Rochester Center for Economic Research

Wealth, Financial Literacy and Behavioral Biases in Japan: the Effect of various Types of Financial Literacy

Shizuka Sekita, Vikas Kakkar, and Masao Ogaki

Working Paper No. 607

March 2021

UNIVERSITY OF
ROCHESTER

Wealth, Financial Literacy and Behavioral Biases in Japan: the Effects of various Types of Financial Literacy[1]

Shizuka Sekita [2], Vikas Kakkar[3], and Masao Ogaki[4]

This Draft: March 20, 2021

Abstract:

This paper considers the relationship between wealth, financial literacy and several other variables using data from Japan's first large-scale survey on financial literacy. Using an instrumental variables approach to account for possible endogeneity of financial literacy, we find that financial literacy has an economically large and positive impact on wealth accumulation. We also decompose financial literacy into 5 sub-categories and find that deposits literacy, risk literacy and debt literacy have significant impacts on wealth accumulation in Japan, whereas inflation literacy and insurance literacy do not. Several variables suggested by behavioral economics, such as over-confidence, self-control, myopia and risk-aversion are also significant determinants of wealth.

Keywords: Financial literacy, wealth, biases, survey, instrumental variables.

[2] Kyoto Sangyo University; sekita@cc.kyoto-su.ac.jp
[3] City University of Hong Kong; efvikas@cityu.edu.hk
[4] Keio University; mogaki@econ.keio.ac.jp

1. Introduction

A growing literature documents that measured financial literacy levels around the world are alarmingly low, even in economically advanced countries (see, for instance, Bucher-Koenen, Lusardi, Alessie and van Rooij (2014)). With life expectancy increasing globally, the responsibility of accumulating sufficient savings for retirement shifting from employers to employees, and the increasing sophistication and complexity of financial products, these low levels of financial literacy may lead to significantly lower levels of well-being via poor economic decisions. Survey evidence showing that many adults have no retirement plan and insufficient savings for retirement sits uncomfortably with conventional economic theory depicting individuals as maximizing inter-temporal utility by optimally accumulating and decumulating assets over the life-cycle.[5]

This paper explores the impact of financial literacy on a key economic variable with important consequences for overall well-being – the amount of wealth accumulated by household. Although the relationship between financial literacy and certain kinds of economic and financial behavior have been well documented[6], the relationship between financial literacy and wealth has been relatively less explored. Using data on Chilean, Dutch and Japanese households, respectively, Behrman, Mitchell, Soo and Bravo (2010), Van Rooij, Lusardi, and Alessie (2012), and Sekita (2020) find that financial literacy has a positive and significant impact on wealth accumulation.

Using data from Japan's first large scale survey on financial literacy, our paper contributes to the nascent literature on the relationship between financial literacy and wealth accumulation in two ways. First, in addition to considering financial literacy as a uni-dimensional variable, we also decompose it into 5 different sub-components comprising different types of financial literacy and conduct an instrumental variables analysis by utilizing some plausible instruments for different types of financial literacy. Our results show that these sub-components have significantly differential impacts on wealth accumulation, and this analysis enables us to identify which aspects of financial literacy are especially important in the Japanese context. This knowledge is very useful from a policy perspective because it can aid in the optimal design of financial education and training programs to improve financial literacy and decision-making.

---

[5] See for example, Bernheim *et al* (2001) and Lusardi and Mitchell (2007a and 2007b).
[6] Financial literacy has been found, for instance, to increase stock market participation in several countries around the world.

A second contribution of this paper is that, while controlling for other determinants of wealth such as age, income and education, we also consider the impact of several variables suggested by behavioral economics, such as over-confidence, self-control, myopia, risk-aversion and loss-aversion as possible determinants of wealth. Although these variables seem intuitively important and could plausibly affect financial decisions and therefore wealth accumulation, they have received relatively little attention in the extant literature.

The rest of the paper is structured as follows. The next section reviews the existing literature on the relationship between financial literacy and wealth accumulation. Section 3 describes the data we use and the construction of key variables of interest. Section 4 discusses our empirical results, and Section 5 presents some concluding remarks.

2. Literature Review

Since the seminal work of Bernheim (1995) highlighting the importance of financial knowledge in explaining differences in saving behavior, there has been a plethora of research on measuring financial literacy and its possible effects on various kinds of household behavior. Bernheim and Garrett (2003), Lusardi (2004) and Clark and D'Ambrosio (2008) show that workplace retirement seminars tend to increase savings in general as well as retirement savings.

Van Rooij *et al* (2011) and Yoong (2010) show that financial literacy has a significant and positive impact on stock market participation. Xia, Wang and Li (2014) show that individuals who are more overconfident about the level of their financial knowledge tend to participate more in equity markets. Christelis *et al* (2010) show that the propensity to invest in the stock market directly or indirectly is strongly associated with cognitive abilities in 11 European countries.

