (NS)	-0.730 (NS)	0.249 (NS)

Source: our elaborations on AMECO and TED data. Notes: LS: Level Stationary; NS: Non Stationary; TS: Trend Stationary.

Table B – Correlation matrix for some EU members (1970-2009).

Country	***Correlation between TGDPGK and CATEGG***
Austria	0.0725
Belgium	0.1738
Denmark	0.5766
Finland	0.4687
France	0.7048
Germany	0.4180
Greece	0.3844
Ireland	-0.8408
Italy	0.1196
Netherlands	-0.2078
Portugal	0.9164
UK	0.0505

Source: our elaborations on AMECO and TED data.

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