The Precautionary Saving Effect of Government Consumption*

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Abstract

We study a largely neglected channel through which government expenditures boost private consumption. We set up a lifecycle model in which households are subject to health shocks. We estimate a negative impact of public health care on household consumption dispersion, wealth and saving. According to our model, this result is explained by a change in the level of precautionary saving, with public health care acting as a form of consumption insurance. We compute the implied consumption multipliers by simulating the typical government consumption shock within a calibrated general equilibrium version of our model, with flexible prices. The impact consumption multiplier generated by the decrease in the level of precautionary saving is positive and sizable. When we include the effect of taxation, the sign of the impact multiplier depends on a few features of the model, such as the persistence of the health shocks. The long-run cumulative multiplier is negative across all calibrations.

JEL classification: E21, E32, E62.

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1 Introduction

The relationship between private consumption and government spending has been at the heart of academic and government policy debates. In particular, the existing empirical evidence on the sign of the reaction of private consumption to government spending shocks obtains contrasting results (see, e.g., Blanchard and Perotti, 2002 and Ramey, 2011). It is qualitatively easy to reconcile a negative consumption response, on impact, to a government spending shock with the predictions of a standard real business cycle model. However, building a rational expectation model that generates a positive consumption response has represented a challenge. Recently, some papers have taken up this challenge and emphasized different channels through which government spending can boost private consumption, within general equilibrium models. For example, Ravn *et al.* (2006) consider a particular form of habits, while Galí *et al.* (2007) focus on myopic consumers.

This paper studies an alternative channel: the precautionary saving motive. We consider a lifecycle model with incomplete insurance markets in which individuals are subject to income and health shocks. Within this framework, we allow government spending to influence how much health shocks affect individuals' consumption demand. We take the model's predictions to the data and estimate a negative impact of public health care on household consumption dispersion. We further estimate a negative impact on various measures of household wealth and saving. These results are explained by a change in the level of precautionary saving: as the public provision of health services increases, individuals save less in order to self-insure themselves against future adverse health shocks. This reduces household wealth and increases current private consumption.

The implied consumption multiplier is computed by simulating the typical government consumption shock within a general equilibrium version of our model, with flexible prices. The model is calibrated using our empirical estimates. The general equilibrium framework allows us to account for both the negative wealth effects produced by the need of financing the increased government consumption and the effects on prices. We calculate both impact and long-run multipliers, and separate out the increase in private consumption due only to the decrease in the level of precautionary saving. We find three main sets of results. First, the impact multiplier generated by the precautionary saving effect alone is positive and sizable. Second, the 'total' impact multiplier - which accounts for both precautionary saving and wealth effects - is positive, when health shocks are highly persistent. The total impact multipliers are negative for other parametrizations of the model. Third, across all calibrations, the total cumulative multiplier is negative in the long run.

In our empirical analysis, we employ information from two datasets for Italy: the Survey of Households Income and Wealth (SHIW) from the Bank of Italy, and the Regional Economic Accounts (REA) from the National Institute for Statistics (ISTAT). The SHIW provides panel data about households, such as private consumption, income, wealth, and demographic characteristics. The REA delivers data about national government consumption, disaggregated both at the regional level and by function. This includes a breakdown in defense, justice, health, education, economic services, and so on. We build a panel data set linking household private consumption to the various categories of government consumption of the region in which the household lives.

The empirical specification of the (partial equilibrium) model is characterized by three processes: the Euler equation governing the evolution of consumption growth, the stochastic process for private consumption dispersion, and the process for public consumption. We use a Two Stages Least Square technique in order to measure the effect of different categories of government consumption on consumption growth. First, as our main objective, we use regional and time variability of government consumption to estimate government consumption's effects on household consumption dispersion. Second, we measure the reaction of household consumption growth to variations in perceived consumption dispersion (induced by changes in regional government spending).

Our dataset provides several advantages over national aggregate data. First, we are able to identify the 'direct' effect of regional government expenditures, isolating it from the effects of taxes. This is because the Italian taxation was essentially centralized over the period under analysis. Second, because the distribution of government expenditure is not homogenous within Italy, the combined use of regional and time variability of government expenditure allows us to identify the channel of interest while remaining agnostic about the determinants of the national business cycle. Third, we are able to control for the regional business cycle and for potential feedback effects of private consumption to government spending within the regions.[1] Finally, we support the interpretation of our findings by exploiting additional information - available in our dataset - on demographic heterogeneity across households and about a subjective measure of 'desired precautionary wealth'.

This paper is related to the well established fiscal policy literature that suggests that the sign of the empirical response of private consumption to government spending shocks might be a discriminant between the plausibility of the Neoclassical versus the Keynesian

[1]Some of these advantages are shared with the recent literature of local multipliers. Among others, see Moretti (2010), Giavazzi and McMahon (2012), Shoag (2013), Acconcia *et al.* (2014) and Nakamura and Steinsson (2014).

models. In the standard real business cycle model, where public spending enters separably in the utility function (e.g., Baxter and King, 1993), government spending crowds out private spending because the tax increase, which funds government spending, reduces the net present value of disposable income.[2] Ravn *et al.* (2006) show that a positive reaction of private consumption to government spending shocks can be obtained within a real business cycle model featuring imperfectly competitive product markets and 'deep habits'. It is well recognized that, in models with nominal rigidities, consumption may increase as a consequence of a rise in government spending, see e.g., Galí (2007). Further, within the new Keynesian framework, Christiano *et al.* (2011) show that the zero lower bound constraint on the nominal interest rate may trigger an increase in private spending as a consequence of a government spending shock. Our findings contribute to this debate by emphasizing the role played by *the functional composition of government spending shocks* and by proposing the use of models with incomplete markets, especially in light of the potential precautionary saving effects.

Aiyagari and McGrattan (1998) and Challe and Ragot (2011) study the effect of an increase in government debt within models with incomplete markets. They consider a Neoclassical model in which agents face uninsurable income risk and can save against future income shocks but, crucially, have limited ability to borrow. Within this framework, a rise in public debt increases the stock of assets available to the private sector. This may effectively relax the liquidity constraints enhancing self-insurance possibilities. Our mechanism is different from theirs. First, our channel is based on a 'partial equilibrium' effect of government consumption while the increase in available funds relies heavily on a general equilibrium effect. Second, consistent with the data, and in contrast to their mechanism, our precautionary saving effect depends crucially on the composition of the changes in government expenditures.[3]

Other studies focus on the heterogeneous effects of taxes and transfers across agents in the presence of liquidity constraints. These include Heathcote (2005) and, more recently, Oh and Reis (2012), Kaplan and Violante (2014), and Misra and Surico (2014).[4] Unlike them,

[2]Among others, Bailey (1971) and Barro (1981) allow government consumption to directly affect the welfare of agents. Clearly, in this case, the response of private consumption to public spending shocks would also be determined by the degree of substitutability between the two items of interest.

[3]Another somewhat related paper is Angeletos and Panousi (2009). They study the effects of public expenditure in a model where agents face uninsured idiosyncratic investment risk, and focus on the effect on GDP induced by changes in the interest rate coming from the precautionary behavior of firms.

[4]Among these articles, perhaps the most related work is Oh and Reis (2012) who develop a model with price rigidities in which households face borrowing constraints and suffer health and income shocks against which they cannot insure. They focus on the effect of public monetary transfers and show that

we study the effects of government consumption (which does not include any monetary transfers) and focus on the precautionary effect induced on private consumption.

The paper is structured as follows. In Section 2, we outline the key economic mechanism by presenting our baseline model of precautionary saving. Section 3 presents the dataset, the empirical strategy, and summarizes the estimation results. In Section 4, we compute the consumption multipliers in general equilibrium. Section 5 concludes.

2 A Model of Precautionary Saving

In this section, we formalize the link between the individual precautionary motive and the dynamics of public consumption. The model will guide us through the empirical specification and the interpretation of the estimation results. It will also constitute the fundamental building block for the general equilibrium model we use as a tool in the measurement of the consumption multipliers.

Our model builds on a simple lifecycle framework with inelastic labor supply. Consider an economic environment in which individuals are subject to income and preference shocks and trade a risk-free asset, A_t, with deterministic return $1 + r_t$. Agent i maximizes the expected discounted utility with subjective discount factor β and isoelastic preferences for consumption, with intertemporal elasticity of substitution $\frac{1}{\gamma}$:

$$\max_{\{C_t^i, A_t^i\}_{t=0}^{\infty}} \mathbf{E}_0 \sum_{t=0}^{\infty} \beta^t \frac{(C_t^i)^{1-\gamma} V_t^i}{1-\gamma}; \tag{1}$$

subject to budget constraint

$$C_t^i + \frac{A_t^i}{(1+r_t)} = A_{t-1}^i + Y_t^i, \tag{2}$$

where C_t^i represents the agent's non-durable consumption expenditures, V_t^i is the level of the preference shock, and Y_t^i is the net labor income. Preference shocks, V_t^i, are (idiosyncratic) random variables and the agent can only self-insure against them. The purpose of introducing a preference shock is to capture the effects on non-durable consumption of a health shock. For example, an adverse health shock may increase the demand for health care goods and decrease the one for non-health related goods such as holidays or travels.

re-distributive transfers increase the labor supply of households and increase consumption of liquidity constrained agents.

We allow government consumption to influence the process of the health shocks.[5] This way, we capture the fact that government spending may affect the consequences of health shocks on consumption demand, for example, through an increase in transfers in kind or in the quality of publicly provided services.[6]

The Euler equation, approximated to the second-order (and derived in Appendix A), reads as follows:

$$\mathbf{E}_t^i\left[\Delta c_{t+1}^i\right] \simeq \frac{1-((1+r_t)\beta)^{-1}}{\gamma} + \frac{1+\gamma}{2}\mathbf{E}_t^i\left[\left(\Delta c_{t+1}^i\right)^2\right] + \frac{1}{\gamma}\mathbf{E}_t^i[\Delta v_{t+1}^i] - \mathbf{E}_t^i[\Delta c_{t+1}^i \Delta v_{t+1}^i], \quad (3)$$

where lower case letters indicate logs of the original variables and $\mathbf{E}_t^i$ indicates the agent's i expectation conditional on information at time t. The expected consumption growth is governed by three main components. First, the desire to postpone consumption, which is increasing in $\beta(1+r_t)$ and is proportional to the intertemporal elasticity of substitution $1/\gamma$. Second, the conditional consumption dispersion - represented here by the second order moment $\mathbf{E}_t^i\left[\left(\Delta c_{t+1}^i\right)^2\right]$ - is the key indicator of the presence of a precautionary saving motive as it represents the consumption risk perceived by households. The coefficient of relative prudence $1+\gamma = \frac{-CU'''_{ccc}}{U''_{cc}}$ indicates the strength of such an effect: for a (marginal) unit increase in the standard deviation of log consumption, the agent increases savings so that consumption growth increases (at the margin) by $1+\gamma$ units. Third, the last two terms of equation (3) describe how the agent adapts consumption to the evolution of the level of preferences that, by assumption, can be affected by public expenditures.[7]

A flexible specification for the second moment $\mathbf{E}_t^i\left[\left(\Delta c_{t+1}^i\right)^2\right]$ that allows for government consumption to affect the consequences of health shocks on consumption dispersion reads:

$$\mathbf{E}_t^i\left[\left(\Delta c_{t+1}^i\right)^2\right] = \sum_{j=0}^{J} B_j(c_{t-j}^i, y_{t-j}^i, g_{t-j}, \Delta g_{t-j}, \Delta c_{t-j}^i, \Delta y_{t-j}^i), \quad (4)$$

where, for each j, $B_j(\cdot)$ represents a polynomial (at least of the second order) in the argu-

[5]For example, in Section 4.3, we assume that V_{t+1} follows an AR(1) process with innovation η_{t+1} and allow for both the mean and the variance of η_{t+1} to depend on current and past government consumption.

[6] In Appendix B, we present a model where shocks to health expenditures are modeled as an exogenous expenditure process into the agent's budget constraint (e.g., as in De Nardi *et al.*, 2010). This alternative model has empirical implications similar to ours. However, as we explain in the Appendix, in order to estimate this model one would need a panel of individual medical expenses (which, unfortunately, we do not have).

[7]For example, let's focus on the effect of government consumption (G) on the mean of preference shocks. If μ represents the elasticity of the mean of V_{t+1} with respect to G_t, a one percent increase in G_t changes the term $\mathbf{E}_t^i[\Delta v_{t+1}^i]$ in equation (3) by μ.

ments and their interactions. Individual log income is represented by y, while g represents the log of government consumption. This specification encompasses, as a special case, the evolution of the second moment of consumption changes implied by a consumption growth process which is linear in logs, analogous to that in Blundell *et al.* (2008) and Attanasio and Pavoni (2011).[8] The process (4), with all variables in levels, is also a generalization of the evolution of consumption dispersion we obtain for CARA preferences (see equation (32) in Appendix C).

Finally, for the sake of concreteness, let's assume an AR(1) process for log government consumption:

$$g_{t+1} = (1 - \rho_g)g_{ss} + \rho_g g_t + \varepsilon^g_{t+1}, \tag{7}$$

with $0 < \rho_g < 1$, where g_{ss} is the steady state of government consumption in logs and ε^g_{t+1} a white noise error term.[9]

This simple model has the potential to generate what we term 'the precautionary saving effect of government consumption'. If government consumption acts as a form of public insurance against consumption risk generated by health shocks, then increases in government consumption dampen expected consumption dispersion. This effect is captured by

[8] In order to derive the expression for the second moment of consumption as in (4), one would need to recover the process of consumption growth underlying equation (3) (which only represents the process of the first moment of consumption growth). Unfortunately, incomplete markets models with additive income shocks and isoelastic preferences very rarely deliver clean closed forms. Useful insights about the process for consumption growth can however be gained by solving the model with CARA preferences. In Appendix C, we solve the version of our model with this kind of preferences in closed form. In an analogy to equation (31) in Appendix C, and consistent with equation (3), let's assume the following process for consumption growth (where we omit the individual index i):

$$\Delta c_{t+1} \simeq \Gamma_t + \frac{1}{\gamma}\Delta v_{t+1} + \psi_y \Delta y^p_{t+1} + \psi_v \Delta v^p_{t+1}, \tag{5}$$

where Γ_t summarizes the deterministic components of consumption growth (only with the exclusion of the drift in preferences $\frac{1}{\gamma}\mathbf{E}_t\Delta v_{t+1}$). The terms Δy^p_{t+1} and Δv^p_{t+1} represent permanent innovations to (log) income and preferences, respectively (hence, by construction, $\mathbf{E}_t\Delta y^p_{t+1} = \mathbf{E}_t\Delta v^p_{t+1} = 0$). Assuming preference and income innovations are orthogonal to each other, from (5) we obtain the following expression for the conditional second moment of consumption growth:

$$\mathbf{E}_t[(\Delta c_{t+1})^2] \simeq (\mathbf{E}_t\Delta c_{t+1})^2 + \psi_y^2 var_t(\Delta y^p_{t+1}) + var_t\left(\frac{1}{\gamma}\Delta v_{t+1} + \psi_v \Delta v^p_{t+1}\right), \tag{6}$$

with $\mathbf{E}_t\Delta c_{t+1} = \Gamma_t + \frac{1}{\gamma}\mathbf{E}_t[\Delta v_{t+1}]$. The last term on the right hand side of (6) illustrates how private consumption dispersion may be affected by government spending through its effect on the variance of the preference shocks.