The papers closest to the issues we focus on here are Behrman *et al* (2010), Van Rooij *et al* (2012) and Sekita (2020). Utilizing household level data on a panel of Chilean households, Behrman *et al* (2010) use an instrumental variables approach to isolate the causal effects of financial literacy and schooling on wealth accumulation. Their estimates of the impact of financial literacy on wealth accumulation are large enough to suggest that social investments in financial literacy are likely to have large payoffs. In addition to showing that financial literacy has a positive and significant causal impact on wealth accumulation for Dutch households using an instrumental variables approach, Van Rooij *et al* (2012) also investigates two channels through which financial

literacy facilitates wealth accumulation. The first channel operates via higher stock market participation given that higher financial literacy lowers the informational barriers to participating in the stock market. The second way in which financial literacy increases wealth is via inducing a higher propensity to devising and sticking to a retirement savings plan because a higher level of financial knowledge reduces planning costs. Using micro data on Japanese households, Sekita (2020) analyzes the relationship between financial literacy and wealth accumulation after controlling for many determinants of wealth and possible endogeneity concerns. Consistent with Behrman *et al* (2010) and Van Rooij *et al* (2012), she also documents a positive and economically significant impact of financial literacy on wealth. She also shows that higher financial literacy increases the probability of holding equities as well as having a retirement plan, which are the two channels identified in Van Rooij *et al* (2012).

While retaining the instrumental variables approach to allay possible concerns regarding the endogeneity of financial literacy, this paper complements and extends the existing literature by decomposing financial literacy into five major components to identify which components have the largest and most significant impact on wealth accumulation. In addition, we also consider several variables suggested by behavioral economics as possible determinants of wealth accumulation.

3. Data and Variable Construction

3.1 Data

Our data are taken from the Financial Literacy Survey 2016 conducted by the Central Council for Financial Services Information in Japan. The Financial Literacy Survey 2016 is Japan's first large-scale questionnaire survey conducted with the aim of evaluating the financial knowledge and decision-making skills of Japanese adults. The survey was administered online to 25,000 individuals aged between 18 and 79 who were chosen in proportion to Japan's current demographic structure. After cleaning the data and removing observations for which some of the variables being analyzed were missing, we ended up with 15,298 observations.

3.2 Variable Construction

3.2.1 Wealth

Our measure of wealth is based on Question 51 of the Financial Literacy Survey which asks the respondents to choose one of the following ranges into which their household's financial assets (deposits, stocks, etc.) currently fall[7]: *1. Don't have any financial assets; 2. Less than 2.5 million yen; 3. At least 2.5 million but less than 5 million yen; 4. At least 5 million but less than 7.5 million yen; 5. At least 7.5 million but less than 10 million yen; 6. At least 10 million but less than 20 million yen; 7. At least 20 million yen; 8. Don't know/Prefer not to say*. For category 1, wealth is zero; for categories 2 to 6, wealth is regarded as the mid-point of that category, and for category 7, wealth is regarded as 25 million yen.[8]

3.2.2. Financial Literacy

We measure overall financial literacy as the respondent's total score out of 12 questions selected from the survey. Our measure of overall financial literacy is significantly broader relative to the measures used in other studies which typically utilize a smaller set of questions. In addition to quantifying the impact of overall financial literacy on wealth accumulation, it is also important to analyze whether different facets of financial knowledge have similar or differential impacts on wealth accumulation. We further decompose financial literacy into the 5 sub-categories of deposits literacy (2 questions), risk literacy (2 questions), insurance literacy (2 questions), debt literacy (4 questions) and inflation literacy (2 questions).

Appendix A provides details of the questions used to construct our measure of overall financial literacy and the 5 sub-measures.

3.2.3 Behavioral Variables

We turn next to the construction of variables suggested by behavioral economics. The variable "myopia" is based on Question 1_10 of the Financial Literacy Survey which asks respondents to answer the following question: "*How much do you agree or disagree that the following statement applies to you personally? Choose from a scale of 1 to 5 where 1 means 'agree'*

---

[7] Student respondents are asked choose the range for their own their own financial assets instead of the household to which they belong.

[8] Ideally, one would like to have a measure of net wealth of the respondents, but since the survey does not provide information about their financial liabilities, we use the value of gross financial assets as our measure of wealth.

and 5 means 'disagree'. "If I had the choice of (1) receiving 100,000 yen now or (2) receiving 110,000 yen in 1 year, I would choose (1), provided that I can definitely receive the money"". The key idea behind myopia is to capture present-biased preferences in which one places extra value on more immediate awards. We define the variable "myopia" as the difference between 5 and the answer to Question 1_10, so that a higher value is associated with a greater degree of myopia.

The variable "herding" captures the notion that a person prefers to follow others in making a financial decision, rather than making an independent decision. It is based on Question 1_3 of the Financial Literacy Survey which asks: *"How much do you agree or disagree that the following statement applies to you personally? Choose from a scale of 1 to 5 where 1 means 'agree' and 5 means 'disagree'. "When there are several similar products, I tend to buy what is recommended as the most selling product, rather than what I actually think is a good product""*. We define the variable "herding" as the difference between 5 and the answer to Question 1_3, so that a higher value reflects a greater degree of herd-like behavior.

The variable "self-control" encapsulates the degree to which a person makes deliberate and well thought-out decisions rather than deciding impulsively. It is based on Question 1_1 of the Financial Literacy Survey, which asks: *"How much do you agree or disagree that the following statement applies to you personally? Choose from a scale of 1 to 5 where 1 means 'agree' and 5 means 'disagree'. "Before I buy something I carefully consider whether I can afford it""*. Our measure of "self-control" is defined as the difference between 5 and the answer to Question 1_1, so that a higher value reflects a lower tendency of impulsive spending and hence a higher degree of self-control.

