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Abstract

Long-term care (LTC) is one of the biggest yet largely uninsured financial risks facing the elderly. In a context of increasing individual responsibility over this risk we expect financial literacy to be an important determinant of the insurance decision as is the case in other financial domains. This paper empirically investigates the effect of financial literacy on the probability of holding a private insurance contract using data from a European survey of the elderly which contains information on these key variables. We find that financial literacy helps explain the small size of the insurance market as more financially sophisticated respondents are more likely to have an insurance contract controlling for a number of covariates and potential endogeneity. This effect is large and distinct from other factors such as risk factors, risk tolerance and time discounting.

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1 Introduction

Population ageing and the decline of informal care supply in recent years have given rise to a new type of financial risk in old age: that of costly formal long-term care (LTC). These trends are projected to persist in the future putting upward pressure on such expenditures (Colombo and Mercier 2012). So far people have mainly relied on public support, self-insurance or informal support from family members to face LTC needs (Costa-Font and Courbage 2012). The role of private insurance on the other hand has been limited even in countries such as the US (Colombo, Llena-Nozal et al. 2011). This finding is puzzling. First, insurance would be optimal for a rational and risk-averse individual in the context of LTC where expenditures are large, uncertain and potentially catastrophic.² Second, with reduced availability of informal care and tight government budgets one would expect an expansion of financing arrangements. Although LTC risk is increasingly becoming individuals' responsibility, insurance coverage has not yet developed in a complementary nor a substitutive way to the traditional financing options.

A growing body of research has developed for the study of this puzzle and several explanations have been put forward. Market imperfections on the supply side such as adverse selection or moral hazard and dynamic contracting problems are partly to be blamed for the high loads and market contraction although not enough to explain the puzzle without also considering demand-side constraints (Brown and Finkelstein 2009). Among the most common ones, shown to mitigate the development of the market, are crowding out by home equity, public coverage programs and substitution from informal care (Davidoff 2010, Pauly 1990, Brown and Finkelstein 2008, Costa-Font 2010). The decreasing availability of formal and informal

² The estimated probability of a 65 year old person entering a nursing home is over 40% and stays can last for as long as over 5 years for about 15-20% of newcomers (Kemper and Murtaough (1991), Murtaough, Kemper et al. (1997)). To get a sense of the associated costs, the median cost for a private room in a nursing home in 2014 in the US was \$240/day (Genworth 2014).

substitutes however, suggests that other aspects of the demand side could be at play. In particular the role of behavioural and information biases remains largely unexplored in the context of LTC decision making. A few studies have highlighted the role risk perceptions, knowledge and myopic denial play in the development of the market (Zhou-Richter, Browne et al. 2010, Costa-Font and Font 2009, Coe, Skira et al. 2015) but evidence on the role of consumer knowledge and rationality remains scant.

This paper contributes in that direction by examining the effect of financial literacy on LTC insurance demand. Financial literacy, by which we mean the skill to process economic information in making informed financial decisions, is likely to influence insurance demand for a number of reasons. First, in recent years it is recognised as a core skill, essential for all key financial decisions (OECD 2016). More financially sophisticated individuals are shown to be better prepared for retirement, participate in financial markets and accumulate more wealth and less debt to name a few (Lusardi and Mitchell 2014). It is conceivable that the effect of financial literacy extends to LTC, a complex decision that would require one to understand survival probabilities and estimate highly uncertain future medical expenditures in order to make a sound financial decision. This effect is likely to matter more for the elderly, among whom financial illiteracy is widespread and whose skills start to decline at this phase of the life cycle (Agarwal, Driscoll et al. 2009, Banks 2010). Second, a substantial part of the market, where it has developed, is characterised by individual as opposed to group contracts.³ This suggests that, in the absence of employers' potential agency role, individual rationality is likely to play a greater

³ In 2009 individual contracts represented 55% of the market in France, 58% of new contracts sold and 67% of policies in force in the United States (Colombo, Llena-Nozal et al. 2011, Brown and Finkelstein 2011).

role in the decision making process and LTC becomes an ideal framework for disentangling the financial literacy effect.

To the best of our knowledge, there is no prior empirical research on the effect of financial literacy on LTC insurance demand. Furthermore, whilst evidence usually comes from the US this analysis focuses on Europe whose LTC insurance market is not yet well understood due to its small size. To this end we use individual level data from a European survey of elderly people which is unique in that it includes data on both insurance and financial literacy status.

We find evidence that financial literacy and insurance coverage are low among Europe's elderly. Higher financial literacy is associated with a higher probability of holding private LTC insurance. The effect is sizeable and statistically significant even after we control for a number of characteristics and account for the endogeneity of financial literacy, across a number of specifications.

This paper is organised as follows. Section 2 provides some background on LTC financing in Europe with a particular emphasis on private insurance. Section 3 discusses how financial literacy can affect LTC insurance demand. Section 4 describes the data and econometric approach. Section 5 reports the empirical evidence and section 6 concludes.