[9] As we will see in Section 3, we consider more general specifications for (7), investigating the possibility of endogeneities and feedback effects from c to g.

equation (4). Once individuals perceive that consumption risk has diminished, they dissave by increasing current private consumption relative to future consumption. This effect on consumption growth is visible in equation (3). According to the mechanism we just outlined, also the process (7) - and especially the persistence parameter ρ_g - plays a role in our analysis. In particular, the more persistent is the increase in government consumption, the larger the precautionary saving effect is.

3 Empirical Analysis

This section is structured into three parts. We first describe the datasets. Then we present the empirical strategy. We conclude by summarizing and interpreting the estimation results.

3.1 Data

Household-level data, such as measures for private consumption, income, and wealth, are taken from the SHIW of the Bank of Italy. We consider four waves of data: 1995, 1998, 2000, and 2002. The SHIW only distinguishes between two categories of private consumption: durable and non-durable consumption. For more information about the variables' definitions and how we treat the data, see Appendix D.

Government consumption data are taken from the REA issued by ISTAT whose first release was in 1995. The REA follows the general principles of the European System of National Account (Eurostat, 1996) so that government consumption is composed by purchases of goods and services, wages, and transfers in kind to households. Transfers in kind can be directly provided to households by the government itself or the government can pay for goods and services that sellers provide to households. Transfers in kind may have medical or social protection nature. Examples of government transfers related to health care are expenditures for medicines, for the use of family doctors, or for the use of services provided by private hospitals. Examples of transfers related to social protection are reimbursements for periods in retirement institutes and asylums, provision of low-cost housing, day nurseries, assistance to sick or injured people, and professional training (see Eurostat, 1996, section 3.79).[10]

This dataset also provides a functional classification of government consumption according to the COFOG scheme published by the United Nations Statistics Division. It divides

[10] Transfers in cash are not included in our government consumption variable (examples of cash transfers are: retirement subsidies and pensions, unemployment benefits, and family allowances).

public consumption into ten categories: general services, defense, public order and safety, economic affairs, environmental protection, housing and community amenities, education, health, recreation and culture and religion, and social protection. Table 1 displays government consumption as a share of regional GDP for each of the 20 Italian regions. Following the national accounts' principles, we also disaggregate government consumption into two main categories: collective goods and services, and individual goods and services. The first category includes goods and services that are provided simultaneously to all members of the community. These are public goods, such as, defense, public order, bureaucracy, etc. The second category represents goods and services provided to households for which it is possible to observe and record individual purchases. These goods are referred to as publicly provided private goods or merit goods (e.g., education and health). The share of the government consumption in Italy is around 20% of GDP and ranges between 13.5% in Lombardia and 31.5% in Calabria. Individual goods (merit goods) are the lion's share of government consumption; they are roughly twice as large as collective goods (public goods).

Table 1 shows that the distribution of government consumption is not uniform across regions. Further, we present two additional figures in Appendix F. Figure 1 shows the residuals of the regression of the logarithm of government consumption on time dummies, pooled by regions. Figure 2 displays the residuals of the regression of the first difference of the logarithm of government consumption on time dummies, pooled by regions. These figures show that government consumption has an important degree of variability within and across regions, even after controlling for common macro shocks (see the next subsection for a few explanations of this variability, especially focusing on health expenditures).

The figures of government consumption provided by REA are consolidated at the regional level. For each region, government consumption corresponds to the sum of the expenditures in towns and provinces within the region, together with those of the region itself, as well as those of the central government imputed to the region. To impute central government consumption in each region, the REA follows the 'beneficiary of the service' principle. For example, teachers' wages, although paid by the central government, are assigned according to the distribution of teachers across different regions. Expenditures related to defense and public order are allocated according to the residential population in each region, irrespective of the origin of the disbursement. As we will see, the bulk of health services are provided at the local level, either by the towns within a region or by the region itself. Thus, no imputation is needed, except for the tiny share of expenditures

Table 1: 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

borne directly by the Ministry of Health, which are allocated across regions according to the number of hospitalizations (for more details on these methods, see Malizia, 1996).

The REA follows the Eurostat's (1996) accrual basis method in that expenses are recorded as their economic counterpart occurs, regardless of the timing of the respective cash disbursements.

Table 2 gives the share of each category of spending on total government consumption for Italy over the years of our dataset. Health and education represent the largest items among merit goods.

We merge the SHIW and the REA data to create a unique panel dataset which links household private consumption to the government consumption of the region where the

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**
	Defence	6.3	6.0	5.6	5.6	5.9	5.7	5.7	5.7	**5.8**
	Public order and safety	11.1	11.5	11.2	11.2	10.9	10.5	10.0	9.8	**10.8**
	Economic affairs	7.7	7.5	7.4	7.3	7.1	6.7	6.7	6.7	**7.1**
	Environmental protection	0.7	0.6	0.8	1.0	1.3	1.4	1.4	1.4	**1.1**
	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**
	Recreation, culture and religion	2.3	2.3	2.4	2.4	2.3	2.2	2.1	2.2	**2.3**
	Education	25.3	25.6	25.6	25.6	25.2	24.7	24.0	23.8	**25.0**
	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

household is located. Due to the characteristics of the SHIW, our final dataset contains four waves of data for government consumption.

The underlying assumption of our dataset is that households utilize only the public services offered by the region in which 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. In particular, in the next subsection we provide evidence supporting the local fruition of public health services.

3.2 The Italian Health Care System

Since government consumption in health plays a key role in our study, it is worth describing the main features of the Italian Health System, with a particular focus on our period of analysis.

The European Observatory on Health Systems and Policies (henceforth EOHSP, 2001 and 2009), has documented that, since 1978, the Italian Health System (NHS) has been a regionally based national health service that provides universal coverage, free of charge at the point of service. The National Health Fund is financed by health contributions that are income-related through a system of regressive payroll taxes.[11] The central government then allocates resources among the regions according to the population weighted by age,

[11] Social contributions were replaced in 1998 by a business tax (*IRAP*) which is formally classified as a regional tax. In fact, it was levied nationally and a fraction of its revenues were allocated to the region. To dampen the possible interregional differences in the *IRAP* tax base, a central grant financed with value added tax (VAT) revenues was created. For details, see France *et al.* (2005).

historical expenditures, and other criteria (see France *et al.*, 2005 for details). Regions provide health services through their networks, i.e., ambulatories and hospitals.[12] Regions must comply with some basic national guidelines, such as universal access and comprehensiveness, but are rather autonomous in the provision of services. In particular, two major health reforms, in 1992-'93 and 1997-'98, introduced clear principles of decentralization for the health services' administration. Often regions spent more than planned. During the period of interest, any ex-post financial discrepancy has been fully financed by the central government (see Caruso, 2001).

In summary: (i) NHS funding is mainly centralized at the national level, while the responsibility for health care provision is delegated to regional governments. In addition, (ii) although the NHS sets national basic standards, there is considerable regional variability in the distribution and coordination of resources across regions, arguably resulting in differences in the quality of health care. Jappelli *et al.* (2007) provide evidences for these differences. For example, they show that crucial indicators for the quality of health care - such as the proportion of mammographies and pap smear tests in the absence of symptoms or the citizens' assessments on the quality of public health care - vary across Italian regions and provinces. They also show that these indicators are positively correlated with the number of doctors per 1000 inhabitants, and the number of hospitals and of hospital beds, while they are negative correlated with the length of waiting lists for specific treatments.

The composition of health national expenditures in Italy emphasizes the predominance of public funding over the private sector. According to the REA, public spending accounts for roughly 75% of the total health spending during the period 1995-2002. The remainder is private spending and is divided between out-of-pocket and voluntary health insurance payments. Out-of-pocket expenditures include co-payments for diagnostic procedures, drugs, and specialistic visits, as well as direct payments by users to purchase private health care services and over-the-counter drugs. As documented by EOHSP (2009) and Paccagnella *et al.* (2008), out-of-pocket payments represent 22-24% of the total health spending, while voluntary health insurance expenses are estimated to be between 1% and 3%. Since NHS does not allow members to opt-out from the system, only supplementary private insurances exist. In terms of level of coverage, within our SHIW sample, roughly 12% of the households pay premiums for health insurances.[13] Thus, the majority of Italians rely on health

[12] According to ISTAT (1998), in 1998 there were 1489 hospitals in Italy, and more than half of these (846) were public. Moreover, the majority of private hospitals (535) were accredited, that is, they provided services to the local health system and were then reimbursed by the government.

[13] Other sources provide both higher and lower estimates to this figure. For example, Paccagnella *et al.*

care provided directly by the national health system, and even the few that possess some forms of private health insurance are not untied from the NHS.

Most people utilize the health services provided by the region in which they live. For example, Levaggi and Menoncin (2012) show that, during the first half of the 2000s, the hospital admissions of other regions' residents amounted to one tenth of the admissions of the residents, on average. Note that if the poor quality of the regional health service is partially responsible for such 'intra-state migrations', the moving costs paid by the households are an example of foreseen expenses triggering precautionary saving against adverse health shocks.[14]

3.3 Estimation

In this section, we first show our estimates of the effects of household consumption dispersion on consumption growth, as in the Euler Equation (3). Second, we present the central result of our empirical analysis, i.e., the estimation of the impact of various categories of government consumption on household consumption dispersion as in equation (4). We use a Two Stages Least Square (2SLS) technique to measure the effects of government consumption on consumption growth, mediated by consumption dispersion. Third, we estimate the process for government consumption (7), with particular focus on health care expenditures. We also estimate an extended version of (7) that allows for the possibility of feedback effects of private consumption on government consumption, within the region. Finally, to gain further evidence on the precautionary saving behavior of the agents, we estimate the effects of the different categories of government consumption on various measures of household wealth and saving.

Since observations in our dataset are yearly quantities recorded at bi-annual frequency, the notation we use in this section allows for the difference operator to embed a time span different from the standard one. In particular, for the annual variable x_t, we denote $\Delta x_{t+1} := x_{t+1} - x_{t-1}$. That said, in the tables of this section, the 'next' period refers to $t+1$, the 'current' period refers to $t-1$, and the 'lagged' one to $t-3$.[15]

(2008) find that, according to the Survey of Health, Ageing and Retirement in Europe (SHARE), only 7.51% of Italian people older than 50 years have at least one private health insurance. EOHSP (2009) reports instead, that in 1999 around 15% of the population was enrolled into complementary or supplementary schemes.

[14]The precise pattern of these intra-state migrations is not easy to describe. Although it is typically a southern household member that moves to a norther region, the choice of the mover is at least in part dictated by the presence of relatives in the region of destination.

[15]Such notational choice - taken with the sole target of improving transparency and rigor - should not

Euler Equation (second-stage regression)

The empirical counterpart of equation (3) is the following:[16]

$$\begin{aligned}\Delta c_{t+1}^{i,r} \simeq\ & Z_{t-1}^{i,r} + \phi_0^r + d_{t-1} + \psi_1(\Delta c_{t+1}^{i,r})^2 + \psi_2(\Delta c_{t-1}^{i,r}\Delta g_{t-1}^r) + \psi_3 health_{t-1}^r + \psi_4 health_{t-3}^r \\ & + \psi_5 publ_{t-1}^r + \psi_6 publ_{t-3}^r + \psi_7 edu_{t-1}^r + \psi_8 edu_{t-3}^r + \psi_9 cult_{t-1}^r + \psi_{10} cult_{t-3}^r + \epsilon_{t+1}^{i,r}. \quad (8)\end{aligned}$$

In the previous expression, $c^{i,r}$ indicated the level of the log of (real) non-durable consumption for household i who lives in region r, while $Z^{i,r}$ represents a vector of household demographics such as age and the level of education of the head of household. We control for the size of the household using the equivalent scale factor (see Appendix D for details). The constants ϕ_0^r represent regional dummies aimed at capturing, for example, persistent differences in public provision of goods and services. We also include time dummies (d_{t-1}) that capture common shocks and time effects (such as movements in national taxes, interest rate, and GDP). Following Bertola *et al.* (2005), we note that both conditional consumption growth and dispersion are not directly observed as we just observe their realizations. Thus, $\epsilon_{t+1}^{i,r}$ is a composite expectation error defined as the difference between $\Delta c_{t+1}^{i,r} - \mathbf{E}_{t-1}^{i,r}[\Delta c_{t+1}^{i,r}]$ and $\psi_1(\mathbf{E}_{t-1}^{i,r}\left[(\Delta c_{t+1}^{i,r})^2\right] - (\Delta c_{t+1}^{i,r})^2)$. We hence have $\mathbf{E}_{t-1}^{i,r}[\epsilon_{t+1}^{i,r}] = 0$. Preference shocks are not observed by the econometrician. Consistently with our modeling assumptions, we capture the dependence of the conditional mean of the preference shocks $\mathbf{E}_{t-1}^{i,r}\left[\Delta v_{t+1}^{i,r}\right]$ to government expenditures by including, as regressors, four government consumption items: public goods (*publ*), education (*edu*), recreation and culture and religion (*cult*), and health and social protection (*health*).[17] The variable $\Delta c_{t-1}^{i,r}\Delta g_{t-1}^r$ is included as a proxy for the conditional expectation $\mathbf{E}_{t-1}^{i,r}\left[\Delta c_{t+1}^{i,r}\Delta v_{t+1}^{i,r}\right]$. Regional variables are divided by the number of the households within the region.