We measure the variable "over-confidence" as the difference between "subjective financial literacy" and "objective financial literacy". Our measure of subjective financial literacy is based on Question 17 of the Financial Literacy Survey: *"How would you rate your overall knowledge about financial matters compared with other people? Choose only one answer. 1. Very high, 2. Quite high, 3. About average, 4. Quite low, 5. Very low, 6. Don't know"*. We define "subjective financial literacy" as the difference between 5 and the answer to Question 17, so that a higher value corresponds to a higher level of "subjective financial literacy". "Objective financial literacy", by contrast, is defined as the sum of the 5 sub-categories of financial literacy defined earlier. A high value of the "over-confidence" variable reflects that there is a big gap between the respondent's

perception of their own financial literacy and their actual level of financial literacy, reflecting more over-confidence.

We measure the variable "loss aversion" based on Question 6 of the Financial Literacy Survey, which asks: *"Suppose that, if you invested 100,000 yen, you would either get a capital gain of 20,000 yen or a capital loss of 10,000 yen at 50% probability. What would you do? Choose only one answer. 1. I would invest, 2. I would not invest"*. We define "loss-aversion" to be a dummy variable which takes the value 1 if the respondent chooses option 2 in the question above, and 0 otherwise.

We also create a measure of "risk aversion" using Question 1_9 of the Financial Literacy Survey, which asks: *"How much do you agree or disagree that the following statement applies to you personally? Choose from the following scale of 1 to 5. "I am prepared to take a risk when saving or making an investment""*. We define "risk aversion" as the answer to the question above minus 1, so that a lower value is associated with a higher degree of risk aversion.[9]

We also use several other variables, such as gender, age, education and income as controls in our regressions.

4. Results

Table 1 provides some summary statistics for our measure of wealth and the financial literacy variables. Wealth has a mean value of JPY 8,234,200[10], with a standard deviation of JPY 9,049,400. Financial Literacy has a mean value of 6.95 out of 12, which corresponds to a percentage score of 58%. These results are consistent with Sekita (2011), who also finds that the level of financial literacy is not high in Japan. When we consider the sub-categories of financial literacy, we find

---

[9] The intuition behind using Question 6 to proxy for loss aversion and Question 1_9 for risk aversion can be perhaps be better understood by considering the parametrization used by Tversky and Kahneman (1992), who propose the two-part value function of the form

$$v(x) = \begin{cases} x^{\alpha} & \text{if } x \geq 0 \\ -\gamma(-x^{\beta}) & \text{if } x < 0. \end{cases}$$

Here the parameter α measures risk aversion for the gain phase, the parameter β measures risk aversion for the loss phase, and the parameter γ measures loss aversion. Since Tversky and Kahneman (1992) find α and β to approximately the same, we can use Question 1_9 as a proxy for risk aversion given that we are controlling for loss aversion by Question 6.

[10] This corresponds to approximately USD 75,640 at the exchange rate of March 19, 2021.

that the mean scores for Debt Literacy and Insurance Literacy are relatively low (51.5% and 54.5%, respectively), whereas those for Risk Literacy and Inflation Literacy are relatively higher (66.5% and 64.5%, respectively).

4.1 OLS Estimation

Table 2 reports the results of the relationship between wealth, financial literacy and several other socio-economic and behavioral variables using OLS. The first column reports the results for overall financial literacy. Financial literacy has a positive effect on wealth which is both economically and statistically significant. An increase in overall financial literacy by 1 point increases wealth by JPY 1.97 million. Wealth is monotonically increasing with age up to age 69, and thereafter starts to diminish. Education also has a positive and significant impact on wealth, with university graduates' accumulating JPY 1.52 million more in wealth relative to those with less than junior-college education. The relationship of employment status with wealth is more complex, with the self-employed, homeworkers and the unemployed all accumulating more wealth than corporate and government employees. The higher wealth of the unemployed may be a reflection of the fact that retirees are classified as unemployed. Income has the expected positive and monotonic relationship with wealth accumulation.

Turning to the behavioral variables, we find that individuals with higher myopia, accumulate significantly lower wealth, which is consistent with our a-priori expectations. The coefficient of loss aversion also has the expected negative sign and is statistically significant at conventional levels. A higher degree of risk aversion also leads to lower wealth accumulation. The coefficient of herding is small and insignificant. The coefficient of self-control differs from our a-priori expectation in that a higher degree of self-control is associated with lower wealth. The coefficient of overconfidence is positive and both economically and statistically significant.

The second column of Table 2 reports the results for the relationship between wealth and the 5 different sub-categories of financial literacy that we consider. All five components of financial literacy have a positive and significant impact on wealth accumulation, with deposits literacy and inflation literacy yielding the largest beneficial impact. The coefficients of the other variables are similar to those in first column.

To summarize, the OLS estimates suggest that overall financial literacy has a significant and positive impact on wealth accumulation in Japan, along with several other socio-economic and behavioral variables also playing an important role in determining wealth.

4.2 Instrumental Variable Estimation

Although the OLS results are encouraging, they need to be viewed with some circumspection given the possibility that they could be affected by possible endogeneity concerns. Richer individuals could, for instance, acquire higher financial literacy through their higher exposure to risky financial assets.

One way to address these endogeneity concerns is to conduct an instrumental variables analysis by utilizing some plausible instruments for financial literacy. We construct instruments for financial literacy from the Financial Literacy Survey of 2016. Our first instrument is a dummy variable which takes the value of 1 if the respondents have had the opportunity to have some financial education at school, university or in their workplace, and 0 otherwise.[11] Our second instrument is the number of newspapers in circulation in each prefecture divided by the population of that prefecture. In addition, we also use the average prefectural-level financial literacy as instruments for the 5 sub-components of financial literacy. Similar instruments have been used in the literature. For instance, Lusardi and Mitchell (2007b) and van Rooij, Lusardi and Alessie (2011, 2012) use the level of economics education as an instrument. van Rooij, Lusardi and Alessie (2011) also consider the parents' understanding of financial matters as an instrument. Bucher-Koenen and Lusardi (2011) use voting shares for different political parties at the regional level as instruments. Calcagno and Monticone (2015) use the average financial literacy at the regional level as an instrument for financial literacy. In a similar vein Sekita (2011) uses average Japanese skills in each prefecture as an instrument for financial literacy.

