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Roots of Financial Literacy

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Roots of Financial Literacy

Antonia Grohmann, Roy Kouwenberg and Lukas Menkhoff

Abstract

Our study aims to uncover the roots of financial literacy. Better financial literacy predicts more informed savings and borrowing decisions in our sample, covering the urban middle-class in an emerging economy. We then test education at school, family background, parental teaching, and childhood experiences with money as potential determinants of financial literacy. In addition to risk tolerance and having basic numeracy skills, we find that family variables matter most, in particular better education of the mother and encouragement to save by parents. Our findings suggest that regular formal education may play only a limited role in shaping financial literacy.

JEL-Classification: D 14 (personal finance), G 20 (general financial institutions and services), O 16 (financial markets)

Keywords: financial literacy, saving, borrowing, instruments, family background, education

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Roots of Financial Literacy

1 Introduction

Many economic decisions require basic understanding of financial concepts, such as interest rates or inflation. However, people often lack this understanding. The degree of this deficiency has been systematically researched using tests, which collect “financial literacy” scores. There is growing evidence that individuals who possess higher financial literacy have better economic outcomes as it improves financial decision making. In this sense, better financial literacy also improves economic welfare in general. Whereas the impact of financial literacy has been frequently examined during the last years, it is not clear where financial literacy really comes from?

Despite this being an important question, it has largely been neglected so far, especially if one thinks about possible policy measures. Accepting that better financial literacy improves welfare, the question arises of what could be done in order to realize such welfare gains? The first instinct may be teaching financial issues in specialized courses, but coverage of such programs will be quite limited. More comprehensive would be integrating financial literacy lessons into the regular curriculum at school, but implementing this change may take a long time. Moreover, it is not fully obvious to which degree one can easily learn financial literacy because this measure is related to but different from numeracy. It seems plausible that family background, preferences and personality traits play a role and these origins are difficult to influence by any policy measures.

Overall, we find for our sample that indeed two family-related roots are important, namely general *family background* and *parental teaching* on financial behavior. From a policy perspective these roots of financial literacy are difficult to target, if possible at all. In contrast, the traditional dimension of public intervention, *education at school*, is much less important. Interestingly, good education that improves numeracy is helpful but this is almost self-evident, whereas specific economics education at school is less important for the degree of financial literacy. In addition, we do not find that *early experiences with money* have a significantly positive influence on financial literacy. Finally, financial literacy may be rooted in *personality traits* as we find that more risk tolerance is positively related to it.

The analysis of possible roots of financial literacy requires detailed knowledge about decision makers. Therefore, we have conducted a new questionnaire which is specifically designed for our research purpose. The implementation involves several decisions on which we give our arguments for the chosen procedure. This process starts with target group and location. We survey people from a broadly defined middle class in order to consider respondents whose decisions involve a lot of variety, e.g. on forms of savings products, other than the poor who are often targeted in research on developing countries (Xu and Zia, 2012). Moreover, the survey is conducted in an emerging economy, namely Thailand, with a faster changing environment compared to advanced economies, which makes financial literacy more important (Campbell, 2006).

Our survey covers more than 500 middle class people from Bangkok, the capital city and economic powerhouse of Thailand. These persons were interviewed in December 2012 and are responsible for their own or their household's financial decisions. Due to the use of standard survey items, performance on financial literacy can be compared to other countries and populations. This shows that our target group scores similarly to other groups we know from the literature so that we feel encouraged to draw generalized conclusions.

An important aspect in the questionnaire design is that we aim for broad coverage of possible effects of financial literacy. Evidence mainly stems from studies with a specific focus, such as retirement savings (Lusardi and Mitchell, 2007), debt taking (Lusardi and Tufano, 2009) or stock market participation (van Rooij et al., 2011a). Thus evidence is somewhat eclectic which is unsatisfying for implementing possible policy measures which ideally should improve a broad range of financial outcomes at the same time. Extending many earlier studies, we examine possible effects of financial literacy on both savings and borrowing decisions.

After confirming the impact of financial literacy on relevant outcomes, we address the main objective of the paper and ask the crucial question where financial literacy comes from. This issue has not been directly examined before; however, it has been indirectly touched upon in several papers when instruments for financial literacy are used. Instrumentation is sometimes used in order to ensure that the relationship between financial literacy is not due to reverse causality (i.e., from financial outcomes on financial literacy). For example, making better savings decisions contributes to wealth which increases the incentive to care more about financial assets. Moreover, instruments are used to deal with potential endogeneity problems, caused by unobserved variable

bias or potential measurement errors. Consequently, the variables being suggested to instrument for financial literacy should be unrelated to financial outcomes; therefore they typically refer to childhood experiences.

We pick up on this idea that childhood experiences may be a good predictor for financial literacy. As these experiences clearly happened in the past, their direct effect on financial outcomes today should be of little concern. Thus we compile a set of possible (instrumental) variables, most of them suggested in the literature, and examine which ones may be important in explaining financial literacy.

Our main finding is the high importance of family-related variables, in addition to risk tolerance. Two of these family-related variables are very robust to the inclusion of control variables: (1) advanced education of the mother (vocational training or university degree) and (2) that parents encouraged their children to save. The relevance of both variables is supported by evidence from other strands of literature. Education of the mother may be seen as proxy for positive early childhood experiences which are important for favorable later outcomes (Carneiro and Heckman, 2003). Parents' encouragement to save may be seen as an attempt to provide financial education at home; moreover, one may interpret it as an effort to decrease time preference, which is also linked to several desired life outcomes (Webley and Nyhus, 2006, Mischel et al., 2011).

Our second finding regarding roots of financial literacy is that overall a variety of influences is relevant which limits the relative importance of economic education at school. This is interesting from a policy perspective because variants of school education seem to be natural candidates if policy makers would like to tap the full potential of financial literacy. Among the variables beyond the family-related ones is individual risk aversion. More risk tolerant persons show a higher degree of financial literacy.

Our research is clearly linked to the rapidly growing literature on financial literacy. The earlier studies, pioneered more than ten years ago, mainly focus on advanced economies and on individual behavior regarding retirement savings and asset allocation. The last few years have seen an extension of studies on financial literacy to developing countries and the consideration of borrowing decisions. We selectively survey this literature in the following Section 2. Our focus is on the roots of financial literacy. In order to examine this reliably we use a broader set of potential outcomes than often before. Finally, the existing literature provides limited information about

financial literacy among the rapidly expanding urban middle class in developing economies, the target group of our research.

This study is organized in five sections following the introduction. Section 2 summarizes relevant literature to provide the background for our own work. Our unique dataset is described in Section 3, and we show the influence of financial literacy on relevant outcomes. Section 4 gives the main results of our empirical research on the roots of financial literacy. Robustness checks are documented in Section 5, and Section 6 concludes.

2 Literature

Research on financial literacy has grown enormously over the last ten years (see surveys by Lusardi and Mitchell, 2011, 2014, or Xu and Zia, 2012). We mainly refer to these surveys when we discuss the evidence on the relation between financial literacy and financial decisions (Section 2.1) and correlates of financial literacy (Section 2.2). In Section 2.3 we cover studies that use instrumental variables to reveal the causal impact of financial literacy.

2.1 Financial literacy and financial decisions

The first issue being that was researched is a possible influence of financial literacy on retirement savings. Starting from the observation that people save to a very different degree for their retirement phase in life, the question arises whether the understanding of financial concepts might play a role. The argument is that people with higher savings think about and plan more for their pensions and that this planning is supported by their better financial literacy. In this sense financial literacy provides the skills to make more rational financial decisions which lead to higher welfare in the end. This line of argument has been well documented for the U.S., where private savings decisions for retirement are particularly important, and has been extended to further countries since (Lusardi and Mitchell, 2008, Bucher-Koenen and Lusardi, 2011, van Rooij et al., 2011b).

Starting with these insights about retirement savings, the literature has since moved on to examine the effect of financial literacy on a large number of saving and borrowing decisions. With regards to savings, the decision to participate in pensions plans can be seen as an example for sophisticated savings. Similarly, financially literate individuals are more likely to invest in stocks (van Rooij et al., 2011a) and have more diverse portfolios (Guiso and Jappelli, 2008).

Regarding borrowing decisions, financially literate people have lower cost debt and are more likely to report that they know their optimal level of debt (Lusardi and Tufano, 2009). They have less high cost consumer credit (Disney and Gathergood, 2013) and fewer problems with repaying credit card debt (Gathergood, 2012).

2.2 Correlates of financial literacy

Studies find several quite robust and economically plausible socio-demographic correlates of financial literacy. We do not refer here to single studies but mainly rely on the surveys by Lusardi and Mitchell (2011, 2014).

