



# Wealth, Financial Literacy and Behavioral Biases in Japan: the Effects of Various Types of Financial Literacy

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## 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.

## 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<sup>1</sup>, 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.<sup>2</sup>

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, 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 (2012), 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

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<sup>1</sup> According to Resona Bank (2021), the number of Japanese workers joining defined-contribution corporate pensions has grown rapidly from 90,000 in 2001 to 7,470,000 in 2020.

<sup>2</sup> See for example, Bernheim, Skinner, and Weinberg (2001) and Lusardi and Mitchell (2007a and 2007b).

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literacy and decision-making.

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 and discusses our empirical results, and Section 4 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. They find that financial literacy is related to greater tendency to plan for retirement (e.g., Sekita (2011) and van Rooij et al., (2011a)), less anxiety about retirement life (e.g., Kadoya and Khan (2018) and Kadoya, Khan, Hamada, Dominguez (2018)), greater tendency to set aside savings for emergencies (e.g., de Bassa Scheresberg (2013)), more investment in stocks (e.g., Yoong (2010) and van Rooij et al., (2011b)), larger amount of cash holdings (Fujiki(2020a)), lower tendency to access a high-cost borrowing (e.g., Lusardi and Tufano (2015)), lower tendency to be delinquent (Gathergood (2012)), lower tendency to gamble (Watanapongvanich, Binnagan, Putthinun, Khan, and Kadoya (2021)), greater tendency to hold crypto assets (Fujiki (2020b)), greater demand for non-face-to-face financial services and cashless payments under the spread of COVID-19 (Fujiki (2021)), lower tendency to be victims of fictitious billing fraud and loan guarantee fraud (Kadoya, Khan, Narumoto, and Watanabe (2021)), and lower tendency to smoke (Watanapongvanich, Khan, Putthinun, Ono, and Kadoya (2021)). While many previous studies show benefits from financial literacy, Kawamura, Mori, Motonishi, and Ogawa (2021) found that people with high levels of financial literacy tend to make speculative investments, overborrow, and hold naïve financial attitudes, indicating that even if people are equipped with financial literacy, they need to be careful not to engage in daring and reckless financial behaviors and attitudes.

The papers closest to the issues we focus on here are Behrman et al., (2012), van Rooij et al., (2012) and Sekita (2020). Utilizing household level data on a panel of Chilean households, Behrman et al., (2012) 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., (2012) 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 Estimation

### 3.1. Data

Our data are taken from the Financial Literacy Survey 2016 (hereafter, FLS2016) conducted by the Central Council for Financial Services Information in Japan. The FLS2016 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 is an opt-in panel<sup>3</sup> which is based on the monitors in the *Intage* and is administered online to 25,000 individuals aged between 18 and 79 who were chosen in proportion to Japan's current demographic structure.

We dropped observations on respondents who are students because there is a high likelihood that their financial assets were given to them by their parents, respondents who answered "don't know or refuse to answer" to the question of financial asset balances, and respondents who answered "don't know" to the question of subjective financial literacy. Consequently, we ended up with 15,600 observations.

### 3.2. OLS Estimation

First, in order to consider the effect of overall financial literacy on wealth, we estimated the following equation.

$$\text{Financial assets} = a(\text{Financial literacy}) + d(\text{Behavioral biases}) + e(\text{Other variables}) + u \quad (1)$$

*Financial assets*<sup>4</sup> is financial asset balances held by respondents' households. Ideally, one would like to have a measure of net wealth, but since the survey does not provide information about their financial liabilities balance, we use the value of gross financial asset balances as our measure of financial wealth. *Financial Literacy* is the number of correct answers on twelve financial literacy questions (Q18, Q19, Q21\_3, Q21\_4, Q25, Q26, Q21\_2, Q30, Q31, Q22, Q20, Q21\_1 of the FLS2016).

<sup>3</sup> Because the FLS is an opt-in panel, the data is subject to the bias inherent to an opt-in panel. For example, reflecting the FLS respondents are all internet users, they are highly educated than representative Japanese population. According to the Employment Status Survey 2017, university graduates or master's level graduates are 24% of the total, however, in our sample, university graduates or master's level graduates are 44%, as shown in Table 1.

<sup>4</sup> Q51 asks the respondents to choose one of the following ranges into which their household's financial assets (deposits, stocks, etc.) currently fall: 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/Refuse to answer. For category 1, financial asset balances are zero; for categories 2 to 6, financial asset balances are regarded as the mid-point of that category, and for category 7, financial asset balances are regarded as 25 million yen.

**Table 1**  
Descriptive Statistics

This table shows definitions and summary statistics for variables used in our estimation.

Variables	Financial Literacy Survey 2016	Definition	Obs	Mean	Std. Dev.	Min	Max
<b>Financial asset balances</b>							
Financial assets	Q51	Q51 asks the respondents to choose one of the following ranges into which their household's financial assets (deposits, stocks, etc.) currently fall: 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/Refuse to answer. For category 1, financial asset balances are zero; for categories 2 to 6, financial asset balances are regarded as the mid-point of that category, and for category 7, financial asset balances are regarded as 25 million yen	15,600	823.3141	907.481	0	2,500
<b>Financial literacy</b>							
Financial literacy	Q18, Q19, Q21_3, Q21_4, Q25, Q26, Q21_2, Q30, Q31, Q22, Q20, Q21_1	The number of correct answers on twelve financial literacy questions	15,600	6.9624	3.4735	0	12
Deposits literacy	Q18, Q19	The number of correct answers on two deposits literacy questions	15,600	1.1935	0.8017	0	2
Risk literacy1	Q21_3, Q21_4	The number of correct answers on two risk literacy questions	15,600	1.3271	0.7394	0	2
Insurance literacy	Q25, Q26	The number of correct answers on two insurance literacy questions	15,600	1.0921	0.8171	0	2
Debt literacy	Q21_2, Q30, Q31, Q22	The number of correct answers on four debt literacy questions	15,600	2.0623	1.2765	0	4
Inflation literacy1	Q20, Q21_1	The number of correct answers on two inflation literacy questions	15,600	1.2874	0.8131	0	2
Big3	Q18, Q19, Q21_4, Q20	The number of correct answers on two deposits literacy questions, a risk literacy question, and an inflation question	15,600	2.3381	1.3637	0	4
Risk literacy2	Q21_3	The number of correct answers on a risk literacy question	15,600	0.8035	0.3974	0	1
Inflation literacy2	Q21_1	The number of correct answer on a inflation literacy question	15,600	0.6663	0.4715	0	1
<b>Gender (the reference group is female)</b>							
Male	Q42	A dummy equal to one if respondents are male	15,600	0.5257	0.4994	0	1
<b>Age (the reference group is respondents aged 18 to 29)</b>							
Age30-39	Q43	A dummy equal to one if respondents are aged 30 to 39	15,600	0.1988	0.3991	0	1
Age40-49	Q43	A dummy equal to one if respondents are aged 40 to 49	15,600	0.1826	0.3864	0	1
Age50-59	Q43	A dummy equal to one if respondents are aged 50 to 59	15,600	0.1769	0.3816	0	1
Age60-69	Q43	A dummy equal to one if respondents are aged 60 to 69	15,600	0.1994	0.3995	0	1
Age70-79	Q43	A dummy equal to one if respondents are aged 70 to 79	15,600	0.1360	0.3428	0	1
<b>Employment status (the reference group is company employee and government employee)</b>							
Self-employed	Q44	A dummy equal to one if respondents are self-employed	15,600	0.0726	0.2594	0	1
Part-time	Q44	A dummy equal to one if respondents are part-time workers	15,600	0.1345	0.3412	0	1
Homemaker	Q44	A dummy equal to one if respondents are stay-at-home mum/dad	15,600	0.2036	0.4027	0	1
Unemployed	Q44	A dummy equal to one if respondents are unemployed	15,600	0.1603	0.3669	0	1
Occupation_other	Q44	A dummy equal to one if respondents answer "other"	15,600	0.0183	0.1339	0	1

