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Financial Sophistication and Private Long-term Care Insurance Purchase Decision

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Abstract

Despite significant financial risk associated with long-term care expenditure, the market for private long-term care insurance (LTCI) remains severely limited. Understanding the sources of such under-insurance is important to evaluate any potential reforms to strengthen the private LTCI market so that it becomes a significant source of financing long-term care services and supports for the elderly. Considering LTCI as a form of retirement planning, one would expect an individual's financial literacy to affect their LTCI purchasing decision. Implementing an instrumental variable approach, the current study isolates the causal impact of financial sophistication on optimal decision to purchase a private LTCI coverage. Consistent with the literature on retirement planning, results show that individuals with more sophisticated financial knowledge were likely to purchase a private LTCI coverage.

JEL classification: I13; I38

Keywords: Long-Term care insurance purchase; retirement planning, financial sophistication

Introduction

Long-term care support and services (LTSS) represent a significant and growing source of expenditures for elderly in the U.S. A very few Americans can protect themselves against this financial risk due to lack of comprehensive public coverage for LTSS. Approximately $339 billion, or about 14% of all healthcare spending in the US, was consumed by LTSS in 2013 (Brown and Finkelstein 2011; Colello and Talaga, 2015))[1]. Favreault and Dey (2016) projected that formal LTSS expenditures are, on average, $138,000 per person turning 65 in 2015-2019, expressed in 2015 dollars. These costs are largely driven by nursing home care, where the average daily rate for a private room was $253 or over $97,000 annually in 2017 (Ujvari, 2018). Financing long-term care therefore presents a significant source of uncertainty for elderly individuals in the U.S. Yet despite these financial risks, nearly 20% of long-term care expenditures are financed out-of-pocket, with less than 10% of individuals purchasing a private long-term care insurance (LTCI) plan (Brown and Finkelstein 2007; Munnell et al. 2009). The current study considers financial literacy as one factor that may help explain this apparent under-insurance puzzle.

The limited market for private LTCI and perceived market failures have been the subject of substantial research and policy attention.[2] On the supply-side, high administrative costs, information asymmetry, and imperfect market competition are some of the factors cited to explain the limited availability of affordable private LTCI plans. Brown and Finkelstein (2008) provide empirical evidence that LTCI plans are priced well above actuarially fair values and limited in coverage generosity. The authors also estimated a large difference in loading[3] factors for men versus women despite no corresponding difference in generosity of coverage. More recently, Ameriks et al. (2016) estimate a life-cycle model to predict demand for private LTCI. Comparing predicted to observed LTCI purchases as well as detailed survey questions regarding hypothetical insurance products, the authors conclude that availability of better insurance products can explain a meaningful share of under-insurance in this market; however, there remains a sizable under-insurance puzzle even when comparing hypothetical products to stated preferences. Finkelstein and McGarry (2006) similarly concluded that supply-side factors by themselves may be insufficient to explain the limited size of the private LTCI market. On the demand-side, the presence of Medicaid as an outside LTCI option may crowd-out the private LTCI market. Brown and Finkelstein (2008) estimated the crowd-out effect to be as high as 70%. However, it is also unclear to what extent individuals fully anticipate future Medicaid coverage for LTSS, and recent evidence suggests only 17% of individuals anticipate Medicaid to cover their long-term care needs.[4] Other demand-side factors may include bequest motives, availability of informal care, self-reported expectations of future nursing home utilization, and experience with long-term care system (Finkelstein and McGarry 2006, Brown and Finkelstein 2011, Coe et al. 2015).

Given the large financial risk of LTSS and the role of private LTCI in retirement planning (Gupta 2004), one can expect an individual's financial literacy plays an important in his/her LTCI purchasing decision. This hypothesized relationship is natural given the literature on financial literacy and retirement planning (Ameriks2003; Lusardi and Mitchell 2004; Lusardi and Mitchell 2011). For example, Lusardi and Mitchell (2007a) provide evidence that a large proportion of the population in several industrialized countries is unable to perform simple financial calculations and has a poor understanding of basic financial products. Using the 2004 Health and Retirement Study (HRS) data, Lusardi and Mitchell (2007b) found that financial literacy had important implications for retirement planning even after controlling for various other factors influencing retirement decisions. A positive and significant relationship between increased financial knowledge and expected return on risky assets, and wealth accumulation has been noted in the literature as well (Delavande et al., 2008; Behrmanan et al., 2012). Bernheim (2001) similarly find that the expansion of high school financial education mandates had a positive effect on wealth accumulation.

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[1] Excluding Medicare expenditures, O'Shaughnessy (2013) estimates total spending for LTSS of $220 billion in 2011, or 9.3% all U.S. personal healthcare spending

[2] See Norton (2000) for a more detailed discussion of the theoretical limitations of the private LTCI market. Despite this theoretical literature, empirical investigation on the nature of this market remains relatively limited.