(i) Among the robust findings is a *gender* effect in that women usually score lower on financial literacy measures, probably because of lesser involvement of women in financial decisions. (ii) Regarding *age*, it has been shown that the relationship between age and financial literacy is humped-shaped, with the young and the old scoring the lowest, whereas those in between have exposure to and experience with financial affairs. (iii) Very robust is the finding that *income and wealth* are positively related to better financial literacy. This seems almost self-evident, although causality is unclear, as higher income also requires more financial decisions. (iv) The relationship is similar regarding *education*, as better educated people understand financial concepts more easily. (v) Again related to financial literacy is an education-outcome or education-correlate, namely *numeracy*. Obviously, persons with good numeracy skills understand financial concepts more easily. Some researchers have also proposed to extend the range of possibly related variables to (vi) individual *attitudes*. Prominent examples are attitudes towards risk and towards time discounting as more risk tolerance and more patience are related to better financial literacy.

2.3 Causal impact of financial literacy

Even though theoretical reasoning may prefer a causal link from literacy to good decision making, it not clear that these links are not due to reverse causality. This is especially true on the savings or asset side, for example, holding stocks compared to holding just a bank account may provide some kind of financial literacy training. On the borrowing side, however, reverse causality is hard to imagine, as it seems unlikely that individuals with high debt become less financially literate because they have high debt. However, endogeneity is still an issue in these models as well. It seems possible that unobserved variables codetermine financial literacy and

financial behavior. Furthermore, it is possible that financial literacy is measured with error, which would lead to further endogeneity. Therefore, several researchers have used an instrumental variable (IV) approach in order to clarify causality and isolate the effect of financial literacy.

The main conclusion arising from studies employing IV-methods is that financial literacy has a direct causal effect on wealth accumulation (Behrman et al., 2010, 2012; van Rooij et al., 2012), retirement planning (Lusardi and Mitchell, 2009; van Rooij et al., 2011b) and stock market participation (van Rooij et al., 2011a). In many cases the effect of financial literacy on the outcome variable becomes *stronger* after changing the methodology from ordinary least squares to a specification where financial literacy is instrumented.

For our research the instruments used in these studies are especially relevant, as they are potential determinants of financial literacy. Natural candidates are early-life financial education, and childhood experiences that favor the development of financial literacy; we refer to these instruments in more detail below. Proxies for the ease at which a household can access information about financial issues (e.g. being an economist or living with an economist) have also been used to explain beneficial financial outcomes. Other instruments refer to the unstable financial situation of relatives (van Rooij et al., 2011a), which is seen as a motivation to improve one's own behavior. Finally, some studies exploit regional differences, such as the number of universities (Klapper et al., 2013) or the proportion of the general population that votes for a certain party (Bucher-Koenen and Lusardi, 2011).

Childhood experiences and family background as instruments. A large number of studies document the importance of early life events for later economic outcomes. Webley and Nyhus (2006, 2013) find that the amount of money adults save is positively related to economic socialization early in life, for example having had a bank account as child, whether the parents taught budgeting, or parental encouragement to save. Shim et al. (2010) show the importance of parents for stimulating good financial behavior and financial knowledge, with the role of parents being more important than the combined effect of financial education and work experience during high school. The mechanism through which this works is not entirely clear, but a number of studies find that early childhood experiences, and possible childhood interventions, are important for the formation of cognitive as well as non-cognitive skills (Heckman, 2007). Behrman et al.

(2010) use several family background variables¹ as instruments for financial literacy in a regression explaining wealth accumulation among adults in Chile. They find that all family background variables have a significant impact on financial literacy, but only primary schooling in an urban area is also a good instrument, because it does not directly predict wealth accumulation.

Financial education variables as instruments. Early training in financial decision making, either directly or indirectly through economic education, has also been used as an instrument for financial literacy (van Rooij et al. 2011b, 2012; Lusardi and Mitchell, 2009). These studies show that early financial education has a significant impact on financial literacy. However, because financial education and outcome variables such as wealth accumulation may be driven by a common unobserved factor, the validity of these instruments is not always clear. For example, Bernheim et al. (2001, 2003) find that financial education leads to higher levels of wealth later in life. These results hold for employer based training, as well as when exploiting state-level variation in the mandatory coverage of financial education in U.S. high schools. However, Cole and Shastry (2009) find that when they extend the specification used by Bernheim et al. (2001) to include state fixed effects, financial education has no direct effect on financial market participation or investment income. Carlin (2012), show that in a hypothetical decision game, students that has previously received financial literacy training, have significantly higher savings rates.

3 Data

This section describes the conduct of the survey implemented in Bangkok in December 2012 (Section 3.1), provides definitions and descriptive statistics about socio-demographic variables used (Section 3.2), our measure of financial literacy (Section 3.3) and numeracy and risk attitude (Section 3.4).

3.1 Data collection by a survey

The data necessary for this research is not available and thus had to be collected. Data collection took place in Bangkok over a ten day period in December 2012 in order to get useful responses from more than 500 persons. Interviews were conducted face to face by a Bangkok

¹ The variables are: education level of the mother and the father, considering ones economic background as a child to be poor, working before the age of 15, and having completed primary school in an urban area.

based market research company. This company has a long-standing relationship and cooperation with various researchers from one of the participating universities. The research team designed the questionnaire and the market research company gave advice regarding its implementation. As next step we conducted a test run with individuals who have the same characteristics as the target group and the final version of the questionnaire was the basis for training the interviewers.

Survey participants were intercepted in public places throughout Bangkok and were chosen at random. The areas in which each team operated were decided on before the start of the survey; they consisted of six different main areas in Bangkok and 28 specific locations. Locations were chosen so that a balanced sample with respect to income, education, wealth and employment status would be collected. Hence data collection took place in business as well as residential areas of Bangkok. Interviewer teams consisted of three to four people, with one person acting as team leader. Each interviewer had previous experience conducting interviews and was trained on this specific questionnaire. On a given day each team was responsible for a certain area of Bangkok. Despite working in teams, respondents were approached and interviews were conducted by one person only. Rates of participation were fairly high with 85% of those approached willing to be part of the survey. Participants were made aware that the information would be used for academic research purposes only. Interviews took 20 to 30 minutes and participants were given a small present as a thank you for taking part.

Due to the potential difficulty caused by surveying using street intercepts, great care was taken to stratify the sample. Thus a number of four pre-selection criteria were used (and respective questions asked) in order to determine suitability of each potential respondent. These four criteria are: age, income, financial responsibility and gender. (1) The individual's age was required to be between 18 and 60 years, with 60 being the mandatory retirement age, in order to target financially active respondents. (2) Participants had to earn at least 15,000 Baht per month (460 USD). The amount is equivalent to the starting salary for a recent graduate with a bachelor degree in Bangkok, as the aim of this paper is to study financial literacy among the urban middle class. According the Thai National Statistics Office (2011), 29% of the regularly employed in Bangkok earn 15,000 Baht or more. (3) Interview subjects also had to be responsible for their own, or their household's, financial decisions. (4) Finally, regarding gender we aimed for a balanced group, considering the fact that women as well as men often have financial responsibility in the country. If individuals approached did not fulfill these requirements,

interviews were discontinued after the preliminary questions. Roughly 31% of those approached failed initial screening, mostly due to incomes being too low.

3.2 Description of socio-demographic variables

As this paper focuses solely on the urban middle class, both average individual and household income are higher than the Bangkok average. Mean individual income in our survey (see [Table 1](#), Panel A) is 26,800 Baht per month (840 USD) which is considerably higher than average income of an employee in Bangkok of 16,961 Baht per month (530 USD) in 2011 according to the Thai National Statistics Office. It is worth mentioning that the standard deviation for our income variable is high at 20,499, so there is substantial heterogeneity. Indeed, 21.1% of our sample earn just 15,000 Baht a month. Household income, as was estimated by the respondent, is also higher for our sample than the Bangkok average: the mean in our sample is 64,400 Baht per month (2,010 USD), whereas the Bangkok average as published by National Statistics is 41,600 Baht per month (1,300 USD).

Our sample is not only richer than the Bangkok average; it is also young and highly educated, as 47% are 30 years of age or younger and most respondents have a higher educational degree. The highest educational attainment of 64% of our respondents is a bachelor degree, compared to 36% in the Bangkok labor force (National Statistics, 2011). As an explanation for the high education level in our sample (see [Table 1](#), [Panel B](#)), we note that bachelor degrees have become a minimum requirement for white collar jobs in Thailand. As part of a push by the government to raise education levels, bachelor degree programs have grown rapidly.

The proportion of women in our sample is 48%, close to the 49.6% population proportion among the labor force in Bangkok (National Statistics, 2011). Information on household composition is also collected, the average number of children is 0.8 and the number of adults per household is 3.0. The average number of full-time income earners in the household is 2.5. These results indicate that many households include grown up offspring living with their parents, despite being part of the work force, which can be explained both by the family-centered Asian culture and the high costs of living.

