The Effect of Government Consumption on Private Consumption: Macro Evidence from Micro Data

Valerio Ercolani* and Nicola Pavoni†

November 2008
JOB MARKET PAPER

Abstract

We estimate the effect of different government consumption shocks on private consumption. First, we build a unique panel dataset which links household's private consumption to the government consumption of the region where the household lives, for Italy. Then, we use regional variability of government consumption and measure its direct effect on individual consumption for different categories of government expenditures. We find that individual's consumption expenditure increases as government consumption increases in the region. This positive relation is driven by publicly provided private goods (e.g. education, health). Health care government consumption has the strongest impact on households' consumption. The results can be interpreted in the light of complementarity between goods. Finally, we use our estimates from micro data to calibrate an otherwise standard RBC model. We find that government consumption shocks are able to generate a positive response for private consumption, even considering wealth and general equilibrium effects in a dynamic framework with fully flexible prices.

JEL classification: E21, E32, E62
Keywords: Consumption, Government Purchases, Individual Data Estimation.

*Bocconi University. Email address: valerio.ercolani@unibocconi.it
†UCL and IFS. Department of Economics, University College London, Gower Street, London WC1E 6BT. Email address: n.pavoni@ucl.ac.uk. The authors thank, without implicating, Richard Blundell, Pedro Carneiro, Carlo Favero, Tommaso Monacelli, Roberto Perotti, Imram Rasul, and Jean Marc Robin for comments and discussions.

1 Introduction

Over past years, the relationship between private consumption and government spending has been at the heart of the economics and government policy debates. In particular, the sign of the empirical response of private consumption to government spending shocks has been suggested as a crucial discriminant between the plausibility of the Neoclassical versus the Keynesian models.

Most of the debate is based on the implicit assumption that private consumption and government consumption enter in an additive separable way in the utility function. In the standard RBC model (Baxter and King (1993)) - where public spending is assumed to be pure waste - government spending *crowds out* private spending because the tax increase induced by the increase in government spending reduces net present value of disposable income which decreases consumption. In models with nominal rigidities consumption may increase as a consequence of an increase in government spending. In fact, Linnemann and Schabert (2003) show that - although the strength of the demand effect depends on the response of the real interest rate governed by the monetary policy regime - stickiness alone is quantitatively not sufficient to explain a rise in consumption as predicted by Keynesian theory. The negative effect on permanent income tends to dominate the demand effect due to sticky prices. Gali, Lopez-Salido and Valles (2007) strengthen the Keynesian effect due to nominal rigidities by introducing a share of liquidity constrained (and myopic) consumers in the economy, and show that their New-Keynesian model is able to generate a positive reaction of private consumption to public spending.

Other authors have allowed government consumption to directly affect the welfare of agents. Among others, Bailey (1971) and Barro (1981) argue that a general model of consumption should allow for the direct effect of government purchases of goods services on a consumer's utility. In this case, the response of private consumption to public spending is affected, ceteris paribus, by the degree of substitutability (complementarity) between the two items of interest.

The aim of this paper is to provide new evidence on the sign and magnitude of the reaction of private consumption to public consumption changes. This paper constitutes the first attempt to estimate the effects of government consumption on private consumption, using individual data. Moreover, our approach will provide a structural economic explanation for these effects.

We exploit information from two datasets: The Survey of Households Income and

Wealth (SHIW) from Bank of Italy, and The Regional Economic Accounts (REA) from ISTAT. The first dataset provides information on households, such as private consumption, wealth, demographic characteristics and so on. REA delivers data on government consumption consolidated at a regional level. Moreover, for each region, REA disaggregates government consumption along a functional scheme based on COFOG classification (defense, justice, health, education, economics services and so on).

We construct an intertemporal model that allows public and private consumption to enter in a non-separable way into the agent's utility function. The resulting Euler equation contains the parameter identifying the relation of complementarity/substitutability between items. This parameter is estimated using our dataset. Then, the coefficient of interest is used as input in an otherwise standard RBC model. This allows us to control for any general equilibrium effects that may influence the relationship between private and government consumption (e.g., negative wealth effect). We produce an impulse response of private consumption to different government consumption shocks.

We obtain two main results. First, we estimate a positive relationship between public and private consumption, which indicates a complementarity between the two goods. This relation is driven by publicly provided private goods (e.g., education, health). Interestingly, health care positively affects households' private consumption. In reality, there can be motives for both substitutability and complementarity between private consumption and health care provided by government. Public health care services might appear as substitutes for private spending in basic medical treatments; people may prefer to exploit public services to heal pneumonia or to fix a broken arm. On the other hand, public health care services can act as complements for private spending in non-standard medical treatments; after a medical check in a public hospital, people discover that they need a treatment which is not provided by government, so that they need to go privately. Complementarity can also manifest itself between public health services and other categories of private consumption which are not necessarily related to health. The more government provides health services, the more individuals may exploit them[1], and as such the likelihood that individuals are healthy is higher. This may lead them to consume more as shown by Olsho (2006).

Second, we study how various typologies of government consumption shocks affect private consumption even within a RBC framework and we consistently find a positive

[1] The underling hypothesis is that the quality of public services is non-decreasing in the aumount spent by government to provide these services. However, in the empirical analysis we control for possible geographical heterogeneity in the quality of public services.

effect. Our results from the calibration exercise are in line with the recent VAR evidence (e.g., Blanchard and Perotti (2002)). It is worth noting however, that the composition of government consumption matters greatly for the impulse response of consumption; a public health shock has a more significant impact on private consumption than an aggregate government consumption shock of equal size.

Finally, we also study the possibility of heterogeneous responses across households. We find that the effect of public health care on private consumption increases as the number of elderly people increases within the household. Moreover, the positive relationship between health care and private consumption is quantitatively more important for the regions in the south of Italy.

The existing evidence is all based on aggregate data and uses different methodologies, with contrasting results. Ramey and Shapiro (1997) use a 'narrative' or 'dummy variable' approach and find that private consumption reacts negatively to public expenditure shocks for US. This contrasts to the positive relationship estimated by Blanchard and Perotti (2002) within a SVAR methodology, for the same country. Other studies estimate the response of private consumption to government spending shocks within general equilibrium models. Smets and Wouters (2003) estimate a negative response of consumption, while Forni, Monforte and Sessa (2007) estimate a positive one, both with Euro data.

A number of studies analyze the complementarity/substitutability between public and private consumption following a partial equilibrium-approach based on Euler equations. Auscher (1985) finds a significant degree of substitutability between the two variables of interest for the US, while, Amano and Wirjanto (1998), for the same country, find a weak complementarity. Fiorito and Kollitznas (2004) split government consumption in two groups named as 'public goods' and 'merit goods'. The first includes spending for defense, public order and justice, the second contains health, education and other services that could have been provided privately. They show that, for twelve European Countries, public goods substitute while merit goods complement private consumption. Finally, Bouakez and Rebei (2007) estimate the parameter governing complementarity within a general-equilibrium framework, they find a strong complementarity between private and public spending in US aggregate data.

The use of individual data has several advantages. First of all, since Attanasio and Weber (1993) it is well know that aggregation problems might cause biased estimates of individual parameters based on Euler equation defined on aggregate data. Second, few important endogeneities that are well known issues at the aggregate level, are more credibly excluded when using individual data. For example, it is realistic to suppose that government consumption may affect the consumption of a single household, but the contrary is unlikely to occur. Third, we can see how heterogeneity among households can affect the relation between private and government consumption. Indeed, in principle, the response of private consumption to a government consumption shock could depend on the composition of the population when some items of public consumption affect more heavily certain groups of individuals. Fourth, we can explain part of the mechanism underlying the relation of interest. Finally, the regional dimension of public consumption considerably improves the identification scheme over existing ones. Indeed, the distribution of the general government expenditure is not homogenous across the Italian territory, so that using a regional measure of government spending could be a good proxy for the quantity and the quality of public services exerted in that specific area[2]. The use of cross-sectional variability of consumption expenditure permits us to identify the parameters of interest while remaining agnostic about the determinants of the business cycle.

