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by

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1. Introduction

Financial literacy holds growing importance for managing assets/savings during the longer retirement period currently experienced in rapidly aging countries. Indeed, the case is most pronounced in and relevant to Japan, where population aging is taking place at the most rapid rate in the world in an environment that combines a persistent long-term low level fertility rate and continuing rise in life expectancy.¹ These factors have resulted in the older generation occupying a higher proportion of the total population at 27.3% while putting pressure on the sustainability of the pay-as-you-go public pension program (Shimizutani, Oshio and Fujii, 2016).

Under these circumstances, there are two devastating forces that act to lower the adequacy of retirement savings and thus obstruct the management of economic resources in later life for middle and older generations. One is a reduction in pension benefits and the other is a longer time horizon that has to be compensated. Thus, a higher level of financial literacy may serve as a device to contribute to mitigation of a decline in economic well-being in later life or even to enhance the potential standard of living in old age.

Despite the rapidly changing demographic structure, research on financial literacy has a relatively shallow history.² Economists started to focus on study of financial literacy in the 2000s (Lusardi and Mitchell, 2014). With some theoretical development, empirical studies, which have been undertaken mostly in the U.S., used

¹ According to National Institute of Population and Social Security Research, the latest TFR (Total Fertility Rate) of Japan is 1.44 in 2016. The figure declined to below 1.3 in 2003-2005 and slightly recovered afterwards. The post-war development of TFR is described in detail by Shimizutani (2015). The latest life expectancy at birth in Japan is 80.98 year for males and 87.14 year for females in 2016, both of which represent the second longest life expectancy in the world.

² Lusardi and Mitchell (2014) is a useful survey of the literature on financial literacy. They define financial literacy as “people’s ability to process economic information and make informed decisions about financial planning, wealth accumulation, debt and pensions.” It is true also that the research history on financial literacy for younger generations is scarce.

“metrics” to examine the level of financial literacy in various subgroups and associated financial literacy to actual economic/financial decision. The current standardized measure of financial literacy is the number of correct answers to a set of three questions: 1) understanding of compounded interest, 2) understanding of inflation, and 3) understanding of risk and diversification; these questions were asked in a special module of the 2004 HRS (Health and Retirement Study) (Lusardi and Mitchell, 2014).

Using these and other metrics of financial literacy, Lusardi and Mitchell (2014) concludes that the level of financial literacy is low and people are not financially literate in the U.S. Moreover, the low level of financial literacy is found to be prevalent in other countries including Japan (Lusardi and Mitchell, 2011, 2014). When looking at the data by subgroup, the level of financial literacy is hump-shaped along with age and is higher for males, the educated, individuals employed, or who are higher earners (Lusardi and Mitchell, 2014). Furthermore, a large volume of empirical research documented that the module of financial literacy is indeed associated with a variety of financial decisions or economic behaviors, and financial literacy is confirmed to play a non-negligible role in those decisions/behaviors if instrument variable (IV) estimation is employed to address endogeneity (Lusardi and Mitchell, 2014).

This study examines determinants of level of financial literacy in middle and older generations in Japan and then investigates its association to household decisions regarding asset allocation. In contrast to a large volume of research abroad, particularly in the U.S., there has been scarce research on this subject in Japan. Among the few previous studies, Clark, Matsukura and Ogawa (2013) revealed that a significantly higher probability of a correct answer to the standard financial literacy

questions is found in males, residents in urban areas, the higher educated, or high income earners in Japan.³ The study utilized a micro-level dataset on individuals from the 2010 National Survey on Work and Family, focusing on individuals in the sample who were aged 40 to 59 and employed at the time of the survey. Furthermore, they found that financial literacy is partially linked with the demand for human capital investment, measured by the need for additional skills to be competitive at the current job.⁴ In a more recent work, Yoshino et al. (2017) used a dataset collected by the Central Council for Financial Service Information, which is not based on a standard two stage random sampling, to examine factors linking to financial literacy and the relationship between financial literacy and household asset allocation.

This study performs two sets of analysis: the first is the determinants of the level of financial literacy and the second is the association between financial literacy and household asset allocation. While we share the spirit of the analytical approach with Yoshino et al. (2017), we use a more pertinent dataset: the individuals in the sample were randomly selected by household registration, contrasting to nonrandom and non-representative data used by Yoshino et al. (2017). Moreover, we focus on middle and older generations who are sensitive to retirement preparation or who are indeed retired. Furthermore, most importantly, we include some new variables as covariates which were not included in the previous literature in Japan. One group of new variables includes those related to behavioral economics such as risk attitude and time discounting. Another group contains variables to capture current mental/cognitive state and expectations for the future such as symptoms of

³ Sekita (2011) performed a similar analysis and obtained the same pattern on the coefficients.

⁴ Clark, Matsukura and Ogawa (2013) did not explore an association between financial literacy and asset holdings. Surprisingly, Yoshino et al. (2017) does not quote Clark, Matsukura and Ogawa (2013) or Sekita (2011) in their literature survey and proceeds with the discussion without mentioning those previous studies.

depression, cognitive ability, as well as survival probability to measure the life horizon. We believe that these additional variables will help to uncover a more accurate assessment of the impact of socio-economic status on financial literacy or household asset allocation.⁵

This paper is organized as follows. Section 2 describes the dataset used in the empirical analysis and presents descriptive statistics of financial literacy. Section 3 performs regression analysis to associate the level of financial literacy with a variety of factors including household demographics, socio-economic status, and measures of behavioral/mental/expectation. Further, Section 4 investigates the relationship between financial literacy and household asset allocation. Section 5 concludes.

2. Data description

In this study, we use microdata from JSTAR (Japanese Study on Aging and Retirement). JSTAR is a world-standard longitudinal dataset on middle-aged and older generations and holds the position as the Japanese counterpart of Health and Retirement Study (HRS) in the United States, English Longitudinal Study of Ageing (ELSA) in UK, the Survey of Health, Ageing and Retirement in Europe (SHARE) in continental Europe, and other sister surveys in Asia and other regions. Similar to those surveys, JSTAR's questionnaire covers a wide variety of variables related to health, employment, economic status, family formation, and other life features. The unit of the sample of JSTAR at baseline is individuals aged 50 to 75 who were randomly chosen from household registration within each municipality. If a respondent is married, selected questions are also asked of the spouse. JSTAR began collection of

⁵ While not included in the current version, we plan to perform a U.S.-Japan comparison in financial literacy and its impact on household asset holding using HRS and JSTAR.

data in 2007 in five municipalities (first wave) and added two municipalities in 2009 (second wave), followed by the third wave (2011-12) with three new municipalities, the fourth wave (2013), and the fifth wave (2015).⁶

Among these waves, the second wave performed in 2009 on the individuals surveyed in five municipalities in the first wave contains a battery of questions on financial literacy. The questions include the relevant set of three questions: 1) understanding of compounded interest, 2) understanding of inflation and, 3) understanding of risk and diversification. In addition, the wave includes two related questions. One is self-assessment of own knowledge of economics (response is scaled 1(lowest) to 7 (highest)) and the other is whether a respondent has ever studied accounting or economics.

Table 1 presents a simple average of each measure of financial literacy. Since the proportion of correct/incorrect answers relies on a response style, we added the statistics of HRS in the corresponding age range (52-79) as a reference.⁷ At a glance, the level of financial literacy is much lower in Japan than that in the U.S. For example, Panel A shows that the proportion of correct responses to “compound interest” is 38.6% in Japan, which is substantially lower than that in the U.S. (71.8%). This is also the case for “inflation” in Panel B; the proportion of correct response is 38.7%, much lower than 82.4% in the U.S.; for “stock risk” in Panel C, the proportion of correct response is 30.9%, much lower than 66.4% in the U.S. It might be tempting to conclude that the level of financial literacy is lower in Japan, but we should be

⁶ The total number of municipalities in the third wave is 10. The five municipalities in the first wave are Takikawa city, Sendai city, Adachi ward (metropolitan Tokyo), Kanazawa city, and Shirakawa town. The two municipalities that were added in the second wave are Naha and Tosu cities. The three municipalities that were added in the third wave are Hiroshima, Chofu, and Tondabayashi cities. The total number of individuals in the sample is about 8,000 at baseline.

⁷ HRS in 2010 has a module for financial literacy and similar questions as those included in JSTAR in 2009 can be found. We use the data for Japan-U.S. comparison.

careful how to interpret these figures since the proportion of “Don’t Know” or “Not Sure” is much higher in Japan. Indeed, the proportion of “incorrect” answers is larger in the U.S. than in Japan for all three questions.