3.3 Description of financial literacy

Financial literacy is usually measured by a score and there are various ways to do this. We motivate our choice and show the resulting level and distribution of financial literacy in our sample.

Financial literacy measure. In our analysis we choose to use the basic Lusardi and Mitchell score, which is based on three items, and extend it with our own item about financial institutional knowledge.

The Lusardi-Mitchell score is the most prominent measure of financial literacy. We include three questions first used by Lusardi and Mitchell in the 2004 US Health and Retirement survey (Lusardi and Mitchell, 2006), which have become standards in the literature. Regarding the first question we follow the slight adaptation to a developing country as proposed by Cole et al. (2011). These questions test understanding for three key financial concepts: interest rates, inflation, and risk diversification. In line with the literature, we simply award one point for each question that is answered correctly. Hence these questions award a score between 0 and 3.

In addition to these standard items, we also ask respondents to name foreign banks that operate in Thailand. There are about ten foreign banks operating in the retail market in Bangkok. Being able to name these foreign retail banks, beyond more familiar local banks, is a proxy of knowledge of financial institutions. The question is open-ended and there is no time limit on how long respondents can take to answer. Respondents are able to name up to four foreign banks. To construct our overall financial literacy measure, on top of the Lusardi and Mitchell literacy score, we award 0.25 points per foreign bank. This way we are giving the same weight to being able to name four foreign banks as we are giving to one of the other three questions. Thus, the overall financial literacy final score is in the range between zero and four. There are also other ways to measure financial literacy, but our results do not depend on the specific measure, as we demonstrate in the robustness section.

Financial literacy results. Regarding the Lusardi-Mitchell measure, the number of correct answers is fairly high for the first and second question. Knowledge of interest rates seems good, with 79% answering the first question correctly ([Table 2](#), Panel A). Slightly fewer people seem to have a good grasp of inflation. Only 62% answered this question correctly, with 12% claiming that they don't know or refuse to answer. Most striking are the answers to the third question, which requires knowledge of the concept of portfolio diversification in the stock market context. Only 24% of respondents can answer this question correctly, with a high 52% answering I don't

know/refuse to answer. It is not clear whether these poor results are due to a lack of knowledge on the working of the stock market, or alternatively, because individuals do not grasp risk diversification. Unsurprisingly, only 17.6% of the respondents answer all three questions correctly. Most respondents, 41.1% of the sample, give two correct answers, while a small minority of 11% does not have correct answers at all.

As the benchmark questions have been used in many other countries, we can compare results across countries. It is most noticeable that the number of correct answers in Bangkok is not hugely different from those in developed countries (Xu and Zia, 2012). At the same time, our Bangkok middle class residents do considerably better in all questions than the rural poor surveyed by Cole et al. (2011).

When it comes to naming foreign banks, respondents name between zero and four foreign banks, with only one person was able to name six foreign banks. To avoid an outlier in the financial literacy measure, this single observation was set back to four. The mean number of foreign banks mentioned is 2.24 (Table 2, Panel B), with 20.1% being able to name four and 6.5% being able to name none at all. Figure 1 shows the distribution of our new financial literacy measure that includes the name foreign banks score (scale: 0 to 4) in Panel B, and the standard Lusardi-Mitchell score (scale: 0 to 3) in Panel A. The new financial literacy measure is more evenly distributed, with a mean of 2.2 and mode of 2.5, while only 1.1% get a score of zero.

Correlations (Table 2, Panel C) show that each question measures a different element of financial literacy, as none of the correlations exceeds 0.3. Relatively, the highest correlation is between the inflation question and the portfolio diversification question. The name foreign bank score is correlated with the inflation and diversification questions, although not strongly.

3.4 Description of numeracy and risk attitude

Financial literacy clearly involves a certain level of numeracy (mathematical ability), but pure knowledge of financial concepts is also necessary. In order to differentiate between financial literacy and numeracy, we ask four math-based questions, which correspond to four of the eight maths questions used by Cole et al. (2011). Respondents perform much better on these questions than on financial literacy, with the average number of correct answers being 3.6 (Table 3, Panels A and B), as opposed to 2.2 for the financial literacy items. These results indicate that the

respondents are able to perform simple calculation tasks and poor performance on the financial literacy questions is mostly due to lack of financial knowledge.

In addition to this, two questions on risk attitudes are included. The first item is a qualitative measure of risk attitude, where respondents are required to place themselves on a scale from 0 to 10, with 0 meaning “unwilling to take risk” and 10 meaning “fully prepared to take risk”. This item has been applied before, see, for example, Dohmen et al. (2011) for Germany and Hardeweg et al. (2013) for Thailand.² The second risk measure asks respondents what proportion of a 10,000 Baht lottery win they would invest in a business that has equal chances of winning and losing. We turn both these measures of risk tolerance into a measure for risk aversion by reversing the scale to a score between zero and one.

Correlations between our measure of financial literacy, numeracy and the two measures of risk attitude are shown in Table 3, Panel C. The signs of coefficients are as expected and the closest relation emerges, naturally, between the two risk measures. In further correlation exercises (presented in Appendix 1) we find that our data mainly show the expected patterns. For example, financial literacy is higher for more educated and higher income respondents.

3.5 The influence of financial literacy on financial decisions

We now briefly report how financial literacy influences financial decision making. We examine five saving and five borrowing decisions. The savings decisions comprise four decisions about savings products and one decision about diversification. The products are somewhat specific to the Thai context: (1) As virtually everybody in Bangkok’s middle class holds a savings account, we take holding “assets other than a savings account” as a simple indicator of informed savings behavior. (2) For the middle class in Thailand, “fixed savings deposits” indicate an informed decision due to tax advantages and attractive interest rates. (3) In line with the literature, we analyze the ownership of “stocks and stock mutual funds” as sign of an informed financial decision making. (4) We examine having “life insurance” as an uninformed financial decision, as the life insurance policies offered to individuals in the Thai market are savings products with low effective interest rates. (5) Finally, we simply measure the useful diversification of assets by counting the “number of different asset types” that a person holds.

² The average response is 5.5, implying that the distribution of answers is somewhat shifted towards willingness to take risk, which is unusual for earlier applications of this measure (Table 3, Panel B). Nevertheless, as we are interested in risk attitude relative to others, the mean of this distribution does not require further attention.

In regards to borrowing decisions we analyze two dimensions, three decisions about the use of credit cards and two decisions about loans: (1) A persons who “does not know the [high] interest rate on credit card” to be paid can be seen as tentatively uninformed and may underestimate the effective debt burden. (2) In Thailand (and elsewhere) a full monthly repayment of the credit card debt is advisable as this kind of debt is particularly expensive. Thus we ask people whether he or she “has difficulty paying off credit card”, where such a difficulty would also be an indicator of uninformed behavior. (3) As an indicator regarding the concern of policy makers about the level of debt for consumption purposes, we ask for the “number of credit cards” where a large number may signal a lack of spending control and excessive credit. (4) Even more consequent, but probably exaggerating the concern, we analyze whether there is a link between “having debt” and financial literacy. (5) Finally, as a rough measure of potentially uninformed excessive borrowing, we examine “having debt larger than annual income”.

Results for these ten regressions are presented in [Table 4](#) in shortened form, showing only coefficients of the financial literacy measure, the Pseudo- R^2 and the number of observations. The full regression results are available in [Appendix 2](#), including the estimates for all control variables, including numeracy, education, income and assets. Panel A of Table 4 covers saving decisions: we find that the relationship between financial literacy and better savings behavior – as proxied by the variables (1) to (5) – is mostly statistically significant and economically meaningful. Further, financial literacy is not synonymous with numeracy and general education, as they were explicitly controlled for (see Appendix 2). Panel B covers borrowing decisions: regarding the first two decisions on the use of credit card debt, financial literacy has a significant effect in reducing uninformed behavior. In contrast, the three remaining indicators of (too much) borrowing do not show a direct relationship with the degree of financial literacy.

We thus confirm that financial literacy has a positive effect on financial decisions. Higher financial literacy relates to informed savings, choosing more advanced financial products and better diversification. Furthermore, it relates to a more informed use of credit card debt. These results are novel in the sense that they cover a newly compiled data set in a country (Thailand) where financial literacy has not been studied before, and they inform about a rapidly growing group in the world economy, i.e. the “new” middle class in emerging economies. Moreover, we extend many studies by incorporating both saving and borrowing decisions, and we control for a large number of socio-demographic characteristics, including numeracy and risk attitude.

4 Determinants of financial literacy

In this section we examine possible determinants of financial literacy. As a first step we shortly describe the respective variables (Section 4.1). Then we test these variables as determinants of financial literacy (Section 4.2), and analyze their robustness and relative importance (Section 4.3).