2 Private insurance and LTC in Europe

The market for insurance for LTC is markedly underdeveloped. Except for the United States and Japan, France, Germany and Israel are the countries where this market is most present (Colombo, Llana-Nozal et al. 2011). In most European countries the market is practically non-existent with private insurance financing less than 2% of total LTC expenditure (Colombo and Mercier 2012). The scope for expansion of private insurance in those countries has been

traditionally shaped by the combination of public insurance and informal care which vary across Europe (Costa-Font and Courbage 2012). Where the market has been present in Europe, two types of contracts have developed: partial reimbursement and indemnity policies (Colombo, Llana-Nozal et al. 2011).

France is the largest LTC insurance market in Europe with about 5.5 million policyholders in 2010 (about 15% of population aged over 40) (OECD 2011, FFSA 2010). Indemnity policies are the dominant model. Individuals typically pay an annual premium in exchange of a fixed future stream of income in the form of monthly cash benefits (Colombo, Llana-Nozal et al. 2011), (Courbage and Roudaut 2008). LTC insurance contracts can be individual or collective with the group market in France representing about 45 percent of the market in 2009 (OECD 2011).

In Israel there are three types of private LTC insurance: commercial individual LTC insurance, commercial collective LTC insurance and collective LTC insurance through the health plans. Over 4 million people (60% of the entire population including children) have some form of private LTC insurance policy. The majority of policy holders (88%) have collective insurance, mainly through their health plan, but also commercial, purchased together with other supplemental insurances. Approximately 18% have either form of commercial LTC insurance (Brammli-Greenberg, Waitzberg et al. 2012).

Germany's private insurance market consists of two types. A compulsory (reimbursement policy) one for individuals who have opted out of the social health insurance (approximately 9% of the population) and a voluntary one (indemnity policies) which insures eligible expenses not covered by the LTC insurance programme (approximately 3.5% of the population) (Colombo, Llana-Nozal et al. 2011).

In other European countries the private insurance market remains stagnant (e.g. the UK), with some growing trends observed in countries such as Spain and Italy based on indemnity policies (Colombo, Llena-Nozal et al. 2011).

Contrary to the private market, public support for LTC is more extended in Europe. Most European countries have developed some public system to finance LTC expenditure although there is great variation across countries in terms of coverage arrangements. Several countries have universal coverage within a single program, either as part of a tax-funded social care system (e.g. Nordic countries), through dedicated social insurance schemes (e.g. Germany, the Netherlands) or by arranging for LTC coverage mostly within the health system (e.g. Belgium). Other countries have more mixed systems comprising of different benefits and schemes with different degrees of coverage depending on target groups, specific LTC cost components and in some cases jurisdiction (e.g. Austria, France, Italy, the Czech Republic) (Colombo and Mercier 2012).

3 Financial literacy and LTC insurance

In the context of private LTC insurance we discuss two potential frameworks financial literacy could impact through: limited information and reference-dependence preferences. Standard economic theory assumes that individuals are perfectly rational agents who maximise expected utility fully utilising all available information and based on stable preferences; when new information is acquired expectations are updated typically assumed in a Bayesian manner. In practice, it is likely that people do not have full information with respect to the risks and costs associated with LTC and insurance. In other domains of catastrophic insurance, people tend to have difficulties understanding low-probability high-loss events and under-insure even when

premiums are close to actuarially fair levels (Johnson, Hershey et al. 1993, Kahneman and Tversky 2000). Kunreuther and Pauly (2004) propose a model of bounded rationality according to which when the event probability is sufficiently small, the search costs associated with collecting information about the loss probability outweigh the expected benefits from insurance to the extent that people find it optimal not to purchase insurance. Limited understanding of fees, costs and benefits of different financial products also seems prevalent in other markets especially among the least financially sophisticated population groups (Baicker, Congdon et al. 2012, Benartzi, Previtro et al. 2011, Lusardi and Mitchell 2014, Dominitz, Hung et al. 2008). In the presence of such information gaps, financial literacy could help reduce information search costs and improve understanding of the financial implications of the insurance decision.

Another concept likely relevant in the context of LTC insurance is that of reference-dependent preferences by which value is perceived in relative rather than in absolute terms (Kahneman and Tversky 1979). This can manifest as loss aversion with people weighting negative utility from losses more than positive utility from gains (Tversky and Kahneman 1992) suggesting less ‘shopping around’ and greater sensitivity to framing. For example when insurance is framed as a loss of premiums traded for an uncertain gain from coverage, take-up is discouraged (Slovic, Fischhoff et al. 1997) while annuities are viewed as less attractive when presented in an investment as opposed to a consumption framework (Brown, Kling et al. 2008). Gottlieb and Mitchell (2015) further found that LTC insurance coverage was lower among ‘narrow framers’, i.e. people taking decisions in isolation. Status quo bias can be another manifestation. People preferring the default option of non-purchase is observed in other markets especially when they are faced with difficult calculations (Kahneman, Knetsch et al. 1991). The extent of these biases is likely to be associated with financial literacy (Mitchell and Lusardi 2011).

It is difficult to identify the mechanisms through which financial literacy impacts on decision making with the available data. We expect the information channel to be the most relevant one but we cannot exclude or disentangle potential effects arising from changes on behavioural biases and heuristics outlined above as SHARE does not record such information.

