Fiscal illusion, fiscal consolidation and government expenditure composition in the OECD: a dynamic panel data approach.

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Abstract

Following the present atmosphere of budgetary cuts in the OECD countries we analyze the effects of fiscal consolidation in the composition of government expenditures by functions. We modify a standard median voter demand model to incorporate a form of fiscal illusion based on the idea that voters-taxpayers may not be fully aware of the true composition of government expenditures because all types of expenditures are not equally visible. Then we exploit the panel structure of the dataset – 26 OECD countries over the period 1970-1997- by GMM estimation of a dynamic model taking into account unobserved country effects and possible endogeinity of the explanatory variables. Under the assumption that governments know the relative visibility of each type of expenditure, the pattern of the last three decades indicates that defense, non-productive economic services and interest payments are the less visible expenditures. On the other hand, education and housing seem to be the more visible expenditures. However, income appears as the most important determinant of composition of government expenditures increasing health, education, social security, transport and communication and public services. Other influencing factors are relative public/private prices, age structure of the population and land area.

JEL Classification: D72, D78, H50, C23
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1. Introduction

As OECD member countries have recently begun to reduce their budgets, governments will be forced to make spending decisions. Fiscal discipline will require cuts in government expenditure leading to trade-off between different functions and affecting government expenditure composition. The pattern of the manner government expenditures size, either in expansions or contractions, have affected its allocation could shed some light on how fiscal discipline might influence public spending composition in the future.

The composition of the adjustment matters in determining the success of a stabilization plan. Thus, Zaghini (2001) and Ardagna (2001) show that fiscal consolidations that concentrate on the expenditure side are more effective at achieving household's welfare increases and long-lasting reduction of public liabilities than tax-based adjustments. Indeed, Zaghini (2001) shows that policymakers have recently shifted their priorities from a past policy of deficit financing to one of expenditure reduction policy. Furthermore, Alesina and Perotti (1995) show that adjustments among expenditures are also relevant: those based on social transfers and the wage component of public consumption are more persistent than the ones based on investments reduction and earned income tax increases. However, many articles argue that fiscal adjustments take place reducing investments because, as pointed out by Kamps (1985), Roubini and Sachs (1989) and Oxley and Martin (1991) political reasons make it easier to diminish this type of expenditure. Thus,

Henrekson (1988) in the case of Sweden and Haan et al. (1996) and Sturm (1998) for the OECD member states show that fiscal adjustment affects investments particularly.

Through its impact on the composition of public expenditures, fiscal consolidation can also affect economic growth. Some endogenous growth models incorporate the composition of government spending, among other fiscal variables, which are capable of yielding steady state effects (Devarajan et al., 1996, Kneller et al, 1999). Moreover Davoodi and Zou (1998) and Xie, Zou and Davoodi (1999) show that there is an optimal composition of government expenditures in which the optimal shares of each component equal its growth elasticity divided by the sum of all the function's growth elasticities. Therefore, the reduction of government expenditures can modify the composition of government expenditures approaching or deviating from its optimal structure.

Nevertheless, effects of fiscal consolidation on the structure of government expenditures by functions have received limited attention unlike its impact on the distribution of expenditures by economic type. Now, in this article we explore how fiscal consolidation has affected each of the functions of the government expenditures. For this purpose, we will modify a standard median voter model incorporating a type of fiscal illusion based, in a analogous way to the case of investments, on the idea that voters may not be aware of the true composition of government expenditures because all types of expenditures are not equally visible. We will also control for other relevant

factors in the determination of the composition of government expenditures observed in Sanz and Velazquez (2002).

In order to investigate all these aspects, in section 2 we review the existing literature on the effects of fiscal consolidation on each of the functions of government expenditures. In section 3, we go on to modify the standard median voter model including a form of fiscal illusion that allows us to analyze the composition of government expenditures. In section 4, we exploit the panel structure of the dataset by estimating a three stage least square static model each of the composition of government expenditure in 26 OECD countries over the period 1970-1997. Thus we will take into account the unobserved heterogeneity between countries as well as possible endogeneity and simultaneity of the explanatory variables. However, adapting to changed median voter demand may be a process requiring a slow adjustment in the public expenditure allocation. Hence, in section 5, we will analyze the determinants of government expenditure composition in a dynamic model framework. For this purpose we will use the Generalized Method of Moments (GMM) suggested by Arellano and Bond (1991) which, besides specific country effects, also takes account of endogeneity of the lagged dependent variable. Finally, in section 5, we draw the most significant conclusions.

2. Determinants of the functions of government expenditures

The literature analyzing government expenditure determinants has focused on

explaining the size of the public sector or one of its components independently (Tridimas, 2001). Many of the studies examining the composition of public expenditures has concentrated in testing Wagner's law[1] for each component (Courakis et al., 1993, Bairam, 1995, Chletsos and Kollias, 1997, Biswal et al.,1999 and Kolluri et al., 2000). As these authors argue the use of dissagregated public spending offers a better explanation of the effects of each determinant in the changes of government expenditures. However, Wagner-type model may be too simplistic (Georgakopoulos and Loizides, 1994), so that it may be necessary to look for determinants other than income to explain public expenditures. Furthermore, the composition analyzed is typically that of economic type (consumption, transfers and investment) or civilian and military expenditure.

Thus, Mauro (1998) explores how corruption affects the composition of government expenditures by functions after controlling for other factors (such as income per capita and population age structure). He finds that corruption reduced public spending on education and to a lesser extent on health. Neither defense, nor transportation displays any significant relationship with corruption[2]. Some other studies have adopted a consumer demand framework in which government maximizes a utility function and allocation of public consumption expenditures depend on prices of public services and total expenditures (see Tridimas, 2001, for a survey). Thereafter

[1] Wagner's law postulates that as per capita income rises in industrializating nations, their public sectors will grow in relative importance, (Bird, 1971, see Gemmell, 1993 and Peacock and Scott, 2000 for a survey on Wagner's Law).

[2] However, Gupta et al. (2001) find that corruption is associated with higher military spending as a share of both GDP and total government spending.

these studies tested and generally do not reject the constraints of the theory of demand. Tridimas, (2001) elaborates a model where the structure of public consumption expenditure is not only the outcome of an optimizing policy but also of the optimization of individual voter utility functions. Hence the allocation of expenditures depend on prices of public services and private consumption goods, total expenditure, the distribution of voter incomes and the expected change in voter support.

The scarcity of analyses of the composition of government expenditure leads us to explore the effects of various determinants on less aggregated government expenditure, which hopefully will lead to more reliable conclusions. Furthermore, we will take into account all the components of public spending and focus particularly on the effects of one of its determinants: total government size. If the reduction or expansion of the public sector size modifies some specific functions to a greater extent than others, then the composition of government expenditures will be altered. The relevance of this result arises from the fact that most fiscal consolidations have been achieved by reducing government expenditures instead of increasing revenues (Zaghini, 2001).

Some articles have already analyzed the effect of the reduction of government expenditures in an individual function. Thus, Cashin et al. (2001) and Baqir (2002) show for a sample of developing and developed countries during 1985-1998 that when governments are faced with the need to cut overall expenditures, education and health are relatively more protected. Hicks and Kubisch (1984) also find that social spending

may be more resilient to cuts in real government expenditures than defense, and that production and infrastructure expenditures are the most vulnerable. In fact, Looney (1997) suggests that military expenditure face hard budgetary constraints while Davoodi et al. (1999) and Gupta et al. (2001) find that IMF-supported programs are associated with lower military expenditures. On the other hand, Ravallion (2002) finds that fiscal consolidation in Argentina in the decade of the 80's and the 90's led to more than proportionate cuts in education, health and social security spending. Along these lines, Jonakin and Stephens (1999) reveal that countries of Central America have changed their composition of government expenditures after entering into formal agreements of adjustments and stabilization policies with international organizations. In particular these countries have reduced the shares devoted to human and physical infrastructure while at the same time increased the shares allocated to defence, transfers and interest payments.

Now, in this section we will use the set of variables pointed out by Sanz and Velazquez (2002) as determining the composition of government expenditures for controlling other factors affecting public spending other than the size of public sector. In this respect, the functions will be arranged in the order introduced by Oxley and Martin (1991), Saunders (1993), Kneller et al. (1999) and shown in Table 1. This classification is very similar to the one used in the Classification of Functions of the Government (COFOG, United Nations, 1981, 2000): public services, defense, health, education, housing, transport and communications, social security and other expenditures. Some variables appeared to be common determinants of the eight

different functions of public spending considered: income, relative public/private prices, population, its density and age structure, institutional factors, and interrelations among functions, reflecting a certain degree of substitution or complementary.

[Table 1]

3. Theoretical model

The base model under which the fiscal consolidation and other demographic determinants of public spending by functions are considered is the median voter model, developed from the studies of Borcherding and Deacon (1972) and Bergstrom and Goodman (1973). In this model it is assumed that citizens vote by means of a majority system and that the size of the public sector is the single issue to be decided. The size of government expenditure will be a function of the median voter's preferences and income, which will be by assumption the median income, together with his perception of the public/private sector price ratio. In fact, the function of the median voter's demand for government expenditure will be expressed by:

$$G_i = aY_i^{\alpha} P_{gi}^{\beta}; \quad \text{i} = 1,2,\ldots\ldots,\text{N}. \tag{1}$$

where:

G_i: quantity of public goods and services demanded by the median voter-taxpayer *i*.

P_{gi}: tax-price as perceived by the median voter-taxpayer *i*.

Y_i: median voter-taxpayer's *i* income, by assumption the median income.

α y β: income and price elasticities.

N: population.