4.1 The set of possible childhood determinants of financial literacy

The variables which may be helpful in explaining financial literacy are typically introduced into the literature as instruments for financial literacy. In their ability to serve as instruments they must be related to financial literacy, but they should not be related to the outcomes of financial literacy, so they are mostly taken from the childhood experiences of adults. Thus, these variables seem to have attractive properties for serving in our study as possible determinants of financial literacy.

We discuss these variables according to their relevance during childhood. We here think of a timeline and distinguish into four broadly defined periods: (1) early childhood where the unspecific influence of the parents and the family dominates, (2) the explicit efforts of parental teaching of growing children, (3) the period of formal education when children go to school, and (4) finally children's own early experiences. In short, we distinguish *family background*, *parental teaching*, *education at school* and *early experiences with money*.

Family background. The first persons to influence a child are the parents, which is why we include the maternal and paternal education level as potential determinants of financial literacy. Moreover, we ask respondent to rate the financial understanding of their parents and whether they consider their economic background when growing up to be poor. We expect that having parents with higher education and better financial understanding improves financial literacy, whereas tentatively a poor economic background may deter development of financial literacy. Descriptive statistics of these and further childhood variables are provided in [Table 5](#). In stark contrast to the respondents themselves, their parents have comparatively poor education considering that just 28% of fathers and 22% of mother received at least vocational training. Seen from this perspective, it seems plausible that a remarkable 28% of respondents regard their

economic background as poor. Interestingly, the assessment of parents' financial understanding on a scale from 1 to 6, representing "very bad" to "very good" is rather good with a mean of 4.4.

Parental teaching. Another important aspect of family background is whether the parents directly stimulated or instructed their children to learn about money, saving and other financial matters. We proxy such "parental teaching" by two items: (1) whether as a child parents taught them how to budget and, (2) whether the parents encouraged savings. Table 5 shows that 83% of the respondents in our sample were taught how to budget as a child, and 86% of parents encouraged savings. We expect both items to positively predict financial literacy.

Education at school. Formal education in general and taking economics as a subject in particular, may support better understanding of financial affairs. Beyond the highest degree completed, we collect data on three additional items. First, and obviously linked to higher financial literacy, we ask respondents whether they took economics as a subject at school. Second, we ask whether the respondent was born in Bangkok. We use this variable as a proxy for having received better basic education, as schools in Bangkok tend to be of higher quality than those in rural areas. Third, along the same lines, completion of the highest educational degree in Bangkok may provide further information about having had a relatively good higher education. We see in Table 5 that two thirds of our sample had economics as a subject at school, 64% were born in Bangkok and 87% received their highest degree in Bangkok.

Early experiences with money. We here tap into the economic socialization literature that looks at how children are exposed to experiences with money. We ask if respondents had an allowance as child, whether they had a job before the age of 15 and if they have had a bank account before turning 18. Remarkably, more than 99% of respondents in our sample had an allowance as child. This high proportion may be due to the ex ante-selection of the sample, in particular due to today's minimum income of 15,000 Baht, which largely also excludes the formerly poorest parts of the population. As a consequence, we have to drop this item from our further analysis because there is no variation in responses. 57% of respondents say that they had a bank account before 18. On the last item here, about half of the participants (47%) answer having had a job before the age of 15. In most cases this was not a full-time job, because most of the respondents have a college education. With regard to our financial literacy measure, only having had a bank account before 18 is, surprisingly, negatively correlated with financial literacy. What we can say is that the early bank account (different from job before age 15) is not related to ones

economic background being poor, indicating that a job before turning 15 is due to necessity, whilst a bank account before 18 may signal a more comfortable upbringing.

4.2 Determinants of financial literacy and their relative importance

This section reports the main results of the paper. We proceed in two steps: (i) we explain the individual's level of financial literacy by the groups of childhood variables introduced in Section 4.1, and (ii) we also consider the set of socio-demographic variables.

Childhood variables as determinants. We discuss the possible influence of childhood variables according to the timeline introduced in Section 4.1. Empirical results are provided in [Table 6](#), specification (1). Starting with the family background, education of the mother is highly significant with the expected sign. By contrast the father's education does not play a role. Among the items reflecting on parental teaching, parents' encouragement to save is also highly significant with the expected sign.

Turning to formal education variables, having economics as a subject at school is significant at the 10% level, while the Bangkok-proxies for good formal education are insignificant. Finally, the experience variables show a somewhat surprising result, as the "bank account before 18" has a negative sign, indicating that this experience has a negative influence on financial literacy; however, this variable becomes insignificant after using more controls as we show later. Overall, the adjusted R^2 is 0.09, not too bad for cross-sectional individual data where many unobserved idiosyncratic influences will play a role.

As an extension of this specification, we stepwise exclude insignificant variables to better take account of the interrelations between variables. It is obvious that some variables are highly correlated, such as mother's and father's education or being born in Bangkok and highest degree awarded in Bangkok. As stepwise exclusion of variables may lead to path dependency, we explore several paths and present a result that is robust as specification (2) in [Table 6](#). What stands out is that the significant variables in the original specification (1) remain in the reduced model (2), that their significance levels are always at least at 5% and that there is hardly any decrease in explanatory power despite the much reduced number of variables.

The economic interpretation of this regression is obviously that childhood variables of various origins seem to play an important role as roots of financial literacy. Two family variables, mother's education and encouragement to save, plus economics at school are the main

determinants of financial literacy. The negative impact from having a bank account before 18 may pick up other effects, as it is not robust to inclusion of socio-demographic variable and risk aversion (as we will see soon).

Considering also socio-demographic variables. As next step we include standard socio-demographic variables as controls of the childhood variables, as well as risk aversion, numeracy, monthly income and dummies for the amount of financial assets. Specification (3) in Table 6 shows that the adjusted R^2 increases considerably, from 0.09 to 0.16. A very important variable is risk aversion, showing that higher risk aversion is associated with lower financial literacy. Beyond the simple interpretation of risk averse people simply being less likely to hold risky financial assets and so having less training in financial affairs, it is also conceivable that our measure of risk aversion is a more abstract measure of cognitive ability (Dohmen et al., 2010), which would explain this very robust correlation. Numeracy and income are also statistically significant; stronger numeracy scores and higher income are associated with better financial literacy. As a consequence of including these additional variables, the previously significant determinants “economics at school” and “bank account before 18” turn insignificant.

In more detail, controlling for numeracy reduces the significance of having had economics as a subject at school, whereas having a bank account before 18 is no longer significant after taking into account risk aversion. Thus, among the set of childhood variables, only the family-related ones survive, whereas the others are substituted by risk preferences (risk aversion), basic math skills (numeracy) and socio-demographic variables.

In another specification (4) we again eliminate insignificant variables stepwise, leaving only significant variables. We learn that this leads to five “surviving variables”: financial literacy is improved by good education of the mother, parents’ encouragement to save, good numeracy, high risk tolerance and high income. The result remains if we exclude income because of its potentially endogenous character, see specifications (5) and (6).

The economic interpretation of these findings is clear cut: childhood experience with money is irrelevant, at least in the way being captured here. Even education at school is relatively unimportant; only the variable numeracy survives, which is not surprising given the fact that correctly answering some of the financial literacy items requires basic mathematical skills. Nevertheless, numeracy and thus formal education helps. By far dominant, however, is the role of family background, parental teaching and risk preferences, here proxied by mother’s education,

parents' encouragement of saving behavior and low risk aversion. These variables seem to best explain the degree of financial literacy in our sample and are at the same time beyond the reach of conventional policy measures.

4.3 Extended analyses of the role of childhood experiences

Our results so far show that family background has the strongest influence on financial literacy. We now analyze the role of childhood experiences in more detail, by addressing three questions: (i) Do different childhood experiences influence the four individual elements of the financial literacy measure differently, (ii) do childhood experiences influence financial literacy differently for those from well-to-do and less well-off families, and (iii) do childhood factors influence numeracy as well as financial literacy?

Separate financial literacy questions. In [Table 7](#), instead of looking at the aggregated financial literacy score, we examine the effect of childhood variables in our timeline on the four financial literacy questions (items) separately. Since each question measures a slightly different aspect of financial literacy, this can help us to understand the roots of financial literacy further. What is clear from Table 7 is that most of our results are driven by the questions on inflation and diversification, which are also the hardest questions for people to answer. It is not surprising that the question on interest rates is not significantly related to childhood experiences, as almost 80% of the respondents answer that question correctly, so there is little variation left to explain.