[3] The load is defined as how much a policy holder receive in terms of expected present discounted value (EPDV) of benefits for every dollar paid in expected present discounted value of premium on a typical LTCI policy. It is calculated as the difference between unity and the ratio of the EPDV of benefits to EPDV of premiums (Brown & Finkelstein, 2007)

[4] Results from a 2013 survey from the Associated Press and NORC Center for Public Affairs Research at the University of Chicago, available at \href{http://www.longtermcarepoll.org/Pages/Polls/Report.aspx}{www.longtermcarepoll.org}.}

Although the retirement literature offers a clear link between financial literacy and LTCI purchase decisions, this relationship has not been formally examined as a source of under-insurance in the private LTCI market. The current study examines this directly using data from the 2008-2014 HRS, where financial knowledge is measured with supplemental survey questions from the HRS regarding key interest areas of capital market, risk diversification, knowledge of fees and savvy/numeracy (Lusardi et al., 2014). Consistent with LTCI as a source of retirement planning, results show that financial sophistication is strongly correlated with LTCI purchases. Furthermore, a simple association between financial sophistication and LTCI purchase decision may raise questions whether this relationship reflects causality. For example, if the observed correlation between financial sophistication and LTCI purchase decision owes to some underlying and usually unobservable third factor such as impatience, which contributes to both financial literacy and LTCI purchasing decision, then it is difficult to conclude whether boosting financial education would enhance improved financial decision-making such as LTCI purchase. To address this issue, the current paper employed the instrumental variable methodology to identify the relationship between financial sophistication and LTCI purchasing decision.

This paper makes three important contributions to the growing literature on private LTCI and the associated under-insurance puzzle. First, a rigorous measure of financial sophistication is created that aggregates a more complete set of questions assessing knowledge of the stock market, investment strategies, the importance of fees and other related topics of finances. This new measure evaluates more sophisticated financial knowledge, including capital market and asset pricing and its impacts on LTCI purchasing decision. Second, using a set of plausible exogenous instrumental variables to control for potential omitted variables and random measurement error biases and show that financial literacy is still significantly and substantially associated with LTCI purchasing decision. Third, from a policy perspective, the Medicaid reform or other supply-side adjustments will not fully alleviate an extremely low rate of LTCI prevalence and unintended consequence of changes to Medicaid long-term care coverage may be to further disadvantage individuals with lesser financial sophistication.

The findings offer implications for financial education policy in that I find higher financial sophistication can make a significant difference in LTCI purchasing decision. It is possible that financial literacy is an outcome of one's formal and informal education. The current study considers financial literacy as capturing some element of one's education not otherwise captured by years of schooling or accumulated wealth. I leave the study of financial literacy as an outcome for future research and instead focus on the potential effects of financial literacy on optimal decision to purchase a LTCI coverage for financing long-term care costs.

Data and Methodology

Financial sophistication is measured using a rich set of 17 financial literacy questions that were asked in a special purpose experimental module to evaluate sophisticated financial knowledge among older adults in 2008 Health and Retirement Study (HRS). The HRS is a nationally representative biennial panel survey of Americans aged 50 years or older (Juster et al., 1995). The current study uses data from the HRS, which has been approved by the Institutional Review Board (IRB) at University of Michigan.[5] The survey began in 1992 and included non-institutionalized individuals born between 1931 and 1941, as well as their spouses of any age. Individuals born between 1925-1930 and 1942-1944 were added in 1998, with younger cohorts added in 2004 and 2010. The HRS includes a rich set of demographic and socioeconomic variables both at the individual and household levels. In addition, participants are asked specifically whether they have purchased private LTCI that covers nursing home care for a year or more, or any part of personal or medical care at home. This purchasing decision is our outcome variable of interest in this study.

[5] IRB approval information can be found at https://hrs.isr.umich.edu/sites/default/files/biblio/HRS_IRB_Information%28web%29_08_2018.pdf

The "3 big" HRS experimental module questions in 2004 have been widely and successfully used to explore the relationship between financial literacy and retirement planning as well as wealth accumulation (Lusardi and Mitchell, 2011 b, d). These three questions have also been adopted by several international surveys (Lusardi and Mitchell, 2011c and 2014). Nonetheless, these three questions evaluate basic knowledge of three economic concepts, namely interest compounding, inflation and risk diversification. However, an expanded knowledge of financial sophistication is important while making complex economic decision such as LTCI purchase. This measure of financial literacy evaluates more sophisticated knowledge beyond the basic financial literacy by eliciting what people know about the difference between stocks and bonds, how the stock market works, and the basic asset pricing. This additional financial literacy module in the HRS fielded in 2008 (Lusardi, Mitchell and Curto, 2014). This new HRS module (described in more detail below) allows the evaluation of the role of financial sophistication in LTCI purchasing decision.

To assess whether people understand the survey questions, it is important that questions are posed with alternative wordings while measuring financial sophistication. In HRS 2008 experimental module, respondents were randomly assigned to one of the two set of alternative questions wordings. For example, the first set of respondents was asked whether the statement "*If you invest for the long run, the annual fees of mutual funds are important*"; is *true* or *false;* while the second question is asked: "*If you invest for the long run, the annual fees of mutual funds are unimportant."*[6] This difference in the wording of the questions allows evaluating whether respondents understood the questions as asked to them in the survey, which is critical when measuring financial sophistication and knowledge of advanced financial concepts.