The use of individual data makes our paper somewhat related to the extensive microeconometric literature on the evaluation of *specific* policy interventions (e.g., see the summary by Heckman et al. (1999)). Unlike them, we are interested in quantifying the effect of general government spending changes on private consumption in normal times.

The paper is structured as follows. In Section 2 we outline the model while the data is described in Section 3. In Section 4, we describe our empirical strategy and present the estimation results. In Section 5 we perform the calibration and measurement exercises accounting for the general equilibrium effects. Section 6 concludes and outlines our plans to extend the paper in light of some preliminary results on households heterogeneity.

2 Model

The framework is a standard consumption saving problem under uncertainty with inelastic labor supply. We assume that households, indexed by i, derive utility from both private consumption (C^i) and public consumption (G). The latter can be decomposed into various (n) categories. We assume that households have isoelastic preferences of the following

[2] The underlying hypothesis is the households tend to utilize the great part of public services in the region where they live.

form[3]:

$$u\left(C_t^i, G_t\right) = v(G_t) + \frac{\left(C_t^i \prod_{j=1}^{n} (G_t^j)^{\xi_j}\right)^{1-\sigma}}{1-\sigma} \exp(\psi Z_t^i + \upsilon_t^i), \tag{1}$$

where $\frac{1}{\sigma}$ is the intertemporal elasticity of substitution and $v(G_t)$ is a term which ensures the concavity of the utility function with respect to G. The term Z_t^i represents a set of demographics while υ_t^i represents an individual component which is unobservable (preference shocks). Interpreting G as a single category, we have $u_{cg} = (C_t^i)^{-\sigma}(1-\sigma)\xi G_t^{\xi(1-\sigma)-1}$ which is positive (negative) whenever $(1-\sigma)\xi > 0$ (< 0)[4]. Accordingly, C^i and G are defined to be complements (substitutes).

The individual budget constraint at each node is:

$$C_t^i + qB_t^i = Y_t^i + B_{t-1}^i, \tag{2}$$

where Y^i is disposable income[5] and q is the price of the risk-less bond B. If the subjective discount factor is δ, the resulting Euler equation for individual i is:

$$\mathbf{E}_t \left[\left(\frac{C_{t+1}^i}{C_t^i} \right)^{-\sigma} \prod_{j=1}^{n} \left(\frac{G_{t+1}^j}{G_t^j} \right)^{\xi_j(1-\sigma)} \exp(\psi Z_t^i + \upsilon_t^i) \right] = \frac{q}{\delta}, \tag{3}$$

if the distribution of C^i and G_t^j is jointly log-normal, than the Euler equation (in logs) takes the following form:

$$\Delta c_{t+1}^i = \frac{\ln\left(\frac{\beta}{q}\right)}{\sigma} + \Gamma + \sum_{j=1}^{n} \alpha_j \Delta g_{t+1}^j + \psi \Delta Z_t^i + \Delta \upsilon_t^i + \varepsilon_{t+1,}^i \tag{4}$$

where small letters indicate the log of the original variable, and $\alpha_j := \frac{(1-\sigma)}{\sigma}\xi_j$. A positive α hence implies that C^i and G^j are complements. The parameter Γ summarizes the second

[3] Agents however are subject to labor market costs that either force them to take leisure or allow them to work at cost v. The full specification of preferences is hence:

$$u\left(C_t^i, G_t\right) - v l_t,$$

where $l_t \in \left\{0, \bar{l}\right\}$ and $\bar{l}$ coresponds to a full time job.

[4] Imposing the usual restriction on σ $(\sigma > 1)$, u_{cg} is positive (negative) whenever $\xi < 0$ (> 0).

[5] Individuals are hence subject to both wage shocks and non labor income shocks. Y includes all such shocks and includes taxes and transfers to and from the public authorities.

order moments which we assume as being constant (both over time and across households), while ε_{t+1}^{i} represents the individual forecast error which, under rational expectations, satisfies $\mathbf{E}_t(\varepsilon_{t+1}^{i}) = 0$.

If we use the sequence of individual budget constraints[6], an extended permanent income equation of the following form can be obtained:

$$\Delta c_t^i + \alpha \Delta g_t = \Delta y_t^p + \alpha \Delta g_t^p, \tag{5}$$

where Δy_t^p and Δg_t^p are the permanent innovations to disposable income and government expenditure. The agent not only reacts to income shocks. The agent also reacts to shocks to his marginal utility. Equation (5) takes into account both effects.

3 Data

Individual data, such as private consumption and disposable income, are taken by the SHIW of Bank of Italy. We take into account four waves of data (1995-'98-'00-'02). For more information regarding the way of treating data, see Appendix.

Regional data, government consumption in particular, are taken by REA issued by ISTAT. REA follows the general principles of the European System of National Account (ESA '95). Government consumption is the sum of the spending of the Central Government, Regions, Provinces, and Towns. REA consolidates government consumption at a regional level. Specifically, government consumption contains purchases of goods and services, transfers in kind and wages. Moreover, this dataset provides a functional classification of the government consumption following the COFOG scheme. It divides public consumption in ten categories, such as, general services, defense, economic affairs, public order, education, health, social security and some other minor items. The period covered from REA goes from 1995 to 2002[7].

In Table 1, we present government consumption as a share of GDP for each region. Furthermore, following the national accounts (ESA '95), we disaggregate government consumption in two categories: the collective goods and services and the individual goods

[6] Actually we use an approximated budget constraint in logs (see Cambpell (1993) and Naleweik (2006) for details).

[7] It is worth noting that similar datasets don't exist for US. In fact, on the one hand the definition of consumption taken from PSID covers just food. On the other hand, CEX does not have detailed information on the location of households. Finally, US does not have measures of government consumption consolidated at a federal level.

and services. The first category groups goods which are provided simultaneously to all members of the community or all households living in a particular region. They are public goods, such as, defense, public order, bureaucracy, etc. The second category is represented by goods that are provided to households for which is possible to observe and record its acquisition by an individual household. These goods are referred to as publicly provided private goods or merit goods (e.g. education and health).

The share of the government consumption for Italy is around 20% of GDP, in particular, it ranges from 13.5% of Lombardia to 30% of Sicily. Moreover, we see that individual goods (merit goods) are the lion's share of the government consumption, indeed they are roughly twice as much as collective goods (public goods). Importantly, the distribution of government consumption is not uniform across regions.

[**insert Table 1 here**]

Table 2 represents the share of each category of spending on total government consumption for Italy from 1995 to 2002. Important to say is that education and health represent the largest items among merit goods.

[**insert Table 2 here**]

Figure 1 represents the residuals of the regression of the logarithm of government consumption on time dummies, pooled by regions. Figure 2 represent the residuals of the regression of the first difference of the logarithm of government consumption on time dummies, pooled by regions. The implication we draw from these figures is that government consumption shows a certain degree of variability within and across regions despite we control for common macro shocks.

[**insert Figure 1 here**]
[**insert Figure 2 here**]

4 Estimation

The main aim of this section is to obtain an estimate for α, the parameter stating the degree of complementarity/substitutability between private and government consumption. First, we take to the data the Euler equation described in Section 2. Second, we estimate a permanent income model to check whether we obtain results which are similar with the previous ones.

4.1 Model with Non-separabilities

We want to estimate equation (4). In fact, we take to the data an equation which has a more flexible structure than (4); this allows us to control for possible non unit root preference shocks and some forms of habit. The regression we perform is the following:

$$\Delta c_{t+1}^{i} = \phi_0 + \phi_1 \Delta c_t^i + \alpha \Delta g_{t+1}^r + d_t + Z_{t+1}^r + \psi \Delta Z_t + \varepsilon_{t+1}^i + \Delta u_{t+1}^i + \Delta u_t^i, \qquad (6)$$

for ease of notation, we consider government consumption as a single category, so that g^r is the log of the government consumption for region r. The variable Z_{t+1}^r includes regional controls such as GDP, a proxy for public wages, and total government expenditure[8]. The variables d_t represent time dummies which are supposed to capture common macro shocks (like interest rate shocks). The regressor Z_t includes age, age squared and the level of education of the head of family. The values Δu_{t+1}^i and Δu_t^i represent measurement errors associated to Δc_{t+1}^i and Δc_t^i, respectively. Importantly, our dataset links household's private consumption to the government consumption of the region where the household lives. The underlying hypothesis is that households tend to utilize the great part of public services in the area (region) where they live. This is a reasonable hypothesis if we think to several categories of public consumption, such as, primary and secondary education, public order, and health care. Finally, it is worth noting to say that the cross-sectional variability of government consumption permits us to identify the α parameter.

