E C O N O M I C S B U L L E T I N

Competition in the allocation of public spending: a new model to analyse the interaction between expenditure categories

JULIAN RAMAJO
UNIVERSITY OF EXTREMADURA

MIGUEL MÁRQUEZ
UNIVERSITY OF EXTREMADURA

FRANCISCO PEDRAJA
UNIVERSITY OF EXTREMADURA

JAVIER SALINAS
UNIVERSITY OF EXTREMADURA / INSTITUTE FOR FISCAL STUDIES

Abstract

Starting from the median voter model commonly used in the literature to analyse the determinants of the functional distribution of public spending, we propose a new multiproduct dynamic model that also allows one to classify the nature of the interaction –complementarity or substitutability– between the different categories of government expenditure. As empirical application, we examine the pattern of public spending in Spain from 1990 to 1997. The results show that the basic determinants of the different items of expenditure are per capita income, population, the size of the public sector, and the presence of budget deficits, and that there are significant interdependencies between some components of the public expenditure.

This research was supported by the Institute for Fiscal Studies of Spain (Ministry of Finance)
Citation: RAMAJO, JULIAN, MIGUEL MÁRQUEZ, FRANCISCO PEDRAJA, and JAVIER SALINAS, (2007) "Competition in the allocation of public spending: a new model to analyse the interaction between expenditure categories." *Economics Bulletin*, Vol. 8, No. 4 pp. 1-7
Submitted: December 20, 2006. **Accepted:** April 4, 2007.
URL: http://economicsbulletin.vanderbilt.edu/2007/volume8/EB-06H50003A.pdf

1. Introduction

There exists a recent, but fertile literature on the influence on economic growth of the size and structure (of both income and expenditure) of the public sector[1]. In this sense, there have been several proposals of theoretical models to analyse under which conditions certain changes in the composition of taxation and public spending affect an economy's equilibrium growth rate (Barro, 1990; Barro and Sala-i-Martin, 1992; Cashin, 1995; Devarajan *et al.*, 1996; Mendoza *et al.*, 1997; Gemmell and Kneller, 2002; among others). Likewise, there have been some models developed in which both the taxation (Hettich and Winer, 1988) and the expenditure structures (Tridimas, 2001) result from a process of maximization on the part of the government, in which the objective function represents the expected electoral backing for the taxation and spending decisions that the government is thinking of making.

Two questions arise from the aforementioned studies. What factors determine the differences between countries in the functional distributions that are observed? And, for a given country, how have the spending structure evolved historically, what are the principal determinants of each function, and what is the observed pattern of complementarity-substitutability between the different budgetary items?

The first of these questions was addressed by Tanzi and Schuknecht (2000) and Sanz and Velázquez (2002), *inter al.* The former made a detailed analysis of the observed tendencies in the composition of the public spending of several countries during the XX century. And the latter analysed the main factors determining the differing functional composition of public spending observed in a sample of OECD countries in the period 1970-1997.

The present work addresses the second group of questions, proposing an empirical model that can be used in order to make explicit the nature of the interactions between all expenditure components. As an application, this model is used with reference to data for Spain's public administration sector from 1970 to 1997, analysing the factors that have determined the observed functional distribution in Spain's public spending in that period, and the nature of the relationship (whether competition or complementarity) between the various functions of that expenditure.

The article is structured as follows. Section 2 develops the model to use as the basis for the estimations: after describing the standard –static– model of demand for public services, this is extended to include the temporal evolution of the system describing each expenditure function's share in the total. The result is a new –dynamic– demand model that allows a simultaneous analysis of the effect of the moderating variables and of the relationship between the different types of expenditure. Section 3 presents details of the most significant results of the estimates made with this model applied to the Spanish economy. Finally, Section 4 gives the main conclusions of the work.

2. The theoretical and the empirical model

As in most studies of the demand for public services, the theoretical model that will be used as the point of departure is based on the median voter-taxpayer approach developed by Borcherding and Deacon (1972) and Bergstrom and Goodman (1973). In this model, the amount of public goods and services that taxpayers consume is basically a function of the *per capita* income of those demanding public spending, of the relative price of public expenditure with respect to private sector goods, and of the size of the population. Specifically, the

[1] For a detailed analysis of the current state of the topic see, inter al., the works of Agell et al. (1997, 1999), Bleaney et al. (2001), Fölster and Henrekson (1999), Kneller et al. (1999), Zagler and Dürnecker (2003) and the references therein.

aggregate government expenditure demand function derived from individual voter-taxpayer consumption functions is:

$$G = aY_{pc}^{\alpha} P_r^{\beta} N^{\gamma} \tag{1}$$

where $\gamma = (\beta+1)(\eta-1)+\eta-2\alpha$, α and β are the income and price elasticities of demand for general government provided good and services, respectively, η is the degree of privatization of the public services, G is the total public spending in real terms, Y_{pc} is the real *per capita* income, P_r the relative price of the public sector (defined by C/P_x, C being the unit cost of G and P_x the price of private goods), and N is the population.