4 Data and empirical strategy

4.1 Data

We use data from Wave 5 (release 5-0-0) of the Survey of Health, Ageing and Retirement in Europe (SHARE), a multidisciplinary cross-national survey of micro data on health, socio-economic status and social and family networks of individuals aged 50 and over and their spouses independent of age (Börsch-Supan, A. 2015).⁴ Wave 5 collects 2013 data from a number of European countries.⁵ Except for the wealth of information on numerous individual characteristics, this dataset is uniquely suited for the purposes of this study as it contains measures of the two main variables of interest, LTC insurance coverage and financial literacy. Data on these variables either separately or in combination is scarce, particularly for Europe. Furthermore, Wave 5 includes a mini childhood module which complements the retrospective SHARELIFE interview of Wave 3 and contains information on respondents' early life such as living and health conditions, school performance and financial situation in childhood. This information is used in the context of the instrumental variables empirical strategy which we discuss in a subsequent section. Information for the longitudinal sample on steady characteristics (such as education, gender, year of birth etc.) and childhood life was merged in the dataset from previous waves. Imputed variables were used for variables with a substantive number of missing

⁴ For more information on SHARE data see Börsch-Supan, A. et al. (2013).

⁵ Wave 5 countries include: Austria, Germany, Sweden, Netherlands, Spain, Italy, France, Denmark, Switzerland, Belgium, Israel, Czech Republic, Luxembourg, Slovenia and Estonia

values such as wealth. Finally, we dropped extreme age values restricting the sample above 30 and below 100 years old.

4.2 Measures

4.2.1 Dependent variable

In Wave 5 a new question was introduced in the SHARE questionnaire as part of the health care module:⁶ “Do you have any of the following public or private LTC insurances?”. The choices were: “1. Public; 2. Private mandatory; 3. Private voluntary/supplementary; 96. None”. Respondents could select as many answers as they wanted. An indicator variable for whether individuals have private voluntary or supplementary LTC insurance is the measure of insurance coverage.

A few things are worth noting regarding this data. First, the question was not asked in Germany, Belgium, Slovenia and Estonia (Bucher-Koenen, Schütz et al. 2015).⁷ Second, there are country-specific differences in the way questions are phrased across countries to account for the different care arrangements but we don’t expect this to affect the measure of insurance coverage.⁸ One exception to this is the Swedish questionnaire that asked respondents if they have a public or private ‘hälsovårdsförsäkring’ which translates as private health care insurance and therefore doesn’t cover accurately the subject-matter of interest.

⁶ SHARE has a similar question on long-term care insurance in Wave 1. However in that wave LTC insurance was imperfectly defined while self-reported data did not match other sources of evidence on long-term care insurance coverage. We opted for the Wave 5 question in this analysis as this question measures more accurately and reliably the variable of interest.

⁷ In the case of Belgium more specifically the question was only asked in the French speaking part but not in the Flemish speaking part.

⁸ For example, in Austria, Switzerland and Sweden respondents were asked whether they owned any private long-term care insurance and could opt for ‘yes’ or ‘no’. The Danish survey does not distinguish between private mandatory and private voluntary long-term care insurance but only offers the category ‘private’ insurance. Given the universal system for long-term care in Denmark we expect this question to capture accurately those with private voluntary insurance.

For the above reasons, Germany, Sweden, Belgium, Slovenia and Estonia are excluded all together from the sample. Table 1 presents the rates of private insurance coverage for the remaining countries. The highest coverage rates are reported in France and Israel followed by the Netherlands, Switzerland and Luxembourg. For the rest of the countries coverage rates remain very low, not exceeding 5%.

Table 1 Private insurance coverage by country in SHARE

Country	LTCI in country (%)
Austria	1.69
Netherlands	13.72
Spain	5.27
Italy	2.42
France	14.26
Denmark	1.92
Switzerland	19.53
Israel	31.18
Czech Republic	2.65
Luxembourg	11.35
Total	8.25

Source: SHARE Wave 5 release 5.0.0 using calibrated individual weights.
 Excluding Germany, Sweden, Belgium, Slovenia and Estonia for spurious or missing data.
 Excluding individuals below 30 and above 100 years old.

Some of the self-reported answers need to be treated with caution. Bucher-Koenen, Schütz et al. (2015) cross-checked the rates of coverage found in the SHARE data with the most recent information from official reports on the development of the LTC insurance market in respective countries. For only a sub-group of countries the reported figures on insurance coverage were found to be in correspondence with the market information. Countries like Spain, the Netherlands, Switzerland and Luxembourg seem to overestimate their private insurance uptake and are consequently excluded from the main analysis. For the remaining ones, the shares of private insurance coverage lie close to the market statistics whether that is for developed markets such as Israel and France or very thin ones like Austria, Denmark, the Czech Republic and Italy.

We end up therefore with a subgroup of six core countries whose data on insurance coverage are more reliable. Further in the analysis we repeat the estimation including the other countries as well as a robustness test.

