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To love or to pay: Savings and health care in older age

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Abstract

This paper develops a dynamic structural life-cycle model to study how heterogeneous health and medical spending shocks affect the savings behavior of the elderly. Individuals are allowed to respond to health shocks in two ways: they can directly pay for their health care expenses (self-insure) or they can rely on health insurance contracts. There are two possible insurance options, one through formal contracts and another through informal care provided by family. Formal contracts may be affected by asymmetric information problems, whereas informal insurance depends on social ties (cohesion) and on bequeathable wealth. I estimate the model on SHARE data using simulated method of moments for four levels of wealth in a sample of single retired Europeans. Counterfactual experiments show that health, medical spending and health insurance are indeed the main drivers of the slow wealth decumulation in old age. I also find that social cohesion rises with age, declines with wealth and is higher in Mediterranean countries than in Central European and Scandinavian countries. Finally, high social cohesion appears typically associated with increased life expectancy.

Key Words: savings, health, health insurance, social cohesion, life expectancy.

JEL Classification: D1, D31, E27, H31, H51, I1.

1 Introduction

Why do the elderly decumulate their wealth so slowly? The economic literature has mainly focused on explanations based on bequest and precautionary savings motives (Kotlikoff and

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Summers, 1981; Bernheim et al., 1985; Dynan et al., 2002). Among the sources of risk that induce the elderly to engage in precautionary savings, health and medical spending have long been recognized as two of the most significant (Hubbard et al., 1994, 1995; Palumbo, 1999; Dynan et al., 2004; De Nardi et al., 2010). Other factors, such as the availability of formal (market provided) and informal (family provided) health insurance, also appear to be important (Starr-McCluer, 1996; Guariglia and Rossi, 2004), but relatively little is known about their effect on wealth profiles. This is mainly because a comprehensive analysis of these contracts typically requires comparisons between (rather than within) countries.

The current paper addresses this issue by studying the joint effect of health, medical spending and insurance on old-age savings in eleven European countries. In this respect, the paper is related to De Nardi et al. (2010) that model the savings behavior of retired U.S. households and account for heterogeneous medical expenses and life expectancy. I further extend their framework to account for the availability of private (formal) health insurance and family transfers and study their effect on savings in old age. To this purpose, I develop a rich life-cycle model with endogenous medical spending where the elderly can: i) insure, either formally by purchasing private insurance or informally via family transfers provided in anticipation of a future bequest, and ii) self-insure by accumulating wealth. Formal contracts may be affected by asymmetric information problems, whereas informal insurance depends on social ties (family cohesion) and bequeathable wealth. Since wealth holdings encourage family members to provide retirees with informal care, the model also allows for a strategic bequest motive. With this formulation, it is possible to study the interactions between the public, private and informal health insurance markets. Moreover, the model captures the effect of social norms regarding caring for one's elderly parents on the demand for private (formal) insurance and wealth decumulation.

To the best of my knowledge, this is the first European structural study on wealth decumulation in old age. I estimate the model on data from the Survey of Health, Ageing and Retirement in Europe (SHARE), using the simulated method of moments (SMM) for four levels of wealth and three European regions: Scandinavia - Denmark and Sweden, Central Europe - Austria, Belgium, France, Germany, Netherlands, Switzerland, and the

Mediterranean - Italy, Spain and Greece (Gullestad and Segalen, 1997). For each region, several country-specific details on public, private and informal insurance are accounted for.

I find that health risks and potentially high medical spending can explain much of the slow wealth decumulation (and consequently of bequests) after retirement in Europe. Moreover, the absence of perfect formal insurance markets coupled with borrowing constraints and health dynamics creates a strong incentive for the elderly to keep wealth for strategic reasons (i.e., to induce family to provide care). Indeed, since informal care is likely to increase with bequeathable wealth (Bonsang, 2007) and family cohesion rises with age (Hank, 2007), individuals have an incentive to slow their dissaving. My estimates confirm these dynamics and also show a positive association between social cohesion and life expectancy. In Mediterranean countries, survival probabilities are high and the level of formal insurance is relatively low, as health care is mainly covered by the family (Bolin et al., 2008). On the contrary, in Scandinavian and Central European countries, individuals register shorter life expectancies despite the high formal coverage.

The results on health and insurance being the main drivers of savings are confirmed by several counterfactual experiments. For instance, maintaining the same health as when 65 years old throughout one's life would lead to an average drop in wealth of roughly 40 percent in Southern Europe and 60 percent in Central and Northern Europe. Because health deteriorates with age, a scenario that keeps health constant will make medical goods less needed and diminish the incentive to save for their (formal or informal) future provision. Moreover, with no private formal insurance available, wealth profiles would have been considerably or remarkably lower across all regions. However, Mediterraneans would reach the age of 90 with only 20 percent less wealth, whereas the equivalent reduction would be 54 percent for Central Europeans and 64 percent for Scandinavians. This is not surprising, as both Central and Northern Europeans spend a larger share of their budget on formally-provided medical goods than the Mediterraneans. With no access to this type of arrangement, they will therefore decumulate faster than the Mediterraneans. Conversely, the absence of informal insurance has a much stronger effect on wealth in the Mediterranean than in the rest of Europe. With no incentive to keep wealth for health care provision, Southern Europeans will start to decumulate early and save roughly only 53 percent of what they would have otherwise saved. In contrast, the effect is almost inexistent for Scandinavians who rely less on informal care and decumulate only 5 percent of their wealth by age 88.

With the current demographic and socio-economic trends, understanding the main drivers of the elderly' savings is crucial for policy-makers. If the slow dissaving in old age is due to longevity or medical spending risks, then changes in health insurance programs or in social and family policies may influence the saving behavior of the elderly by controlling risk exposure. For the Europeans, any changes should however account for country-specific factors such as the characteristics of the health care system, social cohesion, life expectancy and wealth. In this sense, a model that is capable of explaining the choices of European elderly can significantly improve the understanding and design of reforming policies.

The remainder of the paper is organized as follows: Section 2 gives an overview of the health care systems in Europe. Section 3 develops the dynamic model, and Section 4 describes the data. Section 5 presents the estimation method, using the SMM methods. Results are illustrated in Section 6, and experiments are conducted in Section 7. Section 8 concludes.

2 Health Care in Europe

Health insurance arrangements vary enormously across Europe, providing an ideal setting to study the effect of institutional and cultural differences across countries. Some of these differences are reflected in the design and financing of health care. This section summarizes several interesting insurance patterns that will be accounted for in the model.

First, health insurance can be provided formally (by the market) and informally (via family arrangements). The formal health insurance schemes may be classified into public and private ones, i.e., provided as pre-paid financial mechanisms (Colombo and Tapay, 2004). Table 1 provides selected statistics related to the prevalence of formal versus informal, and public versus private health care funding across the eleven European countries in SHARE.

A quick glance reveals that the public policy in these states is based on the principle of health care funded by the state or by social insurance, made available to all individuals and covering most of the major health shock. There are three types of public health-care systems, following a north-south gradient: i) national health services in Scandinavia, ii) social-insurance systems in Central Europe, and iii) a mixed type of systems that can be seen as 'third way' (Freeman, 2000), established in the early 1980s in the Mediterranean. The common feature of these systems is that they provide almost universal health care, across two dimensions. On the one hand, because they are financed through taxation or contributions from employers and employees, participation in the public system is usually mandatory.[1] On the other hand, these systems cover all severe (life-threatening) medical conditions, offering comprehensive benefits that account for more than 70 percent of the total health care expenditure.[2]

The existence of near universal public coverage reduces the basic need for additional insurance. However, the exclusion of certain health services from the statutory coverage, like specialist or diagnostic outpatient services, drugs, dental care, medical appliances, glasses, alternative medicine, occasional choice of better or faster inpatient care for important interventions (Paccagnella et al., 2008) has led to the development of the private health insurance market. Private health insurance can be offered as a short-term or as a long-term contract, with premiums used to finance health care costs. The norm for private health insurance in the European Union is short-term contracts (typically annual), with roughly €500 premiums (as shown in Table 1).[3] In terms of coverage, roughly a third of the SHARE countries population had private medical insurance in 2004. The benefits however accounted for less than 5 percent of the total expenditure on health in most countries.[4]

As expected, the private insurance market may be affected by adverse selection and moral hazard. For instance, individuals who are unwell benefit more from buying health insurance, and hence they are more willing to buy it. Healthy individuals will opt out, choosing informal

[1] Around 99 percent of the European population is covered by these schemes. The exceptions are Germany and the Netherlands, where people with income above to a certain threshold have to be privately insured.

[2] The exceptions are Switzerland that has a private health care system, compulsory for everyone, and Greece that has a mix of national health, social and private insurance system.

[3] As for the long-term contracts, some insurers terminate contracts when people reach retirement age, but this is more common among group rather than individual policies. In this case, subscribers often have the option of switching to individual policies, sometimes for the same level of benefits and at a reasonable rate.

[4] The outlier is the Netherlands with 87.3 percent of the population covered and 18.1 percent of total health costs covered by formal benefits. This is due to the Dutch higher-earners being completely excluded from statutory cover and covered only by private insurers.

coverage (via family arrangements) or paying out-of-pocket. In Europe however, this effect is strongly mitigated by two factors. First, informal insurance becomes more important with age. As an individual ages and the prevalence of poor health rises, family cohesion generally increases (Hank, 2007) and bequeathable wealth becomes more valuable for informal care provision (Bonsang, 2007). To the extent that formal and informal care are substitutable, informal insurance can considerably reduce the private (formal) insurance demand for sick people. Second, healthy individuals are typically richer and can more easily afford to pay for insurance, whereas the poor face tighter budget constraints. With potentially high premiums to pay, those who would most benefit from private insurance are less likely to buy it. Data regarding the distribution of private health insurance coverage in the European Union confirm that most subscribers come from higher income groups (Thompson and Mossialos, 2009). As a result, Mediterraneans and generally poor Europeans have lower private coverage and rely mainly on informal care (Bonsang, 2007).

Formal insurance can also affect health spending as insured individuals tend to spend more on medical services due to moral hazard. This effect is moderated by the extensive European public health coverage and by the limited access to formal insurance. To this effect, private insurers attempt to prevent moral hazard through higher premiums and 'getting tougher on claims' (Thompson and Mossialos, 2009). They can also delay payments to raise justifiable questions about submitted claims. These practices limit the ability of the poor and sick, who typically have higher morbidity rates, to access private (formal) insurance. Data on the costs-sharing structure in Europe are limited, but available evidence suggests that claims ratios are around 80 percent in most SHARE countries (see Table 1).[5]

Several empirical studies have documented the strong correlation between the amount of care provided via the formal schemes and the care supplied informally by close relatives or neighbors. For instance, Bolin et al. (2008) finds that informal and formal home care are substitutes, while informal care is a complement to doctor and hospital visits. These relationships also differ according to a European north-south gradient: compared to those residing in Italy, Spain or Greece, the negative effect of informal care on formal home care is

[5]The exception is Germany, with very high levels of provisions for ageing (roughly 124%).

significantly lower for Central Europeans and absent for Danish and Swedish. On the other hand, Bonsang (2009) shows that informal care is an effective substitute for long-term care only as long as the needs of the elderly are low and require unskilled type of care.

Informal care can be provided in the form of time and financial transfers given to parents. First, we note that time transfers are much more common than financial transfers. In SHARE, 32.8 percent of the single individuals of age 65 and above receive help in the form of time, which is almost seven times higher than the prevalence of financial help. Moreover, the extended families in Northern and Central Europe are more likely to get involved in giving time assistance to their elderly (34.9 and 33.6 percent respectively), compared to Mediterraneans (29.9 percent). However, the actual time they devote is the same in the north as it is in the south (around 16 hours monthly). Conversely, the prevalence of financial transfers appears roughly twice as high in the Mediterranean (7.7 percent) than in Central Europe (3.6 percent) and Scandinavia (2.8 percent), although the amounts of money actually transferred by Italians or Greeks are slightly smaller.

One reason for the north-south gradient in informal care provision is related to cultural factors that refer to family norms on filial and parental responsibility. The differences in social cohesion between the Mediterranean, Central Europe and Scandinavia have been well-documented. Reher (1998) argues that family ties in the northern and continental countries are generally 'weak', i.e., the elderly do not rely on their children and the youths detach from their parents relatively early. In the southern regions, a 'strong' family cohesion implies children taking care of their parents in old age and intragenerational co-residence. Using SHARE, Kohli et al. (2005) also associates the "weak-strong" dichotomy to a north-south European gradient: the Scandinavian countries are found to have the "weakest" family ties, the Mediterranean countries the "strongest", with all the continental countries in between.

Besides social cohesion, the existing welfare systems have a strong impact on family transfers (Esping-Andersen, 1999). The Nordic countries have a highly developed social protection system, whereas in the Mediterranean countries less welfare is provided through the institutionalized systems. Accordingly, more than 60% of SHARE respondents receive practical help from a child outside the household in Spain, Italy and Greece, compared to less than 45% in the other SHARE countries. In southern countries, help is mostly given within families, while in Sweden, Denmark and partially in the Netherlands, the help tends to take place between households.

Another motive for providing informal care could be related with the strategic effect of future bequests on current informal care provision. Unlike the U.S., succession rules in many European countries prohibit parents from completely disinheriting their children. As a result, more than 80% of the bequests in the SHARE data are transferred within families. Towards the end of their life, the elderly also face relatively low risks of large out-of-pocket health care expenses because of the generous public insurance system. This makes bequeathable wealth more certain, and gives the elderly more leverage to elicit informal care in exchange of the promise of bequest.