Table 3 shows the results for the first-stage regressions. The first column provides the results for overall financial literacy. Both the financial education and the number of newspapers per-capita instruments have the expected positive sign and are statistically significant. The coefficient of the Male dummy is positive and significant, indicating that men have higher financial

---

[11] This instrument is based on Question 39 of the Financial Literacy Survey 2016.

literacy than women, a finding which has been documented for Japan (Sekita (2011) and (2020)) and many other countries as well. Previous studies show that the relationship between financial literacy and age shows an inverted U-shaped pattern, being the lowest for youngest and oldest groups, and reaching a peak in middle age (Lusardi and Mitchell (2011)). However, we find a monotonic relationship between age and financial literacy in Japan. Consistent with previous literature, higher educational attainment and income also have a positive effect on financial literacy. With the exception of herding, all the other behavioral variables have a significant impact on financial literacy, which is consistent with their expected sign. A higher degree of myopia, loss aversion, risk aversion and overconfidence have a negative impact on financial literacy, whereas more self-control is associated with greater financial literacy. Kakkar and Ruiz (2017) also find overconfidence and myopia have a significantly negative impact on financial literacy for Spain, although they do not consider loss aversion and herding. Higher risk aversion in Japan is associated with lower overall financial literacy.

Columns 2 through 6 of Table 3 show the results of the first-stage regressions for the 5 sub-components of financial literacy. The coefficient of the prefectural-level average literacy for each sub-component is positive and significant for itself but not for other components. With the exception of deposits literacy, the coefficient of financial education is positive and significant for all the other sub-components of financial literacy. Interestingly, although men have significantly higher levels of deposits literacy and inflation literacy, women have higher levels of insurance literacy.[12] For the behavioral variables, the coefficients are similarly signed for all the 5 sub-components as for overall financial literacy.

Table 4 reports the LIML estimates of the effects of financial literacy and other control variables on wealth. The first column reports the results for overall financial literacy, with financial education and the number of newspapers per capita as instruments. The Effective F-statistic (Montiel-Pflueger robust weak instrument test) is 112.53, which exceeds the LIML critical value of 13.76 at the 5% significance level, so we can reject the null hypothesis of weak instruments. The P-value for Hansen's J test of overidentifying restrictions is 0.71, which is consistent with the instruments being valid.

---

[12] This result may be driven by the fact that in Japan, more women work in the insurance industry relative to men.

Even after controlling for possible endogeneity, the impact of overall financial literacy on wealth is positive and significant. A one-point increase in overall financial literacy is associated with an increase of JPY 2.91 million[13] in the wealth of the respondent, which is an economically large effect. Controlling for overall financial literacy and other variables, men have significantly lower levels of wealth compared to women. Wealth increases almost monotonically with education, income and age (up to age 60-69).

Among the 6 behavioral variables, myopia, self-control, loss-aversion and risk-aversion are significantly negative whereas overconfidence has a significantly positive impact on wealth. The coefficient of herding is not statistically significant.

The positive coefficient of overconfidence may seem counterintuitive. However, overconfidence has been associated with significantly higher stock market participation. Using the same measure of overconfidence as we use here, Xia, Wang and Li (2014) find that a one-unit increase in overconfidence increases the probability of stock market participation by approximately 20% in China. Given that Japanese households are well-known to be highly risk-averse, and the proportion of stockholdings in their portfolio is very low[14], overconfidence may have a significant beneficial impact on wealth both by increasing participation in the stock market and the weight allocated to stocks in their portfolio. Another possibility is that higher wealth could also plausibly lead to more overconfidence, which could in turn lead to lower self-control. More research is needed to confirm which of these interpretations is valid.

The negative coefficient of self-control is contrary to our expectation, and this could be caused by simultaneity if individuals with higher wealth tend to lack self-control.

The second column of Table 4 reports the LIML estimates of the effects for the 5 sub-components of financial literacy on wealth. The Sanderson-Windmeijer multivariate F-values of excluded instruments for each sub-component of financial literacy exceed the rule of-thumb level

---

[13] This is roughly US$ 26,732 at the exchange rate of March 19, 2021.
[14] According to Bank of Japan, Japanese households hold only 6% of their total assets in stocks compared with 33% in the U.S. and 15% in Europe. See http://topforeignstocks.com/2013/01/20/stock-market-participation-rate-across-countries/ for details.

of 10, so we can reject the null hypothesis that our instruments are weak. The *P*-value for Hansen's *J* test of overidentifying restrictions is 0.69, which is consistent with the instruments being valid.

The results show that the impact of different sub-components of financial literacy on wealth varies considerably, with deposits literacy, risk literacy, and debt literacy having economically large and statistically significant impacts on wealth accumulation. Deposits literacy has the largest impact on wealth, with a 1 point increase in deposits literacy being associated with an increase in wealth of JPY 6.4 million. The coefficients of inflation and insurance literacy are positive but are not significantly different from zero. Inflation literacy's impact on wealth is more likely to be important when inflation's volatility is high. In Japan, however, both the level of inflation and its volatility have been very low for several years. Given this low and stable inflation environment, the benefits from inflation literacy are likely to small for wealth accumulation. One reason why insurance literacy is not significantly related to wealth accumulation could be due to the fact that many types of insurance that protect us from financial ruin are not choice variables but mandated by the government (for example, health insurance, pension insurance and long-term care insurance etc). To the extent that a significant portion of insurance is mandated, the impact of insurance literacy on wealth accumulation may be muted, as we observe in the data.