Table 2 shows the summary statistics for the analysis below. Household demographics show that the average age is 65.6 years old and each sex contributes to one half. More than one half of the respondents were working at the time of the survey, and more than 80% were currently married. As regards educational attainment, the proportion of senior high school graduates or less is three quarters and the proportion of university graduates or more is slightly larger than 10%. Turning to behavioral variables, the proportion to prefer no uncertainty is about 20% and the figures are comparable for risk preference with 10-30%, and 40-60%.⁸ Note that the proportion of no response is more than 30%. The subjective discount rate ranges from 0 to 0.5% for more than 30% of the respondents and from 1 to 6% for fewer than 30%. The higher discount rate (more than 10% annually) is about 10%. Again, we should note that about 30% of the respondents did not respond regarding their time preference. Looking at the cognitive/mental measure, the proportion of correct answers to serial seven is 45.3% and the average number of 10 word instant recall is 4.2 words. Of the respondents, 6.6% have symptoms of depression measured by CES-D (Center for Epidemiology Scale of Depression) which has a threshold of 20. The proportion of those who have ever studied accounting or economics is slightly more than 10%. Self-assessment of own knowledge of economics is low because more than 60% of the respondents give a scale of 1, 2, or 3. Only a small portion (about 3%) gives a scale of 6 or 7. The subjective probability to live to age 85 is on average 31.1%. The dominant bracket of individual income is 1 to 2 million yen (16.7%),

⁸ The questions on risk attitude and discount rate in JSTAR are described in the Appendix.

followed by 0 to 1 million yen (14.8%) while that of household income is 3-5 million yen (18.7%). Lastly, household asset holding reveals that the proportion of risky financial instrument is low; bond holders make up more or less 20% depending on individual or household, and stock holders occupy less than 20%. About 90% have saving accounts, suggesting that Japanese middle and older generations are generally conservative in asset investment.

3. Determinants of financial literacy

In this section, we examine determinants of the level of financial literacy by regression analysis. The basic specification for the analysis is described as follows.

$$(1) FL_i = \beta X_i + \varepsilon_i$$

where FL_i measures the level of financial literacy. The variable takes two forms. One is the number of correct answers to a set of three financial literacy questions and the other is the principal component of the answers of the three questions, which summarizes the element of three different answers. X_i is a vector of variables related to individuals including age, sex, work status, marital status, educational attainment, risk attitude, time discounting, cognitive skills (serial seven and instant word recall), depression symptom (CES-D scale), taking coursework in economics or accounting, subjective probability to live age 85, and individual income. Moreover, dummy variables to indicate each municipality (five municipalities) are also included.

The first two columns report the estimated coefficients using OLS. The dependent variable is the number of correct answers in the first column and principal components of the answers of the three questions in the second column. First, looking

at individual characteristics, the coefficient on age is negative and significant and that on sex is positive and significant, showing that the level of financial literacy declines along with age and is higher for males. These are consistent with findings in previous studies. When taking the coefficient in Column (1), the gap between males and females in the number of correct answers is 0.2. The coefficients on work status and marital status are not significant. The coefficients are significant and larger for higher educational attainment, which again conforms to the result in previous studies. Second, turning to behavioral variables, the coefficients on risk attitude are not significant, though the size is larger for respondents with more preference for risk. In contrast, the coefficient on subjective discounting is positive and significant for an annual rate of 1-6%. The coefficients are positive and significant for serial seven and word recall. This is natural since respondents with higher cognitive skills are more likely to retain a higher level of financial literacy. On the other hand, the coefficients on depression symptoms, subjective probability to live up to age 85, and taking an economics/accounting coursework are not significant. Third, the size of the coefficients is larger for higher income, showing that higher earners are more likely to enjoy a higher level of financial literacy. In particular, the coefficients are significant when annual income levels are 3-5 million or more.

In sum, we found higher level of financial literacy in individuals who are younger, male, more educated, with higher cognitive skills or a higher level of annual income. These patterns are generally confirmed in Columns (3) and (4) with some distinctions. In these columns, the coefficients are produced by ordered probit model instead of OLS. The pattern of the coefficients on individual characteristics are the same between OLS and ordered probit model: individuals who are younger, male, or higher educated are more likely to have a higher level of financial literacy. However,

there are some additional findings in the results of the ordered probit estimations. The coefficients on an incidence of depression symptoms by the CES-D measure are negative and significant, showing that respondents with depression symptoms are likely to have lower financial literacy. At the same time, the coefficients on taking economics/accounting coursework are positive and significant, suggesting that a higher level of financial literacy is associated with the experience of study of that coursework. The coefficients on the subjective probability to live to age 85 are now positive and significant, showing that a subjective assessment of a longer life time horizon is linked to a higher level of financial literacy. Lastly, the coefficients are larger for higher earners, which is found in the first and second columns too, and those on the income range 1-2 million and 2-3 million yen are now positive and significant. In addition to age, sex, education attainment, time discounting, cognitive skills and income levels, those observations using ordered probit model show that the level of financial literacy is associated with risk attitude, depression state, taking coursework in economics/accounting or subjective life expectancy, which are new details in the Japanese literature on financial literacy.⁹

4. Financial literacy and individual asset allocation

Next, we aim to understand the level of financial literacy that associates with individual asset holding. By “individual” assets, we mean bonds, stocks, and deposits in the name of the respondent. A natural speculation is that higher a level of financial literacy is associated with a greater variety of financial instruments to invest. The

⁹ We present the results using household income instead of individual income in Appendix Table 1. Household income here is defined as the sum of income of the respondent and the spouse (if married), otherwise as only the income of the respondent. While the pattern of most of the coefficients are the same as those in Table 2, the coefficients on income level are slightly different. In the first and second columns, the coefficients are largely not significant and the size is not necessarily larger for higher income level.

basic specification for the analysis is described as follows.

$$(2) A_i = \alpha FL_i + \beta X_i + \varepsilon_i$$

where A_i measures individual-level asset allocation of individual i . The dependent variable is an indicator variable to take one if a respondent holds non-zero financial asset by type (bonds, stocks, or deposits). The main independent variable FL_i is the level of financial literacy measured in either the number of correct answers or principal components of answers of the three questions, which connect financial literacy to individual asset holding. The other covariates (a vector of X_i) refer to individual characteristics which are exactly the same in specification (1); age, sex, work status, marital status, educational attainment, risk attitude, time discounting, cognitive skills (serial seven and word recall), depression symptom (CES-D), taking coursework in economics or accounting, subjective probability to live to age 85, individual income, and dummy variables to indicate each municipality.

In what follows, we will focus on the coefficients of the main variable, the level of financial literacy. The first three columns report the results for bond holding (Column (1)), stock holding (Column (2)), and deposit holding (Column (3)) if we use the number of correct answers to the set of the three questions on financial literacy. These coefficients are obtained by using a linear probability model. As expected, the coefficients of those variables are positive and significant, showing that financial literacy is associated with individual asset holding. Moreover, we should pay attention to the size of the coefficient. The coefficient shows that one more correct answer to the financial literacy question is significantly associated with 4.2% higher probability to hold bonds, 2.4% higher to have stocks, and 1.3% higher to have

deposits. The remaining columns (Columns (4) to (6)) present the results if we use the principal component of three answers instead of the number of correct answers. The pattern is same. The coefficients are positive and significant and the size is larger for bond holding, followed by stock holding and savings. The remaining cells show the coefficients on the covariates. In contrast to the level of financial literacy, the coefficients on age and sex are not significant except that males are less likely to invest in bonds. Moreover, the coefficients on work status are negative and significant, showing currently working respondents are less likely to invest in bonds or stocks. Most of the coefficients on educational attainment are positive and significant. Note that the gradient of the size of the coefficients on education is steeper for bonds and stocks than deposits, showing that the more educated are more likely to invest in more risky assets. Further, the coefficients on risk attitude are significant and larger for bond and stock holding while they are not significant for deposit holding. In contrast, a higher subjective discount rate is associated with less investment in all types of asset holdings due to the preference for consuming over saving. While the coefficients on cognitive skills are generally insignificant, respondents with depressive symptoms are significantly less likely to invest in bonds. What is interesting is that taking coursework in economics or accounting is significantly linked to investment in bonds or stocks, suggesting that another measure of financial literacy is indeed associated with financial decision. The coefficient on subjective probability to live to age 85 is positive and significant for bond holding though the size of the coefficient is very small. The coefficients on income category are generally significant and higher for higher income earners, though those in a higher income bracket (more than 10 million yen) are positive and significant for deposits but not for bond/stock holding.

Columns (7) to (12) of Table 4 report the results using probit model, not OLS. Marginal effects are reported. Columns (7) to (9) report the estimated coefficients if the number of correct answers is employed as the level of financial literacy and Columns (10) to (12) show those if the principal component is used. The observation of the pattern in the coefficients is almost identical to that in Columns (1) to (6).¹⁰

5. Conclusion

We examine the levels and determinants of financial literacy as well as its association to asset allocation among middle and older generations in Japan where population aging is taking place at the most rapid rate in the world. Using JSTAR from 2009, we obtain some interesting findings. First, we found a higher level of financial literacy in individuals who are younger, male, more educated, have higher cognitive skills or a higher level of annual income, results which conform to findings by previous studies. If we employ a different estimation method, we found that level of financial literacy is associated with risk attitude, depression state, taking coursework in economics/accounting, or subjective life expectancy. Second, we found that the level of financial literacy is significantly associated with individual asset holding and the impact is larger for bond and stock holdings than for savings deposits.

Financial literacy holds growing importance for managing assets/savings during the longer retirement period currently experienced in rapidly aging countries, a societal feature particularly relevant to Japan. One direction of further study should put the case of Japan in an international perspective to extract policy implications.

