Grupo de Economía Europea

European Economy Group

Working Paper no. 13/2002

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Abstract

In this article we analyze the determinants of the functional distribution of government expenditure using for this purpose the models of the median voter's demand common in public choice literature. First of all, we review the economic literature on the factors affecting each component of government expenditure. Then, secondly, we develop a demand model of expenditure structure and we estimate the demand equations system for the sample of OECD countries in the period 1970-1997. The results reveal that, besides income and prices, institutional factors, population density and its age structure have significant effects on the composition of government expenditure.

JEL Classification: D72, D78, H50, C23

Keywords: Composition of government expenditures, Median-voter model, Panel data, Determinants of public expenditure, Ageing.

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1. Introduction

The recent models of government expenditure and economic growth developed by Barro (1990) and Devarajan et al. (1996) point to the functional composition of government expenditure as a decisive factor. These authors distinguish between the functions of productive character that stimulate growth and the non-productive ones that increase social welfare. They also reach the conclusion that there is a functional distribution of spending that maximizes growth. Hence, we might expect that, inasmuch as the elasticities of each function with regard to growth are similar in one country and another, governments would tend towards compositions of government expenditures that are also similar. Sanz and Velázquez (2001), however, confirm that, although there has been an alignment in the structure of government expenditure by functions over the last thirty years in the OECD, this convergence has been conditional rather than absolute.

Now, in this article we use the most widespread theoretical model, that of the median voter, to ascertain what that factors are that determine the composition of government expenditures by functions and which may therefore be impeding this alignment. The conclusions that are obtained will therefore be of great interest as, in accordance with the afore-mentioned models, the determinants of the functional structure of government expenditure have a direct impact on economic growth. What is more, in the case of variables in which governments have little room for manoeuvre, they could be one of the factors that explain the varying growth rates recorded by countries.

In order to investigate all these aspects, in section 2 we review the theoretical and empirical evidence regarding determinants of each one of the functions of public spending. We go on to set forth the theoretical framework of median voter demand models, following in the footsteps of the pioneering studies of Bocherding and Deacon (1972), Bergstrom and Goodman (1973) and the most recent one of Gemmel et al. (1999), brought into line with the different functions under consideration. In section 4, we perform an econometric estimation of a demand equations system of each of the functions of

government expenditure in the OECD countries over the last thirty years. Finally, in section 5, we draw the most significant conclusions.

2. Determinants of public spending functions

The literature analyzing government expenditure determinants has focused on explaining the size of the public sector or one of its components separately (Tridimas, 2001). Now, in this section we review the main studies that have analyzed the factors determining every one of the functions of government expenditure so as to obtain a set of determinants that are common to all of them. In this respect, the functions will be arranged in the order introduced by Oxley and Martin (1991), Saunders (1993), Bleaney et al. (1999), which may be seen in table 1.

[See Table 1]

Now, income is singled out as the first and foremost of all the government expenditure functions, almost always with a positive elasticity. Thus, in defence and public order and security it increases the resources for providing protection while at the same time raising the cost of an attack (Murdoch and Sandler, 1984, 1985, 1990, Okamura, 1991, Pradhan and Ravallion, 1998, and Sezgin, 2000)[1]. In merit goods - health, education and housing - a wide range of studies find elasticities greater than one, revealing their luxury good nature (Newhouse, 1977, 1987, Leu, 1986, Gerdtham el al., 1992, Falch and Rattso, 1997, Hitiris, 1999, Snyder and Yackovlev, 2000, and Heshmati, 2001).

However, Culyer (1988), McGuire et al. (1993), Gerdtham et al. (1994), Hansen and King (1996), Fernández and Rogerson (1997) and Di Matteo and Di Matteo (1998) contend that this outcome may be due to the omission of variables, failure to utilize the cross-section variation, the possibility of spurious relations, and the absence of regional disaggregation of spending. Thus, Manning *et al*. (1987), Gbesemete and Gerdtham

[1]Fritz-Assmus and Zimmerman (1990) and Bairam (1995), however, do not find a significant effect.

(1992), Gerdtham et al. (1994), Murthy and Ukpolo (1994), Borge and Rattso (1995), Fernández and Rogerson (1997) and Di Matteo and Di Matteo (1998) find an elasticity that is lower or not significantly different from unity.