Now, the price to be paid for public goods and services may be specified as:

$$P_{gi} = T_i CN^{\eta} \quad (2)$$

where:

T_i: median voter-taxpayer *i* share in total tax revenue.

C: cost of a unit of public goods and services.

η: degree of congestion of public goods and services.

As Bocherding and Deacon (1972) we assume non-discrimination in taxation[3] ($T_i = 1/N$), then $P_{gi} = CN^{(\eta-1)}$ and substituting (2) in (1) we would get:

$$G_i = aY_i^{\alpha} C^{\beta} N^{\beta(\eta-1)} \quad (3)$$

However, the voter-taxpayer's i consumption of public goods and services is not just the level of per capita public spending, but:

$$G_i = GN^{-\eta} \quad (4)$$

where:

G: total public spending in real terms demanded by the median voter-taxpayer *i*.

Note that if η is zero, it is a case of a pure public good or service, whereas if it is unity, it will be a private one. Furthermore, Gemmell et al. (1999) argue that with this specification the assumption is that the public/private sector price ratio remains constant

[3] This is an assumption of convenience based on data availability that should be modified wherever better information is available.

over time. To enable this ratio to be modified in the course of time, relative prices (C/Px, where Px is the price of the private sector) are included. Therefore, taking this circumstance into consideration, substituting (4) in (3) and aggregating to express the demand function for the total government expenditure, we get the expression[4]:

$$G = aY_i^{\alpha} P_r^{\beta} N^{\phi} \qquad (5)$$

where:

Y: total income of the country

ϕ: population elasticity and;

$\phi = (\beta + 1)(\eta - 1) + \eta - \alpha$

This is the standard median voter model. Now, we will also incorporate demographic factors affecting the utility function of the median voter. To be specific, we assume that the age structure of the population, land area and population density of the country in which the median voter lives reflects to some extent characteristics of the median voter. That is, we assume that a country with higher mean age will have also an older median voter. Comparing across time, as population in a country gets older also does the median voter, a factor which will influence his demand for public services. Certainly, some public services such as education and pensions are directed at specific age groups of population. Thus, Biswal et al. (1999) and Visco (2001) suggest that ageing of the population and the gain in life expectancy may increase demand for pensions, health and social services. In fact, the age structure of the population was already taken into account in the empirical analysis of

[4] We have taking into account that the data relating to total public spending in real terms in the theoretical model *G* would be the nominal expenditure *E* divided by the tax price P_{gi}. The data that is observed, however, is the nominal expenditure divided by the unit cost of *G*, *C*.

Borcherding and Deacon (1972), who pointed to school-aged population rates as relevant in exploring the determinants of cross-sectional variations of per capita public spending and Bergstrom and Goodman (1973), who include the share of population over 65 as a factor influencing the expenditure decision of a municipality.

The distance of the median voter to the public services will also increase his demand for certain types of public services (Ellis-Williams, 1987). In fact, Mueller (1989) points out that the actual definition of public goods and services and externalities connotes geographic proximity. Particularly the distance may affect his demand for transport and communications expenditures. Thus, we assume that the larger is the land area of a country the higher is the distance of the median voter to the public services. In fact, Borcherding and Deacon (1972) and Bergstrom and Goodman (1973) point out that urbanisation and land areas are relevant for the demand of citizens for public services and include these variables in their estimations. As population is already taken into account in the standard median voter model, the inclusion of land area reflects also the effect of population density, which is not fully captured in η. The congestion parameter captured by η reflects the divisibility of public service consumption and therefore the amount of public services captured by the median voter, assuming non-discrimination in expenditure (Borcherding and Deacon, 1972). However, rural population may be discriminated, as the amount of services captured by them may be less than for urban areas population from a given level of expenditure.

In short, ageing and distance to the public services could create an excess demand for services such as social security, health or transport and communications so that more of this public expenditure is demanded than would be in the absence of these demographic factors. Thus, observed expenditure will be greater for certain kinds of functions than predicted by a simple standard median voter model. Therefore, we assume that the median voter maximises a utility function which not only depends on public good and services G and consumption of a composite private good X but also on the age and distance to the public services of the median voter reflected by demographic factors of the country in which he lives Z_i, subject to a budget constraint such:

$$\max_{G_i} \; U\left(G_i, X_i, Z_i\right) \qquad s.t. \qquad P_{gi}G_i + X_i = Y_i \tag{6}$$

The inclusion of demographic factors in the utility function of the median voter still makes that the problem has the form of an ordinary two-good consumer problem where the price for G_i is P_{gi}. The demand for G_i will be of the form:

$$G_i = f\left(Y_i, P_{gi}, N_j, L\right); \quad j = 1, 2, 3. \tag{7}$$

where:

N_1, N_2, N_3: population in the median voter's country in the age interval of 0-15 years, 16-64 years and over 64, respectively.

L: land area of the country where the median voter lives.

If we suppose again constant elasticities, then we could express the demand as:

$$G_i = aY_i^{\alpha} P_{gi}^{\beta} \left(\prod_{j=1}^{3} \left(N_j \right)^{\phi_j} \right) L^{\phi_l}; \quad \text{i} = 1,...., \text{N}. \tag{8}$$

where:

ϕ_j, ϕ_l: age group and land area elasticities.

Following the same steps as the restricted model we arrive to:

$$G = aY_i^{\alpha} P_r^{\beta} N^{\phi} \prod_{j=1}^{3} N_j^{\phi_j} L^{\phi_l} \tag{9}$$

Note that the standard median voter model includes also per capita central government grants to median voter's municipality in the right hand side of the budget constraint equation (6). However, as this model will be used for explaining consolidated government expenditures, including all levels of administration spending, transfers between all levels of administration offset each other. Therefore, results should be taken with some caution since the median voter model perform less adequately in explaining public spending for higher levels of administration than for lowest level governments (Turnbull and Mitias, 1999). In fact Oates (1985) states that higher levels of administration are less responsive to voters than lower levels of government.

To apply the median voter model to the composition of government expenditures it will be useful to assume that the demand for each of the functions of government expenditures is also decided in a median voter model framework. In fact, the median voter may have different demand functions for each of the types of spending considered, according to its income, price perception and demographic factors. We assume that there is correlation between these determinants and the median voter relative preferences for each of the eight functions considered. Functions will be

arranged in a order very similar to the one used in the Classification of the Functions of the Government (COFOG, United Nations, 1981, 2000): public services, defense, health, education, housing, transport and communications, social security and other expenditures (mainly interest payments).

Voters choose by majority rule the allocation of government expenditures between these eight different functions. That means that total government size is decided simultaneously, since it is the sum of each of the functions. In this set up, median tastes dominate if the number of voters is large relative to the number of issues and the preference peaks of the citizenry are normally distributed over the issue space (Tullock, 1967). In addition, Turnbull and Djounddourias (1994) show that median voter demand model performs stronger when issues are multi-dimensional than in single-dimensional settings:

$$G_f = a_f Y_i^{\alpha_f} P_{r_f}^{\beta_f} N^{\phi_f} \left(\prod_{j=1}^{3} N_j^{\phi_{j,f}} \right) L^{\phi_{j,f}}; \quad f = 1,...8. \quad \sum_{1}^{8} G_f = G$$

and

$$P_{r_f} = \left(\frac{C_f}{Px} \right); \quad C = \left(\sum_{f=1}^{8} \frac{G_f}{G} C_f \right) \tag{10}$$

where:

G_f: quantity of public goods and services devoted to function *f* demanded by the median voter-taxpayer i.

C_f: cost of a unit of public goods and services of function *f*.

$P_{f,r}$: public prices for the function *f* relative to private prices.

f : eight functions considered;

$\alpha_f, \beta_f, \phi_f, \phi_{j,f}$, *and* $\phi_{l,f}$: income, price, population, age structure and land area elasticities of function *f*.

$$\phi_f = (\beta_f + 1)(\eta_f - 1) + \eta_f - \alpha_f$$

η_f: degree of congestion of public goods and services allocated to function *f*.

Ideally we would specify a cost unit C_f for each type of expenditure and the median income. However, these data are not available for every country of the OECD and on yearly basis. Therefore, we will assume that public deflator is the same across functions so that $C_f = C \ \forall \ f$ and hence $P_{r,f} = P_r \ \forall \ f$. Thus G_f will reflect the opportunity cost of not having assigned those resources to another function. We also assume that Y_i equals the mean income per capita in every country $\overline{Y}$.

Now, we will consider that voter-taxpayers may not be aware of the true government expenditure because public spending is not totally visible. Further all types of spending are not equally visible. Hence, the true composition of government expenditure is a function of the perceived composition ($\square_f$) and a perception parameter (ω_f):

$$\hat{G}_f = G_f^{1+\omega_f} \qquad f = 1,...8; \qquad \sum_1^8 G_f = G \qquad \sum_1^8 \hat{G}_f = \hat{G} \tag{11}$$

Where ω_f measures the degree visibility of function *f*. A negative value of ω_f will indicate that the perceived expenditure in function *f* is lower than the true expenditure. This will be a sort of fiscal illusion affecting the structure of expenditures. For these

functions where the median voter perceives the true total government expenditures of this function ω_f will take a value 0, i.e. is totally visible. The percentage of the expenditure in function *f* perceived by the median voter $\square_f/G_f$, is decreasing in this type of public expenditure G_f. This will also lead to a mismatch between total government expenditures perceived by the median voter $\square$ and true total public spending, as long as total perception parameter ω is negative:

$$\sum_{f=1}^{8} \hat{G}_f = \sum_{f=1}^{8} G_f^{1+\omega_f} = \hat{G} = G^{1+\omega}; \tag{12}$$

We do not know which characteristics may be lagging behind the visibility of function *f*. However we hypothesise that governments are fully aware of the different visibility of each type of spending as well as the total perception parameter and benefit from this asymmetric information. Governments devoting more resources to more visible expenditures may be seen as offering more public services than those allocating public expenditures to less visible type of spending, even when having the same total government expenditure. Moreover, governments facing the need for budgetary cuts will reduce the less visible expenditures. For example, Kamps (1985), Roubini and Sachs (1989) and Oxley and Martin (1991), Haan et al. (1996) and Sturm (1998) claim that public investment is less visible than public consumption or transfers. Hence, when fiscal consolidation take place, this reduces investments because political reasons make it easier to diminish this less visible expenditure.