Assuming that the total spending G may be disaggregated into n groups, and that one has a function of type $G_i = a_i Y_{pc}^{\alpha_i} P_r^{\beta_i} N^{\gamma_i}$,[2] for each expenditure function i=1,2,…,n, then the proportion of public spending allocated to each expenditure group will be given by the expression

$$w_i = G_i / G = (a_i / a) Y_{pc}^{\alpha_i - \alpha} P_r^{\beta_i - \beta} N^{\gamma_i - \gamma} \tag{2}$$

which is the basic (static) theoretical expression for the disaggregated demand for public services in terms of each expenditure function's share.

The theoretical relationship (2) can be made dynamic by applying the following statistical support. Let the share of the i-th spending function in total public spending at time t be $w_i(t)$. Then this model examines the possible forms of interaction between those shares by describing the temporal evolution of the system given by the n-dimensional vector $W(t) = \left(w_1(t), w_2(t), \ldots, w_n(t)\right)'$ for t=1,2,..,T (where n indicates the number of spending categories considered and T is a finite time period).

The model gives the (discrete) dynamics of the system as (Dendrinos and Sonis, 1990, p. 20):

$$w_i(t) = \frac{F_i\left(W(t-1)\right)}{\sum_{j=1}^{n} F_j\left(W(t-1)\right)} \qquad i = 1,2,\ldots,n \quad t = 1,2,\ldots,T \tag{3}$$

with $0 < w_i(t) < 1$, $\sum_{i=1}^{n} w_i(t) = 1 \ \forall t$ and $F_k\left(W(t)\right) > 0$, and the function $F_k(\bullet)$ being arbitrary as long as it satisfies the condition of being positive.

If one takes the n-th expenditure group as being numerary[3], one could then work with the functions $H_k(\bullet) = F_k(\bullet)/F_n(\bullet) \quad k = 1,2,3,\ldots,n-1$, and the dynamic system will be given by the expression

---

[2] In principle, one would expect a different relative price ($P_{r,i}$) for each expenditure group, and a function for G_i that would not only depend on this relative price but also on the prices of the other groups. In our case, given the lack of disaggregated price data for the various public services, we did not test this possibility.

[3] All the statistical procedures are invariant with respect to the choice of numerary function (for details of this result, see Aitchison, 1986, pp. 93-98).

$$\begin{cases} w_n(t) = \dfrac{1}{1+\sum_{j=1}^{n-1} H_j\big(W(t-1)\big)} \\ w_i(t) = w_n(t) H_i\big(W(t-1)\big) \quad i = 1,2,3,\ldots,n-1 \end{cases} \tag{4}$$

Instead of working with the specification $H_i\big(W(t)\big) = A_i \prod_k w_k(t)^{a_{ik}}$ put forward by Dendrinos and Sonis (1990), the following function is proposed in this work (the introduction of the function $G(\bullet)$ is based on the theoretical results of Aitchison ,1986, pp. 220-227):

$$H_i\big(W(t)\big) = \frac{w_i(t+1)}{w_n(t+1)} = A_i \prod_{k=1}^{n-1} \left(\frac{w_k(t)}{w_n(t)} \right)^{a_{ik}^n} G(t+1)^{a_{iG}^n} \tag{5}$$

where $G(t) = \sum_{i=1}^{n} G_i(t)$ is the total public spending.

This expression together with the theoretical specification (2) leads to the following system of log-linear equations:[4]

$$\begin{aligned} \log H_i(t) = \delta_i^n + \alpha_i^n \log Y_{pc}(t) + \beta_i^n \log P_r(t) + \gamma_i^n \log N(t) + \\ + \sum_{k=1}^{n-1} a_{ik}^n \log H_k(t-1) + a_{iG}^n \log G(t) \end{aligned} \tag{6}$$

where $H_i(t) = w_i(t)/w_n(t)$, δ_i^n is the intersect of each equation, $\alpha_i^n = \alpha_i - \alpha_n$, $\beta_i^n = \beta_i - \beta_n$ and $\gamma_i^n = \gamma_i - \gamma_n$.

One observes that the parameters of the variables Y_{pc}, P_r and N are elasticities relative to that of the numerary spending function, and therefore measure the effect of a unitary change in the relevant variable, balanced out by an also unitary change in the numerary category. Furthermore, a null value of any of these parameters should not be interpreted as indicating that the corresponding variable does not affect the spending allocated to a given group, but that the way it does so is the same as that of the numerary spending group.