4.2.2 Explanatory variable

A measure of financial literacy is taken from the set of numerical and financial questions asked in SHARE. There are four questions asking people to sequentially calculate a percentage, the price of a good after discounting, the original price of a good sold at a fraction of its cost and interest rate compounding. Especially knowledge of interest rate compounding has been widely used and is considered a good proxy for financial literacy (Atkinson and Messy 2012, Lusardi and Mitchell 2007, Lusardi, Mitchell et al. 2010). Depending on whether the first question was answered correctly or not respondents are then directed to questions three and four or two respectively. SHARE combines these questions into a single summary index which we interpret as the measure of current financial literacy; higher values indicate higher financial sophistication. Overall, this index is a measure of basic knowledge and skills with financial matters. The exact wording of the questions and details on how the financial literacy index was constructed are set out in the Appendix. Table 2 presents the distribution of the financial literacy index overall and Table 3 across countries for the restricted sample of six countries. The financial literacy score ranges from 1 to 5 corresponding to the lowest and highest possible literacy levels respectively. The mean of the distribution lies around 3 which is indicative of low financial literacy levels in the sample. Close to 57% of the respondents have got no or only one question right (scores 1 to 3) while approximately 30% have answered two questions correctly (score 4). Only 14% of respondents reached the highest score which corresponds to three correct answers including the interest rate compounding question one. This is particularly interesting as the question on

compounding is basic and most people of the age profile of the survey are expected to have used a savings account or similar product in their lifetime. Low levels of financial literacy are observed across countries but with some variation. Austria reports the highest level of financial literacy on average (3.78) followed by Denmark (3.72) and Italy the lowest one (3.04). France, Israel and Czech Republic lie in between.

Table 2 Financial literacy index

Financial literacy score	Percentage (%)
1	7.38
2	16.74
3	32.78
4	29.14
5	13.96
Mean	3.25

Source: SHARE Wave 5 release 5.0.0 using calibrated individual weights.
 Sample: Austria, Italy, France, Denmark, Israel, Czech Republic.
 Excluding individuals below 30 and above 100 years old.

Table 3 Financial literacy by country

Country	Financial literacy index (mean)
Austria	3.78
Italy	3.04
France	3.28
Denmark	3.72
Israel	3.43
Czech Republic	3.54

Source: SHARE Wave 5 release 5.0.0 using calibrated individual weights. Excluding individuals below 30 and above 100 years old.

4.2.3 Other control variables

SHARE collects rich data for a range of outcomes. As controls, we selected variables that are shown to be important determinants of insurance demand in the literature. Key socio-demographic characteristics include age, age squared to capture non-linear effects, gender and

formal education (primary, secondary, tertiary and above).⁹ To capture family effects we controlled for the number of children and marital status distinguishing between married, single, divorced and widowed. How family affects demand for LTC insurance is not clear a priori. Insurance demand may increase if people feel the need to protect their partner or children from the financial burden of impoverishment due to LTC expenses. With respect to children the relationship may reverse if informal care from children acts as a substitute to insurance or parents choose to forego the purchase of insurance due to intra-family moral hazard. Regarding risk factors for LTC we used the number of chronic conditions, an indicator for less than very good subjective health status and an indicator for whether individuals currently smoke. We also controlled for the logarithm of individual-level wealth as higher wealth is correlated with a higher probability of holding LTC insurance (Finkelstein and McGarry 2006).¹⁰

In an extended specification we also wanted to include some type of variables related to risk and time preferences in an attempt to control for other potential confounding factors that are though typically hard to measure (see following section for a discussion on omitted variables). The closest measures we could find in SHARE were the following. First, a question asking respondents about the financial risk they are willing to take when making investments. Four options were offered as possible answers: taking substantial financial risks expecting to earn substantial returns, taking above financial risks expecting to earn above average returns, taking average financial risks expecting to earn average returns and not willing to take any financial risks. From that we created a dummy variable for financial risk tolerance grouping the first three

⁹ SHARE uses the 1997 International Standard Classification of Education ISCED-97 as an international standard coding to allow for international comparisons. Education levels in each country were mapped to the respective ISCED-97 code. These were then grouped into wider categories corresponding to primary, secondary, tertiary and above levels.

¹⁰ Wealth is the sum of real and financial assets. Individual-level wealth was calculated by dividing household-level wealth with household size.

categories together and having those individuals not willing to take any financial risks as the reference group. Second, SHARE also asks individuals to choose what better describes their saving and spending planning horizon given the following options: next few months; next year; next few years; next 5-10 years and longer than 10 years. An indicator for short-term planning horizon was generated by grouping the ‘next few months’ and ‘next year’ answers together while the remaining categories capture together the reference group of long-term planning.

Lastly, in all specifications, we include country-level fixed effects to account for institutional, supply and cultural differences regarding LTC and insurance across countries.

4.3 Empirical strategy

In order to examine the effect of financial literacy on the probability of holding a private LTC insurance policy we estimate the following equation:

$$Pr(LTCI_i = 1) = f(\beta_0 + \beta_1\Phi_i + X_i'\beta_2 + v_c + \varepsilon_i) \quad (1)$$

where $LTCI_i$ is an indicator variable for whether individual i has private voluntary or supplementary LTC insurance. Φ_i is the level of current financial literacy of individual i measured by the SHARE financial literacy index. X_i is the vector of individual level characteristics and v_c is a vector with country-level fixed effects. The error term ε_i captures all other factors affecting LTC insurance demand but are not measureable. The parameter β_1 is the coefficient of interest, which under a causal interpretation measures the impact of financial literacy on the probability of insurance. Equation (1) is estimated using a linear probability model for simplicity but in the robustness analysis we also consider a non-linear specification.