Those expenditures related to long-term projects or with higher degree of pure public good nature such as defence or transport and communications may have

lower visibility than social security, education, health or general public services. We do not know the total perception parameter but we will hypothesise that governments reveal the relative visibility of each type of expenditure when expanding or contracting total government expenditure. If we want to focus on the composition of government expenditures rather that in absolute terms, from (12) we get:

$$\frac{G_f}{G} = \left(\frac{\hat{G}_f}{\hat{G}}\right)^{\frac{1}{1+\omega_f}} G^{\frac{\omega-\omega_f}{1+\omega_f}}; \qquad f = 1,2.....,8; \qquad \sum_{f=1}^{8} \frac{G_f}{G} = 1; \tag{13}$$

That is, the residual of the variance of government expenditures devoted to a type of spending G_f/G that can not be explained by the demand of the median voter $\square_f/\square$ is expected to give indications of how governments benefit from this asymmetric information. Replacing G by $\square$ in (9), G_f by $\square_f$ in (10) and taking into account the assumptions of $P_{r,f}=P_r \; \forall f$ and $Y_i=\overline{Y}$ we get:

$$\frac{G_f}{G} = \left(a_f / a\right)^{\frac{1}{1+\omega_f}} \overline{Y}^{\frac{\alpha_f-\alpha}{1+\omega_f}} P_r^{\frac{\beta_f-\beta}{1+\omega_f}} N^{\frac{\phi_f-\phi}{1+\omega_f}} \prod_{j=1}^{3} \left(N_j^{\frac{\phi_{j,f}-\phi_j}{1+\omega_f}}\right) L^{\frac{\phi_{l,f}-\phi_l}{1+\omega_f}} G^{\frac{\omega-\omega_f}{1+\omega_f}}; \quad f = 1,2....,8; \tag{14}$$

Hence, observed elasticity of each factor is affected by visibility of each type of spending. In addition, elasticities in equation (14) are relative to that of the total government expenditure. A zero value should not be interpreted as that the determinant does not affect the demand for the public good, but that it does not do so in a way significantly different from the rest of government expenditure. A positive and significant relative elasticity is thus reflecting that this function is more elastic than total government expenditure. Finally, a negative and significant relative

elasticity reflects is inelastic compare to total government expenditure. Functions with low visibility will have a positive coefficient associated with total government expenditure (ω-ω_f) and therefore when total government expenditure decreases (increases), function *f* contracts (expands) more than demanded by the median voter. For these functions with higher visibility, (ω-ω_f) will be negative indicating that this type of spending will be protected either in contractions or expansions of government expenditures. As functions will react differently to government contractions and expansions, considering fiscal consolidation process will produce a different composition of government spending as the standard median voter model.

The use of disaggregated expenditures allows each component to have a different elasticity in respect of one of the determinants specified. In fact, Courakis et al. (1993), Bairam (1995) and Chletsos and Kollias (1997) claim that disaggregated expenditure plays an important role leading to more reliable results. Observed response of total government expenditures to a change in a determinant, *ceteris paribus,* will be the weighted mean of observed responses to each of its component, where the weight is the share of each function in total government expenditures. From (14):

$$\sum_{f=1}^{8}\left(a_f / a\right)^{\frac{1}{1+\omega_f}} \overline{Y}^{\frac{\alpha_f-\alpha}{1+\omega_f}} P_r^{\frac{\beta_f-\beta}{1+\omega_f}} N^{\frac{\phi_f-\phi}{1+\omega_f}} \prod_{j=1}^{3}\left(N_j^{\frac{\phi_{j,f}-\phi_j}{1+\omega_f}} \right) L^{\frac{\phi_{l,f}-\phi_l}{1+\omega_f}} G^{\frac{\omega-\omega_f}{1+\omega_f}} = 1 \qquad (15)$$

and taking derivatives in both sides yields:

$$\alpha\sum_{f=1}^{8}\frac{1}{1+\omega_f}G_f=\sum_{f=1}^{8}\frac{\alpha_f}{1+\omega_f}G_f;\quad \beta\sum_{f=1}^{8}\frac{1}{1+\omega_f}G_f=\sum_{f=1}^{8}\frac{\beta_f}{1+\omega_f}G_f;$$

$$\phi\sum_{f=1}^{8}\frac{1}{1+\omega_f}G_f=\sum_{f=1}^{8}\frac{\phi_f}{1+\omega_f}G_f;\quad \phi_j\sum_{f=1}^{8}\frac{1}{1+\omega_f}G_f=\sum_{f=1}^{8}\frac{\phi_{f,j}}{1+\omega_f}G_f;$$

$$\phi_l\sum_{f=1}^{8}\frac{1}{1+\omega_f}G_f=\sum_{f=1}^{8}\frac{\phi_{f,l}}{1+\omega_f}G_f;\quad \omega\sum_{f=1}^{8}\frac{1}{1+\omega_f}G_f=\sum_{f=1}^{8}\frac{\omega_f}{1+\omega_f}G_f;$$

$$j=1,2,3. \quad (16)$$

It can be argued that population age structure and land area may not be relevant for some functions, i.e. $\phi_{j,f}=0$ or $\phi_{l,f}=0$ for some *f*. However, as long as, these variables are relevant for some any other function *f*, then $\phi_j\neq 0$ or $\phi_l\neq 0$, and $(\phi_{j,f}-\phi_j)\neq 0$ or $(\phi_{l,f}-\phi_l)\neq 0$. That is, increased or decreased expenditures needs on other functions may have a significant effect on the share of the rest of the functions. Finally, expressing it in logarithmic form, rearranging terms and considering that the model will be estimated for a panel structure of 26 OECD countries over the period 1970-1997, we get:

$$\ln\left(\frac{G_{f,t,k}}{G_{t,k}}\right)=\frac{1}{1+\omega_f}\ln\left(\frac{a_f}{a}\right)_k+\frac{\left[(\alpha_f-\alpha)+(\omega_f-\omega)\right]}{1+\omega_f}\ln(\bar{Y}_{t,k})+$$

$$\frac{(\beta_f-\beta)}{1+\omega_f}\ln(P_{r,t,k})+$$

$$\frac{\left[(\phi_f-\phi)+(\alpha_f-\alpha)+(\omega_f-\omega)+\sum_{j=1}^{3}(\phi_{j,f}-\phi_j)\right]}{1+\omega_f}\ln(N_{t,k})+$$

$$\sum_{j=1}^{3}\frac{(\phi_{j,f}-\phi_j)}{1+\omega_f}\ln(\frac{N_{j,t,k}}{N_{t,k}})+\frac{(\phi_{l,f}-\phi_j)}{1+\omega_f}\ln(L_k)+\frac{(\omega_f-\omega)}{1+\omega_f}\ln\left(\frac{G_{t,k}}{Y_{t,k}}\right)$$

$$+\sum_{k=1}^{K}u_k+\sum_{k=1}^{K}\sum_{s=1}^{S-1}u_{k,s}+\varepsilon_{t,k};\qquad(17)$$

Where k is the country t is the year, s the sub-periods considered, u_k is a dummy than takes value 1 for country k and 0 otherwise, $u_{k,s}$ is a dummy taking value 1 for country k and sub-period s and 0 otherwise and $\varepsilon_{t,k}$ is the classical disturbance term. Country fixed effects will be useful to capture preferences and institutional and historical factors specific to each country and reflecting preferences of the median voter in the determination of the share of each function in total government expenditures. These dummies could be assumed to be constant over large periods (u_k) if related to political systems, such as the electoral rule[5] and regime type (Persson and Tabellini, 1999). We also include country dummies interacted with time dummies ($u_{k,s}$) to capture those preferences and politico-institutional factors, such as ideological preferences (Borge and Rattso, 1995, Haan and Sturm, 1997, Sturm, 1998 and Merrifield, 2000) or government cohesion (Roubini and Sachs,

1989), which could change over large periods[6].