Having a mother with at least vocational training has a significant positive effect on the ability to answer questions two (inflation) and three (diversification) correctly. Parental encouragement to save significantly increases the ability to answer question three (diversification) correctly and also has a significant effect at the 10% level on being able to name foreign banks. The socio-demographic variables also show some interesting results. Risk aversion has a highly significant negative effect on all aspects of financial literacy. In line with the argument that our results are mostly driven by the harder questions, the regression results show that the link between income and financial literacy only exists for question two and three. On the other hand, it makes sense that numeracy only improves the chance of answering questions one (interest) and two (inflation) correctly, as answering these two questions requires some calculations.

Family background. In order to analyze the possibility of our variables having different effects for people from different family backgrounds, we split our sample by two different

criteria: first, we examine the determinants of financial literacy for those that have uneducated and educated mothers separately; second, we examine separately those who consider their economic background to be poor, and those who do not. We can use both indicators as proxies for a less (or more) privileged upbringing and therefore the results may guide targeted policy measures.

Results are presented in [Table 8](#). As in previous regression results, risk aversion shows the strongest link to financial literacy. Apart from this some interesting patterns emerge. Parental encouragement to save seems to have a stronger effect on financial literacy for those with an uneducated mother. Conversely, economics at school only shows significant effects for those that have educated mothers. Similarly, in this table the link between numeracy and financial literacy only exists for those with non-poor economic backgrounds. We can only speculate about the exact forces at work here, but it is possible that those from better socio-economic backgrounds gain more knowledge at school, or are better at learning in a formal setting. On the other hand, those from poorer backgrounds benefit more from informal teaching at home.

Another interesting finding is that income only has a significant positive relation with financial literacy among those from poorer socio-economic backgrounds. However, endogeneity is a plausible explanation here: innate abilities may strongly influence both financial literacy and income among those from less privileged backgrounds, such as cognitive abilities and determination to succeed.

Numeracy. So far we have treated numeracy as independent from the other childhood factors that we analyze. However, it is highly likely that numeracy is also influenced by the same childhood factors that determine financial literacy. We have tested this and results are shown in [Table 9](#). The models in columns 1 and 2 include childhood variables and socio-demographic factors as predictors of numeracy. In columns 3 and 4 we also add financial literacy to the model. The most notable result is that numeracy is determined by other variables than financial literacy. Other than for financial literacy, formal education has a very strong effect on numeracy. Both economics at school and having attained the highest degree in Bangkok, which is a proxy for educational quality, have a highly significant positive effect on numeracy in all specifications.

Family background seems to have no effect on numeracy, and neither do early experiences with money. Parental teaching appears to be important, especially having been taught how to budget, which is interesting as it has no effect on financial literacy. Parents encouraged savings is only significant at the 10% level, and becomes insignificant after controlling for financial literacy.

The socio-demographic variables show that numeracy and risk aversion are also strongly linked, and higher income goes hand in hand with higher numeracy. As these are not childhood variables, the line of causality is unclear and unobserved factors may play a role. It is also worth noting that having a bachelor degree has no effect on basic numeracy.

The analysis in this section shows us that even though formal education has only limited influence on financial literacy, it has a strong effect on numeracy. This in turn can improve aspects of financial literacy that require basic calculations.

5 Robustness tests

This section presents several tests of the robustness of our results. These tests include (i) the use of modified measures of financial literacy, (ii) the use of other regression approaches, in particular the use of OLS, (iii) the explicit consideration of the lower income part of the sample in order to see whether financial literacy has possibly even larger impact there and (iv) a test to see if our significant variables in the timeline approach can be replaced by other variables from the same sections.

Other measures of financial literacy. As a modification of the benchmark measure above, we apply three other measures of financial literacy which have been suggested before. First, we use the classical Lusardi and Mitchell score of three items. Secondly, financial literacy has been approximated by a full score only (Bucher-Koenen and Lusardi, 2011, Gathergood, 2012). Consequently, the earlier score from 0 to 3 is transformed into a 0-1 variable. This score only shows the result for those respondents with very high financial literacy. Third, we also use another question that Cole et al. (2011) supplement the three standard Lusardi and Mitchell-items with. This question asks respondents to distinguish between two loans. *Suppose you need to borrow 50,000 Baht. Two people offer you a loan, the first loan you have to pay back 60,000 Baht in one month, with the second loan you have to pay back 50,000 Baht plus 15% in one month. Which loan is the better option? a) the first b) the second.* As the construction of this item is similar to the other ones introduced by Lusardi and Mitchell, correct answers are simply added up, leading to a score between 0 and 4.

In our sample many respondents have good knowledge of practical borrowing, with 73% answering the additional question taken from Cole et.al (2011) correctly. Further, this item is highly correlated with the basic Lusardi-Mitchell question on interest rates. Due to their

construction, all the alternative measures of financial literacy are positively correlated, with coefficients ranging from 0.63 to 0.95. Nevertheless, these measures are not the same and thus we will inspect their contribution in explaining financial decision making. Therefore, [Table A6](#) in the appendix shows results of regressions which reproduce the main specifications of Table A3 and A4; the table shows the coefficients of the various financial literacy measures in comparison to each other, plus the R^2 s. In general, the results for most dependent variables are robust to changing the financial literacy measure.

Other regression approaches. We basically repeat the main regressions with a simple OLS approach in order to see whether results are robust to even less appropriate techniques. Results are given in [Table A7](#) which is structured analogously to Table A6. The sign and significance of coefficients remain almost unchanged compared to former results, such as documented in Table A3.

Focus on lower income households. We have repeated all analyses with respondents who report aggregate household income below, or exactly at, the median value of 50,000 Baht per month (the median in our sample). In line with the main result, the significant roots of better financial literacy in this lower middle-class group are having an educated mother, higher risk tolerance, and having been encouraged to save as a child. Numeracy and income are not significant in this smaller group.

Different variables in timeline approach. [Table A9](#) shows some exercises where we “exchange” single variables within the groups of the timeline approach. Specifications (1) and (3) are repeated from Table 6 (specifications 1 and 3). Compared to these benchmarks, specifications (2) and (4) exclude the previously significant variables in order to see whether other variables from the same group of possible determinants pick-up the same influence. For example, by excluding education of the mother, one may see the importance of the father’s education. Indeed, some of this “transfer” of importance works. The variable “financial understanding of parents” becomes significant, while the coefficient of father education turns positive but remains insignificant. Also “parents taught to budget” is able to substitute “parents encouraged saving”. However, there is no other case of significance in the groups of variables covering “education at school” and “early experience with money”. Further, specification (4) shows that none of these variables survives the inclusion of socio-economic controls. All this shows that some alternative

variables may work, but that the ones we have selected in the parsimonious regressions in Table 6 indeed seem to be the best ones.

6 Conclusions

In our target group, the rapidly growing urban middle-class of Bangkok, we find that better financial literacy explains more informed savings decisions, including holding attractive financial assets, and better diversification. Moreover, better financial literacy is associated with more informed use of credit cards, including finding it less difficult to pay off credit card debt and knowing the interest rate on credit card debt. All of these results are robust to controls for numeracy and education, and instrumentation of literacy. Our results are in line with findings for other countries in the literature. However, despite the broad consensus about the importance of financial literacy, it is much less clear what might be done to *improve financial literacy*. For example, what are the roles of school and family education, is financial training effective, or repeated counseling on budgeting and saving? Potential policy measures would benefit from deeper understanding about determinants of financial literacy. This paper aims to improve this understanding.

We identify possible determinants of financial literacy based on instrumental variables that have been applied in the literature. These determinants concern early childhood experiences, spanning family background, parental teaching, formal education at school and early experiences with money. Among these variables, we find that family-related variables best explain financial literacy. In particular, the education level of the mother and parental encouragement to save money seem to support financial literacy later in life. Further analysis shows that formal economic education only improves financial literacy for those from better-off family backgrounds, whereas parental encouragement to save is more important for those from less comfortable upbringings.

Beyond this group of variables, personality traits may play an important role; in our data higher risk tolerance is associated with better financial literacy. Our emphasis on family background and risk preferences seems to be largely consistent with studies emphasizing the importance of genetic heritage (Cesarini et al., 2010) and time preference (Meier and Sprenger, 2013). Finally, having basic math skills helps, obviously, with numeracy and financial literacy being positively related. As numeracy skills are higher among those who had economics at school

and those attending better quality schools, financial literacy can also benefit indirectly from improving formal education.

As this paper does not directly examine policy measures, we cannot draw explicit policy conclusions. Nevertheless, our results suggest that proposals for financial literacy training among adults need to be assessed carefully, in line with recent skeptical assessments of financial literacy education programs (see Fernandes et al., 2013). For example, we find no strong evidence that having had economics in school and the quality of education received improve financial literacy, beyond their effect on basic numeracy. When designing training programs, approaches that stimulate regular savings habits and higher risk tolerance may be worth considering. Still, the good news from a policy perspective is that financial literacy at least provides a channel through which policy may have an impact on relevant financial outcomes.