(continued on next page)

*Behavioral biases* are myopia, self control, loss aversion, risk aversion,<sup>5</sup> herd, and over-confidence.<sup>6</sup> *Other variables* include gender, age, self-employed, part-time, homemaker, unemployed, educational background, income, debt, and area dummies. **Table 1** provides definitions and summary statistics of variables shown in our estimation. **Appendix 1** provides details of the questions used to construct our measures of

<sup>5</sup> 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  $\alpha$  measures risk aversion for the gain phase, the parameter  $\beta$  measures risk aversion for the loss phase, and the parameter  $\gamma$  measures loss aversion. Since Tversky and Kahneman (1992) find  $\alpha$  and  $\beta$  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.

<sup>6</sup> The definition of overconfidence is subjective financial literacy minus objective financial literacy, where objective financial literacy is the sum of *Deposits literacy*, *Risk literacy1*, *Insurance literacy*, *Debt literacy*, and *Inflation literacy1*, and subjective financial literacy is 5 minus the answer to the following question. "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." The question on subjective financial literacy appears before the question on objective financial literacy. Thus, subjective financial literacy is not influenced by financial literacy quiz. On the other hand, [Anderson, Baker, and Robinson \(2017\)](#) and [Kawamura et al. \(2021\)](#) defined overconfidence as the difference between the score obtained on the self-evaluation of one's financial literacy quiz and one's actual score. In this case, it is inevitable that subjective financial literacy is influenced by objective financial literacy.

financial literacy.

The estimation results of specification (1) are shown in the first column of **Table 2**. *Financial literacy* has a positive effect on financial asset balances which is both economically and statistically significant. An increase in *Financial literacy* by 1 point increases financial asset balances by JPY 1.85 million. Men have significantly lower levels of financial asset balances compared to women. Financial asset balances are monotonically increasing with age up to age 69, and thereafter starts to diminish. The relationship of employment status with financial asset balances is more complex, with the self-employed, homemakers and the unemployed all accumulating more financial assets than corporate and government employees. The higher financial asset balances of the unemployed may be a reflection of the fact that retirees are classified as unemployed. Education has a positive and significant impact on financial asset balances, with university graduates' accumulating JPY 1.21 million more in financial assets relative to those with less than junior-college education. Income has the expected positive and monotonic relationship with the accumulation of financial assets. Having debt links to smaller financial asset balances.

Turning to the behavioral bias 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. This could be caused by simultaneity if individuals with higher wealth tend to lack self-control. The coefficient of overconfidence is positive and both economically and statistically significant. The positive

Table 1 (continued)