Next, we estimate a process for government consumption at a regional level, that is assumed to follow:

$$\Delta g_{t+1}^r = \beta_0 + \beta_1 \Delta g_t^r + \beta_2 \Delta c_{t+1}^r + \beta_3 \Delta y_{t+1}^r + d_t + Z^r + \varepsilon_{t+1}^r, \qquad (7)$$

where c^r is the log of regional private consumption and y^r is the log of regional GDP which is included as a regional control. Then, Z^r represent regional dummies which have been included to control for differential rate of growth in government consumption across regions. The motivation for which we estimate a process like (7) is that a feedback effect of private consumption to government consumption may arise. Indeed, there could be preference shocks that increase private consumption. As a consequence of these shocks,

[8] All these variable but total government expenditure, are taken by ISTAT. Total government expenditure is drawn from Italian Treasury (CPT dataset) and is the sum of the current part of government spending (less government consumption) plus public investment.

individuals consume more of any kind of goods and services, on average. Thus, they can ask more even for those services which are freely provided by government (e.g. medical treatments), inducing government to increase the expenditures for these services.

The identification strategy we use to estimate (6) and (7) is the one typical of simultaneous equation models. In (6) Δg^r_{t+1} is instrumented with g^r_t and earlier lags, while Δc^i_t is instrumented with c^i_{t-2} because of measurement errors. In (7) Δc^r_{t+1} is instrumented with Δc^r_t and earlier lags. We use GMM techniques applied to panel data, as such we use lagged instruments of any variables in the equations.

The estimation results of (6) and (4) are in Table 3 and 4, respectively. In both columns of Table 3 the coefficient of the autoregressive term of government consumption is estimated to be around -0.3, and is highly significant. Specifically, the first column does not contain neither Δy^r_t nor Δc^r_t in the estimation. Instead, the second column contains both Δy^r_t and Δc^r_t. Interestingly, regional private consumption has no effect on government consumption, that is the potential feedback effect of private consumption to government consumption does not seem to be important empirically.

Table 4 represents the results for the Euler equation having total private consumption as dependent variable. In column 1, government consumption is treated as a single item. The coefficient related to Δg^r_{t+1} is estimated to be large and positive, significant at 5%. In column 2, we split government consumption into two categories, public and merit goods. Merit goods have a positive coefficient, significant at 2%. Public goods have no effect on private consumption. In column 3, we split merit goods into three categories, which are education (edu), health and social protection (health), recreation, culture and religion (cult). The coefficient associated with health is positive and significant at 1%. Column 4 presents the results for the excess sensitivity test, private consumption is not sensitive to predictable changes in individual income. Passing this test is somewhat important as it can be seen as validation of our estimation strategy based on the Euler equation. It is well known that this test tend to be rejected when aggregate data is used instead (e.g., Attanasio and Weber (1993)).

Table 4bis presents some robustness analysis for the estimate of the Euler equation in which government consumption is considered as being disaggregated. In column 1, we estimate (6) without habit. The coefficient related to public health care is the same as the one estimated in the specification with habit, however, in the case of no habit the Sargan test rejects the null hypothesis that the moment conditions are equal to zero. In column 2, we take out from our sample people that work in the government sector, to control for a possible direct effect of public wages on government employees. In the last one, we control for individual fixed effect (e.g. heterogeneity in the coefficient of relative risk aversion). In all these cases, the coefficient of health remains positive and significant, at least at 1.5%.

Table 4ter represents the results of the estimate of (6), having non-durable consumption as dependent variable. The coefficients of interest have the same sign of the ones in Table 4. However, they are significant at a lower level.

4.2 Permanent Income Model

The aim of this section is to check that the empirical results obtained from the Euler equation in Section 4.1 do not contradict with those of the permanent income approach.

Next to the permanent income equation, developed in Section 2, we assume a process for both government consumption and individual income. The resulting system has the following form:

$$\begin{aligned} \Delta g_t^r &= \beta_0 - \rho \Delta g_{t-1}^r + \beta_2 \Delta c_t^r + d_t + Z_t^r + Z^r + \varepsilon_t^g \\ \Delta y_t^i &= \theta_0 + \theta_1 \Delta y_{t-1}^i + \theta_2 \Delta g_t^r + \theta_3 \Delta g_{t-1}^r + d_t + Z_t^r + \varepsilon_t^{y^i} \\ \Delta c_t^i &= \gamma_0 + \gamma_1 \Delta y_t^i + \gamma_2 \Delta y_{t-1}^i + \gamma_3 \Delta g_t^r + \gamma_4 \Delta g_{t-1}^r + d_t + Z_t^r + \varepsilon_t^{c^i}, \end{aligned} \tag{8}$$

where Z_t^r are regional controls.

The form of system (8) subsumes the following assumptions. First, government consumption is potentially affected by private consumption through preference shocks (as explained in Section 4.1). Second, individual disposable income is affected by government consumption[9]. Third, private consumption is affected by both government consumption and individual income (permanent income equation).

The estimation results of the first row of (8) are visible in Table 3, and have been commented on already in Section 4.1.

Table 5 reports the estimation for the income process, that is the second row of (8). Current government consumption tends to positively affect disposable income. However, the coefficient related to government consumption is not highly significant especially in the last two columns, that is, when we augment the specification with geographical dummies and when we do not consider government employees in the sample.

[9] This assumption can find evidence from the fact that government consumption and labor income could be related in a standard government budget constraint.

Table 6 reports the estimation for the permanent income equation, that is the third row of (8). The coefficient related to government consumption happens to be positive and significant at 5%, even when the specification is augmented with geographical dummies.

We now relate the analysis of the coefficients estimated in (8) with the parameter α estimated in the Euler equation (6). If we combine (8) with the equation for the permanent government consumption process ($\Delta g_t^p = \varphi(q)\varepsilon_t^g$), we recover that $\gamma_3 = \alpha(1 - \varphi(q))$ and $\gamma_4 = -\alpha\varphi(q)\rho$. Given $\rho > 0$, and $\varphi(q) < 1$, then:

$$\alpha = \gamma_3 - \frac{\gamma_4}{\rho} \tag{9}$$

Given the estimates for γ_3 and γ_4 (see Table 6), although the resulting α is lower than that estimated from the Euler equation (see Table 4), it is unambiguously positive, fully in line with the Euler equation estimates.

4.3 Discussion of the Estimation Results

We have estimated a positive relationship between public and private consumption, which indicates a complementarity between the two goods. This relation is driven by publicly provided private goods (e.g., education, health). Interestingly, health care positively affects households' private consumption. In reality, there can be motives for both substitutability and complementarity between private consumption and health care provided by government. Public health care services might appear as substitutes for private spending in basic medical treatments; people may prefer to exploit public services to heal pneumonia or to fix a broken arm. On the other hand, public health care services can function as complements for private spending in non-standard medical treatments; after a medical check in a public hospital, people discover that they need a treatment which is not provided by government, so that they need to go privately. Complementarity can also manifest itself between public health services and other categories of private consumption which are not necessarily related to health. The more government provides health services, the more individuals may exploit them. Thus, the probability that individuals are healthy can increase, and they may consume more (e.g. trips, social events, foods). Actually, some studies in health economics (e.g. Palumbo (1999), Smith (1999), and Olsho (2006)) find a correlation between the individual health status and the economic status. In particular, Olsho (2006) finds that rational agents consume at higher levels when they are healthier.

The hypothesis that has to hold in our estimates is that the quality of public services is non-decreasing in the amount spent by government to provide these services. However, in the empirical analysis we have implicitly controlled for possible geographical heterogeneity in the quality of public services by performing an analysis in first differences. Moreover, as a further robustness check, we have applied fixed effect techniques to first differenced variables.