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Table 1: Summary Statistics**Panel A: Demographics**

	mean	stdev	min	max	N
Female	0.48	0.50	0	1	530
Age in years	34.58	9.49	18	60	530
Married	0.46	0.50	0	1	530
Personal monthly income in Baht	26,794	20,499	15,000	200,000	530
Household monthly income in Baht	64,353	99,166	15,000	2,000,000	530
Number of children in HH	0.83	1.03	0	6	529
Number of adults in HH	2.97	1.59	1	12	529
Number of incomes HH	2.49	1.26	1	10	529

Panel B: Education

	Percent	N
No education	0.4	2
Primary school	4.2	22
Secondary school	14.0	74
Vocational	14.5	77
Bachelor degree	64.0	339
Masters degree	2.8	15
PhD	0.2	1
Total	100.0	530

Table 2: Financial Literacy

The financial literacy questions are repeated below. The first three questions are multiple choice and responses “I don’t know” and “I refuse to answer” are available in addition to the listed options.

1. Interest rate:

If you borrow 10 000 Baht, at an interest rate of 2% a month, after 3 months how much do you owe? a) Less than 10 200 Baht b) More than 10 200 Baht c) Exactly 10 200 Baht

2. Inflation:

If you have 10 000 Baht in an account, the interest rate on the account is 1% per year, and the price of goods and services rises by 2% per year, after one year can you buy:

a) Less than today b) More than today c) Exactly the same as today

3. Diversification:

Buying a single company’s stock is safer than buying a stock mutual fund.

a) True b) False

4. Institutional knowledge:

Name foreign banks. Open answers

Panel A: Responses to Financial Literacy Questions

	Correct (%)	Wrong	Don’t Know	Refuse to Answer
Interest rate	79.2	15.3	5.3	0.2
Inflation	62.5	25.8	10.9	0.8
Diversification	23.6	24.3	50.6	1.5

Panel B: Financial Literacy Measures

	mean	stdev	min	max
Sum correct 3 basic questions (<i>Lusardi-Mitchell</i>)	1.65	0.89	0	3
Total number of foreign banks named	2.24	1.19	0	6
Score between 0 and 1 for naming foreign banks	0.56	0.30	0	1
Sum correct 3 basic questions and name banks score out of 4 (<i>Lusardi-Mitchell</i> + <i>banks</i>)	2.21	1.00	0	4

Panel C: Correlations

	Interest Rate	Inflation	Diversification	Name Foreign Banks
Interest rate	1.00			
Inflation	0.21***	1.00		
Diversification	0.07	0.27***	1.00	
Naming foreign banks	0.08*	0.17**	0.24***	1.00

***, ** and * denote significance at the 1%, 5% and 10% levels, respectively

Table 3: Numeracy and Risk Aversion**Panel A: Numeracy Question**

	Correct (%)	Wrong	Don't know	Refuse to Answer
35+82	0.834	0.113	0.025	0.028
4 friends, 4 sweets ^a	0.838	0.125	0.006	0.032
10% of 400	0.942	0.015	0.015	0.028
1000-370 ^b	0.947	0.017	0.004	0.032

^a The question asks, if you have four friends and you want to give each friend four sweets, how many sweets do you need? ^b If you buy a bag of rice for 370 Baht and you pay with 1000 Baht note, how much change do you get?

Panel B: Statistics of Numeracy and Risk Aversion

	mean	stdev	min	max
Numeracy score out of 4	3.56	0.88	0	4
Scale of risk taker	5.45	2.28	0	10
<i>Risk aversion scale 1 (0-1)</i>	0.46	0.23	0	1
Proportion invest in business	50.89	22.16	0	100
<i>Risk aversion scale 2 (0-1)</i>	0.49	0.22	0	1

Panel C: Correlations

	Numeracy	Risk aversion scale 1	Risk aversion scale 2	Financial Literacy (3+banks)
Numeracy	1			
Risk aversion scale 1	-0.26***	1		
Risk aversion scale 2	-0.13***	0.45***	1	
Financial literacy (3+banks)	0.25***	-0.38***	-0.15**	1

***, ** and * denote significance at the 1%, 5% and 10% levels, respectively

Table 4: Savings, Borrowings and Financial Literacy**Panel A**

	(1) Assets other than savings account	(2) Fixed deposit	(3) Stocks	(4) Insurance	(5) Number of asset types owned
Financial literacy	0.072*** [0.020]	0.059*** [0.021]	0.008 [0.008]	-0.034** [0.015]	0.105*** [0.032]
Pseudo-R ²	0.29	0.20	0.39	0.33	0.21
Observations	525	529	527	529	525

Notes: The table reports regression marginal effects, with robust standard errors in brackets.

***, ** and * denote significance at the 1%, 5% and 10% levels, respectively

Panel B

	(1) Does not know interest rate on credit card	(2) Has difficulty paying off credit card	(3) Number of credit cards	(4) Has Debt	(5) Has debt larger than annual income
Financial literacy	-0.120*** [0.039]	-0.063** [0.029]	0.033 [0.052]	0.013 [0.025]	0.002 [0.013]
Pseudo-R ²	0.11	0.12	0.08	0.05	0.21
Observations	172	170	529	511	413

Notes: The table reports marginal effects, with robust standard errors in brackets.

***, ** and * denote significance at the 1%, 5% and 10% levels, respectively

Table 5: Family Background, Formal Education and Financial Experiences

	Mean	Stdev	N	Corr. Fin. Lit.	Previously used in
<i>Family Background</i>					
Father has vocational degree or higher	0.28	0.45	474	0.06	Behrman et al. (2010)
Mother has vocational degree or higher	0.22	0.42	479	0.14***	Behrman et al. (2010)
Financial understanding of parents (1-6)	4.39	1.53	516	0.25***	van Rooij et al. (2011b)
Considers economic background to be poor	0.28	0.45	504	-0.06	Behrman et al. (2010)
<i>Parental teaching</i>					
Parents taught to budget	0.83	0.38	527	0.23***	Webley and Nyhus (2013)
Parents encouraged saving between 12 and 16	0.86	0.35	515	0.25***	Webley and Nyhus (2013)
<i>Education at School</i>					
Had economics in school	0.67	0.47	519	0.11**	van Rooij et al. (2011a, 2012)
Was born in Bangkok	0.64	0.48	530	0.13***	Behrman et al. (2010)
Completed highest educational degree in Bangkok	0.87	0.34	530	0.16***	/
<i>Early Experiences with Money</i>					
Had allowance as a child	0.99	0.09	523	0.02	Webley and Nyhus (2013)
Had bank account before 18	0.57	0.50	517	-0.13***	/
Had job before age 15	0.47	0.50	526	-0.01	Behrman et al. (2010)

Note: ***, ** and * denote significance at the 1%, 5% and 10% levels, respectively

Table 6: Determinants of Financial Literacy

	(1)	(2)	(3)	(4)	(5)	(6)
Father has vocational degree or higher	-0.215 [0.136]		-0.218 [0.139]		-0.204 [0.139]	
Mother has vocational degree or higher	0.388*** [0.142]	0.240** [0.103]	0.393*** [0.145]	0.237** [0.096]	0.393*** [0.143]	0.235** [0.095]
Financial understanding of parents 1-6	0.044 [0.035]		0.023 [0.035]		0.022 [0.036]	
Poor economic background	0.011 [0.111]		-0.081 [0.104]		-0.064 [0.105]	
Parents taught to budget	0.170 [0.148]		0.074 [0.143]		0.077 [0.144]	
Parents encouraged saving	0.389** [0.163]	0.518*** [0.162]	0.328** [0.156]	0.380*** [0.143]	0.326** [0.157]	0.366** [0.145]
Economics in school	0.238* [0.122]	0.293** [0.117]	0.068 [0.132]		0.061 [0.131]	
Born in Bangkok	0.051 [0.107]		-0.002 [0.109]		0.004 [0.108]	
Highest educational degree in Bangkok	0.082 [0.143]		-0.034 [0.178]		-0.020 [0.173]	
Bank account before 18	-0.203** [0.099]	-0.213** [0.095]	-0.153 [0.098]		-0.135 [0.098]	
Job before age 15	0.055 [0.101]		0.045 [0.102]		0.067 [0.102]	
Numeracy score out of 4			0.107* [0.055]	0.120** [0.050]	0.121** [0.055]	0.129** [0.051]
Risk aversion			-1.047*** [0.232]	-1.144*** [0.217]	-1.075*** [0.234]	-1.175*** [0.220]
Higher education			0.041 [0.137]		0.082 [0.137]	
Log of income			0.252* [0.134]	0.214** [0.097]		
Female			0.050 [0.088]		0.034 [0.087]	
Age in years			-0.001 [0.036]		-0.004 [0.036]	
Age squared			-0.000 [0.000]		0.000 [0.000]	
R ²	0.11	0.09	0.20	0.18	0.19	0.17
R ² -Adj	0.09	0.08	0.16	0.17	0.15	0.16
F-Stat	4.28	8.49	6.56	20.30	6.25	23.39
Observations	408	408	408	408	408	408

Notes: The table reports OLS regression results with robust standard errors in brackets. The dependent variable is the financial literacy measure. ***, ** and * denote significance at the 1%, 5% and 10% levels, respectively.

