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日本の金融教育がリスク性資産投資選択に及ぼす不均一な影響に係る実証分析

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【要旨】

本稿は「金融リテラシー調査」を用いて、日本人の金融教育経験と金融市場への参加との関係を分析した。推計には Finite Mixture Modelを採用し、個人の投資行動に係る観察不能な不均一性を仮定した。異質な行動モデルを持つ部分集合(classes)への所属の事前確率は、年齢、教育年数、経済状況などの社会人口学的特性の関数として定義し、各クラスにおける家庭または学校・職場での金融教育経験とリスク性資産への投資経験との関係を、その個人の金融リテラシー（項目反応理論推計値）や他の行動特性を制御した上で推計した。分析の結果、明らかに他のクラスとは異なる投資行動の特徴を持つ、より若く、貧しく、教育年数の低い集団があることが示された。さらに、学校や職場での教育は、あらゆる人のリスク資産への投資確率と有意に正の相関があるが、家庭での金融教育の影響はより異質であり、最も経済的に脆弱な人々に対してのみ、リスク性資産への投資を踏みとどまらせる可能性があることも示された。今回の結果は、金融教育プログラムの設計における重要な課題を提供するものと考えられる。

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The Heterogeneous Relationship Between Financial Education and Investment Behavior in Japan *

Hiroko Araki † Juan Nelson Martínez Dahbura ‡

Abstract

This research employs data from Japan to study the relationship between the experience of financial education and the participation of Japanese persons on financial markets. We account for unobserved heterogeneity by employing a three-class Finite Mixture Model. The prior probability of class membership is a function of socio-demographic characteristics of the person. We examine the association between the investment experience probability conditional on class membership, and the experience of financial education at home, school and the workplace, controlling for a financial literacy score measured through Item Response Theory, and several behavioral traits. The results allow us to extract a segment of *striving* persons whose investment behavior differs in important ways from other groups. Education at school or work is significantly associated with higher investment probabilities across all classes of individuals. The impact of financial education at home is more heterogeneous, and may be negative for the most fragile groups. We believe that our results may offer important insights for policy-makers involved in the design of financial education programs.

JEL Classification: G02, D14

Keywords: Personal Financial Decisions, Financial Education, Financial Literacy, Finite Mixture Model

1 Introduction

Rapid demographic changes have led to reforms of social security and pension systems all around the world. As the life expectancy of the generation born

*The data from the Financial Literacy Survey (2016 and 2019) employed in this research was kindly provided by the Central Council for Financial Services Information (CCFSI), Bank of Japan. We appreciate Professor Kohei Komamura of Keio University recommending this discussion paper for submission. We also appreciate the comments by attendants to the 14th Meeting of the Association of Behavioral Economics and Finance, the seminar at Keio University's Research Center for Financial Gerontology and the 96th Annual Conference of the Western Economic Association International.

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during the 21st century is expected to reach 100 years, in order to help their citizens achieve lifelong economic security, governments are not only improving labor policies aimed at extending the length of employment, but are also strongly promoting policies that encourage individuals to actively engage in asset building on their own, such as participation in defined contribution pension plans. As a result, the burden of assets management is rapidly shifting from governments and employers to the individuals. This trend has resulted in an increased recognition of the importance of financial literacy and education and the growing interest in financial literacy and the need for education, which initially started in developed countries such as the OECD, has now spread around the world. Since 2012, the OECD and the International Network for Financial Education have been running Global Money Week, an annual campaign to raise awareness of the importance of improving financial literacy among young people and the resulting economic well-being. The campaign, which started with the participation of 21 countries, has grown into a huge movement involving 40 million children and youth in 175 countries as of 2021.[1]

Japan has one of the world's most aged populations and plans to reduce the level of public pension benefits in order to avoid a financial crisis. In response to the growing responsibility of individuals to manage their own lifelong financial security, defined contribution pension plans (both individual and company plans) were finally introduced in 2001, two decades after the US, but the number of individual plan users remains low [2]. As we will see in Section 2, the rate of ownership of risky financial assets among Japanese is considerably lower than in Western countries. In order to overcome this situation, the Financial Services Agency (FSA) has been actively promoting the introduction of financial literacy education in recent years. from April 2022, investment education will be introduced in home economics classes at high schools, where students will learn about the characteristics of basic financial products such as stocks, bonds, and investment trusts.

In other countries, as the need for financial education has increased and policy interventions have increased, empirical studies examining the effects of such education have accumulated and developed. As several previous studies, including meta-analyses, have shown, the impact of financial education on financial literacy and financial behavior is not uniformly positive, and the effects vary greatly depending on the target and the timing of the intervention (Fernandes, Lynch Jr, and Netemeyer, 2014; Kaiser and Menkhoff, 2020; Lusardi, Michaud, and Mitchell, 2020). On the other hand, although Japan has had a long history of savings education policies since the early modern period, including common education, there are still a few empirical studies that have examined the effects of such education on financial behavior quantitatively, to our knowledge, due to data limitations. At a time when investment education is being introduced in

[1] `https://www.globalmoneyweek.org/`

[2] As of June 2021, there were approximately 2.06 million participants in individual-type defined contribution pension plans in Japan, which is about 3% of the total number of eligible participants. `https://www.ideco-koushiki.jp/library/pdf/number_of_members_R0306.pdf` (in Japanese)

the school curriculum in Japan, there is a need to accumulate empirical studies that measure the effects of financial education and contribute to policy findings. The purpose of this paper is to play a part in this process.

This research studies the relationship between financial education and investment in risky assets in Japan, filling several gaps on the previous literature. We employ a Finite Mixture Model to account for unobserved heterogeneity, and extract three population segments with significantly different investment behaviors, which are relevant for policy-makers. We employ an Item Response Theory model to obtain a measure of financial literacy that accounts for the difficulty of the questions. In contrast with other studies employing similar data, we also employ information on the experience of financial education at home by parents and guardians. The paper is organized as follows: Section 2 presents the context, comparing investment patterns in Japan with other developed countries and looking at the historical background of financial education as a possible factor explaining the differences. Section 3 introduces the relevant literature on the relationship between investment and financial literacy, and presents previous research on the heterogeneity in the impact of financial education. Section 4 briefly introduces the finite mixture model employed in this paper, and Section 5 presents the data. Section 6 shows the estimation results for a model. Finally, Section 7 discusses the main findings and concludes.