Outcome variable

Starting from 2002, HRS respondents were asked about their ownership of LTCI in such that *allows researchers to distinguish between participants who own a private LTCI and those who think they carry LTCI but in fact do not.* HRS participants are initially asked about their basic health insurance, including private and government-sponsored plans. The survey then asked "*Not including government programs, do you have any LTCI which specifically covers nursing home care for a year or more, or any part of personal or medical care in your home*." If a respondent answered *"yes"* to this question, he or she was then asked whether this insurance is one of the plans that they already described earlier (e.g. Medicaid, Medicare, VA, private HMO etc.) and, if so, to specify which plan. Respondents in the current study were classified as having a private LTCI if they acknowledged that they were ***not*** referring to any other insurance coverage but the LTCI. In fact, approximately 19% of respondents indicated that they referred to other government programs (Medicare, Medicaid, VA etc.) in 2008 and not the ownership of a private LTCI coverage when asked about LTCI ownership question. This indicates that the follow-up question is important in order to accurately estimate the LTCI prevalence rates in the HRS data.

The analytic sample restricts individuals 50 years or older who participated in the financial literacy experimental module in 2008. In total, 1482 respondents (not having any proxy respondents) were randomly selected for one of the two sets of alternative question wordings as described above. The binary outcome variable is constructed if a respondent had purchased a private LTCI any time between 2008 and 2014. About 9% of respondents who participated in 2008 financial literacy module purchased LTCI between 2008 and 2014.

Independent Predictors

[6] The Dutch DNB Household Survey and the American Life Panel used a related survey for a small subset of questions and found that the wording of questions does matter, especially for items measuring financial sophistication (Lusardi and Mitchell, 2009; Van Rooji, Lusardi and Alessie, 2011)

Measure of Financial Sophistication

In 2008, a subset of HRS respondents (about 1482) were selected for an experimental module that asked a battery of questions to assess their knowledge of the stock market, asset pricing, investment strategies, risk diversification the importance of investment fees, financial attitude and other related topics. This module is ideal for measuring financial sophistication as the questions were designed to evaluate in-depth knowledge and understanding of financial concept beyond the "big 3" questions that have been widely used as a measure of financial literacy. There were five different sub-groups of questions according to the topics that they cover. More details about this experimental module of the HRS can be found in Lusardi, Mitchell and Curto, (2009). Below is the description of some of the important questions that respondents were asked in all five areas in the survey and the definition of sophistication.

A. Knowledge of capital markets

(1) An employee of a company with publicly traded stock should have [a lot / little or none] of his or her retirement savings in the company's stock.
Sophisticated respondent: little or none

(2) (Please indicate whether you think each statement is true or false. If you are not sure, give your best guess.) If the interest rate falls, bond prices will [rise/fall].
Sophisticated respondent: rise

(3) (Please indicate whether you think each statement is true or false. If you are not sure, give your best guess.) [If/Even if] you are smart, it is [easy/hard] to pick individual company stocks that will have better than average returns.
Sophisticated respondent: Even if/hard

B. Risk diversification

(1) (Please indicate whether you think each statement is true or false. If you are not sure, give your best guess.) You should invest [most of your money in a few good stocks that you select rather than in lots of stocks or in mutual funds/ in either mutual funds or a large number of different stocks instead of just a few stocks].

Sophisticated respondent: **most of your money in a mutual funds or a large number of stocks…**

(2) When an investor spreads money between 20 stocks, rather than 2, the risk of losing a lot of money [decreases/increases].
Sophisticated respondent: decreases

C. Knowledge of fees

(1) If you invest for the long run, the annual fees of mutual funds are [unimportant /important]
Sophisticated investor: important

(2) It is [hard/easy] to find mutual funds that have annual fees of less than one percent of assets.
Sophisticated respondent: easy

D. Savvy/numeracy

(1) To make money in the stock market, you [should not/have to] buy and sell stocks [too often.]
Sophisticated investor: should not

(2) Using money in a bank savings account to pay off credit card debt is usually a [good/bad] idea.
Sophisticated respondent: good

(3) If you start out with $1,000 and earn an average return of 10% per year for 30 years, after compounding, the initial $1,000 will have grown to [more/less] than $6,000
Sophisticated respondent: more

E. Attitude towards investing and risks

(1) (Please indicate whether you think each statement is true or false. If you are not sure, give your best guess.) You should put all your money into the safest investment you can find and accept whatever return it pays

Sophisticated respondent: false

(2) [Even if] you are smart, it is [easy/hard] to pick individual company stocks that will have better than average returns

Sophisticated respondent: hard

(3) Financially, investing in the stock market is [no better/better] than buying lottery

Sophisticated respondent: better

Financial Sophistication Index

While the questions as described above measure knowledge of financial decision-making, construction of a single index is generally preferred in order to categorize respondents as relatively more or less financially sophisticated. The index is created by summing the number of questions answered correctly, subtract it from the mean and divide by 17 (the total number of questions asked in the survey) ; the result is centered to zero (range of -1 to 1) with a standard deviation of 0.2. This simple index has shown to be highly correlated with the PRIDIT weighted index as described in Lusardi, Mitchell and Curto (2014).

The analysis controls for a rich set of demographic and individual level characteristics that economic theory or previous empirical literature suggests are important determinants of LTCI purchasing decision. A list of covariates controlled in the analysis include whether the respondent is married or living with a partner, number of children, educational attainment (high school graduate, some college education), race, gender, financial wealth (by quartile), expectation of using nursing home in next five years, expectations of living between 80 to 100 years(depending on respondent's current age), future source of informal care, and financial planning horizon.