Table 7: Determinants of Each Financial Literacy Item

	Question 1 Interest rate	Question 2 Inflation	Question 3 Diversification	Question 4 Foreign Banks
Father has vocational degree or higher	-0.202 [0.235]	-0.403* [0.236]	-0.348 [0.236]	0.043 [0.077]
Mother has vocational degree or higher	0.015 [0.249]	0.660*** [0.255]	0.822*** [0.249]	-0.021 [0.082]
Financial understanding of parents 1-6	0.093* [0.054]	0.029 [0.052]	-0.021 [0.060]	-0.013 [0.019]
Poor economic background	0.275 [0.188]	-0.166 [0.163]	-0.303* [0.169]	-0.036 [0.060]
Parents taught to budget	0.166 [0.219]	0.051 [0.219]	-0.228 [0.214]	0.112 [0.084]
Parents encouraged saving	-0.020 [0.235]	0.194 [0.234]	0.814*** [0.261]	0.165* [0.093]
Economics in school	0.077 [0.187]	0.130 [0.185]	-0.286 [0.195]	0.136* [0.076]
Born in Bangkok	-0.206 [0.184]	-0.010 [0.159]	0.021 [0.178]	0.054 [0.053]
Highest educational degree in Bangkok	0.195 [0.268]	-0.371 [0.269]	0.322 [0.298]	-0.036 [0.094]
Bank account before 18	0.140 [0.159]	-0.260* [0.149]	-0.279* [0.162]	-0.064 [0.053]
Job before age 15	0.150 [0.163]	-0.041 [0.150]	0.157 [0.163]	-0.062 [0.056]
Numeracy score out of 4	0.150* [0.086]	0.188** [0.084]	0.004 [0.091]	-0.015 [0.029]
Risk aversion	-0.602* [0.364]	-0.778** [0.331]	-0.997** [0.420]	-0.670*** [0.127]
Higher education	0.084 [0.205]	0.181 [0.191]	-0.329 [0.211]	0.049 [0.081]
Log of income	0.108 [0.204]	0.423** [0.212]	0.421** [0.181]	-0.067 [0.063]
Female	-0.029 [0.150]	-0.016 [0.137]	0.132 [0.152]	0.042 [0.048]
Age in years	-0.087 [0.059]	0.024 [0.057]	0.027 [0.060]	0.008 [0.020]
Age squared	0.118 [0.080]	-0.056 [0.078]	-0.043 [0.082]	-0.002 [0.027]
Pseudo-R ²	0.09	0.10	0.10	0.03
Observations	408	408	408	408

Notes: The table reports Probit and Poisson regression results with robust standard errors in brackets. The dependent variable in columns 1 to 3 is unity if the respective question was correct. Column 4 takes value of 1 to 4 for each foreign bank that was named). ***, ** and * denote significance at the 1%, 5% and 10% levels, respectively.

Table 8: Determinants of Financial Literacy, Split by Two Measures of Family Background

	Uneducated mother	Educated mother	Poor background	non-Poor background
Father has vocational degree or higher	-0.234 [0.169]	-0.124 [0.261]	-0.712 [0.546]	-0.170 [0.141]
Mother has vocational degree or higher			1.082** [0.517]	0.269* [0.151]
Financial understanding of parents 1-6	0.045 [0.040]	-0.041 [0.077]	0.042 [0.069]	0.027 [0.041]
Poor economic background	-0.120 [0.119]	-0.022 [0.223]		
Parents taught to budget	0.012 [0.166]	0.192 [0.285]	-0.160 [0.239]	0.181 [0.170]
Parents encouraged saving	0.344** [0.168]	0.152 [0.391]	0.413* [0.234]	0.356* [0.190]
Economics in school	-0.068 [0.141]	0.549* [0.328]	-0.171 [0.232]	0.108 [0.161]
Born in Bangkok	-0.012 [0.120]	-0.121 [0.242]	-0.078 [0.173]	0.002 [0.131]
Highest educational degree in Bangkok	-0.133 [0.183]	0.494 [0.383]	-0.070 [0.292]	0.047 [0.217]
Bank account before 18	-0.204* [0.115]	0.049 [0.221]	-0.081 [0.189]	-0.131 [0.114]
Job before age 15	0.039 [0.117]	0.103 [0.225]	0.124 [0.185]	0.013 [0.123]
Numeracy score	0.098 [0.063]	0.157 [0.097]	-0.141 [0.134]	0.151*** [0.057]
Risk aversion	-0.954*** [0.266]	-1.162** [0.500]	-1.956*** [0.468]	-0.705*** [0.262]
Higher education	0.103 [0.155]	0.105 [0.345]	-0.318 [0.267]	0.160 [0.162]
Log of income	0.376** [0.146]	-0.183 [0.346]	0.571*** [0.186]	0.129 [0.171]
Female	0.097 [0.096]	-0.018 [0.180]	0.121 [0.169]	0.045 [0.102]
Age in years	0.025 [0.040]	-0.108 [0.067]	-0.123* [0.064]	0.058 [0.041]
Age Squared	-0.042 [0.053]	0.154* [0.089]	0.133 [0.085]	-0.072 [0.056]
R2	0.19	0.35	0.34	0.24
Observations	313	95	108	300

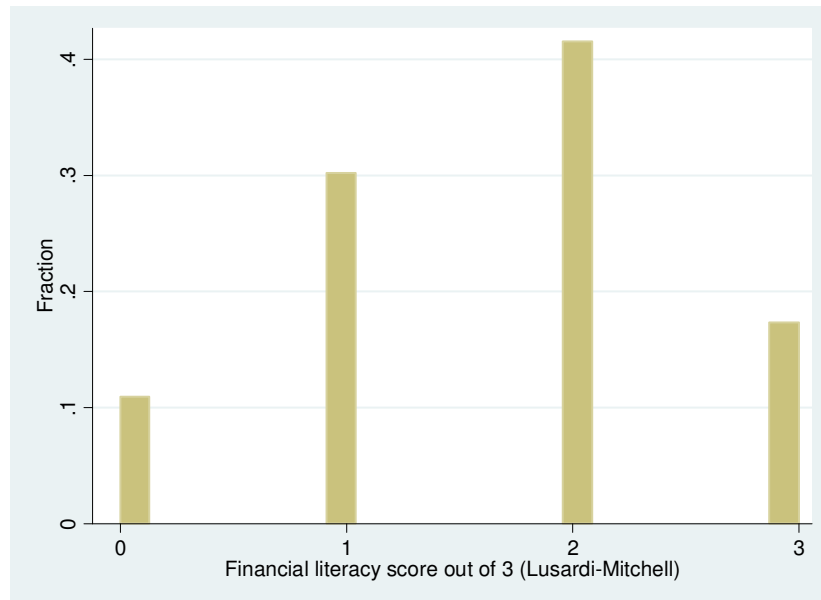
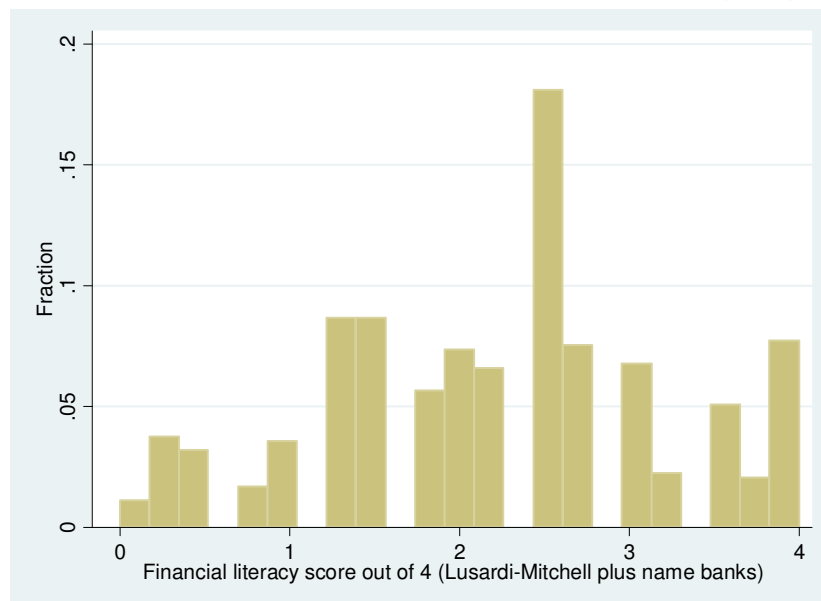
Notes: The table reports OLS regression results with robust standard errors in brackets. The dependent variable is the financial literacy measure. ***, ** and * denote significance at the 1%, 5% and 10% levels, respectively.