¹⁰ We present the results using household asset holdings and household income instead of individual asset holding and individual income in Appendix Table 2. By “household assets,” we mean assets (bonds, stocks, and deposits) in the name of either or both of the respondent or/and spouse if married. Household assets are equivalent with individual assets if a respondent is unmarried. While the pattern on most of the coefficients are generally same as those in Table 4.

While improvement of financial literacy in middle and older generations seems to be a common policy agenda, consensus on concrete policy intervention is lacking. One reason is that there are too many factors to determine the level of financial literacy and the effectiveness of intervention, which depends on policy instrument, is ambiguous. An international research project will contribute toward revelation of important elements that lead to formulation of policy to raise financial literacy in each country.

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Table 1 Financial literacy in Japan with a comparison with the U.S.

A. Compound interest

"Suppose you had \$100 in a savings account and the interest rate was 2% per year.

After 5 years, how much do you think you would have in the account if you left the money to grow? More than \$102, exactly \$102, or less than \$102?"

	JSTAR		HRS (52<age<79)	
	Freq.	Percent	Freq.	Percent
More than \$102	1100	38.57	1,057	71.76
Exactly \$102	177	6.21	205	13.92
Less than \$102	196	6.87	148	10.05
Don't Know/Not Sure	1365	42.56	57	3.87
Refused to answer	165	5.79	6	0.41

B. Inflation

"Imagine that the interest rate on your savings account was 1% per year and inflation was 2% per year. After 1 year, would you be able to buy more than today, exactly the same as today, or less than today with the money in this account?"

	JSTAR		HRS (52<age<79)	
	Freq.	Percent	Freq.	Percent
More than today	126	4.42	81	5.5
Exactly the same as today	83	2.91	126	8.55
Less than today	1103	38.67	1213	82.35
Don't Know/Not Sure	1365	47.86	47	3.19
Refused to answer	175	6.14	6	0.41

C. Stock risk

"Do you think that the following statement is true or false: buying a single company stock usually provides a safer return than a stock mutual fund?"

	JSTAR		HRS (52<age<79)	
	Freq.	Percent	Freq.	Percent
TRUE	249	8.73	244	16.56
FALSE	881	30.89	978	66.4
Don't Know/Not Sure	1536	53.86	241	16.36
Refused to answer	186	6.52	10	0.68

(Note) The questionnaire in C differs slightly between HRS and JSTAR.

HRS specifies "a single company stock usually..." in HRS. JSTAR does not specify a SINGLE stock company and refers to "always" instead of "usually."

Table 2 Descriptive statistics

Variables	N Obs.	Average	S.D.	Min	Max
Compound interest (=1 if correct, 0 otherwise)	2,852	0.3857	0.4868	0	1
Inflation (=1 if correct, 0 otherwise)	2,852	0.3867	0.4871	0	1
Stock risk (=1 if correct, 0 otherwise)	2,852	0.3089	0.4621	0	1
# of correct answers	2,852	1.0813	1.0925	0	3
Score of principal component analysis of the three question	2,852	0.0000	1.3175	-1.3	2.31
age (years)	2,852	65.6462	6.9737	52	79
sex (=1 if male, 0 otherwise)	2,852	0.5116	0.5000	0	1
work (=1 if working, 0 otherwise)	2,852	0.5263	0.4994	0	1
work: missing dummy	2,852	0.0021	0.0458	0	1
current_married (=1 if yes, 0 otherwise)	2,852	0.8079	0.3941	0	1
current_married: missing dummy	2,852	0.0021	0.0458	0	1
primary/jounior high schoool	2,852	0.3527	0.4779	0	1
senior_high	2,852	0.4018	0.4904	0	1
junior_college	2,852	0.1224	0.3278	0	1
university	2,852	0.1073	0.3095	0	1
graduate	2,852	0.0074	0.0855	0	1
Education variable: missing dummy	2,852	0.0042	0.0647	0	1
Risk preference: no uncertainty	2,852	0.2055	0.4041	0	1
Risk preference: 10-30%	2,852	0.1939	0.3954	0	1
Risk preference: 40-60%	2,852	0.2034	0.4026	0	1
Risk preference: 70-90%	2,852	0.0835	0.2766	0	1
Risk preference: missing dummy	2,852	0.3138	0.4641	0	1
Time discounting preference: 0-0.5%	2,852	0.3121	0.4634	0	1
Time discounting preference: 1-6%	2,852	0.2742	0.4462	0	1
Time discounting preference: 10-40%	2,852	0.1262	0.3322	0	1
Time discounting preference: missing dummy	2,852	0.2875	0.4527	0	1
Serial 7 (=1 if correct, 0 otherwise)	2,852	0.4530	0.4979	0	1
Instant word recall	2,852	4.2107	2.4860	0	9
CESD (=1 if score>=20, 0 otherwise)	2,852	0.0656	0.2476	0	1
CESD: missing dummy	2,852	0.2034	0.4026	0	1
ever studied accounting/economics? (=1 if yes, 0 otherwise)	2,852	0.1112	0.3144	0	1
ever studied accounting/economics?: missing dummy	2,852	0.1024	0.3032	0	1
Self-assessment of own knowledge of economics: 1(lowest) to 7 (highest)					
scale: 1	2,852	0.2619	0.4398	0	1
scale: 2	2,852	0.1515	0.3586	0	1
scale: 3	2,852	0.2244	0.4173	0	1
scale: 4	2,852	0.1122	0.3157	0	1
scale: 5	2,852	0.0764	0.2657	0	1
scale: 6	2,852	0.0228	0.1493	0	1
scale: 7	2,852	0.0077	0.0875	0	1
scale: missing dummy	2,852	0.1431	0.3502	0	1
Subjective probability living up to 85	2,852	31.1241	35.2432	0	100

Table 2 Descriptive statistics (continued)

Variables	N Obs.	Average	S.D.	Min	Max
Income (individual): 0 yen	2,852	0.0691	0.2536	0	1
Income (individual): 1-1million yen	2,852	0.1476	0.3548	0	1
Income (individual): 1-2 million yen	2,852	0.1669	0.3730	0	1
Income (individual): 2-3 million yen	2,852	0.1336	0.3403	0	1
Income (individual): 3-5 million yen	2,852	0.1094	0.3122	0	1
Income (individual): 5-7 million yen	2,852	0.0358	0.1857	0	1
Income (individual): 7-10 million yen	2,852	0.0245	0.1548	0	1
Income (individual): more than 10 million yen	2,852	0.0098	0.0986	0	1
Income (individual): missing dummy	2,852	0.3131	0.4638	0	1
Income (household): 0 yen	2,852	0.0487	0.2154	0	1
Income (household): 1-1million yen	2,852	0.0761	0.2652	0	1
Income (household): 1-2 million yen	2,852	0.1210	0.3261	0	1
Income (household): 2-3 million yen	2,852	0.1283	0.3345	0	1
Income (household): 3-5 million yen	2,852	0.1872	0.3902	0	1
Income (household): 5-7 million yen	2,852	0.0719	0.2583	0	1
Income (household): 7-10 million yen	2,852	0.0435	0.2040	0	1
Income (household): more than 10 million yen	2,852	0.0270	0.1621	0	1
Income (household): missing dummy	2,852	0.2963	0.4567	0	1
Having bonds (individual level)	2,421	0.1681	0.3740	0	1
Having stocks (individual level)	2,409	0.1208	0.3260	0	1
Having saving accounts (individual level)	2,384	0.8880	0.3154	0	1
Having bonds (household level)	2,177	0.2255	0.4180	0	1
Having stocks (household level)	2,157	0.1752	0.3803	0	1
Having saving accounts (household level)	2,358	0.9389	0.2395	0	1
Municipalities					
Sendai	2,852	0.1918	0.3938	0	1
Kanazawa	2,852	0.2321	0.4223	0	1
Takikawa	2,852	0.1553	0.3623	0	1
Shirakawa	2,852	0.2279	0.4196	0	1
Adachi	2,852	0.1928	0.3946	0	1

(Note) Authors' calculation.

