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Public goods, merit goods, and the relation between private and government consumption

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Abstract

In this paper, we investigate the relation between public and private consumption, by constructing a general government spending data set, by function, for 12 European countries. In particular, we split government consumption into two categories. The first category—“public goods”—includes defence, public order, and justice. The second category—“merit goods”—includes health, education, and other services that could have been provided privately. Equations from a relatively general permanent income model are estimated by GMM. The estimates are fairly robust in showing that public goods substitute while merit goods complement private consumption. However, the relation between merit goods and private goods turns out to be stronger than that between public goods and private goods. Thus, in the aggregate government and private consumption are complements.

JEL classification: E6; H3; C33

Keywords: Public goods; Merit goods; Government consumption; Dynamic panel estimation

1. Introduction

The response of economic aggregates to government spending changes has always been at the very heart of macroeconomics and government policy debates. It has been long recognized that this response varies across government spending categories (e.g., consumption, investment, income transfers, interest payments).[1] In particular, the

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[1] See, e.g., Barro (2000, Chapter 12).

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response of economic aggregates to changes in government consumption is thought to depend on the relationship between government and private consumption (Bailey, 1971; Hall, 1980; Barro, 1981, 1989). For example, this response will depend on whether government consumption substitutes for private consumption, in the sense of a public policeman reducing the need for a private policeman. Since then, a large literature has been developed that estimates this relationship (Kormendi, 1983; Aschauer, 1985; Reid, 1985; Bean, 1986; Ahmed, 1986; Campbell and Mankiw, 1990; Graham and Himarios, 1991; Graham, 1993; Karras, 1994; Ni, 1995; Amano and Wirjanto, 1998). However, the evidence is not conclusive. Aschauer, Kormendi, and Bean using different data sets for the United States find a small substitution effect between private and public consumption. Ahmed using a long data set for the UK also finds evidence of substitutability between private and public consumption. However, Campbell and Mankiw do not find any significant effect in a postwar data set for the US. And, Karras finds complementarity between public and private consumption in a number of countries. The uncertainty of results is confirmed by Ni, who shows that the relationship between private and government consumption is sensitive to the choice of the utility function and the interest rate measurement. In the meantime, this relation has come to play an important role for the working of both theoretical and empirical stochastic dynamic general equilibrium models that form the mainstream paradigm in contemporary macroeconomics.[2]

In this paper, starting from a permanent income model we estimate the relationship between public and private consumption, splitting the former into two categories. The first category—"public goods"—includes defence, public order, and justice. The second category—"merit goods"—includes health, education, and other services that could have been provided privately. Our motivation for doing so is both theoretical and empirical. The theoretical motivation has to do with important differences in the very nature of these goods. For example, public goods are to a great extent non-rival in consumption, while merit goods are to a great extent rival in consumption and their positive externalities depend on distributional and demographic characteristics. The empirical motivation has to do with the different paths followed by these two categories of goods, due to the growth of the Welfare State, especially since the 1970s.[3]

In Section 2, we present the "stylized facts" of functional government spending. We construct an international data set from 1970 to 1996, made up from 12 European countries. The data are described and explained in an appendix at the end of the paper. The public and merit goods categories are generated by adopting a functional classification of general government spending, along the lines set forth by Saunders and Klau (1985), in their OECD study.

In Section 3, we present a model of household behavior in the presence of private, public and merit goods. This model belongs to the class of permanent income models of consumption. But, neither the behavior of the other agents in the economy nor the economy's equilibrium laws of motion are modeled explicitly. The underlying

[2] See, e.g., Aiyagari et al. (1992), Christiano and Eichenbaum (1992), Baxter and King (1993), Correia et al. (1995), Devereux et al. (1996), and Kollintzas and Vassilatos (2000).

[3] See Tables 2–4 of this paper.

idea is simply to derive an estimable equation that characterizes the relation between private and public goods consumption, on the one hand, and between private and merit goods consumption, on the other. An effort is made so that this characterization takes into account some potentially important features of the underlying goods, such as non-rivalness in consumption and time non-separability of the utility function. More importantly, however, we depart from the literature in that we do not employ any specific temporal utility functional form. For, as we show, the specific functional forms used in this literature would imply restrictions that severely limit the nature of the relations we try to estimate.

In Section 4, we report the estimation methodology and results. The equations from the theoretical model are estimated by GMM, using the panel data described in Section 2. The estimates are fairly robust in showing that public goods substitute and merit goods complement private consumption. Further, the relation between merit and private goods is stronger than the relation between public and private goods. Moreover, since merit goods consumption is about two-thirds of government consumption, these findings imply that in the aggregate government and public goods are complementary. Given the overall increase of the merit goods share, this can explain why in most of the early studies there was evidence of substitutability between aggregate private and public consumption, while in the most recent studies there is evidence of complementarity. At any rate, it suggests that the potential calibration bias from ignoring the composition of government consumption might be quite substantial, at least in the European case. In Section 5, we offer some ideas about related future research.

2. Government spending in Europe

Since the 1970s, general government spending in Europe and elsewhere has not simply increased, but has also changed in composition. Moreover, the ratio of government spending to GDP has not been fluctuating around some constant ratio, as implied by stabilization policies, but, instead, it has steeply increased. In most cases, this increase lasted until the early 1990s, when the EMS crisis and the EMU-entry criteria brought about increased costs of debt financing and thus the need for higher fiscal discipline. The increases in government spending were paralleled by its changing composition. This is evident by looking at both economic and functional categories of government spending. This holds true, in general, and for the 12 European countries we study in this paper. The selection of these countries—Austria, Denmark, Finland, France, Germany, Greece, Italy, Norway, Portugal, Spain, Sweden and the United Kingdom—was made on the basis of data availability alone.

2.1. Economic classification

Comparing the main trends, reported in Table 1, we find that government consumption stopped, in most cases, being the largest component of government spending (Alesina and Perotti, 1996). Fixed investment expenditures, which is the remaining part of government purchases, was remarkably reduced everywhere. This is probably

Table 1
Major types of expenditures as % shares of total general government spending

	Consumption	Transfers	Investment	Interests	Total/GDP
Austria					
1971–75	41.6	39.9	12.1	2.6	40.5
1976–80	39.3	39.4	9.1	4.4	46.2
1981–85	39.1	40.1	7.3	6.3	49.1
1986–90	38.9	41.2	6.4	7.8	50.0
1991–95	38.8	41.6	6.0	8.2	51.5
1996–99	38.9	42.3	4.1	8.0	51.1
Finland					
1971–75	51.1	32.1	6.9	2.4	31.0
1976–80	50.5	34.6	5.8	2.3	36.5
1981–85	50.0	35.0	6.4	3.7	39.2
1986–90	48.6	36.2	8.0	3.6	42.9
1991–95	43.0	43.0	5.6	6.1	56.2
1996–99	44.1	42.9	5.8	7.9	50.2
Germany					
1971–75	43.4	37.7	9.7	2.7	41.5
1976–80	42.3	40.4	7.3	3.6	46.1
1981–85	42.9	40.5	5.6	5.9	46.6
1986–90	42.7	40.9	5.2	6.1	44.5
1991–95	43.2	40.6	5.9	7.3	45.6
1996–99	41.9	44.2	4.1	7.8	46.2
Italy					
1971–75	40.0	38.4	8.3	6.3	37.2
1976–80	35.3	37.2	7.6	10.9	40.8
1981–85	33.9	35.8	7.6	14.8	48.4
1986–90	33.0	36.1	6.6	16.4	51.2
1991–95	32.5	36.5	4.9	20.8	53.8
1996–99	36.3	36.9	4.7	17.9	49.8
Portugal					
1971–75	59.2	21.8	10.2	2.2	21.9
1976–80	42.1	33.1	10.6	6.7	31.2
1981–85	33.3	24.9	8.7	14.6	41.3
1986–90	37.1	29.9	8.3	19.0	39.3
1991–95	39.8	33.9	8.3	15.4	44.1
1996–99	42.7	38.6	9.7	9.0	43.8
Sweden					
1971–75	53.5	29.6	10.6	4.4	44.5
1976–80	51.4	32.7	7.5	5.1	54.6
1981–85	48.1	31.9	5.8	11.3	60.4
1986–90	48.2	35.0	5.3	10.2	56.1
1991–95	43.5	38.3	4.6	9.3	63.6
1996–99	46.4	37.8	4.2	10.6	57.9

Table 1 (*continued*)

	Consumption	Transfers	Investment	Interests	Total/GDP
Denmark					
1971–75					
1976–80					
1981–85					
1988–90	45.9	34.5	3.3	13.0	56.4
1991–95	44.1	37.1	3.0	11.6	59.0
1996–99	45.7	37.4	3.2	9.6	56.4
France					
1971–75	47.8	34.2	9.3	2.3	38.7
1976–80	48.2	34.9	7.6	2.8	43.8
1981–85	46.9	35.9	6.4	4.7	50.1
1986–90	45.5	36.4	6.7	5.5	50.0
1991–95	44.9	37.4	6.7	6.5	52.6
1996–99	45.3	38.3	5.7	6.9	52.8
Greece					
1971–75					
1976–80					28.9
1981–85					37.6
1986–90	31.9	34.4	6.9	15.0	43.3
1991–95	31.1	34.6	6.9	22.8	45.9
1996–99	34.6	38.9	8.5	19.6	43.3
Norway					
1971–75	46.7	29.6	12.2	4.5	38.1
1976–80	44.3	30.3	10.3	5.6	43.7
1981–85	43.8	33.6	7.3	7.1	43.1
1986–90	42.0	36.1	7.8	7.7	48.3
1991–95	42.9	37.9	6.9	6.3	50.2
1996–99	45.6	38.2	7.7	4.7	45.4
Spain					
1971–75	49.2	34.4	12.1	1.4	21.5
1976–80	48.5	37.6	7.8	1.2	26.9
1981–85	44.1	37.3	8.0	2.7	35.1
1986–90	42.4	34.3	10.2	10.0	38.4
1991–95	42.8	35.4	9.6	10.5	42.7
1996–99	43.9	36.0	7.7	11.3	39.9
UK					
1971–75					
1976–80					
1981–85					
1986–90	47.9	32.6	5.4	6.4	41.3
1991–95	45.7	38.0	4.9	5.3	44.6
1996–99	45.5	40.0	3.3	6.8	40.8

Source: OECD, Fiscal Position and Business Cycle (FPBC) Database, June, 2000.

a result of an effort to reduce government spending without cutting income-related spending. In the sample period, in most cases, transfers became the largest spending component. In turn, the lion's share of transfers (80–90%, in most cases) consists of social security benefits. Finally, the interest spending share rose notably in some cases, but fell in the late 1990s.