5 Accounting for General Equilibrium Effects

So far, we have found that there is a positive relation between private and government consumption. However, this relation has been estimated within a partial equilibrium framework. To study the total effect of government consumption changes on private consumption we need to take into account even wealth and general equilibrium effects. In particular, the negative wealth effect is a crucial element to be taken into account for studying the relation between private and government consumption. When a positive government spending shock hits the economy, individuals revise downwards their permanent income so that they decrease their consumption. This is an effect that always operates in the economy regardless of the models or the econometric specification used in the analysis[10]. Thus, to control for general equilibrium effects, we resort to an otherwise standard RBC model and we calibrate it for the Italian economy, using as input our estimates from micro data.

We want to relate our study with those ones in the literature who investigate on the response of private consumption to government spending shocks. All of these studies utilize macro data. Some of them use a VAR analysis (e.g. Ramey and Shapiro (1998), Blanchard and Perotti (2002), and Mountford and Uhlig (2005)). Others estimate the response of private consumption to government spending shocks within general equilibrium models (e.g. Smets and Wouters (2003), Bouakez and Rebei (2007), and Forni, Monforte and Sessa (2007)). The results are mixed even using similar approaches. For example, Ramey and Shapiro (1998) find a negative response of consumption while Blanchard and Perotti (2002) estimate a positive one, both with US data. Moreover, Smets and Wouters (2003) estimate a negative response of consumption while Forni et al. (2007) estimate a positive one, both with Euro data.

[10] The coefficient α, estimated in Section 4.1, is not affected by any wealth effect since government consumption is instrumented with its past lags.

5.1 Representative Agent Model

We assume that government and private consumption enter non-separable in the utility function. The utility function of the representative agent is the following:

$$u\left(C_t, G_t\right) = \frac{\left(C_t (G_t)^{\xi}\right)^{1-\sigma}}{1-\sigma} - \psi \frac{N_t^{1-\eta}}{1-\eta}, \tag{10}$$

where N_t measures hours worked by households, $\frac{1}{\eta}$ is the Frisch elasticity of labor supply, and ψ is a positive constant.

In a general equilibrium framework, the model we estimated in the previous sections can be seen as a Aiyagari (1994) framework with individual inelastic labor supply. In a complete markets framework where individual shocks are fully insured, Rogerson (1988) shows that the representative agent presents a utility function of consumption which is the same as the individual agents and a linear labor supply margin where movements in hours is interpreted as the number of people actually employed times a fixed number of hours per person. This would imply $\eta = 0$.

Unfortunately, the complete market analysis cannot be directly applied to our framework with incomplete insurance markets. As we will discuss below, a fuller analysis might be needed to solve a general equilibrium model with heterogeneous agents, especially since the effects of government expenditure might change across different individuals. Nevertheless, we believe that the representative agent model we use in this section is a satisfactory tool to account for general equilibrium effects, at the first order, if effects are homogeneous across the population. In line with the analysis by An, Chang, and Kim (forth.), we perform sensitivity analysis to the value of η (although we retain the values for ξ and σ based on the microeconometric estimates).

The individual budget constraint is:

$$C_t + I_t + B_{t+1} = \left(1 + r_t\right) B_t + (1 - \tau^w) W_t N_t + r_t K_t - T_t, \tag{11}$$

where I_t is private investment, B_t is the stock of public debt at time t, W_t is the wage, r_t is the interest rate, and τ^w is the tax rate on labor income.

The law of motion for capital is the following:

$$K_t = (1 - \delta_k) K_t + I_t, \tag{12}$$

where δ_k is the depreciation rate of capital.

The household maximizes its expected lifetime utility, subject to the budget constraint, by choosing C_t, N_t, and K_{t+1} at every node of the decision tree.

The aggregate production function is Cobb-Douglas:

$$Y_t = K_t^{\theta} N_t^{1-\theta}, \tag{13}$$

and firms maximize profits by choosing labor and capital inputs taking factor prices W_t and r_t as given.

The government budget constraint is:

$$G_t + (1 + r_t)B_t = B_{t+1} + \tau_t^w W_t N_t, \tag{14}$$

where G_t is assumed to follow a standard autoregressive process (e.g. see Burnside, Eichenbaum, and Fischer (2003)) :

$$\ln G_t = (1 - \varphi) \ln G + \varphi \ln G_{t-1} + u_t \tag{15}$$

where G indicates the deterministic steady state for G_t .

To close the model we use a fiscal rule that insures that the intertemporal government budget constraint is satisfied and debt is stabilized over time. Specifically:

$$\frac{\tau_t^w}{\tau^w} = \left(\frac{B_t}{B}\right)^{\phi_b}, \tag{16}$$

where ϕ_b is a strictly positive constant and where τ^w and B indicate the deterministic steady state for τ_t^w and B_t, respectively.

The model is log-linearized around the deterministic steady state, then is solved using linear techniques.

5.2 Calibration

The model is calibrated at a quarterly frequency for the Italian economy. We need to calibrate 13 parameters. To calibrate these parameters we exploit information from our dataset and resort to previous studies available in the literature. Specifically, the capital share θ is set to 0.42 and is consistent with the labor share calculated with the data (see

Censolo and Onofri (2003)). The discount factor δ and the depreciation rate of capital δ_k are set to 0.988 and 0.025, respectively, to imply a steady state for real interest rate of 3.5% (see Chiarini and Piselli (2005)). The steady state government consumption output ratio $g_y := \frac{G}{Y}$ is set to 0.19 and is consistent with the information of our dataset (see Table 1). The steady state consumption output ratio $c_y := \frac{C}{Y}$ and the steady state investment output ratio $i_y := \frac{I}{Y}$ are set to 0.60 and 0.21, respectively, to match the long-run averages computed from Italian National Accounts (see Forni, Gerali and Pisani (2008)). The level of steady state public debt output ratio $b_y := \frac{B}{Y}$ is set to 1.13 on annual basis, to match the average of public debt over GDP ratio for the period covered by our dataset. The steady state tax rate on labor income is calibrated using effective average tax rates estimated for Italy in Eurostat (2007), that is τ^w is set to 0.431. The coefficient of government consumption process φ is estimated to be equal to 0.96, using aggregate data for government consumption for Italy. Specifically, we take the quarterly series of Government final consumption expenditure for Italy from Eurostat database (1980:q1-2007:q4). Equation (15) has been estimated using the (linear) detrended series of the logarithm of the real government final consumption expenditure[11]. The parameter of the fiscal rule ϕ_b is set to 0.07, following estimates for Italy of Gali and Perotti (2003). The bulk of existing literature on calibration for Italy assumes that the intertemporal elasticity of substitution is 1 (see Forni, et al. (2008)). This implies a value for σ equal to 1. Actually, we can't set σ equal to the mentioned value since the channel of complementarity would be ruled out from the model. In line with the micro estimates for other countries (e.g., Attanasio and Weber (1993)), we set σ equal to 1.5, and we do sensitivity analysis on this parameter. We borrow the value for the labor supply elasticity from Pistaferri (2003), that is we set η equal to 1.43[12]. Finally, setting a value of 1 for ψ allows us to match the ratio of hours worked on total available time calculated by Censolo and Onofri (2003) for Italy. Table A summarizes the values used in calibration.

[11] Note that the process for G is estimated at a national level. This is consistent with the representative agent approach of this section. Recall indeed that the coefficients for the regional process of government consumption were estimated in Section 4.1 by using time dummies to partly capture aggregate shocks such as the national G. We use the Eurostat database, instead of our data, in order to exploit a longer time series than the eight waves in our regional panel dataset.

[12] This is a value that is in line with the micro estimates for other countries. In fact, Fuster, Imbrohoroglu and Imbrohoroglu (2007) argue that a plausible value for η equals 1. However, a value which is above the unity dampens a bit the response of labor supply to a government consumption shock, which we will see is going to be relatively large. We perform sensitivity analysis on η.