As noted earlier, we would like to take into account the different relative prices for each of the functions and the median income of each country. If we had the deflator for each of the functions and the median income, omitting for simplicity the year and country terms, we would be estimating:

$$\ln\left(\frac{E_f / C_f}{E / C}\right) = \frac{\ln(a_f / a)}{1+\omega_f} + \frac{(\alpha_f - \alpha) + (\omega_f - \omega)}{1+\omega_f}\ln(\overline{Y}) + \frac{\beta_f}{1+\omega_f}\ln(P_{r,f})$$
$$- \frac{\beta}{1+\omega_f}\ln(P_r) + \frac{(\phi_f - \phi) + (\alpha_f - \alpha) + (\omega_f - \omega) + \sum_{i=1}^{3}(\phi_{i,f} - \phi_i)}{1+\omega_f}\ln(N) +$$
$$\sum_{j=1}^{3}\frac{(\phi_{j,f} - \phi_j)}{1+\omega_f}\ln(\frac{N_j}{N}) + \frac{(\phi_{l,f} - \phi_l)}{1+\omega_f}\ln(L) + \frac{(\omega_f - \omega)}{1+\omega_f}\ln\left(\frac{G}{Y}\right) + \varepsilon_t \qquad (18)$$

which is the same as:

$$\ln\left(\frac{E_f}{E}\right) = \frac{\ln(a_f / a)}{1+\omega_f} + \frac{(\alpha_f - \alpha) + (\omega_f - \omega)}{1+\omega_f}\ln(\overline{Y}) + \left(1 + \frac{\beta_f}{1+\omega_f}\right)\ln\left(\frac{C_f}{C}\right)$$
$$+ \frac{(\alpha_f - \alpha) + (\omega_f - \omega)}{1+\omega_f}\ln\left(\frac{Y_i}{\overline{Y}}\right) + \frac{\beta_f - \beta}{1+\omega_f}\ln(P_r) +$$
$$\frac{(\phi_f - \phi) + (\alpha_f - \alpha) + (\omega_f - \omega) + \sum_{i=1}^{3}(\phi_{i,f} - \phi_i)}{1+\omega_f}\ln(N) +$$
$$\sum_{j=1}^{3}\frac{(\phi_{j,f} - \phi_j)}{1+\omega_f}\ln(\frac{N_j}{N}) + \frac{(\phi_{l,f} - \phi_l)}{1+\omega_f}\ln(L) + \frac{(\omega_f - \omega)}{1+\omega_f}\ln\left(\frac{G}{Y}\right) + \varepsilon_t \qquad (19)$$

[5] Though the median voter demand model assumes majority rule, Downs (1957) has shown that in a representative democracy a two party system electoral competition produces essentially the same outcome as the median voter theorem.

This expression (19) differs from (17) we are estimating only by the term $[(1+(\beta_f/(1+\omega_f))]\ ln(C_f/C)$ and $[((\alpha_f-\alpha)+(\omega_f-\omega))/(1+\omega_f)]\ ln(Yi/\overline{Y})$. Thus assuming that C_f is the same for all functions we do not incorporate any bias. Furthermore, the bias will be smaller as the ratio (C_f/C) approaches unity. Alternatively, under the assumption that price-elasticity $(\beta_f/(1+\omega_f))$ is close to one for all functions we will incorporate a small bias in the estimation. Moreover if the ratio (C_f/C) is constant across time the omitted term would only affect to the intercept since we will use panel data techniques. On the other hand, if *Yi* is close to there will be small bias in the estimation, which will be zero if the assumption *Yi*= is true. Further, if this ratio is constant over time, the bias will influence only the intercept. In fact, Gemmell et al. (1998) find that using median and mean income gives the same outcome in the case of local public spending in England and Wales, both measures are equally valid representations of the decisive voter. Moreover, Pommerehne (1978) shows that the mean income fits better than the median for representative government, as is the case of most of OECD countries. However, using the mean income instead of median income, we deviate from the median voter demand model including ad-hoc specifications (Mueller, 1989).

The median voter model is the most widely used in the public choice literature. This model reflects political choices of the composition of public expenditures, since public expenditure is allocated through a political mechanism. Congleton and Shugart (1990) and Congleton and Bennett (1995) show that median voter models are stronger in explaining public spending on social security and highway than

[6] However, it will not be possible to infer from the results what exactly those factors are, which is beyond

interest group models. This does not mean that interest group, or other institutional or redistributive factors are also important but that median voter model hold a slight advantage over models based on these other factors (Ahmed and Greene, 2001). Moreover, median voter model allows us to include the relative price of government goods and services, which has been proved to be relevant, in the determination of the composition of government expenditures (Gemmell et al., 1998). In fact, Pitarakis (2001) points out that the allocation of consumption public expenditures depends also on the prices of private consumption goods, typically ignored by traditional demand theory. Finally, the logarithmic form has been shown to be the most appropriate empirically Gerdtham (1992), while conveniently relating the median voter consumption of government provided services and goods (which are unobservable because the degree of publicness is not known) to expenditures (which are observable).

However, this model is compatible with a number of other analyses of the allocation of public spending using different frameworks other than the median voter. Thus, our analysis does also permit a test of functions for which Wagner's law is particularly applicable. The parameter estimation of relative prices may be also interpreted as the extent to which functions are exposure to Baumol's conjecture[7]. The population, age group and land parameters may also reflect economies of scale in the production of these functions. Finally, the visibility of each type of expenditure is compatible with two other theoretical model frameworks. On the one hand to a

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the scope of this article, just their significance.

[7] Baumol (1967) observed that productivity growth was lower in the public sector than in private sector, while wage increase were similar. Hence, the share of government spending in GDP will tend to grow in nominal terms.

separately expenditure component public-choice analysis in which a leadership maximises a welfare function depending on private consumption, a expenditure function, other public expenditures and state variables subject to constraint of resources (Hewitt, 1991, 1992, 1993, Clements et al.,1998, Davoodi et al., 1999 and Gupta et al., 2001). On the other, the perception parameter its also compatible to the above mentioned Tridimas (2001) model.

4. Econometric analysis

In order to test the visibility of each type of expenditure we will use data from the OECD publication *National Accounts. Volume II: Detailed Tables.* This source is chosen inasmuch as it offers information on the consolidated spending of all levels of government and, in addition, it follows the accrual criterion. Therefore, this source includes imputed expenditures not necessarily taking place in the current period. Data from national agencies, OECD and World Bank country reports, Eurostat: *General Government Accounts and Statistics* and the IMF publication: *Government Finance Statistics*, is used on a supplementary basis so as to make use of OECD data to obtain longer statistical series and supplement the informative shortcomings of the basic sources[8].

[8]Although IMF data covers a longer period of time, it is not as a rule consolidated for all the Public Administrations. Therefore, it has been necessary to separate transfers between different administrative levels expenditures (see Easterly and Rebelo, 1993a, Clements et al., 1998, and Baqir, 2002, for a discussion on the limitations of the data of this publication). Furthermore, it uses the cash criterion. Hence its information has been used only to estimate the evolution of each function for the years in which no OECD National Accounts, OECD and World Bank country reports, national agencies and Eurostat data was available.

The share of each function among total government expenditures is calculated at current prices, assuming as already mentioned that the deflators across types of expenditure are the same. Relative prices are approximated as in Gemmell et al. (1999) by the ratio of the public sector deflator to the GDP deflator. Public sector deflator is the result of the weighted mean of government investments deflator, public consumption deflator and public transfers, the latter represented by the consumer price index, all obtained from the OECD: Economic Outlook and national sources. The per capita income (in Purchasing Power Parities of the 1995 dollar and in real terms of that year), population and government expenditures series are obtained from the OECD: National Accounts: Volume I. Main Aggregates, while the population age structure is taken from the OECD: Labour Force Statistics. Some countries did not have data prior to 1975 and have had to be completed using domestic sources.

Panel data techniques are going to be used for the estimation of the expression (19) since country-specific unobservables are likely to be correlated with the error term. The inclusion of a country dummy will thereby prevent bias in the estimations at the same time as capturing country effects for each of the sub-periods considered (the '70s, '80s and the period available of the '90s, that is 1990-1997) according to the intervals differentiated in Tanzi and Schuknecht (2000)[9]. Thus we

[9] These authors analyse with detail the evolution of the size and scopes of the public sector in developed countries and differentiate three periods since 1970. The first period covers the decade of the seventies until 1980, characterised by a rapid expansion of public expenditures. During the eighties, this increase definitely slowed down, following the scepticism about the role of the state emerged in the 70's. In the first half of the 90's, public expenditure increase again as a share of GDP until 1995, the maximum of the whole period.

solve a shortcoming of some studies which include a country dummy for the whole period restricting these factors to be invariant over the whole period.

In addition panel techniques combine utilisation of the time series and the cross-section variation. Thus, studies analysing determinants of health and education expenditures contend that failure to utilise cross-section variation overestimates the income elasticity (Culyer 1988, Gerdtham, 1992, McGuire et al. 1993, Gerdtham et al., 1994, Fernández and Rogerson, 1997, and Di Matteo and Di Matteo, 1998, Okunade and Karakus, 2001). On the other hand, having multiple observations for each country enables to take into account dynamics effects and country-specific fixed effects (Gerdtham. 1992, Hitiris and Posnett, 1992 and McCoskey and Selden, 1997, Hitiris and Nixon, 2001).

Note, moreover, that in fact it is the estimation of a system composed of eight equations, one for every spending function, so two problems arise. First of all, these equations are related as median voter take into account his preferences with regard to all the functions when deciding the percentages allocated to each function. Thus, the shares devoted to each function are simultaneously decided and therefore contemporary errors are correlated. In fact, as shown in (19) if one determinant increase the share of a function it must decrease the participation of another so that the effect is offset. Moreover the economies of OECD member countries are increasingly interrelated hence common shocks could affect in similar ways to different functions of government expenditures.

Secondly, the inclusion of income and the share of government expenditures in the GDP as determinants introduce endogeneity and simultaneity therefore biasing estimates. In fact, Devarajan et al. (1996) and Bleaney et al. (1999) show that the composition of public spending is a highly significant factor in economic growth[10]. In addition the size and scope of total government expenditure is simultaneously decided. Thus, government expenditures should be treated as endogenous. In fact, Pitarakis and Tridimas (1999) strongly reject the hypothesis of exogeneity of total public consumption expenditure in a study of the allocation of public consumption expenditure for the UK during the period 1963-1993 in a Rotterdam model context. These authors conclude that insufficient attention to the issue of the endogeneity of total expenditure in demand equations may lead to biased estimates of the various elasticity coefficients. Moreover, total public spending may respond to exogenous changes in one of its components (Davoodi et al. 1999). Thus the recent reduction in interest payments (included in other expenditures) may have contributed to reductions on the size of public spending.