<b>Educational level (the reference group is less than junior college)</b>							
Junior college	Q46	A dummy equal to one if respondents graduated from junior college	15,600	0.1090	0.3116	0	1
University	Q46	A dummy equal to one if respondents graduated from university	15,600	0.4448	0.4970	0	1
Eduation other	Q46	A dummy equal to one if respondents answer "other"	15,600	0.0013	0.0358	0	1
<b>Household income (the reference group is less than 2.5 million yen)</b>							
Inc250-500	Q50	A dummy equal to one if respondents' household income is 2.5million yen to less than 5 million yen	15,600	0.3695	0.4827	0	1
Inc500-750	Q50	A dummy equal to one if respondents' household income is 5million yen to less than 7.5 million yen	15,600	0.2109	0.4080	0	1
Inc750over	Q50	A dummy equal to one if respondents' household income is 7.5million yen or over	15,600	0.2013	0.4010	0	1
IncDK	Q50	A dummy equal to one if respondents answer "do not know or refuse to answer"	15,600	0.0227	0.1489	0	1
<b>Household debt (the reference group is no debt)</b>							
Debt	Q45	A dummy equal to one if respondents' household has mortgage, consumer loan, and/or other loan	15,600	0.3269	0.4691	0	1
<b>Behavioral economics variables</b>							
Myopia	Q1_10	5 minus the answer to the following question. <i>How much do you agree or disagree that each of the following statements applies to you personally? Choose from the following scale of 1(Agree) to 5(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"</i>	15,600	2.1997	1.5621	0	4
Self control	Q1_1	5 minus the answer to the following question. <i>How much do you agree or disagree that each of the following statements applies to you personally? Choose from the following scale of 1(Agree) to 5(Disagree). "Before I buy something I carefully consider whether I can afford it"</i>	15,600	2.9531	0.9997	0	4
Loss aversion	Q6	A dummy equal to one if respondents chose 2 in the following question. <i>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</i>	15,600	0.7526	0.4315	0	1
Risk aversion	Q1_9	The answer to the following question minus 1. <i>How much do you agree or disagree that each of the following statements applies to you personally? Choose from the following scale of 1(Agree) to 5(Disagree). "I am prepared to take a risk when saving or making an investment"</i>	15,600	2.1983	1.2483	0	4
Herd	Q1_3	5 minus the answer to the following question. <i>How much do you agree or disagree that each of the following statements applies to you personally? Choose from the following scale of 1(Agree) to 5(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"</i>	15,600	1.5798	1.0435	0	4
Overconfidence	Q17, Q18, Q19, Q21_3, Q21_4, Q25, Q26, Q21_2, Q30, Q31, Q22, Q20, Q21_1	Subjective financial literacy minus objective financial literacy, where objective financial literacy is the sum of Deposits literacy, Risk literacy1, Insurance literacy, Debt literacy, and Inflation literacy1, and subjective financial literacy is 5 minus the answer to the following question. <i>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</i>	15,600	-5.2831	3.2942	-12	4
<b>Regions (the reference group is Kanto)</b>							
Hokkaido	Q49	A dummy equal to one if respondents live in Hokkaido	15,600	0.0463	0.2101	0	1
Tohoku	Q49	A dummy equal to one if respondents live in Tohoku	15,600	0.0711	0.2570	0	1
Hokuriku	Q49	A dummy equal to one if respondents live in Hokuriku	15,600	0.0405	0.1972	0	1
Koshin	Q49	A dummy equal to one if respondents live in Koshin	15,600	0.0213	0.1445	0	1
Tokai	Q49	A dummy equal to one if respondents live in Tokai	15,600	0.1160	0.3202	0	1
Kinki	Q49	A dummy equal to one if respondents live in Kinki	15,600	0.3621	0.4806	0	1
Chugoku	Q49	A dummy equal to one if respondents live in Chugoku	15,600	0.0450	0.2073	0	1
Shikoku	Q49	A dummy equal to one if respondents live in Shikoku	15,600	0.0310	0.1734	0	1
Kyushu	Q49	A dummy equal to one if respondents live in Kyushu	15,600	0.1271	0.3330	0	1
<b>Instrumental variables</b>							
Financial education	Q39	A dummy equal to one if respondents have been offered financial education at schools, universities, or workplaces (the reference group is respondents who have not been offered financial education)	15,600	0.0932	0.2907	0	1
Financial education_DK	Q39	A dummy equal to one if respondents do not know whether or not they have been offered financial education at schools, universities, or workplaces (the reference group is respondents who have not been offered financial education)	15,600	0.1279	0.3340	0	1
News_perpop		The number of newspapers in circulation per prefecture divided by population of each prefecture	15,600	339.8675	32.5835	240.3906	424.6330
Average deposits literacy	Q18, Q19, Q49	The average "Deposits literacy"at prefectural level	15,600	1.1935	0.0584	1.0133	1.3929
Average risk literacy1	Q21_3, Q21_4, Q49	The average "Risk literacy1"at prefectural level	15,600	1.3271	0.0500	1.1429	1.5119
Average insurance literacy	Q25, Q26, Q49	The average "Insurance literacy"at prefectural level	15,600	1.0921	0.0485	0.9591	1.2217
Average debt literacy	Q21_2, Q30, Q31, Q22, Q49	The average "Debt literacy"at prefectural level	15,600	2.0623	0.0995	1.7135	2.3039
Average inflation literacy1	Q20, Q21_1, Q49	The average "Inflation literacy1"at prefectural level	15,600	1.2873	0.0560	1.1220	1.4702
Average big3	Q18, Q19, Q21_4, Q20, Q49	The average "Big3"at prefectural level	15,600	2.3381	0.1062	2.0769	2.7262
Average risk literacy2	Q21_3, Q49	The average "Risk literacy2"at prefectural level	15,600	0.8035	0.0244	0.7193	0.8869
Average inflation literacy2	Q21_1, Q49	The average "Inflation literacy2"at prefectural level	15,600	0.6663	0.0302	0.5673	0.7760

**Table 2**

Financial Literacy and Financial Asset Balances (OLS Estimates)

This table reports the Ordinary Least Squares estimates of the relationship between financial asset balances and financial literacy and other variables. We have also included 9 regional dummies whose coefficients are not reported here. Heteroskedasticity-robust standard errors are in parenthesis. \*, \*\*, and \*\*\* indicate statistical significance at the 10%, 5% and 1% levels, respectively.

	OLS		
	Financial assets	Financial assets	Financial assets
Financial_literacy	185.2495*** (6.6708)		
Deposits_literacy		191.0801*** (10.8446)	
Risk_literacy1		161.2980*** (11.6667)	
Insurance_literacy		189.6334*** (10.9331)	188.0217*** (10.9199)
Debt_literacy		192.6795*** (9.0539)	192.8829*** (9.0500)
Inflation_literacy1		183.8060*** (11.1419)	
Big3			185.6798*** (8.7209)
Risk_literacy2			124.4471*** (17.5083)
Inflation_literacy2			189.4855*** (15.7032)
Male	-86.7960*** (14.5118)	-86.7543*** (14.6758)	-89.4513*** (14.6981)
Age30_39	116.1148*** (16.3794)	116.5189*** (16.3834)	117.5089*** (16.3678)
Age40_49	181.7223*** (17.7844)	183.1471*** (17.8273)	183.9558*** (17.7908)
Age50_59	316.1508*** (20.1160)	316.9389*** (20.2692)	318.4299*** (20.1473)
Age60_69	615.4090*** (21.1142)	617.1650*** (21.3030)	617.9747*** (21.1563)
Age70_79	597.6633*** (24.9392)	600.4442*** (25.2492)	601.2159*** (25.0872)

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coefficient of overconfidence may seem counterintuitive. However, overconfidence has been associated with significantly higher stock market participation. Since the FLS2016 asks about the experience of stock market participation, we checked the effect of overconfidence on stock market participation. We found that overconfidence increases the probability of stock market participation (see Appendix2 for details). Given that Japanese households are risk-averse, and the proportion of stockholdings in their portfolio is very low,<sup>7</sup> overconfidence may have a significant beneficial impact on financial asset balances 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.

Next, in order to check if different types of financial literacy have different effects on financial asset balances, we decompose *Financial literacy* into five sub-categories and estimated the following equation.

$$\begin{aligned}
 \text{Financial assets} = & b1(\text{Deposits literacy}) + b2(\text{Risk literacy1}) \\
 & + b3(\text{Insurance literac y}) + b4 \\
 & (\text{Debt literacy}) + b5(\text{Inflation literacy1}) \\
 & + d(\text{Behavioral biases}) + e(\text{Other variables}) + u
 \end{aligned} \tag{2}$$

*Deposits literacy* is the number of correct answers on two deposits literacy questions (Q18 and Q19). Likewise, *Risk literacy1*, *Insurance literacy*, *Debt literacy*, and *Inflation literacy1* are constructed using the number of correct answers on two risk literacy questions (Q21\_3 and Q21\_4), two insurance literacy questions (Q25 and Q26), four debt literacy questions (Q21\_2, Q30, Q31, and Q22), and two inflation literacy questions (Q20 and Q21\_1), respectively. The second column of **Table 2** reports the results for the relationship between financial asset balances and the 5 different sub-categories of financial literacy. All five components of financial literacy have a positive and significant impact on financial asset balances.