2.2. Functional classification

Following Saunders and Klau (1985), we examine the same changes in terms of a functional classification of government spending. In particular, we look in Tables 3 and 4 at three major categories: First, the "traditional domain," which corresponds to the provision of public goods such as defence, public order, justice, etc. Second, the "Welfare State domain," which in turn is made up by two subcategories: "merit goods," such as education and health services and "income maintenance programs," that include social security benefits and many other cash benefits for the eligible recipients (disability, injury, sickness, unemployment, housing benefits, etc.). Third, "Mixed Economy" interventions, which mostly amount to infrastructure spending (economic services) and to interest payments on the outstanding general government debt.

We compare first our data for 1985 with those provided by Saunders and Klau (see Table 3). Despite changes in data and accounting systems, differences are found to be negligible. Then, we compare the spending composition in each country with that found in the last available year. This turns out to be around 1995 (see Table 4). Summarizing, the functional classification shows that the provision of public goods is roughly a constant and a relatively small share of total government spending. This share is always smaller than 10% and cannot account for the spending increase found in the economic classification. Most of the spending increase is associated with the Welfare State components. However, the increase in the merit goods is in general relatively small, so that the increase in income maintenance programs dominates. This evidence matches the economic classification evidence, showing the parallel reduction among government purchases and the increase in transfers and taxation (see, e.g., Masson and Mussa, 1995; Fiorito, 1997). The reduction in public investment spending is often paralleled by the increased interest spending, though there are differences among countries and periods. By looking at government consumption only (Table 2), we find that the share between government and household consumption generally rises in nominal terms but falls in volumes. This reveals a different pattern for relative price movements. That is, government consumption deflator exceeds private consumption deflator. When looking at government consumption only, it appears that the public good component is much smaller than the merit good component. The public good component tends to fall and ranges between one-fourth and one-third of the overall consumption. Greece seems to be the only exception. The merit good component dominates and has a positive growth trend. Education and health are the most important subcategories (Table 2) and account for about four-fifths of the merit goods aggregate. These findings confirm the fact that the public goods category has behaved differently from the merit goods category over the last 30 years or so (Tables 2–4).

Table 2
Public and merit goods components of government consumption

	Govt/private consumption ratio		Government consumption % composition			
	Nominal	Real	Public goods	Merit goods		
				Total	Education	Health
Austria						
1971–75	28.9	36.8				
1976–80	32.3	36.7	27.9	63.1	20.7	23.1
1981–85	33.3	36.9	26.8	63.8	21.1	22.8
1986–90	34.1	35.0	25.4	64.3	21.2	23.8
1991–95	35.4	33.2	24.8	65.1	21.2	25
Denmark						
1971–75	44.1	44.3	22.5	67.6	23.4	22.1
1976–80	47.6	47.9	20.1	65.9	22.0	20.5
1981–85	52.8	54.8	19.7	64.8	21.2	18.7
1986–90	50.7	51.7	19.4	66.0	20.8	18.7
1991–95	51.8	50.7	18.2	69.1	21.1	19.3
Finland						
1971–75	28.1	34.5				
1976–80	32.5	39.5	24.0	67.7	28.0	21.6
1981–85	35.2	41.2	23.7	68.4	26.0	22.2
1986–90	38.2	40.0	22.3	70.3	25.5	22.5
1991–95	41.5	42.5	21.9	69.4	25.7	21.8
France						
1971–75	26.5	29.5				
1976–80	30.0	29.8				
1981–85	31.8	31.1	33.3	59.2	25.9	16.5
1986–90	30.7	30.6	34.0	59.3	25.6	16.7
1991–95	31.8	31.7	32.5	60.9	26.1	17.3
Germany						
1971–75	33.3	36.7	35.8	58.6	19.1	26.6
1976–80	35.0	36.3	32.6	62.4	20.1	29.1
1981–85	35.4	37.4	32.0	63.4	20.1	29.4
1986–90	35.1	35.6	31.0	64.6	19.1	30.5
1991–95	34.7	33.6	26.6	69.2	18.6	32.2
Greece						
1971–75	15.5		74.7	23.7	14.3	8.2
1976–80	19.5		73.8	24.1	13.9	9.0
1981–85	22.7		70.7	25.4	14.0	9.9
1986–90	23.0		68.0	27.8	14.8	11.5
Italy						
1971–75	24.3	33.4				
1976–80	24.0	31.6				
1981–85	27.0	30.8	35.6	57.4	29.0	19.5
1986–90	27.6	29.7	37.2	56.1	28.1	19.3
1991–95	27.8	28.7	37.8	56.3	26.6	21.1

Table 2 (*continued*)

	Govt/private consumption ratio		Government consumption % composition			
	Nominal	Real	Public goods	Merit goods		
				Total	Education	Health
Norway						
1971–75	35.2	34.3	27.6	51.4	26.2	15.7
1976–80	38.7	36.8	25.1	54.6	25.3	18.8
1981–85	40.2	40.1	25.3	56.0	24.1	20.8
1986–90	40.0	39.4	25.6	57.5	23.9	21.7
1991–95	43.2	43.6				
Portugal						
1971–75	18.5	13.2				
1976–80	18.7	17.5				
1981–85	20.3	21.5				
1986–90	23.1	24.1	37.0	53.3	28.0	16.7
1991–95	26.9	25.5	34.1	55.5	30.3	17.1
Spain						
1971–75	15.1	15.9				
1976–80	18.4	17.8				
1981–85	21.7	21.2				
1986–90	23.9	24.0	25.6	61.1	18.5	23.6
1991–95	26.9	26.6	26.6	61.6	21.4	24.9
Sweden						
1971–75	44.1	46.3				
1976–80	52.9	49.9				
1981–85	55.4	55.5	23.1	69.4	20.2	25.1
1986–90	51.7	52.9	23.4	69.0	19.8	24.2
1991–95	50.6	55.7	25.2	66.8	19.3	19.2
UK						
1971–75	31.7	40.5				
1976–80	35.1	41.7	34.7	55.4	22.5	21.5
1981–85	36.2	40.1	35.7	54.9	21.0	22.1
1986–90	32.4	33.7	34.5	56.1	20.9	22.8
1991–95	34.1	33.6	32.3	59.6	20.5	25.6

Sources: See Table 1. For the public and merit good distinction, see the Statistical Appendix. For France, the time periods are 1983–1985 and 1991–1993, respectively. For the UK, the time period is 1977–1980.

3. The model

3.1. Private, public, and merit goods consumption

We consider an economy that is populated by a large number of identical households. The number of households, N_t, evolves exogenously, according to

$$N_{t+1} = (1 + g_N)N_t, \quad N_0 \in R_+ \text{ given,} \tag{1}$$

Table 3
The structure of general government expenditure in 1981 (GDP % shares)

	Denmark		*France*		*Germany*		*Italy*		*United Kingdom* (1979)		*Spain* (1985)	*Norway*
			1983	1981								
Total expenditure	**59**	*59.5*	**52.3**	*49.2*	**49.8**	*49.3*	**46.6**	*51.2*	**45.5**	*43.2*	**42.6**	**44.5**
The traditional domain												
Public goods	**7.8**	*8*	**8.2**	*7.5*	**8.6**	*6.8*	**6.8**	*7*	**7.8**	7.7	**5.5**	**5.8**
Defence	2.5	*2.6*	3.5	*3.8*	2.9	*2.9*	1.8	*2*	4.5	*4.5*	2	2.9
General public services[a]	5.2	*5.4*	4.7	*3.7*	5.7	*3.9*	5	*5*	3.3	*3.2*	3.6	2.9
Welfare State	**37.7**	*33.8*	**39.1**	*33.2*	**30.9**	*31*	**27.2**	*29.8*	**25.5**	*22.7*	**24.8**	**26.8**
Merit goods	**16.4**	*17.4*	**19.2**	*16*	**14**	*14.3*	**12.8**	*14*	**13.6**	*13.6*	**11.3**	**13.9**
Education	7.7	*8.4*	5.7	*5.9*	5.2	*5.2*	5.4	*6.1*	5.2	*5.1*	3.7	5.7
Health	5.7	*5.7*	8.9	*6.4*	6.5	*6.8*	5.4	*6*	4.6	*4.4*	4.7	5.9
Housing and community amenities	1.3	*1.6*	3.6	*2.8*	1.4	*1.4*	1.5	*1.5*	3.2	*3.5*	2	1.1
Recreational, cultural and religious services	1.7	*1.7*	1.1	0.9	*0.9*	*0.9*	0.5	*0.4*	0.6	*0.6*	0.9	1.2
Income maintenance[b]	**21.3**	*16.4*	**19.9**	*17.2*	*16.9*	*16.7*	**14.4**	*15.8*	**11.9**	*9.1*	**13.5**	**12.9**
Pensions[c]	7.8	*8.1*	11.5	*11.9*	11.6	*12.6*	11	*13.1*	—	*6.5*	8.9	—
Sickness benefits	1.7	*1.2*	0.6	*1.2*	0.5	*0.6*	0.5	*0.8*	—	*0.4*	0.7	—
Family allowances	1.1	*1.2*	2.5	*2.2*	1.8	*1.2*	1.2	*1.2*	—	*1.4*	0.2	—
Unemployment compensations	5	*5.1*	2.3	*1.9*	1.2	*1.4*	0.8	*0.6*	—	*0.7*	2.8	—
Other	5.3	*0.8*	2.4	—	1.4	*0.9*	0.8	—	—	—	0.5	—
The mixed economy	**12.2**	*10.6*	**6.1**	*6.1*	**7.0**	*7.1*	**12.6**	*14.7*	**8.0**	*8.2*	**7.9**	**11.6**
Economic services	**6.3**	*5.3*	**3.6**	*3.9*	**4.8**	*4.9*	**6.5**	*7.5*	**3.6**	*3.6*	**6**	**8.6**
Interest payments[d]	**5.9**	*5.3*	**2.5**	*2.2*	**2.2**	*2.2*	**6**	*7.2*	**4.4**	*4.6*	**1.9**	**3**
Discrepancy	1.3	*7.1*	−1.1	*2.4*	3.3	*4.4*	0.1	*−0.3*	4.2	*4.6*	4.4	0.3

Note: Unless specified, the data source is OECD, National Accounts—Detailed Tables, several years. The columns in italics report Saunders and Klau (1985) results.