Guided by the properties of the expectation error $\epsilon_{t+1}^{i,r}$, we use the following 2SLS technique. In the first stage, we regress $\left(\Delta c_{t+1}^{i,r}\right)^2$ on variables dated at $t-1$ and before. These are the items of regional government expenditures, together with a set of individual variables such as $\Delta c_{t-1}^{i,r}$, $c_{t-1}^{i,r}$, $\Delta y_{t-1}^{i,r}$, $y_{t-1}^{i,r}$ and a vector of regional controls which we define

impose an excessive cost on the reader.

[16] It is under debate whether the use of a second order approximation to the Euler equation generates consistent and/or unbiased estimates (Carroll, 2001, and Attanasio and Low, 2004). Note however, that the set of instruments we use is very different from that considered by Carroll (2001) in his critique of the use of the approximated Euler equations. Moreover, as we discuss below, our estimates are in line with those obtained in studies such as Jappelli and Pistaferri (2000) or Bertola *et al.* (2005) who use instruments that are arguably free from Carroll's main concerns.

[17] We merge health and social protection categories because in the latter there are health related expenditures as, for example, sickness and disability transfers *in kind*.

below. In the second stage, we use *the predicted values of* $\left(\Delta c_{t+1}^{i,r}\right)^2$ to estimate equation (8).

Columns 3 and 4 of Table 3 display the estimation results associated with the second stage. Before commenting on these results, let us briefly describe what columns 1 and 2 in Table 3 show. Column 1 displays the results of a simple OLS regression of (8) where we omitted the consumption dispersion term. In column 1 we see that, if we exclude health care, none of the coefficients for government consumption items is significantly different from zero. The health care coefficients are both statistically different from zero. In column 2, we present the results of the same regression with government consumption items in differences.[18] Again, only the coefficient associated with health care is significantly different from zero, and it equals -0.71. Clearly, the regressions of columns 1 and 2 are based on a potentially mis-specified model. Note, however, that these represent the regressions we would perform if we had approximated the Euler equation to only the first-order, ignoring the precautionary effect. A possible interpretation of these results would rely on some sort of non-separability between public and private consumption in the agent's utility function (e.g., see Fiorito and Kollitznas, 2004). Below we argue for a different mechanism.

We now go back to our original model, and note the following interesting facts. The comparison between columns 2 and 3 shows that, when we include $(\Delta c_{t+1}^{i,r})^2$ as a regressor (and instrument it), the coefficient associated with the health care variable (as all other government expenditure variables) is no longer significantly different from zero.[19] Further, first-order autocorrelation in the residuals no longer appears (see *Ar(1) resid* in columns 2 and 3).

The p-value for the overidentification test (see *overid*) for column 3 'rejects' the selected set of instruments.[20] In order to obtain a specification with fewer instruments, we estimate a second-stage Euler equation without regional dummies or items of government consumption.[21] Column 4 presents the results for this specification, which we take as our benchmark estimation. In this case, the p-value for the overidentification test is above 0.1. The coefficient associated with consumption dispersion is estimated to be $\hat{\psi}_1 = 2.43$, which is quite close to that estimated in column 3, with an associated p-value that is lower than

[18]The specification in differences is motivated by the results of column 1. We tested the null hypothesis: $\psi_3 + \psi_4 = 0$, and did not reject it (see the p-value of *F test for health* in column 1).

[19]This result remains true even when we treat the items of government consumption in levels, as in column 1. The regression results for this specification are available upon request.

[20]Since error terms are clustered by region, the overidentification test uses the Hansen's J statistic.

[21]Note that the joint effect of government consumption's items on $\Delta c_{t+1}^{i,r}$ is not significantly different from zero (see *F test for G's* in column 3).

Table 3: Euler Equation

	(1)	(2)	(3)	(4)	(5)	(6)
	OLS	OLS	IV	IV: Benchmark	IV	IV
	Δc(+1)	Δc(+1)	Δc(+1)	Δc(+1)	Δc(+1)	Δc(+1)
[Δc(+1)]^2			**2.66****	**2.43****	**2.63****	**2.59****
			[0.000]	**[0.000]**	**[0.000]**	**[0.000]**
ΔcΔg	-4.70**	-4.70**	-1.13+	-1.25*	-1.07+	2.15
	[0.000]	[0.000]	[0.069]	[0.017]	[0.092]	[0.272]
publ	0.3					
	[0.789]					
publ(-1)	0.7					
	[0.269]					
edu	-0.08					
	[0.893]					
edu(-1)	-0.60+					
	[0.099]					
cult	0.28					
	[0.369]					
cult(-1)	0.17					
	[0.348]					
health	**-0.91***					
	[0.034]					
health(-1)	**1.12****					
	[0.006]					
Δpubl		0.08	0.63			
		[0.808]	[0.342]			
Δedu		0.52	0.17			
		[0.134]	[0.742]			
Δcult		-0.02	0.04			
		[0.730]	[0.785]			
Δhealth		**-0.71****	-0.14			
		[0.003]	[0.724]			
y					-0.02	-0.01
					[0.566]	[0.756]
y(-1)					0.01	0.00
					[0.666]	[0.987]
Δc						-0.24+
						[0.078]
constant	-2.22	0.21**	-0.35**	-0.30**	-0.31**	-0.28**
	[0.524]	[0.008]	[0.005]	[0.001]	[0.033]	[0.049]
Observations	2633	2633	2600	2600	2600	2600
overid. (p-value)			0.00	0.19	0.01	0.01
Ar(1) resid. (p-value)	0.02	0.02	0.34	0.27	0.32	0.41
F test for health (p-value)	0.67					
F test for G's (p-value)			0.84			
F test for y (p-value)					0.84	

Data are in logs. *p values* in brackets (+ significant at 10%; * significant at 5%; ** significant at 1%). Associated standard errors are clustered by region. Time dummies are added. Regional dummies are added to columns 1, 2, 3, 5 and 6 . Demographics are not reported; Education of the household head is the only demographic with a positive coeffcient significantly different form zero.

1%.[22] This value of the coefficient is well within the range of the most recent findings for Italy: Jappelli and Pistaferri (2000) estimate a coefficient associated with consumption risk of approximately 5, while Bertola *et al.* (2005) find a lower value of 1.6. Both works use the same dataset as ours (although over different time spans), and adopt slightly different identification methodologies.[23]

Columns 5 and 6 display a couple of representative robustness results for the second stage. Column 5 shows that private consumption is not sensitive to predictable changes in individual income. Passing this excess-sensitivity test can be seen as a validation of our estimation strategy based on the individual Euler equation.[24] Finally, we augment the Euler equation with $\Delta c_{t-1}^{i,r}$. This might capture forms of persistence in consumption growth. The results of this regression are shown in column 6. Including $\Delta c_{t-1}^{i,r}$ does not change significantly the results, and the associated coefficient is barely significantly different from zero.

Consumption Dispersion Process (first-stage regression)

The results of the first stage, associated with the benchmark second-stage regression, are presented in column 1 of Table 4. Health care is the only regional variable that is significantly, and negatively, correlated with consumption dispersion. Additionally, the coefficient of the square of the mentioned regressor, $[\Delta health]^2$, is significantly different from zero. A positive coefficient on this variable may suggest two things. First, the negative effect of health care expenditures on $(\Delta c_{t+1}^{i,r})^2$ is non-linear. Second, government consumption volatility mitigates the insurance effects (or, equivalently, tends to increase private consumption risk). Both stories are plausible and perhaps coexist. In the quantitative section, we adopt the first interpretation as the only one consistent with our modeling assumptions. For completeness, in column 1 bis, we report the first stage associated with column 3 of Table 3, and it confirms the findings of the column 1. In both regressions, no first-order autocorrelation is detected in the residuals (see *Ar(1) resid*).

In order to obtain a richer description and a more accurate estimate for the consumption dispersion process of equation (4), we augment the first stage regressions and use the

[22] In column 4, the exclusions restrictions are represented by both the government expenditure items and the levels and differences of household consumption and income.

[23] In both works, the main instrument is the conditional subjective variance of the income growth. This variable is built by exploiting information on subjective expectations over individual earnings that are available up to 1995 in the SHIW dataset.

[24] It is well known that this test tends to be rejected when aggregate data is used instead (e.g., Attanasio and Weber, 1993).

following specification for consumption dispersion:

$$\begin{aligned}(\Delta c_{t+1}^{i,r})^2 &= Z_{t-1}^r + COV_{t-1}^{i,r} + Z_{t-1}^{i,r} + \phi_0^r + d_{t-1} + \beta_1 c_{t-1}^{i,r} + \beta_2 \Delta c_{t-1}^{i,r} + \beta_3 (\Delta c_{t-1}^{i,r})^2 + \beta_4 y_{t-1}^{i,r} \\ &\quad + \beta_5 \Delta y_{t-1}^{i,r} + \beta_6 (\Delta y_{t-1}^{i,r})^2 + \beta_7 \Delta health_{t-1}^r + \beta_8 \left(\Delta health_{t-1}^r\right)^2 + \beta_9 \Delta publ_{t-1}^r \\ &\quad + \beta_{10} \Delta edu_{t-1}^r + \beta_{11} \Delta cult_{t-1}^r + \beta_{12} \left(\Delta g\_noh_{t-1}^r\right)^2 + \kappa_{t+1}^{i,r}. \qquad (9)\end{aligned}$$

In the specification above, Z_{t-1}^r is a vector of regional variables, such as GDP, public sector's value added and a government expenditure variable (which includes investment and money transfers).[25] The inclusion of the first two variables aims at excluding the possibility that the effect we estimate is due to regional business cycle shocks that generate co-movements between public an private consumption growth, and its square. The government expenditure variable controls for the effect of government spending on the consumption dispersion that is not generated by government consumption itself.

The term $(\Delta c_{t-1}^{i,r})^2$ allows for some degree of persistence in the consumption dispersion. The vector $COV^{i,r}$ includes all interaction terms between individual variables (such as $c^{i,r}$ and $y^{i,r}$) and regional government consumption items, thus controlling for potential interactions effects on consumption risk. The specification also includes regional and time dummies. The term $\kappa_{t+1}^{i,r}$ is an expectation error term. For parsimony, we aggregate the items of government consumption other than health care under the variable labeled as $(\Delta g\_noh^r)^2$.

Column 2 of Table 4 displays the estimation results related to equation (9), and suggests that the qualitative results of the first stage regressions (i.e., column 1 and 1 bis) are robust to the inclusion of a larger set of regressors.[26]

In column 3, we present the results of an important extension of the baseline framework, where we allow for heterogeneous effects across households. In this specification, we include the interaction between the regressors associated to health care and the *number of elderly people* within the household, labeled as *old*.[27] The results show that as the number of

[25]The REA does not provide items related to public investment and money transfers, which are taken from another source (see Appendix D for details).

[26]We estimate many variations of (9). For example, if we keep the social protection category separated from health care, the quantitative results remains almost the same. In this case, the coefficients for the linear part of health and social protection are -1.46 and -0.13, respectively (with associated p-values below 3%). We also add $(\Delta c_{t-1}^{i,r})^4$ to column 2's regressors and the results virtually do not change. Further, we include government spending items to the third power, but their coefficients were never significantly different from zero. Finally, we run the specification with all quadratic items of public consumption disaggregated and find that the results do not change in any significant way. Details are available upon request.

[27]We define an individual to be elderly when her age is 65 or more. The average number of elderly people

Table 4: Consumption Dispersion Process

	(1)	(1 bis)	(2)	(3)	(4)	(5)	(6)
	First Stage (of the Benchmark)	First Stage	Full Process	Full Process: Number of Elderly	Full Process: Non PA Employees	Regional Averages	Cross Section *(a)*
	OLS	OLS	OLS	OLS	OLS	OLS	OLS
	[Δc(+1)]^2	[Δc(+1)]^2	[Δc(+1)]^2	[Δc(+1)]^2	[Δc(+1)]^2	[Δc(+1)]^2	[Δc]^2
old				0.05+			
				[0.056]			
[Δc]^2			0.11**	0.11**	0.13**	-0.08	
			[0.000]	[0.000]	[0.000]	[0.681]	
Δpubl	0.19	-1.18	-1.19+	-1.21+	-1.08	0.68	0.20
	[0.780]	[0.171]	[0.086]	[0.076]	[0.192]	[0.195]	[0.962]
Δedu	0.14	-0.62	-0.68	-0.67	-0.6	0.28	0.18
	[0.650]	[0.205]	[0.128]	[0.119]	[0.234]	[0.358]	[0.564]
Δcult	-0.03	-0.01	-0.03	-0.02	-0.04+	-0.03	-0.16*
	[0.363]	[0.881]	[0.148]	[0.241]	[0.097]	[0.543]	[0.021]
Δhealth	**-1.11****	**-1.51***	**-1.41****	**-1.09****	**-1.52****	**-1.28****	**-1.86****
	[0.000]	**[0.034]**	**[0.000]**	**[0.005]**	**[0.001]**	**[0.004]**	**[0.006]**
Δhealth*old				**-1.67***			
				[0.012]			
c	-0.17**	-0.18**	-0.15**	-0.16**	-0.16**	0.01	-0.16**
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.895]	[0.000]
Δc	-0.04	-0.03	-0.01	-0.01	-0.01	-0.01	0.02
	[0.378]	[0.530]	[0.913]	[0.928]	[0.798]	[0.841]	[0.878]
y	0.07**	0.07**	0.06**	0.06**	0.05**	-0.08	0.07**
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.318]	[0.001]
Δy	-0.03*	-0.03*	-0.06+	-0.06+	-0.06	-0.01	-0.04*
	[0.011]	[0.021]	[0.091]	[0.083]	[0.138]	[0.888]	[0.029]
[Δy]^2	0.02*	0.02*	0.02*	0.02*	0.02*	0.05	0.04*
	[0.013]	[0.000]	[0.018]	[0.017]	[0.034]	[0.458]	[0.032]
[Δhealth]^2	**5.28****	**8.09***	**7.73****	**6.16****	**8.64****	**6.52****	**9.49****
	[0.005]	**[0.021]**	**[0.001]**	**[0.007]**	**[0.001]**	**[0.008]**	**[0.003]**
[Δhealth]^2*old				**8.24***			
				[0.013]			
[ΔNOhealth]^2	-9.28	9.21	10.42	11.01	7.99	-13.95+	-10.52
	[0.306]	[0.021]	[0.210]	[0.176]	[0.458]	[0.089]	[0.233]
Constant	0.56**	0.62**	0.58**	0.57**	0.60**	1.41	0.50**
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.217]	[0.000]
Observations	2600	2600	2600	2600	2040	38	3951
Ar(1) resid. (p-value)	0.49	0.56	0.61	0.51	0.57	0.40	

Data are in logs. *p values* in brackets (+ significant at 10%; * significant at 5%; ** significant at 1%). Associated standard errors are clustered by region in columns 1, 1 bis, 2, 3,4 and 6, and are robust in column 5. Time dummies are added in columns 1, 1 bis, 2, 3, 4 and 5. Regional controls are added in columns 1, 1 bis, 2, 3, 4, and 6. Regional dummies are added in columns 1 bis, 2, 3 and 4. Demographics, not reported, are not significantly different from zero.