5. Conclusions

Using data from Japan's first large-scale survey on financial literacy, this paper finds that improvements in financial literacy can yield rich dividends for Japanese households and increase their wealth substantially. These results are robust and the estimated impact of financial literacy on wealth increases significantly when we account for the possible endogeneity of financial literacy by using an instrumental variables approach. An important new finding is that it is useful to distinguish between different types of financial literacy since they have differential impacts on wealth. Deposits literacy, risk literacy and debt literacy have a much greater impact on wealth accumulation relative to insurance literacy and inflation literacy, a fact which has important policy implications for the design of financial education programs. We also find that behavioral biases can have important and unexpected consequences for wealth accumulation. Future research should explore the channels through which these behavioral biases affect investment decisions and wealth accumulation in more detail.

References

Ameriks, John, Caplin, Andrew, and Leahy, John (2003) "Wealth Accumulation and the Propensity to Plan," *Quarterly Journal of Economics*, 118, 1007-1047.

Behrman, Jere R., Mitchell, Olivia S., Soo, Cindy, and Bravo, David (2010) "Financial Literacy, Schooling, and Wealth Accumulation," *NBER Working Paper* 16452 http://www.nber.org/papers/w16452.

Bernheim, B. Douglas (1995) "Do Households Appreciate Their Financial Vulnerabilities? An Analysis of Actions, Perceptions, and Public Policy," in *Tax Policy and Economic Growth*, 1-30, Washington, DC: American Council for Capital Formation.

Bernheim, D., Skinner, J. and Weinberg, S. (2001). "What accounts for the variation in retirement wealth among U.S. households?," *American Economic Review*, vol. 91(4), pp. 832-857.

Bernheim, D. and Garrett, D. (2003). "The effects of financial education in the workplace: evidence from a survey of households," *Journal of Public Economics*, vol. 87(7), pp. 1487-519.

Bucher-Koenen, T. and Lusardi, A. (2011). Financial literacy and retirement planning in Germany, Journal of Pension Economics and Finance, vol. 10(4).

Bucher-Koenen, Tabea, Lusardi Annamaria, Alessie, Rob, and van Rooij Maarten (2014) "How Financially Literate are Women: An Overview and New Insights," NBER Working Paper 20793 http://www.nber.org/papers/w20793.

Calcagno, Riccardo and Chiaro Monticone (2015). "Financial literacy and the demand for financial advice," *Journal of Banking and Finance*, vol. 50, pp. 363-380.

Christelis, Dimitris, Jappelli, Tullio, and Padula, Mario (2010) "Cognitive Abilities and Portfolio Choice," *European Economic Review*, 54, 18-38.

Clark, R. and D'Ambrosio, M. (2008). "Adjusting retirement goals and saving behavior: the role of financial education," in (A. Lusardi, ed.), *Overcoming the Saving Slump: How to Increase the Effectiveness of Financial Education and Saving Programs*, pp. 237–56, Chicago, IL: University of Chicago Press.

Kakkar, Vikas and Elisabet Ruiz (2017). "Determinants of Financial Literacy: Evidence from Spain", manuscript, City University of Hong Kong.

Lusardi, A. (2004). "Saving and the effectiveness of financial education", in (O. Mitchell and S. Utkus, eds.), *Pension Design and Structure: New Lessons from Behavioral Finance*, pp. 157–84, Oxford: Oxford University Press.

Lusardi, Annamaria and Mitchell, Olivia S. (2007a) "Baby Boomer Retirement Security: The Roles of Planning, Financial Literacy, and Housing Wealth," *Journal of Monetary Economics*, 54, 205-224.

Lusardi, Annamaria and Olivia S. Mitchell. 2007b. "Financial Literacy and Retirement Planning: New Evidence from the RAND American Life Panel," Michigan Retirement Research Center Research Paper No. WP 2007-157.

Sekita, Shizuka (2011) "Financial Literacy and Retirement Planning in Japan" *Journal of Pension Economics and Finance*, 10, 637-656.

Sekita, Shizuka (2020) "Japanese Asset Formation and Financial Literacy," *Public Policy Review*, 16, 1-19.

Stock, James H., Wright, Jonathan H. and Yogo, Motohiro (2002) "A Survey of Weak Instruments and Weak Identification in Generalized Method of Moments," *Journal of Business and Economic Statistics*, 20, 518-529.

Van Rooij, Maarten C.J., Lusardi, Annamaria, and Alessie, Rob J.M. (2011) "Financial Literacy and Stock Market Participation," *Journal of Financial Economics*, 101, 449-472.

Van Rooij, Maarten C.J., Lusardi, Annamaria, and Alessie, Rob J.M. (2012) "Financial Literacy, Retirement Planning and Household Wealth," *Economic Journal*, 122, 449-478.

Yoong, Joanne, (2010). "Financial Illiteracy and Stock Market Participation: Evidence from the RAND American Life Panel," *Pension Research Council Working Paper No. 2010-29*

Xia, Tian, Wang, Zhengwei and Li, Kunpeng (2014) "Financial Literacy Overconfidence and Stock Market Participation," *Social Indicators Research*, 119, 1233-1245.