Table 3 Financial literacy and associated covariates (individual income)				
	(1)	(2)	(3)	(4)
	OLS	OLS	Ordered probit	Ordered probit
VARIABLES	# of correct answers	Principal component analysis	# of correct answers	Principal component analysis
age	-0.018** [0.005]	-0.022** [0.006]	-0.022*** [0.006]	-0.021*** [0.005]
sex (=1 if male, 0 otherwise)	0.214*** [0.042]	0.258*** [0.051]	0.265*** [0.046]	0.256*** [0.046]
work (=1 if working, 0 otherwise)	-0.054 [0.047]	-0.065 [0.057]	-0.046 [0.054]	-0.046 [0.057]
work: missing dummy	-0.074 [0.197]	-0.082 [0.242]	-0.165 [0.300]	-0.116 [0.338]
current_married	0.005 [0.021]	0.005 [0.025]	0.016 [0.025]	0.010 [0.025]
current_married: missing dummy	-0.569 [0.362]	-0.688 [0.432]	-0.708 [0.572]	-0.719 [0.526]
Education category (default: primary/junior high school)				
senior_high	0.153** [0.051]	0.186** [0.061]	0.175*** [0.056]	0.187*** [0.054]
junior_college	0.195* [0.077]	0.235* [0.092]	0.225*** [0.078]	0.226*** [0.077]
university	0.375** [0.111]	0.454** [0.133]	0.419*** [0.113]	0.425*** [0.110]
graduate	0.403*** [0.059]	0.480*** [0.072]	0.445*** [0.066]	0.381*** [0.082]
Education variable: missing dummy	-0.101 [0.131]	-0.118 [0.164]	-0.197 [0.212]	-0.139 [0.262]
Risk preference (default: no uncertainty)				
risk: 10-30%	-0.101 [0.061]	-0.123 [0.073]	-0.101 [0.064]	-0.106* [0.063]
risk: 40-60%	-0.048 [0.036]	-0.057 [0.043]	-0.058 [0.045]	-0.049 [0.046]
risk: 70-90%	0.078 [0.147]	0.092 [0.178]	0.074 [0.156]	0.052 [0.171]
risk preference: missing dummy	-0.153*** [0.028]	-0.187*** [0.033]	-0.199*** [0.037]	-0.212*** [0.041]
Time discounting preference (default: 0-0.5%)				
time: 1-6%	0.158** [0.043]	0.189** [0.052]	0.161*** [0.053]	0.146** [0.057]
time: 10-40%	0.082 [0.050]	0.098 [0.061]	0.063 [0.056]	0.060 [0.062]
time discounting preference: missing dummy	-0.008 [0.067]	-0.009 [0.081]	-0.050 [0.084]	-0.036 [0.082]
Serial 7 (=1 if correct, 0 otherwise)	0.103** [0.024]	0.126** [0.028]	0.107*** [0.027]	0.115*** [0.022]
Word recall	0.069** [0.019]	0.083** [0.023]	0.081*** [0.020]	0.082*** [0.021]
CESD (=1 if score>=20, 0 otherwise)	-0.095 [0.047]	-0.118 [0.058]	-0.108** [0.052]	-0.131** [0.056]
CESD: missing dummy	-0.062 [0.045]	-0.074 [0.056]	-0.064 [0.052]	-0.062 [0.062]
ever studied accounting/economics? (=1 if yes, 0 otherwise)	0.225 [0.112]	0.271 [0.136]	0.252** [0.117]	0.244** [0.115]
ever studied accounting/economics? missing dummy	0.102* [0.039]	0.123* [0.048]	0.091 [0.057]	0.096 [0.063]
subjective probability living up to 85	0.002 [0.001]	0.002 [0.001]	0.003* [0.001]	0.003* [0.001]

Table 3 Financial literacy and associated covariates (individual income) continued.				
	(1)	(2)	(3)	(4)
	OLS	OLS	Ordered probit	Ordered probit
VARIABLES	# of correct answers	Principal component analysis	# of correct answers	Principal component analysis
Income category (default: 0 yen)				
income: 1-1million yen	0.089 [0.067]	0.107 [0.081]	0.117 [0.073]	0.107 [0.069]
income: 1-2 million yen	0.137 [0.067]	0.162 [0.080]	0.157** [0.068]	0.126* [0.067]
income: 2-3 million yen	0.158 [0.083]	0.190 [0.100]	0.173* [0.092]	0.164* [0.089]
income: 3-5 million yen	0.295** [0.087]	0.352** [0.105]	0.300*** [0.095]	0.266*** [0.087]
income: 5-7 million yen	0.410*** [0.083]	0.492*** [0.100]	0.405*** [0.082]	0.367*** [0.081]
income: 7-10 million yen	0.464* [0.207]	0.559* [0.246]	0.470* [0.241]	0.455** [0.204]
income: more than 10 million yen	0.412** [0.134]	0.499** [0.162]	0.468*** [0.143]	0.485*** [0.142]
income: missing dummy	-0.113* [0.052]	-0.138* [0.063]	-0.143** [0.062]	-0.157** [0.066]
Municipality dummy (default: Sendai)				
Kanazawa	-0.004 [0.022]	-0.005 [0.027]	0.007 [0.024]	0.001 [0.027]
Takikawa	-0.282*** [0.013]	-0.342*** [0.015]	-0.303*** [0.012]	-0.316*** [0.012]
Shirakawa	-0.355*** [0.018]	-0.427*** [0.022]	-0.408*** [0.024]	-0.393*** [0.024]
Adachi	-0.078** [0.021]	-0.094** [0.026]	-0.064*** [0.019]	-0.060*** [0.021]
Constant cut1			-1.018*** [0.348]	-0.973*** [0.324]
Constant cut2			-0.374 [0.315]	-0.800*** [0.299]
Constant cut3			0.476 [0.310]	-0.568* [0.299]
Constant cut4				-0.332 [0.294]
Constant cut5				-0.159 [0.290]
Constant cut6				0.035 [0.288]
Constant cut7				0.511* [0.292]
Constant	1.727*** [0.315]	0.773 [0.377]		
Observations	2,852	2,852	2,852	2,852
R-squared	0.215	0.215		
Standard errors clustered at municipality-level in brackets				
*** p<0.01, ** p<0.05, * p<0.1				

Table 4 Financial literacy and investment behaviors						
	(1)	(2)	(3)	(4)	(5)	(6)
	OLS	OLS	OLS	OLS	OLS	OLS
VARIABLES	Bond =1 if invested	Stock =1 if invested	Saving =1 if saving	Bond =1 if invested	Stock =1 if invested	Saving =1 if saving
# of correct answers	0.042*** [0.005]	0.024*** [0.004]	0.013** [0.004]			
PCA				0.035*** [0.004]	0.020*** [0.003]	0.011** [0.004]
age	0.002 [0.001]	0.003 [0.002]	0.001 [0.001]	0.002 [0.001]	0.003 [0.002]	0.001 [0.001]
sex (=1 if male, 0 otherwise)	-0.068** [0.020]	0.008 [0.017]	-0.017 [0.014]	-0.068** [0.020]	0.008 [0.017]	-0.017 [0.014]
work (=1 if working, 0 otherwise)	-0.057* [0.021]	-0.025* [0.010]	-0.004 [0.024]	-0.057* [0.021]	-0.025* [0.010]	-0.004 [0.024]
work: missing dummy	-0.098* [0.045]	-0.092 [0.048]	0.198*** [0.016]	-0.098* [0.045]	-0.092 [0.048]	0.197*** [0.017]
current_married	-0.020 [0.012]	-0.011 [0.028]	0.041* [0.019]	-0.020 [0.012]	-0.011 [0.028]	0.041* [0.019]
current_married: missing dummy	-0.162*** [0.022]	-0.090** [0.020]	0.151*** [0.024]	-0.162*** [0.022]	-0.090** [0.020]	0.151*** [0.024]
Education category (default: primary/junior high school)						
senior_high	0.068** [0.021]	0.051* [0.020]	0.063** [0.019]	0.068** [0.021]	0.051* [0.020]	0.063** [0.019]
junior_college	0.091** [0.023]	0.077** [0.024]	0.064* [0.025]	0.091** [0.023]	0.077** [0.024]	0.064* [0.025]
university	0.073* [0.032]	0.130* [0.052]	0.035 [0.022]	0.073* [0.032]	0.130* [0.052]	0.035 [0.022]
graduate	0.283** [0.093]	0.274* [0.108]	0.116*** [0.024]	0.283** [0.093]	0.274* [0.109]	0.116*** [0.024]
Education variable: missing dummy	0.231 [0.117]	0.184 [0.094]	0.097 [0.127]	0.231 [0.117]	0.184 [0.094]	0.097 [0.127]
Risk preference (default: no uncertainty)						
risk: 10-30%	-0.009 [0.008]	0.022 [0.021]	0.010 [0.021]	-0.009 [0.008]	0.022 [0.021]	0.010 [0.021]
risk: 40-60%	0.032* [0.012]	0.047*** [0.007]	-0.009 [0.030]	0.032* [0.012]	0.047*** [0.007]	-0.009 [0.030]
risk: 70-90%	0.051** [0.016]	0.067* [0.030]	0.019 [0.021]	0.051** [0.016]	0.067* [0.030]	0.019 [0.021]
risk preference: missing dummy	-0.005 [0.022]	-0.002 [0.020]	-0.031 [0.024]	-0.005 [0.022]	-0.002 [0.020]	-0.031 [0.024]
Time discounting preference (default: 0-0.5%)						
time: 1-6%	0.003 [0.009]	-0.014 [0.013]	-0.030* [0.011]	0.003 [0.009]	-0.014 [0.013]	-0.030* [0.011]
time: 10-40%	-0.066** [0.015]	-0.044* [0.019]	-0.061* [0.024]	-0.066** [0.015]	-0.044* [0.019]	-0.061* [0.024]
time discounting preference: missing dummy	0.017 [0.015]	0.023 [0.021]	-0.032 [0.033]	0.017 [0.015]	0.023 [0.021]	-0.032 [0.033]
Serial 7 (=1 if correct, 0 otherwise)	-0.009 [0.012]	-0.002 [0.019]	0.025* [0.011]	-0.009 [0.012]	-0.002 [0.019]	0.025* [0.011]
Word recall	-0.002 [0.003]	-0.003 [0.004]	-0.001 [0.003]	-0.002 [0.003]	-0.003 [0.004]	-0.001 [0.003]
CESD (=1 if score>=20, 0 otherwise)	-0.040* [0.017]	-0.022 [0.016]	-0.038 [0.035]	-0.040* [0.017]	-0.021 [0.016]	-0.038 [0.035]
CESD: missing dummy	0.008 [0.016]	-0.021 [0.016]	-0.015 [0.032]	0.008 [0.016]	-0.021 [0.016]	-0.015 [0.032]
ever studied accounting/economics? (=1 if yes, 0 otherwise)	0.101*** [0.015]	0.062** [0.015]	0.022 [0.016]	0.101*** [0.015]	0.062** [0.015]	0.022 [0.016]
ever studied accounting/economics?: missing dummy	0.003 [0.034]	-0.054* [0.022]	0.019 [0.024]	0.003 [0.034]	-0.054* [0.022]	0.019 [0.024]
subjective probability living up to 85	0.000** [0.000]	0.000 [0.000]	-0.000 [0.000]	0.000** [0.000]	0.000 [0.000]	-0.000 [0.000]