The estimates from this model are unlikely to be consistent if financial literacy is endogenous. Financial literacy has been typically treated as a type of human capital, endogenously determined with respect to saving decisions in the literature (Jappelli and Padula 2013, Lusardi and Mitchell 2014). In the context of LTC insurance endogeneity may arise as a result of reverse causality, whereby those with experience in having insurance develop a better understanding of financial matters, or as a result of omitted variables that we don't fully control for. Such variables may include unobserved risk factors and preference-based variables such as time preferences, risk preferences, cautiousness or taste for financial issues. These variables are usually not measured accurately (for example (Finkelstein and McGarry 2006) found evidence of residual private information about risk factors even after controlling for a wide range of risk factors) and are expected to affect both decisions to buy LTC insurance and invest in acquiring financial literacy (Jappelli 2010, Bradford and Burgess 2010, Meier and Sprenger 2013, de Meza and Webb 2001, Cox, Brounen et al. 2015, Bajo, Barbi et al. 2015). The direction of the effect of these unobserved factors is not clear a priori and thus the sign of the bias is ambiguous.

As a first step in the identification strategy, we try to control for as many variables as possible including measures of the potentially omitted ones. However we don't expect to capture everything affecting insurance demand even in the more extended specification as SHARE does not include measures on all possible unobserved determinants. To deal with the remaining endogeneity concerns we employ an instrumental variables approach. Building on equation (1) we estimate the following linear probability model that accounts for the potential endogeneity of financial literacy with the use of instruments using the generalized method of moments (GMM):

$$Pr(LTCI_i = 1) = \beta_0 + \beta_1 \Phi_i + X_i' \beta_2 + v_c + \varepsilon_i \quad (2)$$

$$\Phi_i = \gamma_0 + X_i' \gamma_1 + Z_i' \gamma_2 + v_c + u_i \quad (3)$$

where X'_i is the vector of control variables as in (1) and Z'_i is a vector of instruments for financial literacy.

As a candidate instrument for financial literacy, we propose a measure that relates to the cost or efficiency of acquiring financial knowledge, namely early life ability as measured by school performance. Early life skills are likely to be highly correlated with the current level of financial literacy by reducing the cost or increasing the efficiency of acquiring financial knowledge, exogenous to unobserved factors affecting LTC insurance demand in later life and have no direct effect on the LTC insurance choice other than through later life financial literacy. To the extent that our measure captures an exogenous early life endowment then these assumptions are likely to be satisfied. Under these assumptions the IV estimates will be consistent estimates of the effect of financial literacy on LTC insurance coverage. In particular the measure used from SHARE is a question from the childhood module asking respondents about their relative performance in language at school at the age of ten.¹¹ According to Havari and Mazzonna (2011) the childhood information found in the SHARE retrospective studies shows a good level of internal and external validity. This finding mitigates potential concerns about recall bias in the answers and makes us more confident about using this data.

5 Results

Table 4 presents summary statistics for all the variables used in the empirical model. LTC insurance coverage lies on average around 7% and financial literacy at 3.25 for the restricted

¹¹ SHARE also has a question on the relative school performance with respect to maths. Although we experimented with this variable as a possible instrument it didn't satisfy the Hansen's test of joint validity of instruments. We therefore used only language performance as an instrument in the main analysis and augmented the instrument set with other instruments for robustness.

sample of six countries. On average the age of the sample is close to 67 years old reflecting the focus of the survey on the elderly population. The percentage of women is higher than that of men at approximately 60%. The majority of the sample, 66%, are married or in partnership and 15% widowed. Primary education is the level of education reported more frequently (40%) followed by secondary education (36%); only a quarter of the sample have graduate or post-graduate education. The average number of children is 2.26. In terms of health outcomes, a large proportion of the sample (72%) report having a good to poor health status while on average people suffer from approximately two chronic conditions. Approximately 22% of the sample currently smoke. The vast majority of the sample (approximately 70%) report that they are not willing to take any financial risks while the saving and spending planning horizon does not extend beyond a year for approximately 60%.

Table 4 Summary Statistics

Variable	Mean	St. Dev.	Min	Max
Private LTCI	0.07	0.26	0	1
Financial literacy index	3.25	1.12	1	5
Age	66.78	10.17	31	100
Female	0.57	0.50	0	1
Married	0.66	0.47	0	1
Single	0.09	0.29	0	1
Divorced	0.09	0.29	0	1
Widowed	0.15	0.36	0	1
Pre-primary/ primary education	0.40	0.49	0	1
Secondary education	0.36	0.48	0	1
Tertiary education	0.24	0.42	0	1
Post-graduate education	0.01	0.12	0	1
Number of children	2.26	1.43	0	17
Number of chronic diseases	1.78	1.61	0	13
Good/Fair/Poor health	0.72	0.45	0	1
Smoker	0.22	0.41	0	1
Financial risk tolerance	0.29	0.45	0	1
Short-term planning horizon	0.59	0.49	0	1
Wealth (log)	10.79	2.33	-26.66	15.90

Source: SHARE Wave 5 release 5.0.0 using calibrated individual weights. Sample: Austria, Italy, France, Denmark, Israel, Czech Republic. Excluding individuals below 30 and above 100 years old.

