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Is "I Don't Know" a Signal of Lack of Financial Knowledge?: Some Preliminary Findings

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Abstract

Previous studies indicated “I don’t know” (DK) item in an option to financial literacy question is a proxy of lack of financial knowledge. However, is the DK option a proxy for only a lack of knowledge? We examined whether persons who frequently answered DK to financial literacy questions were at the level of "don't know the answer at all" or " narrow down the choices to some extent” based on a web survey in Japan. Then we compared the factors that lead to the selection of DK with the factors that form financial literacy and explored the impact of those factors. The results indicated that the group chose DK was at a knowledge level where they could narrow down their answers to some extent, did not check it box with “a pure guesswork.” Respondents with investment experience and with rich experience in economics or finance courses had higher financial literacy score and lower the number of DK responses. This suggests that both knowledge and experience are important in the formation of appropriate financial literacy.

JEL classification: G41, G53

Keywords: financial literacy, “I don’t know” option, experience of investment, experience in taking economics or finance courses

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1. Introduction

Due to the spread of COVID-19 identified worldwide in 2020, the number of households whose incomes declined and whose livelihoods have become unstable has increased. According to the US Census Bureau's *Household Pulse Survey* conducted from April 14 to July 5, 2021 (Phase 3.1), "the percentage of adults living in households not current on rent or mortgage where eviction or foreclosure in the next two months is either very likely or somewhat likely" is 35.8%, and approximately 4.74 million adults were projected to face that risk. The Japan Housing Finance Agency announced that the number of borrowers who have changed their repayment method for 35-year fixed-rate mortgages handled by the agency has increased rapidly since April 2020, reaching more than 10,000 at the end of March 2021. Financial planning is “the process of determining whether and how an individual can meet life goals through the proper management financial resources” (Certified Financial Planner Board of Standards, 2013). To prepare for an unexpected personal financial crisis, sufficient knowledge of financial planning is essential (Luu, Lowe, Butler, and Byrne, 2017).

A number of previous studies show that financial literacy influences individual’s financial planning. Agarwal, Amormin, Ben-David, Chomsisengphet, and Evanoff (2010) examined an education program in Indiana and indicated that providing financial education to borrowers with low credit scores and incomes, who are likely to default on their mortgages and other debts in the future, reduce their risks. Lusardi and Mitchell (2007a, 2011) showed that those who lack basic financial knowledge are more likely to face inadequate retirement planning (e.g., no plan, no savings). In Japan, Sekita (2011) verified the results of Lusardi et al. by *Japan Household Panel Survey on Consumer Preferences and Satisfaction* conducted by the Global COE Program " Human Behavior and Socioeconomic Dynamics" at Osaka University and found similar results to their studies.

Questions appropriate for measuring financial literacy have been proposed by Huston (2010), Lusardi and Mitchell (2011), Knoll and Houts (2012), and so forth. However, very few studies have focused on choices of the questions. When measuring financial literacy, multiple-choice tests are often adopted. In the test methods, the literacy scores are calculated based on the assumption that a respondent who chooses a correct answer to a question understands which is the correct answer to it, but it is not clear whether "guesswork" due to lack of knowledge is included.

In this regard, Lusardi and Mitchell (2011), Lusardi (2015) and Sekita (2011) suggested including an "I don't know"(hereafter, DK) item in an option to each financial literacy question, and they indicated that DK option was expected to reduce the number of correct answers due to guesswork, and we got the picture of the tendency of respondents to choose DK. Lusardi and Mitchell (2011) and Lusardi (2015) measured American middle-aged and elderly's understanding of basic financial literacy (compounding, inflation, and risk diversification investing) introduced as modules of *the 2004 Health and Retirement*

Study. The results showed that there was a very strong tendency to answer DK to questions on a compound interest calculation and the meaning of inflation, and a very weak tendency for those who answered a question incorrectly to also answer another question incorrectly.

In addition to the above questions, Lusardi and Mitchell (2007b) also asked eight questions about investment. The results showed that the choice of DK was strongly related to the correct answer. After the confirmation of several statistics, Lusardi et al. made an assertion that those who were not financially literate tended to choose DK instead of the incorrect item, and DK choice as a proxy for “financial illiteracy”.

Financial illiteracy, or lack of financial knowledge, leads to "ignorance," the inability to foresee future risks in personal finance. The cognitive bias that leads to overconfidence through the illusion of "I know" without being aware of that ignorance is known as the Dunning-Kruger effect (Kruger and Dunning, 1999). Balasubramnian and Sargent (2020) investigated persons who perceive their financial literacy to be "high" in spite of their low literacy tend to engage in high-risk financial behavior. Kramer (2016) indicated that persons who estimate their own financial literacy higher are less likely to seek financial advice, and Kim, Lee and Hanna (2020) reported that overconfidence in one's financial literacy increases the probability of the delay in mortgage payments.

However, is the DK option a proxy for only a lack of knowledge? Sanchez and Morchio (1992), who conducted a study on the choice of political party support (decision-making), showed that when interviewers probe DK responses to knowledge questions, their probing behaviors lead answers of respondents to pure guesswork. Roy and Zeckhauser (2015) also pointed out that when persons recognized their ignorance, they become indecisive and unable to make up their minds.

In a consignment survey without the intervention of an interviewer, if the question does not include DK as an option (and the respondents cannot refuse to answer), it may mandatorily lead respondents who would check the “DK” box to choose other options by guesswork. On the other hand, when the options include DK, respondents who recognize their lack of financial knowledge may not be able to make a decision on the option they consider to be the correct answer and may choose DK.

When DK is included in the choices, it is considered that the degree of awareness of ignorance depends on whether a respondent does not know the correct answer at all or has narrowed it down to the middle. If they do not know the answer at all, they are likely to recognize their ignorance strongly and choose DK. However, if they have narrowed down the answers to the middle of the questionnaire yet are still indecisive, there is a possibility that they choose DK with less aware of their ignorance. When answering multiple financial literacy questions, respondents who choose DK more often for the latter reason are more likely to have a severe cognitive illusion of “I know”.