Table 4 Financial literacy and investment behaviors (continued)						
	(1)	(2)	(3)	(4)	(5)	(6)
	OLS	OLS	OLS	OLS	OLS	OLS
VARIABLES	Bond =1 if invested	Stock =1 if invested	Saving =1 if saving	Bond =1 if invested	Stock =1 if invested	Saving =1 if saving
Income category (default: 0 yen)						
income: 1-1million yen	0.015 [0.023]	0.039* [0.015]	0.066 [0.038]	0.015 [0.023]	0.039* [0.015]	0.066 [0.038]
income: 1-2 million yen	0.034 [0.019]	0.036** [0.009]	0.103*** [0.015]	0.035 [0.019]	0.036** [0.009]	0.103*** [0.015]
income: 2-3 million yen	0.075** [0.021]	0.048*** [0.009]	0.148** [0.036]	0.075** [0.021]	0.048*** [0.009]	0.148** [0.036]
income: 3-5 million yen	0.099** [0.030]	0.099*** [0.015]	0.153*** [0.015]	0.099** [0.030]	0.099*** [0.015]	0.153*** [0.015]
income: 5-7 million yen	0.138*** [0.024]	0.104* [0.039]	0.187*** [0.022]	0.138*** [0.024]	0.104* [0.039]	0.187*** [0.022]
income: 7-10 million yen	0.182** [0.052]	0.184*** [0.038]	0.191*** [0.027]	0.182** [0.052]	0.184*** [0.038]	0.191*** [0.027]
income: more than 10 million yen	0.138 [0.092]	0.169 [0.121]	0.093*** [0.011]	0.138 [0.092]	0.169 [0.122]	0.093*** [0.011]
income: missing dummy	0.031 [0.020]	0.059*** [0.011]	0.126*** [0.022]	0.031 [0.020]	0.059*** [0.011]	0.126*** [0.022]
Municipality dummy (default: Sendai)						
Kanazawa	0.043*** [0.007]	0.038*** [0.006]	0.029** [0.010]	0.043*** [0.007]	0.038*** [0.006]	0.029** [0.010]
Takikawa	-0.113*** [0.009]	-0.061*** [0.004]	0.057*** [0.008]	-0.113*** [0.009]	-0.061*** [0.004]	0.057*** [0.008]
Shirakawa	-0.076*** [0.016]	-0.006 [0.012]	0.040** [0.012]	-0.076*** [0.016]	-0.006 [0.012]	0.040** [0.012]
Adachi	-0.044*** [0.007]	0.024** [0.006]	0.003 [0.008]	-0.044*** [0.007]	0.024** [0.006]	0.003 [0.008]
Constant	0.019 [0.083]	-0.166 [0.130]	0.651*** [0.091]	0.065 [0.087]	-0.140 [0.129]	0.665*** [0.095]
Observations	2,421	2,409	2,384	2,421	2,409	2,384
R-squared	0.120	0.093	0.055	0.120	0.093	0.055
Standard errors clustered at municipality-level in brackets						
*** p<0.01, ** p<0.05, * p<0.1						

Table 4 Financial literacy and investment behaviors (continued)						
	(7)	(8)	(9)	(10)	(11)	(12)
	Probit	Probit	Probit	Probit	Probit	Probit
VARIABLES	Bond =1 if invested	Stock =1 if invested	Saving =1 if saving	Bond =1 if invested	Stock =1 if invested	Saving =1 if saving
# of correct answers	0.039*** [0.007]	0.022*** [0.001]	0.013*** [0.004]			
PCA				0.032*** [0.006]	0.018*** [0.001]	0.011*** [0.004]
age	0.002 [0.001]	0.002 [0.002]	0.001 [0.001]	0.002 [0.001]	0.002 [0.002]	0.001 [0.001]
sex (=1 if male, 0 otherwise)	-0.066*** [0.013]	0.009 [0.018]	-0.013 [0.012]	-0.066*** [0.013]	0.009 [0.018]	-0.013 [0.012]
work (=1 if working, 0 otherwise)	-0.054*** [0.013]	-0.023** [0.010]	-0.008 [0.025]	-0.054*** [0.013]	-0.022** [0.010]	-0.008 [0.025]
work: missing dummy						
current_married	-0.023 [0.014]	-0.012 [0.028]	0.034** [0.017]	-0.023 [0.014]	-0.012 [0.028]	0.034** [0.017]
current_married: missing dummy						
Education category (default: primary/junior high school)						
senior_high	0.089*** [0.027]	0.066*** [0.017]	0.058*** [0.014]	0.089*** [0.027]	0.065*** [0.017]	0.058*** [0.014]
junior_college	0.103*** [0.027]	0.088*** [0.017]	0.057** [0.026]	0.103*** [0.027]	0.088*** [0.017]	0.057** [0.026]
university	0.087*** [0.023]	0.112*** [0.031]	0.024 [0.026]	0.087*** [0.022]	0.112*** [0.031]	0.024 [0.026]
graduate	0.209*** [0.050]	0.175*** [0.051]		0.210*** [0.050]	0.175*** [0.051]	
Education variable: missing dummy	0.215*** [0.074]	0.179*** [0.064]	0.079 [0.124]	0.215*** [0.074]	0.179*** [0.064]	0.079 [0.124]
Risk preference (default: no uncertainty)						
risk: 10-30%	-0.012 [0.010]	0.031 [0.023]	0.009 [0.022]	-0.012 [0.010]	0.031 [0.023]	0.009 [0.022]
risk: 40-60%	0.033** [0.013]	0.054*** [0.011]	-0.009 [0.029]	0.033** [0.013]	0.054*** [0.011]	-0.009 [0.029]
risk: 70-90%	0.052*** [0.017]	0.071*** [0.024]	0.029 [0.027]	0.053*** [0.017]	0.071*** [0.024]	0.029 [0.027]
risk preference: missing dummy	-0.007 [0.022]	0.004 [0.024]	-0.028 [0.018]	-0.007 [0.022]	0.004 [0.024]	-0.028 [0.018]
Time discounting preference (default: 0-0.5%)						
time: 1-6%	-0.008 [0.008]	-0.018 [0.016]	-0.032*** [0.010]	-0.008 [0.008]	-0.018 [0.016]	-0.032*** [0.010]
time: 10-40%	-0.080*** [0.011]	-0.047** [0.021]	-0.062*** [0.020]	-0.080*** [0.011]	-0.047** [0.021]	-0.062*** [0.020]
time discounting preference: missing dummy	0.011 [0.017]	0.021 [0.019]	-0.033 [0.029]	0.012 [0.017]	0.021 [0.019]	-0.033 [0.029]
Serial 7 (=1 if correct, 0 otherwise)	-0.007 [0.013]	0.006 [0.019]	0.025*** [0.009]	-0.007 [0.013]	0.006 [0.019]	0.025*** [0.009]
Word recall	-0.003 [0.003]	-0.003 [0.003]	-0.000 [0.003]	-0.003 [0.003]	-0.003 [0.003]	-0.000 [0.003]
CESD (=1 if score>=20, 0 otherwise)	-0.030* [0.018]	-0.023 [0.020]	-0.033 [0.028]	-0.030* [0.018]	-0.023 [0.020]	-0.033 [0.028]
CESD: missing dummy	0.014 [0.016]	-0.021 [0.019]	-0.012 [0.029]	0.014 [0.016]	-0.021 [0.019]	-0.012 [0.029]
ever studied accounting/economics? (=1 if yes, 0 otherwise)	0.076*** [0.007]	0.043*** [0.008]	0.029 [0.025]	0.076*** [0.007]	0.043*** [0.008]	0.029 [0.025]
ever studied accounting/economics?: missing dummy	0.001 [0.037]	-0.067 [0.045]	0.019 [0.024]	0.001 [0.037]	-0.067 [0.045]	0.019 [0.024]
subjective probability living up to 85	0.000*** [0.000]	0.000 [0.000]	-0.000 [0.000]	0.000*** [0.000]	0.000 [0.000]	-0.000 [0.000]