Table 5 presents preliminary evidence of the correlation between the two variables of interest, reporting the level of financial literacy by insurance status. We see that on average financial literacy is higher among insurance owners. When we further look at the distribution across the financial literacy scale we see that the percentage of LTC owners is higher to that of non-owners at the highest financial literacy scores (4 and 5) and lower at the lowest literacy scores (1-3). A positive correlation therefore between financial literacy and LTC insurance becomes evident from this simple cross tabulation. In what follows we explore the effect of financial literacy on LTC insurance ownership after controlling for a number of confounding factors in an econometric model that accounts for the potential endogeneity of financial literacy in the context of LTC insurance.

Table 5 Financial literacy and private insurance

Percentage (%) of (non-) insurance holders by financial literacy score						
	Mean	1	2	3	4	5
No LTCI	3.25	7.5	16.73	33.07	28.78	13.93
With LTCI	3.36	5.19	16.05	30.25	33.9	14.61

Source: SHARE Wave 5 release 5.0.0 using calibrated individual weights. Sample: Austria, Italy, France, Denmark, Israel, Czech Republic. Excluding individuals below 30 and above 100 years old.

Table 6 reports the estimation results from the empirical application. Column (1) reports the linear probability estimates from model (1) with a basic set of controls while column (2) extends the specification to account for financial risk tolerance and planning horizon. We see that financial literacy has a positive and statistically significant effect (at 1% level) on the probability of having private LTC insurance in the baseline specification (column 1). A one-standard deviation increase in the financial literacy index raises the probability of insurance ownership by 0.5 percentage points. The effect remains positive and statistically significant (although now at the 10% level) even after controlling for financial risk tolerance and planning horizon (column

2). The effect in this specification drops to 0.3 percentage points. Age has a non-linear positive effect initially rising and then falling after a certain age. We see therefore that our index of basic financial knowledge has an independent effect on insurance demand, above and beyond the effect of financial risk tolerance. Widowed individuals are significantly more likely to be privately insured compared to married. This may reflect the greater need for formal care after the death of a partner who could have been previously providing informal support. Evidence of substitution from family members is also found in the case of children since the number of children has a negative and statistically significant effect on the probability of having insurance. An alternative mechanism, also compatible with this finding, is that of intra-family moral hazard whereby parents may avoid insurance as a way to incentivize children to provide informal care. The health-related variables like the number of chronic conditions and an indicator variable for average to poor health status are interestingly found to reduce demand for private insurance in a statistically significant way. Although counter-intuitive this result could be explained in the case of supply side effects where people with worse health outcomes face higher insurance prices and therefore reduce demand (Finkelstein and McGarry 2006). The finding is also compatible with the presence of preference-based advantageous selection in the LTC insurance market. If selection in this market takes place on the basis of characteristics like cautiousness, which has been shown to increase both demand for LTC insurance and investment in health prevention activities, it is likely we can observe a negative correlation between bad health conditions and insurance demand (Finkelstein and McGarry 2006). In the second specification (column 2) which controls for variables that could be omitted in the error term we see that the effects remain negative and significant. The smoker indicator which except for a risk factor for LTC may also measure cautiousness (Finkelstein and McGarry 2006) has a negative (yet not statistically

significant) effect on the probability of owning insurance suggesting a possible advantageous selection in this sample. Insurance also seems to be purchased as a way of protecting individual wealth from expensive LTC since the wealth coefficient is estimated positive and statistically significant.

People with greater tolerance towards financial risks are associated with a higher insurance demand compared to those not willing to take any financial risks. Although risk aversion is intuitively associated with greater insurance demand (de Meza and Webb 2001) the positive coefficient can be explained if our measure of financial risk tolerance picks up other characteristics. The question does not correspond to the typical lottery questions used to measure relative risk aversion coefficients. Although potentially highly correlated with the degree of risk aversion as a preference parameter, we expect the specific question to also pick up unobserved factors such as experience, attitude and even trust to financial products and markets. Evidence from other markets (e.g. stock market, mortgages) suggests that risk tolerance is associated with greater and more sophisticated participation in these markets (van Rooij, Lusardi et al. 2011, Cox, Brounen et al. 2015). Lastly, people with a short-term saving and spending planning horizon are, as expected, less likely to own insurance. Columns (3) and (4) report the respective IV estimates from model (2). We see that in the instrumental variables specification the financial literacy index coefficient remains positive and statistically significant (at the 1% level) in both the baseline and extended specifications (columns 3 and 4 respectively). A one-standard deviation increase in the financial literacy index raises the probability of insurance ownership by approximately 5 percentage points. This effect is sizeable when looked in comparison to other important determinants of insurance demand such as family arrangements, wealth and financial risk tolerance. The instrument is highly correlated with financial literacy suggesting no problems

with weak instruments while the endogeneity test shows that financial literacy should be treated as endogenous.