(a) Being column 6's regression a static one, the variables' temporal indeces don't apply here.

elderly people increases within the household, the negative effect of health care on the consumption dispersion is stronger.

Columns 4, 5, and 6 present a set of robustness exercises. In column 4, we estimate equation (9) on a *sample of households* whose head works *outside the public sector*. Notice, indeed, that public wages have a double nature in our analysis. On the one hand, they concur to the production of those services that government offers to households. On the other hand, they represent money that directly enters the pockets of public sector's employees. The results of column 4 are almost identical to those of column 2.

Column 5 presents the estimation results using *regional averages of individual data*. Specifically, we let the sample analog of $\mathbf{E}_{t-1}^{i,r}\left[(\Delta c_{t+1}^{i,r})^2\right]$ for region r at given time t be:

$$\overline{(\Delta c_{t+1}^{r})^2} = \frac{\sum_{i=1}^{I^r}\left(\Delta c_{t+1}^{i,r}\right)^2}{I^r}, \tag{10}$$

where I^r is the number of households in region r.[28] Working with regional averages has the key advantage of mitigating the measurement error problem. Moreover, now individual and regional variables share the same cross-sectional variability.[29] The results with regional averages confirm those obtained in column 2.

Column 6 presents the results obtained by estimating the process of consumption dispersion using only *cross sectional variability.* More precisely, the sample analog of $\mathbf{E}_{t-1}^{i,r}\left[(\Delta c_{t+1}^{i,r})^2\right]$ for individual i, in region r, is:

$$\overline{(\Delta c^{i,r})^2} = \frac{\sum_{j=0}^{J-1}\left(\Delta c_{t+j}^{i,r}\right)^2}{J}, \tag{11}$$

where $J = 4$ is the number of waves in our dataset.[30] Again, the results using cross-sectional variations tend to confirm the ones obtained in column 2.

In a robustness check (not reported in the text), in order to control for *changes over time in the demographic structure* within regions, we augment the specification of column

per household in the dataset is 0.51 and ranges from 0 to 4.

[28]Our final dataset does not include private consumption data for a small Italian region named Valle d'Aosta, for the years 1995 and 1998. This causes the loss of two observations in the regression of column 5.

[29]Note, aggregation problems are absent since we transform individual variables before aggregating them at regional level. Due to the reduced number of observations, we eliminate both regional dummies, the covariance terms, and the regressors Z_{t-1}^{r} from the original specification. Including or omitting the variable $\overline{(\Delta c_{t-1}^{r})}\Delta health_{t-1}^{r}$ - where $\overline{(\Delta c_{t-1}^{r})} := \frac{\sum_{i=1}^{I^r}\Delta c_{t-1}^{i,r}}{I^r}$ - does not change the results.

[30]Clearly, regional variables need to be transformed accordingly.

2 with the index of ageing and the birth rate.[31] Even in this case the results hardly change, i.e., the coefficients for the linear and the non-linear part of health care are -1.36 and 7.27, respectively (with associated p-values below 1%).

Finally, Table 4bis in Appendix F reports a set of regressions where we use *alternative sets of controls for the regional business cycle*. These specifications deliver results that are very similar to those presented in Table 4.

The Process of Government Consumption

Column 1 of Table 5 presents the estimation results for the process of government consumption as specified in equation (7).[32] We focus on health care public expenditures. The process shows a significant degree of persistence over time.

In the estimations presented in Table 4, we control for factors that may generate a correlation between public and private consumption (and hence its dispersion) through movements in the regional business cycle. Here, we want to check whether our estimates might be driven by common dynamics between private and government consumption other than those captured by regional business cycle related controls. For example, there could be common factors - such as an aggregate health shock - that may cause a co-movement between average private consumption and government expenditures within the region.

We hence estimate several extensions of equation (7). In column 2, we include regional averages of non-durable private consumption (in logs), i.e., $\overline{c^r_{t-1}}$ and $\overline{c^r_{t-3}}$ (recall that the time index $t-1$ refers to the current period in the Table, while $t-3$ to the lagged one). The results indicate that $\overline{c^r}$ does not 'Granger-cause' g^r. We also consider a few 2SLS specifications. In column 3, we extend the regression in column 2 by including $\overline{c^r_{t+1}}$ instrumented with lags of both $\overline{c^r}$ and regional GDP (gdp^r). In columns 4 and 5, we regress public health care against the dependent variables used in Tables 3 and 4 (i.e., $\overline{\Delta c^r}$ and $\overline{(\Delta c^r)^2}$), together with the instrumented $\overline{c^r_{t+1}}$. The set of instruments considered for the three 2SLS specifications are $\overline{c^r_{t-1}}$, $\overline{\Delta c^r_{t-1}}$, $\overline{\Delta c^r_{t-3}}$, gdp^r_{t-1} and Δgdp^r_{t-1}.[33] By looking at columns 3, 4 and 5 we can

[31] The index of ageing is the percentage of the population aged 65 and above, for each year and region. The birth rate is the ratio between the new born and the resident population, for each year and region, expressed in percentage terms. Both indices are taken from ISTAT.

[32] Recalling the bi-annual nature of our data, the empirical counterpart of equation (7) is:

$$g_{t+1} = \phi_g + \rho_g g_{t-1} + \varepsilon^g_{t+1}.$$

[33] Note that, because of collinearity with the variables in the second stage, some instruments are dropped across the specifications. The legend of Table 5 reports the exclusion restrictions for each specification.

Table 5: Government Consumption (Health) process

	(1)	(2)	(3)	(4)	(5)
	OLS	OLS	IV	IV	IV
	health(+1)	health(+1)	health(+1)	health(+1)	health(+1)
health	**0.89****	**0.85****	**0.82***	**0.82****	**0.83****
	[0.000]	**[0.000]**	**[0.012]**	**[0.000]**	**[0.000]**
health(-1)		0.18	0.22	0.21	0.19
		[0.308]	[0.555]	[0.197]	[0.207]
c_r		0.03	0.07		
		[0.637]	[0.831]		
c_r(-1)		-0.05	-0.03		
		[0.453]	[0.847]		
c_r(+1)			-0.06	-0.02	-0.02
			[0.906]	[0.450]	[0.671]
Δc_r				0.13	0.12
				[0.193]	[0.128]
Δc_r(-1)				0.03	0.01
				[0.789]	[0.933]
[Δc_r]^2					0.29
					[0.233]
[Δc_r(-1)]^2					-0.25
					[0.100]
const	0.50+	0.09	0.09	0.12	0.12
	[0.070]	[0.805]	[0.795]	[0.711]	[0.738]
Observations	60	38	38	38	38
overid. (p-value)			0.57	0.26	0.16
Ar(1) resid. (p-value)	0.71	0.35	0.36	0.17	0.31

Data are in logs. p values in brackets (+ significant at 10%; * significant at 5%; ** significant at 1%). Standard errors are robust. Time dummies are added. Variables with the suffix "r" are regional averages of individual variables. The exclusion restrictions in column 3 are Δc_r(-1) and Δgdp_r. The exclusion restrictions in column 4 and 5 are c_r(-1), gdp_r and Δgdp_r.

conclude that lags of levels, of differences, and of squared differences of private consumption do not have any effects on public health care.[34] As well, the estimates of the autoregressive coefficient are roughly stable across specifications.

Regressions with Wealth and Saving

In Table 8 of Appendix F, we regress various measures of household wealth and saving against public health care and a set of control variables typically used in the literature. Among the measures of wealth, we also use a variable that proxies the 'desired wealth for precautionary motives' (for a precise definition of this variable see Appendix D). We find that that *public health care has a negative impact on all these measures of wealth and saving.*

[34]Including or not the instrumented $\overline{c^r_{t+1}}$ among the regressors of columns 4 and 5 does not change the qualitative results; in particular, the coefficients related to $\overline{\Delta c^r}$ and $\overline{(\Delta c^r)^2}$ remain statistically not different from zero.

3.4 Interpretation of the Empirical Results

The estimation results can be summarized as follows. First, using regional and time variability of government consumption, we estimate a negative impact of public health care on household consumption dispersion. Second, when the Euler equation is specified to include the consumption dispersion term, we do not detect any direct effect of government consumption on private consumption growth. Third, household consumption growth is positively affected by the expected consumption dispersion (instrumented by items of regional government spending, among other variables). Finally, government consumption, in particular health care, shows a high degree of persistence over time.

According to our model, these results are explained by a change in the level of precautionary saving, with public health care expenditures acting as a form of consumption insurance for households who are subject to health shocks. A persistent rise in health expenditures reduces the perceived consumption risk, stimulating current private consumption and reducing wealth.

This interpretation is further corroborated by two additional findings. First, as shown in column 3 of Table 4, the effect of public health care on household consumption dispersion is stronger for households with a larger number of elderly people. Arguably indeed, elderly people are hit by health shocks more frequently relative to the rest of the population (e.g., see De Nardi *et al.*, 2010). Second, in line with our mechanism, the results reported in Table 8 show that public health care has a negative impact on several measures of wealth and saving.

A plausible example, consistent with our model and empirical results, is the following. An agent expecting poor public health service (e.g., long waiting lists) saves in part to be able to use privately provided health services in case of adverse health shocks. Suppose now that the region hires more doctors (hence, regional public wages costs increase), increasing the efficiency of the service (e.g., the length of the waiting lists is reduced).[35] This could have two effects. On the one hand, the improved quality of the public sector's services increases consumption via a reduction in precautionary wealth: if hit by a negative health shock, the agent will be less reliant on the expensive services provided by the private sector. In our model, this would be captured by the effect of government consumption on the variance of health shocks. On the other hand, an increase in publicly provided health services might also reduce expenses on private health-related goods, e.g., reducing

[35]This example seems consistent with the evidence of Jappelli *et al.* (2007) which we have reported in Section 3.2.

the mean of health shocks in our model.[36] As indicated in Table 3, we do not find this last effect on non-durable consumption. A possible explanation for this is that agents substitute expenses in health-related goods both for other classes of goods and for other non-essential health related goods which are typically not publicly provided.

4 Computing Consumption Multipliers

Our results predict a boost in the current *level* of private consumption as a consequence of the insurance effect of government consumption in health services. In order to measure this increase, we simulate the path of household expenditures in response to an upward shift of government consumption. To perform these computations, we consider a general equilibrium version of our model with flexible prices. In this model, the household sector is the one described in Section 2, where agents are hit by health shocks and are allowed to self-insure by modifying their private savings.[37] The model is calibrated using our estimates from micro data.

Adopting a general equilibrium framework allows us to account for other effects, such as the negative wealth effects produced by the need to finance the increased government consumption as well as the effect on prices. From counterfactual exercises, we are also able to isolate the increase in private consumption due to the precautionary effect alone at equilibrium prices.

Below, we describe the general equilibrium model, the steady state calibration, and the simulation results. Finally, we compare our measurements to other studies.

4.1 Computable General Equilibrium Model

The general equilibrium version of our model consists in an incomplete insurance market framework similar to Aiyagari (1994), with a (measure one) continuum of ex-ante identical and infinitely lived agents. In every period, each agent supplies inelastically one unit of labor, and faces idiosyncratic shocks to labor productivity. Household i, with labor

[36] Publicly provided transfers in kind, such as medicines or treatments, are another example of regional health expenditure that might reduce household precautionary saving and the demand for private health-related goods.

[37] For simplicity, we do not allow agents to purchase private health insurance. This seems to be a reasonable approximation for Italy (and to contained perturbations to its economy), given that, as we explain in Section 3.2, only a modest fraction of individuals possesses a (supplementary) private health insurance.

productivity S_t^i, receives gross labor income $W_t S_t^i$, where W_t is the real wage per efficiency unit. In order to have a finite state space, we assume that S_t follows a finite state Markov process with support $\mathcal{S}$ and transition probability matrix $\Pi(S, S') = \Pr(S_{t+1}^i = S' | S_t^i = S)$. Agents are also subject to idiosyncratic preference shocks. Again for computational purposes, we assume that these shocks follow a finite state Markov process with support $\mathcal{V}$ and transition probability matrix $\Omega_G(V, V') = \Pr_G(V_{t+1}^i = V' | V_t^i = V)$. As explained in Section 2, we interpret V_t as health shocks, whose variance depends on government consumption G.[38]

The agent solves the same intertemporal maximization problem as described in Section 2, with objective function (1) and budget constraint constraint (2), where $Y_t^i = (1-\tau_t) W_t S_t^i$ with τ_t representing the tax rate on labor income.

Markets are competitive and all firms have the same standard Cobb-Douglas production function with constant returns to scale. At aggregate level, the economy uses capital K_t and labor input (in efficiency units) $N = \mathbf{E}^{\Pi}[S]$ to generate $K_t^{\alpha}(N)^{1-\alpha}$ units of consumption goods.[39] Firms maximize profits by choosing labor and capital inputs taking factor prices as given, that is:

$$W_t = (1-\alpha)\left(\frac{K_t}{N}\right)^{\alpha}, \qquad r_t^K = \alpha\left(\frac{N}{K_t}\right)^{1-\alpha}. \tag{12}$$

Since δ is the capital depreciation rate, we have $r_t = r_t^K - \delta$. For simplicity, we assume that the government balances its budget every period:

$$\sum_{i=\text{health, edu, publ, cult}} G_t^i = \tau_t W_t N, \tag{13}$$

where, for example, G^{health} represents public expenditures in health.