Table 4 Financial literacy and investment behaviors (continued)						
	(7)	(8)	(9)	(10)	(11)	(12)
	Probit	Probit	Probit	Probit	Probit	Probit
VARIABLES	Bond =1 if invested	Stock =1 if invested	Saving =1 if saving	Bond =1 if invested	Stock =1 if invested	Saving =1 if saving
Income category (default: 0 yen)						
income: 1-1million yen	0.022 [0.024]	0.059*** [0.021]	0.039 [0.026]	0.022 [0.024]	0.059*** [0.021]	0.039 [0.026]
income: 1-2 million yen	0.045** [0.019]	0.059*** [0.018]	0.074*** [0.009]	0.045** [0.019]	0.059*** [0.018]	0.075*** [0.009]
income: 2-3 million yen	0.076*** [0.010]	0.069** [0.027]	0.122*** [0.027]	0.076*** [0.010]	0.069** [0.027]	0.122*** [0.027]
income: 3-5 million yen	0.105*** [0.014]	0.114*** [0.028]	0.130*** [0.017]	0.105*** [0.014]	0.114*** [0.028]	0.130*** [0.017]
income: 5-7 million yen	0.139*** [0.027]	0.120*** [0.033]	0.193*** [0.056]	0.139*** [0.027]	0.120*** [0.033]	0.193*** [0.056]
income: 7-10 million yen	0.158*** [0.030]	0.157*** [0.032]	0.193*** [0.058]	0.158*** [0.030]	0.157*** [0.032]	0.193*** [0.058]
income: more than 10 million yen	0.119** [0.051]	0.107* [0.061]		0.119** [0.052]	0.107* [0.061]	
income: missing dummy	0.034 [0.024]	0.080*** [0.020]	0.095*** [0.014]	0.034 [0.024]	0.080*** [0.020]	0.095*** [0.014]
Municipality dummy (default: Sendai)						
Kanazawa	0.041*** [0.005]	0.030*** [0.004]	0.028*** [0.008]	0.041*** [0.005]	0.030*** [0.004]	0.028*** [0.008]
Takikawa	-0.121*** [0.008]	-0.076*** [0.003]	0.063*** [0.006]	-0.121*** [0.008]	-0.076*** [0.003]	0.063*** [0.006]
Shirakawa	-0.084*** [0.012]	-0.015** [0.007]	0.036*** [0.007]	-0.085*** [0.012]	-0.015** [0.007]	0.036*** [0.007]
Adachi	-0.031*** [0.004]	0.021*** [0.004]	0.005 [0.005]	-0.031*** [0.004]	0.021*** [0.004]	0.005 [0.005]
Observations	2,411	2,400	2,329	2,411	2,400	2,329
Marginal effects are reported.						
Standard errors clustered at municipality-level in brackets						
*** p<0.01, ** p<0.05, * p<0.1						

Appendix Questions on risk attitude and subjective discounting in JSTAR

(1) Risk attitude

09B-014-1: The first game is about receiving pay. If the method by which you are paid at work were to change next month only, which of the following options would you prefer? Please assume that the amount your pay increases is not related to your ability or effort, and that this change will be in effect for the next month only. This question is not related to whether you are actually working, or whether this would actually happen at the company you work at. This is just a hypothetical question, like a quiz, so could you please try to answer in that spirit?

1. There is a 100% probability that your pay will increase by 50%.
2. There is a 100% probability that your pay will increase by 10%.
3. Refused to answer.

If answer to 09B-014-1 is 1, go to 09B-014-2, otherwise, the question session ends.

09B-014-2: Which of these would you prefer?

1. There is a 90% probability that your pay would increase by 50%, and a 10% probability that your pay would increase by 5%.
2. There is a 100% probability that your pay would increase by 10%.
3. Refused to answer.

If answer to 09B-014-2 is 1, go to 09B-014-3, otherwise, the question session ends.

The following questions are alike. The value of X takes 80, 70, 60,and 10. If a respondent takes the second or third choice, then he/she goes to the next question.

Which of these would you prefer?

1. There is an X% probability that your pay would increase by 50%, and a (100-X) % probability that your pay would increase by 5%.
2. There is a 100% probability that your pay would increase by 10%.

3. Refused to answer.

(B) Subjective discount rate

09B-016-1a: I will ask you to choose between two options: receiving one million yen one month from today, or receiving a different sum thirteen months from today. There is no chance that you would not receive either sum.

1. Receive 1 million yen one month from today.
2. Receive 1 million yen 13 months from today (Interest rate difference: 0%).
3. Refused to answer.

If answer to 09B-016-1a is 1, go to 09B-016-2a, otherwise, the question session ends.

09B-016-2a: Which of these would you prefer?

1. Receive 1 million yen one month from today.
2. Receive 1,001,000 yen 13 months from today (Interest rate difference: 0.1%).
3. Refused to answer.

If answer to 09B-016-2a is 1, go to 09B-016-3a, otherwise, the question session ends.

The following questions are alike. The value of X_1 is 1,000,000 times $(1 + X_2/100)$ where X_2 takes 0.5, 1, 2, 6, 10, 20, 30 and 40. If a respondent takes the second or third choice, then he/she goes to the next question.

Which of these would you prefer?

1. Receive 1 million yen one month from today.
2. Receive X_1 yen 13 months from today (Interest rate difference: $X_2\%$).
3. Refused to answer.

Appendix Table 1 Financial literacy and associated covariates (household income)				
	(1)	(2)	(3)	(4)
	OLS	OLS	Ordered probit	Ordered probit
VARIABLES	# of correct answers	Principal component analysis	# of correct answers	Principal component analysis
age	-0.017** [0.005]	-0.020** [0.006]	-0.020*** [0.005]	-0.019*** [0.005]
sex (=1 if male, 0 otherwise)	0.245*** [0.047]	0.295*** [0.057]	0.293*** [0.053]	0.280*** [0.051]
work (=1 if working, 0 otherwise)	-0.041 [0.052]	-0.050 [0.063]	-0.032 [0.061]	-0.036 [0.065]
work: missing dummy	-0.072 [0.218]	-0.079 [0.267]	-0.141 [0.331]	-0.093 [0.363]
current_married	-0.068 [0.034]	-0.082 [0.041]	-0.061 [0.044]	-0.063 [0.042]
current_married: missing dummy	-0.563 [0.363]	-0.681 [0.435]	-0.698 [0.570]	-0.710 [0.526]
Education category (default: primary/junior high school)				
senior_high	0.155** [0.053]	0.189** [0.064]	0.179*** [0.058]	0.192*** [0.056]
junior_college	0.194* [0.073]	0.234* [0.088]	0.224*** [0.073]	0.226*** [0.073]
university	0.381** [0.114]	0.460** [0.136]	0.423*** [0.116]	0.427*** [0.111]
graduate	0.417** [0.101]	0.497** [0.124]	0.451*** [0.087]	0.386*** [0.098]
Education variable: missing dummy	-0.067 [0.110]	-0.077 [0.138]	-0.161 [0.188]	-0.103 [0.243]
Risk preference (default: no uncertainty)				
risk: 10-30%	-0.110 [0.055]	-0.133 [0.066]	-0.110* [0.058]	-0.114** [0.057]
risk: 40-60%	-0.058 [0.033]	-0.068 [0.039]	-0.069 [0.042]	-0.059 [0.041]
risk: 70-90%	0.068 [0.151]	0.081 [0.183]	0.064 [0.163]	0.042 [0.177]
risk preference: missing dummy	-0.178*** [0.038]	-0.216*** [0.046]	-0.230*** [0.051]	-0.241*** [0.052]
Time discounting preference (default: 0-0.5%)				
time: 1-6%	0.152** [0.043]	0.182** [0.052]	0.156*** [0.052]	0.142** [0.057]
time: 10-40%	0.081 [0.058]	0.097 [0.071]	0.063 [0.063]	0.061 [0.070]
time discounting preference: missing dummy	-0.009 [0.065]	-0.010 [0.078]	-0.048 [0.082]	-0.034 [0.081]
Serial 7 (=1 if correct, 0 otherwise)	0.107** [0.023]	0.130*** [0.028]	0.111*** [0.027]	0.118*** [0.021]
Word recall	0.066** [0.018]	0.080** [0.022]	0.078*** [0.020]	0.079*** [0.021]
CESD (=1 if score >= 20, 0 otherwise)	-0.090 [0.047]	-0.111 [0.057]	-0.106** [0.050]	-0.130** [0.055]
CESD: missing dummy	-0.064 [0.044]	-0.077 [0.054]	-0.066 [0.050]	-0.065 [0.060]
ever studied accounting/economics? (=1 if yes, 0 otherwise)	0.227 [0.109]	0.273 [0.132]	0.256** [0.112]	0.247** [0.111]
ever studied accounting/economics? missing dummy	0.100 [0.049]	0.120 [0.060]	0.089 [0.071]	0.091 [0.076]
subjective probability living up to 85	0.002 [0.001]	0.002 [0.001]	0.002* [0.001]	0.002* [0.001]

Appendix Table 1 Financial literacy and associated covariates (household income) continued