Table A: parameters calibration		
parameters		values
θ	capital share	0.42
δ	discount factor	0.988
δ_k	depreciation rate of capital	0.025
g_y	government consumption output ratio	0.19
c_y	consumption output ratio	0.60
i_y	investment output ratio	0.21
b_y	public debt output output ratio	1.13
τ^w	tax rate on labor income	0.431
φ	autoregressive coefficient for G_t	0.96
ϕ_b	fiscal rule	0.07
σ	coefficient of relative risk aversion	1.5
η	inverse of the Frisch elasticity	1.43
ψ	preferences	1

5.3 Impulse Response Function Analysis

Within our calibrated RBC model, we produce impulse responses of private consumption (and other model variables) to shocks coming from different categories of government consumption.

Figure 3 shows two sets of impulse response functions. Dotted lines describe the impulse responses to a 1% increase in government consumption if we set ξ equal to zero, that is we impose that government and private consumption are unrelated in preferences. Standard results emerge, in particular, private consumption goes down on impact due to the negative wealth effect. Solid lines describe the impulse responses to a 1% increase in government consumption if we set ξ in line with the estimate of α from the first column of Table 4. We see that the complementarity effect more than offsets the negative wealth effect produced by the government spending shock, so that, private consumption increases on impact. Interestingly, the response of labor supply is stronger than in the case of non-separability since government consumption positively affects the marginal utility of consumption, as such individuals are willing to work more the present period. Moreover, the fact that government shocks are quite persistent implies that when the agent observes an increase in G, she forecasts the desire to high consumption levels in future periods as well. This informational shock induces a further increase to N as the agent aims at increasing labor income to sustain the forecasted expensive consumption path. Accordingly, wages decrease by a larger amount in our model than in the standard case.

Figure 4 presents three impulse responses for private consumption. The first one is caused by a shock from government consumption considered as a single aggregate, the second one by a shock coming from merit goods, and the third one by a shock from public health care. All shocks have the same size (1% increase in the item of interest), however, their weight on GDP in steady state is obviously different. Using information from Table1, we set the steady state values of government consumption, merit goods, and health care (as a share of GDP) to 0.19, 0.13, and 0.06 respectively. Solid lines describe the response of private consumption to the three spending shocks, conditioned on the different estimates of α (Table 4). In accordance to our estimates, we set to zero all other coefficients for $G^{i\prime}$s. The solid line in the upper left panel describes the response of private consumption to aggregate government shock conditioned on the point estimate for α drawn from column 1 of Table 4 (1.94). Dotted lines are drawn conditional on the 90% confidence interval of the coefficient α. The solid line in the upper right panel describes the response of private consumption to a merit goods shock conditioned on the point estimate for α drawn from column 2 of Table 4 (0.9). The solid line in the bottom panel describes the response of private consumption to a health care shock conditioned on the point estimate for α drawn from column 3 of Table 4 (0.72). All three spending shocks generate a positive response of private consumption, conditioned on their respective α's, however, the health care shock is the one that provides a response for private consumption which is clearly positive. The response of private consumption to the health care shock is the smallest one considering solid lines, however, the associated dotted lines always remain in the positive region and are rather shrunk to the solid line. This is not the case when government consumption shock is considered; although the associated solid line is larger than the other two, the lower dotted line contains the zero value.

6 Conclusions and Extensions

We estimated the effect of different government consumption shocks on private consumption, exploiting micro data. First, we have built a unique panel dataset which links household's private consumption to the government consumption of the region where the household lives, for Italy. Then, we have used regional variability of government consumption and measured its direct effect on individual consumption for different categories of government expenditures. Finally, we have used our estimates from micro data to calibrate an otherwise standard RBC model.

We obtained two main results. First, we found a positive relationship between public and private consumption, which we interpret structurally as complementarity between the two goods. This relation is driven by publicly provided private goods (e.g., education, health). Interestingly, health care positively affects households' private consumption.

Second, we studied how various typologies of government consumption shocks affect private consumption even within a RBC framework and we have consistently found a positive effect. Our result from the calibration exercise are in line with the recent VAR evidence (e.g., Blanchard and Perotti (2002)). It is worth noting however, that the composition of government consumption matters greatly for the impulse response of consumption; a public health shock has a more significant impact on private consumption than an aggregate government consumption shock of equal size.

Our dataset gives us the possibility to study how individual heterogeneity affects the relation between government and private consumption. We use equation (6) to pursue this aim. Table 7 presents the results once we split the sample according to certain individual characteristics. In particular, in the first two columns we split the sample into two. The first one contains the estimate for households with a head aged less than 45, the second one with a head over 45. The effect of health on private consumption is not significantly different from the two groups. In column 3, the analysis is more refined. We interact government consumption with the number of the elderly (over 65) within the family. Results show that the effect of health expenditure on private consumption is stronger as the number of the elderly increase within the family. In the fourth and the fifth column we split households according to their level of residence. Consumption by people from the south and islands tends to be affected more by public health care with respect to the one of those living in the north. However, consumption of people in the north is still affected by public health care; the associated coefficient is positive and significant at 1.5%[13].

Our calibration exercise has been conducted within a standard representative agent model. On the other hand, the (preliminary) analysis on individual heterogeneity has

[13] We also investigated whether other individual characteristics, such as, level of education, sex, total wealth, matter but we did not find any (statistically) significant difference in consumption responses. Details are available upon request.

shown that the demographic structure of the population can potentially matters greatly for the relationship between government and private consumption. We plan to perform a similar quantitative exercise within a general equilibrium model which takes into account for the existence of uninsured idiosyncratic shocks as in Aiyagari (1994). The aim will be to study more in detail what is the response of private consumption to various typologies of government consumption shock, taking into account for the demographics and heterogeneity across households.

The fact that public health care is the item that has the strongest impact on private consumption may motivate the existence of additional explanations for the relationship between government and private consumption. In particular, if we believe that government consumption can affect the variability of future consumption, then precautionary saving motive constitutes another channel through which public expenditures may affect private consumption decisions, which has been neglected so far by the literature. For example, if public spending for health increases, and the process for government expenditure happens to be persistent, individuals have to save less today to insure themselves for future negative health shocks. This may create a future increase in private consumption. Some of the empirical results coming from the heterogeneity analysis could reinforce this view. Indeed, as the number of elderly people expands within a family, the likelihood that family is hit by negative health shocks increases. Thus, public health care can act as a form of insurance for these households. These issues are investigated in Ercolani and Pavoni (2008).

7 References

An, S., Y. Chang, and S.B. Kim (forthcoming), “Can a Representative-Agent Model Represent a Heterogeneous-Agent Economy,” *American Economic Review.*

Aiyagari, S. R. (1994), “Uninsured Idiosyncratic Risk an Aggregate Savings”, *Quarterly Journal of Economics*, 109 (3), 659-684.

Amano, A.R. and T.S. Wirjanto (1998), "Government Expenditures and the Permanent-Income Model", *Review of Economic Dynamics,* 1 (3), 719-30.

Attanasio, O. P. and G. Weber (1993), "Consumption Growth, the Interest Rate and Aggregation", *Review of Economic Studies*, 60 (3), 631-649.

Auscher, D. (1985), "Fiscal policy and aggregate demand", *American Economic Review*, 75 (1), 117–127.

Bailey, M. J. (1971), "National Income and the Price Level: A Study in Macroeconomic Theory", 2nd Edition. New York: McGraw–Hill.

Barro, R. J. (1981), "Output effects of government purchases". *Journal of Political Economy* 89 (6),1086–1121.

Baxter, M. and R. G. King (1993), "Fiscal Policy in General Equilibrium", *American Economic Review*, 83 (3), 315-334.

Blanchard, O. J. and R. Perotti (2002), “An Empirical Characterization of the Dynamic Effects of Changes in Government Spending and Taxes on Output,” *Quarterly Journal of Economics*, 117 (4), 1329-1368.

Bouakez, H. and R. Rebei (2007), "Why Does Private Consumption Rise after a Government Spending Shock?", *Canadian Journal of Economics*, 40 (3), 954-979.

Campbell, J.Y. (1993) "Intertemporal Asset Pricing without Consumption Data", A*merican Economic Review*, 83(3), 487-512.