The parameters a_{ik}^n and a_{iG}^n represent the pseudo-elasticities of inter-functional and total growth, respectively. The former are basic in the analysis of substitutability/complementarity between the different spending functions, in terms of both sign and magnitude: a positive value for a parameter a_{ik}^n will denote complementary growth between the two expenditure groups and a negative value a competitive relationship (if the relative share of the function *k* rises one year, the other relative share will fall the following year).[5] Likewise, if the parameter

[4] It is interesting to note that the conditions established by Devarajan *et al.* (1996, p. 319) for a change in the share of group *i* -compensated by the group *n*- to produce a rise in the economy's equilibrium rate may be written as $\log w_i / w_n < \theta \log \beta_i / \beta_n$. One sees that the variable on the left-hand side of this equation is the same as the dependent variable of model (6), so that the latter could be interpreted as a form of analysing the temporal evolution of the basic variable defining the equilibrium condition corresponding to each observed spending structure.

[5] The interpretation of the parameters a_{ii}^n is, of course, different. In this case, they are associated to the degree of persistence of the volume of resources dedicated to the *i*-th expenditure item: in particular, they measure to what degree the (relative) share of one year determines the proportion dedicated to this expenditure function the following year.

a_{iG}^{n} is positive, the relative share of the *i*-th expenditure group grows when total public spending grows, while a negative value means that this group loses share when the total spending rises.

Finally, it should be remarked that the system (6) can be understood as "basic", in the sense of deriving from both the elementary theoretical specification (2) and the dynamic system (4)-(5). Nevertheless, it could be extended by adding other control variables proposed in the literature to explain the variations in median-voter's preferences or the growth of specific public spending groups, and other political and institutional variables that can help to improve the specification of the system. Candidates for such additional variables are the country's demographic structure, the population density, the ratio of revenues to public spending, the level of visibility of taxes, the degree of decentralization in public spending, or additional lags in the explanatory variables.

We here extend the original model (6) in two directions. Firstly, we start with the hypothesis that taxpayers may have a mistaken perception of the price of public services (Gemmell *et al.*, 1999). We shall thus assume that the phenomenon of fiscal illusion is basically caused by inadequate visibility in the payment of taxation, as well as by the existence of deficits in public accounts. This means the addition of two new variables to the system: the logarithm of the deficit ratio ($\log D$) and the logarithm of the degree of visibility of taxes ($\log V$).

One also finds reports in the literature that the demographic structure can bias the structure of public spending towards specific items[6]. For this reason, while bearing in mind that the groups of spending considered here are too broad to allow clear results to be derived concerning this issue, we also incorporated the variables $\log PN15$ and $\log PN65$ into the model. These measure the logarithm of the fractions of the population below 15 years old and above 65 years old, respectively.

3. Empirical application: The allocation of public spending in Spain

In this section, the model described in the previous section will be used to analyse the disaggregated demand for public services in Spain during the period 1970-1997.[7]

With respect to the categories of public expenditure (G_i) that we shall consider, since the data are for a single country only and a time period of less than thirty years, we aggregated the initially available groups into just four. Specifically, we distinguished between expenditure on public goods (defence and general Administration services), social benefits (pensions, unemployment, and other benefits), preferential goods (education, health, housing and collective services), and State intervention in the economy including both economic services (investment, subsidies to exploitation and capital transfers) and interest payments on

[6] For example, the older the population, the higher the proportion of public expenditure dedicated to transfer payments (typically dominated by pensions and social security benefits). Also a rise in the ratio of young people could generate parents' pressure to increase public educational expenditure.

[7] The statistical data were obtained from the National Statitical Institute (INE), the Bank of Spain, the Ministry of Finance and other indirect sources (Alcaide, 1988; Argimón *et al.*, 1999; Valle, 1996). Even though a longer series for some variables is available, it has only been possible to work with homogeneous data for the disaggregated public expenditure for the period 1970-1997. Previous to 1970 there is no reliable data, and after 1997, the statistical classification used (SEC95) is not compatible with the one used for 1970-1997 (SEC79). Then, because our data period ends almost a decade ago, our paper could be framed more as an application of the proposed model rather than as a statement of the current state of the public spending in Spain. [For more details on methodological issues and statistical sources, see, among others, Argimón *et al.* (1999) and Utrilla and Pérez (2001). For a detailed analysis of the evolution of public expenditure in Spain, see Salinas and Álvarez (2003).]

public debt. Figures 1 and 2 show the evolution of the different categories of spending (in real terms) together with their growth rates during the period studied.

The other variables used in the estimation are the following: total public spending in real terms (G) is the sum of the expenditures in the four categories considered; real *per capita* income (Y_{pc}) as measured by the *per capita* GDP at 1995 market prices in pesetas; the relative price (P_r) as approximated by the ratio between the public sector deflator (calculated as the weighted mean of the deflators of the different components of consumption of the public administrations –government final consumption, government gross domestic fixed capital formation and transfers) and the implicit GDP price index (base 1995=100); the public administration deficit, D, calculated as the ratio between revenues and expenditures; Spain's total resident population, N; the proportions, *PN15* and *PN65*, below 15 years old and above 65 years old, respectively; and a measure of the degree of visibility of taxation, V, as the ratio between indirect taxes (specifically, the taxes linked to production and imports) and total government revenues. Table 1 contains the main descriptive statistics of the variables used in this empirical section.