Moreover, since many empirical papers about financial literacy use the Big3 index for financial literacy, we estimated the following equation which includes *Big3* and other financial literacy variables to test if controlling only *Big3* as financial literacy variables is sufficient to capture the effects of financial literacy.

<sup>7</sup> According to Bank of Japan, Japanese households hold only 10% of their financial assets in stocks compared with 37.8% in the U.S. and 18.2% in Europe. See <https://www.boj.or.jp/en/statistics/sj/sjhiq.pdf> for details.

Table 2 (continued)

Self_employed	56.1657** (24.3120)	56.3977** (24.3200)	57.5657** (24.3300)
Part_time	-0.0576 (17.9201)	-0.3604 (17.9216)	1.0768 (17.9115)
Homemaker	117.5929*** (19.2269)	116.9646*** (19.2342)	118.1011*** (19.2298)
Unemployed	153.8697*** (21.5521)	153.2764*** (21.5586)	153.9876*** (21.5473)
Occupation_other	156.3381*** (46.5714)	155.4475*** (46.4770)	157.4492*** (46.4828)
Junior_college	81.3459*** (19.4159)	81.7981*** (19.4202)	81.4909*** (19.4104)
University	121.8801*** (13.0808)	121.3359*** (13.1116)	120.6971*** (13.1196)
Education_other	-21.1159 (117.1123)	-17.1130 (117.1245)	-22.6110 (117.5732)
Inc250_500	260.7737*** (15.4780)	260.4092*** (15.5080)	261.5623*** (15.4908)
Inc500_750	435.9203*** (18.2857)	434.9477*** (18.3420)	435.6513*** (18.3143)
Inc750_over	905.3265*** (21.2538)	903.6943*** (21.3045)	904.5456*** (21.2686)
IncDK	157.7616*** (41.0065)	158.3821*** (40.9129)	157.4394*** (40.9078)
Debt	-408.0000*** (11.9719)	-408.9350*** (12.0254)	-407.9846*** (12.0313)
Myopia	-46.3756*** (3.7949)	-46.3699*** (3.7945)	-46.2573*** (3.7957)
Self_control	-37.9074*** (5.8873)	-37.9184*** (5.8880)	-37.6486*** (5.8977)
Loss_aversion	-83.3886*** (15.1111)	-84.0214*** (15.1141)	-82.7847*** (15.1068)
Risk_aversion	-34.4632*** (5.0777)	-34.6637*** (5.0794)	-33.8616*** (5.0838)
Herd	-6.9640 (5.6170)	-7.0165 (5.6179)	-7.0461 (5.6182)
Over_confidence	150.9396*** (6.7528)	150.8991*** (6.7572)	149.7298*** (6.7621)
Constant	110.2251*** (37.1375)	117.6808*** (37.2398)	126.4252*** (37.2473)
Observations	15,600	15,600	15,600
R-squared	0.4037	0.4039	0.4041

$$\text{Financial assets} = c1(\text{Big3}) + c2(\text{Risk Literacy2}) + c3(\text{Insurance Literacy}) + c4(\text{Debt Literacy}) + c5(\text{Inflation Literacy2}) + d(\text{Behavioral biases}) + e(\text{Other variables}) + u$$

(3)

Big3 is the number of correct answers on two deposits literacy questions (Q18 and Q19), a risk literacy question (Q21\_4), and an inflation literacy question (Q20). Likewise, Risk literacy2, Insurance literacy, Debt literacy, and Inflation literacy2 are constructed using the number of correct answers on a risk literacy question (Q21\_3), two insurance literacy questions (Q25 and Q26), four debt literacy questions (Q21\_2, Q30, Q31, and Q22), and an inflation literacy question (Q21\_1), respectively. The third column of Table 2 reports the results for the relationship between financial asset balances, Big3 and other types of financial literacy. Again, all five components of financial literacy have a positive and significant impact on financial asset balances, indicating that controlling only Big3 is not sufficient to capture the effects of

financial literacy on financial asset balances.

### 3.3. Instrumental Variables 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. In that case, the coefficient for financial literacy has an upward bias (simultaneity). In addition, financial literacy variables defined in our estimation may have tainted the respondents' actual financial knowledge. If so, the coefficient for financial literacy has a bias toward zero (measurement errors).

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 FLS2016. Our first instrument is a dummy variable which takes

**Table 3**

## First Stage Regressions

This table reports the results for the first-stage regressions. We have included 9 regional dummies whose coefficients are not reported here. Heteroskedasticity-robust standard errors are in parenthesis. \*, \*\*, and \*\*\* indicate statistical significance at the 10%, 5% and 1% levels, respectively.

	First-stage regressions										
	Financial literacy	Deposits literacy	Risk literacy1	Insurance literacy	Debt literacy	Inflation literacy1	Big3	Risk literacy2	Insurance literacy	Debt literacy	Inflation literacy2
Financial_education	0.3575*** (0.0241)	0.0091 (0.0156)	0.0312** (0.0138)	0.1193*** (0.0164)	0.1523*** (0.0199)	0.0451*** (0.0144)	0.0713*** (0.0198)	-0.0225*** (0.0086)	0.1193*** (0.0164)	0.1523*** (0.0199)	0.0366*** (0.0099)
Financial_education_DK	-0.1922*** (0.0223)	0.0509*** (0.0162)	-0.1505*** (0.0139)	-0.0600*** (0.0143)	-0.0690*** (0.0174)	0.0361** (0.0149)	0.1184*** (0.0197)	-0.1606*** (0.0103)	-0.0600*** (0.0143)	-0.0690*** (0.0174)	-0.0215** (0.0099)
News_perpop	0.0005** (0.0002)										
Average_deposits_literacy		0.7998*** (0.1527)	-0.1173 (0.1330)	-0.1699 (0.1517)	-0.2665 (0.1834)	-0.1667 (0.1459)					
Average_risk_literacy1		-0.2211 (0.2053)	0.7527*** (0.1777)	-0.2804 (0.2018)	-0.4617* (0.2544)	-0.1802 (0.1954)					
Average_insurance_literacy		-0.1394 (0.1624)	-0.1298 (0.1393)	0.8664*** (0.1568)	-0.2816 (0.1851)	-0.1631 (0.1500)	-0.2369 (0.1987)	-0.0704 (0.0841)	0.8626*** (0.1529)	-0.2721 (0.1830)	-0.0744 (0.0992)
Average_debt_literacy		-0.1287 (0.1022)	-0.1431 (0.0889)	-0.1789* (0.1008)	0.6953*** (0.1197)	-0.1570 (0.0968)	-0.2873** (0.1270)	-0.0713 (0.0548)	-0.1811* (0.1008)	0.6907*** (0.1203)	-0.0711 (0.0652)
Average_inflation_literacy1		-0.1506 (0.1607)	-0.1553 (0.1376)	-0.1108 (0.1592)	-0.2932 (0.1958)	0.7555*** (0.1474)					
Average_big3							0.6791*** (0.1162)	-0.0518 (0.0491)	-0.1630* (0.0917)	-0.2646** (0.1119)	-0.0904 (0.0597)
Average_risk_literacy2							-0.7800* (0.4269)	0.8593*** (0.1828)	-0.3199 (0.3382)	-0.6169 (0.4046)	-0.1698 (0.2123)
Average_inflation_literacy2							-0.3601 (0.3432)	-0.0762 (0.1467)	-0.1599 (0.2701)	-0.4006 (0.3242)	0.8876*** (0.1730)