Ercolani and Pavoni (2008), "Government Expenditures, Precautionary Savings and Private Consumption", *mimeo Bocconi University and UCL.*

Eurostat (2007), "Taxation Trend in the European Union".

Fiorito, R. and T. Kollitznas (2004), "Public goods, merit goods, and the relation between private and government consumption", *European Economic Review*, 48 (6), 1367-1398.

Forni, L., L. Monteforte and L. Sessa (2007), "The general equilibrium effects of fiscal policy: estimates for the euro area", *Economic working papers 652*, Bank of Italy.

Forni, L., A. Gerali, and M. Pisani (2008), "The Macroeconomics of Fiscal Consolidations in a Monetary Union: the Case of Italy", mimeo, Bank of Italy.

Fuster, L., A. Imbrohoroglu and S. Imbrohoroglu (2007), "Elimination of Social security in a Dynastic Framework", *Review of Economic Studies*, 74 (1), 113-145.

Galí, J., J. D. López-Salido and J. Vallés (2007), "Understanding the Effects of Government Spending on Consumption", *Journal of the European Economic Association*, 5 (1), 227-270.

Gali, J., and R. Perotti (2003), "Fiscal policy and Monetary Integration in Europe", Economic Policy, 18 (37), 533-572.

Hagenaars, A., K. de Vos and M.A. Zaidi (1994), "Poverty Statistics in the Late 1980s: Research Based on Micro-data", *Office for Official Publications of the European Communities.*

Heckman, J., R. LaLonde, and J. Smith (1999), "The Economics and Econometrics of Active Labor Market Programs", in *Handbook of Labor Economics*, Volume 3, Ashenfelter, A. and D. Card, eds., Amsterdam: Elsevier Science

Linnemann, L. and A. Schabert (2003), "Fiscal Policy in the New Neoclassical Synthesis", *Journal of Money, Credit and Banking*, 35 (6), 911-929.

Mountford A. and, H. Uhlig (2005), "What are the Effects of Fiscal Policy Shocks?", *CEPR Discussion Paper 3338.*

Nalewaik, J. J. (2006), "Current Consumption and Future Income Growth", *Journal of Monetary Economics*, 53 (8), 2239-66.

Olsho, L. (2006), "Spend It While You Can Still Enjoy It: Health, Longevity, Aging, and Consumption in the Life Cycle", *ASHE Working Paper.*

Pistaferri, L. (2003) "Anticipated and Unanticipated Wage Changes, Wage Risk, and Intertemporal Labor Supply", J*ournal of Labor Economics*, 21(3), 729-728.

Palumbo, M. G. (1999), "Uncertain Medical Expenses and Precautionary Saving Near the End of the Life Cycle." Review of Economic Studies 66 (2), 395–421.

Ramey, V. and M. Shapiro (1997), "Costly capital reallocation and the effects of government spending", Carnegie Rochester Conference on Public Policy.

Rogerson, R. (1988), "Indivisible Labor, Lotteries, and Equilibrium", *Journal of Monetary Economics*, 21 (1), 3-16.

Smets, F. and R. Wouters (2003), "An Estimated Dynamic Stochastic General Equilibrium Model of the Euro Area", J*ournal of the European Economic Association*, 1(5), 1123-1175.

Smith, J. P. (1999), “Healthy Bodies and Thick Wallets: The Dual Relation between Health and Economic Status”, *Journal of Economic Perspectives*, 13 (2),145–166.

8 Appendix

8.1 Data

Individual data are treated before to be used in the estimation. We rule out households having negative values on income and consumption, with inconsistent data on age sex and level of education. We consider in the sample households with the age of the head ranging from 25 to 65. We do not consider observations when household's head change. In order to eliminate possible outliers, we rule out individuals having consumption less (above) the 1 (99) percentile of the dsitribution and those having the rate of growth of consumption less (above) the 1 (99) percentile of the distribution. Furthermore, individual variables (such as consumption and disposable income) are adjusted for the equivalent scale; specifically we refer to the "OECD-modified scale" which assigns a value of 1 to the household head, of 0.5 to each additional adult member, and 0.3 to each child (see Haangenars et al. (1994) for details). Regional data are divided by the number of household of the regions (census information issued by ISTAT). All data are deflated by a national deflator (NIC issued by ISTAT).

Table1: government consumption (% of GDP), year 2002

Regions	government consumption	collective goods (public goods)	individual goods (merit goods)
Piemonte	15.9	6.1	9.8
Valle d'Aosta	26.1	14.6	11.5
Lombardia	13.5	5.1	8.4
Trentino-Alto Adige	20.9	8.4	12.5
Veneto	15.4	5.8	9.6
Friuli-Venezia Giulia	18.2	7.2	11.04
Liguria	17.8	6.8	11.0
Emilia Romagna	14.7	5.5	9.2
Toscana	17.4	6.5	10.9
Umbria	21.3	8.1	13.2
Marche	19.0	7.0	12.0
Lazio	18.5	6.1	12.4
Abbruzzo	22.6	8.1	14.5
Molise	25.6	9.6	16.0
Campania	27.7	9.9	17.8
Puglia	25.0	8.7	16.3
Basilicata	28.3	10.7	17.6
Calabria	31.5	11.6	19.9
Sicilia	30.0	12.0	18.0
Sardegna	27.2	10.6	16.6
Italy	**19.0**	**6.0**	**13.0**

Source: author's compilation using REA

Table 2: percentage of each category on total government consumption (Italy)

	categories	1995	1996	1997	1998	1999	2000	2001	2002	mean
public	**General public services**	12.0	12.8	12.3	12.3	12.2	12.2	12.3	12.3	**12.4**
public	**Defence**	6.3	6.0	5.6	5.6	5.9	5.7	5.7	5.7	**5.8**
public	**Public order and safety**	11.1	11.5	11.2	11.2	10.9	10.5	10.0	9.8	**10.8**
public	**Economic affairs**	7.7	7.5	7.4	7.3	7.1	6.7	6.7	6.7	**7.1**
public	**Environmental protection**	0.7	0.6	0.8	1.0	1.3	1.4	1.4	1.4	**1.1**
public	**Housing and community amenities**	1.3	1.2	1.3	1.3	1.4	1.3	1.3	1.3	**1.3**
merit	**Health**	28.8	28.8	29.6	29.7	29.9	31.4	32.2	32.6	**30.4**
merit	**Recreation, culture and religion**	2.3	2.3	2.4	2.4	2.3	2.2	2.1	2.2	**2.3**
merit	**Education**	25.3	25.6	25.6	25.6	25.2	24.7	24.0	23.8	**25.0**
merit	**Social protection**	3.8	3.8	3.7	3.7	3.7	3.9	4.2	4.2	**3.9**

Authors' calculation based on REA

Table 3: government consumption process

	(1)	(2)
	ols	**gmm**
	Δg	Δg
Δg(-1)	**-0.32****	**-0.30****
	[0.001]	**[0.001]**
Δc_reg		-1.04
		[0.276]
Δy_reg		0.34+
		[0.068]
const	0.03**	0.03**
	[0.000]	[0.000]
Obs	120	120

Data are in logs. p values in brackets (+ significant at 10%; * significant at 5%; ** significant at 1%). Associated standard errors are robust. The overidentification test does not reject the null that the moments conditions are equal to zero.

Table 4: euler equation - total consumption

	(1)	(2)	(3)	exc. Sens.
	Δc	Δc	Δc	Δc
Δage	0.33*	0.32*	0.30*	0.22
	[0.026]	[0.029]	[0.037]	[0.303]
Δage^2	-0.00*	-0.00*	-0.00*	-0.00*
	[0.017]	[0.022]	[0.023]	[0.025]
Δeducation	-0.01	0	0	0.01
	[0.822]	[0.926]	[0.960]	[0.876]
Δc(-1)	0.24	0.16	0.08	0.3
	[0.207]	[0.360]	[0.513]	[0.157]
Δg	**1.94***			2.88*
	[0.047]			[0.019]
Δmerit		**0.90***		
		[0.019]		
Δpubl		**0.45**	**0.36**	
		[0.572]	**[0.562]**	
Δedu			**0.26**	
			[0.367]	
Δhealth			**0.72****	
			[0.003]	
Δcult			**0.01**	
			[0.948]	
Δy(-1)				-0.29
				[0.409]
const	-0.72*	-0.66+	-0.66+	-0.43
	[0.044]	[0.059]	[0.054]	[0.398]
Obs	4218	4218	4218	4174
sargan (pval)	0.443	0.72	0.293	0.161

Data are in logs. p values in brackets (+ significant at 10%; * significant at 5%; ** significant at 1%). Associated standard errors are robust. Regional controls and time dummies are added.