After this description of the variables, we shall next describe how we approached the problem of estimating the demand system formulated in the previous section.

Firstly, with respect to the econometric specification used, we added to the formulated system of equations a multivariate normal *(n-1)*-vector $u = (u_1,\ldots,u_{n-1})$, with null means and non-diagonal (constant) covariance matrix given by Ω, to take into account the possible correlation between the errors of the different equations. Given this specification, the method of estimation chosen was the SUR (Zellner, 1962) as being appropriate for these "seemingly" unrelated regressions.

Secondly, we estimated the demand system with all the control variables ("basic" and "complementary") included. Of the extra variables initially added to the model (6), only the variable $\log D$ was found to be globally significant[8]. We therefore decided to eliminate the rest, and only include the basic variables plus the aforementioned deficit variable. Neither in this model was the price variable found to be significant at the standard significance levels (W=5.843, P=0.11), but since it did lie within the 90% interval, we finally decided not to eliminate it. The final results following this initial specification search are given in Table 2.[9]

In general terms, the statistical fit was good for the three equations estimated ($R^2 \approx 0.9$), with several significant variables in each, and was especially so for the preferential goods and social benefits demand equations. Nevertheless, we shall perform a conjoint significance analysis of each of the model's variables because of the problems of multicollinearity to which the estimated system may be subject. As mentioned in Section 3, the elasticities of the Y_{pc}, P_r and N regressors (and the variable D) should be interpreted in relation with that corresponding to the numerary group –in our case government expenditure on intervention in the economy.

With regard to the first variable in order of statistical significance, *per capita* income was found to be a basic determinant in the distribution of public spending (W=25.338, P=0.00),

---

[8] The Wald statistic and the P-value corresponding to the nullity constraints of the parameters of the variables $\log V$, $\log PN15$ and $\log PN65$ were W=5.016 (P=0.17), W=0.837 (P=0.84), and W=2.102 (P=0.55), respectively. Since we are searching for additional explanatory power of other regressors, we have decided to drop those variables not found to be significant in the empirical analysis in order to avoid problems of multicollinearity between all the variables of the system. Anyway, when the variables $\log V$, $\log PN15$ and $\log PN65$ are included in the model, the results do not differ significantly from those reported in Table 2. The authors will provide these results upon request.

[9] The estimated system passed all the standard specification tests. Thus, as well as the (multivariate) test of functional specification, serial correlation, normality, and heteroskedasticity not being significant, the model's associated eigenvalues were less than unity, so that the system satisfies the stability condition.

with notably high values of the (relative) income elasticities of the preferential goods and social benefits groups. This result indicates that government expenditures in these groups appear to increase –relatively– more than proportionately with *per capita* national income.[10]

Secondly, total public spending (*G*) was also highly significant (*W*=18.429, *P*=0.00), with the estimated pseudo-elasticities being negative in the three cases. This result suggests a preference to increase the share of intervention expenditure (to the detriment of the rest) when the available volume of resources increases, and it also shows that in Spain the size of the public sector has a decisive effect on both economic services and public debt interest expenditures.[11]

The third variable in order of significance (*W*=10.980, *P*=0.01) was the deficit (*D*), which indicates that the share of taxation-financed spending significantly conditions not only the volume of resources available but also how they are allocated.[12] Thus, our empirical evidence supports the hypothesis of deficit illusion and it also shows that Spanish fiscal policy influences the preferences of the median voters, changing their expenditure allocation model on the various public goods and services.[13]

In addition to the above variables, the population also has a major impact on the distribution of public spending (*W*=7.197, *P*=0.06), again with a notably different effect on the allocations to preferential goods and social benefits. However, as previously mentioned, the age structure of the population does not seem to affect the pattern of demand for public services[14], although this result is probably reflecting the aggregated nature of those expenditure groups considered in this work.

Last, the relative price of public-sector goods and services seems to have no significant differential effect on any of the budgetary groups, although this result could be an artefact of the high degree of aggregation of the expenditure groups considered and/or to the fact that we are using the same price for all expenditure groups (see note 2). Nevertheless, as was observed in the results for the estimated aggregate expenditure function, the effect of the

---

[10] A wide range of studies in the literature have found absolute elasticities greater than one for public spending on health, education or housing, revealing their luxury good nature (see, for example, Falch and Rattso, 1997; Gerdham *et al.*, 1992; Newhouse, 1987; Snyder and Yackovlev, 2000). Additionally, the level of per capita income allows broader social security coverage, at the same time that influences aspects related to inequality (Atkinson, 1995; Clements *et al.*, 1998; Tait and Heller, 1982).