Similarly, Tait and Heller (1982), Randolph et al. (1996), Canning and Pedroni (1999) and Fay (2000) find that spending on economic services, including those relating to transport and communications, responds primarily and directly to per capita income changes. With regard to interest payment and contrary to the other public spending functions, per capita income has an inverse effect on debt service as it lowers the country's risk or premium. Lastly, per capita income level assists the generation of wider social security coverage, whilst concern for aspects relating to inequality (Tait and Heller, 1982, Atkinson, 1995, Concialdi, 1999).

In relation to prices, government competes with the private sector in a large number of markets. In this way, the significant variable will be the public price in relation to the private, which to some extent will reflect the relative efficiency of the public sector. Citizens will therefore demand more public goods only if the State is capable of producing them efficiently. Now, as suggested by Baumol (1967), in the public sector the wages and salary component is greater than in the private, which causes productivity to rise less and inflation more. This circumstance is finally reflected in an increase in the share of government expenditure in the GDP when both variables are measured in nominal terms, which has a varying impact on each function (Mueller, 1989). In addition, the difficulty of obtaining the prices of the public goods of each type of function and their relation to the private ones lies in the fact that the majority of empirical studies do not include this variable, so the ratio is assumed to remain constant in time. With regard to studies that have estimated this relationship, Okamura (1991) finds an unexpected positive elasticity for defense. Gerdtham et al. (1992), do not find a significant effect of the ratio Purchasing Power Standard (PPS) for health and GDP on per capita health spending. As for educational expenditure, many studies agree on the fact that it is inelastic (Rubinfeld and Shapiro, 1989, Aronsson and Wikström, 1996, Falch and Rattso, 1997, Dahlberg and Jacob, 2000, and Ahlin and Johansson, 2001).

Insofar as demographic variables are concerned, population and its density play a highly important role in per capita spending on the purest or non-rival goods, such as defense and transport and communications, as well as merit goods and the other economic services, showing negative elasticities[2] (Murdoch and Sandler, 1985, Murdoch and Sandler, 1990, Gerdtham et al., 1992, Randolph et al., 1996, Fernández and Rogerson, 1997, Clements et al., 1998, Falch and Rattso, 1999, Fay, 2000, and Heshmati, 2001). There is evidence, therefore, that the provision of these public services makes it possible to take advantage of economies of scale, whilst they also have a public dimension. On the other hand, density raises housing expenditure, as it increases the support required from the public sector (Curie and Yelowitz, 2000).

Population age structure also proves significant for many functions. Thus, Marlow and Shiers (1999) suggest that, in respect of spending connected with public order and security and defence, the bulk of illegal actions are committed by individuals between 18-25 years old. The youngest and the oldest increase spending on health, housing and social security since they are the ones who make most use of health services and the ones who benefit most from public pension and welfare systems (Heller et al., 1986, Hagemann and Nicoletti, 1989, Murthy and Ukpolo, 1994, Di Matteo and Di Matteo, 1998, Hitiris, 1999 and Curie and Yelowitz, 2000). Now, some studies contend that health spending does not depend so much on the patient's age as on the time remaining until death (Kleiman, 1974, Leu, 1986, Hitiris and Posnett, 1992, Gerdtham et al., 1994, and Blomqvist and Carter, 1997). In the case of social security, moreover, governments may well bring in reforms to forestall the impact of population ageing on pensions, in addition to the fact that certain of its items, such as unemployment benefit, are allocated to the economically active population, i.e. people between the ages of 15 and 64. (Than Dang et al., 2001).

[2]Leu (1986), however, points out that density may also lead to increase expenditure on health as the risk of infection is greater, whilst at the same time reducing the transport time and costs to consume health services (Kleiman, 1974). Indeed, Chawla et al. (1998) do not find a significant effect for the concentration of population in urban areas. In addition, Marlow and Shiers (1999) suggest that density may increase education spending as its production costs are higher in metropolitan areas.

In education, Marlow and Shiers (1999) and Ahlin and Johansson (2001) point out that, in the framework of the median voter model, a rise in the proportion of young people will generate pressure by their parents for increases in public spending on education. However, Poterba (1997), Fernandez and Rogerson (1997), Marlow and Shiers themselves (1999) and Painter and Bae (2001) do not find empirical evidence of this impact, while they are joined by Falch and Rattso (1997) in underlining the negative influence of the proportion of the population aged over 65.