(continued on next page)

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. 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 et al., \(2011b, 2012\)](#) use the level of economics education as an instrument. [van Rooij et al., \(2011b\)](#) also consider the parents' understanding of financial matters as an instrument. [Kawamura et al. \(2021\)](#) use parents' financial work experience and parents' stock trade experience as instruments. [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.

In this way, although we address the nexus of causality, we do not claim to have fully resolved the dispute about the causality. For example, our instruments such as being offered financial education at schools, regional newspaper circulation, and regional financial literacy might directly affect financial asset balances. Although we show in [Table 4](#) that our instruments passed OIR test, it is possible that the power of the test is not enough to detect this.

[Table 3](#) shows the results for the first-stage regressions of specifications (1)-(3). The first column (*Financial literacy*) 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 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.

Columns 2 through 6 of [Table 3](#) (*Deposits literacy, Risk literacy1, Insurance literacy, Debt literacy, Inflation literacy1*) show the results of the first-stage regressions for specification (2). 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 literacy1*, women have higher levels of *Insurance literacy*. This result may be driven by the fact that in Japan, more women work in the insurance industry relative to men. For behavioral bias variables, the coefficients are similarly signed for all the 5 sub-components as for overall financial literacy.

Columns 7 through 11 of [Table 3](#) (*Big3, Risk literacy2, Insurance literacy, Debt literacy, Inflation literacy2*) show the results of the first-stage regressions for specification (3). Expectedly, 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 *Risk literacy2*, the coefficient of financial education is positive and significant for all the other sub-components of financial literacy.

[Table 4](#) reports the LIML estimates of the effects of financial literacy and other control variables on financial asset balances. The first column of [Table 4](#) 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 114.879, which exceeds the LIML critical value of 13.832 at the 5%

Table 3 (continued)