All these country-specific factors have a strong impact on the elderly wealth decumulation patterns. Moreover, these patterns are also well known to vary with wealth. As a result, the model will be calibrated and estimated separately for four levels of wealth and three regions: the Mediterranean, Central Europe and Scandinavia.

3 The Model

Preferences. For simplicity, consider a single retired individual[6] that wishes to maximize her expected lifetime utility at time t by choosing current and future level of non-medical and medical consumption. The model consists of a series of one-year periods indexed by t, starting at age 65 when the individual retires and ending with her death (restricted to occur by maximum age 100). In each period there is a stochastic survival probability $s_t \in [0, 1]$. The within-period utility depends on health m_t, non-medical consumption C_t and medical care provided via formal and informal insurance, F_t and I_t respectively,[7]

$$u(m_t, C_t, F_t, I_t) = \delta(m_t)\frac{C_t^{1-\gamma} - 1}{1-\gamma} + \epsilon(m_t)\frac{\left[\alpha_t F_t^{\theta} + (1-\alpha_t) I_t^{\theta}\right]^{\frac{1-\sigma}{\theta}} - 1}{1-\sigma}, \tag{1}$$

[6] This approach allows one to focus on consumption, health insurance and savings decisions without considering choices related to retirement timing or household dynamics.

[7] The face value (or coverage) of a health insurance policy is the total amount payable for medical goods and services if a certain medical condition is verified. Thus, choosing the (insurance-provided) medical consumption is equivalent to choosing insurance coverage.

where $1/\gamma$ and $1/\sigma$ are the intertemporal elasticities for the two types of goods and θ is the substitution parameter between formal and informal care.

Note that medical care directly increases one's well being. However, the utility derived can vary substantially depending on the provider (Byrne et al., 2009). Formal medical insurance can cover for instance more expensive drugs, treatment by specialist or a single room during hospital stays. On the other hand, health care provided by the family, especially at advanced age, addresses mostly long term care and can offer additional benefits to the elderly. For instance, family members can provide emotional support, and they are generally endowed with better information on the elderly's tastes and preferences. By modeling medical consumption as above, it is possible to study these additional elements and to analyze the interactions and complementarities between formal and informal health insurance.

Health status m_t takes four values between 0 and 1, increasing as health improves, as follows: State 1 is death ($m_t = 0$), while State 2 implies some form of long-term care (invalidity or poor health). In State 3 the individual has medical problems but no need for long-term care (fair health), and State 4 is good health ($m_t = 1$).

The terms $\delta_t(m_t)$ and $\epsilon(m_t)$ capture the dependency of utility on health (Palumbo, 1999). As health deteriorates, the marginal utility for non-medical consumption decreases (consumption goods are complements for good health), whereas the marginal utility for medical consumption increases (medical goods are substitutes for good health). Specifically, $\delta_t(m_t)$ determines how a person's utility from non-medical consumption depends on her health status, and is given by

$$\begin{cases} \delta(m_t) = 1 + m_t, & \text{for } \; m_t \neq 0 \\ \delta(m_t) = 0, & \text{for } \; m_t = 0. \end{cases} \tag{2}$$

Therefore, the healthier an individual is, the more she enjoys consumption. Similarly, $\epsilon(m_t)$ captures the need for medical goods, as follows:

$$\begin{cases} \epsilon(m_t) = 1 - m_t, & \text{for } m_t \neq 0 \\ \epsilon(m_t) = 0, & \text{for } m_t = 0, \end{cases} \tag{3}$$

such that being sick has a positive effect on the utility from medical care.

Finally, α_t represents the consumption value of care financed formally relative to that provided by the family. This parameter depends on health $\alpha_t = a \cdot m_t$, and captures the possibility that, in bad health states, individuals may get less utility from care provided formally than informally.

Insurance. The model considers two main insurance schemes:

i) *Formal insurance.* All Europeans 65 or older are eligible for government-provided universal health care. Some choose to further supplement the public plan with private insurance. Private health insurance is financed by risk-rated premiums that vary with the extent of the costs-sharing and with the benefit levels. Generally, the costs-sharing schemes are used to prevent moral hazard. With no form of copayment, individuals will consume more care than if they were to pay for all or some of it. In Europe, however, it has been repeatedly reported that insurers contain costs by increasing premiums and "getting tougher on claims" (Thomson and Mossialos, 2009), rather than by adjusting the copayment schemes. As a result, I model a simplified version of a typical contract. In exchange for paying an annual premium, individuals are eligible to receive a certain level of benefits that will cover a share of their medical costs. For these contracts, the premium exceeds the expected discounted benefits by country-specific loading factors.

The timing is as follows: At the beginning of period $t-1$, the individual chooses the premium f_{t-1}. Next period, depending on the realized health state m_t, the total (public and private) value of the formal insurance coverage is

$$\begin{cases} F_t(f_{t-1}, m_t, C) = \overline{F}_t(m_t, C) + \omega(C) f_{t-1}, & \text{for } 0 < m_t < 1 \\ F_t(f_{t-1}, m_t, C) = 0, & \text{for } m_t \in \{0, 1\}, \end{cases} \tag{4}$$

where $\overline{F}_t(m_t, C)$ is time t health- and country-specific public coverage (i.e., the minimum health care consumption floor in country C) and $\omega(C)$ is the inverse of the country-specific loading factor.[8] This timing prevents individuals from waiting until they receive an adverse

[8] $\omega(C) > 1$ allows for a tax subsidy, while $\omega(C) < 1$ captures the administrative costs or adverse selection.

health shock before rising their insurance coverage.

ii) *Informal insurance.* The informal health insurance I_t represents the value of in-kind and financial transfers that an individual receives from the family. Bonsang (2007) showed that these two types of transfers are substitutes. Thus, the value of in-kind transfers is considered equivalent to what the individual saves by receiving care from the family.[9] The results in Bonsang (2007) also suggest that the parent's age and bad health significantly increase the likelihood of family transfers. On the other hand, the expectation of receiving an inheritance has a dual effect: it significantly increases the occurrence of time assistance, but it slightly decreases the chances of providing financial transfers. As a result, I assume informal insurance to be function of: i) the total bequeathable wealth B_t, ii) the probability of dying before the next period $(1-s_t)$, and iii) a country- and wealth-specific social cohesion coefficient η_t,[10]

$$\begin{cases} I_t(\eta_t, s_t, B_t) = \eta_t(1 - s_t)B_t, & \text{for } 0 < m_t < 1 \\ I_t(\eta_t, s_t, B_t) = 0, & \text{for } m_t \in \{0, 1\}, \end{cases} \tag{5}$$

with

$$\eta_t = \beta_0(1 + \beta_1 * t + \beta_2 * t^2 + \beta_3 * t^3 + \beta_4 * t^4), \;\; \eta_t \in [0, 1], \tag{6}$$

where β_0 is the time-invariant level of family cohesion, while the fourth-order polynomial captures its age-structure. Note that informal insurance offers individuals a strong incentive not to decumulate wealth quickly. As health deteriorates with age, the chance of severe medical conditions and high health costs increases. This boosts the demand for care and the need for insurance in general. Moreover, family cohesion makes bequeathable wealth increasingly valuable (via its impact on informal care). Hence, the model allows for intentional bequests through the strategic motive for care provision.[11]

Unlike formal insurance, the informal market is assumed perfect from the informational

[9] An alternative approach would set the value of hours of care function of the care giver's opportunity cost of time. As a result, in higher income families, time would tend to be substituted for financial assistance. However, Bonsang (2007) found that household income has a very weak negative impact on the quantity of time transfers to parents (e.g., if income doubles, the hours of care decrease only by 5% and the coefficient is only significant at the 10%-level).

[10] It captures the strength of social ties or the social norm on caring for one's elderly parents.

[11] Consistent with De Nardi et al. (2010), this model does not feature purely altruistic bequests.

point of view. In each period, the family (modeled as one unit) knows exactly what states are realized and provides informal care equivalent to a fraction of the elder's wealth. Also, the informal benefits are received each period, but the costs are paid only after one's death. However, since bequests include total wealth (i.e., real and financial), this arrangement does not imply a complete lack of commitment (Bernheim et al., 1985, Venti and Wise, 2004, Chiuri and Jappelli, 2010). The family thus expects the bequest with certainty, which is consistent with the data.

Uncertainty. There are two main sources of uncertainty:

i) *Out-of-pocket medical spending risk.* Out-of-pocket medical spending hc_t is defined as the share of total health costs not covered by insurance (formal and informal), and includes a shock ψ generated via an $AR(1)$ process as follows:

$$hc_t = h(m_t, t, C) - (F_t + I_t) + \sigma_{\varepsilon_t}(m_t, t, a_t, C) * \psi(m_t, t, a_t, C) \geq 0, \text{ for for } 0 < m_t < 1 \quad (7)$$

where $h(m_t, t, C)$ is the deterministic total amount spent on health care in one period and

$$\ln \psi(m_t, t, a_t, C) = (1 - \rho_\psi) \ln \overline{\psi}(C) + \rho_\psi \ln \psi(m_{t-1}, t-1, a_{t-1}, C) + \varepsilon_t, \varepsilon_t \backsim N(0, \sigma^2_{\varepsilon_t}). \quad (8)$$

Note that being in good health implies no medical costs ($hc_t(t, a_t, C|m_t = 1) = h(t, C|m_t = 1) = 0$), whereas death implies that $hc_t(t, a_t, C|m_t = 0) = h(t, C|m_t = 0)$, where $h(C|m_t = 0)$ is the deterministic funeral cost.

ii) *Health risk.* Individuals face heterogeneous health risks,[12] modeled as Markov chains with age-varying one-period state transitions. The one-period ahead transition matrix at age $(65 + t)$ allows current health to depend on previous health, age and wealth, as follows:

$$p_{kj}(t) = \Pr(m_t = j | \, m_{t-1} = k, t, a_t), \quad (9)$$

where k, j represent the four possible health states.

[12] Older people have already shaped their health and lifestyle, but can still choose how to respond to the medical spending risks via savings and insurance.

To capture the age effect, I use an age-adjustment matrix A_t. It shifts probability mass from the left (worse health, death) towards the right (better health), relative to the transitions at age 65 (Ameriks et al., 2005),

$$A_t = \begin{bmatrix} 1 & 0 & 0 & 0 \\ c_1 t^e & 1 - c_1 t^e & 0 & 0 \\ c_1 t^e \frac{1}{1+c_2} & c_1 t^e \frac{c_2}{1+c_2} & 1 - c_1 t^e & 0 \\ c_1 t^e \frac{1}{1+c_2+c_2 c_3} & c_1 t^e \frac{c_2}{1+c_2+c_2 c_3} & c_1 t^e \frac{c_2 c_3}{1+c_2+c_2 c_3} & 1 - c_1 t^e \end{bmatrix}. \tag{10}$$

The three parameters c_1, c_2 and c_3 control how fast this shift occurs: c_1 controls the transition from invalidity to death as age increases, c_2 determines how much more likely is death relative to invalidity when in fair or good health and c_3 determines an individual's chance to persist in good health. Due to significant differences in wealth- and country-level mortality and morbidity, c_1, c_2 and c_3 will be estimated separately for each wealth- and country-group.

Besides age, previous health, wealth and country, one could also account for the impact of education on health transitions. Avendano et al. (2009) finds however that education is not significantly associated with transitions to or out of (long-term) illness. As for disability, switching from primary school to postgraduate levels matters only in Central Europe and the Mediterranean, and only for transitions into this state (not out of it). The relative association between education and health also diminishes with age (Huisman et al., 2005a) and even disappears after retirement (due to stable incomes and universal insurance coverage). Since the focus is on retirees, not accounting for education at this stage seemed reasonable.

Timing of the model. At the beginning of the period, the individual has wealth a_t, receives the pension y_t and pays the premium f_t (to access next period's formal private coverage). Then, the health shock is realized. If she is alive and healthy, she consumes and saves. If in fair or poor health, medical costs are incurred, insurance transfers are received, she consumes and finally saves. If she does not survive the next period, funeral costs are paid and the remaining wealth is transferred as bequest.

Budget constraint. Assuming there is one composite riskless asset in which a household can invest and which yields a constant interest rate r, the next period's wealth is given by

$$a_{t+1} = (1+r)a_t + y_t - f_t - hc_t - C_t. \tag{11}$$

Wealth must satisfy the borrowing constraint $a_{t+1} \geq 0$, which eliminates the possibility that individuals die in debt. Given the medical spending timing, an individual with very high health costs currently could still have zero net worth in the next period. Note that the borrowing constraint includes the out-of-pocket medical expenses, assumed to be realized at the beginning of the period, after health and medical spending shocks are realized. This assumption is reasonable given that time-t medical spending risk is not completely unknown[13] when individuals decide to maintain their formal or informal health insurance or not.

Recursive framework. The individual chooses the optimal medical and non-medical consumption paths to maximize the value function

$$V_t(m_t, \psi_t, f_{t-1}, a_t) = \underset{C_t, f_t}{Max} \left\{ u(m_t, C_t, F_t, I_t) + \beta s_t E_t \left[V_{t+1}(m_{t+1}, \psi_{t+1}, f_t, a_{t+1}) \right] \right\}. \tag{12}$$

with discount factor $\beta > 0$, subject to: i) an initial level of wealth and formal health insurance; ii) the wealth accumulation equation (11) and iii) the no-borrowing constraint. An individual's decision depends on her state variables, $\boldsymbol{\nabla}_t = (m_t, \psi_t, f_{t-1}, a_t) \in \mathbb{R}^4_+$, and the overall set of parameters, $\phi = (\sigma, \gamma, \theta, a, \beta, \rho_\psi, \sigma_{\varepsilon t}, c_{i=\overline{1,3}}, \beta_{j=\overline{0,4}}, \overline{F}, \omega, h, \overline{\psi}, e, r) \in \mathbb{R}^{21}$.