As for institutional factors, Hicks and Kubisch (1984), Smith (1989) and Looney and Mehay (1990) state that the budget process has a significant impact on military spending. The size of the public sector and its degree of decentralisation also have a decisive effect on merit goods and on economic services and other expenditure (Gerdtham et al., 1994, Murthy and Upkolo, 1994, Randolph et al., 1996, Falch and Rattso, 1997, Mongelli, 1997, Clements et al., 1998, Falch and Rattso, 1999, Marlow and Shiers, 1999, Snyder and Yackovelev, 2000 and Heshmati, 2001)[3]. Lastly, institutional factors affect social security spending, sometimes to the extent of being as important as income (Hicks and Swank, 1992 and Alesina, 1999).

Functions also prove to be complementary or substitutive to a certain degree. Indeed, Heller and Diamond (1990) and Clements et al. (1998) find that the significance of the other functions increases the magnitude of economic services and of social security spending. Likewise, Looney (1997) claims that defence and infrastructure spending are competitors, whilst Marlow and Shiers (1999) show that expenditure on education is complementary to that on defence and public order and security.

Alongside these variables common to the vast majority of the functions we find others more specific to each one. Thus, fiscal policy - the budgetary stability processes primarily - affects defence, education and transport and communications (Looney and Mehay, 1990, Murdoch and Sandler, 1990, Randolph et al., 1996, Falch and Rattso, 1997,

[3]However, Hitiris and Posnett (1992), Di Matteo (2000) and Snyder and Yackovelev (2000) do not find significant impacts of variables relating to political systems.

Marlow and Shiers, 1999, Jonakin and Stephens, 1999). Unemployment affects social security directly (Wright, 1985) and public order and security and education indirectly (Falch and Rattso, 1997, Marlow and Shiers, 1999, Snyder and Yackovelev, 2000, Painter and Bae, 2001). Inequality is a factor to be taken into account in spending on public order and security, housing and social security (Lindert, 1996, Perotti, 1996, Curie and Yelowitz, 2000, Pradham and Ravallion, 1998, Snyder and Yackovelev, 2000, and Moene and Wallerstein, 2001). The stock or flow of previous years' spending to some extent determines the amount of resources allocated to public order and security and health[4] (Gerdtham et al. 1994, Murthy and Ukpolo, 1994, Pradham and Ravallion, 1998 and Di Matteo and Di Matteo, 1998). Lastly, the defence spending of both allies and enemies affects each country's military budget[5].

In short, seven variables appear repeatedly as determinants of the government expenditures functions: income, prices, population, its density and age structure, institutional factors, and the other functions, reflecting the mutual interrelation that exists between them. In this way, table 2 shows a synoptic chart of the determinants found. Insofar as the estimation method is concerned, many studies concur in pointing out that panel data techniques combine utilisation of the time series, which takes dynamic effects into account, and the cross-section series, avoiding to overestimate elasticities.

[See Table 2]

3. Theoretical model

The base model that will be used to analyze the determinants of public spending by functions will be the median voter model, developed from the studies of Bocherding and

[4]However, other empirical studies (Newhouse, 1992, Chawla et al., 1998) find no evidence of this effect on health spending.

[5]In fact, both in the public good model, based on the study by Olsen and Zeckhauser (1966), and in the club good model (Murdoch and Sandler, 1984), which incorporates the possibility that allied spending may be complementary, the demand for defence goods and services is determined in accordance with income, price per unit of military activity, and the level chosen by allies and enemies (see Sandler and Hartley, 2001, for a recent survey).

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 only issue to be decided. It may be inferred from this approach, therefore, that the magnitude of government expenditure will be a function of the median voter's preferences and 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:

$$G_i = aY_i^a P_{gi}^b \qquad i=1,2,\ldots\ldots,N \qquad (1)$$

where:

G_i: quantity of public goods and services demanded by the voter-taxpayer i.
P_{gi}: tax-price as perceived by the voter-taxpayer i.
Y_i: voter-taxpayer's i income.
α y β: income and price elasticities.

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

$$P_{gi} = T_i CN^h \qquad (2)$$

where:

T_i: voter-taxpayer's i share in total tax revenue.
C: cost of a unit of public goods and services.
N: population
η: degree of congestion of public goods and services.