Methods

Linking financial literacy to LTCI purchasing decision is difficult because the measure of financial sophistication variable stems from non-experimental data. In such a scenario, endogeneity presents a pervasive problem, where some underlying unobserved factors that may contribute to higher level of financial literacy and LTCI purchasing decision. For this reason, analyses that do not control for such unobserved factors may be vulnerable to biases (likely in upward direction) in the estimated effects of financial sophistication on LTCI purchasing decision. Measures of financial sophistication are also likely subject to measurement errors, and thus biases. Instrumental variable (IV) approach is one way to address the problem of endogeneity due to measurement error.

The goal of the current analysis is to evaluate whether LTCI purchasing decision could be optimized with greater financial sophistication. Assume the true relationship between financial sophistication and LTCI purchasing decision for the i^{th} respondent as:

$$LTCI_i = \beta_0 + \beta_1 FS_i + \beta_2 X_i + \beta_3 E_i + \varepsilon_i \quad (1);$$

where $LTCI_i$ represents individual's decision to purchase private LTCI coverage which is impacted by the level of financial knowledge measured by financial sophistication, FS_i, other observed individual level characteristics X_i, unobserved characteristics E_i, and random error term ε_i. Financial sophistication is the only endogenous variable that directly impacts LTCI purchasing decision in equation (1) above. In order to augment the IV estimation approach, it is assumed that financial sophistication is determined by some observed individual characteristics, X_i^* (which may overlap with X_i), Z_i that affect financial sophistication but not LTIC purchasing decision, unobserved individual characteristics E_i, and the error term u_i.

$$FS_i = \alpha_0 + \alpha_1 X_i^* + \alpha_2 Z_i + \alpha_3 E_i + u_i \quad (2)$$

For ordinary least square (OLS) estimate of FS_i to be consistent it requires that the covariance between disturbance terms in equation (1) and (2) be zero; meaning there is no unobserved factors that are correlated with financial sophistication but also affect the LTCI purchasing decision. However, any unobserved individual factors included in the vector E_i usually appear in the compound disturbance terms making the OLS estimate to be biased due to omitted variables. The direction of this bias will depend upon whether the true values of β_3 and α_3 have opposite or same signs. For example, if the unobserved factor is the ability (or motivation to deal with personal finances,

intelligence) that positively affects financial sophistication and also positively impact LTCI purchase decision, then the OLS estimate of FS_i (β_1) will be biased upward.

To address this problem, the most commonly used method is to employ instrumental variable (IV) approach which accounts for the potential unobserved factors impacting both financial literacy and LTCI purchasing decision and the possibility of measurement errors in financial sophistication measure (Behrman et al., 2012; Hastings et al., 2013). The current study follows an instrumental variable (IV) method with robust standard errors to estimate the financial sophistication index of equation (1) in light of equation (2). This estimation strategy allows to isolate the causal effect of financial sophistication on LTCI purchasing decision and to control for measurement errors. The standard approach of two-stage residual inclusion method (2SRI) (Terza et al. 2008) was used to implement the IV technique. While researchers have acknowledged the difficulty of finding good instruments for financial literacy to establish a causal link, the current study has identified some family level variables as good candidate instruments in the HRS for financial sophistication. Recent literature has tested ingenuity of these instruments as one can find in a rich observational dataset, like HRS. Respondents in the HRS survey were asked regarding the personal finances of their siblings and parents, especially, whether the financial situation of their siblings and parents were better, worse or the same than their own financial situation. These variables particularly qualify for good instruments because these family level variables are exogeneous with respect to respondents' decision to LTCI purchasing since arguably, the financial experience of other family members is beyond respondents' control (Stolper and Walter, 2017). On a similar note, respondents can learn from their family members thereby promoting their own financial literacy. In fact, a strong connection between financial literacy and parental background has been reported in the literature as well. Financial literacy may well begin in the family, perhaps during early childhood by observing parents' savings and investment behaviors or receiving financial education from parents (Li 2009; Shim et al., 2009). Other studies also reported that there is a gap in financial literacy with foreign born citizen reporting lower financial literacy than U.S. born (Brown and Craf, 2013). HRS collects information whether the respondents born outside the U.S. The candidate instruments of financial sophistication index used in the estimation are mother's level of education[7], whether born in U.S. and financial situation of respondents' parents and siblings.[8]

Results

Table 1 shows that older Americans lack understanding about key domains of financial literacy related to risk diversification, bond prices and portfolio choice. For example, many respondents indicated support for acquiring own-company stock, even though it is unwise to hold much of own-employer stock from the risk diversification perspective. It is also of interest to see that responses were sensitive to how questions were worded in the survey. For example, when respondents were asked the 1st wording of this question (An employee of a company with publicly traded stock should have a lot of his or her retirement savings in the company's stock), they stated that it is *not a good idea* to hold much of own-employer stock. But when presented the same question in reverse ordering, most rejected the idea of holding *little or none* in own-employer stock. It is interesting to note how little older adults knew about key financial concepts as this module was fielded amid 2008 financial crisis.

Most respondents also lack understanding of key financial concepts. For example, about 60% of respondents do not seem to understand the key concept about asset pricing which was evaluated by asking whether individuals knew about the inverse relationship between interest rates and bond prices. When respondents were asked "*If the interest rate falls, bond prices will rise",* about 43% answered correctly, but when presented in reverse wording "*If the interest rate falls, bond prices will fall"*, only about 33% answered correctly. This difference is statistically significant. This implies that wording of the questions influenced the responses. Table 1 also indicates that about two-third of respondents knew that it is not a good idea "to invest most of your money in a few good stocks that you select rather than in lots of stocks or in mutual funds". Both version of this question might reflect some degree of financial
Table 1. Financial Sophistication Questions: Percent Correct

[7] Measured by the number of years of education completed.