Therefore we proceed to estimate by the three stages least squares method. At the initial stage we instrumented income per capita and the share of government expenditures in GDP using its lagged values and all the other regressors. In this way, at a second stage, we performed an OLS-type two-stage estimation of the covariance

[10]This potential source of endogeinity, however, is reduced if we bear in mind that the effect of the distribution of public spending is not immediate but takes several years to become apparent (Devarajan et al., 1996).

matrix of the disturbance, taking into account that it may not be diagonal, i.e. contemporaneous errors may be correlated. Finally, we performed a GLS-type estimation using the covariance matrix of the previous step[11]. Hence, we obtain the same are performing Seemingly Unrelated Regressions (SURE) obtaining the correlation matrix of the residuals between equations and performing a Breusch-Pagan test for independent equations.

In Table 2 we show the results obtained from the three least squares estimation. Note, as already mentioned, that elasticities of each function have to be interpreted in relation to those of total government expenditure. Thus, first of all, we carried out a Hausman Test of the null hypothesis of no correlation between the unobservable effects and the explanatory variables. If the hypothesis is rejected, we choose the single unbiased estimator (within estimates), or what amounts to the same, the OLS including dummies per country. Hausman test confirms that country unobserved variables seem to be important when explaining government expenditures[12]. In addition, significance of country dummies interacted with time dummies suggest that considering country specific factors as fixed over time may be inappropriate.

[Table 2]

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[11] Note that each equation has the same set of right-hand-side variables. Therefore the coefficients estimated are the same as if we regress independent equations for each function. However, we gain efficiency by estimating the third phase, reducing standard deviations.

[12]For the case of social security, the null hypothesis is rejected only at 10% significance. However, we decided to introduce country dummies for this function as well, as at all events it impairs the efficiency of estimation but assures its consistency. Arellano and Bover test (1990) also rejects the absence of correlation between the regressors and the unobservable effects for most of the functions. This test compares the coefficients in levels and first differences, so that if these are different the hypothesis of absence of correlation between unobservable effects and explanatory variables is rejected.

Many studies have already suggested the relevance of institutional factors determining a type of expenditure. Thus, Visco (2001) and Than Dang et al. (2001) point out to individual country pension systems as the major determinant in pension spending, so that reforms to characteristics as the individual's level of benefit and eligibility, could partly offset the impact of ageing on spending. Health expenditures reflect a wide range of preferences and historical and institutional factors, including the public-private mix, decentralisation of public sector, systems arrangements and life style (Leu, 1986, Gerdtham et al., 1994, Murthy and Upkolo, 1994, Hitiris, 1999, Okunade and Karakus, 2000, Snyder and Yackovelev, 2000, Heshmati, 2001 and Than Dang et al., 2001). Indeed, the degree of decentralisation has also an important role on transport and communications expenditures (Randolph et al., 1996). Falch and Rattso (1997) show that political strength of the central government and ideological orientation are important in the determination of teacher wages and teacher employment and, hence, in education spending. Furthermore, Fernandez and Rogerson (1996) and Heinesen (2001) point out that this dummy variable could also reflect the preferences for private education in some OECD countries. Institutional factors also appear to be important for other expenditures function. Thus Mongelli (1997) predicted an harmonization in interest rates for Member States as a result of the European Economic and Monetary Union (EMU), thus reducing interest payments for those countries which had higher inflation/devaluation risk premiums. In addition Maastricht criteria requires a public debt-to-GDP ratio below 60% and a public deficit-to-GDP ratio below 3%. Finally, Clements et al. (1998) find that individual country-specific factors play an important

role in determining government subsidies, which may be partially considered as economic services.

Secondly, the Breusch-Pagan test rejects the hypothesis of independent equations, i.e. the disturbance covariance is not diagonal. This is consisting with median voter taking into account their preferences in respect of all functions when demanding each one. This result can be suggesting that functions prove to be complementary or substitutive to a certain degree. Indeed, Tait and Heller (1982), Heller and Diamond (1990) and Clements et al. (1998) find that the significance of defence, education, social welfare, health and interest payments increases the magnitude of government subsidies and transfers as a share of GDP. Along these lines, Looney (1997) points out that defence expenditures increase interest payments and compete with infrastructure for funding. Moreover defence expenditure is identified as competitor of education and health spending (Baqir, 2002). In fact, Davoodi et al. (1999) show that the share of nonmilitary expenditures increases in response to exogenous reductions in defence spending, an effect which these authors associate with the so called "peace dividend". In contrast with these findings, Marlow and Shiers (1999) reveal that this expenditure and spending related to public order and security is complementary to that on education. In fact, Pradhan and Ravallion (1998) find that education increases demand for safety in the case of Brazil because it increases the knowledge about the true probabilities of crime.

Of the determinants, we find that the income elasticity is significant for every

function, confirming that is the most important determinant of the composition of public expenditures. It has a positive elasticity for public services, housing, social security, education, health and transport and communications. On the other hand, increases in income per capita decrease the share of other expenditures and defence. As regards the public/private sector price ratio the estimation shows that it is significant for four functions, increasing the share of public services and social security while reducing the participation of housing and education. Defence, public services, transport and communications and housing reveal that they are the closest to have a more purely public nature, showing a robust negative relationship with population. At the other extreme, other expenditures reveals a positive relative elasticity.

Apart from these basic variables of the model, the size of government expenditures, land area and age structure of the population prove to be significant determinants in the composition of public spending. Total government expenditures appear to increase the share devoted to other expenditures and housing. On the other hand, increases in total spending reduce the participation of education, transport and communication and social security. Land area increases the needs for higher transport and communications, defence, general public services and housing at the cost of the participation of social security. This result may be suggesting that land area does not expand demand for social security hence reducing its share in total government expenditures.

The effects of population density will be captured by the elasticity of

population less the elasticity associated with land area. The negative elasticity found for transport and communications is based, according to Randolph et al. (1996) on the fact that low population density may need higher expenditure for a given level of infrastructure service. Thus per capita infrastructure will be inversely related to population density[13]. Moreover, as shown by Strum (2001) rural areas may demand more infrastructures since they need relatively more spending on infrastructure as compared to urbanised areas. Defence spending shows negative density elasticity. Public services also decreases its shares with population density. Alternatively, population density has a positive influence on the participation of social security. Overall, results for population density may be also consistent with a supply view, above all with the possibility of taking advantage of economies of scale with transport and communications (Randolph et al., 1996, Fay, 2001). We only find higher economies of scale in education and health comparing these functions to social security expenditures (Gerdtham, 1992 and Taylor and Bradley, 2000). Neither we find any relative positive effect of population density indicating costs associated with congestion in the production of education, as suggested by Marlow and Shiers, (1999) and corroborated by Baqir (2002).

As regards population age structure, the share of people older than 64 years raises the expenditure allocated to social security presumably through the increase in pensions. In this respect and if the pattern of recent years continues this increase will take place at the expense of spending on transport and communications and defence.

[13] In fact, our demand for a public expenditure function can be also interpreted in per capita terms, since dividing both G_f and G by N in (19) yields the same equation.

No significant effect is found, however, of the older population on the health share. For its part, the percentage of the population aged 0-15 has an even greater impact on the distribution of public spending by functions. It has a positive effect on the share of the education, health and social security functions, while other expenditures has a negative young population elasticity of great magnitude.

5 Dynamic adjustment

Adapting to changed median voter demand may be a process requiring a slow adjustment in the public expenditure allocation. In fact, inertia in reformulating the budget results in composition of expenditure responding very slowly to changes in the demand. Hence, we may analyse the determinants of government expenditure composition in dynamic model framework. In specifying a dynamic model we assume that actual government expenditure does not match the median voter desired level immediately, but by a partial adjustment process. The obstacles in a rapid adjustment may be found in the fact that some of the expenditures are commitments, as those related to social security or interest payments, and most of the public employees and physical stock are also fixed. Along these lines some authors have suggested that particular components of government expenditures tend to change reasonably slowly over time (Marlow and Shiers, 1998, Looney et al., 1998, in the case military expenditures, Gerdtham et al., 1994, health, Fay, 2000, transport and communications, Hanesen, 2001 education). The way governments benefit from the different visibility

of expenditures may be also obstructed because of the above mentioned reasons, and follow an adjustment process with the same speed of adjustment . Let (G_f/G) be the actual share of function f in total government expenditures, and (G_f^*/G^*) the perceived share of the median voter:

$$\left(\frac{G_f}{G}\right)_t = \left(\frac{G_f^*}{G^*}\right)_t^{\lambda} \left(\frac{G_f}{G}\right)_{t-1}^{1-\lambda}; \quad f = 1,2.....8; \quad \sum_{f=1}^{8}\left(\frac{G_f}{G}\right)_t = 1; \quad \sum_{f=1}^{8}\left(\frac{G_f^*}{G^*}\right)_t = 1 \qquad (22)$$

Then substituting (G_f/G) by (G_f^*/G^*) in (15) considering (22) and taking logarithms, we get:

$$\ln\left(\frac{G_{f,k,t}}{G_{k,t}}\right) = (1-\lambda)\ln\left(\frac{G_{f,k,t-1}}{G_{k,t-1}}\right) + \lambda \ln\left(\frac{a_{f,k}}{a_k}\right) + \lambda\left[(\alpha_f - \alpha) + (\omega_f - \omega)\right]\ln(\bar{Y}_{k,t}) +$$
$$\lambda\,(\beta_f - \beta)\ln(P_{r,k,t}) + \lambda\left[(\phi_f - \phi) + (\alpha_f - \alpha) + (\omega_f - \omega) + \sum_{j=1}^{3}(\phi_{j,f} - \phi_j)\right]\ln(N_{k,t}) +$$
$$\lambda \sum_{j=1}^{3}(\phi_{j,f} - \phi_j)\ln\left(\frac{N_{j,k,t}}{N_{k,t}}\right) + \lambda\,(\phi_{l,f} - \phi_j)\ln(L_k) + \lambda\,(\omega_f - \omega)\ln\left(\frac{G_{k,t}}{Y_{k,t}}\right) + \lambda \sum_{k=1}^{K} u_k$$
$$+ \lambda \sum_{k=1}^{K}\sum_{s=1}^{S-1} u_{k,s} + \lambda\varepsilon_{k,t}; \qquad t: 1970,...1997; \qquad k: 1,....26 \qquad (23)$$