Balasubramnian and Sargent (2020) indicated that those with heavy cognitive illusions about financial literacy tend to engage in poor financial behaviors such as imprudent borrowing and poor

expenditure management. However, in lots of studies on financial literacy, respondents who choose DK are treated as incorrect answers (simple lack of knowledge), and there are few studies that examine the reasons that respondents choose the option. In this study, we survey different groups of respondents with and without DK as each option for questions on financial literacy. By comparing the distribution of the financial literacy scores (the number of correct answers to the questions) of the two groups, we try to determine whether the answer DKs are pure guesswork or are due to other reasons.

Then, we also check the factors that decrease the number of DK choices. The determinants of financial literacy scores have been examined in previous studies and were comprehensively reviewed in Lusardi and Mitchell (2014). If respondents tend to answer with guesswork when they do not know the correct answer to a question, there is a possibility that they have a strong recognition of ignorance, otherwise, they recognize their ignorance weakly. In the latter case, the impact of financial illiteracy as pointed out by Lusardi and Mitchell (2007b) is heavy, and it is significant to clarify the factors that reduce the number of DK choices.

Section 2 describes the survey method conducted in this study and the questions and options regarding financial literacy. Then, in Section 3, we examine whether there is a significant difference in the distribution of financial literacy scores when the question options include DK and when they do not. We also show that factors forming financial literacy supported by previous studies, such as experience in taking economics or finance courses, also have the effect of reducing the DK choice. Section 4 is a discussion.

2. Data

2.1 Survey method

In December 2012, we conducted *2012 Survey on Basic Knowledge of Economy and Finance* (hereafter, BK survey) among men and women aged 18-69 in Japan and the United States. The BK survey was commissioned by Cross Marketing Inc. and conducted as a web survey. We use only Japanese data.

As pointed out by Bethlehem and Biffignandi (2012) and others, respondents in web surveys are needed to pay attention with respect to their representativeness to the population. First, selection bias arises when persons who do not have any access devices to the Internet are excluded from the survey (undercoverage). According to *2011 Communications Usage Trend Survey* by The Ministry of Internal Affairs and Communications, showed that the penetration rate was almost 95% or higher for those in their 20s to 40s, but it dropped to 86.1% among those in their 50s, and to 73.9% and 60.9% among those in their early and late 60s, respectively. It is rather difficult to survey the condition of people in their 60s and older via web surveys.

In this regard, van Rooij et al. (2011) reported that those who are financially literate are more likely to make use of information in newspapers and the Internet. In addition, Hastings and Tejeda-Ashton (2008) indicated in a survey in Mexico that those who used Internet banking and Internet reservations were more likely to cite financial health, not low fees or high yields, as a reason for selecting a pension management company. According to these previous studies, it is considered that web surveys target groups with a relatively high level of financial literacy.

Next, when we outsource a web survey to a research company, the respondents of the survey are sampled from a group of persons (called "monitors") who have registered for the purpose of participating in various surveys from the research company. There is a difference between the composition of the monitors and the population distribution of *2010 Population Census* of Japan. Compared to the census, most of the monitors were in their 20s to 40s, and the number of them in their 50s and above decreased significantly. In addition, the monitors slightly concentrated in Kanto region include Tokyo metropolitan area, and many of the monitors were employed or commuting to school. The number of monitors aged 18-69 was 1,584,175, which was 1.9% of the census population of the age group[1].

In collecting the completed questionnaires, the distribution of respondents was made close to the age distribution by 10-year age groups based on the census population. A total of 500 responses were collected. Specifically, we asked 5,000 stratified randomly selected respondents from among the monitors to respond to the survey and ended the survey when we received 500 valid responses.

In the next section, we clarify the characteristics of the respondents of the BK survey that are caused by the selection bias described above. The preliminary survey for this study was conducted in October 2012, and 200 responses were collected. Since the survey target, survey method, and survey items are the same for both the preliminary survey and the BK survey, we treat them as a total sample of 700.

2.2 Characteristics of respondents

We examine the characteristics of the respondents in the BK survey in comparison to the census. First, the average age of people aged 18-69 in the 2010 Census was 44.4 years for men and 44.9 years for women. In the BK Survey, on the other hand, the average ages were slightly higher at 45.7 and 46.0, respectively. However, our data was collected according to the 10-year age group distribution of the census, and there is no difference in the shape of the distribution between the two surveys.

Next, Table 1 shows the educational attainment and employment status. The percentage of respondents with a bachelor's degree or a postgraduate degree is considerably larger in the BK survey, 44.7%, compared to one-fifth of the total in the census. Ishida et al. (2009), after examining the results of several mail survey and web survey methods, pointed out that the educational background of the web

[1] Appendix A provides tables comparing the distribution of the monitors and *2010 Population Census*.