	(1)	(2)	(3)	(4)
	OLS	OLS	Ordered probit	Ordered probit
VARIABLES	# of correct answers	Principal component analysis	# of correct answers	Principal component analysis
Income category (default: 0 yen)				
income: 1-1million yen	-0.007 [0.158]	-0.009 [0.190]	-0.007 [0.204]	-0.012 [0.200]
income: 1-2 million yen	0.101 [0.056]	0.121 [0.067]	0.112 [0.075]	0.095 [0.067]
income: 2-3 million yen	0.098 [0.141]	0.118 [0.171]	0.104 [0.167]	0.102 [0.169]
income: 3-5 million yen	0.338* [0.138]	0.406* [0.167]	0.354** [0.159]	0.330** [0.158]
income: 5-7 million yen	0.341 [0.172]	0.408 [0.207]	0.337* [0.201]	0.309 [0.197]
income: 7-10 million yen	0.278 [0.155]	0.336 [0.185]	0.275 [0.191]	0.280 [0.175]
income: more than 10 million yen	0.470* [0.192]	0.567* [0.230]	0.488** [0.225]	0.486** [0.208]
income: missing dummy	-0.072 [0.069]	-0.087 [0.083]	-0.105 [0.091]	-0.107 [0.084]
Municipality dummy (default: Sendai)				
Kanazawa	-0.009 [0.019]	-0.012 [0.023]	0.003 [0.019]	-0.002 [0.022]
Takikawa	-0.291*** [0.015]	-0.353*** [0.018]	-0.314*** [0.016]	-0.326*** [0.017]
Shirakawa	-0.358*** [0.024]	-0.431*** [0.029]	-0.411*** [0.030]	-0.395*** [0.030]
Adachi	-0.082** [0.023]	-0.099** [0.028]	-0.070*** [0.022]	-0.065*** [0.024]
Constant cut1			-0.978*** [0.315]	-0.928*** [0.309]
Constant cut2			-0.333 [0.282]	-0.755*** [0.283]
Constant cut3			0.519* [0.284]	-0.523* [0.282]
Constant cut4				-0.287 [0.280]
Constant cut5				-0.113 [0.274]
Constant cut6				0.082 [0.277]
Constant cut7				0.559* [0.285]
Constant	1.678*** [0.286]	0.714 [0.344]		
Observations	2,852	2,852	2,852	2,852
R-squared	0.218	0.218		
Standard errors clustered at municipality-level in brackets				
*** p<0.01, ** p<0.05, * p<0.1				

Appendix Table 2 Financial literacy and investment behaviors						
	(1)	(2)	(3)	(4)	(5)	(6)
	OLS	OLS	OLS	OLS	OLS	OLS
VARIABLES	Bond =1 if invested	Stock =1 if invested	Saving =1 if saving	Bond =1 if invested	Stock =1 if invested	Saving =1 if saving
# of correct answers	0.056*** [0.008]	0.034*** [0.005]	0.005 [0.003]			
PCA				0.046*** [0.007]	0.028*** [0.004]	0.004 [0.003]
age	0.002 [0.001]	0.003 [0.002]	0.002 [0.001]	0.002 [0.001]	0.003 [0.002]	0.002 [0.001]
sex (=1 if male, 0 otherwise)	-0.048* [0.022]	-0.016 [0.017]	-0.006 [0.005]	-0.048* [0.022]	-0.016 [0.017]	-0.006 [0.005]
work (=1 if working, 0 otherwise)	-0.072* [0.029]	-0.049* [0.020]	0.006 [0.014]	-0.072* [0.029]	-0.049* [0.020]	0.006 [0.014]
work: missing dummy	-0.120 [0.068]	-0.117* [0.048]	0.171*** [0.029]	-0.120 [0.068]	-0.118* [0.048]	0.171*** [0.029]
current_married	0.019 [0.024]	0.037 [0.024]	0.084*** [0.013]	0.019 [0.024]	0.037 [0.024]	0.084*** [0.013]
current_married: missing dummy	-0.186*** [0.018]	-0.090** [0.022]	0.127*** [0.023]	-0.186*** [0.018]	-0.090** [0.022]	0.127*** [0.023]
Education category (default: primary/junior high school)						
senior_high	0.087** [0.024]	0.083*** [0.018]	0.047* [0.019]	0.087** [0.024]	0.083*** [0.018]	0.047* [0.019]
junior_college	0.113** [0.029]	0.138** [0.039]	0.062** [0.019]	0.113** [0.029]	0.138** [0.039]	0.062** [0.019]
university	0.065* [0.026]	0.178** [0.049]	0.044 [0.022]	0.065* [0.026]	0.178** [0.049]	0.044 [0.022]
graduate	0.326** [0.105]	0.291* [0.117]	0.073** [0.019]	0.327** [0.105]	0.291* [0.117]	0.073** [0.019]
Education variable: missing dummy	0.284 [0.176]	0.196 [0.126]	0.101*** [0.019]	0.283 [0.176]	0.196 [0.126]	0.101*** [0.019]
Risk preference (default: no uncertainty)						
risk: 10-30%	-0.019* [0.007]	0.022 [0.020]	0.000 [0.017]	-0.019* [0.007]	0.022 [0.020]	0.000 [0.017]
risk: 40-60%	0.021 [0.014]	0.042** [0.014]	-0.005 [0.017]	0.020 [0.014]	0.042** [0.014]	-0.005 [0.017]
risk: 70-90%	0.031 [0.025]	0.060 [0.028]	-0.002 [0.021]	0.031 [0.025]	0.060 [0.028]	-0.002 [0.021]
risk preference: missing dummy	-0.005 [0.022]	-0.002 [0.037]	-0.021 [0.024]	-0.005 [0.022]	-0.002 [0.037]	-0.021 [0.024]
Time discounting preference (default: 0-0.5%)						
time: 1-6%	0.015 [0.008]	-0.018 [0.014]	-0.011 [0.015]	0.015 [0.008]	-0.018 [0.014]	-0.011 [0.015]
time: 10-40%	-0.075*** [0.014]	-0.068** [0.017]	-0.046* [0.020]	-0.075*** [0.014]	-0.068** [0.017]	-0.046* [0.020]
time discounting preference: missing dummy	0.001 [0.016]	0.026 [0.025]	-0.025 [0.028]	0.001 [0.016]	0.026 [0.025]	-0.025 [0.028]
Serial 7 (=1 if correct, 0 otherwise)	-0.006 [0.014]	-0.020 [0.015]	0.018 [0.012]	-0.006 [0.014]	-0.021 [0.015]	0.018 [0.012]
Word recall	-0.004 [0.004]	-0.000 [0.003]	0.001 [0.002]	-0.004 [0.004]	-0.000 [0.003]	0.001 [0.002]
CESD (=1 if score>=20, 0 otherwise)	-0.040 [0.032]	-0.017 [0.018]	-0.005 [0.020]	-0.040 [0.032]	-0.017 [0.018]	-0.005 [0.020]
CESD: missing dummy	0.016 [0.024]	-0.023 [0.018]	-0.014 [0.016]	0.016 [0.024]	-0.023 [0.018]	-0.014 [0.016]
ever studied accounting/economics? (=1 if yes, 0 otherwise)	0.122*** [0.023]	0.048** [0.017]	0.022 [0.012]	0.122*** [0.023]	0.049** [0.017]	0.022 [0.012]
ever studied accounting/economics?: missing dummy	-0.003 [0.047]	-0.067* [0.028]	0.023 [0.026]	-0.003 [0.047]	-0.067* [0.028]	0.023 [0.026]
subjective probability living up to 85	0.000* [0.000]	0.000 [0.000]	-0.000 [0.000]	0.000* [0.000]	0.000 [0.000]	-0.000 [0.000]

Appendix Table 2 Financial literacy and investment behaviors (continued)						
	(1)	(2)	(3)	(4)	(5)	(6)
	OLS	OLS	OLS	OLS	OLS	OLS
VARIABLES	Bond =1 if invested	Stock =1 if invested	Saving =1 if saving	Bond =1 if invested	Stock =1 if invested	Saving =1 if saving
Income category (default: 0 yen)						
income: 1-1million yen	0.061 [0.033]	0.066** [0.018]	0.111** [0.030]	0.061 [0.033]	0.066** [0.018]	0.111** [0.030]
income: 1-2 million yen	0.054** [0.016]	-0.011 [0.032]	0.061** [0.015]	0.054** [0.016]	-0.011 [0.032]	0.061** [0.015]
income: 2-3 million yen	0.046 [0.028]	-0.001 [0.041]	0.109** [0.026]	0.046 [0.028]	-0.001 [0.041]	0.109** [0.026]
income: 3-5 million yen	0.084** [0.020]	0.044*** [0.008]	0.107** [0.033]	0.084** [0.020]	0.045*** [0.008]	0.107** [0.033]
income: 5-7 million yen	0.100** [0.026]	0.112*** [0.024]	0.122*** [0.021]	0.100** [0.026]	0.112*** [0.024]	0.122*** [0.021]
income: 7-10 million yen	0.212** [0.068]	0.120 [0.074]	0.119** [0.037]	0.212** [0.069]	0.120 [0.074]	0.119** [0.037]
income: more than 10 million yen	0.224*** [0.042]	0.233*** [0.018]	0.141*** [0.030]	0.225*** [0.042]	0.233*** [0.018]	0.141*** [0.030]
income: missing dummy	0.039** [0.010]	0.022 [0.029]	0.117** [0.033]	0.039** [0.010]	0.022 [0.029]	0.117** [0.033]
Municipality dummy (default: Sendai)						
Kanazawa	0.060*** [0.006]	0.052*** [0.003]	0.027*** [0.004]	0.060*** [0.006]	0.052*** [0.003]	0.027*** [0.004]
Takikawa	-0.117*** [0.006]	-0.095*** [0.006]	0.028*** [0.003]	-0.117*** [0.006]	-0.094*** [0.006]	0.028*** [0.003]
Shirakawa	-0.085*** [0.014]	-0.032 [0.017]	0.025** [0.007]	-0.085*** [0.014]	-0.032 [0.017]	0.024** [0.007]
Adachi	-0.035*** [0.004]	0.008 [0.008]	-0.011** [0.002]	-0.035*** [0.004]	0.008 [0.008]	-0.011** [0.002]
Constant	-0.020 [0.088]	-0.144 [0.098]	0.627*** [0.069]	0.040 [0.095]	-0.107 [0.096]	0.632*** [0.070]
Observations	2,177	2,157	2,358	2,177	2,157	2,358
R-squared	0.137	0.124	0.069	0.137	0.124	0.069
Standard errors clustered at municipality-level in brackets						
*** p<0.01, ** p<0.05, * p<0.1						