By discretizing the state variables, I solve for the optimal medical and non-medical consumption path iteratively from the final period ($T = 36$) backwards. In the last period, the decision is trivial, with the individual consuming and transferring the remaining wealth as bequest. Each period, the individual indirectly decides how much to informally insure via the amount she leaves as a bequest. She does so by directly choosing consumption and formal premium, whereas the family provides informal care according to the cohesion measure η_t. The solution is found in two steps. The first step consists of finding the set of rules for consumption $\{C_t(\boldsymbol{\nabla}_t, \phi)\}$, and formal premium $\{f_t(\boldsymbol{\nabla}_t, \phi)\}$. Optimality requires

[13] Due to its $AR(1)$ stucture.

$$C_t^{-\gamma} = \beta s_t(1+r)E_t\left[\frac{(1+m_{t+1})}{(1+m_t)}\frac{(1-\eta_{t+1}(1-s_{t+1}))}{(1-\eta_t(1-s_t))}C_{t+1}^{-\gamma}\right]. \tag{13}$$

Unlike consumption, formal premium does not have a closed-form solution, but it also depends on both current and expected future health. Inserting the decision rules for $\{C_t(\mathbf{\nabla}_t, \phi)\}$ and $\{f_t(\mathbf{\nabla}_t, \phi)\}$ into the wealth accumulation equation yields the next period's wealth, $\{a_{t+1}(\mathbf{\nabla}_t, \phi)\}$, for all the values that compose the grid of the previous period premium, f_{t-1}. Using these optimal values for wealth in the second step, the value function is maximized and the optimal $\{C_t(\mathbf{\nabla}_t, \phi)\}$ and $\{f_t(\mathbf{\nabla}_t, \phi)\}$ are found.

4 Data

The estimation uses the SHARE data, a cross-national microeconomic database that contains household-level information on health, socioeconomic status and social and family networks of individuals age 50 and over. SHARE's first wave was conducted in 2004 in eleven countries representing the main three regions in Europe: Scandinavia (Denmark and Sweden), Central Europe (Austria, France, Germany, Switzerland, Belgium, and the Netherlands) and the Mediterranean (Spain, Italy and Greece). The total sample included 28,853 observations, out of which 4,564 refer to 65+ single individuals.

The three variables of interest are: i) total net worth in 2004 PPP adjusted Euros (wealth henceforth), ii) total expenditures on non-durables (consumption henceforth), and iii) annual voluntary (supplementary) private insurance premium (premium henceforth). Wealth represents the value of all financial and real assets, plus yearly income flow (i.e., pensions, capital income), net of any debts and liabilities (i.e., loan repayment, mortgage, taxes). To insure cross-country comparability, I follow Browning et al. (2003) and calculate consumption as the sum of the amount spent on food (at home and outside home) and on phone bills, adjusted by country-specific weights. These weights represent OLS coefficients of a regression of total non-durable consumption on a subset of household expenses (i.e., groceries, eating out, phone bills and other utilities, transportation, clothing, entertainment, etc) using national expenditure survey data. I use the ISTAT survey for Italy, Spain and Greece, and the Dutch Consumption Survey for the rest of the countries. Finally, the missing values for the premium are imputed using the coefficients of age, health, wealth, consumption and number of children from an OLS regression on the existing premium data.[14]

I further exclude individuals with missing or negative wealth (due to no-borrowing constraint), with negative consumption and with wealth less than consumption of food at home or outside home or phone bills, which results in 2,425 observations.

The question on the amount spent on premium was asked only in the 2004 wave, which is restricting the available data to a cross-section. In order to obtain life-profiles, I follow several steps. First, for every region I group individuals into four wealth categories, as follows: i) below the 1st wealth quartile, ii) between the 1st and the 3rd wealth quartile, iii) above the 3rd wealth quartile, and iv) equivalent to the sample mean wealth (representative agent). Second, for each of the first three wealth-groups, I re-create individual life-profiles by taking the mean wealth, consumption and premium values at each age. Each profile was then double smoothed using a five year moving average filter.

There are two main problems with constructing life-profiles (over time and by wealth) using cross-sectional data. First, there is the general issue of wealth and mortality bias. Due to technical progress, individuals from earlier birth cohorts appear poorer at every age (wealth bias). As in De Nardi et al. (2010), endowing a simulated individual with a certain age, wealth and premium from the data distribution will recreate the wealth bias in the simulation. Also, advanced age observations are more biased towards rich, who live longer and hence run down their wealth slowly (mortality bias). To assess the magnitude of the mortality bias, I use the recently available second wave SHARE data that took place in 2006-2007. Figure 1A plots the median and mean wealth profiles of all individuals interviewed in 2004 (solid line) versus the corresponding profiles of those who survived to 2006 (dotted line). A quick glance shows that the people who died between the two waves were not significantly or systematically poorer than the survivors (i.e., wealth differences are registered only for few age groups and there is no systematic bias when the profiles are indeed different).[15] The

[14] The imputation affected 66.5% of the whole sample of individuals reporting both wealth and consumption. Alternative specifications were explored, but the one implemented fitted best the existing data.

[15] One might argue that this is due to the low mortality rates in the two years between the waves (5.8%

same conclusion is reached when looking at Figure 1B, which reproduces the mortality bias figure in De Nardi et al. (2010) for the SHARE data. It plots the median wealth profiles by birth cohort over the two years between waves, giving a measure of the decumulation over that period. The solid line plots the median wealth of the 2004 unbalanced sample, while the dotted line plots the median wealth of individuals who survived to 2006. Note that again wealth discrepancies appear only for a limited number of age groups and are quite small relative to the wealth scale of either of the two samples.[16]

The second potential issue with using cross-sectional data to construct life-profiles by wealth arises if one's wealth relative to others changes over time. For example, someone who starts with a high wealth at retirement might receive a series of negative shocks and ends up, say, in the lowest quartile. To rule this out, I use the 2006 SHARE data to check the extent to which the individual relative position in the wealth distribution changed between the first and second wave. I found that only a small fraction of respondents decumulated to the extent of actually changing their wealth quartile.[17] This is not surprising since wealth includes illiquid assets and their value remained on average fairly stable over the two years between waves.[18]

5 Calibrations and Estimation Methodology

The life-cycle literature based on European data is quite limited and the institutional differences are potentially significant. Therefore, I estimate most of the model parameters for each wealth- and country-group separately, and calibrate only those parameters that appear as instruments for the dynamic programming model (Gourinchas and Parker, 2002; Cagetti, 2003; French and Jones, 2011). The grid and the initial level of wealth, consumption and formal insurance are set to match the data. The real risk-free asset return is $(1 + r) = 1.04$,

in the Mediterranean, 3.4% in Central Europe, 3.5% in Scandinavia). Even with low mortality however, if wealth differences between survivors and deceased were high, the profiles should have been more diverse.

[16] The mean wealth discrepancy in the unbalanced vs. the balanced sample represents 4.8% (the Mediterranean), 6.1% (Central Europe) and 4.2% (Scandinavia) of the mean survivors wealth, and 4.9% (the Mediterranean), 6.9% (Central Europe) and 4.3% (Scandinavia) of the mean wealth of all first wave respondents.

[17] The share of respondents that changed their wealth quartile was 15.4% in the Mediterranean, 16.2% in Scandinavia and 12.5% in Central Europe.

[18] There has even been a slight appreciation of the housing market in Spain, Netherlands and partially in Greece.

[19] e is set to 1.5, and the loading factor ω matches the country-specific administrative costs of insurance (Comino, 2003). For each European region, the public insurance coverage $\overline{F}$ is set to the mean 2004 level of: i) public curative and rehabilitation (CR henceforth) expenditure per capita, if in fair health; ii) public long-term care (LTC henceforth) expenditure per capita, if in poor health. Similarly, the exogenous total medical spending h matches the country-specific 2004 level of: i) total CR costs per capita, if in fair health; ii) total LTC per capita, if in poor health; iii) funeral costs, if dead (Bjornerud et al., 2005).[20] Since $\overline{F}$ and h represent absolute per capita amounts (OECD, 2006), they are further adjusted to account for the Eurostat (2012) share of population reporting good or fair health (for CR costs) and bad or very bad health (for LTC costs). Finally, the parameter $\overline{\psi}$ is set to match the OECD 2004 PPP adjusted total expenditure on health per capita.

The aim of the analysis is to explain the dissaving pattern, as well as the formal and informal insurance decisions in old age. Hence, I match total wealth, consumption and premium profiles, conditional on age, wealth- and country-group. To compute the optimal choices, I use the Gauss-Hermite quadrature method to discretize the state space of the shocks. I solve the model numerically by backward induction and simulate wealth, consumption, formal premium, health and medical spending histories for $N = 20$ artificial individuals,[21] using Monte Carlo draws for the two stochastic variables. For each artificial profile, I compute the set of moments shown in Table 2 conditional on the initial values of the state variables $\boldsymbol{\nabla}_0$ and on the parameters $\phi' = (\sigma, \gamma, \theta, a, \beta, \rho_\psi, \sigma_{\varepsilon t}, c_{i=\overline{1,3}}, \beta_{j=\overline{0,4}}) \in \mathbb{R}^{15}$. Finally, parameters are chosen to minimize the difference between these artificial moments and their empirical counterparts.[22] The goodness of fit between the two series is assessed by a χ^2-test statistic or corresponding $p-value$. This statistic assesses whether or not the true data moments (m_T) are equal to the realized data moments ($m_n(\boldsymbol{\nabla}_0, \phi')$, $n = \overline{1, N}$), given the stochastic processes for which the true time series is only one realization. Analytically, as $T \to \infty$, keeping the

[19] The average long-term interest rate in 2004 for the Mediterranean countries was 4.2 percent, for Central Europe 3.9 percent and for Scandinavia 4.4 percent (OECD Statistics 2010, Key Economic Indicators).

[20] Further details on funeral costs are in Appendix A.

[21] Note that setting $N = 20$ allows allows one to capture the sample variability, while still satisfying the condition $N \geq \overline{T}$, where $\overline{T}$ is the model's average number of periods ($\overline{T} = 20$).

[22] In practice, the minimization of the SMM estimator is done by grid search, with each parameter taking different values.

number of random sequences fixed, if the weighting matrix W is chosen optimally, then

$$J_T = \arg\min_{\widetilde{\phi}'} \left[\left(m_T - \frac{1}{N}\sum_{n=1}^{N} m_n(\boldsymbol{\nabla}_0, \widetilde{\phi}') \right)' \widehat{W} \left(m_T - \frac{1}{N}\sum_{n=1}^{N} m_n(\boldsymbol{\nabla}_0, \widetilde{\phi}') \right) \right],$$

and

$$T \left[\left(m_T - \frac{1}{N}\sum_{n=1}^{N} m_n(\boldsymbol{\nabla}_0, \widetilde{\phi}') \right)' \widehat{W} \left(m_T - \frac{1}{N}\sum_{n=1}^{N} m_n(\boldsymbol{\nabla}_0, \widetilde{\phi}') \right) \right] \rightarrow \chi^2(j-k),$$

where j is the number of moments, k is the number of estimated parameters and $\phi' \in R^k$ is the unknown parameter vector.[23]

6 Results

For each wealth quartile and region, Tables 3-5 show the parameters estimates, whereas Tables 6-8 in Appendix present the simulated and empirical moments. A quick glance shows that the estimates are economically reasonable across models and that the models fit quite well. The goodness of fit between the simulated and the actual moments is assessed by a χ^2-test or the corresponding p-value. In most cases, the model easily passes the χ^2-test, with χ^2 values well below the 1 percent critical value of 11.345. Thus, we are unable to reject the null hypothesis that the simulated and the actual moments are the same at standard significance levels.

6.1 Data profiles

Figures 2-5 display the simulated and the real profiles of the decision variables, together with 95 percent confidence intervals.[24] In each of these figures, the charts in the first three columns plot wealth, consumption and formal premium, respectively. Note that the simulated profiles

[23] The standard errors of the parameters are obtained using the Newey and West (1994) weighting matrix W and the first order derivatives of the moments conditions with respect to each parameter: $se = \frac{1}{\sqrt{T}}(DW^{-1}D')^{-1}$ with $D' = \underset{T}{plim}\left\{ \left. \frac{\partial\left[m_T - \frac{1}{N} m_N(\nabla_0, \phi')\right]}{\partial \phi'} \right|_{\phi' = \widetilde{\phi}'} \right\}$.

[24] Any missing values in the actual profiles are obtained by linear interpolation within the grid. With non-linear decision rules, extrapolation (for ages beyond the last age reported) proved less reliable than did interpolation. Hence, I extrapolate to age 100 using the mean relative growth rate of the variables in the last 15 years.

generally resemble the real ones quite well (especially for the wealth-specific models), which is remarkable given that the latter came from cross-sectional data. The only exception is the Scandinavian countries: for the top wealth group and the representative agent, the wealth and consumption profiles appear more volatile than the corresponding profiles in the other two European regions. The reason is that in 2004, Denmark and Sweden also interviewed institutionalized individuals, while in the other SHARE countries nursing homes were excluded by sample design. Therefore, the Scandinavian profiles are quite different with respect to the Mediterranean and Central European ones.