Table 6 Estimation results: Private long-term care insurance coverage

	Linear Probability		IV	
	(1)	(2)	(3)	(4)
Financial literacy index	0.00556*** (0.00163)	0.00301* (0.00171)	0.0541*** (0.0168)	0.0448*** (0.0171)
Age	0.00877*** (0.00183)	0.00818*** (0.00188)	0.00481** (0.00221)	0.00584*** (0.00218)
Age squared	-0.0000652*** (0.000013)	-0.0000599*** (0.000013)	-0.0000322* (0.000016)	-0.0000402** (0.000016)
Female	-0.00258 (0.00347)	-0.00147 (0.00357)	0.0104* (0.00536)	0.00857 (0.00525)
Single	0.00228 (0.00694)	0.00387 (0.00718)	0.00710 (0.00723)	0.00759 (0.00738)
Divorced	0.00487 (0.00561)	0.00319 (0.00562)	0.00424 (0.00573)	0.00323 (0.00570)
Widowed	0.0215*** (0.00543)	0.0237*** (0.00568)	0.0254*** (0.00572)	0.0270*** (0.00589)
Primary education	0.00644 (0.0165)	0.0155 (0.0167)	0.0420** (0.0208)	0.0443** (0.0207)
Secondary education	0.00441 (0.0163)	0.00927 (0.0165)	0.0174 (0.0174)	0.0201 (0.0174)
Tertiary education	0.0108 (0.0165)	0.0136 (0.0167)	0.00930 (0.0168)	0.0133 (0.0168)
Number of children	-0.00550*** (0.00127)	-0.00636*** (0.00135)	-0.00400*** (0.00137)	-0.00517*** (0.00142)
Number of chronic diseases	-0.00615*** (0.00112)	-0.00426*** (0.00117)	-0.00423*** (0.00123)	-0.00304** (0.00125)
Good/fair/poor health	-0.0125*** (0.00435)	-0.0121*** (0.00443)	-0.00503 (0.00497)	-0.00599 (0.00499)
Smoker	-0.00351 (0.00390)	-0.00396 (0.00395)	-0.00266 (0.00403)	-0.00369 (0.00405)
Financial risk tolerance		0.0215*** (0.00421)		0.0156*** (0.00480)
Short-term planning horizon		-0.00859** (0.00372)		-0.00642* (0.00389)
Wealth (log)	0.00539*** (0.000640)	0.00504*** (0.000677)	0.00383*** (0.000954)	0.00360*** (0.000931)
Constant	-0.329*** (0.0649)	-0.309*** (0.0665)	-0.419*** (0.0749)	-0.416*** (0.0785)
Weak- <i>id</i> (K-P rk Wald F statistic)			251.037***	237.167***
Endog (Chi-sq(1))			9.345**	6.314**
Observations	21,010	19,456	20,403	19,116

*** p<0.01, ** p<0.05, * p<0.1. Robust standard errors in parentheses. All regressions include country fixed effects. Sample: Austria, Italy, France, Denmark, Israel, Czech Republic. Reference categories: married or in partnership, post-graduate education, excellent/very good health, not willing to take any financial risks, saving and spending planning horizon is next few years/next 5-10 years/longer than 10 years. Excluded instrument: language skills at school (age 10).

5.1 Robustness checks

Table 7 reports a battery of robustness checks. First we wanted to test that school performance at age ten does not affect insurance demand due to a correlation with other early-life events and family background. We therefore estimated the extended IV model now including as additional controls the number of books, the number of rooms and the number of people in the household at the age of ten (column 1). Second, the use of only one instrument does not allow us to test for over identifying restrictions. To this end, we estimated the extended IV model with two instruments this time. In addition to the early life language skills, the average education attainment at the regional level (column 2) and the percentage of total country population of people living in urban areas when individuals were fifteen years old (column 3) were used as instruments. The rationale behind the choice of these instruments is that regional-level education and country-level past fraction of urban population affect the incentives to invest in financial literacy through increases in human capital and social interactions (Jappelli 2010) without affecting the insurance decision. Next we replicated the main estimation model for the bigger sample, now including the countries that were excluded due to potential misrepresentation of coverage rates in the data (column 4). Lastly, we employed a non-linear specification with the use of an IV probit model. The results did not change with the new specifications. The effect of financial literacy is positive and statistically significant under all robustness checks. Furthermore, the diagnostic tests support our hypotheses including the overidentifying restrictions test that does not reject the null hypothesis of instrument validity in the case of two instruments.