Male	0.0992*** (0.0179)	0.0976*** (0.0125)	0.0035 (0.0106)	-0.1377*** (0.0119)	0.0116 (0.0144)	0.1238*** (0.0116)	0.1930*** (0.0154)	-0.0355*** (0.0066)	-0.1376*** (0.0119)	0.0119 (0.0144)	0.0678*** (0.0079)
Age30_39	0.0370 (0.0270)	-0.0332* (0.0178)	0.0025 (0.0158)	0.0259 (0.0176)	-0.0119 (0.0206)	0.0537*** (0.0174)	0.0037 (0.0221)	0.0172 (0.0107)	0.0260 (0.0176)	-0.0119 (0.0206)	0.0020 (0.0115)
Age40_49	0.1371*** (0.0275)	-0.0692*** (0.0184)	0.0365*** (0.0163)	0.0212 (0.0180)	0.0049 (0.0211)	0.1435*** (0.0178)	0.0413* (0.0229)	0.0363*** (0.0108)	0.0213 (0.0180)	0.0050 (0.0211)	0.0331*** (0.0118)
Age50_59	0.2361*** (0.0281)	-0.0519*** (0.0189)	0.0140 (0.0165)	0.0125 (0.0185)	0.0279 (0.0218)	0.2337*** (0.0181)	0.0775*** (0.0235)	0.0426*** (0.0108)	0.0125 (0.0185)	0.0278 (0.0218)	0.0753*** (0.0121)
Age60_69	0.3895*** (0.0285)	-0.0577*** (0.0190)	0.0613*** (0.0167)	-0.0500*** (0.0189)	0.1171*** (0.0221)	0.3197*** (0.0183)	0.1519*** (0.0240)	0.0566*** (0.0108)	-0.0500*** (0.0189)	0.1170*** (0.0221)	0.1143*** (0.0121)
Age70_79	0.4195*** (0.0319)	-0.0383* (0.0213)	0.0857*** (0.0189)	-0.1667*** (0.0214)	0.1358*** (0.0252)	0.4037*** (0.0201)	0.2174*** (0.0268)	0.0707*** (0.0121)	-0.1667*** (0.0214)	0.1358*** (0.0252)	0.1626*** (0.0133)
Self_employed	0.0493* (0.0281)	0.0218 (0.0191)	0.0074 (0.0168)	-0.0232 (0.0188)	0.0152 (0.0227)	0.0288 (0.0176)	0.0064 (0.0242)	0.0199** (0.0100)	-0.0231 (0.0188)	0.0153 (0.0227)	0.0319*** (0.0116)
Part_time	-0.0598** (0.0236)	-0.0152 (0.0162)	-0.0198 (0.0139)	-0.0257 (0.0154)	-0.0244 (0.0187)	-0.0244 (0.0155)	-0.0605*** (0.0200)	0.0136 (0.0089)	0.0254* (0.0154)	-0.0256 (0.0187)	-0.0121 (0.0105)
Homemaker	-0.0362 (0.0232)	-0.0055 (0.0162)	-0.0302** (0.0142)	-0.0113 (0.0158)	0.0079 (0.0189)	0.0021 (0.0156)	-0.0420** (0.0204)	0.0039 (0.0088)	-0.0111 (0.0158)	0.0082 (0.0189)	0.0050 (0.0106)
Unemployed	-0.0366 (0.0245)	0.0121 (0.0167)	-0.0214 (0.0143)	0.0025 (0.0165)	-0.0004 (0.0198)	-0.0298** (0.0147)	-0.0203 (0.0210)	-0.0019 (0.0086)	0.0027 (0.0165)	-0.0001 (0.0198)	-0.0162 (0.0099)
Occupation_other	-0.0064 (0.0502)	-0.0449 (0.0349)	-0.0245 (0.0280)	0.0200 (0.0361)	0.0768* (0.0395)	-0.0330 (0.0315)	-0.1155** (0.0449)	0.0208 (0.0161)	0.0199 (0.0361)	0.0771* (0.0395)	-0.0070 (0.0208)
Junior_college	0.0759*** (0.0232)	0.0273* (0.0161)	0.0245* (0.0140)	0.0181 (0.0157)	-0.0076 (0.0184)	0.0142 (0.0155)	0.0592*** (0.0201)	0.0025 (0.0086)	0.0182 (0.0157)	-0.0075 (0.0184)	0.0042 (0.0104)
University	0.1765*** (0.0153)	0.0413*** (0.0108)	-0.0024 (0.0091)	0.0440*** (0.0104)	0.0233* (0.0125)	0.0699*** (0.0099)	0.0819*** (0.0134)	-0.0116** (0.0055)	0.0440*** (0.0104)	0.0233* (0.0125)	0.0385*** (0.0066)
Education_other	0.1935 (0.1949)	-0.2220** (0.1095)	0.1323 (0.1145)	0.1021 (0.1246)	0.0222 (0.1500)	0.1523 (0.1364)	0.1087 (0.1302)	-0.0209 (0.0804)	0.1022 (0.1246)	0.0227 (0.1552)	-0.0245 (0.0746)
Inc250_500	0.1264*** (0.0199)	0.0461*** (0.0136)	0.0190 (0.0117)	0.0553*** (0.0132)	0.0429*** (0.0159)	-0.0364*** (0.0126)	0.0086 (0.0170)	0.0179** (0.0074)	0.0553*** (0.0132)	0.0429*** (0.0159)	0.0023 (0.0086)
Inc500_750	0.2776*** (0.0225)	0.0707*** (0.0157)	0.0276** (0.0135)	0.1102*** (0.0151)	0.1002*** (0.0183)	-0.0308** (0.0146)	0.0541*** (0.0196)	0.0110 (0.0084)	0.1103*** (0.0151)	0.1004*** (0.0184)	0.0026 (0.0099)
Inc750_over	0.4610*** (0.0239)	0.1235*** (0.0164)	0.0384*** (0.0139)	0.1178*** (0.0160)	0.1863*** (0.0193)	-0.0045 (0.0151)	0.1285*** (0.0202)	0.0149* (0.0086)	0.1178*** (0.0160)	0.1864*** (0.0193)	0.0142 (0.0103)
IncDK	-0.1178** (0.0469)	-0.0854*** (0.0328)	0.0098 (0.0289)	-0.0775*** (0.0300)	0.0657* (0.0364)	-0.0280 (0.0304)	-0.0813** (0.0412)	-0.0042 (0.0208)	-0.0776*** (0.0300)	0.0656* (0.0363)	-0.0180 (0.0203)
Debt	-0.1182*** (0.0151)	-0.0513*** (0.0105)	-0.0354*** (0.0090)	0.0268*** (0.0102)	0.0225* (0.0124)	-0.0813*** (0.0098)	-0.1326*** (0.0131)	-0.0001 (0.0056)	0.0268*** (0.0102)	0.0225* (0.0124)	-0.0355*** (0.0065)
Myopia	-0.0368*** (0.0045)	-0.0073** (0.0030)	-0.0067** (0.0026)	-0.0066** (0.0030)	-0.0124*** (0.0036)	-0.0038 (0.0028)	-0.0179*** (0.0038)	-0.0004 (0.0016)	-0.0066** (0.0030)	-0.0124*** (0.0036)	0.0005 (0.0019)
Self_control	0.0544*** (0.0071)	0.0013 (0.0047)	0.0062 (0.0041)	0.0182*** (0.0045)	0.0183*** (0.0055)	0.0106** (0.0043)	-0.0040 (0.0059)	0.0062** (0.0025)	0.0182*** (0.0045)	0.0183*** (0.0055)	0.0158*** (0.0029)
Loss_aversion	-0.3003*** (0.0170)	-0.0424*** (0.0114)	-0.0713*** (0.0099)	-0.0242** (0.0115)	-0.1140*** (0.0139)	-0.0485*** (0.0103)	-0.1166*** (0.0143)	-0.0075 (0.0059)	-0.0243** (0.0115)	-0.1141*** (0.0139)	-0.0382*** (0.0069)
Risk_aversion	-0.0848*** (0.0061)	-0.0026 (0.0040)	-0.0202*** (0.0034)	-0.0117*** (0.0039)	-0.0293*** (0.0047)	-0.0212*** (0.0037)	-0.0356*** (0.0050)	0.0030 (0.0020)	-0.0117*** (0.0039)	-0.0292*** (0.0047)	-0.0113*** (0.0025)
Herd	0.0027 (0.0068)	0.0014 (0.0045)	-0.0006 (0.0039)	-0.0000 (0.0044)	0.0014 (0.0053)	0.0006 (0.0042)	-0.0038 (0.0056)	0.0004 (0.0024)	-0.0000 (0.0044)	0.0015 (0.0053)	0.0049* (0.0028)
Over_confidence	-0.9674*** (0.0025)	-0.1632*** (0.0015)	-0.1541*** (0.0014)	-0.1736*** (0.0014)	-0.3101*** (0.0018)	-0.1664*** (0.0014)	-0.3329*** (0.0019)	-0.0687*** (0.0010)	-0.1736*** (0.0014)	-0.3101*** (0.0018)	-0.0820*** (0.0010)
Constant	1.4914*** (0.0961)	0.2507 (0.1580)	0.3685*** (0.1382)	0.3061** (0.1559)	0.5728*** (0.1893)	0.1912 (0.1525)	0.7018*** (0.2102)	0.1214 (0.0914)	0.3403** (0.1703)	0.6424*** (0.2030)	0.1065 (0.1104)
Observations	15,600	15,600	15,600	15,600	15,600	15,600	15,600	15,600	15,600	15,600	15,600

significance level, so we can reject the null hypothesis of weak instruments. The  $P$ -value for Hansen's OIR test of overidentifying restrictions is 0.4648, which is consistent with the instruments being valid. Even after controlling for possible endogeneity, the impact of overall financial literacy on financial asset balances is positive and significant. A one-point increase in overall financial literacy is associated with an increase of JPY 3.19 million<sup>8</sup> in the financial asset balances of the respondents' households, which is an economically large effect.

