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What Do OECD Countries Cut First When Faced with Fiscal Adjustments?

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Following the present scale of fiscal imbalances in developed countries, significant fiscal consolidation will be inevitable in the coming years. Fiscal discipline will require cuts in government expenditure, leading to trade-offs between different components of government expenditure. In this article, we explore the relationship between components of government expenditure and government size during the period 1970–2007 for a sample of 25 developed countries to shed light on how fiscal discipline might influence public spending composition in the coming years. Using the Pooled Mean Group estimation we find that fiscal adjustments protect functions that have both a social and productive character, such as education and health spending. In addition, the most productive spending, that related to transport and communications, is also isolated from budgetary cuts. This result shows evidence of governments reacting to the voter's increasing realization that reducing productive expenditures harms long-term economic growth by striking a balance between utility and economic-growth-enhancing expenditure.

JEL Classification: H10, H50, C23

1. Introduction

As OECD member countries have dramatically worsened their public finances, they will be forced to undertake budgetary cuts in the next years. Developed countries will increase their public deficit to 8.8% of GDP in 2010, compared with the 2.1% (on average) of GDP for the period extending between 2000 and 2007, whereas the public debt will increase to 100.2% of GDP, up from 72.6% during the 2000–2007 period (OECD Economic Outlook 85, June 2009). Fiscal discipline will require cuts in government expenditure, leading to a trade-off between different components of government expenditure that will affect the composition of government expenditure. In this article we explore the relationship between components of government expenditure and government size during the 1970–2007 period for a sample of 25 OECD countries to shed light on how fiscal discipline might influence public spending composition in the future.

Many authors (Dunne, Pashardes, and Smith 1984; Borge and Rattsø 1995; Sturm 1998; Tridimas 2001; Shelton 2007) have underscored the surprisingly little research devoted to the determinants of the composition of government expenditure. Moreover, Baqir (2002) claims

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that most of the studies analyzing the effects of aggregate government expenditure on its composition have focused on the economic classification of government spending. Furthermore, those few studies examining the functional disaggregation of government expenditure have concentrated on particular functions—primarily social expenditure, including education and health (Baqir 2002), and occasionally social welfare expenditure (Ravallion 2002)—or on the composition of local government spending (Borge and Rattsø 1995). The contribution of this article is to use the functional disaggregation of consolidated government expenditure, Classification of the Functions of Government (COFOG). To our knowledge, this is the first study on the effects of fiscal consolidation on the composition of government expenditure by functions for the OECD.

The assessment of the effects of aggregate government expenditure is of great interest in the future, especially in the context of budgetary cuts and cost controls. Fiscal consolidation affects economic growth through its impact on the composition of public expenditure. Along these lines, some endogenous growth models incorporate the composition of government spending that is capable of yielding steady-state effects (Devarajan, Swaroop, and Zou 1996; Gemmell, Kneller, and Sanz 2009). Moreover, Davoodi and Zou (1998) show that there is an optimal composition of government expenditures in which the optimal share of each component equals its growth elasticity, relative to all of the growth elasticities. Therefore, by changing the composition of government expenditure, fiscal consolidation can approach or deviate the structure of public spending from its optimal structure.

In order to investigate this aspect, section 2 reviews the existing literature on the effects of fiscal consolidation on the composition of government expenditures. In section 3, we introduce the data to be used and the empirical methodology. In section 4, we analyze how the composition of government expenditure changes when the public sector size decreases in a dynamic model framework. Section 5 checks the robustness of our conclusions by investigating the impact on the composition of government spending decreases in the public debt and deficit. In section 6, we draw the most significant conclusions.

2. Fiscal Consolidation and the Composition of Government Expenditure

During the period ranging from 1970 to 2007, the share of government expenditure in GDP has increased in the OECD, from 30.5% in 1970 to 42.2% in 2007 (OECD: National Accounts. Volume IV: General Government Accounts). However, this expansion has fluctuated over the course of the four decades. During the 1970s and the early years of the 1980s the public sector increased its size constantly. This trend was interrupted in 1983, when public expenditure as a share of GDP became stable. At the beginning of the 1990s public expenditure began to increase its size again until 1993, the peak for the whole period. Thereafter, OECD countries have increasingly implemented government spending reforms aimed toward more controlled government spending and active deficit management (Tanzi and Schuknecht 2000).

The reduction of the public sector size does not necessarily lead to proportional decreases in the components of government spending, but it may change the composition of government expenditures by particularly affecting some of its components while protecting others. Several

studies have analyzed the effects of fiscal consolidation on the composition of government expenditures, focusing on two specific components: public investments and social spending (including education, health, and social welfare expenditure). These studies predict two different and opposite outcomes. The first strand of studies claims that fiscal adjustments will affect investments while protecting social spending. Thus, Roubini and Sachs (1989) claim that during a time of fiscal consolidation, public investments are the first to be reduced because these represent the least rigid component of expenditures. Oxley and Martin (1991) also contend that political reasons make it easier to diminish or postpone investment spending than current expenditure. Furthermore, Sturm (1998) suggests that myopic governments in need of budgetary cuts reduce those less visible and long-term expenditures in order to minimize the political costs associated with government spending cutbacks. Gomes and Pouget (2008) elaborate a model in which international tax competition drives tax rates down, reducing the externality of public capital and thereby leading governments to decrease public investment. De Mello (2008) argues that current spending is increasingly downward rigid, and therefore, fiscal adjustments compress public investment. Finally, Easterly, Irwin, and Servén (2008) argue that if governments reduce productive spending they are improving short-term cash deficit, but they might be worsening fiscal imbalances in the long term if the foregone growth reduces the present value of future government revenues by more than the immediate improvement in the cash deficit. Nevertheless, these authors contend that too much emphasis on short-term cash flows leads governments to reduce productive spending at times of fiscal adjustment and to protect non-productive spending. Along these lines, Henrekson (1988; for Sweden over the period from 1950 to 1984); Sturm (1998; for a sample of 22 OECD countries over the period from 1980 to 1992); Jonakin and Stephens (1999; for a sample of five Central American countries over the period from 1975 to 1993); Mahdavi (2004; for 47 developing countries over the period from 1972 to 2001); and Akitoby et al. (2006; for a sample of 51 developing countries over the period from 1970 to 2002) find that fiscal adjustments particularly affect public investments.

Therefore, we could expect fiscal consolidation to fall primarily on public investments and to protect the rest of the expenditures. In fact, studies examining the effects of fiscal adjustments on pro-poor expenditures—mainly social expenditures—predict that budgetary cuts will not primarily affect social spending. Thus, Ravallion (1999) claims that if cutting expenditures save taxes to the non-poor, these voters, in turn, would be more willing to protect pro-poor expenditure. Furthermore, Ravallion (2000) contends that poor groups could build influential interest groups with Non-Governmental Organizations or non-poor groups interested in avoiding the external costs of poverty. Accordingly, Snyder and Yackovlev (2000; for a sample of 19 Latin American and Caribbean countries during the period from 1970 to 1996) and Cashin et al. and Baqir (2001 and 2002; for a sample of 179 and 167 countries during the period from 1985 to 1998, respectively) find that education and health expenditure are isolated from fiscal adjustments.