We now write the recursive formulation of the maximization problem stated above. We simplify notation indicating next-period variables by 'primes' and by eliminating individual indices. For example, we denote $A_{t-1}^i = A$ and $A_t^i = A'$. We define $A_{\min}$ and $A_{\max}$ as the lower and upper bound values for assets, respectively, and $\mathcal{A} \equiv [A_{\min}, A_{\max}]$. Let the individual state vector of a particular agent be $x = (A, S, V)$. Then, we define $\mathcal{X} = \mathcal{A} \times \mathcal{S} \times \mathcal{V}$ and let $\mathcal{B}$ be the associated Borel σ-algebra. For any set $B \in \mathcal{B}$, $\lambda(B)$ is the mass of agents whose individual state vector lie in B. Clearly, the agent's decision problem depends not only on current idiosyncratic states and asset holdings but also on present and future

[38] Consistently with our empirical results, we assume that government consumption does not affect the mean of the preference shocks.

[39] The unconditional expectation defining N is taken with respect to the stationary distribution associated to the transition matrix Π (assumed to be unique).

aggregate variables such as wages and interest rates, which are affected by the current and future measures over $\mathcal{B}$. To compute such measures, agents need to know the entire current period measure λ and the associated law of motion, indicated by H, so that $\lambda' = H(\lambda)$. We can now define the problem of an agent having an individual state vector x, as follows:

$$\upsilon(A, S, V, \lambda) = \max_{C,A'} \frac{(C)^{1-\gamma}V}{1-\gamma} + \beta \mathbf{E}\left[\upsilon(A', S', V', \lambda')|S, V\right] \tag{14}$$

s.t.

$$\lambda' = H(\lambda),$$

$$C = A - \frac{A'}{(1 + r(\lambda))} + (1 - \tau(\lambda))W(\lambda)S$$

where $\tau(\lambda)$, $W(\lambda)$, and $r(\lambda)$ are the tax rate and price functions, respectively.

4.2 Equilibrium

The policy functions associated with problem (14) are $A' = h_a(x, \lambda)$ and $C = h_c(x, \lambda)$. The kernel function $Q(x, B; \lambda, h_a)$ defines the probability that an agent in state $x = (A, S, V)$ will have a state vector lying in B in the next period, given the current distribution λ and decision rule h for assets. Recalling that S and V are independent, we can denote by B_S and B_V the sets of values S' and V' included in the last two entries of the set B. We can hence define each set B by the Cartesian product of three sets (or projections) as follows $B = B_A \times B_S \times B_V$, where B_A represents the set of (next period) asset levels in B. We have:

$$Q(x, B; \lambda, h_a) := \begin{cases} \Sigma_{V' \in B_V} \Sigma_{S' \in B_S} \Pi(S, S') \Omega_G(V, V') \text{ if } h_a(x, \lambda) \in B_A \\ 0 \qquad \text{otherwise.} \end{cases}$$

The aggregate law of motion implied by Q assigns a measure to each Borel set B, and for each given h_a, defined as:

$$\lambda'(B) = T_{h_a}(\lambda, Q)(B) = \int_{\mathcal{X}} Q(x, B; \lambda, h_a)\ \lambda(dx)\,. \tag{15}$$

Definition 1. Given the government consumption vector $G = (G^i)_i$, and an initial distribution λ_0, a *recursive competitive equilibrium* outcome consists of a tax function, $\tau(\lambda)$, a value function $\upsilon(A, S, V, \lambda)$, the associated policy functions $h_a(x, \lambda)$ and $h_c(x, \lambda)$, a vector of price functions $(W(\lambda), r^K(\lambda), r(\lambda))$, and an aggregate law $H(\lambda)$, such that:

- Given prices, initial distribution λ_0 and aggregate law H, the policy functions solve the optimization problem defining $v(A, S, V, \lambda)$ for all equilibrium values of λ and A, and all $(S, V) \in \mathcal{S} \times \mathcal{V}$.
- Factor price functions are determined according to (12) and $r(\lambda) = r^K(\lambda) - \delta$.
- Government budget balances, that is $\sum_i G^i = \tau(\lambda) W(\lambda) N$ for all distributions in the equilibrium path.
- Markets clear, that is:

$$K' = \int_{\mathcal{X}} h_a(x, \lambda) d\lambda; \tag{16}$$

$$N = \int_{\mathcal{X}} S d\lambda. \tag{17}$$

- The conjectured law of motion on the aggregate distributions is consistent with individual behavior, i.e., $H(\lambda) = T_{h_a}(\lambda, Q)$ along the equilibrium path.

Definition 2. A *stationary equilibrium* outcome is an equilibrium outcome where the probability measure λ is stationary, i.e., $\lambda(B) = T_{h_a}(\lambda, Q)(B)$ for all B in the equilibrium support of $\mathcal{B}$.

4.3 Steady State Calibration

The model is calibrated at a yearly frequency on the Italian economy. There are 9 parameters to calibrate:

$$\left[\alpha, \beta, \delta, \gamma, \rho_s, \sigma^2_{\epsilon_s}, \rho_v, \sigma^2_{\epsilon_v}, \tau\right].$$

To calibrate these values, we employ information from our dataset and resort to previous studies available in the literature. The share of capital α is set to 0.35, which implies the labour share equal to 0.65 (see Censolo and Onofri, 1993, and Maffezzoli, 2006). The discount factor β is calibrated to match the steady state ratio $\frac{Y}{K}$, which equals 0.52 (D'Adda and Scorcu, 2001). See below for more details about the calibration of β. During the period of our analysis, the mean of the yearly real interest rate equals 5.48% (World Bank, 2012). This value, together with the target for $\frac{Y}{K}$ and the value for α according to equation (12) for the r_t^K, implies a depreciation rate $\delta = 0.1272$. In accordance to our results in column 4 of Table 3 and equation (3), the coefficient of relative risk aversion γ is set to 3.9.

We use a finite approximation method for the process of the productivity shocks. Following the literature, the process is approximated by a 7-state Markov chain using the

Tauchen (1986) method. The process reads:

$$\ln(S') = \rho_s \ln(S) + \epsilon'_s, \tag{18}$$

where ϵ'_s is a normal iid with zero mean and variance $\sigma^2_{\epsilon_s}$. To recover the persistence parameter ρ_s, we estimate an AR(1) process using the log of idiosyncratic labor income.[40] The parameter ρ_s is estimated to be 0.70.[41] The variance of productivity shocks $\sigma^2_{\epsilon_s}$ is calibrated to match the mean (over the years of our dataset) of the cross sectional variance of log of idiosyncratic labor income: $var(\ln(S)) = 0.34$.

We use the same method for approximating the process of health shocks. The following process is approximated by a 7-state Markov chain using Tauchen (1986) method:

$$\ln(V') = \rho_v \ln(V) + \epsilon'_v. \tag{19}$$

The innovation ϵ'_v is a normal random variable with zero mean and variance $\sigma^2_{\epsilon_v}(G^{health})$. As referred above, our dataset does not include a measure of individual medical expenses that would allow us to calibrate the persistence parameter of health shocks ρ_v. We hence perform the measurement exercise for three different values of ρ_v: 0 (iid shocks), 0.5, and 0.9.[42] For each exercise, the parameter β and the variance of preference shocks σ_{ϵ_v} are re-calibrated to simultaneously match the output-to-capital ratio and consumption variance in the data. The value $var(\ln(C)) = 0.2$ represents the mean of the yearly cross sectional variance of the log of non-durable consumption over the years of our dataset.

The labour income tax τ is set to 0.273 in order to balance the government's budget for the ratio $\frac{\sum_i G^i}{Y} \simeq 0.178$, which corresponds to the ratio between government consumption and GDP in Italy during the period of analysis (according to REA).

Table 6 summarizes the calibration exercise for the value $\rho_v = 0.9$. For details on steady state computations, see Appendix E.1.

[40] We follow Kruger and Perri (2005) and use our dataset to create earnings. Then, we regress log of earnings on a set of age, sex and educational dummies. We interpret the residuals of this regression as the log of idiosyncratic labor income.

[41] Our model is at yearly frequency. Since our data consists of yearly flows recorded bi-annually, we actually estimate $\ln(S_t) = \rho_s^2 \ln(S_{t-2}) + \rho_s \epsilon_{t-1} + \epsilon_t$. We estimate a value for ρ_s^2 of 0.49; we hence set $\rho_s = \sqrt{49} = 0.70$.

[42] The value of 0.9 is roughly in line with the persistence parameter for individual medical expenses estimated in De Nardi *et al.* (2010), for the US.

Table 6: Steady State Calibration

Parameter	Value	Targeted moment	Source
α	0.35	N/Y	Maffezzoli (2006)
β	0.6221*	Y/K	D'Adda and Scorcu (2001)
δ	0.1272	r_{ss}	World Bank
γ	3.9	Euler equation	Table 3, column 4
ρ_s	0.70	Income process estimation	SHIW
$\sigma^2_{\epsilon_s}$	0.1686	$var(\ln(S))$	SHIW
ρ_v	0.9*	-	De Nardi *et al.* (2010)
$\sigma^2_{\epsilon_v}(G^{health})$	0.935*	$var(\ln(C))$	SHIW
τ	0.273	$\sum_i G^i/Y$	REA

*Parameters whose values are affected by the choice of ρ_v.

4.4 The Effect of a Government Consumption Shift

In this section, we measure the consumption multipliers generated by a change in government consumption within the above described economy. The definition of the equilibrium outcome during the transition period is the natural extension of our equilibrium concept in Definition 1. The transition exercise, summarized below, is described in detail in Sections E.2 and E.3 of the Appendix.

Recall, the core of our calibration exercise relies on the fact that changes in government health expenditures affect the variance of preference shocks. During the transition, we allow the term $\sigma^2_{\epsilon_{v,t}}$ to respond to government health spending as follows:

$$\sigma^2_{\epsilon_{v,t}} = \sigma^2_{\epsilon_v} + \phi_\sigma \left(g_t^{health} - g_{ss}^{health} \right), \tag{20}$$

where ϕ_σ measures the sensitivity of preference shocks' dispersion to the log of public health care, and $\sigma^2_{\epsilon_v}$ represents the variance of ϵ_v when g^{health} is at its steady state level.[43]

Recall that our estimates are based on annual data recorded every two years while the model is calibrated at yearly frequency. In all simulation exercises, we assume that we are in steady state at time, and prior to, $t = 0$. Then, an unexpected increase in government

[43]Public health care might also affect idiosyncratic labor income and its variability. We performed a battery of regressions of both $\ln(S_t^i)$ and $[\ln(S_t^i)]^2$, as defined in footnote 40, against the different items of public spending and a set of individual controls and regional and time dummies. We did not find any significant effect of public health care on the variables of interest. Details are available upon request.

health expenditures manifests itself at $t = 2$ such that $\frac{G_2^{health} - G_0^{health}}{G_0^{health}} \simeq g_2^{health} - g_0^{health} > 0$.[44] Thus, according to the results in column 2 of Table 4, we calibrate the coefficient ϕ_σ so that an $x\%$ increase in the growth rate of government health expenditures changes on average $\mathbf{E}_2\left[(c_4^i - c_2^i)^2\right]$ by $[7.73 * (x\%)^2 - 1.41 * x\%]$. The empirical estimations are obtained within a partial equilibrium framework, therefore we calibrate ϕ_σ by keeping both prices and taxes at their steady state level.

Since the effect of government health expenditures on private consumption dispersion is nonlinear, we set the size of the health care shock to the typical increase we have observed in the data. As typical change we take the 0.8% in terms of (real) GDP, which corresponds to the annual standard deviation of (real) government health consumption observed for Italy during the period of analysis. Clearly, in the data, G^{health} co-moves with total government consumption G. As documented in Table 2, during the years of our analysis, the ratio $\frac{G^{health}}{G}$ remained roughly constant around its average level of 0.3. Throughout our simulations, we hence change both G^{health} and G so that their ratio is kept at its average level.

The quantitative exercise is performed assuming that government consumption and its subcategories are not characterized by uncertainty, i.e., they follow a deterministic path with $\rho_g = \sqrt{0.89}$ (as estimated in Table 5, see also footnote 41). The computation consists of simulating the transition of the economy along the path of the government expenditures with the aim of measuring consumption multipliers both on impact, namely at $t = 2$, and in the long run.[45]

Table 7 summarizes the consumption multipliers for different specifications. We calculate impact and cumulative long-run multipliers as well as multipliers for the different levels of health shocks persistence. Furthermore, we separate out the 'total' consumption multiplier (i.e., the one produced by the model where both the negative wealth effect and the precautionary motive are at work), from the 'precautionary' multiplier (i.e., the one generated by the precautionary effect alone).[46]

[44] Generating the shock at time 2, we implicitly assume that our economy is in steady the state up to time 1. Of course, we could have created the same increase in health spending between time 0 and time 2, generating the shock at time 1.

[45] We use the notion of present value multipliers formulated in Mountford and Uhlig (2009). The present value multiplier of consumption T years after an increase in government consumption is $\sum_{k=0}^{T}(1 + r_{ss})^{-k}\hat{C}_k / \sum_{k=0}^{T}(1 + r_{ss})^{-k}\hat{G}_k$, where $\hat{C}_k$ and $\hat{G}_k$ represent the actual deviation of consumption and government consumption, respectively, from their steady-states. Note that r_{ss} is the steady-state real interest rate as calibrated above. The cumulative long-run multiplier is calculated by setting $T = 200$.

[46] More precisely, we first run a transition where government expenditures are fully financed via labor taxes, obtaining the 'total' multipliers. We then save the path for the equilibrium prices. Second, we run another transition in which government expenditures increase but taxes remain at the initial steady

Table 7: Consumption Multipliers

	Iid health shocks (ρv=0)		Persistent h. shocks (ρv=0.5)		Persistent h. shocks (ρv=0.9)	
Multipliers	Impact	Long-run (cum.)	Impact	Long-run (cum.)	Impact	Long-run (cum.)
Total	-0.29	-1.01	-0.24	-1.03	0.73	-1.49
Precautionary	0.35	0.18	0.42	0.26	1.55	0.63

The results of Table 7 can be summarized as follows. First, the precautionary multipliers are always positive, with cumulative long-run multipliers lower than impact multipliers. Given that the individual budget constraint and the ability to generate income is unchanged, the increase in consumption on impact is obtained by depleting private wealth. In order for assets to return to the initial steady state values, consumption must remain below its long run level for a while before returning to its level of steady state. Second, the persistence of the health shocks affects the multiplier size. In particular, the impact multipliers are increasing with the persistence of the health shocks. However, it is not easy to make a clean comparison across the three different specifications since - as we explain in Section 4.3 - the model is re-calibrated for each one of them.[47] Notice, the total impact multiplier is positive, i.e., 0.73, for highly persistent health shocks. Third, total (cumulative) long-run multipliers are negative across all exercises and specifications. Indeed, the mechanism above described is even stronger in the case of the total multiplier, due to the additional negative wealth effect.