[8] 3 categories were created: parent-sibling financial situation were better than or same respondents' financial situation, worse than respondents' financial situation and if the value if missing. The reference category was respondents' financial situation was worse than or same as their siblings/parents.

Domains	Questions	1st wording	2nd wording	Pooled
Capital market knowledge	An employee of a company with publicly traded stock should have [a lot/little or none] of his or her retirement savings in the company's stock	68.9	33.8	50.9
	It is [best to avoid/good idea to owning] stocks of foreign companies	37.6	37.6	37.6
	If the interest rate falls, bond prices will [rise/fall].	42.9	32.9	37.7
Risk Diversification	You should invest [most of your money in a few good stocks that you select rather than in lots of stocks or in mutual funds/ in either mutual funds or a large number of different stocks instead of just a few stocks]	53.9	67.2	37.7
	When an investor spreads money between 20 stocks, rather than 2, the risk of losing a lot of money [decreases/increases].	56.2	56.5	56.4
	The more you diversify among stocks, the [more/less] of your money you [can/should] invest in stocks.	45.5	49.3	47.4
Knowledge of fees	If you invest for the long run, the annual fees of mutual funds are [unimportant/Important]	56.0	71.1	63.6
	It is [hard/easy] to find mutual funds that have annual fees of less than one percent of asset	28.1	32.7	29.9
Savvy/numeracy	To make money in the stock market, you [should not/have to] buy and sell stocks [too] often	59.6	30.1	44.5
	For a family with a working husband and a wife staying home to take care of their young children, life insurance that will replace three years of income is [not/more than] enough life insurance	68.7	68.5	68.6
	Using money in a bank savings account to pay off credit card debt is usually a [good/bad] idea	59.4	54.8	57.1
	If you start out with $1,000 and earn an average return of 10% per year for 30 years, after compounding, the initial $1,000 will have grown to [more/less] than $6,000	66.2	49.9	57.9
Attitude towards risks/investment	You should put all your money into the safest investment you can find and accept whatever return it pays-True/False			65.0
	[Even older] retired people should [hold some/not hold] stocks.	63.2	83.0	73.3
	[Even if] you are smart, it is [easy/hard] to pick individual company stocks that will have better than average returns	34.3	72.8	54.0
	Financially, investing in the stock market is [no better/better] than buying lottery	30.8	10.6	20.5
	[There is no way to avoid people taking advantage of you if you invest in the stock market]/[It's possible to invest in the stock market in a way that makes it hard for people take unfair advantage of you].	25.4	47.9	36.9

sophistication towards risk diversion. Knowledge about investment fee is another important key concept as higher investment fee can erode financial gains from investment. While about two-third of respondents seemed to understand an importance of investment fees when investing for long-run, nonetheless, responses were sensitive to question wording. About 30% of sample respondents reported that it is difficult to find mutual funds charging annual fess of

less than one percent of assets, suggesting that many older adults may not know about low-cost mutual funds. Table 2 presents the summary statistics for the sample of HRS respondents who participated in the financial literacy module in 2008 and had valid responses to LTCI purchasing questions. Summary statistics are presented for individuals with and without LTCI. Incorporating the HRS survey design, estimates of population mean with estimated standard errors are presented as well. The sample descriptive reveals some clear differences across respondents with and without LTCI where individuals with LTCI are more likely to be White, more educated and wealthier, and more financially sophisticated on average.

Table 2: Summary Statistics for Outcome variable, Independent Predictors and Candidate Instruments by LTCI status (N=1482)

	With LTCI	Without LTCI	Pooled
Variables	Mean/Freq.	Mean/Freq.	
Outcome of interest			
LTCI purchase between 2008-2014			0.09(0.01)
Key independent Predictors			
Financial sophistical index	0.07(0.01)	0.03(0.00)	
Age at 2008	67.41(0.85)	64.9(0.30)	
Female	0.59(0.05)	0.53(0.02)	
Some College***	0.49(0.05)	0.28(0.02)	
High school graduate	0.23(0.05)	0.27(0.02)	
Married/partnered	0.68(0.05)	0.74(0.02)	
White***	0.96(0.01)	0.84(0.02)	
Black***	0.01(0.01)	0.09(0.01)	
Other Race	0.02(0.01)	0.06(0.01)	
Hispanic***	0.01(0.01)	0.09(0.01)	
Moving into NH in 5 yrs.			
Low risk (<10%)	0.48(0.06)	0.53(0.02)	
Medium risk (>10 but <=50%)***	0.29(0.06)	0.17(0.01)	
High risk (>=50%)	0.01(0.01)	0.02(0.003)	
Planning Horizon			
Plan near future (< 1 yr)***	0.41(0.05)	0.53(0.02)	
Plan (>1 but <=5 yrs.)**	0.39(0.05)	0.32(0.02)	
Plan (>5 yrs.)	0.15(0.03)	0.11(0.01)	
Wealth Quartiles			
Lower (25^{th})***	0.07(0.02)	0.26(0.02)	
50^{th} (median)**	0.11(0.03)	0.22(0.01)	
75^{th}	0.29(0.04)	0.27(0.01)	
Highest***	0.51(0.05)	0.24(0.02)	
Prob. of living 80-100 yrs.	55.2 (3.02)	47.2(0.94)	
Candidate Instruments for financial sophistication			
Whether US born			0.88(0.01)
Mother education (in yrs.)			10.34 (0.14)
Parent-sibling financial situation-better/same			0.27(0.02)
Parent-sibling financial situation-worse			0.26(0.01)
Parent-sibling financial situation-missing			0.41(0.01)

Note: *** indicates differences between with and without LTCI are significant at 1% level, and ** indicates significant at 5% level. Standard errors are shown in the parenthesis; HRS survey weight was used to reflect the multi-stage sampling design.