A second strand of studies predicts that budgetary cuts will affect social expenditures and protect productive expenditures. Aubin et al. (1988) argue that reducing investments—a type of productive expenditure—has more adverse political effects than does decreasing public consumption and wages because the former is more visible. In fact, Alesina, Perotti, and Tavares (1998) show that if anything, adjustments, primarily based on public transfers and wages, increased the probability of survival of governments over the period from 1960 to 1995 in a sample of 19 OECD countries. Moreover, Tanzi (2000) maintains that globalization will

reduce government revenues and expenditure because of the tax competition among jurisdictions and increased mobility of factors. These authors suggest that the reduction of government spending will not be proportional but will affect social spending in particular and preserve productive expenditures that enhance countries' competitiveness and attractiveness to foreign direct investment (FDI). Along these lines, Keen and Marchand (1997) elaborate a model in which governments encourage country competitiveness by raising the allocation to productive expenditures above its optimal level and contracting utility-enhancing spending, such as social welfare spending. Furthermore, Ghate and Zak (2002) elaborate a model in which politicians maximize votes, whereas voters support politicians depending on the transfers they receive and the output growth. As a consequence, at a first stage social welfare expenditure drives the growth of government, but then a threshold emerges at which, in order to maintain positive output growth, governments reduce aggregate government expenditure by cutting social welfare expenditure. Finally, Drazen and Eslava (2010) elaborate a model of the political budget cycle in which incumbents try to influence voters by shifting the composition of government spending toward functions that are particularly attractive to voters. These authors find evidence that voters favor infrastructure and education spending because these two functions increase in electoral years at the cost of transfers for a sample of all municipalities in Colombia over the period 1987 to 2002. Accordingly, Tanzi and Schuknecht (1997) show that industrialized countries that undertook reforms in the size of the public sector in the mid-1980s, such as New Zealand and Chile, accomplished it through the reduction of public subsidies and transfers. Furthermore, Ravallion (2002) finds that decreases in aggregate government expenditure in the decade of the 1980s and the 1990s in Argentina have led to more-than-proportional cuts in education, health, housing, and social security spending, whereas increases in aggregate government spending did not increase the size of social spending at all.

3. Data and Methodology

Data for government expenditures is built on OECD publication National Accounts. Volume IV: General Government Accounts. From this source we elaborate time series of government spending by functions over the period extending from 1995 to 2007. We use the standard COFOG (United Nations 2000), which considers the following 11 components of government expenditures (in order of average magnitude in the OECD): social security; education; health; general public services; economic affairs (distinguishing between transport and communication and other economic affairs); defense; public order and safety; housing and community amenities; recreation, culture, and religion; and environment protection. Data for the 1970–2000 period are built on National Accounts: Volume II: Detailed Tables, which follows the previous COFOG (United Nations 1981). There are minor differences between the previous and the updated COFOG classifications (IMF 2002), mainly the inclusion of the new category 'environment protection,' which was previously aggregated with housing and community amenities, and the removal of the component 'other non-classified functions' (mainly interest payments), which is now aggregated with general public services. Nevertheless, there is a subcategory among the new general public services named public debt transactions, which mainly corresponds to the former other non-classified functions.

Table 1. Classification of Government Expenditures by Function

Former COFOG UN (1981)	New COFOG UN (2000)	Kneller et al. (1999)	Ravallion (2002)
Economic affairs	Economic affairs	Non-productive	Non-social
Recreation, culture and religion	Recreation, culture and religion		
Social security and welfare	Social security and welfare	Productive	Social
Education	Education		Non-social
Health	Health		
Housing and community amenities	Housing and community amenities		
	Environment protection		
Defense	Defense		
Transport and communication	Transport and communication		
Public order and safety	Public order and safety		
General public services	General public services		
Other non-classified functions	General public services (public debt transactions)	Other non-classified functions	Other non-classified functions

We have used the time series over the period 1995 to 2007 based on the new COFOG classification and extended it back to 1970 employing the previous COFOG.[1] Table 1 illustrates the correspondence between the previous and the new COFOG classifications. We end up with time series for 10 components of government spending (summing general public services and public order and safety under the aggregated public services) by functions over the 1970–2007 period for 25 OECD countries, all developed countries, excluding the Central and Eastern European Countries (Poland, Czech Republic, Hungary, and Slovakia), for which there are no data available before 1990, and Turkey, with no information after 2001.[2]

Table 1 also shows the functions that, according to Kneller, Bleaney, and Gemmell (1999), have a positive economic growth effect and are hence considered as productive: education, health, defense, public order and safety, transport and communication, housing and community amenities, environment protection, and general public services (excluding public debt transactions). In the last column, we further aggregate functions between those with a

[1] For extension of the new category of environment protection we have used the variation rates of the former housing and community amenity. We have also detracted the new public debt transactions from general public services and extend it back using the variation rates of other non-classified functions. In this way we can distinguish interest payments from the rest of the general public services. We have further summed up general public services (excluding interest payments) and public order and safety under the category of public services, since some countries provide information on these functions aggregated and because the two categories correspond to a similar concept of pure public goods.

[2] We use the OECD National Accounts inasmuch as it offers information on the consolidated spending of all levels of government; additionally, it follows the accrual criterion. Accrual accounting systems record transactions at the time the economic value is created rather than when cash transactions take place. This provides a better picture of the commitments undertaken by governments than does traditional cash accounting. IMF, *Government Finance Statistics*, also provide information related to government spending using the COFOG classification. This covers a longer time period but is generally focused on central government spending and is measured on a cash basis. The OECD data set contains some missing years, and we use the IMF data to fill in the missing observations.

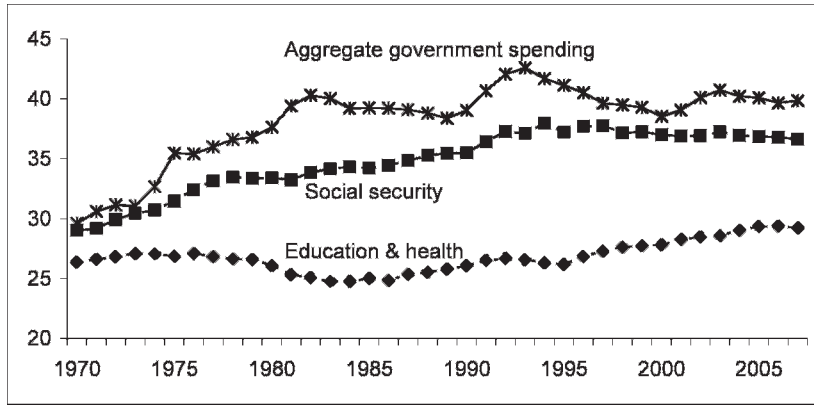

Figure 1. Government Spending on Social Security, Education, and Health in the OECD (1970–2007)

social service character (that is, functions that enhance utility) and those without such social character. Among those functions with a social service character, previous literature has included social protection, education, and health (Ravallion 2002).