Table 1: Educational attainment and employment status

(a) Educational attainment

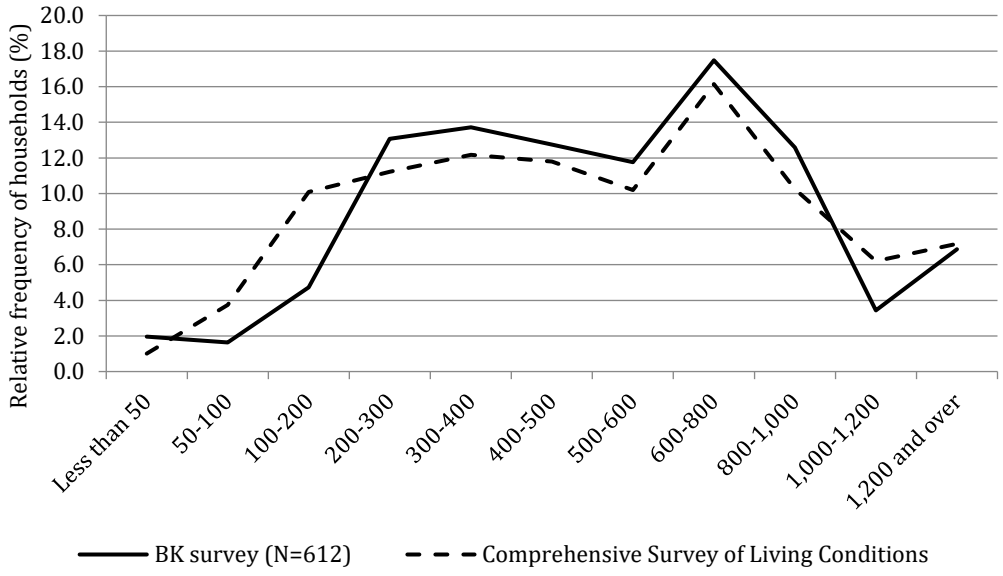
	BK survey (%)	Census (%)
High school graduate or less	34.3	51.0
Some college	15.3	15.4
Bachelor's degree or higher	44.7	20.4
Others (Unknown)	5.7	13.2
N	700	80,785,085

(b) Employment status

	BK survey (%)	Census (%)
Employed	66.9	70.0
Unemployed	3.2	4.9
Not in the labor force	29.9	25.1
Housework	19.0	15.6
Students	2.6	3.9
Others	8.3	5.6
N	695	80,717,222

Note: *Survey on Basic Knowledge of Economy and Finance* (the BK survey) was conducted among aged 18 to 69 as a web survey in December 2012. *Population Census* (Census) was surveyed in October 2010.

Source: Statistics Bureau of Japan (2010) *2010 Population Census*.



Note: The distributions of household income were displayed by *Survey on Basic Knowledge of Economy and Finance* (the BK survey) and *2011 Comprehensive Survey of Living Conditions*.

Source: Ministry of Health, Labour and Welfare (2012) *2011 Comprehensive Survey of Living Conditions*.

Figure 1: Distribution of household income

survey's respondents tended to be higher than that of the mail survey methods. With regard to employment status, the percentage of the housework is 3.4 points larger than in the census. A similar situation was confirmed in other studies dealing with web surveys, such as Honda and Motokawa (2005).

Finally, Figure 1 shows the distribution of household income. Comparing this survey with *2011 Comprehensive Survey of Living Conditions* by Ministry of Health, Labour and Welfare of Japan as the condition of the country, the FY2011 distribution of household income (including tax) in this survey is predominantly in the range of 2 to 10 million yen, with a sharp decline in the under 2 million yen income

groups. The average household income of those aged 18-69 was 5,742 thousand yen, compared to 5,648 thousand yen in overall country. Ishida et al. (2008), Bethlehem and Biffignandi (2012), and other surveys in Japan and abroad showed that the number of web survey monitors is low among low-income groups.

2.3 Survey questions on financial literacy

Referring to Huston (2010) and Knoll and Houts (2012), the questions in the previous studies are broadly categorized into basic literacy questions such as prices, household money management, and saving for retirement, and applied questions such as insurance, credit card, and mortgage structures. Lusardi and Mitchell (2011) asked the fewest number of questions, three. Lusardi et al. presented questions on compound interest calculation, inflation, and risk diversification as the basis of financial literacy and obtained various findings. Therefore, we included the questions of Lusardi et al. in the BK survey.

However, Knoll and Houts (2012) pointed out that the questions asked by Lusardi et al. do not include enough items related to household budget management. Therefore, we extracted seven questions on "income" and "savings and protection of household purchasing power" from thirty-one questions of the Jump$tart survey[2] presented in Mandell (2008) and added them to the questionnaire of the BK survey. Therefore, the financial literacy questions addressed in our study consist of ten questions and are primarily focused on measuring basic financial literacy (see Appendix B for each question). In accordance with previous studies, all questions are multiple-choice tests.

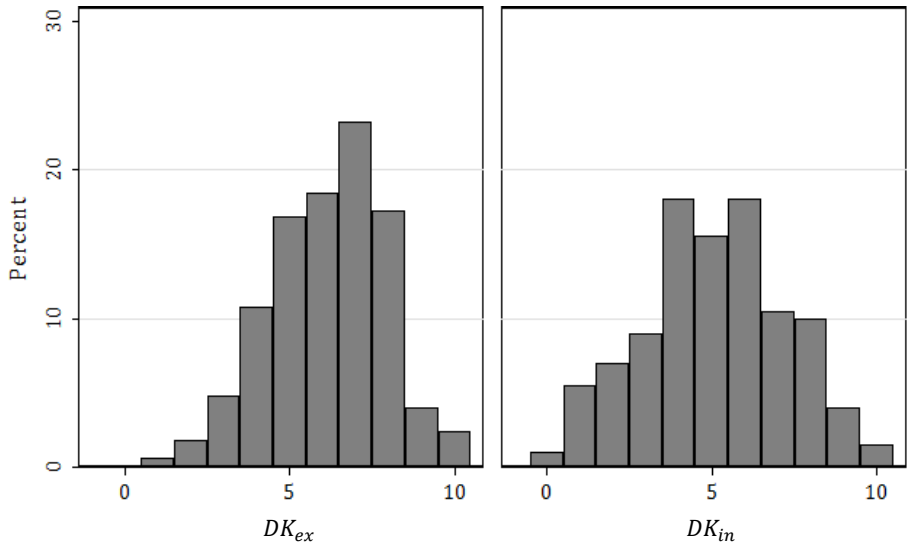
3. Empirical analysis

3.1 Financial literacy score

For each of the ten financial literacy questions, one point is added to the score for each correct answer, and the total score is the financial literacy score (hereafter, *Score*): up to seven points for the Jump$tart survey questions and up to three points for the Lusardi and Mitchell (2011) questions. *Score* is zero to ten points. Figure 2 shows a histogram of the distribution of two groups' *Scores*. The left figure is the group DK_{ex} that does not include DK as an option, and the right figure is the group DK_{in} that includes DK. The number of respondents is 500 in the group DK_{ex} and 200 in DK_{in}.