Comparing much with the existing literature, reduced form binary probit models with LTCI purchasing (between 2008 and 2014) as a binary outcome variable was estimated. This analysis will reveal whether there is an

association between financial sophistication and LTCI purchasing. Results from the instrumental variable estimation were presented to isolate the causal impact of financial sophistication on LTCI purchasing.

Marginal effects from binary probit models (without accounting for endogeneity) are summarized in Table 3. Robust standard errors are presented in the parentheses. Results across two specifications are presented in the table in order to assess the sensitivity of the estimates to the inclusion of other variables also thought to influence LTCI demand (e.g., expectations of future nursing home use). Column 1 presents results on the effects of financial literacy when controlling only for basic demographic/household characteristics. A positive relationship between financial literacy index and the likelihood of LTCI purchasing is not statistically significant.

Table 3: Marginal Effects from ordinary Probit Model

Variables	Marginal Effects (Base model)	Marginal Effects (Full model)
Fin. Sophistication index	0.011(0.007)	0.010(0.007)
Age	0.001(0.001)	0.00(0.00)
Female	0.02(0.01)	0.007(0.02)
Married	0.004(0.02)	-0.01(0.01)
White	0.05(0.03)*	0.05(0.02)*
Hispanic	-0.03(0.03)	-0.03(0.03)
Financial wealth- highest qtrl.	0.09(0.02)***	0.08(0.02)***
- 3rd Qtrl.	0.07(0.02)***	0.06(0.02)***
- Median	0.03(0.02)	0.03(0.02)
Some college	0.06(0.02)***	0.5(0.01)***
HS graduate	0.02(0.02)	0.01 (0.01)
Availability of Future help	-0.001(0.003)	-0.001(0.003)
Longevity 80-100 yrs.		0.0006 (0.0002)**
Moving into NH in 5 yrs. <10%		-0.001(0.04)
bet. 10 &50%		0.04(0.04)
Planning horizon <1 yr.		-0.03(0.02)
bet. 1 and 5 yrs.		0.001(0.02)
Preventive health measures		0.05(0.02)**

Consistent with existing findings in the literature (Finkelstein & McGarry, 2006), an individual's longevity (self-reported probability of living 100 years) appears to be a significant predictor of LTCI purchasing, namely, 10% increase in self-reported probability of living 100 years is associated with 0.1 percentage point increase in likelihood of LTCI purchasing, although expectation of future nursing home use does not appear to impact LTCI purchasing decision.

As in any insurance choice, risk preferences should play some role in whether an individual ultimately purchases a LTCI plan. Risk aversion was assessed using a previously validated measure that describes the number of preventive health behaviors that individuals perform (Finkelstein & McGarry, 2006). This measure was constructed by determining the percentage of gender specific preventive health measures that respondents undertake in past two years. For both men and women these measures include flu shot and blood test for cholesterol; while for men the list also includes prostate exam and for women a mammogram and pap smear tests are included. This measure of risk aversion implies that people are risk averse if they adhere to higher number of preventive health measures. The estimated coefficient on this variable is positive and statistically significant. This is perhaps not initially surprising, as the textbook treatment of insurance purchasing implies that high risk-averse individuals are likely to own LTCI. However, Einav & Finkelstein (2011) discuss how risk aversion may have a different effect empirically, relative to

the textbook insurance model, due to unobserved preference heterogeneity (e.g., high-risk individuals who are also less risk averse). Nonetheless, estimated effects of financial sophistical index and other variables are largely unchanged when including this measure of risk aversion. Expected longevity, financial planning horizon variables in the analysis.

Table 4: Marginal Effects from IV (2SRI) Estimation

Variables	Marginal Effects (Base model)	Marginal Effects (Full model)
Fin. Sophistication index	0.13(0.05)***	0.11 (0.05)**
Age	0.004(0.001)***	0.004 (0.001)**
Female	0.07(0.02)***	0.05 (0.02)**
Married	-0.01(0.01)	-0.02
White	0.07(0.03)**	0.07(0.03)**
Hispanic	-0.03(0.03)	-0.01(0.04)
Financial wealth- highest qtrl.	0.09(0.02)***	0.08(0.02)***
- 3rd Qtrl.	0.06(0.02)***	0.05 (0.02)**
- Median	0.03(0.02)	0.03 (0.03)
Some college	0.01(0.02)	0.02 (0.02)
HS graduate	0.000 (0.01)	-0.001(0.02)
Availability of Future help	-0.000 (0.00)	-0.000(0.00)
Longevity 80-100 yrs.		0.01 (0.003)**
Moving into NH in 5 yrs. <10%		-0.02(0.02)
bet. 10 &50%		0.02(0.02)
Planning horizon <1 yr.		-0.03(0.02)
bet. 1 and 5 yrs.		-0.004(0.02)
Preventive health measures		0.05(0.03)*
Residual from 1st stage	-0.63(0.33)**	-0.61(0.33)**