In sum, there are functions of government spending that are mainly utility-enhancing (social security), growth-enhancing (housing, environment, defense, transport and communication, public order and safety, and general public services), both (education and health), and those that are neither utility nor growth-enhancing (economic affairs and recreation).[3] The first strand of the literature discussed in the previous section claims that fiscal adjustment will protect social spending at the expense of productive but non-social spending. The second strand contends that budgetary cuts disproportionally fall over social but non-productive spending, shielding productive spending. Therefore, the two hypotheses concur in predicting that education and health would be protected from fiscal adjustments and that economic affairs and recreation, culture, and religion would be disproportionally reduced in fiscal consolidations. For the rest of the functions that are considered social but non-productive (social protection) or productive but non-social (transport and communications, defense, public order and safety, general public services, housing and environment protection), the two hypotheses predict contradicting effects from budgetary cuts.

In the empirical analysis we do not consider public debt transactions because this spending is exogenously determined, and it is the consequence of the fiscal imbalances that OECD countries will have to reduce in the next years. We analyze how the public sector size affects the share of each function in the aggregate government spending, excluding these interest payments.

Figure 1 shows the evolution of aggregate government spending excluding interest payment (percentage of GDP) in the OECD and the share devoted to the three most important functions: social welfare, education, and health (as percentage of total government spending excluding interest payments). Social security shows a similar pattern compared with aggregate

[3] Social protection is relevant for the utility function but is considered as non-productive, as it is not privately productive and does not enter the production function. In fact, Gemmell, Kneller, and Sanz (2009) do not find any significant effect (positive or negative) of social protection spending on economic growth. Housing, environment protection, and recreation, culture, and religion are considered as non-social functions since these spending types are mostly devoted to intermediate consumption and gross fixed capital formation rather than social transfers or social benefits in kind (see Eurostat, Statistics in Focus: 28/05).

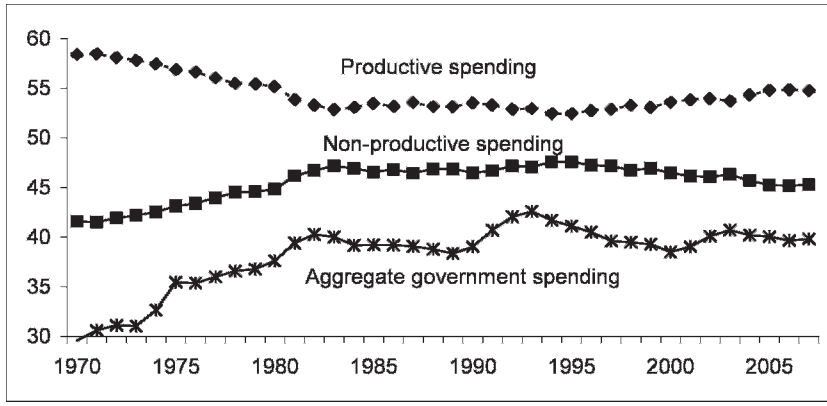

Figure 2. Government Spending on Productive and Non-Productive Functions in the OECD (1970–2007)

government spending. From 1970 to 1993, total government spending as a share of GDP increased 13 percentage points, from 29.6% of the GDP to 42.6% of the GDP. More than half of this increase is explained by social security spending, which in 1994 reached its peak, accruing 37.9% of all public spending. After 1995, both the public sector size and social security have decreased, although the latter to a lesser extent. In contrast, education and health show a divergent pattern compared with the public sector size. These expenditures decrease their share in total government expenditure from 1970 to 1986, from 26.4% to 24.9%, just when the public sector size was growing more heavily. From 1986 to the mid-1990s, education and health maintained an almost constant share in aggregate government spending. These expenditures started to rise later on, from 1994 to 2007, the same period during which the public sector size diminished. Figure 2 confirms the same pattern for the broader definitions of non-productive spending and productive spending. The share of non-productive spending follows the same evolution as that of aggregate government spending: It has increased until the mid-1990s and has slightly decreased since then. Productive spending has obviously followed the opposite pattern, showing a negative correlation with aggregate government spending.

Our analysis uses annual panel data and the Pooled Mean Group (PMG) methodology proposed by Pesaran, Shin, and Smith (1999). These authors show that the assumption of homogeneity of the short-run parameter estimates across countries cannot be accepted and that this assumption may be a more serious problem than the endogeneity bias generated by the inclusion of lagged dependent variables and can lead to inconsistent and misleading results even for large T and large N. To overcome this bias they suggest the use of the PMG estimator. This allows heterogeneous constants and marginal short-run effects across countries to be accommodated, while maintaining homogeneity of the long-run responses. The major advantage of this approach is that it makes full use of the available time-series information and provides estimates of both long-run and short-run parameters. We introduce dynamics into the model to capture the fact that some of the government expenditures show a high degree of rigidity since some of the expenditures are previously committed, as are those related to social security and public employees' wages. Moreover, the incrementalist decision-making literature (Borge and Rattsø 1995) has shown the decisive advantage of the status quo in the determination of government expenditure. We estimate the following PMG estimation for each of the 10 components of government expenditure (aggregating general public services and

public order and safety) and inferring coefficients for environment protection (the smallest function) from the budget restriction:

$$\Delta g_{i,t} = \boldsymbol{\phi}_i (g_{i,t-1} - \boldsymbol{\beta} F_{i,t-1}) + \sum_{m=1}^{M} \lambda_{i,m} \Delta g_{i,t-m} + \sum_{k=0}^{K} \gamma_{i,k} \Delta F_{i,t-k} + \varepsilon_{i,t}, \quad (1)$$

where i denotes the country, t is time, g is the log share of each of the 10 functions in the aggregate government spending, F is a matrix including the log of the public sector size and control variables, and $\varepsilon_{i,t}$ is a classical error term. The parameter vectors $\boldsymbol{\phi}_i$ and $\boldsymbol{\beta}$, respectively, capture the error correction and (homogeneous) long-run growth effects, while $\lambda_{i,m}$ and $\gamma_{i,k}$ capture the heterogeneous short-run responses to g and F, respectively (with lag lengths M, $K = 1$).

Among control variables we introduce variables based on the previous literature (Sanz and Velázquez 2007): per capita income, total population, and young and elderly shares in total population.[4] We also include openness since there are two hypotheses (the compensation and the efficiency hypothesis) that propose that globalization affects the composition of public expenditures (Gemmell, Kneller, and Sanz 2008). The compensation hypothesis contends that the economic insecurity introduced by globalization leads to expanding social expenditures, whereas under the efficiency hypothesis, globalization increases the demand for productive spending and for lower tax squeezing social welfare spending. All variables are included in logs. We also introduce country dummies capturing institutional factors and country preferences affecting the composition of government spending and a time trend reflecting different tendencies of each of the functions. The per capita income (in Purchasing Power Parities of the 2000 dollar and in real terms of that year), total population, and openness (measured as the sum of exports and imports divided by the GDP) are obtained from the OECD: National Accounts: Volume I. Main Aggregates, whereas the age structure of the population is taken from the OECD: Labour Force Statistics. We compute permanent income per capita since demand is based on permanent income rather than on temporary income levels (Peltzman 1980). We approximate permanent income per capita by taking a three-year moving average, reducing the sample by two observations for each country.