Unsurprisingly, wealth appears extremely heterogeneous both across and within the three European regions. It increases from South to North and, regardless of the region, both the empirical and the simulated profiles show slow decumulation in older age. For instance, rich Scandinavians have about €655,000 at age 70, and end up running down their savings by 12.3 percent by age 90. Similarly, poor 70 years old Mediterraneans have roughly 15 times less than their rich Scandinavian counterparts, but will keep only a third of this wealth 20 years later. This decumulation pattern implies that the rich elderly are dissaving more slowly than the poor, which complements the findings of Dynan et al. (2004) and De Nardi et al. (2010) on the U.S.

Since wealth finances consumption, most of the simulated and actual consumption profiles also fall slowly during retirement (with certain exceptions for Scandinavian countries, as discussed above). These profiles confirm Banks et al.'s (1998) findings suggesting that old-age consumption falls with age: as individuals age, their life expectancy falls and they allocate less wealth for future consumption (since they are less likely to benefit from it). Thus, the decline in consumption is also faster for individuals with higher mortality rates.

As for the formal premium profiles, they appear slightly increasing in all models throughout the age of 90, after which they fall. Indeed, if insurance reduces health cost volatility, risk averse individuals may value health insurance at well beyond the cost paid. As a result, they will maintain and even slightly increase their insurance coverage. At advanced ages however, they may value formal insurance differently, conditional on the availability of informal insurance.

6.2 Medical Spending and Health Status

Health costs can impose a significant financial burden on individuals and families, especially at advanced ages. However, the European public insurance system extensively covers prescription drugs and doctor visits, as well as inpatient and outpatient care. As a result, for the current sample, the out-of-pocket mean medical expenses are €425 with a standard deviation of €1,190. The out-of-pocket spending profiles are shown in the last column of Figures 2-5. Interestingly, even if the models did not specifically fit this variable, a quick glance shows that the simulated and actual data profiles are quite similar.[25]

As expected, health costs for the elderly significantly increase with age, as health worsen over time. Their persistence however, at any wealth level, appears to be lower in the Scandinavian countries, compared to the rest of Europe. The rationale is twofold. First, few Scandinavians remain in the highest-cost categories for more than one year. Second, the high mortality rates of the Scandinavians (who use medical services heavily) limit the extent of expenditure persistence.

This finding is replicated within each region, as the wealth-specific estimates indicate that health costs persistence is significantly weaker for the rich compared with the poor, except for Scandinavians. The reason lies in the health status dynamics. In Southern and Central Europe, the poor experience the worst health with age, but also have high life expectancy. With high expenditures in one year, they are likely to have above-average expenditures in other years. In Denmark and Sweden on the other hand, the poor and the rich have almost the same (small) health costs persistence. This is due to the extensive health system that makes the persistence gap between the rich and the poor smaller.

Since the poor can afford to pay less than the rich, their out-of-pocket medical spending will tend to be less volatile and this holds true in each of the three European regions. On the same principle, the variation in health spending is higher for Scandinavians (0.1097) than for the Mediterraneans (0.0739). However, given the national health care systems coverage of some Central European countries (like for example Germany), it is not surprising that the

[25] The out-of-pocket health costs data has not been smoothed or extrapolated, thus the high volatility of the real profiles is not surprising.

lowest health costs variation (0.0263) is registered in this region.

Finally, the level of medical spending is strongly correlated with health status. Figure 6 plots selected health transition profiles by wealth quartile and region. A quick analysis reveals the expected age-dependent health decline (see the top charts in Figure 6), but an unexpected north-south gradient in Europe. Overall, it seems that while maintaining good health becomes less possible as one ages in all three regions, the Mediterraneans register the most elevated morbidity rates in Europe. These profiles are confirmed by several other SHARE health indicators (e.g., self-perceived health, long-standing health problems, daily activity limitations) that point to worse health in the South than in the North (Avendano et al., 2005). Interestingly, these high morbidity rates do not translate into low life expectancies for the Mediterraneans. Although Mediterraneans are sicker, the bottom right chart in Figure 6 shows that Scandinavians and Central Europeans generally die faster.

To illustrate these dynamics in more detail, consider first the Mediterraneans. The three charts in the first column of Figure 6 plot the probability profiles of maintaining good health, becoming invalid or die if in good health, respectively for this region. Results show that the probability of death within the next year for a healthy individual rises roughly from 0.2 percent at age 65 to 3.6 percent at age 100. Moreover, invalidity appears to be quite persistent: being a 70-year-old in poor health implies a 55.6 percent chance of remaining in poor health next year. This probability falls with age, as the survival probability decreases. As expected, at each age, the rich are more likely to maintain or return to good health and less likely to die than are the poor.

This health gap between rich and poor is almost not significant in Central Europe (see the second column of charts in Figure 6), which complements the finding on health costs volatility. However, when comparing healthy poor Mediterraneans to their Central European counterparts, I find the latter to be roughly 10 percent less likely to become invalid and around 69 percent more likely to die than the former.

Turning finally to Scandinavians, it is interesting to note that the death probability if healthy, although it starts fairly close to what the other two regions register (roughly 0.2 percent at the age of 65), it quickly rises with age (15 percent at 100). Interestingly, this probability is considerably higher than in the Mediterranean (3.6 percent) or Central Europe (4.2 percent). As expected, persisting in good health is less likely as age increases, but the poor do so at an average rate of only roughly 2 percent lower than the rich.

6.3 Social cohesion

The morbidity and mortality estimates presented above are consistent with the real trends observed in Europe. They however contradict the expected outcome of longer (and healthier) life for Central and North Europeans, who benefit of more generous and efficient health care systems than do Italians, Spanish or Greeks. Also, the results did not display a strong health gradient by wealth, which challenges the belief that poor are considerably more likely to die than are the rich.

These discrepancies can be explained, among other factors, by social cohesion. Figure 7 plots the relative cohesion coefficients by wealth quartile and region. The estimates confirm two crucial social literature findings (Reher, 1998; Kohli, 2005) on social cohesion: i) it rises with age and decreases with wealth, and ii) the 'map' of family ties displays a north-south gradient, i.e., Central and Northern Europeans have relatively weak family ties, while the Mediterraneans show much stronger cohesion.

These findings are well mirrored by the health profiles. First, despite significant wealth differences, the poor generally appear to be only slightly more likely to die than the rich, although these differences are somewhat higher in Denmark and Sweden. Second, among Europeans, the Mediterraneans have both the highest chances to have medical problems and the lowest probability of dying. Both results are supported by family ties estimates: poor rather than rich and Mediterraneans rather than Central Europeans or Scandinavians display stronger social ties. High family cohesion seems therefore typically associated with higher life expectancy and vice-versa.

7 The Drivers of Wealth Decumulation

In this section I perform several counterfactual experiments to evaluate the effect of different factors on the elderly wealth decumulation patterns. Specifically, I considered how wealth would have changed over time had the individuals i) maintained their initial (65-years-old) health status throughout their life (referred to as "No Health Shock" scenario); ii) experienced no out-of-pocket medical spending risk ("No OOP Shock" scenario); iii) not had access to formal insurance ("No Formal Insurance" scenario), iv) not had access to informal insurance ("No Informal Insurance" scenario), and v) placed no value on insurance-provided medical care (i.e., utility is defined solely over consumption, "No Value for Insurance" scenario). Figure 8 plots wealth for the representative agent model in each of these scenarios. Every simulation modifies certain parameters, solves the model numerically and generates the corresponding wealth profiles. The issue is how wealth in each scenario compares with the wealth profile generated by the baseline model ("Baseline" scenario).[26]

Consider first the left charts in Figure 8. The wealth profile labeled "Baseline" and shown in solid is the one generated by the *representative agent* baseline model. The dashed lines referred to as "No Health Shock" show how wealth would have evolved had individuals remained at their initial level of health. Note that in the absence of health risks, the retirees would have run down their assets significantly faster: Mediterraneans would have saved on average roughly 40 percent less, while Central Europeans and Scandinavians would have conversely kept only around 40 percent of what they would have otherwise saved. The reason for this decumulation is that health deteriorates with age. As a result, keeping health constant will make medical goods less needed and diminish the incentive to save for their (formal or informal) future provision.

Second, completely cancelling out the out-of-pocket risks had almost no effect on wealth. A quick glance at Figure 8 reveals that wealth in the "No OOP Shock" scenario (as shown by the dotted line in the left charts of Figure 8) almost perfectly coincides with "Baseline" wealth. This complements the results in Palumbo (1999) and De Nardi et al. (2010), which find eliminating the health expense risk to have only a very small impact on the asset profiles for U.S. elderly.

[26] Note that all scenarios rely on the implicit assumption that individuals can frictionlessly extract their home equity. An alternative approach would be to conduct the analysis for renters and homeowners, separately. However, the vast majority (85%) of old Southern Europeans own their houses, making the sample size of renters too small to warrant such an analysis.

Next consider the scenarios presented in the right charts in Figure 8. The dotted and dashed lines plot the wealth profiles obtained by shutting down the formal and informal insurance, respectively. According to the simulations, wealth would have been significantly or dramatically lower in all three European regions had individuals not benefit from formal insurance coverage. Without this type of insurance, individuals have no incentive to save for this type of goods and this induces them to decumulate their wealth more rapidly. However, both the magnitude and the shape of the profiles are different across regions. On the one hand, formal insurance generally seems to matter more in the Northern and Central Europe than in the South. For instance, having no access to formal insurance will make Mediterraneans dissave up to 33 percent of their wealth by age 70, but only 20 percent at age 90. These figures are small compared to the decumulation effect for the other Europeans: wealth at age 70 appears 45 and 76 percent lower that the baseline wealth for Scandinavians and Central Europeans, respectively. Moreover, by age 90, the former will be left with only 36 percent of the wealth they would have otherwise had, while the latter will retain only 46 percent. On the other hand, wealth becomes more valuable for the provision of informal care as one grows old, and so, individuals will slightly increase their savings. The exception is the Mediterranean, where individuals start to increase their savings toward the middle of the life-cycle. This is not surprising however given that they rely significantly on informal care and much less on formal services.

The findings of the fourth scenario, "No Informal Insurance" appear to complement the previous ones. We immediately note that the absence of informal care also has a negative effect on wealth in old age. This effect is more accentuated in the Mediterranean, where the lack of incentive to keep wealth for informal care reasons induces individuals to hold significantly less wealth (roughly 53 percent on average). As expected, informal care matters less for Central Europeans, who experience a relatively milder drop (by 38 percent compared to the baseline), while the minimum effects are registered in Scandinavia for most of the life cycle span (around 5 percent decrease on average by age 88 and 34 percent if above 88).

The last two scenarios provide a clear picture of the relative weight attached to formal versus informal care in shaping wealth profiles in Europe: formal insurance to matter more in

Central Europe and Scandinavia, while informal care is more important in the Mediterranean. However, one might ask to what extent the results are driven by one's well-being depending on the (insurance-provided) medical goods. To check this, one interesting experiment to run completely removes the insurance-provided medical good and define utility solely over consumption. The circle solid lines labeled "No Value for Insurance" in the right charts in Figure 8 consider this scenario. Unsurprisingly, if individuals place no value on the formal or informal insurance-provided health care, the wealth profiles would be significantly lower than the baseline. Specifically, the simulations for the Mediterranean, Central Europe and Scandinavia produce roughly 58 percent, 55 percent and 66 percent lower wealth profiles compared with the baseline value, respectively. All in all, for all three regions, formal and informal insurance appear to be key decision variables in old age, with direct spillover to saving rates.

8 Conclusions

This paper presents a life-cycle model that considers the effects of both health and medical spending risks on the insurance and savings decisions of retired single households. Health insurance can be provided formally by the market and informally by the family. Formal insurance contracts may be affected by asymmetric information problems, whereas informal insurance depends on social cohesion and bequeathable wealth. Using SHARE data and the SMM, the model is estimated for four levels of wealth and three European regions and provides several interesting results.

First, counterfactual experiments show that health risks, as well as formal and informal health insurance are crucial determinants of the slow wealth decumulation. The magnitude of their impact however differs by level of wealth and region. For instance, the absence of formal insurance has a relatively small effect on Mediterraneans, but it makes the other Europeans significantly run down their assets to pay their medical costs. Conversely, without the informal insurance, wealth will generally drop considerably, more rapidly though for the Mediterraneans than for the Scandinavians.

Second, the model provides the first estimates on medical spending persistence and volatility for Europe. It also captures the increase of out-of-pocket medical costs with age, and shows that medical spending risks have almost no effect on dissaving.

Third, the morbidity and mortality profiles by wealth and region fit well the existing trends. As expected, health deteriorates with age throughout Europe and Scandinavians have lower morbidity rates than Southern Europeans, due to their wide and efficient health system. Interestingly, the latter however register the highest life expectancy, which confirms the north-south health gradient reported in Europe.

Fourth, results show that life expectancy is positively associated with social cohesion: people with informal support appear to live longer than those without it, and this is especially true for those in poor health. This finding confirms the commonly-observed tendency, particularly in Southern Europe, of substituting professional care for family care if possible. As a result, morbidity rates increase, but life expectancy rises also.

This paper provides an initial exploration into the determinants of the savings behavior of the elderly Europeans. Clearly, further work is needed to help resolve the puzzle of retirement savings. To this effect, in ongoing work, Dobrescu and Iskhakov (2012) explicitly model the strategic interaction between parents and children. The work provides a richer framework for understanding the decumulation patterns observed in old age by considering additional elements related to income and education, and modeling time and money transfers separately to capture the differential role of bequests in the provision of care.