[11] Similar results were obtained in Mongelli (1997) and Randolph *et al.* (1996)

[12] In order to find evidence for how the deficit influences the volume of public spending, we estimated the aggregate expenditure demand function presented at the beginning of Section 2 (extended with fiscal illusion measures). The results were as follows (the equation was estimated by OLS, but a similar result was obtained, except for the case of the price variable, on using the fully-modified OLS estimator proposed by Phillips and Hansen, 1990):

$$\log \hat{G} = \underset{(-10.8)}{-68.19} + \underset{(10.17)}{1.33} \log Y_{pc} - \underset{(-2.13)}{1.24} \log P_r + \underset{(9.85)}{6.51} \log N - \underset{(-2.12)}{0.52} \log D + \underset{(2.09)}{0.30} \log V$$

[The values in parentheses are the *t* statistics for each estimated parameter].

One sees that all the variables are significant at the standard 5% significance level. In particular, the coefficient estimated for the deficit variable (-0.52) indicates that public expenditure is greater the smaller is the ratio *D*, i.e., the smaller the proportion of expenditure financed by taxes. Also it is worthwhile to mention that the measure of invisibility of taxes is significantly different from zero, showing that voter-taxpayers demand more public expenditure when the tax structure switches towards indirect taxes.

[13] Fiscal illusion in the form of excess demand for public goods and services has been also found in Ashworth (1995) and Gemmell *et al.* (1999). On the other hand, some recent evidence about the effects of fiscal policy on the structure of government expenditures can be found, for example, in Cashin *et al.* (2001), Baqir (2002) or Jonakin and Stephens (1999).

[14] The results in the literature broadly show that old-age and school-age sectors of population have a positive impact on education, health, housing and social security expenditures since they are who make most use of these services (Fernández and Rogerson, 1997; Hagemann and Nicoletti, 1989; Heller *et al.*, 1986; Hitiris, 1999; Poterba, 1997).

relative cost of public services is significant and negative in sign, suggesting price-elastic demand for aggregate government-provided goods and services.

Overall, the findings confirm the results in the literature on the importance of income, the size of the public sector, and the population in explaining the behaviour of public administration spending, and also show the significant influence of public deficit on the administration's budgeting process.

With respect to the observed pattern of interaction between the different expenditure functions, firstly there was the weak interrelationship in the case of public goods, where only the elasticity of the preferential goods group ($a_{1,2}^4$) was found to be marginally significant, with a value of 0.52. This positive value shows that an increase of the significance of the expenditures in preferential goods in the Spanish economy also increases the relative proportion of expenditures on public goods.

On the contrary, there were significant interactions between preferential goods expenditure and the public goods and social benefits groups. In the former case, the estimate of -1.06 for the elasticity $a_{2,1}^4$ indicates a high level of substitutability between the two functions while, in the latter ($a_{2,3}^4$), the elasticity of 0.65 indicates a complementarity relationship between the expenditures in preferential goods and in social benefits.

Likewise, in the case of the social benefits demand equation, the value of the elasticity $a_{3,1}^4$ (-0.81) is highly significant, indicative in this case also of a competitive growth relationship between the expenditures of this group and those of the public goods group.

Finally, with respect to the parameters of persistence of the spending $a_{i,i}^4$, there is a highly significant value only in the case of social benefits group. The estimated value (0.78) indicates that the spending allocated each year to this group is highly dependent on the levels of spending of previous years (as measured by the term $\left(w_3 / w_4\right)_{-1}$).

4. Conclusions

This work is intended to be a one-step ahead to the still sparse literature approaching the analysis of the structure of public spending. The main contribution has been to generalize the median voter model by including dynamic aspects. The new model is capable not only of measuring the impact of the classical determinants (income, relative public service prices, population, total expenditure, etc.), but also of yielding additional relevant information on the trade-offs that exist between the different spending categories.

The model's utility was demonstrated by applying it to the Spanish public sector. Thus, firstly, the results reinforce some already known conclusions on the basic determinants of the different items of expenditure. Secondly, the dynamic model adds new evidence to the existing knowledge about the topic of budget expenditure composition. In summary, not only were some of the standard control variables found to be significant, but significant interactions were also detected between some of the public services, and these interactions were classified as relationships of complementarity or substitutability.

References

Aitchison J. (1986), *The Statistical Analysis of Compositional Data*, Chapman and Hall, New York.

Agell J., Lindh T. and Ohlsson H. (1997): "Growth and the public sector: A critical review essay", *European Journal of Political Economy*, Vol. 13, pp. 33-52.

Agell J., Lindh T. and Ohlsson H. (1999): "Growth and the public sector: A reply", *European Journal of Political Economy*, Vol. 15, pp. 359-366.

Alcaide J. (1988): "El gasto público en la democracia española. Los hechos", *Papeles de Economía Española*, N. 37, pp. 2-41.

Argimón I., Gómez A.L., Hernández de Cos P. and Martí F. (1999): "El sector de las administraciones públicas en España", *Estudios Económicos*, N. 68, Banco de España, Servicio de Estudios.