The group DK_{ex} has a mean of *Score* of 6.162 with a standard deviation of 1.765, and the coefficient of variation is calculated to be 0.286. The group DK_{in} has a mean *Score* of 5.085 with a standard deviation

[2] The Jump$tart survey (*Survey of Personal Financial Literacy among College Students*) was conducted in the U.S. from 1997 to 2008 by the Jump$tart Coalition for Personal Financial Literacy, a non-profit organization that aims to improve personal financial education for school-age students.



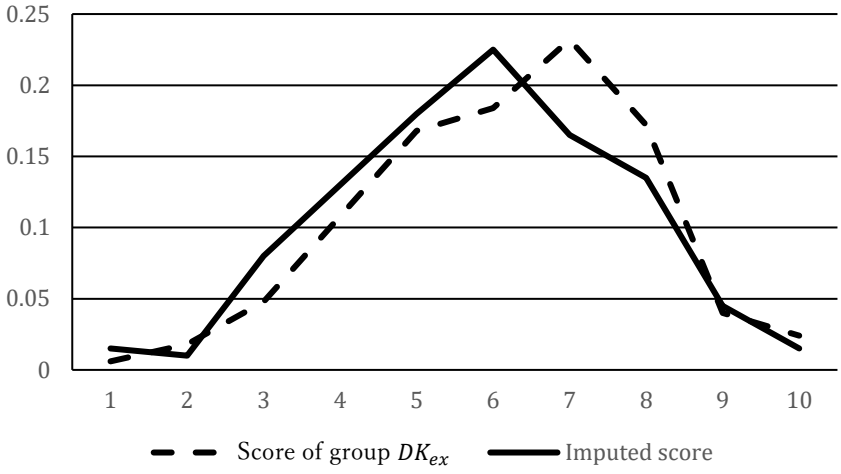
Note: The group DK_{ex} that does not include "I don't know (DK)" as an option in each question on financial literacy is shown on the left ($N = 500$), and the group that includes DK (DK_{in}) is shown on the right ($N = 200$). The financial literacy score is 0 to 10 points.

Figure 2: Distributions of financial literacy score

of 2.198 (coefficient of variation 0.432). DK_{in} has a lower mean and a larger relative variation in *Score*. However, in the group DK_{ex}, if an option chosen as a pure guesswork by a respondent who did not know the correct answer was correct, we are compelled to treat the respondent knew the correct answer. The group DK_{in} reduces this concern because it includes the option DK. When a respondent recognizes their lack of financial knowledge, it is possible for him/her to choose DK because he/she become indecisive about even narrowed down options.

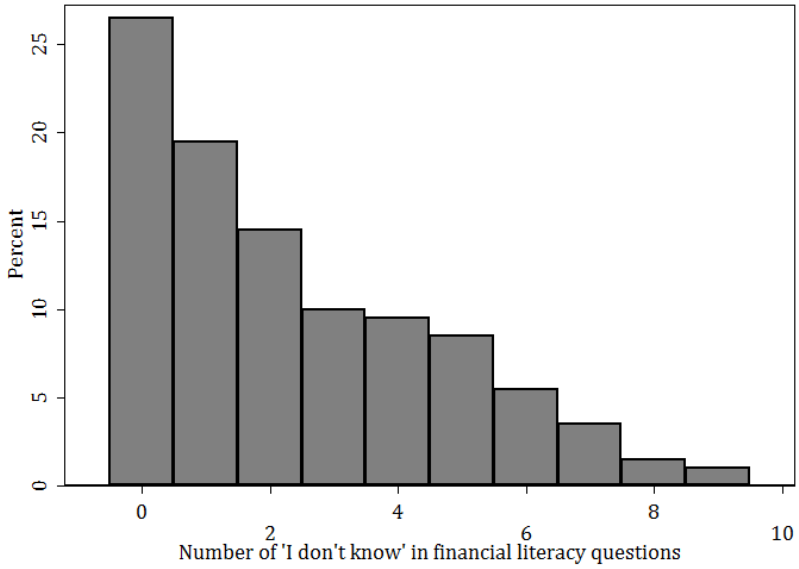
We estimate an imputed score based on the hypothesis that all the respondents chose DK answered the question by a pure guesswork in the group DK_{in}. When there are k alternatives except DK, the probability that a respondent who answers by guesswork choose each option is $1/k$, and the imputed score is calculated by randomly assigning each DK response (i.e., DK response in each question is assigned randomly to other options).

If most of respondents chose DK by a pure guesswork, there would be insignificant difference between the mean of the imputed financial literacy score and of *Score* of the group DK_{ex}. Figure 3 is the distribution of the imputed and the group DK_{ex}'s score. The mode of the imputed score's distribution is 6 and it of the group DK_{ex} is 7. The imputed score is a mean of 5.835 with a standard deviation of 1.815.



Note: The group DK_{ex} does not include "I don't know" (DK) as an option in each question on financial literacy. The imputed score is calculated by randomly assigning each DK response. The number of the group DK_{ex} is 500 and the number of the group that DK responses are randomly assigned to other options is 200.

Figure 3: Distribution of the imputed and the group DK_{ex}'s financial literacy score



Note: The graph is drawn based on 200 respondents in the group that includes "I don't know" (DK_{in}). The number of "I don't know" in financial literacy questions is 0 to 10 points.