The second column of Table 4 reports the LIML estimates of the effects for the 5 sub-components of financial literacy (*Deposits literacy*, *Risk literacy1*, *Insurance literacy*, *Debt literacy*, and *Inflation literacy1*) on financial asset balances. Sanderson-Windmeijer  $F$ -tests show that we can reject the null hypothesis of weak instrument separately for our

endogenous variables (*Deposits literacy*, *Risk literacy1*, *Insurance literacy*, *Debt literacy*, and *Inflation literacy1*). The  $P$ -value for Hansen's OIR test of overidentifying restrictions is 0.8558, which is consistent with the instruments being valid. The results appear that the impact of different sub-components of financial literacy on financial asset balances varies considerably, with *Deposits literacy*, *Risk literacy1*, and *Debt literacy* having economically large and statistically significant impacts on financial asset balances. The coefficients of *Inflation literacy1* and *Insurance literacy* are positive but are not significantly different from zero<sup>9</sup>. *Inflation literacy1*'s impact on financial asset balances is more likely to be

<sup>9</sup> Kawamura et al., (2021) analyzed the effects of inflation and insurance literacy on the share of risky assets and found that either of them do not have significant effects on risky assets. These results are consistent with ours if we can assume that the share of risky assets is related to the size of financial assets.

<sup>8</sup> This is roughly US\$ 28,036 at the exchange rate of December 16, 2021.



**Table 4****Financial Literacy and Financial Asset Balances (LIML Estimates)**

This table reports the Limited Information Maximum Likelihood estimates of the effect of financial literacy and several other control variables on financial asset balances. 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. Heteroskedasticity-robust standard errors are in parenthesis. \*, \*\*, and \*\*\* indicate statistical significance at the 10%, 5% and 1% levels, respectively.

	<b>LIML</b>		
	Financial assets	Financial assets	Financial assets
Financial_literacy	319.9801*** (45.4651)		
Deposits_literacy		543.4982** (240.1276)	
Risk_literacy1		441.9276*** (149.6639)	
Insurance_literacy		124.0364 (174.7100)	130.2853 (172.4017)
Debt_literacy		452.3918*** (130.2989)	479.2412*** (131.8128)
Inflation_literacy1		156.8654 (220.5019)	
Big3			497.7048*** (178.1024)
Risk_literacy2			528.3123*** (187.8956)
Inflation_literacy2			57.4241 (353.6440)
Male	-99.7257*** (15.3769)	-129.5140*** (46.6407)	-136.3229*** (47.5846)
Age30_39	113.4939*** (17.3709)	135.5740*** (23.2347)	116.3446*** (20.6797)
Age40_49	167.4286*** (19.2862)	205.0137*** (40.2806)	164.3490*** (25.1040)
Age50_59	287.9985*** (22.8124)	334.3136*** (56.4902)	282.7628*** (35.6940)
Age60_69	564.8030*** (27.5163)	596.7938*** (82.5083)	527.8244*** (56.7431)
Age70_79	542.7182*** (31.3531)	555.5240*** (111.0508)	478.8031*** (86.0639)
Self_employed	49.7064** (24.5712)	41.6500 (27.8621)	45.8337 (29.2532)
Part_time	9.2251 (18.3917)	19.5305 (22.2083)	23.0030 (22.7555)
Homemaker	123.3287*** (19.5073)	124.8651*** (21.5316)	127.4320*** (22.6922)
Unemployed	159.1029*** (21.7262)	154.2640*** (24.0957)	159.1974*** (23.7341)
Occupation_other	156.9596*** (46.9264)	157.3232*** (52.1391)	163.3191*** (53.6826)

(continued on next page)

Table 4 (continued)

Junior_college	69.0500*** (19.9566)	66.5828*** (23.4151)	63.5457*** (24.0576)
University	96.3029*** (15.7761)	103.6852*** (24.6018)	98.1338*** (22.5639)
Education_other	-49.0202 (116.5787)	26.1976 (144.5283)	-53.7110 (129.4517)
Inc250_500	243.2429*** (16.8145)	229.1981*** (24.3108)	241.8630*** (19.0347)
Inc500_750	396.7588*** (22.6674)	380.3978*** (33.7684)	390.2483*** (27.5968)
Inc750_over	839.9550*** (30.6909)	804.7121*** (46.2452)	810.0903*** (38.6215)
IncDK	173.9079*** (41.4775)	162.9533*** (53.3359)	159.0600*** (50.3647)
Debt	-393.0032*** (13.1549)	-388.1335*** (29.3024)	-377.0104*** (29.1900)
Myopia	-41.4611*** (4.1788)	-39.2442*** (4.9198)	-37.3705*** (5.3782)
Self_control	-46.1619*** (6.5934)	-44.5048*** (7.2357)	-42.2324*** (8.1693)
Loss_aversion	-39.7895* (21.2510)	-19.5913 (29.2577)	-14.3461 (30.0170)
Risk_aversion	-22.8770*** (6.4257)	-21.7598** (8.6673)	-17.5566** (8.8265)
Herd	-7.6501 (5.7085)	-7.8032 (6.0364)	-5.7888 (6.4378)
Over_confidence	282.3938*** (44.4036)	318.0487*** (72.5023)	351.1191*** (70.8991)
Constant	-110.8869 (82.6957)	-230.6660 (152.2284)	-294.9320* (162.8075)
Observations	15,600	15,600	15,600
Effective F statistic (Montiel-Pflueger robust weak instrument test)	114.879		
Critical values for LIML: tau=5%	13.832		
tau=10%	8.867		
Sanderson-Windmeijer F test (Deposits Literacy)		10.38	
Prob>F		0.0000	
Sanderson-Windmeijer F test (Risk Literacy1)		18.19	
Prob>F		0.0000	
Sanderson-Windmeijer F test (Insurance Literacy)		11.01	12.14
Prob>F		0.0000	0.0000
Sanderson-Windmeijer F test (Debt Literacy)		14.19	14.85
Prob>F		0.0000	0.0000
Sanderson-Windmeijer F test (Inflation Literacy1)		12.69	
Prob>F		0.0000	
Sanderson-Windmeijer F test (Big3)			11.81
Prob>F			0.0000
Sanderson-Windmeijer F test (Risk Literacy2)			15.73
Prob>F			0.0000
Sanderson-Windmeijer F test (Inflation Literacy2)			11.26
Prob>F			0.0000
P-value of Hansen's OIR Test	0.4648	0.8558	0.6483

**Table 5****Financial Literacy and Financial Asset Balances (Interval Regression)**

This table reports the interval regression estimates of the effect of financial literacy and several other control variables on financial asset balances. We have also included myopia, self control, loss aversion, risk aversion, herd, overconfidence, gender, age, self-employed, part-time, homemaker, unemployed, educational background, income, debt, and area dummies, whose coefficients are not reported here. 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. Heteroskedasticity-robust standard errors are in parenthesis. \*, \*\*, and \*\*\* indicate statistical significance at the 10%, 5% and 1% levels, respectively.