Introducing dynamics via the lagged dependent variable along with country dummies is equivalent to demeaning all of the variables by their individual specific means. This demeaning procedure induces a correlation between the demeaned lagged dependent variable and the demeaned error term.[5] Following the Lee and Gordon (2005) analysis on taxes and growth, we instrument for the lagged share of each function by the weighted average of the same function in the rest of countries of the OECD, weighted by the inverse of the distance between capitals (source: Centre d'Etudes Prospectives et d'Informations Internationales). This instrument is exogenous, as a country composition of government spending will not determine the average of the rest of countries, but it will be influenced by the fiscal policy in the neighbor countries. Sanz (2006) shows that there is a growing fiscal interdependence among OECD countries over the period from 1970 to 1997, particularly for the case of productive spending, which might be

[4] We have to assume that relative public prices between functions remain constant over the 1970–2007 period. There are no data available on prices for functions of government expenditure. The difficulty of obtaining the prices of the public goods of each type of function lies in the fact that most of the previous empirical studies analyzing particular functions do not include prices (Shelton 2007).

[5] This bias gets smaller as we increase the number of years. We control for endogeneity, though Beck and Katz (2009) show that the Least Squares Dummy Variables lead to relatively good performance when T is 20 or more, in terms of bias and root mean square error.

indicating a competition to attract FDI. Borck, Caliendo, and Steiner (2007) also show significant interaction in almost all spending subcategories using a cross-section of 435 German counties from 2002, which they also attribute to fiscal competition among local governments for mobile factors. Hauptmeier, Mittermaier, and Rincke (2009) find that if a neighbor provides more infrastructure, governments react by increasing their own spending on public inputs, for a sample of 1100 German municipalities in the state of Baden-Württemberg over the 1998–2004 period. Income per capita also introduces simultaneity, as government expenditure and its composition affect long-run economic growth.[6] Furthermore, there might also be a correlation between the errors and aggregate government spending. Therefore, we instrument income per capita and the size of aggregate government expenditure by at least two lagged values of the weighted (by the inverse of the distance) average income per capita and public sector size of the rest of the OECD countries.

4. Econometric Results

Table 2 shows the effects of public sector size changes on the composition of government spending. Appendix 1 provides some diagnostic testing of our IV regressions. For each case, the Sargan test results do not reject the hypothesis that the instruments are valid because they are orthogonal to the error process. However, the instruments should also be correlated with the included endogenous variables. The usual F-statistic and the partial R^2 between all excluded instruments and the endogenous regressors of the first stage cannot reveal the weakness of a particular instrument if the rest of the instruments are highly correlated with the endogenous variables (Staiger and Stock 1997). The Shea partial R^2 (Shea 1997) overcomes this by taking into account cross-correlations among the instruments. As a rule of thumb, Baum, Schaffer, and Stillman (2003) suggest that if the standard R^2 is large (whereas the Shea partial R^2 is small) we may conclude that the instruments lack sufficient relevance to explain all the endogenous regressors. Appendix 1 shows that the Shea partial R^2 values are all satisfactorily high relative to the usual R^2 in each IV regression. A more formal test, which we also report, is the Stock and Yogo (2005) weak instrument test based on the Cragg-Donald statistic. This tests whether the bias in IV parameter estimates due to weak instruments exceeds (above a certain threshold) the bias in equivalent ordinary least-squares estimates.

For all regressions we can reject the null hypothesis that our instruments are weak. We show only the average short-run coefficients across the 25 OECD countries for the sake of space.

Focusing on the variable of interest, we find a negative and significant relationship in the long run between aggregate government expenditure and education and transport and communication. Therefore, reductions (increases) in aggregate government expenditure increase (reduce) the share devoted to these functions. The result for education is in line with the results of Dunne, Pashardes, and Smith (1984) for general current government expenditure in the United Kingdom during the 1950–1980 period and those of Borge and

[6] See Gemmell, Kneller, and Sanz (2009) for a survey on fiscal policy and economic growth. This endogenous issue has not received much attention in empirical studies (Borcherding, Ferris, and Garzoni 2004). This may be because this potential source of endogeneity is reduced, considering that the size and composition of public spending effects on economic growth are likely to unfold slowly (Devarajan, Swaroop, and Zou 1996).

Table 2. Government Size and the Composition of Government Expenditure by Function (1970–2007)

	Social Security	Education	Health	Public Services	Economic Affairs	Transport	Defense	Housing	Cultural Affairs	Environment
Level effects										
Government size	0.098 (1.77)*	−0.466 (6.68)***	−0.075 (1.14)	0.002 (0.04)	0.239 (2.30)**	−0.323 (2.89)***	0.501 (2.44)**	0.418 (1.95)*	0.635 (10.66)***	−0.738 (1.07)
Per capita income	−0.040 (1.21)	0.089 (1.85)*	0.383 (4.45)***	0.037 (0.70)	0.226 (3.22)***	−0.227 (2.23)**	−3.112 (9.47)***	0.309 (2.37)**	1.642 (15.17)***	3.492 (4.63)***
Total population	0.237 (1.64)	−0.013 (0.15)	−0.876 (8.92)***	−0.341 (2.19)**	−0.360 (2.46)**	−0.160 (0.74)	−0.494 (1.78)*	4.464 (13.40)***	−0.801 (3.27)***	2.340 (1.89)*
Share of elderly in population	0.138 (1.97)**	0.033 (0.43)	0.641 (4.63)***	0.581 (6.60)***	0.140 (1.35)	0.247 (1.55)	0.576 (2.21)**	−0.562 (2.74)***	1.550 (8.54)***	−16.976 (18.54)***
Share of young in population	−0.181 (2.69)***	0.414 (6.58)***	0.390 (6.69)***	0.253 (4.33)***	−0.431 (3.73)***	−0.504 (3.97)***	−1.493 (5.95)***	−1.581 (8.58)***	0.980 (5.72)***	5.626 (7.25)***
Openness to international trade	0.053 (1.10)	0.231 (4.73)***	0.104 (2.83)***	0.000 (0.00)	−0.245 (4.42)***	0.327 (5.97)***	−1.093 (9.39)***	0.069 (0.92)	−0.258 (3.61)***	−0.211 (0.52)
Trend	−0.001 (0.39)	−0.006 (3.28)***	0.008 (4.84)***	0.005 (3.20)***	−0.011 (4.66)***	−0.022 (8.20)***	0.041 (7.06)***	−0.069 (12.73)***	−0.014 (3.56)***	0.119 (5.69)***
Adjustment parameter	−0.403 (4.80)***	−0.344 (6.48)***	−0.414 (4.01)***	−0.419 (7.34)***	−0.506 (8.11)***	−0.519 (8.72)***	−0.029 (22.28)***	−0.427 (5.83)***	−0.428 (6.01)***	—
Short-run effects										
Government size	−0.105 (1.50)	0.141 (0.85)	−0.315 (2.62)***	0.018 (0.06)	0.174 (0.92)	0.014 (0.09)	−0.040 (3.08)***	0.197 (1.07)	0.034 (0.22)	2.260 (1.90)**
Per capita income	−0.141 (3.32)***	−0.018 (0.23)	−0.195 (0.89)	0.070 (0.67)	0.212 (1.58)	−0.360 (1.71)*	0.146 (11.69)***	0.034 (0.20)	0.375 (1.30)	3.495 (3.54)***
Total population	−0.743 (0.51)	−4.580 (0.93)	−1.415 (0.74)	10.922 (1.03)	−9.516 (1.30)	7.976 (1.25)	−1.041 (1.40)	−4.438 (0.79)	−6.619 (0.64)	25.324 (0.62)