[a]"Public order and safety" is included.

[b]Data are from the OECD Social Expenditure Database. In the functional classification, "social security and welfare" is the corresponding item. For the UK, we used the National Accounts source since the Social Expenditure Database begins in 1980.

[c]It includes unfunded pensions, social assistance grants and welfare benefits.

[d]General Government debt interest payments (OECD, *Fiscal position and business cycles* database). For Denmark, we used the OECD national accounts data for General Government where the item "other" is essentially made by interest payments.

where $g_N \in [0, \infty)$ is the constant rate of population growth, in all periods, t. Technological progress is labor augmenting and the technology state, Z_t, evolves exogenously, according to

$$Z_{t+1} = (1 + g_Z)Z_t, \quad Z_0 \in R_+ \text{ given,} \tag{2}$$

where $g_Z \in [0, \infty)$ is the constant rate of technological progress in all periods, t.

Table 4
The structure of general government expenditure in 1995 (GDP% shares)

	Denmark	France (1993)	Germany	Italy	Norway (1991)	Portugal	Spain	United Kingdom
Total expenditure	59.7	56.6	57.6	52.6	51.3	49.9	47.2	44.3
The traditional domain								
Public goods	**7**	**8.8**	**7.1**	**8**	**6.8**	**6.4**	**5.6**	**7.4**
Defence	1.7	3	1.4	1.7	2.9	2.2	1.5	3.3
General public services	4.3	4.6	3.9	4.5	3	2	1.8	1.9
Public order and safety	1	1.2	1.7	1.8	0.9	2.1	2.2	2.2
Welfare State	**40.2**	**43.6**	**32.8**	**30.1**	**36.4**	**26.8**	**28.4**	**30.1**
Merit goods	**14.5**	**21.7**	**13.3**	**11.9**	**15.5**	**14.1**	**13.2**	**13.3**
Education	7	6	4.4	4.7	6.5	6.8	4.9	5.4
Health	5	10.8	7	5.4	6.8	5	5.5	5.8
Housing and community Amenities	1	3.7	1.1	1.2	0.8	1.2	1.7	1.5
Recreational, cultural and religious services	1.5	1.2	0.8	0.6	1.4	1.1	1.2	0.6
Income maintenance	**25.7**	**21.9**	**19.5**	**18.2**	**20.9**	**12.7**	**15.2**	**16.8**
Old-age cash benefits	7.4	10.1	10.1	10.9	5.9	6	8	6.5
Disability cash benefits	1.9	1.1	1.1	1.4	2.8	1.7	1.3	2.6
Occupational injury and Disease	0.2	0.4	0.3	0.5	0	—	—	0.2
Sickness benefits	0.6	0.6	0.5	0.1	1.6	0.6	1.1	0.2
Services for the elderly and the disabled people	2.9	0.7	0.6	0.2	3.6	0.2	0.2	0.7
Survivors	0	1.9	0.6	2.6	0.4	1.3	0.9	0.8
Family cash benefits	1.9	2.2	1.2	0.4	2.1	0.7	0.3	1.9
Unemployment	4.4	2.1	2.3	0.9	1.2	0.9	2.4	0.9
Housing benefits	0.8	0.9	0.1	0	0.2	0	0.1	1.8
Other	5.5	2	2.7	1.2	3	1.1	0.9	1.2
The mixed economy	**12**	**8.6**	**15.1**	**16.1**	**10.8**	**12.6**	**11.4**	**6.9**
Economic services	**5.6**	**4.9**	**11.4**	**4.6**	**7.6**	**6.3**	**6.2**	**3.3**
Public debt interests	**6.4**	**3.7**	**3.7**	**11.5**	**3.2**	**6.3**	**5.2**	**3.6**
Discrepancy	0.5	−4.4	2.6	−1.6	−2.7	4.1	1.8	−0.1

We let C, G, and M denote the private, public, and merit goods aggregate consumption in this economy. Then, we make the following definitions for private, public, and merit goods consumption per "effective" household, respectively,

$$c = \frac{C}{NZ},$$

$$g = \frac{G}{NZ}\upsilon(N),$$

$$m = \frac{M}{NZ}\varphi(N, d). \tag{3}$$

As the first of these equations make clear, we think of "effective" consumption, as consumption per technologically efficient household. This is simply a convenient normalization that is common in the RBC and growth literatures. As a consequence of this normalization, we can focus on a transformed economy such that the steady-state growth path of the original economy corresponds to a constant steady state in the transformed economy.[4] We take $\upsilon(\cdot)$ to be a positive and non-decreasing function of N that is bounded below by 1 and above by N. The idea is that "impure" public goods are to some extent rival in consumption. Thus, in the two extreme opposite cases of "pure" public goods, where $\upsilon(N) = N$, we have

$$Zg = \frac{G}{N}N = G.$$

And, in the case of congested public goods, where $\upsilon(N) = 1$, we have

$$Zg = \frac{G}{N}1 = \frac{G}{N}.$$

Likewise, following Musgrave (1959), we think of merit goods as goods that are provided by the government on paternalistic grounds (e.g., individuals ought to consume them even if they (could) would not, acting on their own self-interest), since merit goods are thought to have positive externalities.[5] For that matter, we take $\varphi(.,.)$ to be a positive and non-decreasing function of N and d, that is bounded below by 1 and above by N. d stands for a vector of demographic characteristics that may play a role in the conversion of aggregate merit goods consumption to the corresponding average or representative. For example, education is consumed relatively more by the young and health relatively more by the old. Thus, to the extent that households have relatively more old and young members they get more services from aggregate consumption of the merit goods. The incorporation of $\varphi(.,.)$ and $\upsilon(\cdot)$ will be exploited later in the empirical analysis. In this section, we are only interested in showing that the non-rivalness of the public and merit goods does not affect the substitutability between these goods and private goods, qualitatively.

3.2. Time non-separability and external habit formation

We follow Abel (1990) and Campbell and Cochrane (1999), in postulating that the representative household's preferences are characterized by external habit formation. This postulate captures three ideas. First, the representative household's (temporal) utility depends on the household's current consumption level and on the relation of this level with the household's habit level. Second, this habit level depends on the past consumption of all households in the economy, à la Duesemberry's (1949) relative income model. Third, the expectations of the representative household with respect to its future habit levels are rational. Although the representative household ignores the effect of its current consumption choice on the current economy average consumption level and hence on its future habit level, its expectations about its future habit level turn

[4] See, e.g., King and Rebelo (2000).

[5] See, e.g., Rosen (1999, pp. 51–53).

out to hold, in equilibrium. Apart from the plausibility of the underlying assumptions, the main advantages of this formulation over other time non-separable formulations are in empirical analysis. For example, the formulation based on the distinction between consumption expenditures and consumption services (Eichenbaum et al., 1988) and internal habit formation (Constantinides, 1990) deliver consumption equations with more lags. This is an important issue in empirical analysis, when there are degrees of freedom problems. Moreover, in these formulations the coefficients of lagged consumption levels are overly restrictive.[6] Thus, the representative economic agent's preferences are characterized by the conditional expectations of a life-time utility, of the form

$$U = \mathrm{E}_0 \sum_{t=0}^{\infty} \beta^t u(c_t, g_t, m_t, h_t^c, h_t^g, h_t^m), \tag{4}$$

where $\mathrm{E}_0(\cdot)$ is the expectations operator, conditioned on information available at the beginning of period 0; $\beta \in (0,1)$ is a constant time-discount factor that depends, possibly, on the rates of population growth and technological progress.[7] And $u(c, g, m, h^c, h^g, h^m)$ is a neoclassical temporal utility function in current effective consumption of private goods, c_t; current effective consumption of public goods, g_t; current effective consumption of merit goods, m_t; current habit level of private goods, h_t^c; current habit level of public goods, h_t^g and the current habit level of merit goods, h_t^m. By a neoclassical utility function we mean a real-valued function that is at least twice continuously differentiable, strictly increasing and strictly concave in c_t. It is not necessary to place restrictions on the sign of the cross-partial derivatives between current consumption and its habit level. However, following Abel and Campbell and Cochrane, it is more plausible to assume that this partial derivative is negative, in the sense that the marginal utility of private goods consumption declines with its habit level. The sign of the partial derivatives between current consumption and habit levels of public and merit goods consumption is not clear what they should be. Nevertheless, in the case of public goods and merit goods, habit levels may allow for potential important interactions between consumptions. For example, higher education and/or health expenditures may raise standard of living perceptions and therefore stimulate future private consumption.

The current habit levels of the representative household are taken to be the corresponding economy-average consumption levels of last period:

$$\begin{aligned} h_t^c &= (N_{t-1} c_{t-1})/N_{t-1} = c_{t-1}, \\ h_t^g &= (N_{t-1} g_{t-1})/N_{t-1} = g_{t-1}, \\ h_t^m &= (N_{t-1} m_{t-1})/N_{t-1} = m_{t-1}. \end{aligned} \tag{5}$$

In making its consumption contingency plan, $\{c_t\}_{t=0}^{\infty}$, the representative household takes $\{h_t^c, h_t^g, h_t^m\}_{t=0}^{\infty}$ as given and ignores the equalities in (5). However, its expectations vis-à-vis $\{h_t^c, h_t^g, h_t^m\}_{t=0}^{\infty}$ are rational in the sense that the equalities in (5) turn out to hold, in equilibrium.

[6] This was pointed to us by one of the referees. In an earlier version of this paper, we used time non-separable preferences that capture internal habit formation and/or distinguish between consumption expenditures and consumption services. The results are available on request. See, also, footnote 14.

[7] See, e.g., King and Rebelo (2000).

3.3. Substitutability and the form of the temporal utility function

Following the literature, we take c and $g(m)$ to be "Edgeworth" substitutes, independent or complements, depending on whether the cross-partial derivative of the temporal utility function $u_{cg}(u_{cm})$ is negative, zero, or positive. Obviously, then, the substitutability of private and public (merit) goods consumption depends exclusively on the form of the temporal utility function. Although in the empirical part of our work we shall not employ a particular functional form, it is important to justify our choice. The most commonly used specifications imply restrictions that severely limit the nature of the above-mentioned substitutability relationship. For example, ignoring for simplicity external habit formation, consider the case of the neoclassical temporal utility with linear effective consumption:[8] $u(c,g,m) = U(c + \eta g + \vartheta m)$; $U' > 0$ and $U'' < 0$. Since $u_g = \eta U'$ and $u_m = \vartheta U'$; while $u_{cg} = \eta U''$ and $u_{cm} = \vartheta U''$, and $u_{gm} = \eta\vartheta U''$; it follows that for g and m to be "goods" (i.e., $u_g, u_m \geqslant 0$), all goods must be ("Edgeworth") substitutes with each other. Similar restrictions are implied by the Constant Relative Risk Aversion temporal utility function and the Cobb–Douglas effective consumption or the CES effective consumption cases.[9,10]

Moreover, it should also be mentioned, that there are neoclassical temporal utility functions that do not restrict the substitutability relation between private and public

[8] This is the specification used in Feldstein (1982), Kormendi (1983), Aschauer (1985), Seater and Mariano (1985), Reid (1985), Graham and Himarios (1991), Graham (1993), Karras (1994), Correia et al. (1995) and Kollintzas and Vassilatos (2000).