Figure 4: Number of "I don't know" in financial literacy questions

Here, when we test the difference in mean between the two groups, the t-value is 2.197 ($P = 0.03$) and the difference is significant at the 5% level. These results suggest that when respondents are unsure of the answer to a financial literacy question, they do not always choose from options by guesswork. If the respondents who chose DK had tended to answer by guesswork, then there would have been a strong

possibility of recognizing ignorance. However, since this is not the case in this survey, it is possible that they are less aware of ignorance.

3.2 Response options for survey questions

The group DK_{in} includes DK as an option for questions on financial literacy. The distribution of the number of DK responses by each respondent (hereafter, $Count$) is illustrated in Figure 4. The number of respondents with zero count of DK is 26.5% of 200 respondents in the group DK_{in}. Restricting to Lusardi et al.'s three questions, the percentage rises to 44.5%. Sekita (2011) which used *Japan Household Panel Survey on Consumer Preferences and Satisfaction* found that the percentage was 38.5%. The BK survey has a slightly higher percentage than Sekita (2011). Though no one responded DK to all ten questions, there are 11.5% of respondents did not know more than half of the questions.

Three out of four respondents had financial literacy questions that they were not able to answer clearly, and one in ten did not determine the correct answer to most questions. In the following section, we examine the that influence on the number of DK choices for the financial literacy questions using the group DK_{in} (200 respondents).

3.3 Statistical method

The estimated equation for the formative factors of financial literacy is as follows:

$$L_i = \alpha + \boldsymbol{P}_i\boldsymbol{\beta} + \boldsymbol{S}_i\boldsymbol{\gamma} + \boldsymbol{F}_i\boldsymbol{\theta} + e_i.$$

L_i is the respondent i's financial literacy indices ($Score$ or $Count$), $\boldsymbol{P}_i$ is the vector of personal characteristics, $\boldsymbol{S}_i$ is the vector of the experience in taking economics or finance courses and the experience of investment, $\boldsymbol{F}_i$ is the vector of the family backgrounds in which each respondent grew up, and e_i is the error term. We use the ordinary least squares method (OLS) to the equation with $Score$ as the explained variable.

Here, we create a correlation matrix to find out if respondents tend to choose DK for one question of financial literacy when they also choose DK for another question. As a result, 46.7% of all combinations have a correlation coefficient below 0.2, and 15.6% of all combinations have a correlation coefficient above 0.4. Therefore, we consider that respondents who chose DK for one question would not necessarily tend to choose DK for other choices, and treat $Count$ as count data that takes a non-negative integer value.

In this case, it is known that the use of OLS causes bias in the estimated values, such as loss of efficiency. Though the Poisson regression model (PRM) using the Poisson distribution is known as a count data analysis, it must satisfy the relationship that the conditional mean and variance of the explained variable are equal. The problem of overdispersion is pointed out, where the variance becomes larger in actual data. When overdispersion is observed, PRM is not appropriate. One way to deal with this problem is to use the negative binomial regression model (NBRM) that allows the variance to exceed the mean.

Table 2: Descriptive statistics of explanatory variables of the group DK_{in}

	Mean	Std. dev.
Gender (Female=1)	0.475	0.501
Age	45.540	13.499
Educational attainment		
High school graduate or less	0.345	0.477
Some college	0.225	0.419
Bachelor's degree or higher	0.430	0.496
Employment status (employed=1)	0.675	0.470
Equivalent income (million yen)	3.500	1.822
Experience of investment (Yes=1)	0.430	0.496
Experience in taking economics or finance courses (Frequently or sometimes=1)	0.110	0.314
Parent's educational attainment		
Father: bachelor's degree or higher	0.285	0.453
Mother: bachelor's degree or higher	0.110	0.314
Parent's retirement savings (I don't know=1)	0.405	0.492

Note: The group DK_{in} includes "I don't know (DK)" as an option in each question on financial literacy. The number of the group DK_{in} is 200. The number of respondents answered their income in FY 2011 is 179.

Therefore, both PRM and NBRM are used for estimation with $Count$ as the explained variable, and the more appropriate model is selected by testing for overdispersion.

3.4 Descriptive statistics

We accept from the literature review of Chinen and Endo (2011) as the explanatory variables: experience of investment, experience in taking economics or finance courses, and factors related to parents of each respondent. Gender, age, educational attainment, employment status, and income are set as personal characteristics. These variables were also listed by Lusardi and Mitchell (2014) as important factors in forming financial literacy.

Table 2 shows the descriptive statistics of explanatory variables. Describing the personal characteristics of the 200 respondents of the group DK_{in}, 47.5% are female and their average age is 45.540 years with 13.5 years per standard deviation. The educational attainments of the respondents are 34.5% high school graduates or less, 43.0% college graduates or higher, and 67.5% are employed. The equivalent income, obtained by dividing the household income by the square root of the number of household members, is 3.5 million yen. Respondents reported their income including tax for FY2011. The number of respondents answered their income is 179.

The percentage of respondents with experience of investment is 43.0%. According to *the 2009 National Survey on Securities Investment* (*Shoken Toushi ni Kansuru Zenkoku Chosa*) by the Japan Securities Dealers Association, 21.1% of respondents hold domestic or foreign securities or financial

products denominated in foreign currencies. Since our BK survey asked about the experience of holding investment products, the percentage is higher than the percentage of current holders.

"Experience in taking economics or finance courses" is a dichotomous variable that is defined as 1 if the respondent answered "frequently" or "sometimes" to the question "Have you taken classes on economy, management, or finance either in high school, college, or graduate school?" and the rest as 0. The percentage of respondents answered "frequency" or "sometimes" is 11.0%.