Table 1: Descriptive Statistics

Wealth is measured as the household's (gross) financial assets (comprising bank deposits, stocks etc.). It is based on the answer to Question 51 in the Financial Literacy Survey 2016. Financial Literacy is measured as the number of correct answers to 12 questions in this survey. We further decompose Financial Literacy into Deposits Literacy (2 questions), Risk Literacy (2 Questions), Insurance Literacy (2 questions), Debt Literacy (4 questions) and Inflation Literacy (2 questions).

Variables	Obs	Mean Score	Std. Dev.	Min	Max
Wealth					
Wealth (10,000 JPY)	15,298	823.42	904.94	0	2,500
Financial literacy					
Financial Literacy	15,298	6.95	3.48	0	12
Deposits Literacy	15,298	1.19	0.80	0	2
Risk Literacy	15,298	1.33	0.74	0	2
Insurance Literacy	15,298	1.09	0.82	0	2
Debt Literacy	15,298	2.06	1.28	0	4
Inflation Literacy	15,298	1.29	0.81	0	2

Table 2: Financial Literacy and Wealth (OLS Estimates)

This table reports the Ordinary Least Squares estimates of the relationship between wealth and financial literacy, which controlling for age, employment status, income and several important personal traits suggested by behavioral economics. We have also included 9 regional dummies whose coefficients are not reported here. White's heteroscedasticity-robust standard errors are in parenthesis. *, **, and *** indicate statistical significance at the 10%, 5% and 1% levels, respectively.

	OLS	
	OLS(1) Wealth	OLS(2) Wealth
Financial Literacy	196.86***	
	(6.92)	
Deposits Literacy		209.00***
		(11.22)
Risk Literacy		180.73***
		(12.07)
Insurance Literacy		191.16***
		(11.36)
Debt Literacy		195.33***
		(9.42)
Inflation Literacy		211.43***
		(11.50)
Male	-102.08***	-105.86***
	(15.16)	(15.32)
Age 30-39	72.01***	72.00***
	(16.40)	(16.40)
Age 40-49	124.63***	124.22***
	(17.91)	(17.94)
Age 50-59	274.98***	272.66***
	(20.54)	(20.7023)
Age 60-69	652.78***	649.57***
	(21.73)	(21.94)
Age 70-79	646.38***	641.37***
	(25.56)	(25.90)
Self-employed	59.57**	59.00**
	(24.64)	(24.64)
Part-time	1.03	1.39
	(18.62)	(18.62)
Homeworker	134.13***	133.72***
	(19.92)	(19.93)
Unemployed	194.51***	194.43***

	(22.24)	(22.26)
Junior-college	87.47***	87.35***
	(20.11)	(20.11)
University	151.91***	150.58***
	(13.53)	(13.56)
Income 250-500	215.57***	216.24***
	(15.41)	(15.46)
Income 500-750	343.55***	344.57***
	(18.24)	(18.33)
Income Over 750	812.98***	813.36***
	(21.93)	(21.00)
Myopia	-56.28***	-56.25***
	(3.94)	(3.94)
Self-control	-40.60***	-40.44***
	(6.16)	(6.16)
Loss Aversion	-83.97***	-84.34***
	(15.71)	(15.71)
Risk Aversion	-32.87***	-32.93***
	(5.29)	(5.29)
Herd	-7.72	-7.76
	(5.85)	(5.85)
Over-confidence	165.90***	166.18***
	(6.99)	(6.99)
Constant	60.50	63.53*
	(38.16)	(38.25)
Observations	15,298	15,298
R-squared	0.36	0.36

Table 3: First Stage Regressions

	First-stage regressions					
	Overall Literacy	Deposits Literacy	Risk Literacy	Insurance Literacy	Debt Literacy	Inflation Literacy
Average Deposits Literacy		0.81***	-0.11	-0.18	-0.28	-0.15
		(0.15)	(0.13)	(0.14)	(0.18)	(0.14)
Average Risk Literacy		-0.23	0.75***	-0.29	-0.47*	-0.18
		(0.20)	(0.18)	(0.20)	(0.25)	(0.19)
Average Insurance Literacy		-0.14	-0.13	0.86***	-0.28	-0.16
		(0.16)	(0.14)	(0.15)	(0.18)	(0.15)
Average Debt Literacy		-0.14	-0.14*	-0.16*	0.70***	-0.17*
		(0.10)	(0.09)	(0.10)	(0.11)	(0.09)
Average Inflation Literacy		-0.14	-0.15	-0.11	-0.29	0.76***
		(0.16)	(0.14)	(0.16)	(0.19)	(0.15)
Financial Edu	0.36***	0.01	0.03**	0.12***	0.15***	0.04***
	(0.02)	(0.02)	(0.01)	(0.02)	(0.02)	(0.01)
Financial Edu DK	-0.19***	0.05***	-0.15***	-0.06***	-0.07***	0.04**
	(0.02)	(0.02)	(0.01)	(0.01)	(0.02)	(0.02)
Newspaper	0.0005**					
	(0.0003)					