Table 2. Continued

	Social Security	Education	Health	Public Services	Economic Affairs	Transport	Defense	Housing	Cultural Affairs	Environment
Share of elderly in population	1.381 (0.79)	1.829 (1.05)	1.346 (0.97)	−3.099 (2.49)**	5.831 (1.00)	−2.173 (1.44)	0.030 (0.19)	2.382 (0.53)	3.810 (0.78)	−63.230 (3.33)***
Share of young in population	3.127 (0.95)	0.484 (1.03)	−0.109 (0.10)	−0.701 (0.29)	0.381 (0.19)	−2.260 (1.09)	−0.083 (0.60)	6.856 (1.17)	12.154 (0.85)	−84.447 (3.29)***
Openness to international trade	−0.085 (1.23)	−0.031 (0.51)	0.019 (0.43)	−0.221 (2.52)**	0.029 (0.20)	0.015 (0.10)	0.030 (5.58)***	0.343 (1.67)*	0.141 (0.78)	2.320 (3.26)***
Constant	−0.093 (1.62)	0.453 (5.60)***	3.929 (4.02)***	1.870 (7.37)***	3.343 (7.31)***	4.215 (8.56)***	1.390 (21.84)***	−29.961 (5.74)***	−5.028 (6.40)***	—

t statistics in parentheses.
* Significant at 10%.
** Significant at 5%.
*** Significant at 1%.

Rattsø (1995) for local expenditure in Norway during the 1986–1989 period, who find that education expenditures have the property of necessities. Furthermore, our results are consistent with those of Snyder and Yackovlev (2000), who find that primary and secondary education spending are relatively more insulated from economic shocks, and also with those of Cashin et al. (2001) and Baqir (2002), who find that at a time of budgetary cuts education is protected. We also find that transport and communication is isolated from fiscal contractions. On the other hand, social security, economic affairs, defense, housing, and cultural affairs show a positive and significant relationship with aggregate government expenditures, indicating more than proportional reactions to changes in the size of aggregate government expenditure. Finally, we find that health, public services, and environment protection react proportionally to changes in the size of government expenditure.[7]

These results do not entirely support or reject any of the two hypotheses considered, although they are closer to the second strand of studies, predicting that budgetary cuts will protect productive expenditures and fall on social expenditures. We find that transport and communications, the most productive spending (Easterly and Rebelo 1993), are protected from budgetary cuts, whereas social security is particularly targeted. Nevertheless, we find that productive spending—defense and housing—reduces its share in government spending at times of fiscal contraction. Finally, we confirm the predictions of the two hypotheses discussed in section 2 with respect to education. Since this function is both productive and social, education is isolated from fiscal contractions.

Most of the rest of the results are in line with the economic literature. From the speed of adjustment, it can be seen that defense and education expenditure seem to be the most rigid of the components of government expenditure. These results are in line with those of Dunne, Pashardes, and Smith (1984), who find that military expenditure is the component showing the character of being the most long-planned expenditure among general current government expenditures in the United Kingdom over the 1950–1980 period. Income increases the share of functions such as education and health in the long-run, confirming that Wagner's law is especially applicable for these two social services (Peacock and Scott 2000). We also confirm the result found by Shelton (2007), in which per capita income has no long-run effects on social security spending, once the elderly share has been controlled for. As expected, income has a negative association with social security spending in the short run, confirming that this function is anti-cyclical. Population reduces the allocation to pure public goods such as defense (Murdoch and Sandler [1985], for Australian military demand over the 1961–1979 period), public services, economic services, and cultural affairs. It also shows a negative association with another pure public good, such as transport and communications (Randolph, Bogetic, and Hefley [1996], for 27 low- and middle-income countries over the 1980–1996 period), although not to a significant extent. The elderly population increases the demand for health and social security, as this age group receives more benefits from it than do the other age groups. This result is partially consistent with that of Lindert (1996), who finds that an ageing population is strongly and positively associated with social welfare spending for a panel of 19 OECD countries during the 1960–1981 period. Nevertheless, this author does not find any significant effect of the elderly population on health expenditure. We also find evidence of the elderly

[7] Coefficients for environment protection are computed from the budget constraint. Because of this computation and because environment protection is a small function with great percentage changes, some of the coefficients estimated are very high.

increasing public services and defense spending, showing a preference for security-related functions of government spending. As for the young population, we find a positive and significant impact on education and health spending. Finally, we find that openness to international trade increases social spending: education, health, social security—although the latter not to a significant extent—along with transport and communications. This result is partially consistent with that of Shelton (2007), who finds that openness increases most of the components of government spending, but particularly education, public order, and safety and transport and communication, in a sample of 100 countries over the 1970–2000 period. Nevertheless, Shelton (2007) does not find any particular impact of trade openness in social security spending, in contrast to the compensation hypothesis put forward by Rodrik (1998) and tested in Gemmell, Kneller, and Sanz (2008). Spending on education, economic affairs, transport and communications, housing, and cultural affairs shows a negative time trend, whereas health, public services, defense, and the new environment protection function increase over time. The sign of the time trend matches the evolution of these functions, except in the case of defence, a function that has decreased its share in aggregate government spending since the 1970s. Population, trade openness, and, above all, increasing per capita income are the variables driving down defense spending (rather than a time trend).

In Table 2 the effects of fiscal expansions and contractions on the composition of government expenditure were constrained to be the same. Nevertheless, components may react differently to increases or decreases in government spending. In fact, Ravallion (2002) finds that social spending in Argentina during the 1980s and 1990s decreased more than proportionally after reductions in government expenditure, whereas it did not significantly increase following rises in government spending. Thus, we include a variable that takes the value of the government spending if the public sector is reduced and that equals zero otherwise. Table 3 shows results of the estimation, taking into account possible asymmetry on the effects of government size changes. We choose not to report the results for the control variables for the sake of space. These are available from the author on request. Again, the Sargan test statistic of over-identifying restrictions does not reject the validity of the instruments used (see Appendix 2). For all regressions we can reject the null hypothesis that our instruments are weak.