The speed of adjustment is assumed to be constant. We will use the GMM estimator suggested by Arellano and Bond (1991), based on taking first differences on (23), dropping unobservable country dummies, country dummies interacted with sub-periods and land area. However, taking first differences introduced bias because of the correlation between $\lambda u_{k,t}$ and $\lambda ln(G_{f,k,t-1}/ G_{k,t-1})$. Thus we use as instruments for $\lambda ln(G_{f,k,t-1}/G_{k,t-1})$ at least two periods lagged values of $ln(G_{f,k,t}/ G_{k,t})$. We will also take into account endogeneity of income per capita and public sector size, taking as instruments for $\lambda ln(Y_{k,t})$ and $\lambda ln(G_{k,t}/Y_{k,t})$ at least two lagged values of $ln(Y_{k,t})$ and $ln(G_{k,t}/Y_{k,t})$. Note that after taking first differences we include negative first order autocorrelation in the

transformed model, which would be second order serial correlation if in the original model there was already first order serial correlation. In this latter case we would have to use instruments for $\lambda ln(G_{f,k,t-1}/ G_{k,t-1})$, $\lambda ln(Y_{k,t})$ and $\lambda ln(G_{k,t}/Y_{k,t})$ at least three periods lagged values of $ln(G_{f,k,t-1}/G_{k,t-1})$, $ln(Y_{k,t})$ and $ln(G_{k,t}/Y_{k,t})$. Finally we could compare the results of GMM from the coefficients obtained with the static model, usually used in the literature analysing the allocation of government expenditures.

As Table 3 shows, there is only first order autocorrelation for most of the functions. Only in the case of other expenditures can the hypothesis of second order autocorrelation not be rejected, and thus we have used as instruments at least three lagged values of $ln(G_{f,k,t-1}/G_{k,t-1})$, $ln(Y_{k,t})$ and $ln(G_{k,t}/Y_{k,t})$ in addition to the exogenous explanatory variables. Furthermore, the Sargan test statistic of overidentifying restrictions does not reject the validity of the instruments used. We show the results from the one-step GMM estimates, which do not underestimate standard errors and inferences from this estimates have been proved to be more reliable than inferences from the two-step GMM estimates (Blundell and Bond, 1998).

The sign of the relationships between income and its determinants holds after controlling for dynamic adjustments. Income elasticity captures the degree of complementarity or substitutability between public spending and private consumption, so that a positive sign indicates that public services utility for median voter increases as his income increases. The effect of income changes increases the share of functions such as education, social security, health, public services and transport and

communications[14]. Other expenditures confirm a negative association with income. We do not find any significant effect of income on housing and military expenditures.

These results are in line with other studies analysing the determinants of public spending empirically or in other frameworks. Thus many studies have already pointed to positive effects of income on education expenditures (Miller, 1996, Mauro, 1998, Marlow and Shiers, 1999 and Baqir, 2002), social security (Courakis et al. 1993), health (Hitiris and Posnett, 1992, Gerdtham et al, 1994, Murthy and Okunade, 2000, Getzen, 2000, Gerdtham and Jonsson, 2000 and Okunade and Karakus, 2001), public services, (Pradhan and Ravallion, 1998) and transport and communications (Randolph et al., 1996, Canning and Pedroni, 1999 and Fay, 2001).

Actually, our analysis does also permit a test of functions for which Wagner's law is particularly applicable. These elasticities confirm that Wagner's law is especially applicable for cultural and welfare services: education, health and social security spending (Solano, 1983, Lybeck, 1988, Gemmell, 1993, Saunders, 1993, Oxley, 1994, Sturm, 2001 Baqir, 2002). In fact, education was one of the functions mentioned by Wagner (1883) as a source of public sector growth[15]. Newhouse (1977) already pointed out that the participation of expenditure devoted to total health care expenditure

[14]However, these two functions are significant at a 10% level.

[15] Craig and Inman (1986) and Romer et al. (1992) show evidence of income inelastic educational services in cross-sectional analysis, while Luski and Weinblat (1998) show evidence of Wagner's Law only for middle and low income countries.

(including public and private) increases with GDP with income elasticity higher than one, and that this factor accounted for 92% of the sample variations[16]. Newhouse contend that at the margin, the demand for health care may relate more to caring than to curing, i.e. health care is a luxury rather than a necessary good. Further, Visco (2001) claims that higher level of per capita income provides additional revenue resources to help finance higher government pension and health care expenditure and it may help to ease future fiscal pressures from ageing. Moreover, Than Dang et al. (2001) show that average benefit pension tended to grow in line with income, though recently most of the OECD country members have shift towards pension indexation on prices.

Thus, Pradhan and Ravallion (1998) find that demand for safety (included in public services) has a strong income effect in Brazil[17] and point out that higher income will offer higher taking for potential thieves. High crime rates, in turn, increases demand for public crime related expenditures (Marlow and Shiers, 1998). However, these authors hypothesised that income will have a negative effect on crime rate because of individuals finding criminal activity less attractive as their legal opportunities to earn income rise, though they do not find any significant evidence of this hypothesis. Canning and Pedroni (1999) and Fay (2001) find strong evidence of an effect running

[16] The empirical evidence about elasticity being higher, lower or not significantly different from one remains controversial (see Gerdtham and Honsson, 2000, Okunade and Karakus, 2001 and Sanz and Velazquez, 2002). In addition, some authors as Hansen and King (1996) claim that panel data estimations of income and health relationship may be spurious. However, Blomqvist and Carter (1997), Roberts (1999), Gerdtham and Lothgren (2000) and Okunade and Karakus (2001) show evidence of the existence of a long-run equilibrium cointegrating relationship between health expenditures and GDP.

[17] These authors also find that the poor also demand safety but give, at the same time, higher priorities to other needs. However, Pradhan and Ravallion (1998) reveal higher income increase effects for the poor evidencing a concave relationship between income and demand for safety.

from GDP to the stock of infrastructure related to transport and communications, above all electricity services, sanitation and telecommunications. These authors suggest that infrastructure may respond to the level of GDP through a demand mechanism. Hence, we may infer that as median income becomes richer he demands more infrastructures for consumption purposes. Some articles have pointed to a positive and significant income elasticity of housing and military expenditures as a share of GDP, which is compatible with our results as long as income elasticitity of total government expenditures is positive. Thus, Luski and Weinblatt (1998) find a positive effect of income in welfare spending (including housing, social security and other welfare related spending) for a sample of developed and developing countries. Murdoch and Sandler (1990), Hartley and Sandler (1990), Chletsos and Kollias (1997), Davoodi et al. (1999) also find a positive association between income and military expenditures due to the fact that income increases the resources for providing protection while at the same time raising the cost of an attack (Murdoch and Sandler, 1990). On the other hand Fritz-Assmus and Zimmerman (1990), Bairam (1995), Looney et al. (1998) and Gupta (2001), do not find any significant effect of income on military expenditures.

This can be suggesting that more prosperous countries benefit from lower risk premium. This result is in contrast with Biswal et al. (1999), who conclude that GDP per capita does not Granger cause interest payments.

Education, health and public services are the less price elastic. This may suggest that public provision of these services and goods face less intensive competition from the private sector, as pointed out for health by Gerdtham et al. (1994). It also may indicate that these public services have a high share of fixed expenditures leading to a slower adjustment process. In fact, Okunade and Karakus (2001) reveal that health sector is largely unresponsive to short run price variations in the UK. Moreover GMM estimation changes the sign of education price elasticity confirming the evidence shown by Dahlberg and Jacobsson (2000) that not accounting for dynamic adjustment may bias the price elasticity upwards. Many studies have already pointed to the low price-elasticity of education in the framework of the analysis of determinants of local expenditures (Rubinfeld and Shapiro, 1989, Falch and Rattso, 1997 and Ahlin and Johansson, 2001). On the other hand, housing expenditures are the most price elastic, perhaps due to the fact that is a privately produced good. These results are consistent also with Baumol's conjecture, since wage and salary predominant in less price-elastic functions. In addition, the higher share of investments, and its private good nature reduces the exposure of housing expenditures to Baumol's conjecture.

Public services, defence and transport and communications are corroborated as the most pure public goods and services, a result already found by Murdoch and Sandler, (1985) and Randolph et al., (1996)[18]. On the contrary housing, social security

[18] Some new models in the economics of alliance as the joint product model stressed impurely public good aspects of the shared defence good. These goods may be partially rival among countries and some of its benefits ally-specific. However, defence is considered public and non-rival within an ally (see Sandler and Hartley, 2001, for a survey)

and other expenditures appear to be rival, though not to a significant level. In fact, congestion may increase housing costs. Education and health, typically pointed out as rival expenditures (Baqir, 2002) do not appear to be significantly associated with population. These results are also consistent, from a supply economic view, with the production of public services, defence and transport and communications goods and services making it possible to take advantage of economies of scale.