Comparison with Other Studies

Comparing our measures with the existing literature is not trivial. First, VARs or general equilibrium models are estimated using quarterly data, while our multipliers are produced

state level, and prices are those in the previously saved path. This last run produces the 'precautionary' multipliers. Details on these computations are in Section E.3 of the Appendix. Further, note that since we net out the wealth effects from the computation of precautionary multipliers, a different taxation scheme (e.g., lump-sum) would only have minor effects on the size of these multipliers through the change in prices.

[47] One effect that seems to play a role is the following. In our exercises, the specifications with a larger ρ_v are characterized by a larger unconditional variance for the preference shocks process. When this steady state variance is large, agents accumulate more heavily assets for precautionary motives. To keep the output-to-capital ratio at the target level, the discount factor β associated to each steady state calibration is decreasing in ρ_v. Recall now, that our quantitative exercises are constructed in such a way that impact consumption multipliers are somewhat proportional to the short-term sensitivity of consumption growth to changes in consumption dispersion, in general equilibrium. As it is evident from equation (3), a lower β reduces the short-term sensitivity of consumption growth to changes in the the interest rate. Since the interest rate partially counteracts the change in saving decisions for precautionary motives, the larger is ρ_v the higher the impact consumption multiplier tends to be.

from a yearly calibration exercise. Second, the definition adopted for the government spending differ across studies, and in no case it contemplates a disaggregation based on functional classification. Finally, almost all these studies focus on either the US or the Euro area. Two exceptions are Giordano *et al.* (2007) and Caprioli and Momigliano (2011), who estimate government spending multipliers using the SVAR identification proposed by Blanchard and Perotti (2002) applied to quarterly Italian data.[48] To make their numbers somehow comparable with our (yearly) impact multipliers, we calculate the cumulative consumption multipliers over the first 4 quarters, as explained in footnote 45. For Giordano *et al.* (2007), we calculate an yearly consumption multiplier of around 0.4, while for Caprioli and Momigliano (2011) we find it to be around 0.5.[49] These estimates are of the same order of magnitude of the above mentioned total impact multiplier (0.73), obtained in the case of highly persistent health shocks.

It is well known that for the US, scholars obtain contrasting results for the consumption reaction to government spending shocks. Among others, Blanchard and Perotti (2002) estimate a positive response of private consumption to a shock in purchases of goods and services (both current and capital), during the the first 4 quarters. Ramey (2011), using exogenous shocks on military spending, finds that this response is either zero or negative in the first 4 quarters. Our results are compatible with both studies. On the one hand, the government spending variable used by Blanchard and Perotti (2002) contains also health related expenditures that, consistently with our story, can contribute to generate a positive reaction of consumption on impact. On the other hand, according to our empirical estimates, defense spending has no effect on consumption variability.[50] Simulating such a shock within our framework, would unambiguously generates a negative consumption multiplier (both in the short and in the long run) due to the plain negative wealth effect.

[48] Giordano *et al.* (2007) use the sample 1982:1-2004:4, while Caprioli and Momigliano (2011) use the sample 1982:1-2010:4. Further, Giordano *et al.* (2007) use purchases of goods and services as the government spending variable, while Caprioli and Momigliano (2011) use total government consumption. Finally, note that Caprioli and Momigliano (2011) augment the VAR in Giordano *et al.* by adding foreign demand and public debt.

[49] These numbers are computed by looking at the graphs of the median reactions presented in the papers, so the reported measures are approximations.

[50] Although not reported in Table 4, we also run a regression as equation (9) in which we distinguish government defense spending from the aggregate *publ*. The coefficient related to the defense item is not statistically different from zero and the one related to health virtually does not change. These results are available upon request.

5 Conclusion

In this paper, we show that government consumption can have an expansionary effect on private consumption by dampening households' precautionary saving, with public health care playing a crucial role. Our channel is complementary to other known mechanisms, like, e.g., the consideration of myopic consumers or of a particular form of habit. However, unlike these mechanisms, it requires the recognition that *various public spending categories can affect the economy differently*, and it has to be based on models with incomplete insurance markets.

We have measured the effects using a flexible price model with perfect competition à la Ayiagari (1994). Our model has the potential to generate a positive reaction of consumption to the typical government spending shock in the short run. The sign of the aggregate consumption multipliers depends on a few aspects such as the persistence of health shocks. In the case of highly persistent health shocks, our multiplier is of a comparable magnitude to those obtained with aggregate data for Italy.

In light of our findings, part of the contrasting results of the consumption reaction to government spending shocks (e.g., Ramey, 2011, versus Blanchard and Perotti, 2002) can be explained through the different functional composition of government spending across the studies.

Although the paper has a strict positive target, the identified mechanism suggests that it might be possible to generate positive welfare effects by increasing public consumption in health related goods and so reducing consumption risk. To be able to accurately quantify the welfare gains of such a policy however, we would need to measure the crowding out effect generated to the private health insurance sector, especially in the long run. This is left for future research.

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A Second-Order Approximation to Euler Equation

The derivations that follow are standard. We approximate to the second order the Euler equation of the agent. It is perhaps useful to clarify that we do not approximate the equation around any fixed number such as the level of steady state, our approximation is done around the period t value of consumption after each given history of shocks. The per-period utility is indicated by $U(C,V)$ and the agent faces the budget constraint (2), the Euler Equation takes the form (to ease notation, we omit the individual index i):

$$\mathbf{E}_t\left[\frac{U_c'\left(C_{t+1},V_{t+1}\right)}{U_c'\left(C_t,V_t\right)}\right]=\frac{1}{\beta(1+r_t)}. \tag{21}$$

Recall as well, C_t and A_t are decided after observing both Y_t and V_t, and that V_t is exogenous to the agent. We set:

$$U_c^{'}\left(C_t,V_t\right):=f\left(C_t,V_t\right),$$

and approximate $f\left(C_{t+1}\left(\omega\right),V_{t+1}\left(\omega\right)\right)$ around the realized values $\left(C_t,V_t\right)$. For each ω in the support of the conditional distribution of (C_{t+1},V_{t+1}) given (C_t,V_t), we have:

$$\begin{aligned} U_c'\left(C_{t+1},V_{t+1}\right) &= U_c'\left(C_t,V_t\right)+U_{cc}''\left(C_t,V_t\right)\left(C_{t+1}-C_t\right)+U_{cv}''\left(C_t,V_t\right)\left(V_{t+1}-V_t\right)+ \\ &+\frac{1}{2}\left[C_{t+1}-C_t,V_{t+1}-V_t\right]\begin{bmatrix} U_{ccc}''' & U_{ccv}''' \\ U_{ccv}''' & U_{cvv}''' \end{bmatrix}\begin{bmatrix} C_{t+1}-C_t \\ V_{t+1}-V_t \end{bmatrix}+o(\|[\Delta C,\Delta V]\|^2), \end{aligned} \tag{22}$$

where we neglect the indexing on ω.

Now, recall that the per-period utility function takes the following expression:

$$U\left(C_t,V_t\right):=\frac{C_t^{1-\gamma}V_t}{1-\gamma}. \tag{23}$$

We hance have:

$$\begin{aligned} U_c'\left(C_t,V_t\right) &= C_t^{-\gamma}V_t \\ U_{cc}''\left(C_t,V_t\right) &= (-\gamma)\frac{U_c'\left(C_t,V_t\right)}{C_t} \\ U_{ccc}'''\left(C_t,V_t\right) &= (-\gamma)\left(-\gamma-1\right)\frac{U_c'\left(C_t,V_t\right)}{C_t^2}, \end{aligned}$$

moreover:

$$\begin{aligned} U_{cv}''\left(C_t,V_t\right) &= \frac{U_c'\left(C_t,V_t\right)}{V_t}=C_t^{-\gamma} \\ U_{cvv}'''\left(C_t,V_t\right) &= 0 \end{aligned}$$

$$U'''_{ccv}(C_t, V_t) \quad = \quad (-\gamma)\frac{U'_c(C_t, V_t)}{V_t C_t}.$$

We divide both sides of (22) by $U'_c(C_t, V_t)$. If we ignore the error term, we obtain:

$$\frac{U'_c(C_{t+1}, V_{t+1})}{U'_c(C_t, V_t)} \simeq 1 - \gamma\frac{C_{t+1} - C_t}{C_t} + \frac{V_{t+1} - V_t}{V_t} + \frac{1}{2}\left[C_{t+1} - C_t, V_{t+1} - V_t\right]\begin{bmatrix} \frac{\gamma(1+\gamma)}{C_t^2} & -\frac{\gamma}{V_t C_t} \\ -\frac{\gamma}{V_t C_t} & 0 \end{bmatrix}\begin{bmatrix} C_{t+1} - C_t \\ V_{t+1} - V_t \end{bmatrix}.$$

Unraveling the quadratic form, we obtain:

$$\frac{U'_c(C_{t+1}, V_{t+1})}{U'_c(C_t, V_t)} \simeq 1 - \gamma\frac{C_{t+1} - C_t}{C_t} + \frac{V_{t+1} - V_t}{V_t} + \frac{1}{2}\left\{\left[\gamma(1+\gamma)\right]\left(\frac{\Delta C_{t+1}}{C_t}\right)^2 - 2\gamma\frac{\Delta C_{t+1}}{C_t}\frac{\Delta V_{t+1}}{V_t}\right\}.$$

Using the Euler equation (21) and solving for $\frac{C_{t+1}-C_t}{C_t}$, we obtain:

$$\mathbf{E}_t\left[\frac{C_{t+1} - C_t}{C_t}\right] \simeq \frac{1 - ((1+r_t)\beta)^{-1}}{\gamma} + \frac{1}{\gamma}\mathbf{E}_t\left[\frac{V_{t+1} - V_t}{V_t}\right] + \frac{1+\gamma}{2}\mathbf{E}_t\left[\left(\frac{\Delta C_{t+1}}{C_t}\right)^2\right] - \mathbf{E}_t\left[\frac{\Delta C_{t+1}}{C_t}\frac{\Delta V_{t+1}}{V_t}\right].$$

Equation (3) in the main text is obtained by using the standard local approximation $\frac{X_{t+1}-X_t}{X_t} \simeq x_{t+1} - x_t$, where $x_t = \ln X_t$, applied to both C_t and V_t.

B A Model with Health Expenditure Shocks

Another possibility to capture the precautionary effects of government consumption is to model directly the process of health expenditures (e.g., see De Nardi *et al.*, 2010). In this model, the role played by preference shocks V_t is now played by health expenditure shocks, introduced into the agent's budget constraint. The consumer maximizes expected discounted utility of the form (where we omit the individual index i):

$$\max_{\{X_t, A_t\}_{t=0}^{\infty}} \mathbf{E}_0 \sum_{t=0}^{\infty} \beta^t \frac{(X_t)^{1-\gamma}}{1-\gamma}$$

subject to budget constraint

$$X_t + H_t + \frac{A_t}{(1+r_t)} = A_{t-1} + Y_t, \tag{24}$$

where H_t represents the (exogenous to the agent) expenditure in health related good and X_t represents non-durable household expenditures with the exclusion of H_t (that is, total non-durable consumption is $X_t + H_t$), with all the other variables keeping the usual meaning. This model is mathematically equivalent to a standard permanent income model with income process $\hat{Y}_t :=$

$Y_t - H_t$. The presence of publicly provided services in health related goods (such as transfers in kind) can, quite naturally, be modeled as G_t affecting the stochastic process of H_t. More precisely, if H_t represents the expenditures recorded in the data, and P_t indicates the level of expenditures in health related good the individual would face in absence of publicly provided services, the process of effective (recorded) expenses would correspond to $H_t := P_t - T(P_t, G_t)$. The function $T(P_t, G_t)$ represents the implicit transfer scheme generated by the presence of publicly provided health services. Clearly, consumption dispersion would depend on G_t as long as the dispersion of health expenditure H_t does. As indicated above, changes in the transfer scheme T are equivalent to modifying the distribution of the after tax income $\hat{Y}$ in a standard permanent income model.

This apparently simpler framework is less immediate to bring to the data for us. For example, the Euler equation for this model is formulated on the variable X_t, which, in our case, is an unobservable variable, given that the SHIW dataset does not distinguish between different categories of expenditures within the non-durable aggregate $C_t := X_t + H_t$ (see Appendix D for details).

C The Closed Form with CARA Preferences

Suppose the agent has CARA preferences of the form (where we omit the individual index i):

$$U(C_t, V_t) = -\frac{1}{\rho} \exp\{-\rho C_t\} \exp\{V_t)\},$$

and constant interest rate r. The parameter $\rho > 0$ indicates both the coefficient of absolute risk aversion and the coefficient of absolute prudence. As well, we postulate a stationary MA process with drift for preference shocks and, to simplify the analysis, a pure unit root process for income:[51]

$$Y_{t+1} = Y_t + \xi_{t+1}; \tag{25}$$

$$V_{t+1} = \mu_v t + \theta \eta_t + \eta_{t+1}; \tag{26}$$

with ξ_{t+1} and η_{t+1} i.i.d. Normal random variables with zero mean and variance σ_ξ^2 and σ_η^2, respectively. The drift on preference shocks is governed by the parameter μ_v, while θ allows for a certain degree of persistence on these shocks. This set up allows for a close form solution.