TABLES AND FIGURES

Table 1. Formal Insurance in Europe

Country	Formal Sector								Informal Sector#			
		Public Sector		Private Sector					Money		Time	
	Average Health Care Expenditure per Capita (€)	Public Expendi-ture+	% of Population Covered by Public Insurance	Private Medical Insurance+	Average Premium per Insured (€)	Benefits paid+	Claims Ratio§	% of Population Covered by Private Insurance	% of Individuals Receiving Transfers from Family	Median Amount from Family (€)	% of Individuals Receiving Transfers from Family	Median Hours of Care from Family (€)
Austria	2,658	73.8%	98.0%	3.2%	529	4.5%	86%	31.1%	6.0%	800.0	32.2%	15.0
Belgium	2,639	75.6%	99.0%	4.9%	119	1.7%	94%	44.1%	1.5%	1250.0	41.0%	9.0
Switzerland	4,527	58.5%	100.0%	8.7%	2,370	8.7%	76%	22.9%	5.9%	651.8	23.7%	11.0
Germany	2,723	73.4%	89.8%	9.3%	1,087	9.3%	124%	29.6%	3.8%	500.0	36.9%	18.0
Denmark	3,166	84.1%	100.0%	1.5%	n.a.	6.6%	n.a.	n.a.	2.2%	1344.3	31.7%	10.0
Spain	1,565	70.1%	99.5%	5.9%	373	4.5%	76%	25.6%	5.5%	1100.0	22.1%	19.0
France	2,317	78.5%	99.9%	13.2%	451	3.1%	79%	21.9%	2.1%	1500.0	34.9%	9.0
Italy	1,921	75.0%	100.0%	*(2006) 0.9%	n.a.	1.0%	80%	*(2006) 6.1%	0.8%	500.0	23.4%	13.0
Netherlands	2,321	70.1%	71.2%	13.2%	590	18.1%	83.3%	87.3%	2.4%	1000.0	32.6%	11.0
Greece	^1,608	^61.8%	100.0%	*(2002) 1.6%	n.a.	n.a.	n.a.	*(2002) 12%	16.8%	800.0	44.1%	16.0
Sweden	2,837	82.3%	100.0%	*(2006) 0.3%	417	0.1%	n.a.	1.9%	3.3%	762.5	38.0%	22.0

+ As percent of total health care expenditure. § As percent of premium.

Sources: CEA Statistics No. 41: The European Health Insurance Market in 2008, ^ OECD Health Data: Health expenditure and financing,

* Thomson and Mossialos (2009), # Share 2004 data (singles, age 65+, transfers received monthly)

Table 2. Choice of Moments

$\overline{a_t}$, $\sigma_{\ln(a_t)}$,	$\sigma_{\ln(F_t)}$,	$corr(a_t, f_t)$,	$corr(C_t, \frac{C_t}{a_t})$,	$corr(C_t, C_{t-1})$,
$\overline{C_t}, \sigma_{\ln(C_t)}$,	$\sigma_{\ln\left(\frac{C_t}{a_t}\right)}$,	$corr(a_t, \frac{C_t}{a_t})$,	$corr(f_t, \frac{C_t}{a_t})$,	$corr(F_t, F_{t-1})$,
$\overline{F_t}$, $\overline{C_t/a_t}$,	$corr(a_t, C_t)$,	$corr(C_t, f_t)$,	$corr(a_t, a_{t-1})$,	$corr(\frac{C_t}{a_t}, \frac{C_{t-1}}{a_{t-1}})$.

Table 3. Parameter Estimates, Mediterranean Countries

Param.	*< 1st Quart.*	*1st − 3rd Quart.*	*> 3rd Quart.*	*Repr. Agent*
σ	0.6946	1.3464	1.0709	1.8785
	(0.8982)	(1.1811)	(0.4133)	(0.7146)*
γ	5.5137	5.8465	4.0661	2.9278
	(0.0147)***	(0.9700)**	(0.6272)**	(0.4467)**
θ	3.1228	1.0033	0.6162	1.7264
	(0.0799)***	(0.0423)***	(0.5004)	(0.3524)
a	1.5138	1.3360	1.3514	0.0105
	(1.4933)	(0.2382)**	(1.4761)	(0.0022)*
β	0.7889	0.9206	0.9662	1.0038
	(0.1701)*	(0.0055)***	(0.1996)*	(0.3089)*
ρ_ψ	1.6056	1.9182	1.0179	1.2923
	(0.00001)***	(0.00001)***	(0.00001)***	(0.0098)***
σ_{ε_t}	0.0991	0.0942	0.1368	0.0739
	(0.00001)***	(0.2012)	(1.1293)	(0.0140)**
c_1	0.0001	0.0002	0.00003	0.0001
	(0.0062)	(0.0779)	(0.0075)	(0.0001)**
c_2	0.9481	0.2792	0.1810	0.3168
	(0.00001)***	(0.00001)***	(0.0001)***	(0.0021)***
c_3	$1.7*10^{-5}$	0.0001	0.0002	0.0002
	(0.0011)	(0.0387)	(0.0488)	(0.0013)
β_0	0.0247	0.0839	0.1210	0.1558
	(0.0424)	(0.3093)	(0.1055)	(0.0223)**
β_1*10^{-2}	0.0621	0.0513	0.0779	0.0503
	(0.0949)	(0.0283)	(0.0708)	(0.0192)*
β_2*10^{-4}	0.0005	0.0007	0.0016	0.0018
	(0.0023)	(0.00001)***	(0.0007)	(0.0001)***
β_3*10^{-4}	0.0004	0.0020	0.0020	0.00387
	(0.0001)*	(0.0071)	(0.0023)	(0.0025)
β_4*10^{-8}	0.0052	0.0029	0.0141	0.0046
	(0.0031)	(0.0017)	(0.0040)*	(0.0009)*

Standard errors are in parentheses. (*), (**), (***) indicate significance at 10%, 5% and 1%.

Table 4. Parameter Estimates, Central European Countries

Param.	$< 1st$ *Quart.*	$1st - 3rd$ *Quart.*	$> 3rd$ *Quart.*	*Repr. Agent*
σ	0.6947	1.0709	2.4285	1.9285
	(1.4977)	(1.9219)	(0.0307)***	(0.0821)***
γ	5.5140	4.0661	4.7152	4.7152
	(0.7353)**	(0.5555)**	(0.0587)***	(0.0848)***
θ	3.1228	0.6142	1.0117	1.0117
	(8.8873)	(5.2805)	(0.0096)***	(0.0537)**
a	1.5135	1.3514	0.1898	0.1898
	(5.3659)	(9.0734)	(0.0033)	(0.0047)***
β	0.8890	0.9904	0.9237	0.9179
	(0.4386)	(1.4421)	(0.0339)***	(0.0850)**
ρ_ψ	1.8124	1.5202	0.6173	0.6080
	(0.0001)***	(0.00001)***	(0.0147)***	(0.00001)***
σ_{ε_t}	0.1026	0.1382	0.2263	0.0263
	(8.2386)	(0.00001)***	(0.0009)***	(0.0019)**
c_1	0.0001	0.0002	0.0001	0.0002
	(0.4771)	(0.0636)	(0.0018)	(0.0070)
c_2	0.0038	0.0739	0.0002	0.0018
	(0.0513)	(0.3212)	(0.0008)	(0.0002)**
c_3	0.0002	0.00001	0.0001	0.0001
	(0.9743)	(0.0031)	(0.0016)	(0.0035)
β_0	0.0405	0.0014	0.0638	0.0638
	(1.4221)	(0.0045)	(0.0005)***	(0.0024)***
$\beta_1 * 10^{-2}$	0.1596	0.1959	1.5404	1.5404
	(0.7600)	(0.2543)	(0.0135)***	(0.0361)***
$\beta_2 * 10^{-4}$	0.0049	0.0021	−0.0011	−0.0011
	(0.1784)	(0.0080)	(0.00001)	(0.00001)
$\beta_3 * 10^{-4}$	0.0018	0.0008	0.0025	0.0025
	(0.0544)	(0.0115)	(0.00001)***	(0.0001)***
$\beta_4 * 10^{-8}$	−0.0209	0.0056	0.0389	0.0389
	(0.6034)	(0.0258)	(0.0002)***	(0.00001)***

Standard errors are in parentheses. (*), (**), (***) indicate significance at 10%, 5% and 1%.

Table 5. Parameter Estimates, Scandinavian Countries

Param.	$< 1st$ *Quart.*	$1st - 3rd$ *Quart.*	$> 3rd$ *Quart.*	*Repr. Agent*
σ	1.4193	2.4285	1.4195	1.5707
	$(0.0360)^{***}$	$(0.1283)^{**}$	$(0.0007)^{***}$	$(0.0800)^{**}$
γ	3.4465	4.7152	3.4684	3.4778
	$(0.0157)^{***}$	$(0.0072)^{***}$	$(0.0003)^{***}$	$(0.0272)^{***}$
θ	1.0730	1.0217	1.0798	0.9826
	$(0.0104)^{***}$	$(0.0251)^{***}$	$(0.0019)^{***}$	$(0.0264)^{***}$
a	0.1113	0.1898	0.1146	0.2954
	$(0.0015)^{***}$	(0.6039)	$(0.0379)^{*}$	$(0.0327)^{**}$
β	1.0123	1.0979	1.0254	1.0283
	$(0.0667)^{**}$	$(0.0014)^{***}$	$(0.0047)^{***}$	$(0.0011)^{***}$
ρ_{ψ}	0.2523	0.8080	0.2478	0.2485
	$(0.00001)^{***}$	$(0.00001)^{***}$	$(0.00001)^{***}$	$(0.00001)^{***}$
σ_{ε_t}	0.0590	0.0263	0.0594	0.1097
	$(0.0065)^{**}$	(0.0720)	$(0.0040)^{**}$	$(0.0072)^{**}$
c_1	0.0004	0.0007	0.0002	0.0002
	$(0.0001)^{*}$	$(0.4796)^{***}$	(0.0001)	(0.0024)
c_2	0.1428	0.0071	0.0256	0.0257
	$(0.0005)^{***}$	$(0.0010)^{**}$	$(0.0209)^{***}$	$(0.00001)^{***}$
c_3	0.0003	0.0001	0.00001	0.00001
	$(0.0001)^{*}$	(0.0681)	(0.00001)	(0.0001)
β_0	0.0912	0.0192	0.1004	0.0998
	$(0.0026)^{***}$	$(0.0064)^{*}$	$(0.0041)^{**}$	$(0.0074)^{**}$
$\beta_1 * 10^{-2}$	0.0823	0.2273	0.5873	0.5997
	$(0.0037)^{**}$	(0.3374)	$(0.0031)^{***}$	$(0.0232)^{***}$
$\beta_2 * 10^{-4}$	0.0039	-0.0008	0.0001	0.0001
	$(0.0001)^{***}$	(0.0012)	$(0.00001)^{**}$	$(0.00001)^{**}$
$\beta_3 * 10^{-4}$	0.0022	0.0093	0.0039	0.0039
	$(0.00001)^{***}$	(0.0214)	$(0.0005)^{**}$	$(0.0001)^{***}$
$\beta_4 * 10^{-8}$	0.0034	-0.0075	0.0110	0.0110
	$(0.0001)^{***}$	(0.0200)	$(0.0040)^{*}$	$(0.0009)^{**}$

Standard errors are in parentheses. (*), (**), (***) indicate significance at 10%, 5% and 1%.

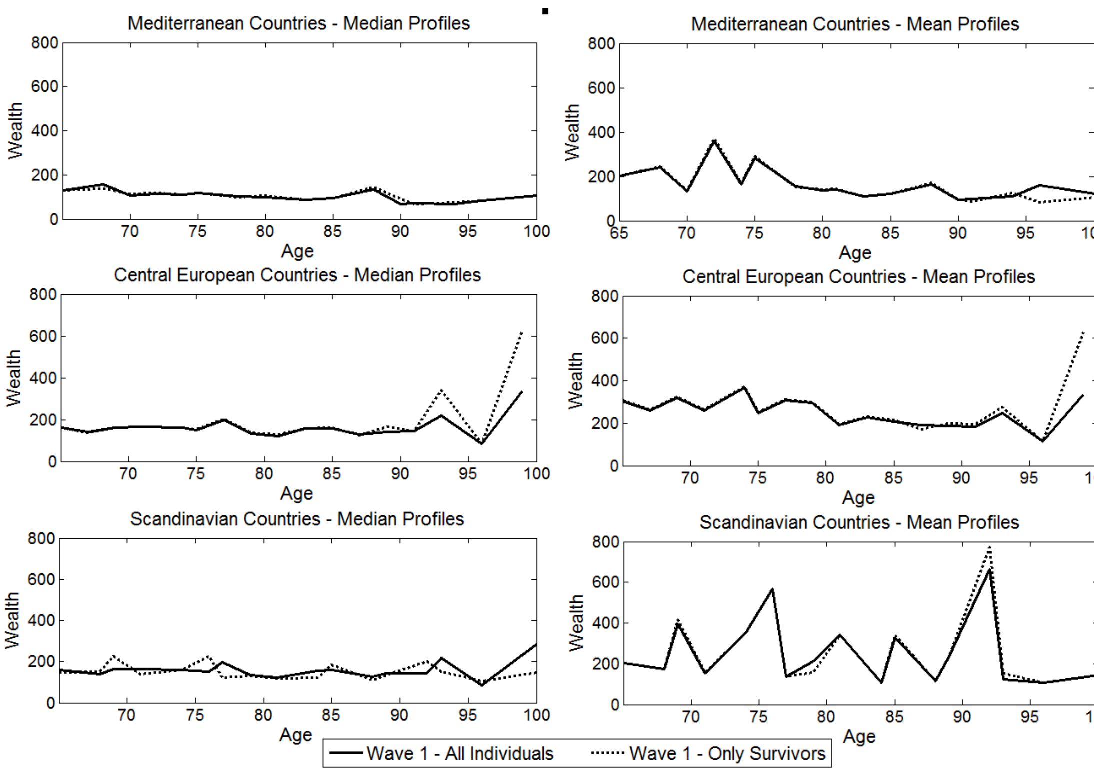

Figure 1A: Wealth Profiles, All Individuals vs. Survivors (thousands of 2004 Euros)