The empirical estimate of financial sophistication using the IV strategy is presented in Table 4. The marginal effects from the probit model using 2SRI shows that when the financial sophistication index is instrumented, the estimate is positive, significant and substantially larger than OLS estimate. This pattern suggests that OLS estimate greatly understate the impact of financial sophistication on LTCI purchasing decision due to random measurement error or omitted variable bias. For example, individuals who are over-cautious, may invest more in financial literacy and purchase LTCI although they tend to healthier compared to who don't purchase LTCI. In fact, Finkelstein & McGarry (2006) found that cautious people invest more in health by adhering to preventive health measures were more likely to purchase LTCI but less likely to use nursing home care. The IV estimate indicates that financial literacy is a powerful determinant of LTCI purchasing decision. Specifically, it shows that 0.2 standard deviation increase in the financial sophistication index would, on average, increase the likelihood of purchasing a LTCI by 11 percent (in the full model). In other words, increased financial literacy can have relatively large impacts on the decision to purchase a private LTCI coverage. The results also suggest that financial literacy does provide some information outside of what is otherwise captured by an individual's years of education. Financial sophistication index remains statistically significant after accounting for other individual level factors including longevity expectation, probability of future use of nursing home care use and the measure of risk aversion. Financial resources as measured by financial wealth and risk aversion measure appear to be important and significant in making optimal decision of LTCI purchasing.

As examined in Van Houtven & Norton (2004), Charles & Sevak (2005), Van Houtven & Norton (2008), Brown et al. (2012), and others, older adults may rely on informal care from family members as a substitute for care from formal market-based sources such as nursing homes, assisted living or independent living facilities. Although empirical evidence on this type of substitution is somewhat mixed (Charles & Sevak, 2005), if individuals can foresee using such informal care in the future, then this may effectively reduce the expected costs of long-term care in the absence of a private LTCI plan. In other words, the value of private LTCI may be inherently lower for individuals planning to rely on their children or other family members to provide care in lieu of market based long-term care. The HRS variable indicating if respondents think that they will have family members or friends who could offer care assistance should they need care in the future was included and result indicates no significant impact on LTCI purchasing decision.

Finally, the presence of Medicaid as an outside option for long-term care expenditures is known to heavily crowd-out the private LTCI market as individuals will eventually be eligible to receive Medicaid coverage if their expenses are sufficiently high (Brown & Finkelstein, 2008). However, there is evidence that most individuals do not fully anticipate such an option at the time of a potential LTCI purchase. If future long-term care financing through Medicaid is not known by an individual at the time of their LTCI purchasing decisions, then it would be inappropriate to incorporate the role of Medicaid in their decision process. That's why the Medicaid insurance status has not been included in the analysis and in fact, people with Medicaid insurance in previous wave (2006) were excluded from the sample because for them purchasing a private LTCI coverage is likely not a choice. Furthermore, substantial evidence on the role of Medicaid in underinsurance of LTCI has been offered by previous researchers (Finkelstein and Brown, 2006; Brown & Finkelstein 2007; Brown &Finkelstein 2008) and the primary goal of the current study was to investigate the role of financial literacy while accounting for potential endogeneity problem due to measurement errors or unobserved factors.

Table 5: First stage Regression Results

First-stage regression with Outcome variable of financial literacy index on instruments and other individual factors

Variables	Estimates
Parent-sibling financial situation-better	0.13(0.06)**
Parent-sibling financial situation-missing	-0.007(0.06)
Mother's education	0.034(0.007)***
Age	-0.008(0.003)***
Female	-0.31(0.05)***
Some College	0.31(0.06)***
HS graduate	0.13(0.06)**
US born	0.27(0.09)***
Constant	0.13(0.26)

First-stage F statistic value=16.2

Candidate instrument used in the IV estimation work quite well here. First, they predict financial literacy as is required by the first condition for a good instrument. The first stage F value (shown in Table 5) of 16.2 (with $p<0.001$) indicating that the instruments have passed the Stock-Yogo weak instrument test critical value for single endogenous variable (which is considered as F-value to be 10). Second criteria for a good instrument is the test of overidentifying restrictions. To gain some confidence on overall strength of instruments used for financial sophistication, overidentifying restrictions were tested using a simple regression-based approach outlined in Woolridge (2002, p.123). In estimating equation (1) via 2SRI, parent-sibling financial situation, mother's education and whether respondents were born in US are used as instruments for the sophistication index. Therefore, there are two overidentifying restrictions. Residual obtained from equation (2) using all instruments was regressed on instruments including other regressors. The test statistic is $N*R_u^2$ obtained from the OLS regression $\hat{u}\ on\ 1\ X_i^*, Z_i$. Under the null hypothesis this test statistic is distributed as χ_2^2. The overidentification test statistic value is close to 0 ($R_u^2 \cong 0$) which fails to reject the overidentifying restrictions at any reasonable level and offers some confidence in the overall set of instruments used for financial sophistication index.