Ashworth J. (1995): "The empirical relationship between budgetary deficits and government expenditure growth: an examination using cointegration", *Public Finance*, Vol. 50, pp. 1-18.

Atkinson A.B. (1995): "The welfare state and economic performance", *National Tax Journal*, Vol. 48, N. 2, pp. 171-198.

Baqir R. (2002): "Social sector spending in a panel of countries", *IMF Working Paper*, N. 02/35.

Barro R. (1990): "Government Spending in a Simple Model of Endogenous Growth", *Journal of Political Economy*, Vol. 98, pp. 103-125.

Barro R. (1991): "Economic growth in a cross section of countries", *Quarterly Journal of Economics*, Vol. 106, pp. 407-444.

Barro R. and Sala-i-Martin X. (1992): "Public finance in models of economic growth", *Review of Economic Studies*, Vol. 59, pp. 645-661.

Bergstrom T. and Goodman R. (1973): "Private demands for public goods", *American Economic Review*, Vol. 63, pp. 280-296.

Bleaney M., Gemmell N. and Kneller R. (2001): "Testing the endogenous growth model: public expenditure, taxation and growth over the long-run", *Canadian Journal of Economics*, Vol. 34, pp. 36-57.

Borcherding T. and Deacon R. (1972): "The demand for the services of non-federal governments", *American Economic Review*, Vol. 62, pp. 891-901.

Cashin P. (1995): "Government spending, taxes and economic growth", *IMF Staff Papers*, Vol. 42, pp. 237-269.

Cashin P., Mauro P., Patillo C. and Sahay R. (2001): "Macroeconomic policies and poverty reduction: Stylized facts and an overview of research", *IMF Working Paper*, N. 01/135.

Clements B., Rodriguez H. and Schwartz G. (1998): "Economic Determinants of Government Subsidies", *IMF Working Paper*, N. 98/166.

Dendrinos D.S. and Sonis M. (1990), *Chaos and Socio-Spatial Dynamics*, Applied Mathematical Sciences 86, Springer-Verlag, New York.

Devarayan S., Swaroop V. and Zou H. (1996): "The composition of public expenditure and economic growth", *Journal of Monetary Economics*, Vol. 37, pp. 313-344.

Easterly W. and Rebelo S. (1993): "Fiscal policy and economic growth: An empirical investigation", *Journal of Monetary Economics*, Vol. 32 (3), pp. 417-458.

Falch T. and Rattso J. (1997): "Political and economic determinants of school spending in Federal states: theory and time-series evidence", *European Journal of Political Economy*, Vol. 13, pp. 299-314.

Fernández R. and Rogerson R. (1997): "The determinants of public education expenditures: Evidence from the States, 1950-1990", *NBER Working Paper*, N. 5995.

Fölster S. and Henrekson M. (1999): "Growth and the public sector: a critique of the critics", *European Journal of Political Economy*, Vol. 15, pp. 337-358.

Gemmell N., Morrissey O. and Pinar A. (1999): "Fiscal illusion and the demand for government expenditures in the UK", *European Journal of Political Economy*, Vol. 15, pp. 687-704.

Gemmell N. and Kneller R. (2002): "Fiscal Policy, Growth and Convergence in Europe", *European Economy Group Working Papers*, N. 14, Universidad Complutense de Madrid (Spain).

Gerdtham U.-G., Sogaard J., Jönsson F. and Andersson F. (1992): "An econometric analysis of health care expenditure: a cross-section of OECD countries", *Journal of Health Economics*, Vol. 11, pp. 63-84.

Hagemann R.P. and Nicoletti G. (1989): "Ageing population: Economic effects and implications for public finance", *OECD Working Paper*, N. 61.

Heller P., Hemming R. and Kalvert P. (1986): "Ageing and social policy in the major industrial countries, 1980-2025", *IMF Occasional Paper*, N. 47.

Hettich W. and Winer S. (1988): "Economic and political foundation of tax structure", *American Economic Review*, Vol. 78, pp. 701-712.

Hitiris T. (1999): "Growth and containment of health care expenditure in industrial countries", *Discussion Paper Series*, N. 15, Department of Economics and Related Studies, University of York (UK).

Jonakin J. and Stephens M. (1999): "The impact of adjustment and stabilization policies on infrastructure spending in Central America", *North American Journal of Economics and Finance*, Vol. 10, pp. 293-308.

King R. and Rebelo S. (1990): "Public policy and economic growth: Developing neoclassical implications", *Journal of Political Economy*, Vol. 98, pp. 126-151.

Kneller R., Bleaney M. and Gemmell N. (1999): "Fiscal policy and growth: evidence from OECD countries", *Journal of Public Economics*, Vol. 74, pp. 171-190.

Lucas R. (1990): "Supply-side economics: an analytical review", *Oxford Economic Papers*, Vol. 42, pp. 293-316.