Table 4bis: euler equation - robusteness

	(1)	(2)	(3)
	no habit	**no PA**	**FE**
	Δc	Δc	Δc
Δage	0.09	0.26	0
	[0.315]	[0.114]	[0.921]
Δage^2	0	-0.00+	0
	[0.108]	[0.064]	[0.893]
Δeducation	0.03	-0.04	0.01
	[0.363]	[0.350]	[0.626]
Δc(-1)		0.09	-0.47*
		[0.531]	[0.011]
Δpubl	-0.02	-0.77	-0.4
	[0.974]	[0.260]	[0.615]
Δedu	-0.1	-0.22	-0.28
	[0.728]	[0.483]	[0.659]
Δhealth	**0.73****	**0.69***	**0.97***
	[0.002]	**[0.014]**	**[0.015]**
Δcult	-0.05	0.07	0.05
	[0.711]	[0.651]	[0.819]
cons	-0.21	-0.57	-0.04
	[0.331]	[0.148]	[0.237]
Obs	6265	3181	1811
Sargan (pval)	0.03	0.472	0.304

Data are in logs. p values in brackets (+ significant at 10%; * significant at 5%; ** significant at 1%). Associated standard errors are robust. Regional controls and time dummies are added.

Table 4ter: euler equation - non durables

	(1)	(2)	(3)
	Δc	Δc	Δc
Δage	0.28*	0.27+	0.26+
	[0.049]	[0.053]	[0.059]
Δage^2	-0.00*	-0.00*	-0.00*
	[0.018]	[0.021]	[0.027]
Δeducation	0	0	0
	[0.920]	[0.989]	[0.958]
Δc(-1)	0.18	0.11	0.05
	[0.363]	[0.568]	[0.750]
Δg	**1.66***		
	[0.049]		
Δmerit		**0.90+**	
		[0.068]	
Δpubl		**0.51**	**0.28**
		[0.476]	**[0.633]**
Δedu			**0.13**
			[0.657]
Δhealth			**0.41+**
			[0.054]
Δcult			**-0.04**
			[0.797]
const	-0.54	-0.49	-0.45
	[0.112]	[0.145]	[0.170]
Obs	4219	4219	4219
sargan (pval)	0.644	0.559	0.09

Data are in logs. p values in brackets (+ significant at 10%; * significant at 5%; ** significant at 1%). Associated standard errors are robust. Regional controls and time dummies are added.

Table 5: disposable income process

	(1)	(2)	(3)
		area	**no PA**
	Δy	Δy	Δy
Δage	0.02	-0.22	-0.03
	[0.944]	[0.651]	[0.924]
Δage^2	0	0	0
	[0.175]	[0.636]	[0.161]
Δeducation	0.03	0.07	0.03
	[0.633]	[0.322]	[0.662]
Δy(-1)	-0.39**	-0.40**	-0.40**
	[0.000]	[0.000]	[0.000]
Δg	**0.67***	**0.65+**	**0.81+**
	[0.046]	**[0.08]**	**[0.090]**
Δg(-1)	-0.36	-0.69+	-0.56
	[0.243]	[0.087]	[0.168]
const	0.08	0.55	0.18
	[0.893]	[0.577]	[0.766]
Obs	2593	2593	2033

Data are in logs. p values in brackets (+ significant at 10%; * significant at 5%; ** significant at 1%). Associated standard errors are robust. Regional controls and time dummies are added.

Table 6: perm. income equation - total consumption

	(1)	(2)
		area
	Δc	Δc
Δage	0.07	0.06
	[0.609]	[0.703]
Δage^2	0	0
	[0.660]	[0.676]
Δeducation	0	0.01
	[0.985]	[0.865]
Δy	0.31**	0.31**
	[0.000]	[0.000]
Δy(-1)	0.02	0.02
	[0.266]	[0.220]
Δg	**0.99***	**0.81***
	[0.025]	**[0.048]**
Δg(-1)	0.12	0.25
	[0.769]	[0.536]
const	-0.13	-0.14
	[0.607]	[0.680]
Obs	2679	2679

Data are in logs. p values in brackets (+ significant at 10%; * significant at 5%; ** significant at 1%). Associated standard errors are robust. Regional controls and time dummies are added.

Table 7: individual heterogeneity (euler equation)

	(1)	(2)	(3)	(4)	(5)
	eta<45	**eta>45**	**interaction: # old**	**center-north**	**south-islands**
	Δc	Δc	Δc	Δc	Δc
Δage	-0.06	0.41*	0.30*	0.19	0.37
	[0.779]	[0.014]	[0.033]	[0.163]	[0.119]
Δage^2	0	0	-0.00+	-0.00+	0
	[0.610]	[0.587]	[0.054]	[0.077]	[0.392]
Δeducation	0.06	-0.02	0	0	0.02
	[0.367]	[0.652]	[0.940]	[0.995]	[0.794]
# old			-0.05+		
			[0.062]		
Δc(-1)	-0.19	0.23	0	-0.09	-0.16
	[0.222]	[0.253]	[0.993]	[0.538]	[0.408]
Δpubl	-1	1.35	0.33	-0.96	-1.53*
	[0.356]	[0.117]	[0.600]	[0.200]	[0.030]
Δedu	-0.61	0.84+	0.28	-0.06	-0.45
	[0.230]	[0.056]	[0.348]	[0.808]	[0.542]
Δhealth	**0.88***	**0.58+**	**0.57***	**0.67***	**1.31****
	[0.042]	**[0.089]**	**[0.022]**	**[0.013]**	**[0.001]**
Δhealth*# old			**0.38****		
			[0.008]		
Δcult	-0.39	0.02	-0.08	0.37+	-0.06
	[0.216]	[0.922]	[0.647]	[0.059]	[0.757]
cons	0.26	-1.00*	-0.58+	-0.37	-0.68
	[0.609]	[0.015]	[0.079]	[0.247]	[0.224]
Obs	1220	2998	4218	2655	1563

Data are in logs. p values in brackets (+ significant at 10%; * significant at 5%; ** significant at 1%). Associated standard errors are robust. Regional controls and time dummies are added.