Male	0.10***	0.09***	0.00	-0.13***	0.02	0.12***
	(0.02)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Age 30-39	0.03	-0.04**	-0.00	0.03*	-0.01	0.05***
	(0.03)	(0.018)	(0.02)	(0.02)	(0.02)	(0.02)
Age 40-49	0.12***	-0.08***	0.03*	0.03	0.01	0.13***
	(0.03)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
Age 50-59	0.23***	-0.06***	0.01	0.02	0.03	0.23***
	(0.03)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
Age 60-69	0.40***	-0.05***	0.06***	-0.05***	0.11***	0.33***
	(0.03)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
Age 70-79	0.43***	-0.03	0.09***	-0.17***	0.12***	0.42***
	(0.03)	(0.02)	(0.02)	(0.02)	(0.03)	(0.02)
Self-employed	0.05*	0.02	0.01	-0.02	0.02	0.03
	(0.03)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
Part-time	-0.06**	-0.02	-0.02	0.03*	-0.02	-0.03*
	(0.02)	(0.02)	(0.01)	(0.01)	(0.02)	(0.02)
Homeworker	-0.03	-0.01	-0.03**	-0.01	0.01	0.00
	(0.02)	(0.02)	(0.01)	(0.02)	(0.02)	(0.02)
Unemployed	-0.02	0.02	-0.02	0.00	0.00	-0.02
	(0.02)	(0.02)	(0.01)	(0.02)	(0.02)	(0.01)
Junior-college	0.08***	0.03*	0.02	0.02	-0.01	0.02

	(0.02)	(0.02)	(0.01)	(0.02)	(0.02)	(0.02)
University	0.19***	0.04***	0.00	0.04***	0.02*	0.08***
	(0.02)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Income 250-500	0.12***	0.05***	0.01	0.06***	0.04**	-0.04***
	(0.02)	(0.01)	(0.01)	(0.01)	(0.02)	(0.01)
Income 500-750	0.27***	0.07***	0.02	0.12***	0.09***	-0.04***
	(0.02)	(0.02)	(0.01)	(0.01)	(0.02)	(0.01)
Income Over 750	0.44***	0.13***	0.03**	0.12***	0.18***	-0.02
	(0.02)	(0.02)	(0.01)	(0.02)	(0.02)	(0.01)
Myopia	-0.04***	-0.01***	-0.01***	-0.01**	-0.01***	-0.01**
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Self-control	0.06***	0.00	0.01	0.02***	0.02***	0.01**
	(0.01)	(0.00)	(0.00)	(0.00)	(0.01)	(0.00)
Loss Aversion	-0.30***	-0.04***	-0.07***	-0.02**	-0.11***	-0.05***
	(0.02)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Risk Aversion	-0.08***	-0.00	-0.02***	-0.01***	-0.03***	-0.02***
	(0.01)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Herd	0.00	0.00	-0.00	0.00	0.00	0.00
	(0.01)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Over-confidence	-0.97***	-0.16***	-0.15***	-0.17***	-0.31***	-0.17***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.02)	(0.00)

Constant	1.45***	0.23	0.36***	0.30*	0.58***	0.17
	(0.10)	(0.16)	(0.14)	(0.16)	(0.19)	(0.15)
Observations	15,298	15,298	15,298	15,298	15,298	15,298
R-squared	0.94	0.49	0.56	0.53	0.72	0.58

Table 4: Financial Literacy and Wealth (LIML Estimates)

This table reports the LIML estimates of the effect of financial literacy and several other control variables on wealth. Financial education and the number of newspaper per capita are used as instrumental variables for financial literacy. For the 5 specific forms of financial literacy considered here, financial education and the average literacy at the prefectural level are considered as instruments. We have also included 9 regional dummies whose coefficients are not reported here. White's heteroscedasticity-robust standard errors are in parenthesis. *, **, and *** indicate statistical significance at the 10%, 5% and 1% levels, respectively.

	LIML	
	LIML(1) Wealth	LIML(2) Wealth
Financial Literacy	291.24***	
	(46.73)	
Deposits Literacy		660.12***
		(251.71)
Risk Literacy		514.36***
		(160.21)
Insurance Literacy		46.74
		(180.63)
Debt Literacy		413.67***
		(136.18)
Inflation Literacy		170.55
		(227.72)
Male	-111.47***	-164.06***
	(15.95)	(47.53)
Age 30-39	71.00***	100.04***
	(17.06)	(24.46)
Age 40-49	115.93***	158.12***
	(18.97)	(40.46)
Age 50-59	255.94***	302.42***
	(22.94)	(56.92)
Age 60-69	616.75***	635.43***
	(28.28)	(87.37)
Age 70-79	606.58***	589.88***
	(32.32)	(117.24)
Self-employed	54.78	39.72
	(24.83)	(29.18)
Part-time	7.43	29.17
	(18.97)	(24.47)
Homemaker	137.18***	143.00***

	(20.06)	(22.93)
Unemployed	196.65***	190.54***
	(22.29)	(25.08)
Junior-college	78.52***	68.60***
	(20.56)	(125.35)
University	133.07***	132.28***
	(16.46)	(27.48)
Income 250-500	203.40***	186.01***
	(16.67)	(26.33)
Income 500-750	317.09***	297.98***
	(22.47)	(36.45)
Income Over 750	768.66***	720.67***
	(30.89)	(49.21)
Myopia	-52.60***	-48.52***
	(4.25)	(5.56)
Self-control	-46.47***	-45.08***
	(6.84)	(7.70)
Loss Aversion	-53.45**	-20.68
	(21.93)	(31.29)
Risk Aversion	-24.85**	-21.10**
	(6.61)	(9.28)
Herd	-8.35	-8.66
	(5.90)	(6.44)
Over-confidence	257.90***	328.42***
	(45.60))	(77.56)
Constant	-90.48***	-306.77*
	(83.35)	(158.32)
Observations	15,298	15,298
R-squared	0.36	0.24
Effective F statistic (Montiel-Pflueger robust weak instrument test) Critical values for LIML: tau=5% tau=10%	112.53 13.76 8.82	
Sanderson-Windmeijer multivariate F test of excluded instruments for deposits literacy: F(3, 15260)		11.00
Prob>F		0.00
Sanderson-Windmeijer multivariate F test of excluded instruments for risk literacy: F(3, 15260)		18.94
Prob>F		0.00
Sanderson-Windmeijer multivariate F test of excluded instruments for insurance literacy: F(3, 15260)		12.48
Prob>F		0.00