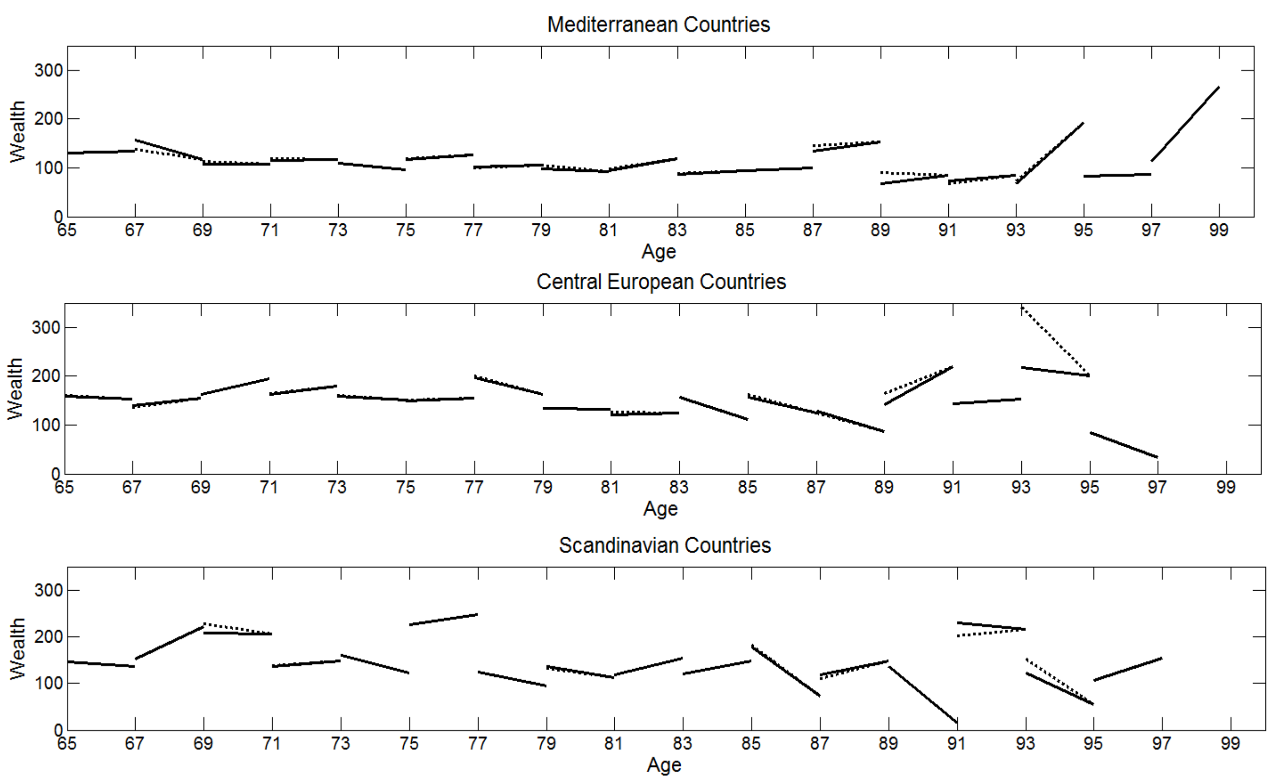

Figure 1B: Median Wealth by Birth Cohort (thousands of 2004 Euros)

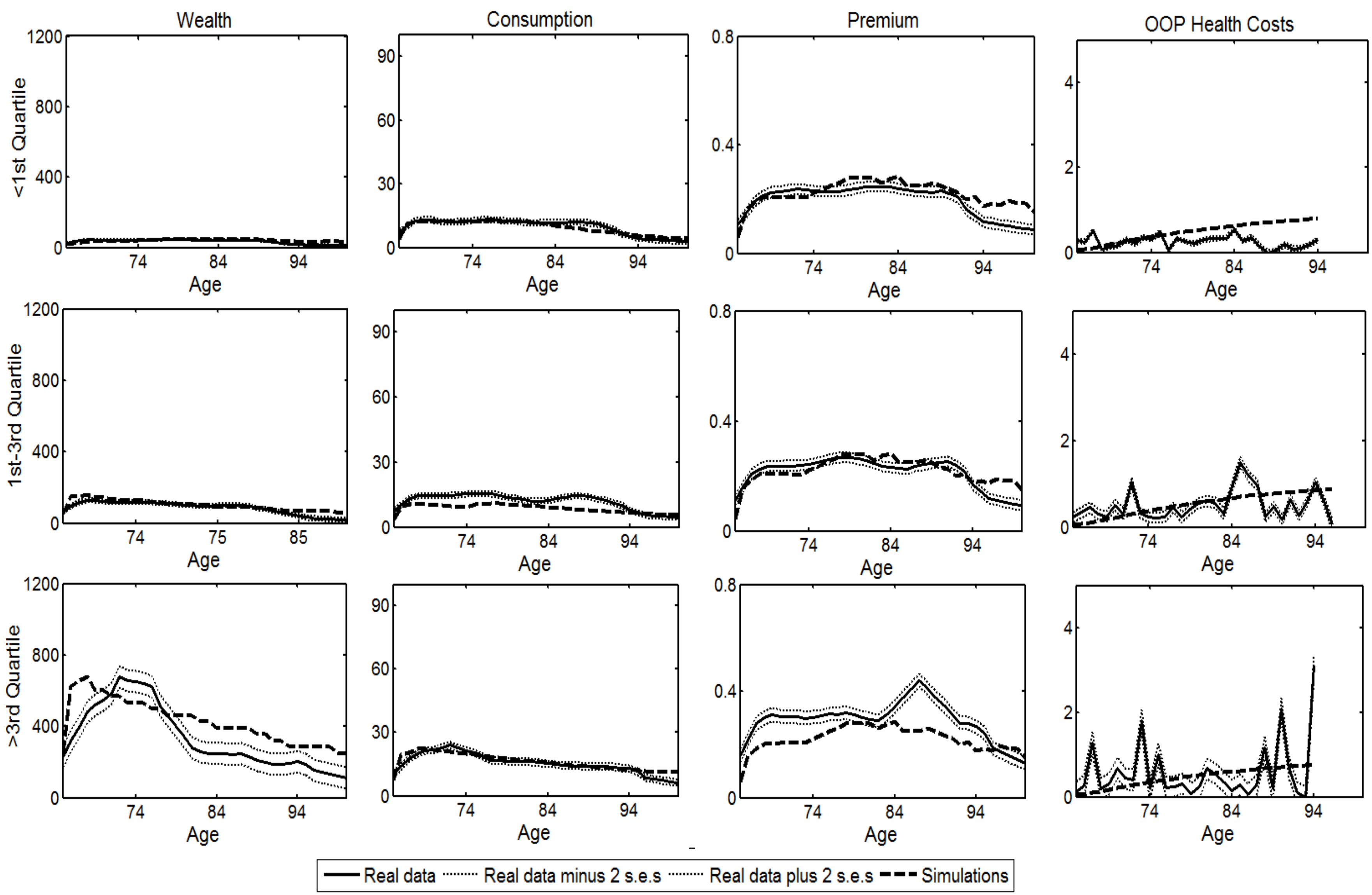

Figure 2: Data Profiles by Wealth Quartile, Mediterranean Countries (in 2004 thousands of Euros)

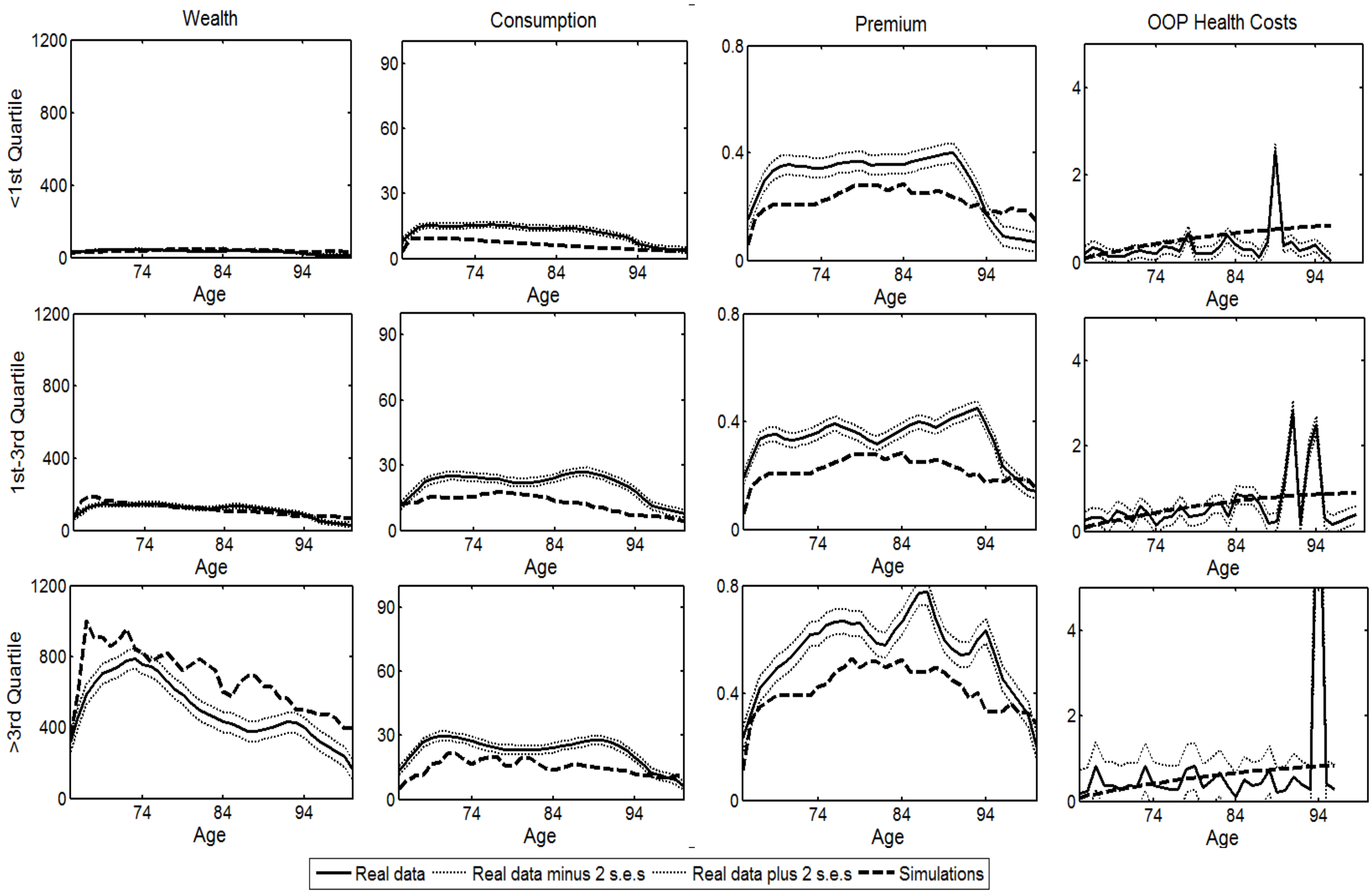

Figure 3: Data Profiles by Wealth Quartile, Central European Countries (in 2004 thousands of Euros)

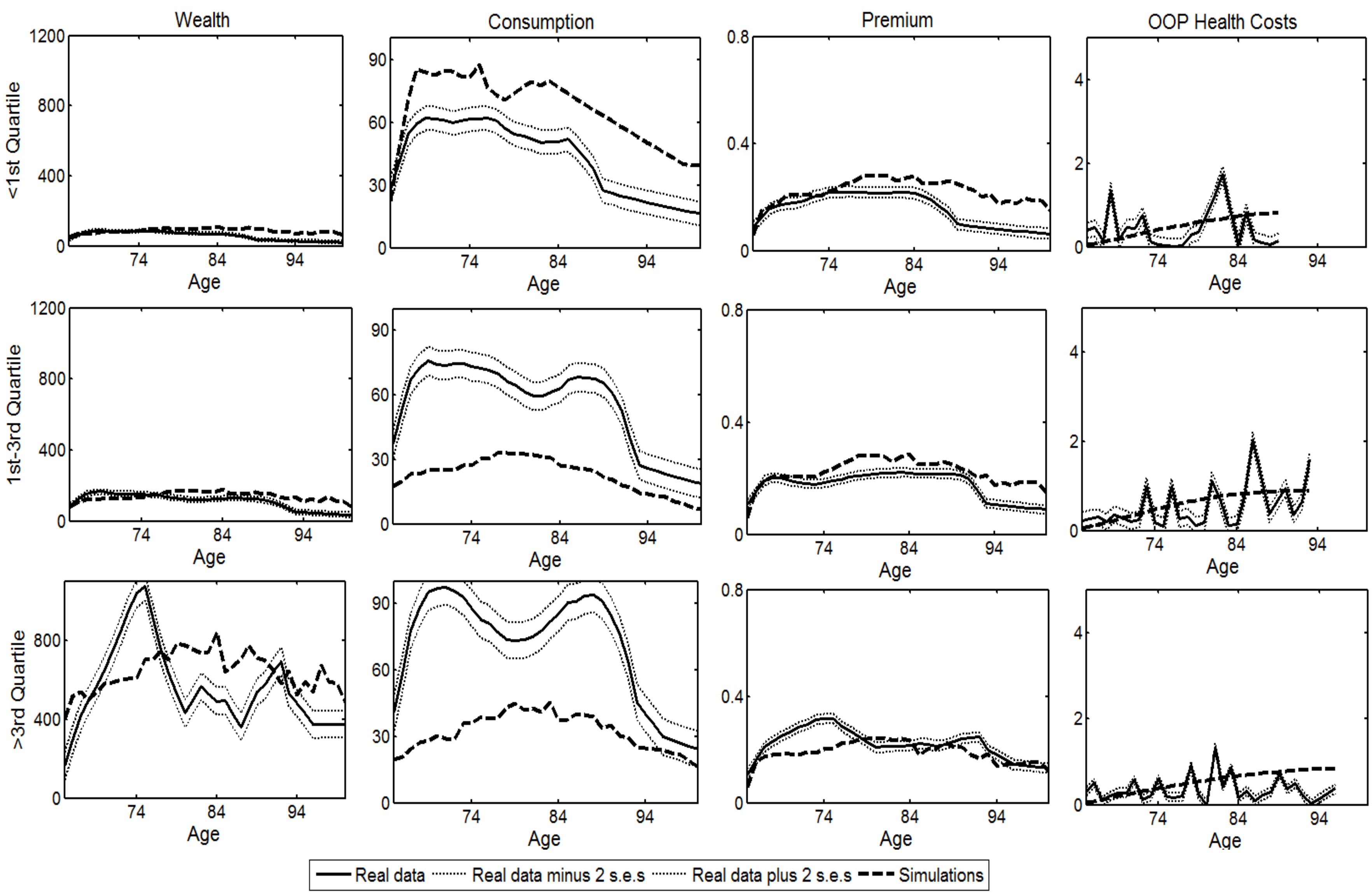

Figure 4: Data Profiles by Wealth Quartile, Scandinavian Countries (in 2004 thousands of Euros)