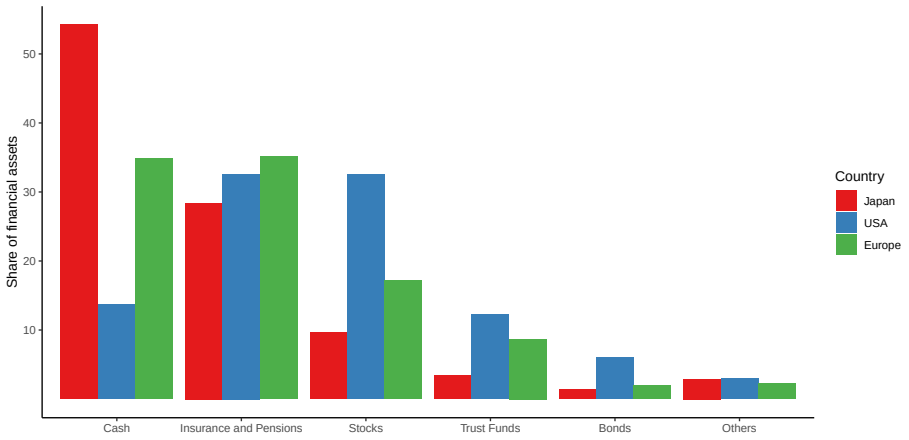
2 Background

2.1 Investment behavior in Japan

As mentioned earlier, it is known that Japanese people hold considerably less risky financial assets than other developed countries. We begin by looking at how the management of financial assets differs between Japan and other countries. Figure 1 shows that, compared to America and Europe, the adoption of investment in risky assets among Japanese households is quite low. An 54.2% of the financial assets in Japan are held in the form of cash, compared to 13.7% in the US and 34.9% in Europe. In contrast, less than 10% of assets are in the form of stocks, barely one third compared with the US.

Nakagawa and Shimizu (1999) uncover some attitudes that differentiate Japanese households from those in other countries. These include a higher degree of risk aversion compared to households in the US, and a higher importance of safety and liquidity rather than profitability. Important factors behind these attitudes include limited information on financial assets, a transaction fee that is inconvenient for small investors, and a taxation system that favors the acquisition of safe assets. Recent years have seen important institutional changes in the fee system, the introduction of small investment tax exemption system (NISA), and the introduction and expansion of a defined-contribution pension scheme (e.g. iDeCo). However, there is no evidence that these reforms have had a large effect on attitudes toward investment in Japan.

Figure 1: Share of financial assets of households by region



Source: The Bank of Japan, 2020. Flow of Funds - Overview of Japan, the United States, and the Euro area.

2.2 Historical background of financial education in Japan

Historically, financial education in Japan has been mostly oriented towards savings and conservative expenditure attitudes, and it is not hard to imagine that this has had an ideological impact on the risk-averse preferences of the Japanese people, as shown in the previous section.

Yoshikawa (2016) reveals important features of the financial education in modern Japan through the history of children savings programs. In the first place, the attitudes of diligence and thrift were held as important virtues by the Jodo Shinshu, the most popular Budhist sect among civilians by Japan's early modern period. This savings ethic was incorporated into the policies of the Japanese government during the Meiji era, which aimed to strengthen the country's power, including military power eventually into the education system. One of these policies was the *School Savings System*, in which children deposited a portion of their allowance or income with the school, which would then deposit these funds in what nowadays is the financial branch of the Japanese Post Office.

The initial policy objective was to foster from childhood the attitudes and ideas that would help the economically fragile achieve their own economic stability in the wake of democratization and other changes in social structure, and to invest the funds in school operations. However, as the 20th century progressed and the nation became more militaristic, the savings became a resource to supplement the military. Eventually, during World War II, the government imposed savings quotas on schools, and in order to meet the quotas, almost all elementary school students participated in School Savings System and diligently carried their savings for the nation. Needless to say, all of this disappeared with Japan's defeat at the end of the war.

After World War II, the Japanese government continued to encourage savings in order to revive the economy and curb inflation, and in 1948, *Children's Banks* were established to replace the School Savings System, and was included in the school curriculum. In other words, savings education was clearly positioned in the official curriculum guidelines. Unlike the pre-war the School Savings System, the Children's Bank is operated by the children themselves. This style of operation was in line with the empiricism introduced in post-war education, and it spread rapidly, partly to make up for the shortage of funds for school operation in the immediate post-war period. By the mid-1950s, about half of the students in elementary and junior high schools were participating. However, due to the rise of mass consumption, the occurrence of scandals, and criticism from the educational field concerned about the decline in academic achievement due to empiricism, the description of the Children's Bank was deleted from the school curriculum in 1958. As a result, the number of children participating in the program rapidly decreased after the 1960s, and the participation rate was only about 15% in 1986, the last year for which statistics were available. However, it was not until April 2001 that the Ministry of Education, Culture, Sports, Science and Technology (the MEXT) and the FSA officially announced their complete withdrawal from involvement.

This was a turning point for financial education in Japan, as the Financial System Council's report of June 2000 clearly stated the need for consumer education in Finance. Since then, the FSA and the Central Council for Financial Services Information (the CCFSI), a division of the Bank of Japan, have taken the lead in organizing financial literacy events and piloting financial education in schools. In 2002, the year after the introduction of defined contribution pension plans, the FSA requested the MEXT to revise the the school curriculum at an early stage to more concretely and clearly position financial education as a means of equipping citizens with the knowledge and ability to make their own decisions and take responsibility for building their own assets. This finally marked the shift from a savings-oriented education to a financial literacy education that promotes rational decision making for the modern financial environment. In 2012, the FSA established the Committee for the Promotion of Financial Education to formulate the minimum level of financial literacy that should be achieved according to school age and age group, as well as educational guidelines for this. In 2014, the guidelines were compiled into the *Financial Literacy Map*, which systematically defines the most important financial literacy content for each age group.[3]

3 Literature Review

The relationship between financial literacy and financial behaviors has been well documented in the literature. Lusardi and Mitchell (2007) and Mitchell

[3]In this guideline, financial literacy is categorized into "household budget management", "life planning", "knowledge of finance and economics and appropriate choice of financial products", and "appropriate use of external knowledge".

and Lusardi (2011) show that those with low financial literacy are less likely to plan for retirement and, as a result, accumulate much less wealth. Lusardi, Schneider, and Tufano (2011) show that financial fragility, defined as the incapacity of a household to obtain $2,000 in 30 days, is higher in households with low educational attainment and no financial education. van Rooij, Lusardi, and Alessie (2011) show for the Netherlands that, although most households have a basic level of financial literacy, more advanced knowledge about the financial markets is rather rare. They also find that persons with a low level of financial literacy are less likely to participate in the stock market. Gerardi (2010) show that lower financial literacy is linked to higher mortgage delinquency, even after controlling for cognitive ability and socio-demographic characteristics, thus suggesting that financial illiteracy is at the core of the 2008 subprime crisis.