Table 7 Robustness checks

	(1)	(2)	(3)	(4)	(5)
Financial literacy index	0.0508** (0.0204)	0.0443*** (0.0171)	0.0654** (0.0255)	0.0316* (0.0168)	0.0413**
Weak-id	168.662***	119.027***	54.757***	306.461***	243.65***
Over-id		0.079	2.561		
Endog	5.902**	6.169**	7.115**	3.065**	6.16**
Observations	18,797	19,115	11,388	33,708	19,116

*** p<0.01, ** p<0.05, * p<0.1. Robust standard errors in parentheses. All regressions include country fixed effects. (1): 2sls estimation; controls and instrument as in model 4 table 5; additional controls include number of books in household at age 10, number of rooms in household at age 10, number of people in household at age 10. (2): 2sls estimation; controls as in model 4 table 5; additional excluded instrument: average educational attainment at regional level. (3): 2sls estimation; controls as in model 4 table 5; additional excluded instrument: percentage of total country population of people living in urban areas when individuals were 15 years old. Historical data on fraction of urban population taken from World Bank World Development Indicators database since 1960. (4): 2sls estimation; controls and instrument as in model 4 table 5; extended sample: Austria, Netherlands, Spain, Italy, France, Denmark, Switzerland, Israel, Czech Republic and Luxembourg. (5): IV probit estimation; controls and instrument as in model 4 table 5; average marginal effect reported.

6 Conclusion

We have considered the role of financial literacy on the demand for private LTC insurance. With population ageing and increasing needs for formal LTC services, understanding the reasons that constrain or stimulate LTC insurance demand is important both from an individual welfare and government spending point of view.

Using data from the European survey SHARE we found evidence of low levels of financial literacy among the elderly despite financial literacy consisting of basic numeracy and financial concepts. When estimating the effect of financial literacy on insurance demand in later life we addressed the issue of endogeneity with an instrumental variables approach using early life ability measured by school performance at the age of ten. The preferred IV estimates indicate that financial literacy has a positive and statistically significant effect on the probability of holding private LTC insurance. This effect is also sizeable and distinct from other effects such as risk factors, financial risk tolerance and time discounting.

A few limitations are worth noting. First, identification rests on the typical instrumental variables assumptions some of which are difficult to test. The weak instruments and overidentifying restrictions tests were satisfied and financial literacy was found significant even after controlling for a range of other early life characteristics. To the extent that our measure of early life skills captures exogenous characteristics we are confident that the instrument is unlikely to be correlated to unobserved characteristics in later life.

A second limitation of this work is that we are not able to identify the mechanisms behind this effect. The positive coefficient suggests that individuals underestimate the value of insurance in the absence of financial literacy but the data does not allow us to disentangle the underlying changes. We have discussed limited information and behavioural biases such as loss aversion, framing and status quo bias as potential frameworks for the financial literacy effect but we cannot be sure which effect is at play. We leave the study of these mechanisms for future research.

The results have useful policy implications. If better financial skills in old age are linked to higher coverage rates then better preparedness of the elderly is an effective way to stimulate demand. Our measure of financial literacy in this application consisted of a set of very basic numerical skills and financial knowledge such as interest rate compounding. The effect was positive and significant beyond and above attitudes towards risk and time discounting suggesting that enhancing even just basic financial knowledge is important. Of course educational programs aimed at the financial sophistication of the elderly need to be considered along with other policy alternatives, such as tax subsidies (Goda 2011) but given the large estimated effect it is likely that they are a potentially cost effective intervention in raising insurance coverage.

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8 Appendix

8.1 Financial literacy in SHARE

SHARE asks four numerical and financial questions that are used to construct the financial literacy index:

1. If the chance of getting a disease is 10% how many people out of 1,000 would be expected to get the disease? Possible answers: 100; 100; 90; 900 and another answer.
2. In a sale, a shop is selling all items at half price. Before the sale a sofa costs 300 euro. How much will it cost in the sale? The possible answers: 150; 600 and another answer.
3. A second hand car dealer is selling a car for 6,000 euro. This is two-thirds of what it costs new. How much did the car cost new? Possible answers: 9,000; 4,000; 8,000; 12,000, 18,000 and another answer.
4. Let's say you have 2,000 euro in a savings account. The account earns 10% interest each year. How much would you have in the account at the end of two years? Possible answers: 2,420; 2,020; 2,100; 2,400 and another answer.

The way the financial literacy index is constructed is the following. If question (1) is answered wrongly then respondents are asked question (2) while if it is answered correctly respondents are directed to question (3). If both questions (1) and (2) are wrong then the financial literacy index score is 1, which is the lowest possible. If question (1) is wrong while question (2) is correct then the score is 2. Those respondents that answer question (1) correctly are taken to questions (3) and (4). If question (3) is wrong then the score is 3. If questions (1) and (3) are correct but (4) is wrong then the score is 4. If all questions (1), (3) and (4) are correct then the score is 5, which is the highest possible score.

8.2 Early life variables in SHARE

SHARELIFE from Wave 3 and the Childhood Module from Wave 5 include a set of questions on various aspects of childhood such as living conditions, accommodation, family structure and performance at school. The school performance variables are used as instruments in the analysis while other childhood variables are used as controls in the sensitivity analysis. The exact wording of these questions was follows.

Relative position in language at the age of 10: “And how did you perform in Language compared to other children in your class? Much better, better, about the same, worse or much worse than the average?”

Living conditions and accommodation: (a) “We would like to find out more about the accommodation where you lived when you lived when you were 10 years old. How many rooms did your household occupy in this accommodation, including bedrooms but excluding kitchen, bathrooms and hallways?”; (b) “Including yourself, how many people lived in your household at this accommodation when you were 10?”; (c) “Approximately how many books were there in the place you lived when you were 10? Do not count magazines, newspapers or your school books.”