The Euler equation for these preferences takes the following expression:

$$\exp\{-\rho C_t\} \exp\{V_t\} = \beta(1+r)\mathbf{E}_t \left[\exp\{-\rho C_{t+1}\} \exp\{V_{t+1})\}\right].$$

Assuming C_{t+1} and V_{t+1} are joint normal (which will be verified below), we can rewrite the Euler equation taking logs both sides as:

[51] Of course, we could have allowed for more general specifications.

$$-\rho C_t + V_t = \ln \beta(1+r) + \mathbf{E}_t\left[-\rho C_{t+1} + V_{t+1}\right] + \frac{\rho^2}{2}\sigma^2_{c,t} + \frac{1}{2}\sigma^2_{v,t} - \rho cov_t(C_{t+1}, V_{t+1}),$$

where σ_t and $cov_t(\cdot,\cdot)$ represent the time t conditional variance and covariance, respectively; and we used the following property of the joint normal:

$$\ln \mathbf{E}_t\left[X^a_{t+1}Y^b_{t+1}\right] = \mathbf{E}_t\left[a\ln X_{t+1} + b\ln Y_{t+1}\right] + \frac{a^2}{2}var_t(\ln X_{t+1}) + \frac{b^2}{2}var_t(\ln Y_{t+1}) + a\cdot b\cdot cov_t(\ln X_{t+1}, \ln Y_{t+1}).$$

Rearranging, we get:

$$\mathbf{E}_t C_{t+1} = C_t + \frac{\ln\beta(1+r)}{\rho} + \frac{\mathbf{E}_t\Delta V_{t+1}}{\rho} + \frac{\rho}{2}\sigma^2_{c,t} + \frac{1}{2\rho}\sigma^2_{v,t} - cov_t(C_{t+1}, V_{t+1}). \tag{27}$$

We will look for closed form solutions such that variances and covariances are time constant. Note that, from (25) and (26), we have:

$$\begin{aligned}
\mathbf{E}_t\Delta V_{t+1} &= \mu_v + (\theta-1)\eta_t - \theta\eta_{t-1} = \mu_v + \theta\eta_t - V_t + \mu_v t;\\
\mathbf{E}_t\left[\Delta V_{t+2} + \Delta V_{t+1}\right] &= 2\mu_v - V_t + \mu_v t;\\
\text{and}\quad \mathbf{E}_t\left[\sum_{k=1}^{s}\Delta V_{t+k}\right] &= s\mu_v - V_t + \mu_v t, \quad \text{for } s > 2.
\end{aligned}$$

Iterating over the intertemporal budget constraint and imposing convergence on the value of discounted assets, we get, for each given history of income and preference shocks:

$$\sum_{s=0}^{\infty}\left(\frac{1}{1+r}\right)^s C_{t+1+s} = A_t + \sum_{s=0}^{\infty}\left(\frac{1}{1+r}\right)^s Y_{t+1+s},$$

which implies:

$$\mathbf{E}_t\sum_{s=0}^{\infty}\left(\frac{1}{1+r}\right)^s C_{t+1+s} = A_t + \mathbf{E}_t\sum_{s=0}^{\infty}\left(\frac{1}{1+r}\right)^s Y_{t+1+s}; \tag{28}$$

$$\mathbf{E}_{t+1}\sum_{s=0}^{\infty}\left(\frac{1}{1+r}\right)^s C_{t+1+s} = A_t + \mathbf{E}_{t+1}\sum_{s=0}^{\infty}\left(\frac{1}{1+r}\right)^s Y_{t+1+s}. \tag{29}$$

If variances and correlations are time constant, using the postulated processes for preference shocks, equation (27) becomes:

$$\begin{aligned}
\mathbf{E}_t C_{t+1} &= C_t + \Gamma + \frac{\mathbf{E}_t\Delta V_{t+1}}{\rho} = C_t + \Gamma + \frac{t\mu_v + \theta\eta_t - V_t}{\rho},\\
\mathbf{E}_t C_{t+2} &= C_t + 2\Gamma + \frac{t\mu_v - V_t}{\rho},
\end{aligned}$$

$$\mathbf{E}_{t+1}C_{t+1} = C_{t+1} \qquad \mathbf{E}_{t+1}C_{t+2} = C_{t+1} + \Gamma + \frac{(t+1)\mu_v + \theta\eta_{t+1} - V_{t+1}}{\rho},$$

where

$$\Gamma := \frac{\ln \beta(1+r) + \mu_v + \frac{1}{2}\sigma_v^2}{\rho} + \frac{\rho}{2}\sigma_c^2 - cov(C,V). \tag{30}$$

By the low of iterated expectations, for $s \geq 2$ we have:

$$\mathbf{E}_t C_{t+1+s} = C_t + (s+1)\Gamma + \frac{t\mu_v - V_t}{\rho},$$
$$\mathbf{E}_{t+1} C_{t+1+s} = C_{t+1} + s\Gamma + \frac{(t+1)\mu_v - V_{t+1}}{\rho}.$$

Recalling that $\sum_{s=0}^{\infty}\left(\frac{1}{1+r}\right)^s = \frac{1+r}{r}$ and $\sum_{s=0}^{\infty}\left(\frac{1}{1+r}\right)^s(s+1) = \left(\frac{1+r}{r}\right)^2$, we have:

$$\begin{aligned}
\mathbf{E}_t \sum_{s=0}^{\infty}\left(\frac{1}{1+r}\right)^s C_{t+1+s} &= \frac{1+r}{r}C_t + (\Gamma + \frac{\mu_v}{\rho})\left(\frac{1+r}{r}\right)^2 + \theta\eta_t + \frac{1+r}{r\rho}\left[t\mu_v - V_t\right] \\
\mathbf{E}_{t+1} \sum_{s=0}^{\infty}\left(\frac{1}{1+r}\right)^s C_{t+1+s} &= \frac{1+r}{r}C_{t+1} + (\Gamma + \frac{\mu_v}{\rho})\left[\left(\frac{1+r}{r}\right)^2 - \frac{1+r}{r}\right] + \frac{1}{1+r}\frac{\theta}{\rho}\eta_{t+1} + \frac{1}{r\rho}\left[(t+1)\mu_v - V_{t+1}\right]
\end{aligned}$$

The unit root property of Y_t implies $\mathbf{E}_t Y_{t+1+s} = Y_t$, and $\mathbf{E}_{t+1} Y_{t+1+s} = Y_{t+1}$, for all $s \geq 0$. Using the above expressions for infinite sums, from (28) and (29), dividing by $\frac{1+r}{r}$, we have:

$$C_t = \frac{r}{1+r}A_t + Y_t - \frac{1+r}{r}\Gamma + \frac{V_t - t\mu_v - \frac{r}{1+r}\theta\eta_t}{\rho},$$

and

$$C_{t+1} = \frac{r}{1+r}A_t + Y_{t+1} + \left[1 - \frac{1+r}{r}\right]\Gamma + \frac{1}{1+r}\frac{V_{t+1} - (t+1)\mu_v - \frac{r}{1+r}\theta\eta_{t+1}}{\rho}.$$

Hence, recalling that $\Delta Y_{t+1} = \xi_{t+1}$ and the definition of V_{t+1}, we have:

$$\Delta C_{t+1} = \Gamma - \frac{\mu_v}{\rho} + \xi_{t+1} + \frac{\Delta V_{t+1}}{\rho} - \frac{\psi(r,\theta)}{\rho}\eta_{t+1}, \tag{31}$$

where $\psi(r,\theta) := \frac{r}{1+r}\frac{1+r+\theta}{1+r}$. Recalling the definition of the constant Γ in (30) and equation (27), we obtain the following closed form Euler equation:

$$\mathbf{E}_t \Delta C_{t+1} = \frac{\ln \beta(1+r)}{\rho} + \frac{\mathbf{E}_t \Delta V_{t+1}}{\rho} + \frac{\rho}{2}\left[\sigma_\xi^2 + \left(\frac{\psi(r,\theta)}{\rho}\right)^2 \sigma_\eta^2\right].$$

According to the closed form, it is indeed easy to see that:

$$cov_t(C_{t+1}, V_{t+1}) = cov_t(\Delta C_{t+1}, \Delta V_{t+1}) = \frac{1-\psi(r,\theta)}{\rho}\sigma_\eta^2;$$

and

$$var_t(C_{t+1}) = var_t(\Delta C_{t+1}) = \sigma_\xi^2 + \left(\frac{1-\psi(r,\theta)}{\rho}\right)^2 \sigma_\eta^2.$$

The second moment for consumption growth is hence:

$$\begin{aligned}\mathbf{E}_t\left[(\Delta C_{t+1})^2\right] &= (\mathbf{E}_t\Delta C_{t+1})^2 + var_t(\Delta C_{t+1}) \qquad (32)\\ &= \left(\frac{\ln\beta(1+r)}{\rho} + \frac{\mathbf{E}_t\Delta V_{t+1}}{\rho} + \frac{\rho}{2}\left[\sigma_\xi^2 + \left(\frac{\psi(r,\theta)}{\rho}\right)^2\sigma_\eta^2\right]\right)^2 + \sigma_\xi^2 + \left(\frac{1-\psi(r,\theta)}{\rho}\right)^2\sigma_\eta^2.\end{aligned}$$

D Household and Regional Level Data

Household-level data are taken from SHIW, issued by the Bank of Italy, which surveys a representative sample of the Italian resident population. Details on sampling and response rates are provided by Brandolini and Cannari (1994). The variables we use from the survey are as follows. *Non durable consumption:* the sum of the expenditure on food, clothing, education, medical expenses, entertainment, housing repairs and additions, and imputed rents. *Disposable income:* the sum of wages and salaries, self-employment income, and income from financial and real assets, less income taxes and social security contributions. Wages and salaries include overtime bonuses, fringe benefits and payments in kind and exclude withholding taxes. Self-employment income is net of taxes and includes income from unincorporated businesses, net of depreciation of physical assets. *Net wealth:* the sum of liquid assets (checking accounts, saving accounts, money market accounts, certificates of deposit), financial assets (stocks, government bonds, other bonds), property and business, net of liabilities (debt owed credit cards, on car loans, other forms of consumer debt, and mortgages on houses, properties, and additions). Net wealth is measured at the end of the year. The *desired precautionary wealth* is a subjective variable recovered from the following question: 'People save in various ways (depositing money in a bank account, buying financial assets, property, or other assets) and for different reasons. A first reason is to prepare for a planned event, such as the purchase of a house, childrens education, etc. Another reason is to protect against contingencies, such as uncertainty about future earnings or unexpected outlays (owing to health problems or other emergencies). About how much do you think you and your family need to have in savings to meet such unexpected events?'. *Education of the household head* is made up of six levels who are coded as follows: no education (0 years of education), completed elementary school (5 years), completed junior high school (8 years), completed high school (13 years), completed university (18 years), postgraduate education (more than 20 years).

Household data are treated before the estimation. We exclude households with negative values of income and consumption, and observations with inconsistent information on age, sex, and education. We include households with the head of household's age ranging from 25 to 65. We exclude observations where the identity of the household's head changes. In order to eliminate possible outliers, we exclude households who have non-durable consumption that is less (above) than 1 (99) percentile of the distribution and those having the growth rate of consumption less

(above) than 1 (99) percentile of the distribution. Furthermore, household variables (such as consumption and disposable income) are adjusted for the equivalent scale factor: we refer to the 'OECD-modified scale' which assigns a value of 1 to the household head, 0.5 to each additional adult member, and 0.3 to each child (see Haangenars *et al.*, 1994 for details).

Regional GPD, unemployment rate, and the public sector's value added are taken from ISTAT. The latter variable is obtained through an imputation method. The government expenditure variable which includes investments and money transfers is taken from the Treasury Department. The real interest rate (World Bank) is the lending interest rate charged by banks on prime loans, adjusted for the GDP deflator. Regional data, except for the unemployment rate, are divided by the number of household of the region (census information by ISTAT).

All data are deflated by a national deflator (the NIC issued by ISTAT).

E Computational Procedures

E.1 Stationary Distribution

We use value function iteration methods to calculate the stationary distribution. We set up a grid for assets $\mathcal{A}$ with 500 points, having $A_{\min} = 0$ and $A_{\max} = 50$. The grid is finer for lower values of assets since we noted a larger mass of individuals on the left tail of the asset distribution.[52] The stochastic processes (18) and (19) are modeled using Tauchen (1986) procedure. We solve the maximization problem (14), conditional on having a target for the steady state interest rate, i.e., r_{ss}. Thus, the steps for calculating the steady state are the following:

1. Start with a first guess for the discount factor, the value function, and the joint distribution of asset and shocks, $(\beta^0, \upsilon^0, \lambda^0)$

2. Using (17), compute N^j. Then, using N^j and r_{ss} in the firm's FOCs, compute K^j and W^j, with $j = 0$ for the first iteration. The second iteration will have $j = 1$ and so on and so forth.

3. Solve:
$$\upsilon^{j+1}(A, S, V) = \max_{C,A'} \frac{(C)^{1-\gamma}V}{1-\gamma} + \beta^j \mathbf{E}\left[\upsilon^j(A', S', V')|S, V\right] \tag{33}$$
s.t.
$$C = A - \frac{A'}{(1+r_{ss})} + (1-\tau(G))W^j S. \tag{34}$$

[52] In the stationary distributions of all calibrated models, the percentage of agents holding zero capital is never above 0.5%. Moreover, the maximum value of assets $A_{\max}$ virtually never binds.

Given that we do not have to calculate v^{j+1}conditional on all the possible distributions λ, we have omitted the dependence of v^{j+1} from λ. Denote $h_a^{j+1}(A, S, V)$ as the policy function for assets associated with the above problem (from (34) one recovers the policy for C).

4. Using the policy function h_a^{j+1}, update the joint distribution for asset and shocks, obtaining λ^{j+1}. Compute the aggregate capital, K^{j+1}.

5. Compare K^{j+1} with K^j and update accordingly the discount factor, obtaining β^{j+1}. Iterate from step 2 until convergence. Note that an equivalent procedure is to update the discount factor in order to match the target for $\frac{Y}{K}$ whose value is described in Section 4.3.

E.2 Computation of the Consumption Dispersion

In this section, we explain how $\mathbf{E}_2(c_4^i - c_2^i)^2$ is computed in the simulation exercises. We compute it taking the cross-sectional mean of the conditional second moments of consumption $\mathbf{E}[(c_4 - c_2)^2|x]$, where, $x = (A, S, V)$ is the state vector of each agent at the time of the shock. Denote (S', V') and (S'', V'') realizations of exogenous states in two consecutive periods (e.g., periods 3 and 4 if the shock happens in period 2) so that $((S', V'), (S'', V'')|S, V)$ is a history conditional on (S, V). We also denote $x_4 = (A_4, S'', V'')$ and $x_3 = (A_3, S', V')$, where $A_4 = h_{a3}(A_3, S', V', \lambda_3)$ and $A_3 = h_{a2}(x, \lambda_2)$. λ_t indicates the distribution in period t which - for a given transition - suffices to infer the whole sequence of future distributions along the transition.