[9] This is specification used in Bean (1986) and Ni (1995).

[10] In the case of Constant Relative Risk Aversion temporal utility function and Cobb–Douglas effective consumption:

$$u(c,g,m) = \frac{(c^{1-\eta-\vartheta} g^{\eta} m^{\vartheta})^{1-\gamma} - 1}{1-\gamma}, \qquad \gamma \geqslant 0; \quad \eta, \vartheta, (\eta + \vartheta) \in (0,1).$$

Clearly, c, g and m are "goods" here. And

$$u_{cg}, u_{cm}, c_{gm} \gtreqless 1 \text{ as } \gamma \gtreqless 1.$$

That is, if any two goods are substitutes, independents or complements depend exclusively on the degree of relative risk aversion. For example, a lot of risk aversion implies that all goods must be Edgeworth substitutes. And, in the case of Constant Relative Risk Aversion temporal utility function and CES effective consumption:

$$u(c,g,m) = \frac{[(1-\eta-\vartheta)c_t^{\zeta} + \eta g_t^{\zeta} + \vartheta m_t^{\zeta}]^{\frac{1-\gamma}{\zeta}} - 1}{1-\gamma}, \qquad \gamma \geqslant 0; \;\; \eta, \vartheta, (\eta + \vartheta) \in (0,1).$$

Again c, g and m are "goods". Moreover,

$$u_{c\zeta}, u_{cm}, u_{gm} \gtreqless 0 \text{ as } \gamma \gtreqless 1 - \zeta.$$

Thus, substitutability, independence, or complementarity depends on the degree of relative risk aversion and the elasticity of substitution between any two goods in the effective consumption, $1/(1-\zeta)$. Hence, it continues to be the case that if any two goods are "Edgeworth" substitutes (independent or complements) they all must be substitutes (independents or complements).

(merit) goods consumption. For example, in the case of the quadratic temporal utility

$$u(c,g,m)=\begin{bmatrix}a_c\\a_g\\a_m\end{bmatrix}'\begin{bmatrix}c\\g\\m\end{bmatrix}-\frac{1}{2}\begin{bmatrix}c\\g\\m\end{bmatrix}'\begin{bmatrix}b_{cc}&b_{cg}&b_{cm}\\b_{cg}&b_{gg}&b_{gm}\\b_{cm}&b_{gm}&b_{mm}\end{bmatrix}\begin{bmatrix}c\\g\\m\end{bmatrix},$$

$$a'=(a_c,a_g,a_m)\geqslant 0 \quad\text{and}\quad B=\begin{bmatrix}b_{cc}&b_{cg}&b_{cm}\\b_{cg}&b_{gg}&b_{gm}\\b_{cm}&b_{gm}&b_{mm}\end{bmatrix}\quad\text{positive definite.}$$

Provided that c, g, and m are bounded: $0\leqslant(c,g,m)'\leqslant B^{-1}$ a, they are all "goods" and the concavity assumption is satisfied. Moreover, any pair of goods are Edgeworth substitutes, independent, or complements depending on B. In particular,

$$u_{cg}\gtreqqless 0 \text{ as } b_{cg}\gtreqqless 0,\quad u_{cm}\gtreqqless 0 \text{ as } b_{cm}\gtreqqless 0\quad\text{and}\quad u_{gm}\gtreqqless \text{ as } b_{gm}\gtreqqless 0.$$

Although this temporal utility does not restrict the nature of the relations substitutability, it is not used in empirical work for it is almost impossible to test or impose the boundedness condition a priori. [11]

To summarize, in the case of a neoclassical temporal utility function with linear effective consumption, public goods consumption and merit goods consumption must be substitute with private goods consumption if they are to be goods (i.e., strictly increasing temporal utility function). In the case of Constant Relative Risk Aversion temporal utility function with Cobb–Douglas effective consumption, public goods consumption and merit goods consumption are either substitutes or complements with private goods consumption depending exclusively on the coefficient of relative risk aversion. Typical risk aversion implying that any pair of consumptions are substitutes. In the case of a Constant Relative Risk Aversion temporal utility function with constant elasticity of substitution-effective consumption, the situation is similar to the previous case. The only difference is that any pair of consumption goods must be substitutes or complements depending on the coefficient of relative risk aversion and the elasticity of substitution. Relatively high risk aversion and strong inputs substitution in effective consumption implies all consumptions are substitutes. Even if one does not object to the idea of Edgeworth substitutability depending on such things as the coefficient of relative risk aversion, these specifications severely restrict the substitution relations in the presence of three goods. For example, this specifications do not allow for public and private goods consumptions to be substitutes, while merit and private goods consumptions to be complements. The quadratic temporal utility case does not have these problems, but entails other restrictions.

[11] A similar specification where all variables were in logs could also be employed. In this case, the temporal utility function should be translog. See Eckstein et al. (1996) for details.

3.4. An approximate solution

We consider an equilibrium for the economy where given $\{(g_t, m_t), R_t, (h_t^c, h_t^g, h_t^m\}_{t=0}^{\infty}$, $\{c_t\}_{t=0}^{\infty}$ is an interior solution to the representative household's problem. Moreover, given $\{c_t, (g_t, m_t), R_t\}_{t=0}^{\infty}$, $\{h_t^c, h_t^g, h_t^m\}_{t=0}^{\infty}$ satisfy (4). The representative household's problem is to find a contingency plan for its consumption, $\{c(t)\}_{t=0}^{\infty}$, so as to maximize its expected life time utility subject to its budget constraint. We assume that this budget constraint implies that the representative household, by giving up one unit of consumption in any period t, gets a stochastic real gross after tax return of R_{t+1} in the next period. Then, a necessary condition for this problem is the Euler condition [12]

$$u_{c_t} = \tilde{\beta} \mathrm{E}_t u_{c_{t+1}} R_{t+1}, \tag{6}$$

where $\tilde{\beta} = \beta/(1 + g_N)(1 + g_Z)$.

The Euler condition may be used to illustrate the concept of Edgeworth substitutability/complementarity. To see this note, that the RHS of (6) is the expected discounted benefit from one unit of assets invested in the current period. Thus, it may be interpreted as the opportunity cost of consumption in the current period, p_{c_t}. That is, $u_{c_t} = p_{c_t}$. This equation, in turn, may be interpreted as the (inverse) demand for current private consumption. Then, if private consumption and, say, public goods consumption are Edgeworth substitutes (complements) an increase in public goods consumption lowers (increases) the demand for private consumption at any given price, p_{c_t}. The situation is depicted in Fig. 1.

In fact, the preceding illustration suggests a strategy for investigating the relation between private consumption and public goods consumption. This relation can be investigated around the steady state equilibrium path of the economy without the need for specifying any particular temporal utility function. The strict concavity of the utility function is all that is needed to pinpoint these relations using an approximation around the steady state equilibrium path.

In full notation, the Euler condition can be written as

$$\mathrm{E}_t[u_{c_t}(c_t, g_t, m_t, h_t^c, h_t^g, h_t^m) - \tilde{\beta} u_{c_{t+1}}(c_{t+1}, g_{t+1}, m_{t+1}, h_{t+1}^c, h_{t+1}^g, h_{t+1}^m)] = 0 \quad \forall t \in \mathbb{N}_+.$$

However, since expectations are rational, (4) must hold and therefore, in equilibrium,

$$\mathrm{E}_t[u_{c_t}(c_t, g_t, m_t, c_{t-1}, g_{t-1}, m_{t-1}) \\ -\tilde{\beta} u_{c_{t+1}}(c_{t+1}, g_{t+1}, m_{t+1}, c_t, g_t, m_t) R_{t+1}] = 0 \quad \forall t \in \mathbb{N}_+. \tag{7}$$

First, we need to assume that a steady-state equilibrium path exists [13]. Then, following Hall (1978), it is straightforward to show that:

[12] Under the curvature restrictions imposed on the utility function, the standard non-negativity conditions and the underlying initial and transversality conditions, the Euler condition is also a sufficient condition. See, e.g., Stokey et al. (1989, pp. 280–283).

[13] See, e.g., Stokey et al. (1989, pp. 131–143) for sufficient conditions for the existence of a unique steady-state equilibrium.

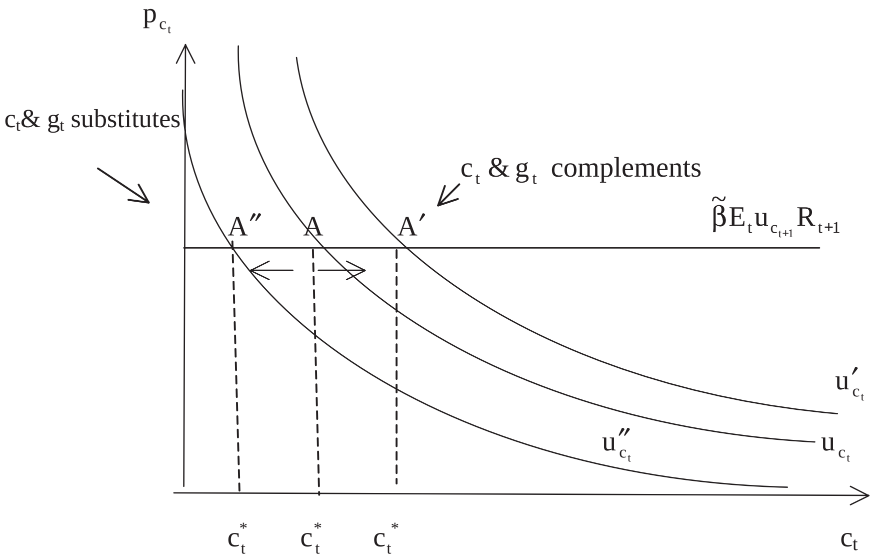

Fig. 1. An illustration of Edgeworth substitutability/complementarity.