Sanderson-Windmeijer multivariate F test of excluded instruments for debt literacy: F(3, 15260)		15.35
Prob>F		0.00
Sanderson-Windmeijer multivariate F test of excluded instruments for inflation literacy: F(3, 15260)		13.70
Prob>F		0.00
P-value of Hansen's OIR Test	0.71	0.69

Appendix A

This Appendix shows the questions selected from the Bank of Japan Financial Literacy Survey 2016 used to construct our measure of financial literacy, its 5 sub-components and the 6 variables suggested by behavioral economics.

The questions are numbered below exactly as they are in the survey. Our measure of Financial Literacy comprises the number of correct answers on 12 financial literacy questions from the survey: Q18, Q19, Q21_3, Q21_4, Q25, Q26, Q21_2, Q30, Q31, Q22, Q20, and Q21_1.

Deposits Literacy is defined as the number of correct answers on 2 deposits literacy questions (Questions 18 and 19). Risk literacy is defined as the number of correct answers on 2 risk literacy questions (Questions 21_3 and 21_4). Insurance Literacy is defined as the number of correct answers on 2 insurance literacy questions (Questions 25 and 26). Debt Literacy is defined as the number of correct answers on 4 debt literacy questions (Questions 21_2, 30, 31, and 22). Finally, Inflation Literacy is defined as the number of correct answers on 2 inflation literacy questions (Questions 20 and 21_1).

Question 18: Suppose you put 1 million yen into a savings account with a guaranteed interest rate of 2% per year. If no further deposits or withdrawals are made, how much would be in the account after 1 year, once the interest payment is made? Disregard tax deductions. Answer with a whole number. [Required entry]

Question 19: Then, how much would be in the account after 5 years? Disregard tax deductions. Choose only one answer. [Required entry]

1. More than 1.1 million yen
2. Exactly 1.1 million yen
3. Less than 1.1 million yen
4. Impossible to tell from the information given
5. Don't know

Question 21_3: Please indicate whether you think the following statements are true or false. Choose one answer for each item. [Required entry]

	True	False	Don't know
3. An investment with a high return is likely to be high risk			

Question 21_4: Please indicate whether you think the following statements are true or false. Choose one answer for each item. [Required entry]

	True	False	Don't know
4. Buying a single company's stock usually provides a safer return than a stock mutual fund			

Question 25: Which of the following statements on the basic function of insurance is appropriate? Choose only one answer. [Required entry]

1. Insurance is effective when a risk occurs with high frequency, causing a large Loss
2. Insurance is effective when a risk occurs with low frequency, causing a large Loss
3. Insurance is effective when a risk occurs with high frequency, causing a small Loss
4. Insurance is effective when a risk occurs with low frequency, causing a small Loss
5. Don't know

Question 26: When a 50-year-old man reviews his life insurance policy (whole life insurance) after his children have become financially independent, which of the following statements is appropriate? Suppose that other circumstances have not changed. Choose only one answer. [Required entry]

1. He should consider increasing the death benefit
2. He should consider decreasing the death benefit

3. There is no need to review the policy in particular

4. Don't know

Question 21 2: Please indicate whether you think the following statements are true or false. Choose one answer for each item. [Required entry]

	True	False	Don't know
2. When compared, a 15-year mortgage typically requires higher monthly payments than a 30-year loan, but the total interest paid over the life of the loan will be less.			

Question 30: Which of the following statements on mortgages is appropriate? Choose only one answer. [Required entry]

1. It is far less costly to continue living in a rented house for your whole life than buying a house with a loan

2. Mortgages can be repaid by either the equal payment method or the equal principal payment method, but the total repayment is the same for both methods

3. Mortgages are offered with either a floating interest rate or a fixed interest rate, and those with a fixed interest rate are always more advantageous than those with a floating interest rate

4. In order to decrease the total mortgage repayment, it is effective to prepare as much down payment as possible and make advanced repayments to the extent possible

5. Don't know

Question 31: Suppose you owe 100,000 yen on a loan and the interest rate you are charged is 20% per year compounded annually. If you didn't pay anything off, at this interest rate, how many years would it take for the amount you owe to double? Choose only one answer. [Required entry]

1. Less than 2 years

2. At least 2 years but less than 5 years

3. At least 5 years but less than 10 years

4. At least 10 years

5. Don't know

Question 22: If interest rates rise, what will typically happen to bond prices? Choose only one answer. [Required entry]

1. They will rise

2. They will fall

3. They will stay the same

4. There is no relationship between bond prices and the interest rate

5. Don't know

Question 20: Imagine that the interest rate on your savings account was 1% per year and inflation was 2% per year. After 1 year, how much would you be able to buy with the money in this account? Choose only one answer. [Required entry]

1. More than today

2. Exactly the same

3. Less than today

4. Don't know

Question 21_1: Please indicate whether you think the following statements are true or false. Choose one answer for each item. [Required entry]

	True	False	Don't know
High inflation means that the cost of living is increasing rapidly			