Interval Regression with Instrumental Variables			
	Financial assets	Financial assets	Financial assets
Financial literacy	321.7955*** (45.6262)		
Deposits literacy		547.3683** (238.6140)	
Risk literacy1		421.1601*** (147.2816)	
Insurance literacy		158.8750 (172.3268)	166.1441 (171.5679)
Debt literacy		440.9781*** (129.3310)	466.4994*** (131.5180)
Inflation literacy1		156.8733 (218.7842)	
Big3			500.8556*** (178.4287)
Risk literacy2			509.7028*** (185.6888)
Inflation literacy2			37.6339 (354.5123)

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 be small for wealth accumulation. One possible reason why *Insurance literacy* is not significantly related to financial asset balances is that many Japanese hold private pension insurance<sup>10</sup>, which is a financial asset very similar to time deposits and requires little financial knowledge. A worse possibility might be because some respondents do not include the amount of insurance products in their financial asset balances, since the FLS2016 asks for financial assets (deposits, stock, etc.) in the question about financial asset balances.

The third column of Table 4 reports the LIML estimates of the effects for another 5 sub-components of financial literacy (*Big3*, *Risk literacy2*, *Insurance literacy*, *Debt literacy*, and *Inflation literacy2*) on financial asset balances. The results are similar to the second column of Table 4. While *Big3*, *Risk literacy2*, and *Debt literacy* have economically large and statistically significant impacts on financial asset balances, the coefficients of *Inflation literacy2* and *Insurance literacy* are positive but are not significantly different from zero.

Lastly, as a robustness check, we run interval regression using the same instrumental variables in LIML estimation because the answers to the question on financial asset balances (Q51) are categorical. Table 5 shows the coefficients of financial literacy only. As in the case of LIML estimation, all the coefficients of overall financial literacy and sub-components of financial literacy are positive and significant, with the exception of *Insurance literacy* and *Inflation literacy*.

Focusing on the magnitude of the coefficients of financial literacy

<sup>10</sup> According to the "Survey on Household Financial Behavior 2020," the share of private pension insurance is 5% of household financial asset balances (<https://www.shiruporuto.jp/public/document/container/yoron/futari/2020/>).

variables in Specification (2), it appears that the impact of *Deposits literacy* is the highest. In order to verify whether *Deposits literacy* has greater effects on financial asset balances than *Risk literacy1* and *Debt literacy*, we test the null hypothesis that  $b_1=b_2=b_4$  in specification (2), but somewhat surprisingly, it is not rejected<sup>11</sup>. It seems that *Deposits literacy*, *Risk literacy*, and *Inflation literacy* are equally important for the accumulation of financial assets.

Moreover, in order to test if controlling only for *Big3* is sufficient to capture the effect of financial literacy, we tested the null hypothesis  $c_2=c_3=c_4=c_5=0$  in specification (3), and it was rejected. This implies that controlling only for the conventional Big3 index as a measure of financial literacy is not sufficient to completely capture the effects of financial literacy on financial asset balances, and that it is necessary to include the other dimensions of financial literacy as captured by *Risk literacy2* and *Debt literacy*.

#### 4. 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 financial asset balances substantially. These results are robust and the estimated impact of financial literacy on financial asset balances 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 financial assets. Deposits literacy, risk literacy and debt literacy have a much greater impact on financial asset balances relative to insurance literacy and inflation literacy. New Japanese curriculum guidelines will commence in high schools in 2022, where students will be taught about the advantages and disadvantages of basic financial assets such as deposits, private insurance, stocks, bonds, and mutual funds, as well as asset management. Our results suggest that high school teachers should allocate more resources to teaching about bank deposits, debt (calculation of compound interest rates, loan repayment method, and the relationship between bond prices and interest rates) and risky assets (risk diversification and the relationship between risk and return). However, according to Nikkei (2019), home economics teachers are confused or reluctant to teach based on the new guidelines. Even if the curriculum guidelines are enhanced, they are meaningless if they cannot be taught effectively in schools. It would be important to increase support for teaching personal finance by providing resources such as educational videos for home economics teachers. 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.

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<sup>11</sup> We also test the null hypothesis that  $b_3=b_5=0$ , and it is not rejected expectedly.

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## Appendix 1

This Appendix shows the questions selected from the Bank of Japan Financial Literacy Survey 2016 used to construct our measure of financial literacy.

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.

**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 "An investment with a high return is likely to be high risk" are true or false. Choose one answer for each item. [Required entry] True, False, Don't know.

**Question 21\_4:** Please indicate whether you think "Buying a single company's stock usually provides a safer return than a stock mutual fund" are true or false. Choose one answer for each item. [Required entry] True, False, Don't know.

**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 "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" are true or false. Choose one answer for each item. [Required entry] True, False, Don't know.

**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 "High inflation means that the cost of living is increasing rapidly" are true or false. Choose one answer for each item. [Required entry] True, False, Don't know

## Appendix 2

This table reports the Ordinary Least Squares estimates of the relationship between stock holding and financial literacy and other variables. We have also included 9 regional dummies whose coefficients are not reported here. Heteroskedasticity-robust standard errors are in parenthesis. \*, \*\*, and \*\*\* indicate statistical significance at the 10%, 5% and 1% levels, respectively.

<b>OLS</b>	
	Stock
Financial_literacy	0.1263*** (0.0038)
Male	0.0521*** (0.0087)
Age30_39	0.0421*** (0.0114)
Age40_49	0.0579*** (0.0118)
Age50_59	0.1048*** (0.0126)
Age60_69	0.1600*** (0.0127)
Age70_79	0.2164*** (0.0146)
Self_employed	-0.0038 (0.0141)
Part_time	-0.0119 (0.0107)
Homemaker	0.0103 (0.0111)
Unemployed	0.0167 (0.0118)
Occupation_other	-0.0187 (0.0238)
Junior_college	0.0446*** (0.0112)
University	0.0514*** (0.0077)
Education_other	0.0028 (0.0699)
Inc250_500	0.0205** (0.0091)
Inc500_750	0.0447*** (0.0108)
Inc750_over	0.0767*** (0.0119)
IncDK	0.0010 (0.0193)
Debt	-0.0282*** (0.0074)
Myopia	-0.0031 (0.0022)
Self_control	-0.0066** (0.0033)
Loss_aversion	-0.1807*** (0.0090)
Risk_aversion	-0.0668*** (0.0029)
Herd	0.0173*** (0.0032)
Over_confidence	0.1051*** (0.0039)
Constant	0.1721*** (0.0222)
Observations	15,600
R-squared	0.2976

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