Mendoza E., Milesi-Ferretti G. and Asea P. (1997): "On the effectiveness of tax policy in altering long-run growth: Harberger's superneutrality conjecture", *Journal of Public Economics*, Vol. 66, pp. 99-126.

Mongelli F. (1997): "Effects of the European monetary union on taxation and interest spending on national governments", *IMF Working Paper*, N. 97/93.

Newhouse J. (1987): "Cross-sectional differences in health spending. What do they mean?" *Journal of Health Economics*, Vol. 6, pp. 159-162.

Phillips P. and Hansen B. (1990): "Statistical inference in instrumental variables regression with I(1) processes", *Review of Economic Studies*, Vol. 57, pp. 99-125.

Poterba J. (1997): "Demographic structure and the political economy of public education", *Journal of Public Policy and Management*, Vol. 16, pp. 48-66.

Randolph S., Bogetic Z. and Hefley D. (1996): "Determinants of public expenditure on infrastructure, transportation and communication", *Policy Research Working Paper*, N. 1661, World Bank.

Sanz I. and Velázquez F.J. (2002): "Determinants of the composition of government expenditure by functions", *European Economy Group Working Papers*, N. 13, Universidad Complutense de Madrid (Spain).

Snyder J.M. and Yackovlev I. (2000): "Political and economic determinants of government spending of social protection programs", *Working Paper*, Massachusetts Institute of Technology (USA), April-2000.

Tait A.A. and Heller P.S. (1982): “International comparisons of government expenditure”, *IMF Occasional Paper*, N. 10.

Tanzi V. and Zee H. (1997): “Fiscal policy and long-run growth”, *IMF Staff Papers*, Vol. 44, pp. 179-209.

Tanzi V. and Schuknecht L. (2000), *Public Spending in the 20th Century: A Global Perspective*, Cambridge: Cambridge University Press.

Tridimas G. (2001): “The economics and politics of the structure of public expenditure”, *Public Choice*, Vol. 106, pp. 299-316.

Salinas J. and Álvarez S. (Coord.) (2003), *El Gasto Público en la Democracia*, Instituto de Estudios Fiscales, Madrid.

Utrilla A. and Pérez C. (2001): “La evolución de las políticas de gasto de las administraciones públicas en los años 90”, *Documentos de Trabajo*, N. 164, Fundación FIES.

Valle V. (1996): “La hacienda pública de la democracia española”, *Papeles de Economía Española*, N. 68, pp. 2-26.

Zagler M. and Durnecker G. (2003): “Fiscal policy and economic growth”, *Journal of Economic Surveys*, Vol. 17 (3), pp 397-422.

Zellner A. (1962): “An efficient method of estimating seemingly unrelated regressions and tests of aggregation bias”, *Journal of the American Statistical Association*, Vol. 58, pp. 500-509.

Figure 1: Composition of public spending in Spain, 1970-1997 (as a proportion of total expenditure)

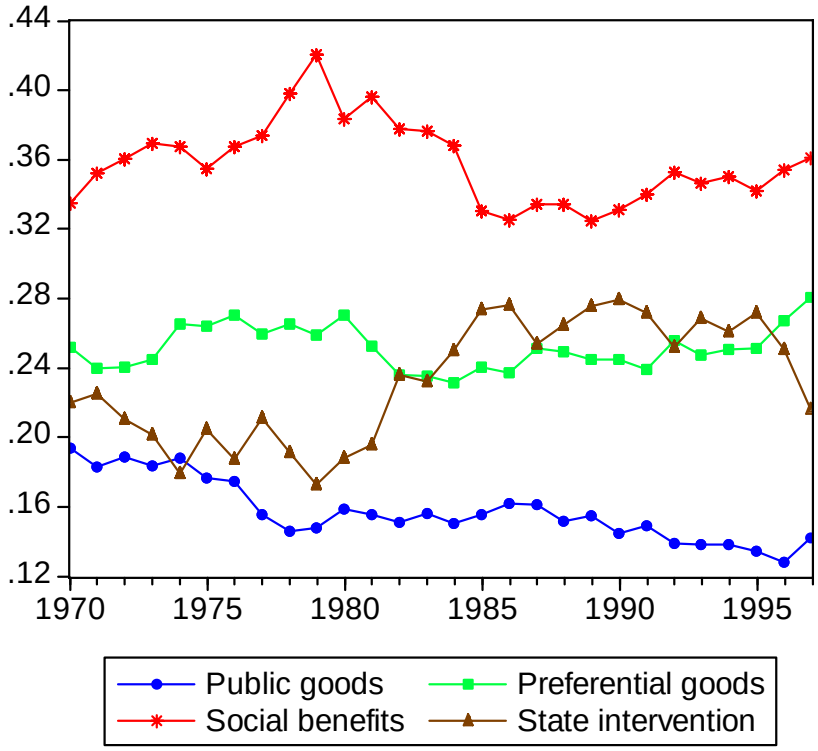

Figure 2: Evolution of specific spending categories (levels and growth rates), 1970-1997