Looking at the coefficients associated with government size, it may be seen that social security shows a positive and significant association with the public sector size at fiscal expansion. When aggregate government spending is decreasing, social security also decreases. Nevertheless, at times of budgetary cuts, this positive association is significantly lower than at times of public sector growth. As indicated by Figure 1, social security spending increases by a greater amount in fiscal expansions than the extent to which it is diminished in fiscal contractions. The other two social functions, education and health, which also represent productive spending, show a negative relation with the aggregate government spending, particularly when the public sector size is diminishing. That is, those two functions are more isolated from fiscal contractions than from fiscal expansions. Transport and communication is also protected from budgetary cuts, showing an inverse and symmetric association with the public sector size changes. Along with social security, fiscal consolidations fall over economic affairs, defense, housing, and cultural affairs. Environment protection shows a negative association with government size, as in the previous table, but positive and significant associations as government size decreases. The non-significant coefficients associated with government size may be due to the fact that it is computed from the budget constraint and hence with some imprecision. Interestingly, we find that smaller functions show a positive

Table 3. Asymmetric Effects of Government Size Changes in the Composition of Government Spending by Function[a]

	Social Security	Education	Health	Public Services	Economic Affairs	Transport	Defense	Housing	Cultural Affairs	Environment
Level effects										
Government size	0.127 (1.81)*	−0.509 (7.27)***	−0.115 (1.26)	0.040 (0.59)	0.222 (2.05)**	−0.603 (4.65)***	0.503 (2.50)**	0.512 (2.26)**	1.035 (10.11)***	−0.454 (0.59)
Government size decreases	−0.012 (5.78)***	−0.005 (2.47)**	−0.010 (3.52)***	0.002 (0.96)	−0.004 (1.40)	−0.002 (0.61)	0.018 (3.69)***	−0.017 (2.94)***	0.007 (1.43)**	0.346 (16.09)***
Short-run effects										
Government size	0.016 (1.76)*	0.005 (0.03)	−0.366 (1.50)	0.092 (0.32)	0.159 (0.84)	0.121 (0.91)	−0.014 (1.07)	−0.111 (0.48)	−0.059 (0.35)	0.938 (0.73)
Government size decreases	0.001 (9.90)***	0.002 (1.84)*	0.001 (1.23)	−0.004 (1.91)*	0.001 (0.44)	0.003 (1.86)*	−0.001 (5.91)***	0.002 (0.81)	−0.004 (−2.18)**	−0.029 (2.99)***

t statistics in parentheses.

[a] Also included in the regression are country fixed effects and time trend, the measures of per capita income, the total population, the share of the elderly and young in the total population, and openness to international trade, all in levels and first differences.

* Significant at 10%.

** Significant at 5%.

*** Significant at 1%.

association with government size, with the exception of environment protection, which is a rather new component of government spending and hence is still saved from the cuts. In the long run, governments adjust those small functions that are less of a necessity. Defense seems to be the most affected by public sector size decreases. This result is in line with that of Gupta, Mello, and Sharan (2001), who find that fiscal consolidations fall primarily over defense expenditure in a sample of 120 countries over the 1985–1998 period, and in contrast to that of Davoodi et al. (1999) and Jonakin and Stephens (1999), who find that defense expenditure is more protected when fiscal discipline is implemented (in a sample of 130 countries for the 1985–1998 period and five Central America countries over the 1975–1993 period, respectively). We also find that short-run reactions of the components to budgetary cuts are usually the reverse of the long-run reactions. Confronted with the necessity of adjusting public spending, governments initially postpone investments in education and transport and communication, maybe because it is a quicker solution, but further budgetary cuts protect these two functions. In contrast, fiscal adjustments does not affect immediately the most rigid category, defense, and public services, a function in which spending is to a large extent pre-committed. Smaller functions, such as cultural and environment protection, are also isolated from budgetary cuts in the short run, perhaps because of the fact that it is more difficult to find, at first, a significant amount of funds to save from an already-small budget.

To sum up, we find that social spending with a productive character, such as that associated with education and health, along with the most productive function, transport and communication, are the categories most protected from fiscal contractions. The other social spending, social welfare, reduces its share in aggregate government spending during times of budgetary cuts, but by less than the increase of years with growth of the public sector size. Fiscal contractions fall primarily over smaller and less visible functions, such as economic affairs, defense, housing, and cultural affairs.

5. Robustness Check

Decreases in government spending are usually the result of a fiscal adjustment that pursues the reduction of public debt and public deficit. Zaghini (2001) shows that European Union Member States achieved cutbacks in the 1990s on public deficit through an expenditure reduction policy. Moreover, Ardagna (2007) shows that fiscal adjustments achieved mainly by reducing government spending, instead of increasing government revenues, are more long lasting and growth enhancing. In this section we check to determine if the effects of public debt and public deficit reduction on the composition of government spending are similar to those found in the previous section. Data is built on OECD: National Accounts. Volume IV: General Government Accounts.

Appendix 3 shows that we cannot reject the validity of the instruments used in both robustness checks, and Appendix 4 indicates that we can reject the null hypothesis that our instruments are weak. Table 4 shows that the effects of reductions in the public debt ratio to GDP on the composition of government spending are indeed very similar to those of aggregate government spending. In the long run, education and health spending increase their share in government spending when the public debt ratio to GDP is shrinking. This result is in line with that of Lora and Oliveira (2007), who find a negative association between the public debt and

Table 4. Asymmetric Effects of Public Debt Changes in the Composition of Government Spending by Function[a]

	Social Security	Education	Health	Public Services	Economic Affairs	Transport	Defense	Housing	Cultural Affairs	Environment
Level effects										
Public debt ratio	0.055 (3.13)**	−0.018 (0.75)	−0.080 (2.71)**	0.071 (2.38)*	0.082 (2.27)*	−0.038 (0.85)	0.204 (2.65)**	0.127 (2.06)*	3.030 (7.89)**	−6.241 (11.96)**
Decreases in public debt	−0.003 (2.04)*	−0.004 (2.61)**	−0.004 (2.01)*	−0.002 (0.91)	0.005 (1.75)	−0.001 (0.25)	−0.005 (1.34)	−0.003 (0.44)	0.065 (5.33)**	0.048 (2.01)*
Short-run effects										
Public debt ratio	0.029 (1.00)	−0.044 (1.85)	0.004 (0.16)	−0.093 (0.95)	0.062 (1.19)	0.020 (1.19)	−0.080 (1.58)	−0.132 (2.41)*	−0.038 (7.60)**	0.479 (1.38)
Decreases in public debt	−0.001 (0.53)	0.003 (2.73)**	0.002 (1.50)	0.001 (0.21)	−0.001 (0.91)	0.001 (0.44)	0.001 (0.23)	0.002 (1.15)	0.000 (1.89)	−0.031 (1.70)*

t statistics in parentheses.

[a] Also included in the regression are country fixed effects and time trend, the measures of per capita income, the total population, the share of the elderly and young in the total population, and openness to international trade, all in levels and first differences.

* Significant at 10%.

** Significant at 5%.

education and health spending for a panel of 50 developing countries between 1985 and 2003, concluding that orthodoxy in fiscal policy avoiding public over-indebtedness is the best way to protect these two functions. Transport and communications shows a negative correlation with public debt, but not to a significant extent. These results are in line with those of Mahdavi (2004), who finds that external public debt in developing countries adversely affects productive spending, whereas debt relief raises these types of spending. Social welfare diminishes its share on aggregate government spending when the public debt is decreasing, but again by a significantly lower amount than the increases of this function when the public debt is rising. Results confirm that fiscal consolidations fall primarily over economic affairs, defense, housing, and cultural affairs, along with public services, which is again positive, but now to a significant extent. Environment protection shows a highly negative association with public debt, and now to a significant extent, confirming that the fact that it is a new function isolates this function from fiscal consolidations. We find again that, in the short run, that fiscal adjustments protect the smallest functions: housing, cultural affairs, and environment.