Bocherding and Deacon (1972) assume that there is no discrimination ($T_i = 1/N$), then $P_{gi} = CN^{(\varsigma-1)}$ and substituting (2) in (1) we would get:

$$G_i = aY_i^a C^b N^{b(h-1)} \quad (3)$$

However, the voter-taxpayer's i consumption of public goods and services is not just the level of per capita public spending, but it also affects its degree of rivalry and congestion, i.e.:

$$G_i = G N^{-h} \quad (4)$$

where:

G: total public spending in real terms.

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. To enable this ratio to be modified in the course of time[6], relative prices (C/Px, where Px is the price of the private sector) are included. Finally, 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). 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:

$$G = aY^a P_r^b N^f \quad (5)$$

where:

$$f = (b+1)(h-1) + h - a$$

[6]In fact, Baumol's conjecture, mentioned above, suggests that this ratio increases with time.

Y: total income of the country

This is the theoretical framework used in the vast majority of empirical studies analyzing the demand for public goods and services and which are based on the median voter model. In this study, we make three contributions to this model. First of all, the degree of consumption of every type of public good or service by the voter-taxpayer i will also be in accordance with the population of his same characteristics with which he has to share that category of spending. To be specific, the demographic feature that appears to have the strongest effect on determination of government expenditure is the age structure of the population (Gemmel et al., 1999)[7]. In fact, these authors state that the omission of this variable may generate an upward bias in the estimation of the total population parameter.

Secondly, population density is included as the utility of public goods and services also depends on the spatial distribution of the population. In fact, Mueller (1989) points out that the actual definition of public goods and services and externalities connotes geographic proximity. The inclusion of these last factors would therefore mean that:

$$G_i = GN^{-h}\prod_{i=1}^{3} N_i^{-hi}\left(\frac{N}{S}\right)^{-hs}$$

and (6)

$$P_{gi} = CN^{h-1}\prod_{i=1}^{3} N_i^{hi}\left(\frac{N}{S}\right)^{hs}; \quad \sum_{i=1}^{3} N_i = N$$

where:

N_1, N_2, N_3 population in the age interval 0-15 years, 16-64 years and over 64.

S: surface.

[7]Thus, the larger the percentage of population aged over 65 is, the higher the social security spending that will be demanded by the voter-taxpayer i. In education the relevant variable for measuring congestion will be the population predominantly requiring this public service: the youngest.

and substituting (6) in (1), following the same steps as the restricted model without the population age structure and its density:

$$G = a\bar{Y}^{a} P_r^{b} N^{f} \prod_{i=0}^{3} N_i^{f_i} \left(\frac{N}{S} \right)^{f_s} \qquad (7)$$

where:

Y : mean per capita income.

$$f = (b+1)(h-1) + h$$

$$f_i = (b+2)h_i$$

$$f_s = (b+2)h_s$$

Finally, the model is used to explain each one of the eight functions that have been considered and it therefore enables us to specify the determinants of the structure of government expenditures[8]:

$$G_f = a\bar{Y}^{a_f} P_r^{b_f} \prod_{i=1}^{3} N^{f_f} N_i^{f_{i,f}} \left(\frac{N_s}{S} \right)^{f_{s,f}} \quad \text{f =1,2,…..8; } \sum G_f = G \qquad (8)$$

In this way, every type of expenditure is allowed to have a different elasticity in respect of one of the determinants specified (Bairam, 1995)[9]. Now supposed that voters choose the share of public spending they want to assign to a given function in separate ballots, taking into account their preferences amongst all the functions. Then dividing expression (8) by (7) and rearranging the terms, we get:

[8]Other studies of the allocation of public expenditure are those that follow the consumer demand theory (Pitarakis and Tridimas, 1999) in which government maximizes a utility function. Tridimas (2001), elaborates a model where public expenditure structure is not only the outcome of a optimizing policy but also of the optimization of individual voter utility functions.