Previous studies show that the impact of financial education on investment and other financial behaviors depends on several factors: the contents of the program, the characteristics of the participants, the time at which outcomes are measured, and the stage in the life cycle of the participants. The impact is thus heterogeneous, and such heterogeneity may depend on observable or unobservable factors.

Lusardi (2003) shows that participation in employer retirement seminars is highly effective in promoting total wealth, especially for less educated families and families with low savings, and suggests that providing financial education can strengthen the financial stability of these individuals in retirement. Similarly, Bernheim and Garrett (2003) examined the effect of the availability of financial education opportunities by employers in the workplace on savings accumulation and 401k participation. The results of their quantile regression showed that the employer-based financial education opportunities had a significant effect on savings rates and 401k participation among those with low wealth (25th and 50th percentile), while no significant effect was found among the wealthy (75th percentile). In addition, Clark and d'Ambrosio (2009) find that women are more likely to adjust their retirement as a result of participating in a financial education seminar.

Lusardi, Michaud, and Mitchell (2020) employ a simulation approach to illustrate how different types of financial education programs at the workplace may impact the level of savings of participants at the time of retirement, in the context of a dynamic model of consumption and investment decisions. Their analysis uncovers some important sources of heterogeneity in the impact of education programs on the share of persons that invest in risky assets. It provides a theoretical framework explaining the self-selection mechanism underlying biases encountered in empirical studies in the past. It also argues that a segment of the population, especially the youngest, less literate, in lower income groups, are less likely to become sophisticated investors despite joining financial education programs, due to the cost of investment and of maintaining the acquired knowledge.

Meta-analyses by Fernandes, Lynch Jr, and Netemeyer (2014) and Kaiser and Menkhoff (2020) empirically confirm these sources of heterogeneity. Fernandes, Lynch Jr, and Netemeyer (2014) analyze results from multiple empirical

studies on the effect of financial literacy. They show that interventions in the form of financial education programs have significant and positive effects on different types of financial behaviors, including investment. These results are heterogeneous depending on the intensity of the intervention and the number of months since the intervention. Kaiser and Menkhoff (2020) show that the effect of financial education programs is significant and positive, tends to be larger among the youngest, and is larger on financial knowledge than on financial behaviors.

An important source of heterogeneity not mentioned so far arises when households can be divided into several mutually exclusive *classes*, which are unobservable to the econometrician, and have different preferences. One frequent way of modeling such setting is by employing Finite Mixture Models (FMM), which estimation requires simultaneously recovering the unobserved heterogeneity and estimating the within-class parameters. Gerhard, Gladstone, and Hoffmann (2018) explores, with a sample of UK households, the role of financial literacy on savings behavior, accounting for latent heterogeneity by employing an FMM. Group membership is modelled as a function of socio-demographic characteristics of the household. The amount of savings conditional on class membership is a function of attitudinal characteristics of the head of household and a measure of financial literacy. They conclude that the data is best explained by a model with two latent groups: *striving* (larger families with children and young/female heads of household) and *established* households. Their findings show that financial literacy has a significantly larger effect on savings for those in the *striving* group, thus confirming the presence of unobserved heterogeneity.

We also look at the literature on financial education and financial behaviors in Japan. A few studies exist that evaluate the level of financial literacy in the population, and explore the association that financial literacy and education have with participation on financial markets. Sekita (2011), Yoshino, Morgan, and Trinh (2017), Kadoya and Khan (2020) and Shimizutani and Yamada (2020) show that financial literacy is significantly associated with gender, age and income levels. A common finding is that financial literacy is lower among women, young individuals and low income groups.

Higher financial literacy levels and the experience of financial education are also found to have a significant and positive effect on financial behaviors such as planning for retirement and investing on risky financial assets. Sekita (2011) employs a panel dataset and shows that a higher literacy level is significantly associated with a higher probability of having a savings plan for retirement. Furthermore, persons who attended a school with a Children's Bank were more likely to have a savings plan for retirement, although the nature of the plan (whether it includes on investment on risky assets) is not clear from the data. Yoshino, Morgan, and Trinh (2017) uses the Financial Literacy Survey (FLS), by the CCFSI of Japan, and find that financial education at school or work has a significant positive impact on having experience investing in risky assets, even after controlling for financial literacy levels. Shimizutani and Yamada (2020) makes a comparative analysis of the role of financial literacy for Japan and the United States, finding that higher literacy levels are significantly associated with

household asset holdings, especially bonds and stocks on both countries. Sekita, Kakkar, Ogaki, et al. (2018) employs the FLS survey data and an Instrumental Variables approach to study the impact of financial literacy on asset accumulation. Their findings show that higher literacy levels are significantly associated with higher asset levels, especially for the case of literacy regarding Deposits, Risk and Debt.

Our study fills several gaps on the literature in Japan. Most studies estimate the impact of financial literacy and education on investment behaviors but fail to account for the existence of unobserved heterogeneity: the possibility that different groups of individuals may have different investment preferences. We employ a Finite Mixture Model to account for this possibility and show that a three-class model does a better job at explaining the data, while yielding population segments that are relevant for policy-makers, describing in detail the profiles of the latent classes obtained during the estimation.

We also introduce some innovations regarding the use of the data. Most studies employ a measure of financial literacy based on the percent of correct responses on a test. However, this measurement method fails to account for differences in the difficulty of the questions. van Rooij, Lusardi, and Alessie (2011) have shown that understanding the most basic concepts is not enough to motivate investment in risky assets. We employ a two-parameters model from Item Response Theory to create a more accurate measure of financial literacy.