Finally, Table 5 introduces public deficit, instead of public debt, along with the control variables. A positive association between public deficit (with a positive sign when expenditures are higher than revenues) and a function of government spending indicates that this type of spending reduces its share in the public sector size when there is a fiscal consolidation process in place and the public deficit is decreasing. Functions protected at times of fiscal adjustment would be those with a negative association, indicating that this type of spending increases its share in aggregate government spending when the public deficit is decreasing. Results confirm previous findings: education and health, along with transport and communication and environment, are the functions most protected during times of fiscal adjustment. Social security spending reduces its share in budgetary cuts, but again to a lower extent than the increases of this function in fiscal expansions. The sums of the coefficients of changes in deficit and decreases of deficit are significantly positive for defense, housing, and cultural affairs, indicating that these functions, along with public services and economic affairs, are cut at times of budgetary cuts.

6. Conclusions

This article explores how fiscal consolidation can affect the composition of government expenditures by analyzing the relationship between the size of aggregate government expenditure and each of its functional components in the OECD over the 1970–2007 period. We find that at times of fiscal consolidation, expenditures with both a social and a productive character are the most protected. Education and health exert a robust negative association with the public sector size, increasing their share in aggregate government spending when countries are implementing fiscal adjustment. This is consistent with both functions reducing their spending less than proportionally to aggregate government spending, maintaining it, or increasing it altogether. Moreover, fiscal consolidation does not fall primarily on the most productive expenditure, transport and communications, but on public services, economic affairs, defense, housing, and cultural affairs. Hence, it seems as if governments protect the most productive expenditures or those that are both productive and social. This result may be evidence of the government's reaction to the voters' increasing opinion that reducing

Table 5. Asymmetric Effects of Public Deficit Changes in the Composition of Government Spending by Function[a]

	Social Security	Education	Health	Public Services	Economic Affairs	Transport	Defense	Housing	Cultural Affairs	Environment
Level effects										
Deficit to GDP ratio	0.030 (6.19)***	−0.005 (2.32)**	0.004 (1.29)	−0.001 (0.54)	0.010 (1.65)*	−0.022 (4.40)***	−0.008 (2.77)***	0.048 (4.71)***	0.022 (1.91)*	−0.657 (18.24)***
Decreases in deficit to GDP ratio	−0.005 (1.71)*	−0.001 (0.31)	−0.004 (2.46)**	0.004 (1.65)*	0.000 (0.05)	−0.000 (0.06)	0.013 (4.87)***	−0.018 (3.24)***	−0.010 (1.72)*	0.120 (5.68)***
Short-run effects										
Deficit to GDP ratio	−0.009 (2.24)**	−0.002 (0.67)	−0.001 (0.45)	0.003 (0.61)	0.004 (0.73)	0.011 (2.75)***	−0.001 (0.46)	−0.003 (0.21)	0.072 (2.73)***	0.033 (0.72)
Decreases in deficit to GDP ratio	0.001 (0.73)	0.002 (0.91)	0.001 (0.77)	−0.003 (1.24)	0.002 (0.93)	0.003 (1.25)	−0.002 (1.60)	−0.001 (0.15)	0.001 (1.45)	−0.040 (2.52)**

t statistics in parentheses.

[a] Also included in the regression are country fixed effects and time trend, the measures of per capita income, the total population, the share of the elderly and young in the total population, and openness to international trade, all in levels and first differences.

* Significant at 10%.

** Significant at 5%.

*** Significant at 1%.

productive expenditures harms long-term economic growth. Along these lines, Ghate and Zak (2002) elaborate a model in which voters' support for politicians depends on the transfers they receive and on output growth. Voters may be willing to accept some reductions in the transfers they desire if they think that this stimulates output growth. Therefore, governments strike a balance between utility and economic-growth-enhancing expenditure by protecting social spending with a productive character the most. The evidence we find here does not fully support or reject the two hypotheses presented in the discussion of previous literature. Some utility-enhancing (growth-enhancing) functions are protected and others are adjusted at times of budgetary cuts. Therefore, it is more useful to analyze the full classification of the composition of government expenditure by functions. This is an important contribution of this article, since most of the few analyses on the effects of fiscal consolidation on the composition of government expenditures have focused on particular functions or on its economic classification.

Nevertheless, these results are also consistent with governments reducing pure public goods, such as public services, economic services, defense, and cultural affairs while protecting merit goods, such as education and health expenditure, when facing budgetary cuts. As pure public goods are less visible than merit goods, by reducing the former, governments may be minimizing the political costs of fiscal consolidations.

Appendix 1: Instrumental Variable Regression Diagnostics (Table 2)[a]

	Social Security	Education	Health	Public Services	Economic Affairs	Transport	Defense	Housing	Cultural Affairs
Sargan test	$\chi^2(8)$ 11.043 [0.20]	$\chi^2(6)$ 7.802 [0.25]	$\chi^2(8)$ 6.056 [0.64]	$\chi^2(8)$ 6.056 [0.64]	$\chi^2(13)$ 3.048 [0.99]	$\chi^2(6)$ 6.847 [0.34]	$\chi^2(5)$ 6.067 [0.30]	$\chi^2(9)$ 10.958 [0.28]	$\chi^2(12)$ 16.593 [0.17]
Anderson under-identification test	$\chi^2(9)$ 140.4 [0.00]	$\chi^2(7)$ 83.2 [0.00]	$\chi^2(9)$ 175.1 [0.00]	$\chi^2(9)$ 175.1 [0.00]	$\chi^2(14)$ 213.2 [0.00]	$\chi^2(7)$ 141.7 [0.00]	$\chi^2(6)$ 111.3 [0.00]	$\chi^2(10)$ 115.8 [0.00]	$\chi^2(13)$ 146.2 [0.00]
Weak identification test: Cragg-Donald statistic[b]	11.40 (CV: 9.01)	9.46 (CV: 7.77)	17.14 (CV: 9.01)	17.14 (CV: 9.01)	14.54 (CV: 10.14)	16.70 (CV: 7.77)	16.62 (CV: 6.61)	10.05 (CV: 9.37)	10.31 (CV: 10.01)
Endogenous variables: Shea partial R^2 (regression R^2)									
Government size	0.21 (0.25)	0.23 (0.28)	0.20 (0.22)	0.20 (0.22)	0.26 (0.31)	0.22 (0.23)	0.20 (0.26)	0.19 (0.20)	0.26 (0.29)
Per capita income	0.38 (0.47)	0.14 (0.40)	0.30 (0.44)	0.30 (0.44)	0.35 (0.50)	0.25 (0.26)	0.17 (0.24)	0.39 (0.42)	0.29 (0.46)
Lagged dependent variable	0.19 (0.21)	0.10 (0.27)	0.19 (0.26)	0.19 (0.26)	0.26 (0.33)	0.21 (0.21)	0.93 (0.98)	0.13 (0.13)	0.19 (0.28)

[a] Values in brackets represent p values.
[b] CV indicates critical value for the weak instrument test computed by Stock and Yogo (2005) for up to three endogenous variables, 10% bias of the UIV estimator relative to OLS and the number of instruments used in each regression.