Discussion and Implications

The current study employs an instrumental variable approach to identify the causal impact of financial sophistication on LTCI purchasing decision. According to the rational choice theory, a rational consumer is concerned about the financing of long-term care costs and likes to protect assets for consumption or bequest purposes and would consider purchasing a private LTCI coverage. Yet, we see only a limited number of people hold such a coverage. The lack of financial knowledge appears to be a potential barrier to a private LTCI purchasing decision. In general, this result mirrors those of the literature on retirement planning, in which financial literacy has been found to have a significant influence on individuals' retirement plans. However, much of this prior literature that studies the potential causes of underinsurance of LTCI coverage has overlooked the role of financial literacy as a significant predictor of LTCI purchasing decision. Implementing an IV approach, the current paper has isolated the causal effect of financial sophistication on LTCI purchasing decision using plausibly exogeneous variation of instruments available in the Health and Retirement Study. Results from this nationally representative sample indicate that financial sophistication measured by a comprehensive knowledge of risk diversification, asset pricing and capita market is positively correlated with LTCI purchasing where the IV estimate uncovers statistically significant and stronger positive impact of financial literacy. No significant positive effect of schooling (conditional on financial literacy) was observed.

There are some implications of the findings that need to be noted. First, prior studies examining the factors impacting LTCI purchasing decision ignores the role of financial literacy. IV estimate of financial sophistication index indicates that financial literacy is at least as important, if not more so, than schooling in explaining individuals' decision to purchase private LTCI, while accounting for measurement error and unobserved factors. Second, measure of financial literacy in the current study is comprehensive incorporating understanding of key concepts of financial sophistication related to risk diversification, asset pricing, numeracy and portfolio choice beyond the "Big 3" questions. The study then constructed a summary index of responses to all the questions that helped categorize respondents as relatively more or less financially sophisticated. Therefore, the impact of this comprehensive measure is more economically meaningful and potentially quite important. Third, the current paper contributes to the growing body of literature that focuses on the individual characteristics impacting their attachment to the financial market. Individuals who could include LTCI purchasing as a part of retirement decision may be better able to secure financial certainty regarding the costs of long-term care costs, as more than 50 of people would likely to use long-term care during their lifetime, especially women.

Limitations of the current study include the lack of objective measure of choices and preferences regarding potential financing options for future LTSS needs. For example, for individuals in the highest wealth groups may prefer to self-insure should they require LTSS in the future rather paying premiums for a long period of time. However, the current study accounts for the availability of family resources for future LTSS needs captures some aspects of consumer preferences. HRS does not include data on underwriting criteria used by the LTCI companies and who were denied coverage due to health conditions. Therefore, it is not clear in the data whether not having a private LTCI coverage is due to denial of underwriting process. Given the observational nature of the study the instruments are chosen carefully based on the evidence suggested in the existing literature linking financial literacy to retirement planning and financial outcomes. Therefore, the study can be considered as a quasi-experimental set up regarding the power of the causal links between financial sophistication and LTCI purchasing decision. However, since the error term is always unobservable, the test of exclusion conditions (whether instruments are correlated with the error term or nor) to ensure that the endogeneity problem has been solved totally is not empirically feasible. As suggested by Roberts and Whited (2013) that true exogeneous instruments are difficult to find in any observational dataset but identifying those in the HRS arguably the best exogeneous instruments that one can expect in any observational dataset. These instruments ensure the robustness of the result linking financial sophistication to LTCI purchasing decision in the current study.

A sizable literature linking financial literacy to retirement planning, and outcomes offer robust evidence that better financial literacy does indeed tend to increase the likelihood of retirement planning, accumulation of retirement wealth (smart investing and stock market participation). These studies primarily employed either panel data techniques or an instrumental approach to establish the positive and significant relationship between financial literacy and

retirement planning and outcomes. Given the fact that most people need LTSS during their post retirement years and costs of obtaining such services being extremely high, purchase of LTCI can be thought of as an integral part of retirement planning. Therefore, the optimal LTCI purchasing decision needs to happen in the pre-retirement phase that will offer some degree of financial security to access LTSS should they need in the future. Using four interrelated models for health evolution, wealth evolution, LTCI premium and coverage, and LTSS cost structure, Gupta and Li (2004) suggest that an individual planner makes health related financial decisions based on wealth status during lifetime and therefore appropriate investment decisions regarding retirement wealth needs to be made in order to purchase LTCI insurance. The result that better financial sophistication leads to higher probability to purchasing LTCI may support the idea that financial literacy can help people make better decisions regarding optimal LTCI purchasing. Then next questions are how to improve financial literacy? Or who would be the target groups those have incentives to invest in improving financial literacy in order to make decisions about LTCI purchasing as a part of retirement planning. This is particularly important because people who rely on state funded retirement plans may have less incentives to invest in financial literacy but LTCI is largely beneficial to middle-income group people who are wealthy enough not to qualify for Medicaid but may not have enough resources either to afford out-of-pocket LTSS costs. There are many compelling reasons for having financial education in school in order to improve exposure to young people to basic financial concepts underlying financial decision-making in adult life. One future extension of the current analysis hopes to implement a pilot study where financial education can be offered in the community places where people may go to learn or gather for social events. That study will also focus on the examination of the costs and benefits of enhancing financial literacy level among adults, especially who are around their 40s and actively engaged in retirement planning process. Nevertheless, the central finding of the current study is that individuals, and policy makers can promote financial security of long-term care financing by investing in financial literacy.

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