Proposition 1. *Suppose that there exists a "steady-state" equilibrium for the economy, such that*

$$c_t = c > 0,\ \forall t \in \mathbb{N}_+,$$

$$g_t = g > 0,\ \forall t \in \mathbb{N}_+,$$

$$m_t = m > 0,\ \forall t \in \mathbb{N}_+,$$

$$R_t = R > 0,\ \forall t \in \mathbb{N}_+.$$

Then,

$$\tilde{\beta} R = [\beta/(1+g_N)(1+g_Z)]R = 1$$

and a first-order approximation of (7), *around* (c, g, m, R), *must satisfy the following* (*regression*) *equation*:

$$\Delta\tilde{c}_{t+1} = \alpha_1 \Delta\tilde{g}_{t+1} + \alpha_2 \Delta\tilde{m}_{t+1} + \alpha_3(\tilde{R}_{t+1} - \tilde{R}) + \alpha_4 \Delta\tilde{c}_t + \alpha_5 \Delta\tilde{g}_t + \alpha_6 \Delta\tilde{m}_t + \varepsilon_{t+1}, \quad (9)$$

where

$$\alpha_1 = -u_{cg} g / u_{cc} c,$$

$$\alpha_2 = -u_{cm} m / u_{cc} c,$$

$$\alpha_3 = -\tilde{\beta} u_c / u_{cc} c,$$

$$\alpha_4 = -u_{ch^c}/u_{cc},$$

$$\alpha_5 = -u_{ch^g}g/u_{cc}c,$$

$$\alpha_6 = -u_{ch^m}m/u_{cc}c$$

and

$$\mathrm{E}_t\varepsilon_{t+1} = 0, \quad \forall t \in \mathbb{N}_+. \tag{10}$$

Here, $\Delta(\cdot)$ *stands for the difference operator,* u_{cx} *for the second partial derivative of* u *with respect to* c *and* x*,* $x = (c, g, m, h^c, h^g, h^m)$*, evaluated at* (c, g, m, c, g, m) *and a "*$\sim$*" over a variable denotes the natural logarithm of this variable.*

The main implication of this result is that one can conveniently characterize the relation between private consumption and public goods consumption as well as the relation between private consumption and merit goods consumption. That is, since u_{cc} must be negative by virtue of the strict concavity of the utility function, u_{cg} and u_{cm} completely characterize the sign of α_1 and α_2, respectively.[14] Formally,

Corollary 1. *If* u *is strictly concave in* c*,* c *and* $g(m)$ *are Edgeworth substitutes, independents or complements if and only if*

$$a_1 \gtreqqless 0 \ (a_2 \gtreqqless 0).$$

In turn, this corollary has two important implications. First, the relationships between c and g and between c and m do not depend on habit formation. That is, they do not depend on u_{ch^c}, u_{ch^g}, or u_{ch^m}. Further, they do not depend on the congestion/non-rivalness properties of g or m. That is, they do not depend on $\upsilon(N)$ and $\varphi(N, D)$.

Since the deviations from the steady-state equilibrium path are measured in logs, the coefficients α_1 and α_2 may be interpreted as elasticities for deviations from the steady-state equilibrium. Before estimating (9), we should point out some further implication of Proposition 1.

Corollary 2. (i) *If* u *is a strictly increasing and strictly concave in* c*, then* $a_3 > 0$.
(ii) *If there is external habit formation in private consumption,* $a_4 > 0$.

We view the results of Corollary 2 as the two most prominent implications of the underlying theory—the permanent income model with external habit formation.

[14] In an earlier version of this paper we considered a model where private consumption is a weighted average of current and past consumption expenditures:

$$c_t = \chi\hat{c}_t + (1-\chi)\hat{c}_{t-1}.$$

Here, $\chi < 1$ captures the motion of durable consumption goods and $\chi > 1$ captures the motion of "internal habit" formation. This formulation gives an equation similar to (9) with one exception. The right-hand side of (9) should include a second lag in consumption, Δc_{t-2}, and the coefficient of this lag should be $-1/\tilde{\beta}$. This creates two problems. First there are fewer degrees of freedom and secondly, the restriction on the coefficient of Δc_{t-2} does not seem to be supported by the data.

4. Dynamic panel estimate

To exploit the time dimension ($T = 27$) of our sample which includes 12 ($N = 12$) European countries, we used a dynamic panel. This is, of course, consistent with the dynamic nature of the underlying Euler equation. To see this note that the regression equation (9) can be written as [15]

$$\Delta Y_{it} = \gamma \Delta Y_{it-1} + \Delta X_{it}' \delta + e_{it}, \tag{11}$$

where i and t are the country and time indexes, respectively; Y_{it} is the log of consumption per effective household; X_{it} is a vector that includes the variables in the right-hand side of (10) and possibly other predetermined variables. In particular, let r_t denote a variable, such that $\Delta \tilde{r}_{it} = \tilde{R}_{it} - \tilde{R}_i$ and $\tilde{r}_{i0} = 1/\tilde{R}_i$. Then, $X_{it} = (\tilde{g}_{it}, \tilde{m}_{it,} \tilde{r}_{it}, \tilde{c}_{it-1}, \ldots)$. Following the theory of Section 3.1, X_{it} could include population, technology, and other demographic variables depending on the definitions of consumption per effective household and the non-rival and congestion properties of the consumption of public and merit goods. In particular, we also added a demographic variable, d_{it}, which is the ratio of the working age population (15–64) to the total population. This variable is justified by the theoretical model, being only a preference shifter accounting for the possibility that the relation between private and government consumption might be affected by demographic factors, as well. Merit goods are mostly education and health expenditures and both should be inversely related to the working age population share. [16]

Instead of only using as Anderson and Hsiao (1981) do past values of ΔY_{it-1} as instruments (which amounts in simulation studies to large estimator variance), Arellano and Bond (1991) suggest using several GMM estimators exploiting further moment conditions. Accordingly, we use GMM estimates, taking as instruments the past levels of the left-hand side variable starting two periods before ($Y_{i,t-2}, \ldots, Y_{i,t-s}$) and the past values of the exogenous differenced terms ($\Delta X_{i,t-1}, \ldots, \Delta X_{i,t-h}$). Finally, we implemented the GMM estimates by evaluating Newey–West covariance matrices that make the estimated parameter standard errors free from serially correlated and heteroskedastic disturbances.

The main finding of our paper is in Table 5. The regression equations we estimated perform quite well since both the sign and the relative sizes of the parameters are consistent with the theory (e.g., Corollary 2). The goodness of fit, which is shown by the uncentered RSQ (because regressions do not include an intercept), is also satisfactory. Most importantly, the J-tests support the plausibility of the instrument

[15] Readers familiar with dynamic panel estimation should realize that in our case there is a theoretical restriction for no fixed effects. This is because the consumption deviation from the steady state for each and every country follows (9). In particular, this does not depend on the particular method of detrending or defining deviations from the steady-state equilibrium.

[16] To see how (9) or (11) would be affected in this case, suppose that $\varphi(N_t, d_t) = d_t^{-\lambda}$; $\lambda > 0$. Then, it can be easily verified that

$$\Delta \tilde{m}_{t+1} = \tilde{m}_{t+1} - \tilde{m}_t = \ln m_{t+1} - \ln m_t = \Delta\left(\frac{\tilde{M}_{t+1}}{N_{t+1}}\right) - \kappa - \lambda \Delta \tilde{d}_{t+1}, \quad \text{where } \kappa = -\ln \frac{1}{1 + g_z} \approx g_z.$$

Table 5
Private and government consumption (dynamic panel—GMM)

Eq.	1	2	3	4	5	6	7
$\Delta c_{i,t-1}$	0.675***	0.773***	0.464***	0.412***	0.544***	0.543***	0.498***
	(0.175)	(0.110)	(0.127)	(0.135)	(0.139)	(0.144)	(0.110)
Δm_{it}	0.353***	0.498***			0.580***	0.610***	
	(0.123)	(0.063)			(0.081)	(0.082)	
$\Delta m_{i,t-1}$	−0.103	−0.277***			−0.336***	−0.359***	
	(0.084)	(0.048)			(0.082)	(0.103)	
$\Delta m2_{it}$			0.504***	0.704***			0.537***
			(0.081)	(0.136)			(0.093)
$\Delta m2_{i,t-1}$			−0.010	−0.377***			−0.257***
			(0.066)	(0.129)			(0.094)
Δg_{it}	−0.102	−0.067	−0.062				
	(0.080)	(0.063)	(0.088)				
$\Delta g_{i,t-1}$	−0.078	−0.093**	−0.248***				
	(0.065)	(0.038)	(0.062)				
$\Delta g2_{it}$				0.028		0.011	
				(0.098)		(0.073)	
$\Delta g2_{i,t-1}$				0.060		0.055	
				(0.065)		(0.047)	
$\Delta g3_{it}$					0.059		0.060
					(0.110)		(0.092)
$\Delta g3_{i,t-1}$					0.064		0.020
					(0.057)		(0.051)
Δd_{it}		−0.375***	−0.218*	−0.181	−0.148	−0.203*	−0.225**
		(0.134)	(0.124)	(0.137)	(0.099)	(0.115)	(0.102)
Δr_{it}	0.284	0.082	0.139	0.804***	0.389*	0.428*	0.613***
	(0.234)	(0.193)	(0.173)	(0.221)	(0.233)	(0.229)	(0.190)
RSQ	0.418	0.273	0.401	0.211	0.347	0.268	0.348
J test	$\chi^2(11) = 13.6$	$\chi^2(15) = 15.3$	$\chi^2(13) = 11.4$	$\chi^2(10) = 9.2$	$\chi^2(13) = 11.5$	$\chi^2(13) = 11.7$	$\chi^2(13) = 13.5$
	Pval = 0.253	Pval = 0.426	Pval = 0.575	Pval = 0.513	Pval = 0.570	Pval = 0.548	Pval = 0.413
EXCLM	$\chi^2(2) = 9.93$	$\chi^2(2) = 70.0$	$\chi^2(2) = 41.0$	$\chi^2(2) = 29.1$	$\chi^2(2) = 57.8$	$\chi^2(2) = 55.2$	$\chi^2(2) = 36.6$
	Pval = 0.01	Pval = 0.00	Pval = 0.00	Pval = 0.00	Pval = 0.00	Pval = 0.00	Pval = 0.00

Table 5 (*continued*)