The remaining variables are related to the respondents' parents. Regarding parental education, 28.5% of the respondents have a father with a bachelor's degree or higher and 11.0% have a mother with the degree. We also apply the variable of whether or not the respondent answered DK to the question "Do you have parent(s) who had stocks or retirement savings as you grew up (between age 12 and 17)?". This variable is used to grasp whether parents provided in-home education on financial matters, such as giving information on retirement preparedness to their children (respondents). Bowen (1996) points out that savings are the most frequent financial management topic as parents discuss with their children. About 40% of the respondents answered, "I don't know if my parents invested or saved for retirement."

3.5 Results

First, we indicate the results of the regression analysis with $Score$ as the explained variable. The left column of Table 3 shows that for personal characteristics, female respondents have lower $Score$ and respondents with higher equivalent income have higher $Score$. Age and educational attainment are not significant to $Score$. Both experience of investment and experience in taking economics and finance courses are expected to increase financial literacy, but only experience of investment has a significant effect on $Score$.

Many of the variables related to parents have significant effects on $Score$ at the 10% level. The results show that when both parents have a bachelor's degree or higher, or when the father has the degree, it significantly increases $Score$. The respondents who did not know whether their parents were prepared for retirement tend to have lower $Score$.

Next, we regress $Count$ on each explanatory variable to examine the factors to lead respondents to choose DK for the financial literacy questions. We test whether the PRM or NBRM is more appropriate. Table 3 shows α, which indicates the degree of overdispersion, is 0.380. As a result of the likelihood ratio test with $\alpha = 0$ as the null hypothesis, the test statistic is 31.423 ($P = 0.000$), and the null hypothesis is rejected. Therefore, since the constraint that the mean and variance of the explained variable are equal is not satisfied, we adopt the estimation results from NBRM.

The results in the right column of Table 3 indicate that, the variation in $Count$ is contributed similar determinants to $Score$: gender, the experience of investment, father has a bachelor's degree or higher,

Table 3: Estimation results

Explained variable	$Score$		$Count$			
	OLS		PRM		NBRM	
Gender (Female=1)	-0.716	**	0.270	*	0.330	**
	(0.327)		(0.145)		(0.167)	
Age	0.019		0.002		0.002	
	(0.013)		(0.006)		(0.006)	
Educational attainment						
Some college	0.186		-0.166		-0.159	
	(0.407)		(0.186)		(0.200)	
Bachelor's degree or higher	0.111		-0.092		-0.066	
	(0.375)		(0.153)		(0.174)	
Employment status (employed=1)	-0.566		0.043		0.047	
	(0.358)		(0.154)		(0.174)	
Equivalent income (million yen)	0.483	**	-0.112		-0.102	
	(0.241)		(0.100)		(0.104)	
Experience of investment (Yes=1)	0.751	**	-0.383	**	-0.420	***
	(0.341)		(0.158)		(0.158)	
Experience in taking economics or finance	0.652		-0.716	**	-0.647	**
(Frequently or sometimes=1)	(0.506)		(0.303)		(0.307)	
Parent's educational attainment						
Parents: bachelor's degree or higher	1.117	*	-0.470		-0.485	
	(0.659)		(0.502)		(0.327)	
Father: bachelor's degree or higher	0.739	*	-0.364	**	-0.415	**
	(0.416)		(0.180)		(0.196)	
Mother: bachelor's degree or higher	0.381		-0.332		-0.315	
	(0.598)		(0.482)		(0.474)	
Parent's retirement savings (I don't know=1)	-0.594	*	0.363	**	0.415	***
	(0.335)		(0.142)		(0.147)	
Constant	3.975	***	0.855	***	0.799	**
	(0.753)		(0.314)		(0.350)	
N	179		179		179	
R^2 / Pseudo R^2	0.207		0.099		0.056	
Log pseudolikelihood			-351.013		335.302	
α			0.380			
Likelihood ratio test of $\alpha = 0$ (P-value)			31.423 (0.000)			

Note: Standard errors are reported in parentheses. Asterisks (*, **, ***) indicate that the difference is significant at 10%, 5% and 1% levels. $Score$ is the financial literacy score, and $Count$ is the number of the choice of "I don't know" in questions on financial literacy. PRM is the Poisson regression model and NBRM is the Negative binomial regression model.

Table 4: Effects of the experience of investment and experience in taking economics or finance courses

Explained variable	$Score$		$Count$	
	OLS		NBRM	
Investment (No) - Taking courses (Frequently or sometimes)	0.354		-0.636	
	(0.736)		(0.392)	
Investment (Yes) - Taking courses (Not frequently or sometimes)	0.673	*	-0.418	**
	(0.365)		(0.164)	
Investment (Yes) - Taking courses (Frequently or sometimes)	1.624	**	-1.081	**
	(0.541)		(0.453)	
N	179		179	
R^2 / Pseudo R^2	0.209		0.056	

Note: Standard errors are reported in parentheses. Asterisks (*, **) indicate that the difference is significant at 10% and 5% levels. $Score$ is the financial literacy score, and $Count$ is the number of the choice of "I don't know" in questions on financial literacy. NBRM is the Negative binomial regression model. Other explanatory variables in Table 3 are included.

and recognition to parent's retirement savings. For example, the number of predictions in $Count$ is reduced 0.657 times[3] for respondents with the experience of investment. If the respondent's father has a bachelor's degree or higher, $Count$ decreases by almost the same amount.

Respondents who did not know whether their parents were taking action to save money for their retirement when the respondents were high school students have 1.514 times[4] increase in $Count$. Equivalent income contributes to higher financial literacy, but the impact on $Count$ is not significant. On the other hand, the effect of experience in taking economics or finance courses on $Score$ is not significant, but the effect of the variable is significant for $Count$ and is expected to reduce the number of DK choices by 47.7%[5].

The difference in $Score$ is not significant for respondents who had taken more courses on economics or finance than for those who had not. The effect of the cross-term of the experience of investment and the experience of taking economics or finance courses on $Score$ and $Count$ is verified in Table 4, where $Score$ is significantly positive for respondents with only investment experience compared to those with no investment experience and little experience of taking courses. As both the experience of investment and the course-taking experience increases, $Score$ increases 5.073 times, where $Count$ decreases 0.339 times[6].