[9] In the demand function for every type of expenditure contained in the expression (8), the ideal thing would be to specify the prices of each expenditure function. However, this series is not available for the time period 1970-1997 and for all the OECD countries. Hence it is assumed that the deflators of each function are the same as that of the total public deflator.

$$\frac{G_f}{G} = \left(\frac{a_f}{a}\right)\left(\bar{Y}^{a_f - a}\right)\left(P_r^{b_f - b}\right)\left(N^{(f_f - f)}\right)\prod_{i=1}^{3}\left(N_i^{(f_{i,f} - f_i)}\right)\left(\frac{N}{S}\right)^{(f_{s,f} - f_s)}$$

f = 1,2,…..8; $\sum G_f = G$ (9)

Note that it is a case of an elasticity relative to that of the total government expenditure, so that a null 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. Expressing it in logarithmic form, the model to be estimated will be:

$$ln\left(\frac{G_f}{G}\right) = ln\left(\frac{a_f}{a}\right) + (\acute{a}_f - \acute{a})ln(\bar{Y}) + (\hat{a}_f - \hat{a})ln(P_r) +$$
$$\left[(\ddot{o}_f - \ddot{o}) + \sum_{i=1}^{3}(\ddot{o}_{i,f} - \ddot{o}_i)\right]ln(N) + (\ddot{o}_{1,f} - \ddot{o}_1)ln(\frac{N_1}{N}) + \quad (10)$$
$$(\ddot{o}_{f,2} - \ddot{o}_2)ln(\frac{N_2}{N}) + (\ddot{o}_{f,3} - \ddot{o}_3)ln(\frac{N_3}{N}) + (\ddot{o}_{f,s} - \ddot{o}_s)ln\left(\frac{N_s}{S}\right) + u$$

4. Econometric analysis

Expression (10) will be estimated using the 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. 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[10].

The structure of government expenditures by functions is calculated at current prices, assuming that prices among all expenditure functions are the same. Therefore, the shares of total public spending of each function will reflect the opportunity cost of not having assigned those resources to another function. The public/private sector price ratio is obtained as the public/private sector deflator ratio (weighted mean of investments, consumption and public transfers, the latter represented by the consumer price index), both obtained from the OECD: Economic Outlook. The per capita income (in Purchasing Power Parities of the 1995 dollar and in real terms of that year) and population 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 (10), since, as already mentioned in the second paragraph, it enables the dynamic effects to be captured without overestimating the elasticities of each determinant. In addition, the individual effects of each country will be of great use for collecting, amongst others, the institutional factors of great importance in the share of each function in government expenditures, thereby preventing bias in the estimations. However, it will not be possible to infer from the results what exactly those factors are, just their significance.

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, when deciding the percentages that are assigned to each function, voters at the same time take into account their preferences with regard to all the functions

[10]Although IMF data covers a longer period of time, it is not as a rule consolidated for all the Public Administrations, so it has been necessary to separate the transfers from among the different administrative levels (see Easterly and Rebelo, 1993, 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 data was available.

and, therefore, contemporary errors are correlated. Secondly, the inclusion of income as a determinant of the shares achieved by each function introduces endogenicity. In fact, Devarajan et al. (1996) and Gemmel et al. (1999) show that the composition of public spending is a highly significant factor in economic growth[11]. This is why we have proceeded to estimate by the three stages least squares method. At the initial stage we have used the per capita physical capital stock[12] and the share of public spending in the GDP as instrument variables of the per capita income. In this way, at a second stage, we performed an OLS-type two-stage estimation of the covariance matrix of the disturbance. Finally, we performed a GLS-type estimation using the covariance matrix of the previous step. Note that since each equation has the same set of right-hand-side variables, the regression results are the same as for the second step. But we obtain the correlation matrix of the residuals between equations and perform a Breusch-Pagan test for independent equations, taking into account that the disturbance covariance matrix may not be diagonal.

Now, in table 3 we may observe the results obtained, wherein, as already mentioned, the 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, or what amounts to the same, the OLS including dummies per country[13]. If the hypothesis is rejected, we choose the single unbiased estimator (within estimates). This first result confirms the importance and significance of institutional factors in determining the composition of government expenditures. Secondly, the Breusch-Pagan test rejects the hypothesis of independent equations, i.e. the disturbance covariance is not diagonal. As a

[11]This potential source of endogenicity, 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.

[12]Each country's private physical stock is obtained using Gross Formation of Fixed Capital and its deflator series from the OECD publication: National Accounts: Volume I. Main Aggregates, by means of the perpetual inventory method and using a depreciation rate of 10%.