Eq.	1	2	3	4	5	6	7
EXCLG	$\chi^2(2) = 2.54$	$\chi^2(2) = 9.07$	$\chi^2(2) = 23.6$	$\chi^2(2) = 1.1$	$\chi^2(2) = 1.36$	$\chi^2(2) = 1.46$	$\chi^2(2) = 0.436$
	Pval = 0.281	Pval = 0.011	Pval = 0.00	Pval = 0.573	Pval = 0.508	Pval = 0.483	Pval = 0.804
Instruments	$c_{it}(-2,\ldots,-5)$	$c_{it}(-2,\ldots,-5)$	$c_{it}(-2,\ldots,-5)$	$c_{it}(-2,\ldots,-4)$	$c_{it}(-2,\ldots,-5)$	$c_{it}(-2,\ldots,-5)$	$c_{it}(-2,\ldots,-5)$
	$\Delta m_{it}(-2,\ldots,-5)$	$\Delta m_{it}(-2,\ldots,-5)$	$\Delta m2_{it}(-2,\ldots,-5)$	$\Delta m2_{it}(-2,\ldots,-4)$	$\Delta m_{it}(-2,\ldots,-5)$	$\Delta m2_{it}(-2,\ldots,-5)$	$\Delta m_{it}(-2,\ldots,-5)$
	$\Delta g_{it}(-2,\ldots,-5)$	$\Delta g_{it}(-2,\ldots,-5)$	$\Delta g_{it}(-2,\ldots,-5)$	$\Delta g2_{it}(-2,\ldots,-4)$	$\Delta g3_{it}(-2,\ldots,-5)$	$\Delta g2_{it}(-2,\ldots,-5)$	$\Delta g3_{it}(-2,\ldots,-5)$
	$\Delta r_{it}(-1,\ldots,-5)$	$\Delta d_{it}(-1,\ldots,-5)$	$\Delta d_{it}(-1,\ldots,-4)$	$\Delta d_{it}(-1,\ldots,-4)$	$\Delta d_{it}(-1,\ldots,-4)$	$\Delta d_{it}(-1,\ldots,-4)$	$\Delta d_{it}(-1,\ldots,-4)$
		$\Delta r_{it}(-1,\ldots,-5)$	$\Delta r_{it}(-1,\ldots,-4)$	$\Delta r_{it}(-1,\ldots,-4)$	$\Delta r_{it}(-1,\ldots,-4)$	$\Delta r_{it}(-1,\ldots,-4)$	$\Delta r_{it}(-1,\ldots,-4)$
(1) Private and government comsumption augmented by disposable income (GMM)							
$\Delta c_{i,t-1}$	0.776***	0.530***	0.633***	0.477***	0.493***	0.513***	0.446***
	(0.242)	(0.142)	(0.193)	(0.123)	(0.161)	(0.134)	(0.118)
Δm_{it}	0.507**	0.534***			0.649***	0.661***	
	(0.226)	(0.115)			(0.129)	(0.154)	
$\Delta m_{i,t-1}$	−0.430**	−0.239*			−0.352***	−0.365***	
	(0.215)	(0.146)			(0.113)	(0.130)	
$\Delta m2_{it}$			0.554***	0.565***		.	0.566***
			(0.105)	(0.129)			(0.121)
$\Delta m2_{i,t-1}$			−0.311*	−0.269**			−0.249**
			(0.141)	(0.116)			(0.100)
Δg_{it}	−0.041	−0.123	0.012				
	(0.223)	(0.095)	0.115				
$\Delta g_{i,t-1}$	−0.138	0.057	0.063				
	(0.009)	(0.066)	(0.068)				
$\Delta g2_{it}$				0.001		−0.029	
				(0.007)		(0.078)	
$\Delta g2_{i,t-1}$				0.083		0.101	
				(0.056)		(0.068)	
$\Delta g3_{it}$					0.010		−0.004
					(0.081)		(0.063)
$\Delta g3_{i,t-1}$					0.096		0.086*
					(0.068)		(0.050)
Δyd_{it}	0.114	0.453**	0.309	0.379*	0.166	0.220	0.392**
	(0.265)	(0.210)	(0.211)	(0.202)	(0.255)	(0.270)	(0.193)

Δyd_{it-1}	−0.207	−0.340	−0.403*	−0.344*	−0.191	−0.252	−0.333*
	(0.280)	(0.208)	(0.222)	(0.199)	(0.189)	(0.226)	(0.175)
Δd_{it}		−0.239	−0.179*	−0.243**	−0.165	−0.215*	−0.251**
		(0.156)	(0.124)	(0.121)	(0.119)	(0.128)	(0.121)
Δr_{it}	0.588	0.054	0.374	0.270	0.111	0.199	0.108
	(0.538)	(0.292)	(0.284)	(0.268)	(0.315)	(0.300)	(0.268)
RSQ	0.171	0.345	0.369	0.354	0.310	0.228	0.374
J test	$\chi^2(9) = 9.7$	$\chi^2(11) = 11.3$	$\chi^2(13) = 9.4$	$\chi^2(11) = 9.2$	$\chi^2(13) = 9.2$	$\chi^2(13) = 9.7$	$\chi^2(13) = 8.4$
	Pval = 0.377	Pval = 0.418	Pval = 0.581	Pval = 0.606	Pval = 0.605	Pval = 0.553	Pval = 0.678
EXCLM	$\chi^2(2) = 5.72$	$\chi^2(2) = 27.0$	$\chi^2(2) = 28.7$	$\chi^2(2) = 23.0$	$\chi^2(2) = 25.4$	$\chi^2(2) = 18.7$	$\chi^2(2) = 24.8$
	Pval = 0.06	Pval = 0.00	Pval = 0.00	Pval = 0.00	Pval = 0.00	Pval = 0.00	Pval = 0.00
EXCLG	$\chi^2(2) = 2.46$	$\chi^2(2) = 2.39$	$\chi^2(2) = 0.89$	$\chi^2(2) = 2.3$	$\chi^2(2) = 2.35$	$\chi^2(2) = 2.23$	$\chi^2(2) = 3.02$
	Pval = 0.292	Pval = 0.302	Pval = 0.64	Pval = 0.317	Pval = 0.308	Pval = 0.328	Pval = 0.221
EXCLYD	$\chi^2(2) = 0.56$	$\chi^2(2) = 5.27$	$\chi^2(2) = 4.63$	$\chi^2(2) = 4.25$	$\chi^2(2) = 1.01$	$\chi^2(2) = 1.26$	$\chi^2(2) = 5.04$
	Pval = 0.757	Pval = 0.072	Pval = 0.099	Pval = 0.120	Pval = 0.601	Pval = 0.533	Pval = 0.080
SUMYD	−0.03	−0.113	−0.094	0.035	−0.025	−0.032	0.059
	(0.282)	(0.224)	(0.277)	(0.193)	(0.193)	(0.209)	(0.177)
Instruments	$c_{it}(-2,\dots,-5)$	$c_{it}(-2,\dots,-4)$	$c_{it}(-2,\dots,-4)$	$c_{it}(-2,\dots,-4)$	$c_{it}(-2,\dots,-4)$	$c_{it}(-2,\dots,-4)$	$c_{it}(-2,\dots,-4)$
	$\Delta m_{it}(-2,\dots,-4)$	$\Delta m_{it}(-2,\dots,-4)$	$\Delta m2_{it}(-2,\dots,-4)$	$\Delta m2_{it}(-2,\dots,-4)$	$\Delta m_{it}(-2,\dots,-4)$	$\Delta m2_{it}(-2,\dots,-4)$	$\Delta m_{it}(-2,\dots,-4)$
	$\Delta g_{it}(-2,\dots,-4)$	$\Delta g_{it}(-2,\dots,-4)$	$\Delta g_{it}(-2,\dots,-4)$	$\Delta g2_{it}(-2,\dots,-4)$	$\Delta g3_{it}(-2,\dots,-4)$	$\Delta g2_{it}(-2,\dots,-4)$	$\Delta g3_{it}(-2,\dots,-4)$
	$\Delta yd_{it}(-2,\dots,-4)$	$\Delta yd_{it}(-2,\dots,-4)$	$\Delta yd_{it}(-2,\dots,-4)$	$\Delta yd_{it}(-2,\dots,-4)$	$\Delta yd_{it}(-2,\dots,-4)$	$\Delta yd_{it}(-2,\dots,-4)$	$\Delta yd_{it}(-2,\dots,-4)$
	$\Delta r_{it}(-1,\dots,-4)$	$\Delta d_{it}(-1,\dots,-4)$	$\Delta d_{it}(-1,\dots,-4)$	$\Delta d_{it}(-1,\dots,-4)$	$\Delta d_{it}(-1,\dots,-4)$	$\Delta d_{it}(-1,\dots,-4)$	$\Delta d_{it}(-1,\dots,-4)$
		$\Delta r_{it}(-1,,\dots,-4)$	$\Delta r_{it}(-1,\dots,-4)$	$\Delta r_{it}(-1,\dots,-4)$	$\Delta r_{it}(-1,\dots,-4)$	$\Delta r_{it}(-1,\dots,-4)$	$\Delta r_{it}(-1,\dots,-4)$

Note: c = per capita household consumption in real terms; d = working age population share (15–64/total population); r = after tax real interest rate defined as: $r_{it} = \ln((1 + ((1 - \text{tauc}_{it}) * (irs_{it}/100)))/(pc_{it}/pc_{i,t-1}))$ where pc is the household consumption deflator, *irs* is the short-run interest rate (OECD, *Economic Outlook*) and *tauc* is the effective consumption tax rate calculated as in Fiorito and Padrini (2001). Except for the population share, all data are logged and first differenced. Data come from Oecd sources and are fully described in the *Statistical Appendix*; *RSQ* = uncentered R^2; Instruments = set of instrumental variables (Z). The autocovariance matrix Z used to evaluate the GMM weighting matrix has four lags; $J(\cdot)$ is the Hansen statistics asymptotically distributed as a $\chi^2(p)$ where p is the number of overidentifying restrictions; Pval = marginal significance level of the test. Finally, we report in parentheses the Newey–West standard errors; m = merit goods (see text and the *Statistical Appendix*) in real terms (household consumption deflator); $m2$ = education and health government consumption in real terms (household consumption deflator); $m3$ = merit goods in real terms (government consumption deflator); g = public goods (see text and the *Statistical Appendix*) in real terms (household consumption deflator); $g2$ = public order and defence government consumption in real terms (household consumption deflator); $g3$ = public order and defence government consumption in real terms (government consumption deflator). EXCLM = Wald test for excluding current and past merit goods variables; EXCLG = Wald test for excluding current and past public goods variables; *yd* denotes logged per capita household disposable income in real terms (household consumption deflator); *SUMYD* = t-test on the sum of disposable income coefficients. *** = 0.01, ** = 0.05, * = 0.10 denote two-tailed significance levels.