Finally, studies employing the FLS data use education at school or the workplace as the only measure of financial education. However, we also employ the experience of financial education at home by the parents and guardians of the individual. We believe this type of education is important for our analysis for two reasons: First, this form of education is the most common in the sample. Second, financial education at home is provided during childhood, and is therefore independent of financial behaviors during adulthood; in contrast, financial education at work tends to be provided for the purpose of facilitating the participation of employees into defined contribution pension plans and stock option programs, and therefore is likely to be partly endogenous with respect to investment behaviors.

4 Model

As in the findings of Gerhard, Gladstone, and Hoffmann (2018), we assume the existence of a number of classes of households. We assume that the utility of agents in each class is a function of the consumption of a risky asset and its shape depends on observable personal characteristics and the class it is affiliated to, which is unobservable to the econometrician. We follow the literature on microeconometric models with unobserved heterogeneity, and model the investment behavior as a Finite Mixture Model (FMM).

Define an investment behavior indicator Y, a set of covariates $\{X^g, X^w\}$ and a set of labels Z which represent the affiliations of each observation to any of the K classes ($z_{ik} = 1$ if observation i belongs to group k).

Preference for investment is represented by the conditional pdf:

$$f_k\left(Y|X^w;\beta^k\right) \tag{1}$$

Where the presence of k indicates that preferences may differ across classes (the parameters β^k may be different depending on the class k). The affiliation to each class z_k is given by the probability density function $\pi_k(X^g;\alpha)$. We are interested in estimating the parameters $\psi = \{\alpha, \beta_k\}$, where α represents the effect of characteristics on the probability of class membership, and β_k contains the preference parameters, conditional on membership to class k.

The likelihood function can be expressed as:

$$L(\psi)_i = \prod_{k=1}^{K} \{L_{ik}(Y|X^w, X^g;\psi)\}^{z_{ik}} \tag{2}$$

Where L_k represents the likelihood of the model conditional on membership to class k.

This can also be written as:

$$L(\psi)_i = \prod_{k=1}^{K} \{\pi_{ik}(X^g;\alpha) f_{ik}(Y|X^w;\beta_k)\}^{z_{ik}} \tag{3}$$

The log-likelihood of the whole sample can be expressed as:

$$logL(\psi) = \sum_{i=1}^{N}\sum_{k=1}^{K} z_{ik}\left[log\pi_{ik}(X^g;\alpha) + logf_{ik}(Y|X^w;\beta_k)\right] \tag{4}$$

A Maximum Likelihood estimator for ψ can be obtained by employing an Expectation Maximization (EM) algorithm which iteratively estimates the posterior probability of affiliation to each class and the utility function parameters until convergence. We assume that the set of observables X^g is disjoint from X^w, meaning that X^g affects the class affiliation probability but is otherwise independent from the investment decision. This works as an exclusion condition which is essential for identification. Compiani and Kitamura (2016) provides a brief summary of usages of FMM in Econometrics and describes the conditions for identification.

For estimation, we assume that class membership probability is a function of socio-demographic characteristics of the person and other characteristics of the household, which are independent of the investment decision within each household class. The investment behavior is represented by a binary variable

that is the realization of the latent expected utility of the investment. We evaluate the effect of having received financial education at home, or at school or the workplace, on the decision to invest, controlling for attitudinal characteristics of the individual and the current level of financial literacy. The following section describes the data in detail.

5 Data

The data comes from the Financial Literacy Survey (FLS), an online survey conducted by the CCFSI in 2016 and 2019. Its aim is to understand the current state of financial literacy of Japanese persons aged 18 to 79 years old, and employs representative samples of 25,000 individuals on each round. The survey contains questions regarding socio-demographic characteristics, 53 standard questions on financial literacy, questions on financial knowledge and skills, and questions on behavioral and attitudinal characteristics related to the characteristics defined in the Financial Literacy Map. This research employs pooled cross-section data from both surveys.

The conditional membership probability follows a Logit model, and is a function of socio-demographic characteristics of the respondent, as well as the annual income and the value of financial assets of the household. Controls for socio-demographic characteristics include age, gender and years of schooling. Age is represented by the central value of the corresponding 5-year age range category from the survey. Gender is represented by a binary value that takes the value of 1 for *female*. Years of schooling represents the number of schooling years until the graduation from the highest educational level of the respondent. Annual household income and household financial assets are measured by the central value for the corresponding income and assets range category respectively.

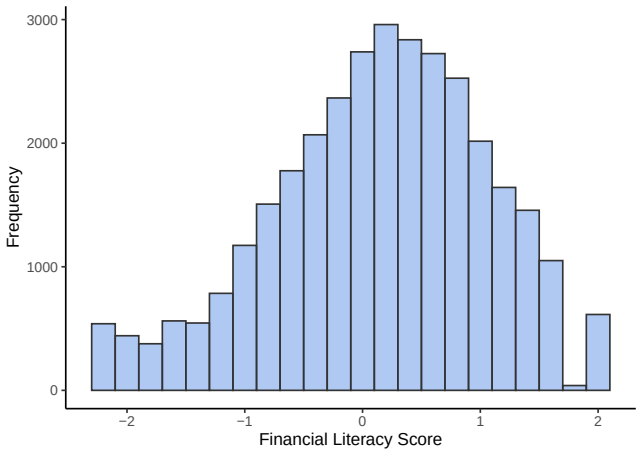
The investment decision is represented by a binary variable that takes the value of 1 if the person has ever made investments in trust funds, stocks or foreign currency, and 0 otherwise, and also follows a Probit model. It is a function of previous experience of financial education, the individual's financial literacy, and behavioral characteristics of the respondent. The survey includes two questions regarding previous financial education:

- *Was financial education offered by a school or college you attended, or a workplace where you were employed?*
- *Did your parents or guardians teach you how to manage your money?*

For the estimation we create a binary variable that takes the value of 1 if the person responded *Yes, and I did participate in the financial education* to the first question, and 0 otherwise. Similarly, we measure the experience of financial at home with a binary variable that takes the value of 1 if the person responded *Yes* to the second question.