[13]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's test (1990) also rejects the absence of correlation between the regressive variables and the unobservable effects for most of the functions. This test consists of comparing 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, which would mean the existence of significant individual effects.

result we confirm that voters take into account their preferences in respect of all the functions when demanding each one.

[See Table 3]

By determinants we obtain that income elasticity is higher in the case of health and social security, which suggests that more developed societies have a preference for a more equitable distribution. This result confirms that Wagner's law is especially applicable for these two functions (Solano, 1983, and Saunders, 1993). On the other hand, other expenditure, defence and, above all, housing present the lowest elasticities, confirming that the most prosperous countries are less affected by debt servicing, as they have a lower risk premium. As regards the public/private sector price ratio the estimation shows that those functions in which the wages and salary component or transfers predominate, as is the case of education, health and social security, they are less elastic, as a reflection of the lower competitiveness of the private sector in this area and in which, Baumol's conjecture is further reinforced. This result coincides with the studies that have analyzed the elasticity of public spending on education in relation to prices (Rubinfeld and Shapiro, 1989, Aronsson and Wikström, 1996, Falch and Rattso, 1997, Boije, 1997, Dahlberg and Jacob, 2000, and Ahlin and Johansson, 2001). On the other hand, housing is more elastic as individuals can more easily resort to the private sector in the light of increases of the prices in the production of public services. In addition, the higher share of investments reduce the exposure of this type of expenditure to Baumol's conjecture.

On the other hand, population rises will have an impact on the share of each function in two ways: directly, measured by the population coefficient, and indirectly by virtue of the elasticity of density. Thus, the net effect will be negative on the importance of defence, health, other expenditure and, in particular, on transport and communications, confirming the results of Murdoch and Sandler, (1985), Randolph et al., (1996) and Heshmati (2001). These functions reveal, therefore, that they are the ones that have a more purely public nature. At the other extreme, housing reveals a positive relative elasticity, as it is the most clearly rival public good. Apart from these basic variables of the model,

population density and its age structure prove to be significant determinants in the composition of government expenditures.

In fact, population density is significant for the majority of functions. Its effect on housing is very important and positive, which may suggest that the government is forced to intervene in this market when increases take place in the concentration of population and, therefore, in the high cost of land. In addition, a high density entails the implementation of measures in the area of urban planning. Similarly, it has a positive impact on the share of defence and the public services, so it is possible to deduce that security increases in importance in countries in which the population is concentrated. Health and above all transport and communications and other expenditure have a significantly lower elasticity than the other functions. We are therefore talking of types of spending that make it possible to take advantage on economies of scale, confirming the results found by Gerdtham et al. (1992) and Randolph et al. (1996).

As regards population age structure, the importance of the over-64 segment increases the share of the housing function, which suggests that funds of this type are allotted mainly to older people, an outcome that was pointed out by Curie and Yelowitz (2000). In addition, and as was to be expected, this segment raises the expenditure allocated to social security through the increase in pensions. In other respects and if the pattern of recent years continues, this increase will take place at the expense of spending on public order and security. No significant effect is found, however, of the older population on the health share, which confirms the results found by Kleiman (1974), Leu (1986), Hitiris and Posnett (1992), Gerdtham et al. (1994) and Blomqvist and Carter (1997). On the basis of this evidence the decline in spending may be found as indicated by Fuchs (1990) in line with the "compression of morbidity" theory, namely that the effect of population ageing on spending has been attenuated by the lengthening of life.

For its part, the percentage of the population aged under 15 has an even greater impact on the distribution of public spending by functions. It has a positive effect on the share of the defence, transport and communications and social security functions. In fact,

the elasticity of the young population is greater in respect of this function than that found for the over-64 segment, which suggests that the economic literature has underestimated the importance of expenditure relating to family benefits. Education and health also display a positive elasticity, although only 10% significant, i.e. contrary to the majority of economic literature (Poterba, 1997, Fernández and Rogerson, 1997, Marlow and Shiers, 1999, and Painter and Bae, 2001), scant evidence has been found of the effect of the school population on education spending[14], while it is confirmed that the early years of life entail higher health spending. The other expenditure category has a negative elasticity of great magnitude in respect of the young population, which indicates that ageing may increase its importance in detriment to the other functions.

In short, along with income and prices, institutional factors, density and population age structure and the mutual interrelations between functions prove highly significant in determining the composition of government expenditures.