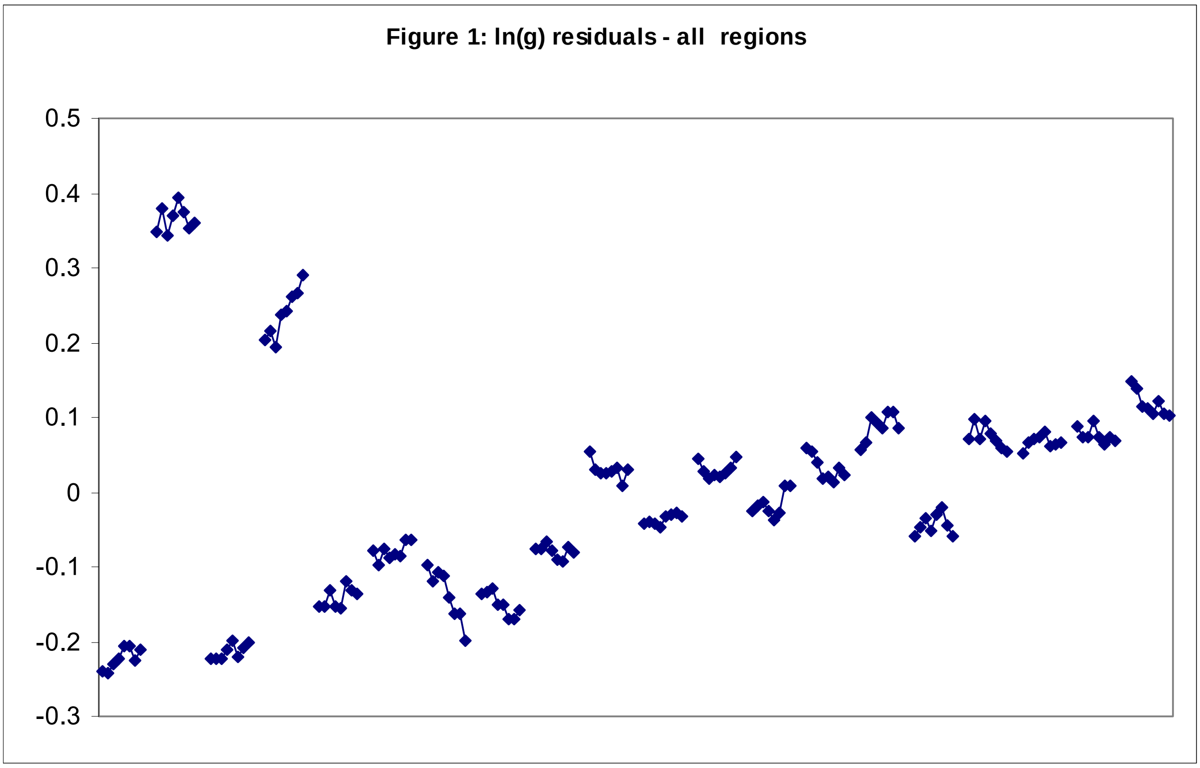
Figure 1: ln(g) residuals - all regions
0.5
0.4
0.3
0.2
0.1
0
-0.1
-0.2
-0.3

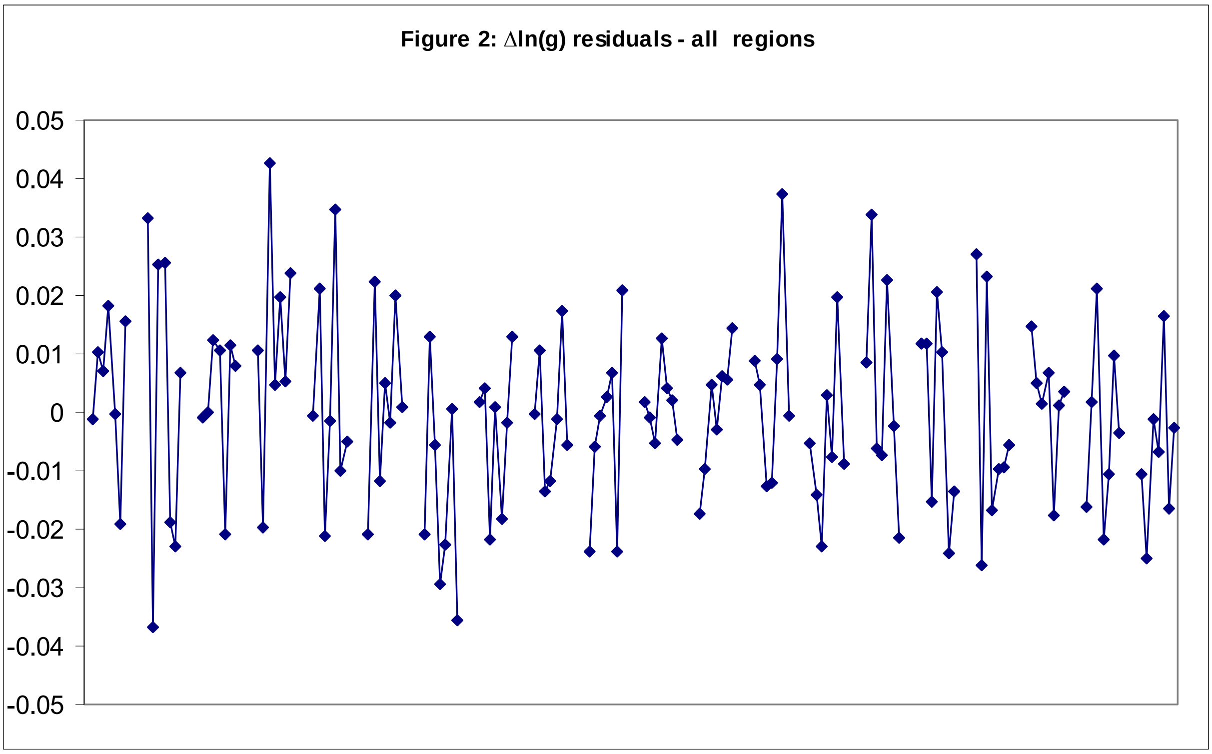
Figure 2: Δln(g) residuals - all regions
0.05
0.04
0.03
0.02
0.01
0
-0.01
-0.02
-0.03
-0.04
-0.05

Figure 3: gov. consumption shock

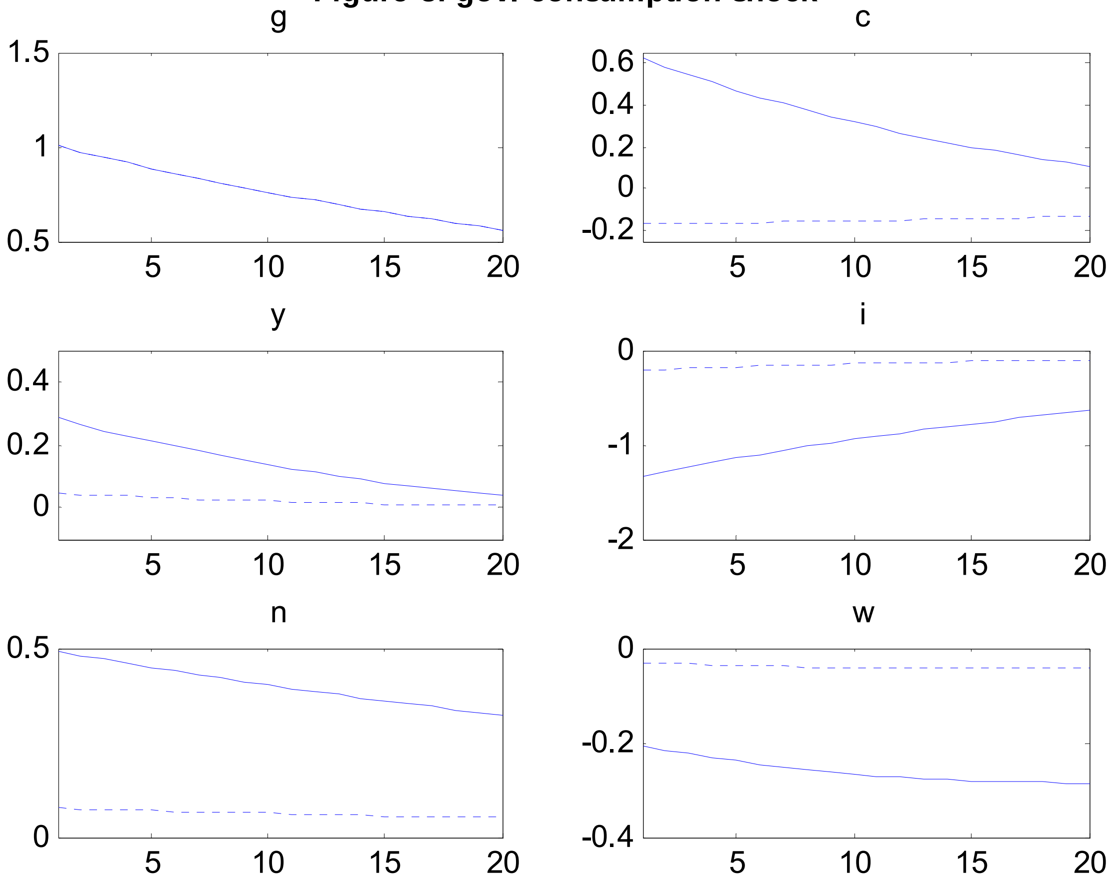

Figure 4: government cons. shock(s)