For measuring financial literacy, we employ a two-parameter logistic model (2PL) from Item Response Theory (IRT). The model allows to create a measure

Figure 2: Distribution of the financial literacy score



The financial literacy score is defined as the value of the *ability* parameter obtained from a 2PL IRT model.

of financial literacy that takes into consideration the difficulty and discrimination levels of each question. The input are the 25 multiple choice questions on financial literacy from the survey, that have a single correct answer. The 2PL model predicts the probability of a certain response based on the examinee's *ability level*, the *item discrimination* parameter, and the item *difficulty/location* parameter. We use the resulting ability level parameter θ as a financial literacy score. The distribution of the financial literacy score is shown in Figure 2.

The survey includes ten questions that measure several attitudes towards personal finances. Each question is presented in the form of a statement, and the respondent has to indicate their level of agreement, where 1 represents the highest level of agreement and 5 is the highest level of disagreement. We recode the values of these variables so that 5 indicates the highest level of agreement, and compute four variables that account for the attitude towards money management, propensity towards herd behavior, myopic behavior and risk tolerance.

There is considerable correlation among the responses to the ten questions. In order to reduce multicolinearity while keeping the important sources of variation, we apply Principal Components Analysis to the recoded questions. We extract the first component, which accounts for roughly 28% of the total variation. Figure 3 shows the absolute value of the correlations of each question with respect to the first principal component, where red bars represent negative correlations. Excluding the three questions with the smallest correlations, the first principal component is associated with a lax money management attitude. We employ the score from this component to represent such attitude. The three remaining questions are used as separate covariates representing myopic behavior, herd behavior and risk tolerance respectively.

Figure 3: Attitudinal characteristics

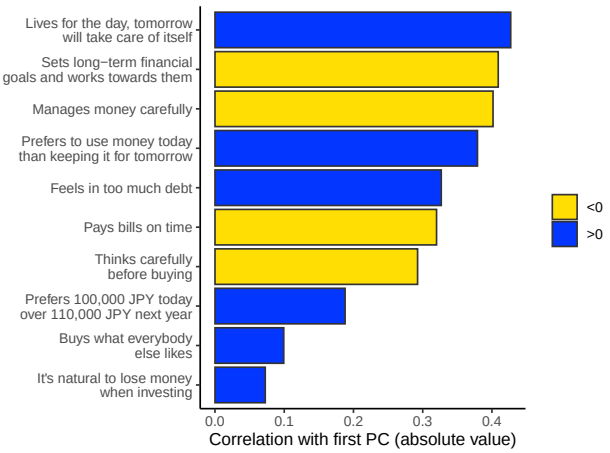


Table 1: Descriptive Statistics of the Sample by Investment Experience

	No Experience N: 17,703		*Has Experience* N: 15,043		
	Mean	Std. Dev	Mean	Std. Dev	t
Age	44.77	16.19	54.15	15.27	53.62***
Female	0.53	0.50	0.38	0.49	−26.83***
Years of Education	13.93	2.06	14.64	1.97	31.69***
Income	4.26	3.22	5.95	3.87	43.10***
Financial Assets	4.46	6.80	12.18	9.65	84.59***
Financial Literacy Score	-0.17	0.90	0.49	0.80	69.23***
FE at Work/School	0.05	0.21	0.12	0.32	23.85***
FE at Home	0.19	0.39	0.23	0.42	8.96***
Lax Money Management	0.25	1.72	-0.33	1.61	−31.18***
Herd Behavior	2.60	1.05	2.60	1.08	−0.00
Risk Tolerance	2.46	1.18	3.26	1.19	61.16***
Myopic Behavior	3.23	1.55	3.12	1.60	−6.08***

*p<0.1 **p<0.05; ***p<0.01;

Table 1 shows the summary statistics for the variables employed in the estimation. Persons with any investment experience are significantly different to those without experience in most of the dimensions. In terms of socio-demographic characteristics, persons with experience tend to be older, male, better educated, have higher household income and financial assets. The financial literacy score is considerably larger among those with experience, and this group is more likely to have experienced financial education at home, school

or work. Regarding behavioral characteristics, persons without any investment experience tend to consider themselves less careful with respect to money management, less risk-tolerant and more myopic. No significant difference exists with respect to herd behavior.

This pattern suggests that observables play an important role in the decision to invest. However, it is not clear whether these relationships can be taken at face value or can be attributed to the distribution of households across unobserved types, as suggested in the literature. In the following section we explore this idea further.

6 Results

In this section we present the estimation results. We first estimate a simple Probit model for the probability of having investment experience. Next, we follow the strategy in Gerhard, Gladstone, and Hoffmann (2018) and estimate with the Finite Mixture Model, which accounts for the possibility that the investment behavior model is heterogeneous across unobservable populations (Classes), where the prior probability is conditioned on socio-demographic characteristics of the respondents.

6.1 Baseline Model

We estimate a Probit model for the probability of having investment experience in any of foreign currency, trust funds and stocks. This model allows us to understand the relationship between financial education and investment experience under the assumption of an absence of unobserved heterogeneity. The results are presented in Table 2.

First, as Column (1) shows, there is a significantly positive association between an individual's investment experience and having received financial education when we do not control for any personal attributes. This trend is the same whether the education took place at home, school or at work, although the value of the coefficient is larger for education at school or work. Next, Column (2) controls for age, gender, years of schooling, and current financial literacy score; Column (3) adds household income and assets to these estimates; and Column (4) controls for behavioral traits. According to these results, the coefficients of financial education at school and the workplace are significantly positive at the 1% level in all specifications of the model, and the magnitude and significance of the coefficient values are mostly unaffected after controlling for personal attributes. However, we fail to observe a significant impact of financial education by parents at home in Column (3) and Column (4), when controlling for the household's economic situation. Regarding the other control variables, we observe that older individuals, especially men, with more years of schooling, income and financial assets are significantly more likely to have investment experience. These patterns are similar to those observed in previous literature. We also observe that individuals who are more risk-tolerant, more

careful about money management and have a less myopic attitude are more likely to have invested in the past. The influence of peers is also associated with a higher probability of investment experience.