Table 6
Aggregate private and government consumption (dynamic panel)

Eq.	Δc_{it}	$\Delta c_{i,t-1}$	Δgc_{it}	Δd_{it}	Δr_{it}	RSQ	DW	Instruments	J test
(1)	OLS	0.345***	0.393***			0.500	1.91		
		(0.051)	(0.049)						
(2)	GMM	0.423***	0.400***			0.454		$c_{i,t-2,\dots,t-5}$	9.43(6)
		(0.135)	(0.096)					$\Delta gc_{i,t-1,\dots,t-4}$	Pval = 0.151
(3)		0.534***	0.335***		0.223*	0.527		$c_{i,t-2,\dots,t-5}$	11.3 (9)
		(0.105)	(0.084)		(0.116)			$\Delta gc_{i,t-1,\dots,t-4}$	Pval = 0.255
								$\Delta r_{it-1,\dots,t-4}$	
(4)		0.423***	0.402***	0.142	0.297***	0.434		$c_{i,t-2,\dots,t-5}$	17.8 (15)
		(0.102)	(0.086)	(0.153)	(0.126)			$\Delta gc_{i,t-1,\dots,t-5}$	Pval = 0.274
								$\Delta d_{i,t-1,\dots,t-5}$	
								$\Delta r_{it-1,\dots,t-5}$	

See Table 5 for the common elements; gc = per capita final government consumption in real terms.

restrictions. Further, the results are quite stable in the sense that the signs and relative sizes of the parameters are quite robust, also in the companion regressions, presented in Tables 6–8. In particular, the results are robust to several definitions/measurements of the merit and public goods variables. The main differences involve two aspects. First, how comprehensive should be the pertinent public/merit goods variable with respect to the COFOG functional classification, which is reported in the Data Appendix. Second, how these nominal variables should be deflated given the fact that the NIPA and the OECD sources deflate the aggregate government consumption only, not reporting separate deflators for any public or merit goods component such as, e.g., education, health, defence, etc. The first point was addressed by defining a *wider* and a *smaller* public and merit good variable: the wider definition includes all the pertinent categories reported in the Data Appendix while the smaller definition defines public goods without the General Public Services item, i.e., in terms of the well-defined “Defence and Public Order and Safety” spending. Similarly, the smaller merit goods definition includes education and health spending only, which are a large and also a well-defined component of the pertinent aggregate (see Table 2). The second point was addressed by using what is available, i.e., by deflating the above-mentioned variables by the household or the government consumption deflator. These definitions/measurements are summarized in Tables 5 and 8.

The main finding of Tables 5–7 is that in all cases they substantiate the fact that public goods are substitutes and merit goods are complements to private goods consumption (see Corollary 1). Other than the signs of the a_1 and a_2 estimates and the implied Edgeworth substitutability for public goods and complementarity for merit goods, the sizes of these estimates are quite interesting. The size of the merit goods elasticity is always larger than the size of the public goods elasticity. These results imply—as we actually found in Table 6—an aggregate relation for private and government consumption in which the estimated elasticity of private consumption to government consumption is positive because of the larger merit goods share (Table 2) and of the higher elasticity of the merit goods.

Table 7
Private and government consumption: The 'pure' public goods case

Eq.	1	2	3	4	5	6
$\Delta c_{i,t-1}$	0.461***	0.485***	0.403***	0.387***	0.388***	0.218***
	(0.101)	(0.159)	(0.096)	(0.104)	(0.093)	(0.036)
Δm_{it}	0.383***	0.379***			0.413***	0.556***
	(0.083)	(0.141)			(0.043)	(0.037)
$\Delta m2_{it}$			0.371***	0.395***		
			(0.078)	(0.094)		
Δgg_{it}	−0.179***		−0.136***		−0.152**	
	(0.080)		(0.058)		(0.062)	
$\Delta gg2_{it}$		−0.139*		−0.129***		−0.085
		(0.072)		(0.045)		(0.054)
Δd_{it}					0.038	−0.094
					(0.183)	(0.133)
Δr_{it}	0.226	0.572**	0.340**	0.653***	0.362**	0.380**
	(0.187)	(0.268)	(0.169)	(0.195)	(0.156)	(0.167)
RSQ	0.457	0.352	0.527	0.442	0.448	0.429
J test	$\chi^2(15) = 13.4$	$\chi^2(15) = 12.2$	$\chi^2(15) = 16.8$	$\chi^2(15) = 15.8$	$\chi^2(15) = 15.4$	$\chi^2(15) = 14.5$
	Pval = 0.573	Pval = 0.664	Pval = 0.328	Pval = 0.394	Pval = 0.424	Pval = 0.491
Instruments	$c_{it}(-2,\ldots,-5)$	$c_{it}(-2,\ldots,-5)$	$c_{it}(-2,\ldots,-5)$	$c_{it}(-2,\ldots,-5)$	$c_{it}(-2,\ldots,-5)$	$c_{it}(-2,\ldots,-5)$
	$\Delta m_{it}(-1,\ldots,-5)$	$\Delta m_{it}(-1,\ldots,-5)$	$\Delta m2_t(-1,\ldots,-5)$	$\Delta m2_{it}(-1,\ldots,-5)$	$\Delta m_{it}(-1,\ldots,-4)$	$\Delta m_{it}(-1,\ldots,-4)$
	$\Delta gg_t(-1,\ldots,-5)$	$\Delta gg2_t(-1,\ldots,-5)$	$\Delta g_{it}(-1,\ldots,-5)$	$\Delta g2_{it}(-1,\ldots,-5)$	$\Delta gg_{it}(-1,\ldots,-4)$	$\Delta gg2_{it}(-1,\ldots,-4)$
	$\Delta r_{it}(-1,\ldots,-5)$	$\Delta r_{it}(-1,\ldots,-5)$	$\Delta r_{it}(-1,\ldots,-5)$	$\Delta r_{it}(-1,\ldots,-5)$	$\Delta d_{it}(-1,\ldots,-4)$	$\Delta d_{it}(-1,\ldots,-4)$
					$\Delta r_{it}(-1,\ldots,-4)$	$\Delta r_{it}(-1,\ldots,-4)$

Note: gg = public goods in real terms; $gg2$ = defence and public order spending in real terms. The corresponding per capita variables are g and $g2$, respectively.

Table 8
Private consumption and government consumption by type (GMM)

Eq.	$\Delta c_{i,t-1}$	Δhea_{it}	Δedu_{it}	$\Delta m2_{it}$	Δdef_{it}	Δpo_{it}	$\Delta g2_{it}$	Δd_{it}	Δr_{it}	RSQ	Instruments	J test
(1)	0.557*** (0.171)	0.134* (0.078)	0.278** (0.112)		−0.079* (0.048)	−0.144* (0.088)				0.387	$c_{i,t-2},\dots,c_{i,t-4}$; $\Delta hea_{it-1},\dots,\Delta hea_{it-4}$; $\Delta edu_{it-1},\dots,\Delta edu_{it-4}$; $\Delta def_{it-1},\dots,\Delta def_{it-4}$; $\Delta po_{it-1},\dots,\Delta po_{it-4}$; Lag = 4	$J(14) = 19.1$ Pval = 0.160
(2)	0.291 (0.241)	0.228* (0.130)	0.364** (0.174)				−0.281*** (0.100)			0.320	$c_{i,t-2},\dots,c_{i,t-5}$; $\Delta hea_{it-1},\dots,\Delta hea_{it-4}$; $\Delta edu_{it-1},\dots,\Delta edu_{it-4}$; $\Delta g2_{t-1},\dots,\Delta g2_{t-4}$; Lag = 5	$J(12) = 16.4$ Pval = 0.173
(3)	0.348*** (0.122)	0.217*** (0.047)	0.335*** (0.101)		−0.12*** (0.04)	−0.139 (0.107)		0.114 (0.246)		0.230	$c_{i,t-2},\dots,c_{i,t-4}$; $\Delta hea_{it-1},\dots,\Delta hea_{it-4}$; $\Delta edu_{it-1},\dots,\Delta edu_{it-4}$; $\Delta def_{it-1},\dots,\Delta def_{it-4}$; $\Delta d_{it-1},\dots,\Delta d_{it-4}$; Lag = 4	$J(17) = 18.9$ Pval = 0.332
(4)	0.325*** (0.101)	0.182*** (0.049)	0.414*** (0.099)				−0.240*** (0.072)	−0.23** (0.10)		0.446	$c_{i,t-2},\dots,c_{i,t-5}$; $\Delta hea_{it-1},\dots,\Delta hea_{it-5}$; $\Delta edu_{it-1},\dots,\Delta edu_{it-5}$; $\Delta g2_{t-1},\dots,\Delta g2_{t-5}$; $\Delta d_{it-1},\dots,\Delta d_{it-5}$; Lag = 4	$J(19) = 19.4$ Pval = 0.432

(5)	0.439***	0.232***	0.193**		−0.039	−0.154***		0.653***	0.404	$c_{i,t-2},\ldots,c_{i,t-5}$; $\Delta hea_{it-1},\ldots,\Delta hea_{it-4}$; $\Delta edu_{it-1},\ldots,\Delta edu_{it-4}$; $\Delta def_{it-1},\ldots,\Delta def_{it-4}$; $\Delta poi_{t-1},\ldots,\Delta po_{it-4}$; $\Delta r_{it-1},\ldots,\Delta r_{it-4}$; Lag = 5	$J(18)=16.5$ Pval = 0.554
	(0.106)	(0.051)	(0.089)		(0.033)	(0.058)		(0.142)			
(6)	0.322***			0.500***	−0.014	−0.159**		0.845***	0.376	$c_{i,t-2},\ldots,c_{i,t-5}$; $\Delta m2_{it-1},\ldots,\Delta m2_{it-4}$; $\Delta def_{it-1},\ldots,\Delta def_{it-4}$; $\Delta po_{it-1},\ldots,\Delta po_{it-4}$; $\Delta r_{it-1},\ldots,\Delta r_{it-4}$; Lag = 5	$J(15)=14.8$ Pval = 0.463
	(0.121)			(0.156)	(0.048)	(0.075)		(0.164)			
(7)	0.274***			0.564***	−0.030	−0.155*	−0.115	0.719***	0.441	$c_{i,t-2},\ldots,c_{i,t-5}$; $\Delta m2_{it}-1,\ldots,\Delta m2_{it-4}$; $\Delta def_{it-1},\ldots,\Delta def_{it-4}$; $\Delta po_{it-1},\ldots,\Delta po_{it-4}$ $\Delta d_{it-1},\ldots,\Delta d_{it-4}$; $\Delta r_{it-1},\ldots,\Delta r_{it-4}$; Lag = 5	$J(17)=15.0$ Pval = 0.599
	(0.060)			(0.076)	(0.020)	(0.058)	(0.073)	(0.122)			

Note: *hea* = health government consumption expenditure; *edu* = education government consumption expenditure; *def* = defence government consumption expenditure; *po* = public order and safety government consumption. All variables have been deflated by using the household consumption deflator. The lag of the autocovariance *Z* matrix is shown after the instruments list.