Let $\mu_{2,3}((S', V'), (S'', V'')|S, V)$ be the transition probability of the exogenous state (S, V) between periods 2 and 3. Then, the cross-sectional mean of the conditional second moments of consumption equals:

$$\int_{\mathcal{X}} \mathbf{E}[(c_4 - c_2)^2|x] d\lambda_2(x) = \tag{35}$$

$$\int_{\mathcal{X}} \left[\sum_{(S'',V''),(S',V')} \{\log h_{c4}(x_4, \lambda_4) - \log h_{c2}(x, \lambda_2)\}^2 \mu_{2,3}\left((S', V'), (S'', V'')|S, V\right) \right] d\lambda_2(x),$$

where the distribution of agents $\lambda_2(x)$ is the same as the steady state distribution $\lambda(x)$ if we interpret it in the cardinal sense, i.e., the probability mass assigned to each level of (S, V) is the same for the two distributions. Thus, the cross-sectional mean of the conditional second moments of consumption computed at the steady state is:

$$\int_{\mathcal{X}} \left[\sum_{(S'',V''),(S',V')} \{\log h_c(h_a(h_a(x, \lambda), S', V', \lambda), S'', V'', \lambda) - \log h_c(x, \lambda)\}^2 \mu((S', V'), (S'', V'')|S, V) \right] d\lambda. \tag{36}$$

Policy functions, distributions and probabilities without time subscripts are those in an economy

without aggregate shocks, and λ is the steady state distribution.

E.3 Transition

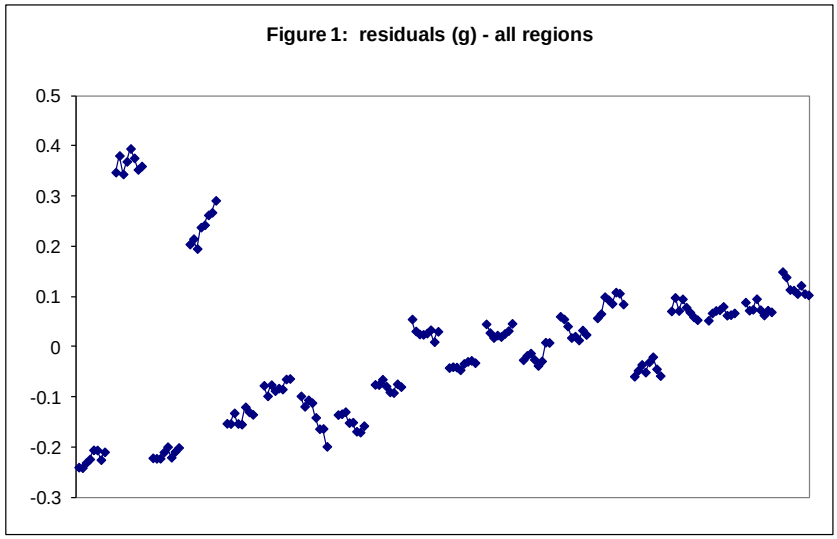
In order to compute the transitions, we adopt a modified version of the code used for the steady state computations where we set the simulation horizon T to 200 and allow any path for prices $\{r_t\}$. We then set both the path for government consumption and health expenditures in accordance with both our model and our empirical results. At this point, the exercise is run in two phases.

First, we need to calibrate the effect of a shock to government consumption on the consumption dispersion, as explained in Section 4.4. Since our empirical estimations are performed within a partial equilibrium model, this phase of transition does not allow prices to change, so we keep the interest rate at its steady state level in each period of the transition. The same is true for the labor tax. Thus, having in mind equation (20), we start with an initial guess for ϕ_σ. We find a stable value function for each period in the transition, conditional on the steady state interest rate. From the resulting policy functions we calculate the joint distributions of asset and shocks for each period t of the transition and of course we compute (35), as defined in Section E.2. We then check if the spending shock has produced the desired change in the consumption dispersion (i.e., the difference between the value obtained from (35) and the one from (36)). If so, we save the coefficient value and name it ϕ_σ^*. Otherwise, we chose another value for ϕ_σ and iterate again on the value functions. Clearly, we calibrate a different coefficient, ϕ_σ^*, for each level of the persistence of the preference shock ρ_v.

Once we have a value for ϕ_σ^*, we perform simulations in a general equilibrium framework where both prices and taxes are allowed to adjust. The first guess for the path of the interest rate is the value of steady state for all T periods. We are able to calculate the aggregate capital in each period of the transition by using the firm's FOCs. Then, we exploit value function iteration in a backward fashion. By considering (33), we identify the iteration label j with the time period $t+1$, and the results of the current iteration, denoted by $j+1$, with values in t. We start by moment $t = T-1$, then, by using the procedure of the step 3 in Section E.1, we update t to $T-2$ and repeat the cycle until $t = 1$. Eventually, we have T value functions and policy functions, one for each period of the transition. The next part of the problem is to update the joint distributions of assets and shocks given the policy functions just calculated. Starting by the steady state joint distribution of assets and shocks, and conditional on the calculated value functions, we update the entire path of the joint distributions following the law of motion (15). We have a joint distribution of assets and shocks for each period of the transition. Finally, for each of the T periods, we compare the aggregate capital calculated from the joint distributions with the one obtained from the firm's FOCs. We update the interest rate for each period accordingly. We repeat the entire procedure until the gap between the two values for the aggregate capital is sufficiently small in all periods.

We then save the path for the equilibrium prices. The consumption multipliers calculated out of this transition are the *'total' multipliers*. The *'precautionary' multipliers* are calculated by simulating a new transition where the prices are those in the previously saved path but taxes remain at their steady state level.

F Additional Figures and Tables



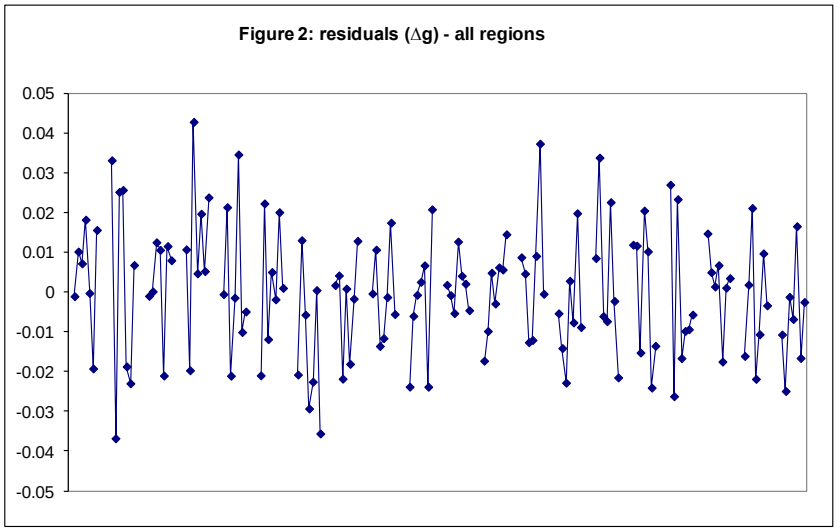


Table 4bis: Consumption Dispersion Process (with alternative sets of controls for the regional business cycle)

	(1)	(2)	(3)	(4)	(5)	(6)
	First Stage (of the Benchmark)		Full Process		Full Process: Number of Elderly	
	OLS	OLS	OLS	OLS	OLS	OLS
	[Δc(+1)]^2	[Δc(+1)]^2	[Δc(+1)]^2	[Δc(+1)]^2	[Δc(+1)]^2	[Δc(+1)]^2
old					0.05+	0.05+
					[0.054]	[0.064]
[Δc]^2			0.11**	0.11**	0.11**	0.11**
			[0.000]	[0.000]	[0.000]	[0.000]
Δpubl	0.98	0.47	-0.52	-0.91	-0.62	-0.97
	[0.182]	[0.488]	[0.358]	[0.244]	[0.268]	[0.200]
Δedu	0.55+	0.26	-0.34	-0.55	-0.37	-0.57
	[0.095]	[0.380]	[0.346]	[0.249]	[0.288]	[0.222]
Δcult	-0.03	-0.04	-0.05*	-0.04*	-0.04*	-0.03*
	[0.398]	[0.316]	[0.010]	[0.022]	[0.011]	[0.047]
Δhealth	**-1.08****	**-1.17****	**-1.38****	**-1.45****	**-1.06****	**-1.13****
	[0.001]	**[0.000]**	**[0.000]**	**[0.000]**	**[0.002]**	**[0.002]**
Δhealth*old					**-1.69***	**-1.66***
					[0.011]	**[0.014]**
c	-0.17**	-0.17**	-0.15**	-0.15**	-0.16**	-0.16**
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
Δc	0.04	0.04	-0.01	-0.01	-0.01	-0.01
	[0.387]	[0.376]	[0.875]	[0.903]	[0.894]	[0.920]
y	0.07**	0.07**	0.06**	0.06**	0.06**	0.06**
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
Δy	-0.03*	-0.03*	-0.05+	-0.05+	-0.06+	-0.06+
	[0.011]	[0.010]	[0.098]	[0.096]	[0.088]	[0.087]
[Δy]^2	0.03*	0.03*	0.02*	0.02*	0.02*	0.02*
	[0.013]	[0.013]	[0.017]	[0.017]	[0.017]	[0.017]
[Δhealth]^2	**4.75***	**5.40****	**7.11****	**7.68****	**5.60****	**6.14****
	[0.015]	**[0.004]**	**[0.000]**	**[0.000]**	**[0.004]**	**[0.005]**
[Δhealth]^2*old					**8.33***	**8.20***
					[0.012]	**[0.014]**
[ΔNOhealth]^2	-19.01+	-12.76	2.06	6.91	3.69	8.03
	[0.059]	[0.150]	[0.768]	[0.458]	[0.595]	[0.375]
Constant	0.53**	0.55**	0.58**	0.58**	0.57**	0.58**
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
Observations	2600	2600	2600	2600	2600	2600

Data are in logs. p values in brackets (+ significant at 10%; * significant at 5%; ** significant at 1%). Associated standard errors are clustered by region. The controls for the regional business cycle are represented by unemployment rate and GDP in columns 1, 3, and 5, whereas they are represented by unemployment rate, GDP, and public sector's value added in columns 2, 4, and 6. The regional government spending variable (including monetary transfers and investment) is added. Time and regional dummies are added. Demographics, not reported, are not significantly different from zero.

In Table 4bis, we take the representative regressions of Table 4 (i.e., those of columns 1, 2, and 3) and check if the associated results are robust to the use of different sets of controls for the regional business cycle. Specifically, in columns 1, 3, and 5 of Table 4bis, we use, as controls, the unemployment rate and the GDP, while in column 2, 4, and, 6 we use the unemployment rate together with the GDP and the public sector's value added. As it can be seen from the table, the results are very similar to those presented in Table 4.

Table 8: Health, Wealth and Saving

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	logs	levels	logs	levels	logs	levels	logs	levels
	OLS	OLS	OLS	OLS	OLS	OLS	OLS	OLS
	wealth	wealth	Δwealth	Δwealth	wealth/ȳ	wealth/ȳ	prec. wealth	prec. wealth
wealth(-1)	0.97**	0.94**						
	[0.000]	[0.000]						
Δwealth(-1)			-0.02	-0.08*				
			[0.314]	[0.032]				
wealth/ȳ(-1)					0.97**	0.94**		
					[0.000]	[0.000]		
prec. wealth (-1)							0.25**	0.24**
							[0.000]	[0.000]
Δpubl	-0.10	9.88	0.28	59.78*	-0.09	0.89	3.84	43.05*
	[0.776]	[0.469]	[0.591]	[0.047]	[0.805]	[0.787]	[0.222]	[0.015]
Δedu	-0.42	-11.14	0.05	16.10	-0.42	-0.89	7.67*	105. 54**
	[0.221]	[0.433]	[0.910]	[0.536]	[0.221]	[0.765]	[0.012]	[0.001]
Δcult	0.14	13.43	0.07	105.99	0.15	-0.41	0.82	25.30
	[0.200]	[0.862]	[0.693]	[0.445]	[0.191]	[0.979]	[0.368]	[0.814]
Δhealth	**-0.76****	**-12.90**	**-0.49+**	**-26.38***	**-0.75****	**-2.55**	**-5.79****	**-44.6****
	[0.001]	**[0.149]**	**[0.070]**	**[0.013]**	**[0.002]**	**[0.111]**	**[0.001]**	**[0.001]**
y	0.06**	0.71**	0.01	0.01	0.05**	0.09*	0.33**	0.86**
	[0.006]	[0.007]	[0.631]	[0.990]	[0.013]	[0.011]	[0.001]	[0.000]
Δy	0.21**	0.38	0.09	1.31*	0.22**	0.15	0.28	0.24
	[0.000]	[0.522]	[0.194]	[0.032]	[0.000]	[0.179]	[0.373]	[0.705]
Constant	1.31	575.48	0.49	709.33	1.3	110.40	1.82	1,116.58
	[0.158]	[0.483]	[0.659]	[0.569]	[0.161]	[0.537]	[0.589]	[0.228]
Observations	4110	4369	2425	2633	4109	4365	1849	1978

Demographics, not reported, are not significantly different form zero. *p values* in brackets (+ significant at 10%; * significant at 5%; ** significant at 1%). Associated standard errors are clustered by region. Time and regional dummies are added in columns 1,2,3,4,5, and 6. Regressions in columns 7 and 8 consider only two years, 2002 and 2004. Regional controls and covariances between regressors are added.

Table 8 shows the results of the regressions of various measures of (end of period) wealth and saving against public health care. In column 1, we use the log of household net wealth. Among the regressors we also include a set of demographics (namely, age, age squared, age to the third power, and education of the household head), individual disposable income, and the controls for the regional business cycle (such as GDP and unemployment rate) and the other categories of public spending (other than government consumption). Column 2 presents the same regression in levels. In columns 3 and 4 we provide additional evidence, using as dependent variable the change in net wealth (saving) both in logs and in levels. In columns 5 and 6, we follow Guiso *et al.* (1992) and use a proxy for the wealth to (permanent) income ratio as a dependent variable. Specifically, we use the ratio between net wealth and the mean of disposable income calculated - over time - within each household. Finally, in columns 7 and 8, we use a variable that proxies for the desired precautionary wealth.[a] The results consistently indicate a negative correlation between public health care and both the various measures of wealth and saving.

[a] The exact question on the precautionary wealth is presented in Appendix D. Note that this variable exists only for the years 2002 and 2004 in the SHIW, while our dataset ends in 2002. Thus, for these two years, we created a new dataset that contains revised figures for the government consumption categories.