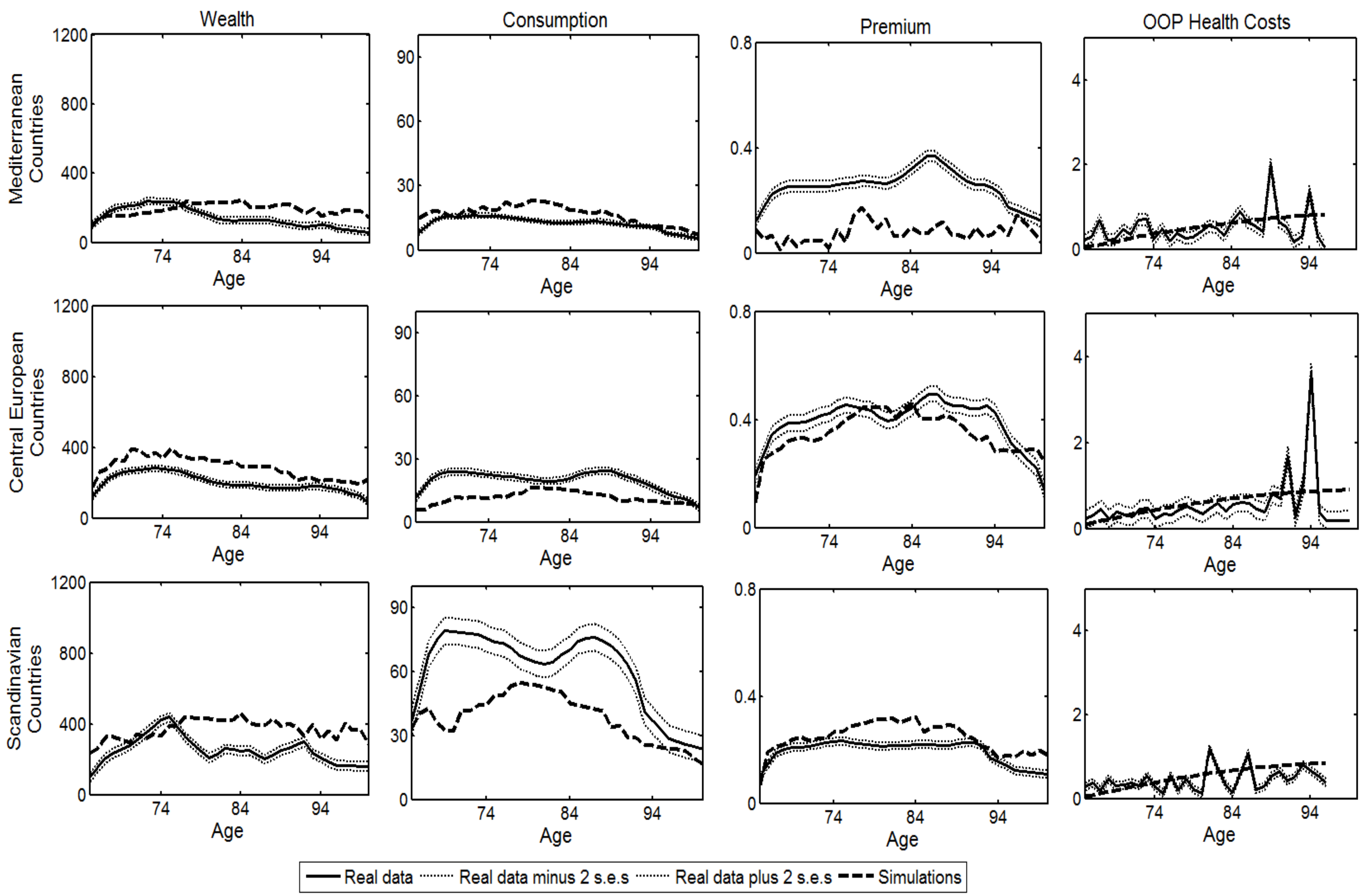

Figure 5: Data Profiles by Region, Representative Agent (in 2004 thousands of Euros)