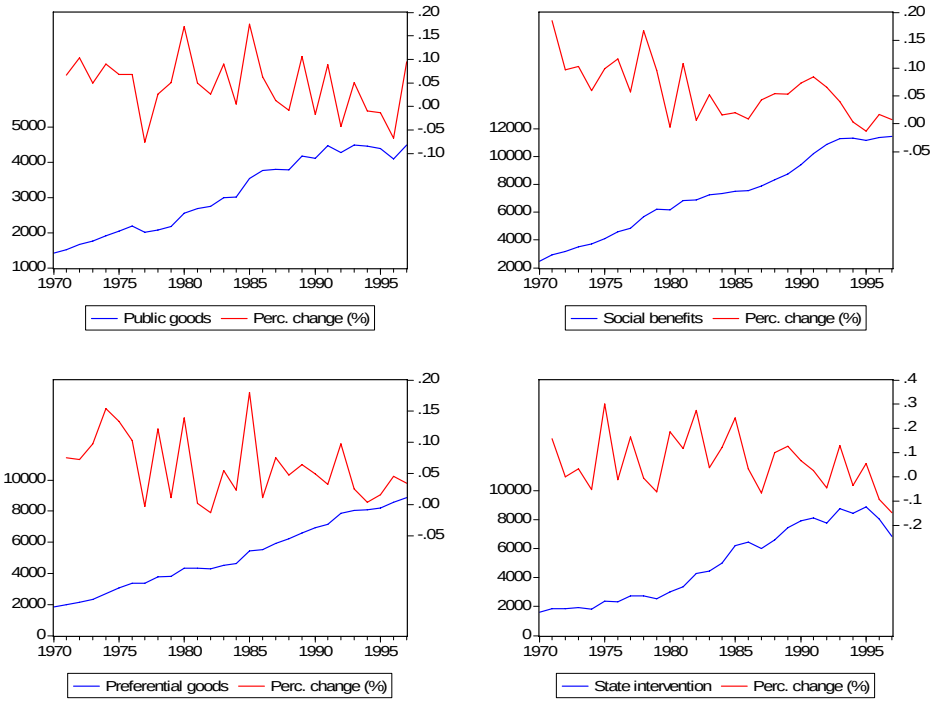

Table 1: Descriptive statistics of the variables

Variable	Mean	Std. Dev.	Maximum	Minimum
w_1	0.16	0.02	0.19	0.13
w_2	0.36	0.02	0.42	0.33
w_3	0.25	0.01	0.28	0.23
w_4	0.23	0.03	0.28	0.17
G	20461.70	8839.68	33087.57	7457.06
Y_{pc}	1461.289	254.06	1946.07	1046.05
P_r	0.973935	0.04	1.03	0.86
D	0.95	0.06	1.05	0.85
N	38145.89	1769.52	39853.00	33885.00
PN15	24.36	4.09	29.00	16.90
PN65	12.05	1.85	15.70	9.60
V	0.27	0.03	0.35	0.23

Table 2: SUR estimates of the (extended) complete demand system (4)

Dependent variable / Explanatory variables	Public goods eq. $\log(w_1 / w_4)$	Preferential goods eq. $\log(w_2 / w_4)$	Social spending eq. $\log(w_3 / w_4)$
δ	-11.98 (26.34)	-46.18 (28.93)	-46.74* (25.49)
$\log Y_{pc}$	0.78 (0.53)	1.51*** (0.58)	1.91*** (0.51)
$\log P_r$	0.07 (0.74)	0.39 (0.81)	0.89 (0.71)
$\log N$	1.29 (2.57)	4.70* (2.83)	4.49* (2.49)
$\log(w_1/w_4)_{-1}$	-0.46* (0.27)	-1.06*** (0.29)	-0.81*** (0.26)
$\log(w_2/w_4)_{-1}$	0.52* (0.30)	0.45 (0.32)	0.12 (0.29)
$\log(w_3/w_4)_{-1}$	0.07 (0.30)	0.65** (0.33)	0.78*** (0.29)

$\log G$	-0.82* (0.43)	-1.49*** (0.47)	-1.51*** (0.41)
$\log D$	0.82 (0.51)	-0.25 (0.56)	-0.06 (0.49)
R^2	0.92	0.89	0.89
SSR	0.10	0.13	0.10
	Residual covariance matrix		
	$\log(w_1 / w_4)$	$\log(w_1 / w_4)$	$\log(w_3 / w_4)$
$\log(w_1 / w_4)$	0.0039	0.0029	0.0032
$\log(w_1 / w_4)$	0.0029	0.0047	0.0033
$\log(w_3 / w_4)$	0.0032	0.0033	0.0036

NOTES: Estimated standard errors are given in parentheses; significance levels are represented as * (10%), ** (5%) and *** (1%); *SSR* is the sum of the squares of the residuals.