Appendix Table 2 Financial literacy and investment behaviors (continued)						
	(7)	(8)	(9)	(10)	(11)	(12)
	Probit	Probit	Probit	Probit	Probit	Probit
VARIABLES	Bond =1 if invested	Stock =1 if invested	Saving =1 if saving	Bond =1 if invested	Stock =1 if invested	Saving =1 if saving
# of correct answers	0.053*** [0.008]	0.032*** [0.004]	0.004 [0.003]			
PCA				0.043*** [0.007]	0.026*** [0.003]	0.003 [0.003]
age	0.002** [0.001]	0.003* [0.002]	0.001 [0.001]	0.002** [0.001]	0.003* [0.002]	0.001 [0.001]
sex (=1 if male, 0 otherwise)	-0.046** [0.018]	-0.014 [0.018]	-0.003 [0.006]	-0.046** [0.018]	-0.014 [0.018]	-0.003 [0.006]
work (=1 if working, 0 otherwise)	-0.066*** [0.021]	-0.043*** [0.016]	0.002 [0.012]	-0.066*** [0.021]	-0.043*** [0.016]	0.002 [0.012]
work: missing dummy						
current_married	0.016 [0.023]	0.038 [0.027]	0.062*** [0.009]	0.016 [0.023]	0.038 [0.027]	0.062*** [0.009]
current_married: missing dummy						
Education category (default: primary/junior high school)						
senior_high	0.102*** [0.028]	0.105*** [0.015]	0.039*** [0.014]	0.102*** [0.028]	0.105*** [0.015]	0.039*** [0.014]
junior_college	0.121*** [0.033]	0.149*** [0.028]	0.060*** [0.020]	0.121*** [0.033]	0.149*** [0.028]	0.060*** [0.020]
university	0.080*** [0.020]	0.169*** [0.023]	0.039 [0.025]	0.080*** [0.020]	0.169*** [0.023]	0.039 [0.025]
graduate	0.262*** [0.069]	0.226*** [0.061]		0.263*** [0.069]	0.226*** [0.061]	
Education variable: missing dummy	0.265** [0.125]	0.194** [0.093]		0.265** [0.125]	0.194** [0.093]	
Risk preference (default: no uncertainty)						
risk: 10-30%	-0.022** [0.009]	0.033 [0.023]	-0.001 [0.017]	-0.022** [0.009]	0.033 [0.023]	-0.001 [0.017]
risk: 40-60%	0.022 [0.016]	0.049** [0.021]	-0.007 [0.019]	0.022 [0.016]	0.049** [0.021]	-0.007 [0.019]
risk: 70-90%	0.032 [0.024]	0.066** [0.026]	0.003 [0.024]	0.032 [0.024]	0.066** [0.026]	0.003 [0.024]
risk preference: missing dummy	-0.006 [0.021]	0.005 [0.042]	-0.019 [0.017]	-0.006 [0.021]	0.005 [0.042]	-0.019 [0.017]
Time discounting preference (default: 0-0.5%)						
time: 1-6%	0.005 [0.006]	-0.024 [0.017]	-0.015 [0.018]	0.005 [0.006]	-0.024 [0.017]	-0.015 [0.018]
time: 10-40%	-0.086*** [0.016]	-0.074*** [0.026]	-0.049*** [0.018]	-0.086*** [0.016]	-0.074*** [0.026]	-0.049*** [0.018]
time discounting preference: missing dummy	-0.005 [0.019]	0.019 [0.028]	-0.030 [0.025]	-0.005 [0.019]	0.019 [0.028]	-0.030 [0.025]
Serial 7 (=1 if correct, 0 otherwise)	-0.003 [0.014]	-0.012 [0.015]	0.020 [0.013]	-0.003 [0.014]	-0.012 [0.015]	0.020 [0.013]
Word recall	-0.004 [0.004]	-0.001 [0.002]	0.001 [0.002]	-0.004 [0.004]	-0.001 [0.002]	0.001 [0.002]
CESD (=1 if score>=20, 0 otherwise)	-0.031 [0.034]	-0.019 [0.022]	0.000 [0.019]	-0.031 [0.034]	-0.019 [0.022]	0.000 [0.019]
CESD: missing dummy	0.021 [0.024]	-0.021 [0.021]	-0.011 [0.012]	0.021 [0.024]	-0.021 [0.021]	-0.011 [0.012]
ever studied accounting/economics? (=1 if yes, 0 otherwise)	0.096*** [0.016]	0.036*** [0.011]	0.038* [0.020]	0.096*** [0.016]	0.036*** [0.011]	0.038* [0.020]
ever studied accounting/economics?: missing dummy	-0.005 [0.052]	-0.077 [0.055]	0.020 [0.029]	-0.005 [0.052]	-0.077 [0.055]	0.020 [0.029]
subjective probability living up to 85	0.000* [0.000]	0.000** [0.000]	-0.000 [0.000]	0.000* [0.000]	0.000** [0.000]	-0.000 [0.000]

Appendix Table 2 Financial literacy and investment behaviors (continued)						
	(7)	(8)	(9)	(10)	(11)	(12)
	Probit	Probit	Probit	Probit	Probit	Probit
VARIABLES	Bond =1 if invested	Stock =1 if invested	Saving =1 if saving	Bond =1 if invested	Stock =1 if invested	Saving =1 if saving
Income category (default: 0 yen)						
income: 1-1million yen	0.062* [0.032]	0.066*** [0.020]	0.071*** [0.019]	0.063* [0.032]	0.066*** [0.020]	0.071*** [0.019]
income: 1-2 million yen	0.065*** [0.018]	-0.012 [0.038]	0.030*** [0.008]	0.065*** [0.018]	-0.012 [0.038]	0.030*** [0.008]
income: 2-3 million yen	0.049 [0.032]	0.001 [0.050]	0.068*** [0.011]	0.049 [0.032]	0.001 [0.050]	0.068*** [0.011]
income: 3-5 million yen	0.089*** [0.028]	0.051*** [0.018]	0.067*** [0.022]	0.089*** [0.028]	0.051*** [0.018]	0.067*** [0.022]
income: 5-7 million yen	0.103*** [0.024]	0.099*** [0.032]	0.097*** [0.015]	0.103*** [0.024]	0.099*** [0.032]	0.097*** [0.015]
income: 7-10 million yen	0.192*** [0.070]	0.102* [0.056]	0.082** [0.041]	0.192*** [0.070]	0.102* [0.056]	0.082** [0.041]
income: more than 10 million yen	0.200*** [0.029]	0.179*** [0.024]		0.200*** [0.030]	0.179*** [0.024]	
income: missing dummy	0.039** [0.016]	0.026 [0.035]	0.075*** [0.019]	0.039** [0.016]	0.026 [0.035]	0.075*** [0.019]
Municipality dummy (default: Sendai)						
Kanazawa	0.056*** [0.006]	0.045*** [0.005]	0.030*** [0.006]	0.056*** [0.006]	0.045*** [0.005]	0.030*** [0.006]
Takikawa	-0.119*** [0.007]	-0.106*** [0.005]	0.030*** [0.002]	-0.119*** [0.007]	-0.106*** [0.005]	0.030*** [0.002]
Shirakawa	-0.091*** [0.013]	-0.039*** [0.008]	0.024*** [0.005]	-0.091*** [0.013]	-0.039*** [0.008]	0.024*** [0.005]
Adachi	-0.023*** [0.005]	0.010** [0.004]	-0.006*** [0.002]	-0.023*** [0.005]	0.010** [0.004]	-0.006*** [0.002]
Observations	2,169	2,149	2,251	2,169	2,149	2,251
Marginal effects are reported.						
Standard errors clustered at municipality-level in brackets						
*** p<0.01, ** p<0.05, * p<0.1						