Appendix 2: Instrumental Variable Regression Diagnostics (Table 3)[a]

	Social Security	Education	Health	Public Services	Economic Affairs	Transport	Defense	Housing	Cultural Affairs
Sargan test	$\chi^2(8)$ 10.078 [0.26]	$\chi^2(6)$ 6.872 [0.34]	$\chi^2(6)$ 2.545 [0.86]	$\chi^2(8)$ 6.056 [0.64]	$\chi^2(13)$ 2.813 [0.99]	$\chi^2(6)$ 7.757 [0.26]	$\chi^2(4)$ 5.330 [0.26]	$\chi^2(9)$ 10.960 [0.28]	$\chi^2(12)$ 17.185 [0.14]
Anderson under-identification test	$\chi^2(9)$ 129.7 [0.00]	$\chi^2(7)$ 83.1 [0.00]	$\chi^2(7)$ 176.4 [0.00]	$\chi^2(9)$ 175.1 [0.00]	$\chi^2(14)$ 214.8 [0.00]	$\chi^2(7)$ 142.1 [0.00]	$\chi^2(5)$ 111.3 [0.00]	$\chi^2(10)$ 115.3 [0.00]	$\chi^2(13)$ 149.2 [0.00]
Weak identification test: Cragg-Donald statistic[b]	10.46 (CV: 9.01)	9.45 (CV: 7.77)	21.14 (CV: 9.01)	17.14 (CV: 9.01)	14.66 (CV: 10.14)	16.73 (CV: 7.77)	16.60 (CV: 6.61)	9.99 (CV: 9.37)	10.53 (CV: 10.01)
Endogenous variables: Shea partial R^2 (regression R^2)									
Government size	0.21 (0.25)	0.23 (0.28)	0.20 (0.23)	0.20 (0.22)	0.27 (0.31)	0.22 (0.23)	0.20 (0.26)	0.19 (0.19)	0.26 (0.29)
Per capita income	0.38 (0.47)	0.14 (0.40)	0.29 (0.43)	0.30 (0.44)	0.34 (0.50)	0.25 (0.26)	0.17 (0.23)	0.38 (0.42)	0.30 (0.46)
Lagged dependent variable	0.18 (0.21)	0.10 (0.27)	0.20 (0.26)	0.19 (0.26)	0.26 (0.33)	0.25 (0.26)	0.93 (0.98)	0.13 (0.13)	0.19 (0.28)

CV indicates critical value.
[a] Values in brackets represent p values.
[b] For economic affairs, the weak instrument test is rejected for a 20% of maximal bias of the IV estimator relative to OLS. Instruments rejecting this test for a lower relative bias do not pass the Sargan test.

Appendix 3: Instrumental Variable Regression Diagnostics (Table 4)[a]

	Social Security	Education	Health	Public Services	Economic Affairs	Transport	Defense	Housing	Cultural Affairs
Sargan test	$\chi^2(6)$ 9.623 [0.14]	$\chi^2(6)$ 8.964 [0.18]	$\chi^2(10)$ 14.89 [0.14]	$\chi^2(8)$ 5.877 [0.66]	$\chi^2(8)$ 1.914 [0.98]	$\chi^2(7)$ 6.507 [0.48]	$\chi^2(5)$ 7.941 [0.16]	$\chi^2(8)$ 7.796 [0.45]	$\chi^2(11)$ 9.920 [0.54]
Anderson under-identification test	$\chi^2(7)$ 83.9 [0.00]	$\chi^2(7)$ 137.7 [0.00]	$\chi^2(11)$ 148.3 [0.00]	$\chi^2(9)$ 139.2 [0.00]	$\chi^2(9)$ 92.6 [0.00]	$\chi^2(8)$ 125.8 [0.00]	$\chi^2(6)$ 94.3 [0.00]	$\chi^2(9)$ 102.9 [0.00]	$\chi^2(12)$ 124.2 [0.00]
Weak identification test: Cragg-Donald statistic	9.57 (CV: 9.01)	16.26 (CV: 7.77)	12.23 (CV: 9.01)	12.43 (CV: 9.01)	8.66 (CV: 10.14)	13.23 (CV: 7.77)	12.20 (CV: 6.61)	9.68 (CV: 9.37)	9.33 (CV: 10.01)
Endogenous variables: Shea partial R^2 (regression R^2)									
Government debt	0.15 (0.25)	0.20 (0.25)	0.16 (0.26)	0.18 (0.22)	0.14 (0.25)	0.15 (0.17)	0.10 (0.15)	0.19 (0.19)	0.19 (0.25)
Per capita income	0.31 (0.44)	0.29 (0.51)	0.48 (0.67)	0.37 (0.46)	0.22 (0.45)	0.24 (0.27)	0.23 (0.24)	0.29 (0.44)	0.38 (0.59)
Lagged dependent variable	0.16 (0.19)	0.25 (0.36)	0.27 (0.37)	0.23 (0.24)	0.15 (0.28)	0.20 (0.21)	0.63 (0.97)	0.17 (0.24)	0.19 (0.28)

CV indicates critical value.

[a] Values in brackets represent p values.

Appendix 4: Instrumental Variable Regression Diagnostics (Table 5)[a]

	Social Security	Education	Health	Public Services	Economic Affairs	Transport	Defense	Housing	Cultural Affairs
Sargan test	$\chi^2(6)$ 6.861 [0.33]	$\chi^2(8)$ 12.488 [0.13]	$\chi^2(5)$ 7.322 [0.20]	$\chi^2(8)$ 4.429 [0.82]	$\chi^2(8)$ 2.508 [0.96]	$\chi^2(7)$ 5.899 [0.55]	$\chi^2(5)$ 4.663 [0.46]	$\chi^2(8)$ 7.890 [0.44]	$\chi^2(11)$ 8.860 [0.64]
Anderson under-identification test	$\chi^2(7)$ 89.9 [0.00]	$\chi^2(9)$ 125.1 [0.00]	$\chi^2(6)$ 109.6 [0.00]	$\chi^2(9)$ 147.4 [0.00]	$\chi^2(9)$ 130.8 [0.00]	$\chi^2(8)$ 180.9 [0.00]	$\chi^2(6)$ 83.6 [0.00]	$\chi^2(9)$ 159.2 [0.00]	$\chi^2(12)$ 196.1 [0.00]
Weak identification test: Cragg-Donald statistic	10.29 (CV: 9.01)	11.98 (CV: 7.77)	14.33 (CV: 9.01)	14.21 (CV: 9.01)	12.50 (CV: 10.14)	19.64 (CV: 7.77)	10.75 (CV: 6.61)	15.47 (CV: 9.37)	15.38 (CV: 10.01)
Endogenous variables: Shea partial R^2 (regression R^2)									
Government deficit	0.18 (0.26)	0.23 (0.23)	0.14 (0.16)	0.17 (0.18)	0.15 (0.20)	0.15 (0.17)	0.09 (0.16)	0.19 (0.20)	0.36 (0.38)
Per capita income	0.44 (0.44)	0.28 (0.50)	0.43 (0.57)	0.43 (0.46)	0.36 (0.46)	0.26 (0.26)	0.16 (0.24)	0.39 (0.44)	0.46 (0.60)
Lagged dependent variable	0.11 (0.16)	0.14 (0.24)	0.20 (0.30)	0.24 (0.24)	0.17 (0.27)	0.22 (0.22)	0.61 (0.97)	0.16 (0.17)	0.24 (0.28)

CV indicates critical value.

[a] Values in brackets represent p values.

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