As mentioned above, we fail to observe a significant effect of financial education at home when employing the full set of controls. The simplest interpretation is that, given the same current financial conditions, whether or not a child received financial education from a parent or guardian has no effect on subsequent investment behavior. However, this finding can also be interpreted as follows: as previous have shown, the sample may be a mixture of different *classes* of individuals, where the impact of financial education at home may vary depending on the *class* the person belongs to. When the estimation is performed on the sample without accounting for the composition of the mixture, the estimates may reflect an average that hides the underlying heterogeneity of the effect. The way that Economics research traditionally deals with this issue is to estimate separate effects by including interaction terms. However, including all the possible interaction terms results in complex models that are difficult to interpret, and fails to account for unobserved sources of heterogeneity. As an estimation method to address this possibility, we follow Gerhard, Gladstone, and Hoffmann, 2018 and employ a Finite Mixture Model. We present the estimation results of a two-class model below.

6.2 Two-Class Finite Mixture Model Results

The Finite Mixture Model employed in this subsection assumes a two-class mixture, where the prior probability of class affiliation follows a logistic distribution and is a function of socio-demographic characteristics. The probability of investment experience conditional on class affiliation follows a Probit model and is a function of the experience of financial education, the financial literacy score, behavioral characteristics and income [4].

Estimates for the conditional prior probability of class affiliation are presented in Table 3. The model separates the sample into two classes. Persons in Class 2 tend to be older, mostly male with higher years of schooling and more financial assets when compared to persons in Class 1. This partition of the data resembles the Striving/Established partition presented in Gerhard, Gladstone, and Hoffmann (2018). Class 2 composes a 60.5% of the sample, and 78% of the persons in this class have invested in the past. In contrast, only 1.6% of the persons in Class 1 have any investment experience.

Table 4 presents the estimation results for the probability of investment experience conditional on affiliation to each class, as well as the χ^2 statistic for the difference of coefficients across classes for each covariate. We observe a similar pattern as in the results in Table 2 for most of the explanatory variables. However we observe significant heterogeneity across classes for the effect of financial education, income and herd behavior. The effect of financial education

[4]Financial assets are excluded from the investment decision regression because asset accumulation may be accompanied by investment experience

at school or work is statistically significant for both classes and is significantly larger in the case of the striving class (Class 1). On the other hand, the effect of financial education at home is positive and significant to the 10% level only in the case of Class 2, but is negative, although insignificant, for the younger, poorer, less educated, and more female population. Higher income is only significantly associated with a higher probability of investment experience in the case of the striving class. Herd behavior has a positive and significant effect, although its magnitude is significantly larger for Class 1. The constant reflects a considerably lower baseline probability of having investment experience for the striving class.

In general, these results suggest the existence of significant heterogeneity in investment behaviors. Striving persons are considerably less likely to invest, and their likelihood of having investment experience receives a significantly larger effect from the experience of financial education at school or the workplace, higher income and from their peers. The results suggest that failure to observe a significant effect of education at home on Table 2 can be explained by the heterogeneous nature of the sample. The decrease in the Akaike Information Criterion with respect to the Probit model suggests that the Finite Mixture Model offers a better balance between parsimony and explanatory power for our sample. In the following subsection we present results from a three-class Finite Mixture Model and show that it is possible to obtain a third class of great relevance for policy-making, while at the same time improving the quality of the model.

6.3 Three-Class Finite Mixture Model

The three-class model presented in this subsection follows a similar specification as the one presented in the previous subsection. The results for the prior probability of class membership for the three-class model are presented in Table 5 along with the χ^2 statistic for the test of the null hypothesis of joint equality of the estimates across classes. Note that the three-class model offers a further reduction in the Akaike Information Criterion. Not only does this model fit better the data, we proceed to show that it yields important findings from the point of view of policy-making.

Comparing to the reference class, Class 2 is only significantly different in terms of income and wealth. Class 3 is composed of persons who are older, mostly male, with a higher education level, and financial assets, and is similar to the *established* class in the two-class model. Income is significantly higher for this class than for the reference group for a significance level of 10%, which may reflect the fact that a larger share of retirees may be included in this group. To put it in fewer words, Class 1 is composed of *truly striving* individuals, composing 18% of the sample. Class 2 is a group of young but *relatively financially stable* persons, and accounts for a 35.6%. Finally, the remainder of the sample corresponds to an *established* class.

There are important differences in employment status across these classes. Among individuals in the *truly striving* class, only 51.2% are employed and only 34.6% of them have full-time jobs. Both shares are considerably lower compared

to the other two classes (67.2% and 50.8% respectively among Class 2 individuals, and 59.1% and 49.3% among Class 3 individuals). Table 7 describes the profile for each class. Only close to 1% of the persons in the *truly striving* group has any investment experience. The mean financial literacy score is considerably lower in this group, and the prevalence of the lax money management behavioral trait is larger for this class. It is also important to point out that the difference in average age between this class and Class 2 is not as large as the difference between the average ages of Class 2 and Class 3, and therefore differences between these classes cannot be only attributed to age differences.

Table 6 shows the estimation results for the probability of investment experience conditional on class affiliation for the three-class model. These results show that the investment behavior among Class 1 individuals is significantly different from other persons in the sample.

The impact of financial education at school or work is positive for all classes but significantly heterogeneous across the three groups. Its largest effect is observed among *truly striving* individuals. In contrast, financial education at home has a **negative** impact for Class 1 (significant at the 10% level), and positive and significant to the 5% level for Class 3 individuals. Also importantly, the group of *truly striving* individuals is the only one for which a significant effect of financial literacy on investment experience is not observed. Furthermore, a lax money management is associated with a higher probability of investing in risky assets among Class 1 households, while a relationship in the opposite direction is observed for the other two classes. Although Class 2 and Class 3 persons with high risk tolerance are more likely to have investment experience, we fail to observe such an impact for Class 1 individuals.

We now look at the relationship between financial fragility and the sample partition obtained from the three-class model. The FLS contains a question on household vulnerability, asking whether the person has set aside emergency or rainy day funds that would cover their expenses for 3 months, in case of sickness, job loss, economic downturn, or other emergencies. Those who answered "no or don't know" to this question were defined as the *urgently fragile*. Intuitively, one would expect that persons with investment experience in risky assets are less likely to be financially fragile. However, this is not the case for the *truly striving* group. Among Class 1 persons with any investment experience in risky assets, as many as 89.2% are *urgently fragile*. This is higher than the percentage of fragile people (84.6%) in the same class who have no investment experience. On the contrary, financial fragility is more prevalent among people with no investment experience in the other two classes. And, notably, Among Class 1 and *urgently fragile* persons with any investment experience, over 70% has received any financial education at school or the workplace, but **none** of them has received financial education at home by their parents.