[3] $exp(-0.420) = 0.657$.

[4] $exp(0.415) = 1.514$.

[5] $1 - exp(-0.647) = 0.477$.

[6] $exp(1.624) = 5.073$. $exp(-1.081) = 0.339$.

4. Discussion

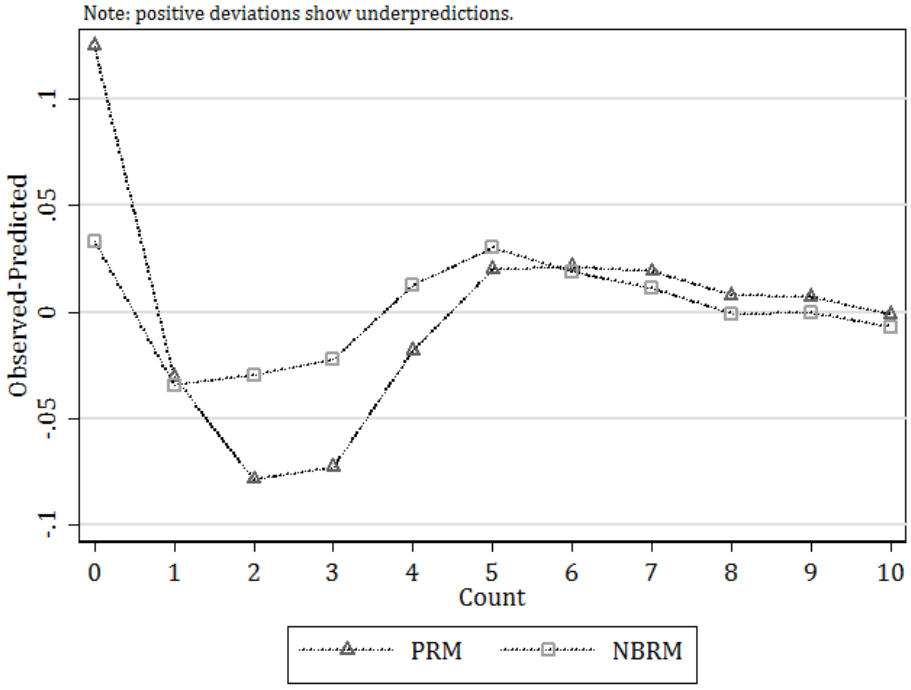
Previous studies, such as Lusardi and Mitchell (2011), showed that the rate of choosing "I don't know“ (DK), rather than the rate of wrong answers, is strongly related to the rate of correct answers to questions on financial literacy. Therefore, Lusardi et al. pointed out that the DK option in financial literacy questions is a proxy indicator of lack of knowledge.

Unrecognition of ignorance leads to overconfidence (Kruger and Dunning, 1999; Balasubramnian and Sargent, 2020). Though Roa García (2013) indicated that advice is effective in the financial behavior of consumers with low financial literacy, Kramer (2016) reported that persons who overestimate their own literacy are less likely to seek financial advice. If financial advice is not delivered to persons who need it, they are likely to continue to make financial decisions with insufficient knowledge. If we identify the factors that cause people to choose DK for financial literacy questions, we expect to mitigate the lack of knowledge through those factors.

To study if the choice of DK option truly represents a respondent's lack of financial knowledge, we examined whether those who frequently chose DK to the questions were at the level of "don't [actually] know the answer at all" or "narrow down the choices to some extent" based on a web survey in Japan (the BK survey). Then we compared the factors that lead to the selection of DK with the factors that form financial literacy and explored the impact of those factors. The results by the BK survey indicated that the group chose DK was at a knowledge level where they could narrow down their answers to some extent, did not check it box with "a pure guesswork." Our results and the findings from previous studies suggests the possibility that respondents choose DK with their indecision and yet have weak recognition of ignorance.

Gender and investment experience were influenced both on the number of the correct answers for financial literacy questions ($Score$) and the number of the DK option for those questions ($Count$). The income level affected only $Score$. The experience in taking economics or finance courses affected only $Count$. According to Beal and Delpachitra (2003), the upper-income class is likely to make more appropriate choices through trial and error because of experiencing facing lots of financial decisions, such as considering the purchase of expensive goods and preserving savings against the removal of full deposit insurance. However, it is difficult to find a clear answer from our study as to why income does not affect $Count$, but only $Score$.

Respondents who did not know whether their parents saved money for their retirement when the respondents were 12-17 years old showed a lower $Score$ and a higher $Count$. Bowen (1996) showed that the most common financial management parents taught their children was saving, but saving was not the most common financial management teenagers remembered being taught by their parents. Even if



Note: The horizontal axis shows the number of the choice of "I don't know" in questions on financial literacy (*Count*), and the vertical axis shows the difference between the distribution based on the observed values and the distribution derived from the predicted values by the Poisson regression model (PRM) and the Negative binomial regression model (NBRM).

Figure 5: The difference between the observed and the predicted values by PRM and NBRM

parents try to educate their children on money management to their children, it is not easy to share the information between parents and children. However, the above results suggest that sustained efforts by parents to make their children recognized the importance of saving money for retirement build their children's financial literacy.

Respondents with investment experience and with rich experience in economics or finance courses had higher *Score* and lower *Count*. According to Forbes and Kara (2010), investment self-efficacy (the belief that a person is able to take appropriate action and achieve his/her goals with respect to an investment) is not enhanced by knowledge of the investment, but is reached by gaining experience based on the knowledge. This suggests that both knowledge and experience are important in the formation of appropriate financial literacy.

Our study found that the Japanese respondents selected the DK option after narrowing their choices to some extent. Previous studies suggest that people with weak financial literacy tend to be less aware of their insufficient financial literacy skills, which often leads them to be overconfident. However, our survey did not include appropriate questions to verify this.