The exclusion tests we report for both public and merit goods variables show that merit goods always belong to the regression. Conversely, the public goods variables tend to be insignificant the higher is their public good content, irrespective of the deflator choice (g_2, g_3). This is also reflected in the exclusion tests and is confirmed in Table 8 where we report the response of private consumption to major items of government consumption. Namely, defence spending has a smaller elasticity than public order and in most cases its elasticity is null. We take this to be consistent with the very nature of these goods. That is, the purer the public goods category the less the expected interaction with private consumption. In the same table we find that education has a bigger effect on private consumption than health when the interest rate variable is omitted, while the effect is about the same when the latter enters the specification. An important result of our estimates is that we find for aggregate NIPA data rather than for individual data units a significant and positive effect of the after tax real interest rate variable. In this respect, while the evidence for intertemporal substitution on aggregate data is rather scanty, in Table 5 the interest rate parameters are significant at least at the 10% level in four out of the seven estimates. This may reflect the additional variability provided by the across-country sample or else the fact that the utility function is not confined to the household consumption component only.[17]

Given that our Eq. (9) refers to a permanent income model allowing for a wider consumption definition, we tried to evaluate whether in our case an alternative "myopic" specification including current and past values of per capita household disposable income could be justified. While liquidity constraints cannot be tested with aggregate consumption data, because they cannot provide the required heterogeneity, the coexistence of rational with "rule of thumb" consumers could be tested as first suggested by Campbell and Mankiw (1989, 1990), on the basis of the fact that the household consumption rate of growth may reflect an excess sensitivity to the observed disposable income. Since the rule of thumb story is not derived by an Euler equation, it is not immediate to provide a well defined alternative to Eq. (9). In Table 5(1), however, we estimated an analog to Eq. (9) by adding to each equation on Table 5 the current and the past value of the logged per capita disposable income changes. The relevant results still confirm the complementarity of the merit goods variable while the public goods appear to be always insignificant in the regression. One major difference is that the interest rate variable is no longer significant, though this should not be surprising in a permanent income consumption model which is contaminated by backward-looking behavior. At the 10% level, the current and past disposable income enters the regression in three cases only. Though it is interesting to note that the signs alternate and tend to cancel, if one takes the sum or the average disposable income effect. Once we apply a t-test to the sum of these coefficients, it seems that the null hypothesis of a zero effect cannot be rejected at the usual confidence levels. This is not surprising by noting that the estimated sum/average effect is close to zero and in most cases slightly negative. All these results seem to suggest that adding the disposable income captures some

[17] We estimated the same equations with a labor augmenting intercept. An intercept can be justified in terms of exogenous technological progress parameters (see the previous footnote). None of our results is affected. These additional results are available upon request.

transient income effect but is not sustained enough to provide a convincing alternative to the permanent income model with external habit formation.

The substitutability between public and private goods conforms with common sense. The complementarity between private and merit goods may be surprising. First, merit goods may increase the consumption of complementary private goods because they are relatively inefficient. For example, attending public schools might coexist with hiring private tutors if the quality of teaching in public schools is not considered adequate. Thus, complementarity of merit goods may be due to the inefficiency of the service. It can also be due to the red tape costs for having the service (time lost for lines, applications, eligibility requirements, etc.). Second, merit goods may increase the consumption of private goods because they are increasing the demand for other goods. For example, attending public schools makes people more educated and this affects the demand for books, newspapers and magazines and, generally, increases incomes and then allows a higher level of private spending. While for education, this source of complementarity should imply long lags, the complementarity between health and private non-health spending could be immediate, since healthy people travel more and in general attend more restaurants, theaters and any other amenity spending.

The substitutability between private and public consumption and the complementarity between private and merit goods consumption have important messages for both theory and policy. The message for policy is, obviously, that government spending will tend to have different effects depending on whether it includes government goods consumption or merit goods consumption. Understanding the precise effects will require a dynamic stochastic general equilibrium model. The message for theory and the construction of such a stochastic dynamic model is that public goods and merit goods consumption should be accounted for separately. It is an open question to assess how distortionary could be for stochastic dynamic general equilibrium models, assuming that substitutability prevails though we know that the earlier estimates behind the substitutability assumption mostly stem from the US data which are not in our sample and which define the government purchases as inclusive of government fixed investment also.

5. Conclusions

In this paper, we estimated an extended permanent income model of the relationship between public and private consumption, splitting the former into two categories. The first category—“public goods”—includes defence, public order, and justice. The second category—“merit goods”—includes health, education, and other services that could have been provided privately. We constructed a data panel from 1970 to 1996, using data from 12 European countries. The public and merit goods categories are generated by adopting a functional classification of general government spending. The estimates are fairly robust in showing that public goods are substitutes while merit goods are always complements with private consumption. And, confirming recent studies, since merit goods consumption is about two-thirds of government consumption, this implies that in the aggregate government and private consumption are complements.

Examples on the possible reasons behind the complementarity of merit goods seem to suggest that complementarity is associated with inefficiency when it occurs *within* the same spending category (e.g., health or education), while positive externalities could explain complementarity whenever—say—public schools or public health improve the consumption of different private goods, i.e., when the relation is *between* spending categories. Still analyzing government functional spending and extending the field to this more complex case, would require wider and better data then the available ones but could possibly contribute to a deeper understanding of the Welfare State effects on the EU economies. Evaluating if and how Welfare State spending can be productive in different private spending categories is probably the most interesting challenge/justification for the future of Welfare State in Europe, though we deem difficult that merit goods consumption can be further sustained if the income maintenance components are so large everywhere.

There are several ways we could extend our analysis. First, it is fairly straightforward to generalize our model, so as to account for durability in consumption goods, as in Eichenbaum et al. (1988); and internal habit formation as in Constantinides (1990). The coefficients of the contemporary public and merit good consumptions in the regression equation will continue to uniquely characterize the substitutability relation between public (merit) and private goods consumption. Second, we could incorporate leisure in the utility function to account for the possible interaction between government consumption and leisure. Third, we could endogenize government consumption decisions, solving the corresponding Ramsey Planner problem, as in Chari and Kehoe (1999). This would result in a system of equations involving private, public and merit goods consumptions that could be estimated as a system.

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Appendix. Data Appendix

We used OECD data both for reporting the economic classification of public spending in thirteen European countries (Austria, Belgium, Denmark, Finland, France, Germany, Greece, Italy, Norway, Portugal, Spain, Sweden, United Kingdom) and for constructing

Table 9
SNA reference system by country and source of data

Country	1.1. Main aggregates	1.2. Detailed tables
Austria	1968 SNA	Former system
Belgium	1968 SNA	1968 SNA
Denmark	1968 SNA	1968 SNA
Finland	1968 SNA	1968 SNA
France	1968 SNA	1968 SNA
Germany	1968 SNA	1968 SNA
Greece	1968 SNA	Former system
Italy	1968 SNA	1968 SNA
Norway	1968 SNA	1968 SNA
Portugal	1968 SNA	1968 SNA
Spain	1968 SNA	1968 SNA
Sweden	1968 SNA	1968 SNA
United Kingdom	1968 SNA	1968 SNA

functional data for general government spending. The functional data follow the United Nations COFOG (1980) guidelines.

To be consistent with the NIPA definitions, we used the General Government aggregata (central government, local government, social security institutions). Altogether, we used three OECD data sets:

1. *National Accounts* (1999):
   1.1. *Main Aggregates* (vol. 1)
   1.2. *Detailed Tables* (vol. 2)
2. *Fiscal Position and Business Cycles* (2000),
3. *Social Expenditure* (1999).

The countries have been selected on the basis of data availability only. However, the OECD/NIPA data (1.1 and 1.2) do not refer to the same SNA/SEC systems for all countries as it is shown in Table 9.

The data obtained by the Main Aggregates are GDP and Government Final Expenditures at current and at 1990 prices. The Detailed Tables have been used to evaluate the functional classification of the public spending which applies to all spending categories.

The COFOG classification considers 10 spending categories:

1. General Public Services,
2. Defence,
3. Public Order and Safety,
4. Education,
5. Health,
6. Social Security and Welfare,
7. Housing and Community Amenities,
8. Recreational, Cultural and Religious Affairs,

9. Economic Services,
10. Other Functions.

We calculated *public goods* as the sum of items 1, 2, 3 while obtaining *merit goods* as the sum of items 4, 5, 6, 7, 8. Both components account for about the 90% of the final government consumption expenditures, the remaining items being a small residual component (*Other Functions*) and the *Economic Services* which applies also—for the appropriate items (1.2)—to subsidies and capital expenditures.

We used the OECD *Social Expenditure Database* to evaluate the social expenditure components, reported in the Welfare State domain of Tables 3 and 4. Despite that the accounting systems are in most cases the same (Table 7), some country differences must be noticed:

Germany: Data refer to the West Germany until 1990 and to the Unified Germany afterwards.

Greece: *Social Security and Welfare* (6) includes the spending functions (7) and (8). The residual item (10) is included into item (9).

Spain: *Public Order and Safety* (3) is included into the *General Public Services* category (1).

Sweden: Since 1985, the classification follows COFOG guidelines. Before 1985, *General Public Services* includes Public order and Safety while *General Research* is included in the General Public Services (1980–1981) and into the *Education* items (1982–1985), respectively.

Finally, the detailed economic classification of public spending consistent with the NIPA is obtained by the database *Fiscal Position and Business Cycle.*

Data used for regressions: To obtain a balanced panel, we removed from our sample Belgium for which only four data were available, yielding a 12 country sample ranging from 1970 to 1996 ($T = 27$). The other data used in the panel regressions (demographic variables, real interest rate components) stem from the OECD *Economic Outlook* database.

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