Table 2: Probit Model Results

	Dependent: Has Investment Experience			
	(1)	(2)	(3)	(4)
FE at School/Work	0.5938***	0.5623***	0.5602***	0.5261***
	(0.0229)	(0.0261)	(0.0315)	(0.0323)
FE at Home	0.1126***	0.0413**	0.0016	0.0161
	(0.0144)	(0.0158)	(0.0197)	(0.0203)
Age		0.0228***	0.0143***	0.0158***
		(0.0004)	(0.0005)	(0.0006)
Female		−0.2644***	−0.3283***	−0.2433***
		(0.0127)	(0.0159)	(0.0168)
Years of Education		0.0809***	0.0516***	0.0508***
		(0.0033)	(0.0041)	(0.0043)
Financial Literacy Score		0.4647***	0.3413***	0.3235***
		(0.0075)	(0.0095)	(0.0102)
Income			0.0148***	0.0160***
			(0.0024)	(0.0025)
Financial Assets			0.0432***	0.0398***
			(0.0011)	(0.0011)
Lax Money Management				−0.0527***
				(0.0056)
Herd Behavior				0.0994***
				(0.0079)
Risk Tolerance				0.3171***
				(0.0069)
Myopic Behavior				−0.0118**
				(0.0056)
Constant	−0.4859***	−2.6482***	−2.0384***	−3.2458***
	(0.0186)	(0.0597)	(0.0740)	(0.0854)
AIC	66,373.00	54,713.21	35,111.35	32,622.48
Observations	50,000	49,935	32,746	32,746

Note: Robust standard errors in parenthesis *p<0.1 **p<0.05; ***p<0.01;
The estimation includes survey year controls.

Table 3: Two-class Finite Mixture Model: Class Affiliation Model Estimates

	Class 2 Membership Probability
Age	0.0375^{***}
	(0.0020)
Female	-0.8153^{***}
	(0.0578)
Years of Education	0.1320^{***}
	(0.0146)
Income	0.0081
	(0.0176)
Financial Assets	0.2832^{***}
	(0.0297)
AIC	32,411.98
Observations	32,746

Note: Robust standard errors in parenthesis *p<0.1 **p<0.05; ***p<0.01;

Table 4: Two-Class Finite Mixture Model: Investment Decision Model Estimates

	Dependent: Has Investment Experience		
	Class 1	Class 2	χ^2 Statistic
FE at School/Work	0.9407***	0.5076***	8.09***
	(0.1115)	(0.0702)	
FE at Home	−0.1470	0.0583*	3.35*
	(0.0974)	(0.0327)	
Financial Literacy Score	0.3794***	0.4289***	0.91
	(0.0450)	(0.0176)	
Income	0.0808***	−0.0038	40.10***
	(0.0133)	(0.0037)	
Lax Money Management	−0.0606**	−0.0605***	0.00
	(0.0242)	(0.0096)	
Herd Behavior	0.1889***	0.0878***	4.55**
	(0.0422)	(0.0128)	
Risk Tolerance	0.4151***	0.4177***	0.00
	(0.0363)	(0.0121)	
Myopic Behavior	−0.0003	0.0032	0.02
	(0.0231)	(0.0087)	
Constant	−3.8238***	−1.1426***	89.69***
	(0.2703)	(0.0766)	
AIC		32,411.98	
Observations		32,746	

Note: Robust standard errors in parenthesis *p<0.1 **p<0.05; ***p<0.01;
Estimations include survey year controls.

Table 5: Three-class Finite Mixture Model: Class Affiliation Model Estimates

	Class Membership Probability	
	(2)	(3)
Age	0.0084	0.0434***
	(0.0062)	(0.0050)
Female	-0.2035	−0.7992***
	(0.1757)	(0.1359)
Years of Education	−0.0407	0.0955***
	(0.0329)	(0.0274)
Income	0.1301***	0.0840*
	(0.0295)	(0.0310)
Financial Assets	1.4252***	1.5000***
	(0.1315)	(0.1333)
AIC	31,889.97	
Observations	32,746	

Note: Robust standard errors in parenthesis *p<0.1 **p<0.05; ***p<0.01;

Table 6: Two-Class Finite Mixture Model: Investment Decision Model Estimates

	Dependent: Has Investment Experience			
	Class 1	Class 2	Class 3	χ^2 Statistic
FE at School/Work	1.8568^{***}	0.5663^{***}	1.6275^{**}	11.88^{***}
	(0.4030)	(0.0824)	(0.7016)	
FE at Home	-4.7032^{*}	0.0025	0.1251^{**}	5.25^{*}
	(2.4417)	(0.0632)	(0.0604)	
Financial Literacy Score	0.0578	0.4282^{***}	0.5718^{***}	15.08^{**}
	(0.1408)	(0.0388)	(0.0402)	
Income	0.0197	0.0326^{*}	0.0195	0.78
	(0.0461)	(0.0192)	(0.0121)	
Lax Money Management	0.1917^{**}	-0.0634^{***}	-0.0733^{***}	11.99^{***}
	(0.0757)	(0.0208)	(0.0174)	
Herd Behavior	0.1634	0.2025^{***}	0.0821^{***}	8.09^{**}
	(0.1084)	(0.0306)	(0.0228)	
Risk Tolerance	−0.0223	0.5636^{***}	0.5156^{***}	37.22^{***}
	(0.0915)	(0.0334)	(0.0240)	
Myopic Behavior	−0.0392	0.0048	−0.0175	0.78
	(0.0684)	(0.0188)	(0.0158)	
Constant	-3.1337^{***}	-3.6934^{***}	-1.0059^{***}	90.62^{***}
	(0.6870)	(0.2664)	(0.1844)	
AIC		31,889.97		
Observations		32,746		

Note: Robust standard errors in parenthesis *p<0.1 **p<0.05; ***p<0.01;
Estimations include survey year controls.