5. Conclusions

In this study we have analyzed the determining factors of the composition of government expenditures using the median voter demand models common in the public choice literature. Thus, following the models of Bocherding and Deacon (1972), Bergstrom and Goodman (1973) and Gemmell (1999), for the size of the public sector we have obtained an expression of a demand function of the shares of each one of the components of government expenditures. In addition, we have carried out a review of the economic literature with regard to the factors that affect each component of government expenditures and we have reached the conclusion that, besides income and prices, population density and its age structure, institutional factors and the interrelations between functions play a very significant role in the majority of functions. In the same way, from a

[14]In fact, Marlow and Shiers (1999) contend that this result may be due to the fact that, besides the 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. This information is not available, however, on a yearly basis for all the OECD countries since 1970.

theoretical standpoint, population density and age structure include the concepts of geographic proximity and publicity in the utilisation of pure public goods and services. Hence we have enlarged the median voter model with the incorporation of these variables so as to reflect the degree of congestion of public goods and services in a more appropriate and comprehensive way.

We have then estimated the demand equations system for a sample composed of the OECD countries during the period 1970-1997. This estimation pointed first of all to the existence of institutional factors that capture the idiosyncratic preferences of government expenditures for each country. Secondly, we also confirm the dependence of each one of the equations, confirming the mutual interrelation of each of the functions. As regards the elasticity estimations, income elasticity proves to be higher in the case of the functions most closely related to the Welfare State, social security and health, showing that the most developed countries display a stronger preference for a more equitable distribution. Along with education, these functions are also the least elastic in relation to the relative prices as a reflection of the lower competitiveness of the private sector in these areas, of the importance of the wages and salary component, and of public transfers, which expose them to a greater extent to Baumol's conjecture. Transport and communications and defence are the ones that reveal their purer public good character. Together with these traditional variables in the median voter models, we also confirm that both population density and age structure have significant effects on the percentage achieved by many of the functions considered. In fact, from the results obtained we may deduce that if the ageing patterns of recent times continue in the developed countries, other expenditure and housing will become of increasing importance in detriment to public order and security, defence, education and health.

Now, the importance of the idiosyncratic effects of each country and of the demographic variables restrict the amount of room for manoeuvre that governments have in choosing the composition of government expenditure that they want. This outcome has two major implications. In fact, the recent models of Devarajan et al. (1996) and Bleaney et al. (1999) underline the influence of the structure of government expenditure by

functions in economic growth. Hence, first of all, the variables beyond government control may be preventing it from having the optimum composition and therefore retarding growth. Secondly, it is inferred that no convergence process may be expected in the public spending structures of countries as this is impeded by institutional factors and demographic variables. In this way, if the various functions of spending have a different elasticity in respect of economic growth, the countries of the OECD area will not achieve similar rates of growth in the future.

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Table 1: Clasiffication of Government Expenditures by Functions

COFOG	Oxley & Martin (1991), Saunders (1993)	Bleaney et al (1999)	Determinants analysis
General Administrative Services	Pure goods	Productive	Public services
Public Order and Safety			
Defence			Defence
Health	Merit goods		Health
Education			Education
Housing			Housing
Transport and communications	Economic services and others		Transport and communications
Other Economic services		Non-productive	Other expenditures
Recreational, cultural and religious affairs			
Other non classified functions			
Social Welfare	Transfers		Social Security

Table 2: Determinants of government expenditures by functions found in the economic literature