Results show that cuts in total government expenditure may fall on defence and other expenditures if it follows the same pattern as in the period 1970-1997. The share of military and other expenditures decreases in response to cuts in overall government spending. The former finding is in line with Gupta et al. (2001) for a sample of 120 developing and developed countries and Hartley and Sandler (1990), who show evidence of a constraining effect of US previous year public deficit on defence spending. However, Davoodi et al.[19] (1999) for a sample of 130 developed and developing countries and Jonakin and Stephens (1999) for developing countries in Central America find that defence expenditures is more protected when fiscal discipline is implemented. It seems important to take into account for fiscal adjustment process in the case of defence, since we find a positive relationship for this function only in the dynamic model. Again, this may be due to the fact that it takes several years to reduce expenditures in a function.

The positive elasticity of other expenditures (interest payments and other

[19] These authors only find that cuts in the government spending to GDP ratio led to a more than proportionate reductions in defence expenditures in countries with IMF-supported programs.

economic services) may be suggesting that cuts in government expenditure reduce future interest payments, decreasing in turn the need for further fiscal adjustments affecting other functions (Mongelli, 1997). If subsidies are identified mainly with economic services, this result is in line with Clements et al. (1998), who find a less than proportionate increases in government subsidies as a response to expand total government expenditures. In fact, governments have already decreased defence expenditure during the '80s and interest payments during the '90s preserving other expenditures (Sanz and Velazquez, 2001). It may be inferred that OECD governments may have first cut defence spending and subsequently benefit from the reduction in interest payments reducing the share devoted to other expenditures.

On the other hand education shows a negative and significant relationship, suggesting that it reacts less than one-to-one to changes in government spending. Therefore reductions in public spending are associated with increases in the share of education and conversely increases in government expenditure reduce the participation of this function. These results corroborate the findings of Cashin et al.(2001) and Baqir (2002). That is education is typically more stable than spending on other functions. In fact, Sanz and Velázquez (2001) find this function is more stable and similar in the OECD countries during the period 1970-1997. Housing also shows a negative relationship with the public sector size, changing its sign compared to the static model. We also find a negative coefficient for health as Cashin et al.(2001) and Baqir (2002), though not at a significant level. However, this result may be due to the fact that if at the

margin health spending are more related to care than cure at a time of fiscal adjustment protection of these spending are not justified (Hitiris, 1999).

To sum up, it appears as if recent years OECD countries have reduced their needs for further budgetary cuts, decreasing above all the share devoted to defence and subsequently to interest payments, reducing proportionally social security, public services, health and transport and communications and preserving education and housing. This is an important result, since transport and communications expenditures were the main suspect for being affected by government expenditure cuts. In contrast with the studies exploring the effects of fiscal consolidation in the composition of government spending by economic type, we do not find evidence of investment, at least those related to transport and communications, being the least visible expenditure.

The age structure of population, either the share of young or elderly population, is significant for every function except transport and communication. This is an important result since the previous literature have pointed to social security, health and education expenditures as the only age related spending. Nevertheless aging increases the demand for social spending and reduces the share of other functions.

The share of population above 64 years increases the participation of health and social security. These results have been already pointed out in the literature (Heller et al., 1986, Hagemann y Nicoletti, 1989, Gerdtham et al., 1992,b Murthy y Ukpolo, 1994, Harrison et al., 1997, Luski and Weinblatt, 1998, Hitiris, 1999, Di Matteo y Di

Matteo 1998, Visco, 2001 and Than Dang et al., 2001)[20]. However, Kleiman (1974), Leu (1986), Newhouse (1992), Hitiris and Posnett (1992), Gerdtham et al. (1994) and Blomqvist and Carter (1997) do not find any significant effect of old population on health expenditures. On the basis of this latter evidence may be that a large part of spending is made in the period just preceding death. Thus, the effect of population ageing on spending may be attenuated by the lengthening of life (Fuchs, 1990). On the other hand, the share of old population decreases the importance of public services and housing (though at a 10% significant level). This outcome is in line with the hypothesis of Marlow and Shiers (1999) who suggest that population aged 18-44 commits a disproportionate share of crimes. Crime rates in turn are expected to rise public demand for crime-related expenditures. However, these authors do not find evidence for their hypothesis.

These outcomes are also compatible with interest group theory as elderly people receive more benefits from social security and health as other age groups of population (Lindert, 1994)[21]. Moreover, we have found a negative elasticity of the share of the population over 64 years as Poterba (1997), Fernández and Rogerson (1997), Marlow and Shiers (1999) and Heinesen (2001), but not at a significant level. It may be also inferred that production of health services has economies of scale (Luski and Weinblatt, 1998). In fact, the introduction of elderly share in logs implies the

[20] Among population aged 65 and above, those being above 80 years are the biggest users of health care services. However, it is not possible to know the share of the group for all this OECD countries and on yearly basis.

[21] In fact, Luski and Weinblatt (1998) find that the elderly elasticity in the higher income countries is significantly higher that in the low income countries, what it may be due to the fact that governments

realistic assumption that economies of scale are diminishing in absolute terms (Heinesen, 2001).

The share of the young population increases the participation of education and health while reducing defence and other expenditures. Parents with children receive benefits from public spending increasing parental demand for it. And higher shares of young population increase the probabilities of median voter having children. In addition young population also increases the share allocated to health. The share of population aged between 0 and 15 years is not, in general, included in the economic literature as a determinant of health expenditures, perhaps suggesting a U-shaped relationship between health expenditures and age as pointed out by OECD (1996). The young share elasticity is, in addition, lower than elderly elasticity, which is an intuitive result.

On the other hand, both the negative elasticity of young population and the insignificant of elderly as determinants of military expenditures lead to a negative association between age dependency ratio and military expenditures as a share of total expenditure. However, Davoodi et al. (1999) and Gupta el al. (2001) show evidence of a positive relationship between age dependency and military expenditures as a share of GDP. Outcomes for education and health are also compatible with interest group theory as children and their parents receive private benefits from these types of spending. It is also consistent with economies of scale in

in high income countries, in general with democratic regimes, have to satisfy the needs of the elderly to be elected.

the production of these services (Easterly and Rebelo, 1993b). Finally from a supply point of view, young population appears as an obvious determinant of the need for expenditure on schooling (Mauro, 1998 and Luski and Weinblatt, 1998)[22].

5. Conclusions

This paper explores how fiscal consolidation can affect the composition of government expenditures. Fiscal discipline will require cuts in government spending leading to trade-offs between different functions and affecting government expenditure composition. For this purpose we have used a standard median voter model in which government can affect the size of public sector perceived by the median voter. Thus, government face in the need of budgetary cuts will decrease the less visible expenditures, i.e. those long-term projects or those having long-term profitability. We have also incorporate demographic factors such as density and age structure of the population along with income and tax-price, for capturing state variables affecting the utility of the median voter. Furthermore, using this theoretical model we examined the effects of various determinants including fiscal adjustment on less aggregated government expenditure, which hopefully could lead to more reliable results. At the same time, we investigate why this structure of public spending differs across countries and periods of time for the same country.

[22] Nevertheless, Marlow and Shiers (1999) contend that, besides young population, it is important to know its distribution by ages, as the spending per pupil at secondary level is much higher than at primary. It would also be necessary to include the population aged between 16-25, since a significant proportion continue their education at public institutions. As in the case of the population over 80 years,

We proceed to estimate the determinants of the composition of government expenditures for a sample of OECD countries in the period 1970-1997 using panel data techniques and by the three stages least squares method. Thus we take into account the possible endogeinity of explanatory variables interdependence among functions and preferences or institutional factors. Moreover we include country dummies interacted with time dummies considering that country specific factors may change over the period.

However, adapting to changed median voter demand may be a process requiring a slow adjustment in the public expenditure allocation. Hence, we may analyze the determinants of government expenditure composition in a dynamic model framework. The obstacles in a rapid adjustment may be found in the fact that some of the expenditures are commitments and most of the public employees and physical stock are also fixed. The preferred estimator is the GMM suggested by Arellano and Bond (1991) which takes into account unobserved country specific effects and possible endogeneity of the explanatory variables.

Results show that future cuts in OECD government expenditure may fall on defence and other expenditures if it follows the same pattern as in the period 1970-1997. On the other hand education shows a negative and significant relationship, suggesting that react less than one-to-one to changes in government spending. That is education is typically more stable than spending on other functions. Housing also shown a negative relationship with the public sector size changing its sign compare to the static model.

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this information is not available, however, on a yearly basis for all the OECD countries since 1970.

This outcome may be suggesting that OECD countries have reduced their needs for further budgetary cuts, decreasing above all the share devoted to defence and subsequently to interest payments, reducing proportionally social security, public services, health and transport and communications and preserving education and housing. We do not find evidence of investment, at least those related to transport and communications, being the least visible expenditure.

In short, though income has been identified as the dominant force, public sector size, institutional factors, density and age structure of the population and complementary and substitutability between functions have been prove highly significant in the determination of government expenditures composition. Therefore, it provides evidence that not only simple Wagner-type model may be too simplistic for explaining government expenditures (Georgakopoulos and Loizides, 1994), but also the standard median voter model which only takes into account income and tax-price faced by the median voter. Furthermore, the inclusion of all these determinants reduces the probability of specification errors arising when relevant factors are not included. In fact, the absence of some of these determinants could lead to bias on the estimation of the income elasticity (Gerdtham et al., 1994, Luski and Weinblatt, 1998, Gerdtham and Lothgren, 2000) or the population parameter (Gemmell et al., 1999).