Table 7: Latent Class Profiles

	Class 1		Class 2		Class 3	
	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
Investment Experience	0.01	0.12	0.06	0.23	0.92	0.26
Age	39.99	16.69	44.70	14.81	55.77	14.63
Female	0.53	0.50	0.55	0.50	0.38	0.48
Years of Education	13.66	2.14	14.01	2.00	14.67	1.97
Income	2.64	2.30	5.11	3.30	5.91	3.87
Financial Assets	0.11	0.35	5.31	6.10	13.02	9.63
Financial Literacy Score	-0.44	0.90	0.03	0.87	0.43	0.83
FE at Work/School	0.06	0.24	0.07	0.25	0.10	0.30
FE at Home	0.16	0.37	0.22	0.41	0.22	0.42
Lax Money Management	0.82	1.73	0.00	1.66	-0.35	1.59
Herd Behavior	2.62	1.10	2.64	1.04	2.56	1.06
Risk Tolerance	2.64	1.24	2.56	1.20	3.10	1.23
Myopic Behavior	3.48	1.50	3.07	1.57	3.15	1.59
Observations	6,002		11,247		15,497	

7 Discussions and Conclusions

We employ the FLS data and evaluate the impact of financial education on investment behavior in Japan. We estimate a three-class Finite Mixture Model, which uncovers important heterogeneity in preferences for investment by extracting three classes of individuals: a truly striving class, a relatively financially stable group, and an established group. We argue that the truly striving group is of special interest for policy makers when evaluating the welfare impact of financial education policies. It is less financially stable on average, and exhibits investment patterns that are considerably different from those of other groups. Persons in this group who have investment experience are more likely to be financially fragile, exhibit the lax money management trait, and their level of financial literacy is not significantly associated with their probability of investment.

Regarding the role of education, we observe that education at school or the workplace has a positive effect on the probability of investment experience, even after controlling for current financial literacy levels and behavioral traits. Its effect is especially strong among the truly striving group. On the other hand, the effect of financial education at home on subsequent investment in risky assets varied greatly depending on the individual's circumstances and stage in the life cycle. In particular, for Class 1 individuals, past parental education on money management is a factor that *discourages* investment in risky assets. This gap in the effects of different types of education is probably due to differences in the content and timing.

As mentioned in Section 2.2, until the 1960s, financial education in Japan was savings-oriented, and by the end of the 1950s, about half of primary and

secondary school students were saving in Children's Banks. In other words, half of the respondents between the ages of 60 and 79 in the FLS sample are expected to have saved in Children's Banks. However, only about 5 percent of them reported having had financial education at school or at work. This indicates that the variable of financial education experience at school or at work does not capture this sort of savings-oriented school education.[5]. On the other hand, 10.7% of the respondents aged 18-29 had experienced financial education at school or at work, which is significantly higher than in other age groups.[6] We can expect that most of these responses refer to education at school rather than the workplace, because some persons in that age range are still students at the time of the survey, and are less likely to have experienced financial education in the workplace compared to other age groups. Also, the financial education they have received at school is likely to be recent, as opposed to the savings-oriented education of the past.

In addition, people in their 30s to 50s received their compulsory education at a time when savings-oriented financial education in schools was declining, and before modern educational guidelines were introduced. For this reason, many of the respondents who said they received financial education at school or at work probably meant education at work. Most financial education in the workplace is likely to be provided for the purpose of managing risky assets. This can be in the form of joining a defined contribution pension plan or a stock options plan for employees. Taken together, this suggests that financial education at schools and workplaces in this study is not biased toward savings-oriented education, but includes a broader range of educational content, including investment.

On the other hand, "education on money management by parents at home" is expected to be biased toward savings. Based on the birth years of the respondents of this survey (1937-2001), we can assume that their parents were born between about 1900 and 1970. In other words, many of them lived during the period when Japan was promoting savings-oriented financial education, and it is reasonable to assume that the money education they provided to their children related to reflects this savings orientation to some extent. Furthermore, in Japan, child rearing is overwhelmingly performed by women. According to data by the Survey on Time Use and Leisure Activities (Statistics Bureau of Japan) for the years 1986 and 1996, among households with children under 6 years old, Japanese women spend on average over 2 hours per day purely on child rearing, compared to under 20 minutes in the case of men. As numerous previous studies and this paper have shown, women are less likely to invest in risky assets, and may also be less likely to provide investment-oriented education to their children.

If this is the case, then the results of this paper can be interpreted to mean that people who have been educated by their parents about the importance of

[5]Because the administrative work of the Children's Bank itself was done by the local children's association, it is possible that many people do not associate the Children's Bank with school education

[6]Figures are from the 2016 survey. For those in their 40s and older, the share is generally only 5 to 6%.

household financial management, especially saving, tend to refrain from making risky investments when their own economic situation is unstable. The FLS does not provide information about the content or timing of each respondent's education, so further verification is necessary.

Back to the analysis results, the lack of a significant effect of financial literacy for Class 1 persons is consistent with the findings in Lusardi, Michaud, and Mitchell (2020). In their model, they show that an exogenous increase in the stock of financial knowledge is less likely to translate into the usage of sophisticated investment technologies for lower income individuals. However, our estimates suggest that financial education may promote investment in risky assets through other mechanisms rather than through the increase in the stock of financial knowledge. Besides improving financial literacy, financial education may also provide know-how, and information about investment tools that may make it easy for individuals to invest in risky assets. However, this sort of information may result in unexpected investment behavior. In fact, we showed that most of the Class 1 financially fragile individuals with some investment experience had received financial education at school.

With the wider availability of mobile devices with access to the web, it has become easier than ever to invest in risky assets, including stocks, foreign currencies and cryptoassets. As transaction fees go down, financial services become more accessible to more financially fragile groups. However, lower costs may come at the expense of lower quality financial information. For this reason, it is important to consider not just the availability of financial education, but also its contents. As mentioned at the beginning of this paper, investment education will be introduced as a standard part of the high school curriculum starting in 2022. In Japan, about 99% of students finish high school, and many of them receive free education. Will the investment education they receive contribute to rational asset building behavior in all aspects of their life cycle? Will they be able to maintain the financial literacy they have acquired? Detailed examination and the accumulation of long-term panel data at the individual level, including information on the educational content, the timing of the education, and subsequent investment behavior, are essential for this purpose.

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