	Income	Prices	Population	Density	Population structure by age	Institutional factors	Other functions	Other determinants
Public services	Pradhan and Ravallion (1998)				Marlow and Shiers (1999)		Marlow and Shiers (1999)	Unemployment, inequality, education attainment.
Defence	Murdoch and Sandler (1984, 1985, 1990), Okamura (1991), Sezgin (2000), Fritz-Assmus and Zimmerman (1990), Bairam (1995)	Okamura (1991)	Murdoch and Sandler (1990)	Murdoch y Sandler, 1985,		Hicks and Kubisch (1984), Smith (1989), Looney and Mehay (1990)	Looney (1997)	Fiscal consolidation, expenditures of allies and enemies.
Health	Newhouse (1977, 1987), Leu (1986), Manning et al (1987), Gbesemete and Gerdtham (1992), Gerdtham et al (1992), Gerdtham et al (1994), McGuire et al. (1993), Murthy and Ukpolo (1994), Di Matteo and Di Matteo (1998), Hitiris (1999), Heshmati (2001).	Gerdtham et al. (1992)	Heshmati (2001)	Kleiman (1974), Leu (1986), Chawla (1998), Gerdtham et al (1992)	Kleiman (1974), Leu (1986), Hitiris and Posnett (1992), Murthy y Ukpolo (1994),Gerdtham et al (1994), Blomqvist and Carter (1997), Hitiris (1999), Di Matteo and Di Matteo (1998)	Hitiris and Posnet (1992), Gerdtham et al (1994), Murthy & Ukpolo (1994), Di Matteo (2000), Heshmati (2001)		Lagged expenditures, female labour participation.
Education	Fach and Rattso (1997), Fernández and Rogerson (1997), Borge and Rattso (1995).	Fach and Rattso (1997), Rubinfeld and Shapiro (1989), Aronsson and Wikström (1996), Boije (1997), Dahlberg		Fernández and Rogerson, (1997), Fach and Ratsso (1999), Marlow and Shiers (1999)	Poterba (1996), Fernández and Rogerson (1997), Falch and Rattso (1997) Marlow and Shiers (1999), Painter and Bae	Fach and Rattso (1997, 1999), Marlow and Shiers (1999)	Marlow and Shiers (1999)	Fiscal consolidation, unemployment, education attainment.

	Income	Prices	Population	Density	Population structure by age	Institutional factors	Other functions	Other determinants
		and Jacob (2000), Ahlin and Johansson (2001)			(2001), Ahlin y Johansson (2001)			
Housing	Snyder and Yackovlev (2000)			Curie and Yelowitz (1997)	Curie and Yelowitz (1997)	Snyder and Yackovlev (2000)		Inequality
Transp. & Comm.	Fay (2000), Randolph et al (1996)		Randolph et al (1996)	Randolph et al (1996), Fay (2000)		Randolph et al (1996)	Looney (1997)	Fiscal consolidation
Other expend.	Tait and Heller (1982)			Clements et al (1998)		Clements et al (1998), Mongelli (1998)	Heller and Diamond (1990), Clements et al. (1998)	
Social Security	Tait and Heller, (1982) Atkinson (1995) Concialdi, (1999)				Heller et al. (1986), Hagemann and Nicoletti (1989), Than Dang et al., 2001 y Lindbeck, 2001	Hicks and Swank (1992), Alesina (1999)	Heller and Diamond (1990), Clements et al. (1998)	Unemployment, inequality

Table 3: Results of the three stage least squares method

Determinants	Dependent variable. Share in total government spending of:							
	Public Services	Defense	Health	Education	Housing	Transp & Comm	Other	Social Security
Income	0,14 (1,26)	-0,54 (-6,39)	0,26 (3,05)	0,00 (0,00)	-2,18 (-7,14)	-0,19 (-1,62)	-0,23 (-2,34)	1,01 (9,67)
Relative Prices	-0,12 (0,85)	0,17 (1,56)	0,26 (2,40)	0,18 (1,85)	-0,80 (-2,09)	-0,10 (-0,71)	0,02 (0,865)	0,67 (5,03)
Population	0,00 (0,01)	-1,66 (-6,03)	0,29 (1,05)	-0,12 (-0,46)	1,20 (1,21)	-0,64 (-1,70)	1,13 (3,44)	-0,22 (-0,64)
Density	0,71 (1,85)	1,38 (4,63)	-0,67 (-2,22)	-0,03 (-0,10)	4,15 (3,89)	-0,96 (-2,36)	-1,37 (-3,85)	-0,28 (0,45)
Population >64 years	-0,59 (-4,00)	-0,04 (-0,32)	0,08 (0,65)	-0,12 (-1,18)	0,99 (2,43)	0,23 (1,50)	-0,16 (-1,15)	0,53 (3,76)
Population <15 years	-0,22 (-1,37)	0,25 (1,97)	0,23 (1,78)	0,19 (1,68)	0,05 (0,12)	0,46 (2,68)	-1,07 (-7,22)	1,03 (6,67)
Hausman Test	46,60 (0,0000)	98,07 (0,0000)	80,05 (0,0000)	17,22 (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								

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