About the rest of determinants and though income has been identified as the dominant force, preferences, institutional factors, public sector size, density and age structure of

the population and complementary or substitutability between functions are also determinants driven the composition of government expenditures. This is an important result since the inclusion of these variables modifies the composition of government expenditures than would be in the absence of these demographic, institutional and fiscal factors. It provides evidence that Wagner-type, and standard median vote model may be too simplistic for explaining government expenditures. Furthermore, the absence of these factors may lead to bias in the estimation of income and tax-price parameter. Nevertheless, it is important to continue investigating in order to build a

Also, in the context to Devarajan et al.'s (1996) model, fiscal consolidation will increase income enhancing effects of the composition of government expenditures, as long as the actual shares devoted to education and housing are lower than their relative growth elasticities. The converse condition must hold for defence expenditure.

Recent models of Devarajan et al. (1996) and Kneller et al. (199) underline the influence of the structure of government expenditure by functions on economic growth. Moreover Davoodi and Zou (1998) and Xie, Zou and Davoodi (1999) show that there is an optimal composition of government expenditures in which the shares of each component equal its relative growth elasticity. Thus, fiscal consolidation can enhance growth if the share of defence and other expenditures is greater than their relative elasticities and if the share of education and housing is lower than their relative elasticities. Furthermore, the results presented here show that many factors determining the composition of government expenditures are variables beyond government control. Thus income, prices, density and age structure of the population

and preferences also drive the composition of government expenditure, which could differ from the optimal composition for growth. Therefore, optimal policies may be not implementable. The distance between the optimal composition of government expenditures and the current structure will determine the extent to which determinants could lead to long run income losses. In addition it may be inferred that no absolute convergence process may be expected in the public spending structures of countries as this may be impeded by different economic, political and demographic factors. Moreover, if the composition of government expenditure is relevant in the determination of economic growth, the countries of the OECD area will be inhibited from achieving similar rates of growth in the future.

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Table 1: Classification of the structure of government expenditures by functions

<table>
<tr><th>COFOG (United Nations, 1981)</th><th>Oxley & Martin (1991), Saunders (1993)</th><th>Kneller et al (1999)</th><th>Sanz and Velazquez</th></tr>
<tr><td>General Administrative Services</td><td rowspan="3">Pure goods</td><td rowspan="6">Productive</td><td rowspan="2">Public services</td></tr>
<tr><td>Public Order and Safety</td></tr>
<tr><td>Defence</td><td>Defence</td></tr>
<tr><td>Health</td><td rowspan="3">Merit goods</td><td>Health</td></tr>
<tr><td>Education</td><td>Education</td></tr>
<tr><td>Housing</td><td>Housing</td></tr>
<tr><td>Transport and communications</td><td rowspan="4">Economic services and others</td><td>Transport and communications</td></tr>
<tr><td>Other Economic services</td><td rowspan="4">Non productive</td><td rowspan="3">Other expenditures</td></tr>
<tr><td>Recreat. cultural & religious affairs</td></tr>
<tr><td>Other non classified functions</td></tr>
<tr><td>Social Welfare</td><td>Transfers</td><td>Social Welfare</td></tr>
</table>

Environment (United Nations, 2000)	-	-	-

Table 2: Results of the three stage least squares method

Determinants	Dependent variable. Share in total government spending of:							
	Public Services	Defence	Health	Education	Housing	Transp & Comm	Other	Social Security
Income	0,7890 (5,96)	-0,3049 (-3,08)	0,3614 (4,33)	0,3168 (3,87)	0,4660 (1,85)	0,3198 (2,30)	-0,5178 (-4,64)	0,3638 (3,35)
Relative Prices	0,4395 (3,58)	-0,0486 (-0,53)	0,0059 0,66	-0.2690 (-3,54)	-0,5051 (-2,17)	-0,0622 (-0,48)	0,0503 (0,49)	0,3376 (3,36)
Population	-2,2176 (-8,72)	-0,8986 (-4,72)	-0,2071 (-1,29)	-0,11498 (-0,95)	-1,6679 (-3,45)	-1,4490 (-5,43)	0,5436 (2,53)	0,3003 (1,44)
Surface	2,0170 (8,37)	1,3158 (7,39)	0,0680 (0,45)	0,0957 (0,64)	1,4267 (3,12)	1,5886 (6,29)	0,1484 (0,74)	-0,4878 (-2,47)
Government expeditures	0,0249 (0,57)	-0,0316 (-0,97)	0,0397 (1,45)	-0,1376 (-5,12)	0,1935 (2,34)	-0,1320 (-2,90)	0,0896 (2,45)	-0,1117 (-3,13)
Population >64 years	-0,2730 (-1,33)	-0,3210 (-2,10)	0,0562 (0,44)	-0,1492 (-1,18)	-0,0252 (-0,06)	-0,8192 (-3,81)	-0,1929 (-1,12)	0,6036 (3,59)
Population <15 years	0,1035 (0,49)	-0,0972 (-0,62)	0,3880 (2,93)	0,4213 (3.25)	0,2437 (0,61)	0,1674 (0,76)	-1,0441 (-5,91)	0,4155 (2,42)
R^2	0,86	0,99	0,98	0,88	0,92	0,91	0,93	0,97
Hausman Test	46,60 (0,0000)	98,07 (0,0000)	80,05 (0,0000)	-0,0440 (0,0085)	106,18 (0,0000)	115,87 (0,0000)	18,90 (0,0043)	11,78 (0,0671)
Arellano Test	215,16 (0,0000)	14,61 (0,0000)	4,62 (0,5940)	538,00 (0,0000)	23,71 (0,0006)	94,09 (0,0000)	6,80 (0,3395)	57,67 (0,0000)
Breusch-Pagan Test (chi28) 1079,069 p-value:0,0000								

Table 3: Results of the Generalised Method of Moments (GMM, Arellano and Bond, 1991)

Determinants	Dependent variable. Share in total government spending of:							
	Public Services	Defence	Health	Education	Housing	Transp & Comm	Other	Social Security
Intercept	0,0246 (1,70)	-0,0025 (-0,62)	-0,0048 (-0,60)	-0,0040 (-(0,77)	-0,0279 (-1,23)	-0,0059 (-0,58)	-0,0083 (-0,76)	-0,0161 (-2,52)
Lagged -1	0,5339 (1,91)	0,7946 (10,98)	0,8400 (11,08)	0,7082 (6,51)	0,7265 (4,56)	0,7476 (8,90)	0,5567 (5,82)	0,8173 (7,82)
Income	0,5440 (1,89)	-0,1426 (-0,95)	0,2520 (1,95)	0,4901 (1,99)	0,7698 (1,32)	0,3390 (1,75)	-0,6213 (-2,19)	0,4828 (2,10)
Relative Prices	0,2543 (2,31)	0,0739 (1,02)	0,3672 2,78	0,4170 (1,89)	-0,5923 (-3,63)	0,1462 (0,78)	0,1197 (1,39)	0,4070 (1,24)
Population	-1,2012 (-2,21)	-0.3274 (-2,63)	-0,5091 (-0,79)	-0,0924 (-0,34)	2,4207 (1,59)	-0,7018 (-2,09)	0,3581 (1,0932)	0,9100 (1,24)
Government expeditures	0,1104 (0,70)	0,0273 (1,72)	-0,0199 (-0,74)	-0,0604 (-2,36)	-0,2061 (-2,22)	-0,0958 (-1,13)	0,0326 (0,56)	-0,0302 (-0,19)
Population >64 years	-0,8085 (-1,90)	-0,2015 (- 0.75)	0,6974 (2,36)	-0,0127 (-0,05)	-1,9278 (-1,75)	-0,1778 (-0,25)	0,1005 (0,21)	0,3136 (1,99)
Population <15 years	0,5296 (1,20)	-0.4343 (-2.08)	0,3428 (1,99)	0,4528 (1.96)	-1,6073 (-1,41)	-0,1903 (-0,72)	-1,1780 (-3,20)	0,1234 (0,54)
M1	-2,048 (26)	-2,779 (26)	-3.187 (26)	-2,155 (26)	-1,904 (26)	-3,325 (26)	-3,014 (26)	-1,274 (26)
M2	-1,281 (26)	-1,019 (26)	-0.424 (26)	-0.864 (26)	-0,440 (26)	-1,364 (26)	-2,118 (26)	-1,088 (26)
Sargant Test	18,734 (26)	37,809 (46)	72,656 (48)	68,51 (46)	33,79 (25)	97,00 (69)	33,47 (22)	20,526 (23)
Instruments	Lagged value 3 Income lagged 2,3,4 Expend.	Lagged value gmm2,1 Income gmm 2,1 Expend lagged 2	Lagged value 2 Income gmm 2,1 Expend. gmm2,1 Country	Income gmm 2,1 Expend. gmm2,1 Country	Lagged value 2 Income gmm 2,1 Expend. lagged 2,3	Lagged value 2 Income gmm 2,1 Expend. gmm2,1 z=lev(7,2)g	Lagged value 3 Income lagged 4 Expend. gmm3,1 Countriy	Lagged value 2 Income lagged 2,3,4 Expend. omitted

	gmm3,1 Country dummies		dummies	dummies	Country dummies lev(8,2)gmm (17,2,1)~dif(11,0)dif(13,0)dif(15,0)dif(19,0)lev(22,2)lev(22,3)	mm(17,2,1)dif(19,1)gmm (22,2,1)	dummies	Country dummies (instruments)
Hausman Test	46,60 (0,0000)	98,07 (0,0000)	80,05 (0,0000)	-0,0440 (0,0085)	106,18 (0,0000)	115,87 (0,0000)	18,90 (0,0043)	11,78 (0,0671)
Arellano Test	215,16 (0,0000)	14,61 (0,0000)	4,62 (0,5940)	538,00 (0,0000)	23,71 (0,0006)	94,09 (0,0000)	6,80 (0,3395)	57,67 (0,0000)
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