Lastly, we provide our observations regarding statistical methods. In analyzing our data, we applied both the Poisson regression model (PRM) and the negative binomial regression model (NBRM) and found

that the NBRM was a more appropriate model to use after testing for overdispersion. Figure 5 shows how close the predicted values of $Count$ by PRM and NBRM are to the observed values. The horizontal axis shows $Count$, and the vertical axis shows the difference between the distribution based on the observed values and the distribution derived from the predicted values by PRM and NBRM. The more the graph is near zero, the higher the prediction accuracy. Figure 5 indicates that NBRM is a more appropriate model because the line graph drawn the difference between the observed values and the predictions by NBRM is drawn nearer to zero than the graph by PRM. However, there is room for reconsideration in the application of the model, because both PRM and NBRM underpredicts when $Count = 0$. It is necessary to apply more appropriate models for the explained variables, including the Zero-Inflated Count model. These issues will be discussed in the future.

Appendix

A. Comparison of the Population Census and "monitors"

We outsourced our web survey to a research company. The respondents of the survey are sampled from a group of persons (called "monitors") who have registered for the purpose of participating in various surveys from the research company.

A-1: Age group

Age	Census	Monitors
10-19	10.3	3.5
20-29	11.8	24.4
30-39	15.6	38.4
40-49	14.4	22.2
50-59	14.0	8.9
60+	33.8	2.6
N	116,198,442	1,655,757

A-2: Region

Region	Census	Monitors
Hokkaido	4.4	4.7
Tohoku	7.3	5.2
Kanto	34.0	41.8
Chubu	17.7	15.4
Kinki	16.3	17.8
Chugoku	5.9	4.8
Shikoku	3.1	2.3
Kyushu / Okinawa	11.3	8.1
N	115,023,245	1,655,757

A-3: Employment status

Status	Census	Monitors
Employed	57.3	62.3
Unemployed	17.1	14.8
Students	6.3	11.7
Unemployed and others	19.3	11.2
N	104,071,474	1,655,757

Note: "Census" is 2010 Population Census and "Monitors" is a group of persons who have registered for the purpose of participating in various surveys from Cross Marketing Inc., the research company. The census is as of October 2010, and the monitor is as of December 2012.

B. Questions on financial literacy

	Item	Options	DK_{ex}	DK_{in}
Q1	Rebecca has saved $12,000 for her college expenses by working part-time. Her plan is to start college next year and she needs all of the money she saved. Which of the following is the safest place for her college money?	Locked in her closet at home	28	10
		Stocks	17	5
		Corporate bonds	15	5
		A bank savings account	440	168
		I don't know		12
Q2	Which of the following types of investments would best protect the purchasing power of a family's savings in the event of a sudden increase in inflation?	A 10-year bond issued by a corporation	71	19
		A certificate of deposit at a bank	300	71
		A 25-year corporate bond	10	2
		A house financed with a fixed-rate mortgage	119	32
		I don't know		76
Q3	Many people put aside money to take care of unexpected expenses. If Juan and Elva have money put aside for emergencies, in which of the following forms would it be of the LEAST benefit to them if they needed it right away?	Invested in a down payment on a house	173	58
		Stocks	251	87
		Savings account	48	18
		Checking account	28	7
		I don't know		30
Q4	David just found a job with a take-home pay of $2,000 per month. He must pay $900 for rent and $150 for groceries each month. He also spends $250 per month on transportation. If he budgets $100 each month for clothing, $200 for restaurants, and $250 for everything else, how long will it take him to accumulate savings of $600?	One month	9	0
		Two months	27	7
		Three months	39	18
		Four months	425	147
		I don't know		28
Q5	Rob and Mary are the same age. At age 25, Mary began saving $2,000 a year while Rob saved nothing. At age 50, Rob realized that he needed money for retirement and started saving $4,000 per year while Mary kept saving her $2,000. Now they are both 75 years old. Who has the most money in his or her retirement account?	They would each have the same amount because they put away exactly the same	64	13
		Rob, because he saved more each year	33	11
		Mary, because she has put away each year	48	18
		Mary, because her money has grown for a longer time at compound interest	355	120
		I don't know		38
Q6	Don and Bill work together in the finance department of the same company and earn the same pay. Bill spends his free time taking work-related classes to improve his computer skills, while Don spends his free time socializing with friends and working out at a fitness center. After five years, what is likely to be true?	Don will make more because he is more social	36	8
		Don will make more because Bill is likely to be laid off	15	0
		Bill will make more money because he is more valuable to his company	298	100
		Don and Bill will continue to make the same money	151	35
		I don't know		57
Q7	Sara and Joshua had a baby. They received money as baby gifts and want to put it away for the baby's education. Which tends to have the highest growth over periods of time as long as 18 years?	Stocks	104	38
		A government savings bond	116	38
		Savings account	264	71
		Checking account	16	6
		I don't know		47

	Item	Options	DK_{ex}	DK_{in}
Q8	Suppose you had $100 in a savings account and the interest rate was 2% per year. After five years, how much do you think you would have in the account if you left the money to grow?	More than $102	388	148
		Exactly $102	45	12
		Less than $102	67	16
		I don't know		24
Q9	Imagine that the interest rate on your savings account was 1% per year and inflation was 2% per year. After one year, you would be able to buy _____ today with the money in this account. Please select the one that applies to _____.	More than	66	10
		Exactly the same as	61	10
		Less than	373	112
		I don't know		68
Q10	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.'	True	94	11
		False	406	94
		I don't know		95

Note: The group DK_{ex} excludes "I don't know" from each question's options, and the group DK_{ex} includes "I don't know" option.

Q1-7 and Q8-10 referred to Mandell (2008) and to Lusardi and Mitchell (2011), respectively.

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