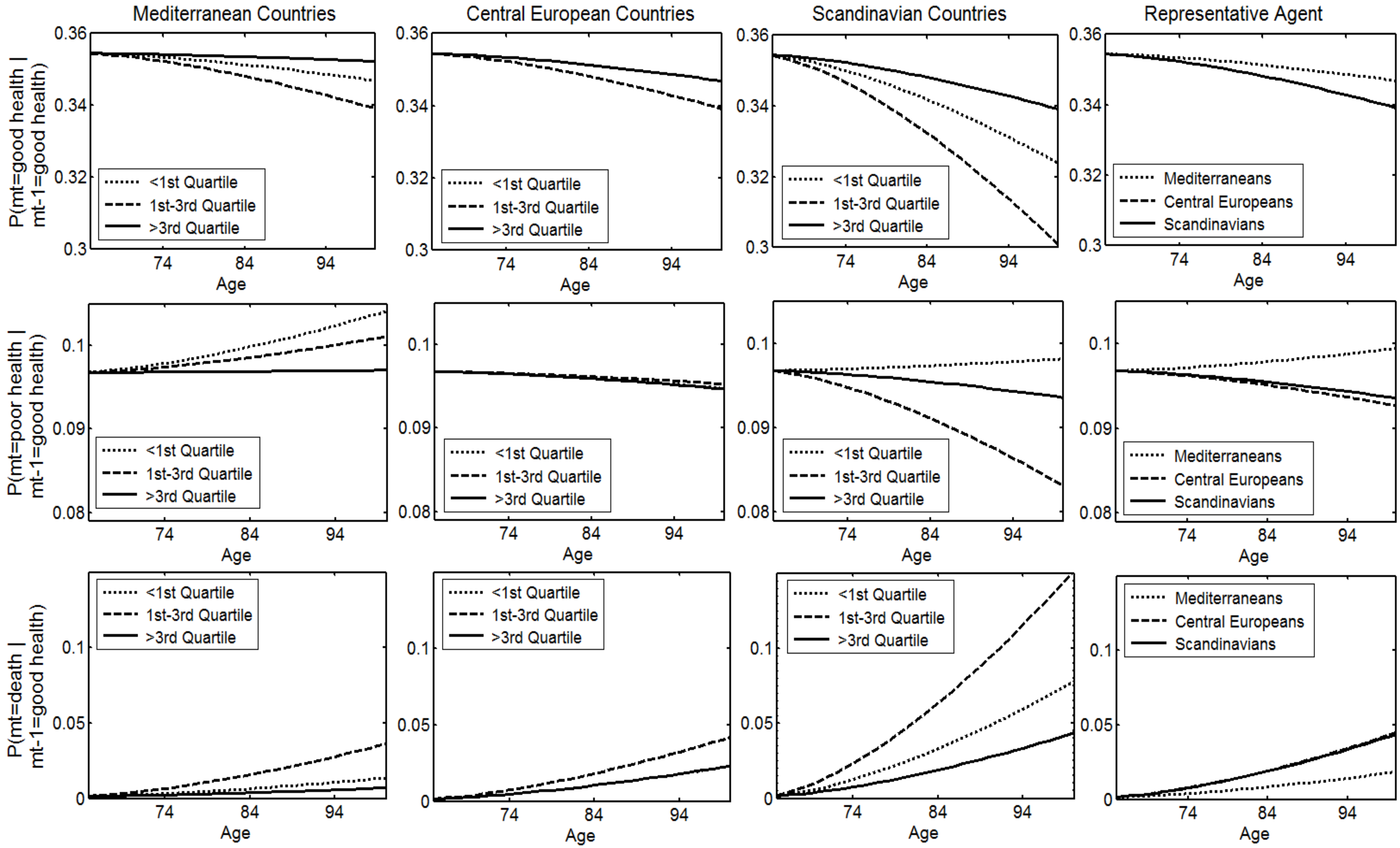

Figure 6: Health Transitions by Wealth Quartile and Region

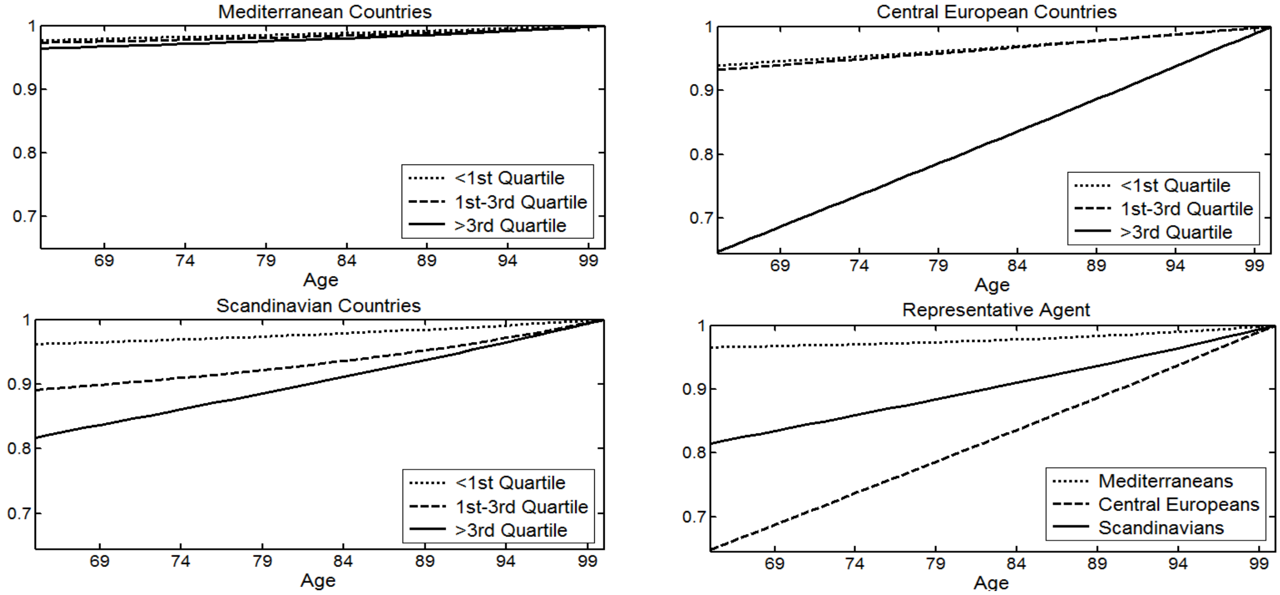

Figure 7: Cohesion Coefficient by Wealth Quartile and Region

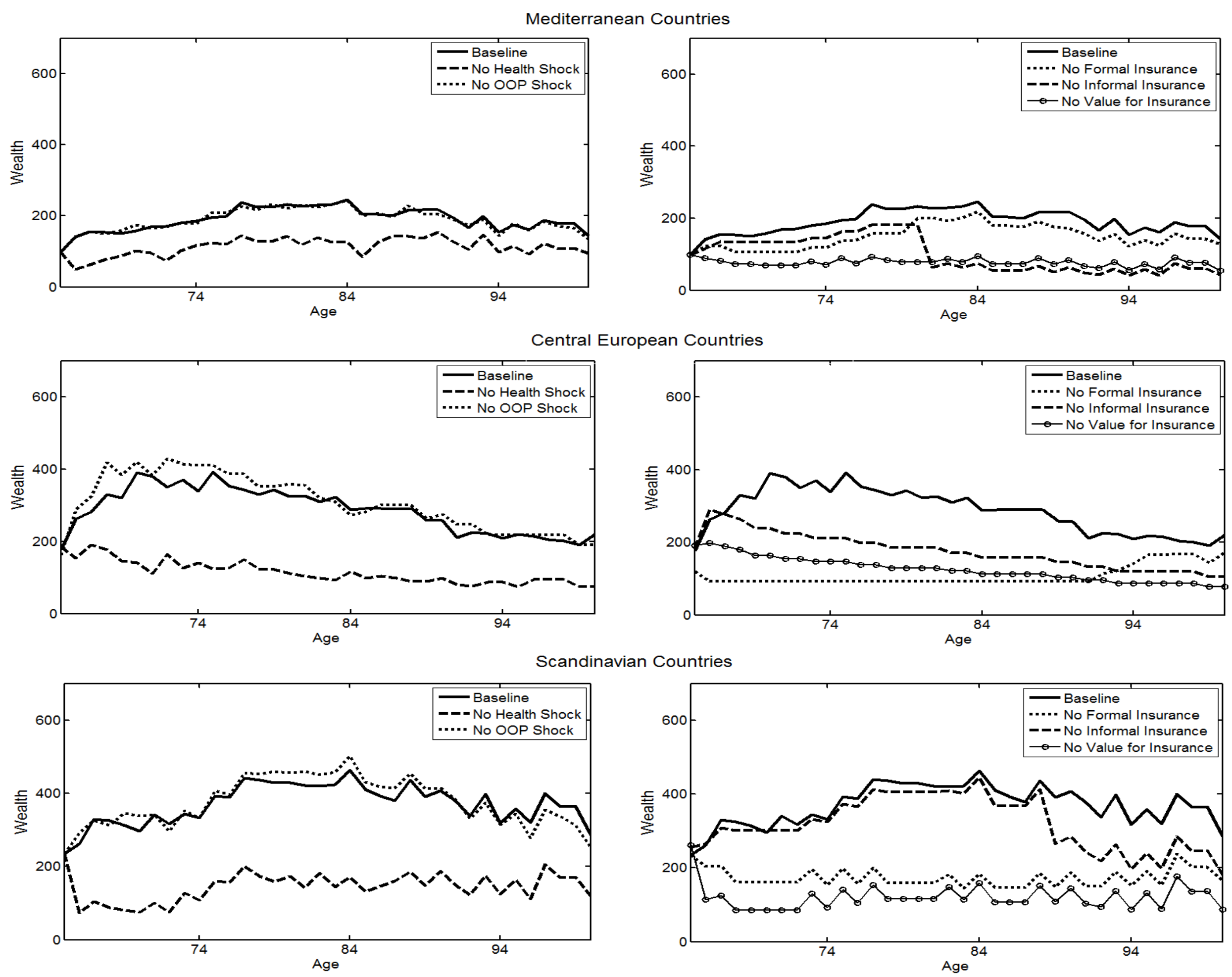

Figure 8: Wealth Profiles, Baseline Model vs. Alternative Scenarios (in 2004 thousands of Euros)

Appendix

A Health and Funeral Costs

When no country data on long term care or curative and rehabilitation care was available, I used the following benchmark countries:

Country estimated	Benchmark countries
Belgium	Netherlands
Denmark	average (Norway, Sweden)
France	Germany
Greece	Spain
Italy	average (Germany, Spain)
Switzerland	Germany

The primary data for funeral costs in the OECD countries analyzed are drawn from the AGIR dataset (Westerhout and Pellikaan 2005, based on EPC 2001) for EU-15 countries and from OECD calculations for 2005. To obtain the 2004 funeral costs, I applied the health expenditure real growth rate to the 2005 series (OECD Health Data 2008). The cost of death for the oldest group (95+) is assumed to be the lowest and was proxied by their observed health expenditure per person, when available. For France, Germany, Italy, Spain and Netherlands, where expenditure data for the oldest group were not available, the cost of people aged 75-79 was taken as a proxy. In fact, when available, expenditure at age 95+ is roughly equal to the level of expenditure at age 75-79. For the countries with no data available, the cost of death for the oldest group was estimated by taking three times the average health expenditure per capita, adjusted by the country-specific residual (Bjornerud et al., 2005; OECD, 2006).

B Estimated Moments and Goodness of Fit

Table 6. Estimated Moments and Goodness of Fit Test - Mediterranean Countries

$Moments$	$<1st\ Quart.$		$1st-3rd\ Quart.$		$>3rd\ Quart.$		$Repr.\ Agent$	
	$Artif.$	$Emp.$	$Artif.$	$Emp.$	$Artif.$	$Emp.$	$Artif.$	$Emp.$
$\overline{a_t}$	0.50	0.39	0.58	0.56	0.48	0.38	0.51	0.33
$\overline{C_t}$	0.09	0.11	0.05	0.08	0.07	0.07	0.17	0.06
$\overline{F_t}$	0.27	0.21	0.27	0.23	0.27	0.26	0.06	0.17
$\overline{C_t/a_t}$	0.18	0.28	0.09	0.15	0.16	0.22	0.35	0.20
$\sigma_{\ln(a_t)}$	0.31	0.25	0.31	0.39	0.30	0.53	0.31	0.40
$\sigma_{\ln(C_t)}$	0.38	0.28	0.25	0.26	0.24	0.34	0.22	0.29
$\sigma_{\ln(F_t)}$	0.35	0.22	0.35	0.22	0.34	0.24	0.38	0.28
$\sigma_{\ln(C/a)_t}$	0.16	0.05	0.13	0.19	0.12	0.27	0.16	0.18
$corr(a_t, C_t)$	0.85	0.97	0.88	0.89	0.94	0.90	0.88	0.89
$corr(a_t, F_t)$	0.99	0.90	0.99	0.64	0.99	0.71	0.49	0.29
$corr(a_t, (C/a)_t)$	0.09	0.30	-0.74	-0.87	-0.75	-0.86	-0.79	-0.80
$corr(C_t, F_t)$	0.89	0.82	0.88	0.85	0.93	0.86	0.37	0.65
$corr(C_t, (C/a)_t)$	0.58	0.50	-0.36	-0.59	-0.51	-0.59	-0.44	-0.46
$corr(F_t, (C/a)_t)$	0.15	0.03	-0.74	-0.31	-0.72	-0.38	-0.52	0.24
$corr(a_{t,t-1})$	0.77	0.90	0.86	0.95	0.85	0.97	0.79	0.97
$corr(C_{t,t-1})$	0.91	0.90	0.88	0.91	0.84	0.95	0.73	0.95
$corr(F_{t,t-1})$	0.82	0.88	0.85	0.87	0.80	0.92	0.38	0.94
$corr((C/a)_{t,t-1})$	0.91	0.89	0.88	0.99	0.86	0.96	0.77	0.97
$\chi^2(3)$, $p-value$	3.61,	30.7%	8.77,	3.2%	7.61,	5.5%	24.55,	$2*10^{-3}$%

Table 7. Estimated Moments and Goodness of Fit Test - Central European Countries

$Moments$	$<1st\ Quart.$		$1st-3rd\ Quart.$		$>3rd\ Quart.$		$Repr.\ Agent$	
	$Artif.$	$Emp.$	$Artif.$	$Emp.$	$Artif.$	$Emp.$	$Artif.$	$Emp.$
$\overline{a_t}$	0.48	0.36	0.44	0.45	0.51	0.38	0.43	0.31
$\overline{C_t}$	0.06	0.13	0.13	0.11	0.09	0.14	0.07	0.12
$\overline{F_t}$	0.28	0.32	0.28	0.35	0.22	0.29	0.17	0.25
$\overline{C_t/a_t}$	0.13	0.36	0.31	0.25	0.18	0.39	0.16	0.39
$\sigma_{\ln(a_t)}$	0.31	0.27	0.30	0.32	0.27	0.36	0.23	0.26
$\sigma_{\ln(C_t)}$	0.34	0.29	0.29	0.28	0.28	0.34	0.27	0.29
$\sigma_{\ln(F_t)}$	0.35	0.35	0.35	0.23	0.38	0.31	0.43	0.28
$\sigma_{\ln\left(C_t/a_t\right)}$	0.08	0.06	0.09	0.13	0.20	0.23	0.22	0.19
$corr(a_t, C_t)$	0.96	0.97	0.96	0.87	0.70	0.69	0.56	0.68
$corr(a_t, F_t)$	0.99	0.84	0.99	0.57	0.76	0.32	0.60	0.44
$corr(a_t, (C/a)_t)$	0.20	0.20	-0.30	-0.55	-0.39	-0.51	-0.34	-0.33
$corr(C_t, F_t)$	0.96	0.85	0.97	0.77	0.80	0.67	0.88	0.84
$corr(C_t, (C/a)_t)$	0.46	0.44	-0.06	-0.09	0.34	0.27	0.58	0.46
$corr(F_t, (C/a)_t)$	0.23	0.29	-0.25	0.09	0.07	0.38	0.44	0.55
$corr(a_{t,t-1})$	0.83	0.92	0.87	0.93	0.84	0.95	0.89	0.93
$corr(C_{t,t-1})$	0.90	0.93	0.86	0.92	0.86	0.93	0.92	0.91
$corr(F_{t,t-1})$	0.81	0.91	0.82	0.81	0.72	0.89	0.91	0.88
$corr((C/a)_{t,t-1})$	0.77	0.94	0.73	0.94	0.79	0.96	0.87	0.96
$\chi^2(3)$, $p-value$	3.39,	33.5%	9.82,	2.0%	9.69,	2.1%	6.66,	30.0%

Table 8. Estimated Moments and Goodness of Fit Test - Scandinavian Countries

Moments	$< 1st\ Quart.$ Artif.	Emp.	$1st - 3rd\ Quart.$ Artif.	Emp.	$> 3rd\ Quart.$ Artif.	Emp.	*Repr. Agent* Artif.	Emp.
$\overline{a_t}$	0.56	0.40	0.54	0.43	0.51	0.40	0.48	0.30
$\overline{C_t}$	0.13	0.10	0.08	0.10	0.08	0.09	0.09	0.08
$\overline{F_t}$	0.26	0.18	0.26	0.19	0.22	0.23	0.24	0.17
$\overline{C_t/a_t}$	0.23	0.26	0.15	0.14	0.17	0.26	0.20	0.28
$\sigma_{\ln(a_t)}$	0.28	0.25	0.32	0.26	0.30	0.39	0.26	0.31
$\sigma_{\ln(C_t)}$	0.30	0.24	0.31	0.24	0.21	0.27	0.22	0.24
$\sigma_{\ln(F_t)}$	0.48	0.26	0.42	0.18	0.50	0.23	0.34	0.19
$\sigma_{\ln(C_t/a_t)}$	0.13	0.02	0.16	0.06	0.25	0.34	0.19	0.24
$corr(a_t, C_t)$	0.90	0.99	0.85	0.96	0.47	0.41	0.72	0.56
$corr(a_t, F_t)$	0.97	0.74	0.97	0.49	0.96	0.93	0.95	0.71
$corr(a_t, (C/a)_t)$	-0.19	-0.32	-0.44	-0.47	-0.78	-0.76	-0.65	-0.70
$corr(C_t, F_t)$	0.93	0.78	0.85	0.64	0.63	0.68	0.81	0.82
$corr(C_t, (C/a)_t)$	0.23	-0.24	0.06	-0.20	0.13	0.16	0.03	0.12
$corr(F_t, (C/a)_t)$	-0.02	0.18	-0.33	0.30	-0.66	-0.56	-0.49	-0.26
$corr(a_{t,t-1})$	0.89	0.82	0.83	0.88	0.79	0.89	0.86	0.87
$corr(C_{t,t-1})$	0.90	0.80	0.88	0.84	0.85	0.85	0.94	0.84
$corr(F_{t,t-1})$	0.86	0.85	0.74	0.77	0.86	0.86	0.88	0.78
$corr((C/a)_{t,t-1})$	0.85	0.91	0.83	0.95	0.91	0.88	0.81	0.89
$\chi^2(3),\ p-value$	9.64,	2.2%	15.55,	0.14%	2.91,	40.6%	4.84,	18.4%

C A Comment on Preferences Estimates

Up to my best knowledge, this is the first study that estimates some of the key parameters of the life-cycle model for Europe. First, note that there is substantial heterogeneity in the estimated discount factor and risk aversion parameters across models. These heterogeneous preferences play a significant role in explaining the large wealth dispersion observed in the data, even for individuals with similar health histories. For instance, the discount factor varies quite a lot with wealth and region. Scandinavians have the highest discount factor, whereas across all regions, the poor discount the future less than do the rich. As a result, the rich (and Scandinavians) will decumulate their wealth at a smaller rate than do the poor, which is consistent with the data. In valuing the future however, one must also consider the interaction between the discount factor and survival probability.

Standard values for consumption relative risk aversion are generally between 1 and 6. The results show values between roughly 2.9 and 5.8 for the Mediterranean countries, 4.06 and 5.5 in Central Europe and between 3.4 and 4.7 for Scandinavia. These high values are likely to reflect the relationship between risk aversion, age and wealth: *ceteris paribus*, risk aversion increases with age and decreases with wealth (Riley and Chow, 1992; Morin and Suarez, 1983). Consistently, rich Scandinavians are less risk-averse than are both Central Europeans and Mediterraneans in the top wealth quartile. Also, within each region, the poor are generally more risk-averse than are the rich. The exception is Scandinavian countries, where the poor are less risk averse as they benefit from additional social support programs and thus need to save less for consumption.

The opposite applies for medical goods consumption: the rich appear to be more risk-averse than the low-wealth individuals. Given the public health programs in place, the basic medical spending associated severe health shocks, even if substantial, is extensively covered. This is not the case with the additional services (i.e., specialist or diagnostic outpatient services, alternative medicine, occasional choice of better or faster inpatient care for important interventions) that are mainly demanded by the rich. Across Europe however, since Scandinavians have the widest public coverage, they have a lower risk-aversion coefficient (1.57) than the other Europeans have (1.88 and 1.93 for the Mediterraneans and Central Europeans, respectively).

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