* p<0.1, ** p<0.05, *** p<0.01

Table 9: Determinants of Numeracy

	Numeracy	Numeracy	Numeracy	Numeracy
Father has vocational degree or higher	-0.036 [0.134]	-0.062 [0.133]	-0.005 [0.135]	-0.040 [0.133]
Mother has vocational degree or higher	0.073 [0.135]	0.091 [0.133]	0.017 [0.139]	0.051 [0.137]
Financial understanding of parents 1-6	0.012 [0.032]	-0.002 [0.033]	0.006 [0.033]	-0.004 [0.033]
Poor economic background	0.138* [0.082]	0.077 [0.082]	0.137* [0.082]	0.084 [0.084]
Parents taught to budget	0.379** [0.163]	0.305* [0.159]	0.355** [0.159]	0.294* [0.157]
Parents encouraged saving	0.336* [0.188]	0.310* [0.183]	0.280 [0.182]	0.275 [0.182]
Economics in school	0.275** [0.110]	0.253** [0.122]	0.241** [0.107]	0.244** [0.120]
Born in Bangkok	0.152 [0.098]	0.107 [0.097]	0.144 [0.097]	0.106 [0.097]
Highest educational degree in Bangkok	0.465*** [0.166]	0.476*** [0.166]	0.453*** [0.165]	0.474*** [0.167]
Bank account before 18	-0.029 [0.086]	-0.041 [0.089]	-0.000 [0.088]	-0.025 [0.091]
Job before age 15	-0.056 [0.086]	-0.086 [0.088]	-0.064 [0.087]	-0.089 [0.089]
Financial Literacy			0.143*** [0.050]	0.098* [0.053]
Risk aversion		-0.644*** [0.221]		-0.535** [0.229]
Higher education		-0.137 [0.122]		-0.139 [0.122]
Log of income		0.272** [0.109]		0.245** [0.107]
Female		0.006 [0.083]		0.001 [0.083]
Age in years		0.016 [0.032]		0.016 [0.031]
Age Squared		-0.040 [0.044]		-0.039 [0.043]
R2	0.19	0.23	0.21	0.24
Observations	408	408	408	408

Notes: The table reports OLS regression results with robust standard errors in brackets. The dependent variable is Numeracy (0,1,2,3,4). ***, ** and * denote significance at the 1%, 5% and 10% levels, respectively. * p<0.1, ** p<0.05, *** p<0.01

Figure 1: Distribution of Financial Literacy**Panel A: Score on Lusardi-Mitchell Questions (0 – 3)****Panel B: Lusardi-Mitchell and Name Banks Score (0 – 4)**

APPENDIX 1

Column 1 shows correlations between our financial literacy measure and the socio-demographic variables or character traits. Stars indicate significance. Column 2 shows a multivariate OLS regression between our financial literacy score and the same variables. The third column shows the same regression, but instead with the Lusardi-Mitchell 0-3 measure for financial literacy.

Table A1: Bivariate and Multivariate Financial Literacy Regressions

	(1) Financial Literacy	(2) Financial Literacy	(3) Lusardi and Mitchell
Numeracy	0.245***	0.133*** [0.046]	0.134*** [0.043]
Risk aversion	-0.376***	-1.324*** [0.189]	-0.881*** [0.175]
Higher education	0.198***	0.160* [0.090]	0.071 [0.083]
Female	0.017	0.125 [0.079]	0.085 [0.072]
Age	-0.043	-0.049 [0.035]	-0.041 [0.031]
Age squared		0.000 [0.000]	0.000 [0.000]
Number of children in HH	0.015	0.006 [0.041]	-0.008 [0.038]
Number of adults in HH	-0.036	-0.024 [0.027]	-0.019 [0.024]
Log of income	0.219***	0.482*** [0.125]	0.434*** [0.122]
Assets low	-0.009	-0.072 [0.111]	-0.099 [0.101]
Assets high	0.077*	-0.207 [0.186]	-0.074 [0.183]
Assets missing	-0.122 ***	-0.393*** [0.127]	-0.303** [0.118]
R ²		0.23	0.18
Observations	529	529	529

***, ** and * denote significance at the 1%, 5% and 10% levels, respectively.

APPENDIX 2

In this appendix we provide the full material used for the examinations presented in Section 3.5 of the main text. We present this in three steps: first, we describe the necessary financial assets and borrowings data in our sample (Section A2.1). The determinants of these financial decisions are then analyzed, separately for savings (Section A2.2) and borrowings decisions (Section A2.3).

A2.1 Description of financial assets and debt

In order to assess the link between financial literacy and financial behavior, variables on the respondent's financial situation have to be collected. This includes detailed information on financial assets and liabilities. Hence we ask for information on the amount of financial assets that respondents hold, along with what form financial assets are being held in. Results are shown in [Table A2](#), Panel A. Penetration of basic financial services is wide; every respondent has a bank savings account. However, ownership of other financial assets is not as widely spread, as only 41% have a fixed deposit account and 8% of people hold gold to store wealth. More sophisticated financial assets are even less common than fixed deposits: only 11% of respondents own bonds or bond mutual funds, 9% hold stocks or an equity mutual fund, and 16% have a life insurance policy. In total 52% of our respondents have other assets apart from a savings account, with the average number of other asset types held equal to 0.75. Furthermore, 62% of the sample hold the largest proportion of their wealth in a savings account.

Due to reservations about passing on financial information, the survey only asks respondents to indicate if their total amount of financial assets falls in five pre-defined categories, instead of asking for the exact amount. The level of assets in our sample is relatively low, with 53% claiming to hold less than 100,000 Baht (3,100 USD), 22% have assets worth between 100,000 and 500,000 Baht (15,600 USD), and the remaining 9% hold assets in excess of 500,000 Baht. A further 19% refuse to answer the question. The small amount of assets reported may be partially explained by the relatively young age of our sample, apart from reservations about sharing this information, and often preferred investment in real estate.

On the debt side, we ask for information on the total amount of debt and we collect information on the use of credit cards (see [Panel B](#) of Table A2), as one of the objectives of this paper is to study the link between consumption credit and financial understanding. Therefore we also gather information on the number of credit cards, as well as information about credit card

debt repayment and awareness of interest rates. Levels of debt are fairly high, with 47% responding that they have an outstanding loan, are borrowing cash or paying for goods by installment. Respondents are reasonably open about their debts, with 79% reporting an exact amount of debt, and 21% not reporting the amount. Among respondents providing a positive debt amount, the average loan value is 272,400 Baht (8,570 USD), with a large standard deviation of 586,700. For 20% of those reporting a positive debt amount, the loan amount is larger than their annual income. Only 33% of respondents have a credit card, showing that credit cards use is not yet widely spread among the Bangkok middle class, potentially due to having insufficient monthly income.³ Out of those with a credit card, 15% claim that they find it difficult to pay off their credit card debt every month and 57% do not know the interest rate charged by the credit card company.

A2.2 Financial literacy and saving decisions

In line with the literature, we analyze two types of savings and investment decisions, namely the use of financial products beyond basic savings accounts and diversification. In detail, we rely on the following definitions of informed savings decisions:

(i) Virtually everyone in Bangkok's middle class holds a savings account. However, apart from convenience and safety, it is not a financial asset with attractive return features; in recent years the effective real rate of return (after inflation) on savings accounts has been negative. Thus holding *assets other than a savings account* serves as a most simple characteristic of informed savings behavior. The dependent variable is a dummy that is unity if the respondent holds an asset other than a savings account.

(ii) For the middle class in Thailand, *fixed savings deposits* are an advantageous product due to tax advantages and offering higher interest rates than savings accounts. Thus we analyze whether financial literacy is related to owning this product. In our analysis we use a dummy that is one if the respondent holds such a fixed deposit account, and zero otherwise.

(iii) Following the literature, another financial asset that offers positive expected long-term real returns but may require financial literacy, we analyze the ownership of *stocks* and *stock mutual funds*.

³ We expect that some respondents fail to meet bank requirements for issuing a credit card, such as having sufficient regular income or liquid assets. A poll among 1,205 people aged 25 to 60-years in Greater Bangkok by Assumption University found that only 23.3% of the respondents used credit cards (source: *The Nation*, 25 Sep 2013).

(iv) We finally analyze the holding of a product which we expect to be less attractive for the financially literate in the Thai context, that is, having *life insurance*. The life insurance products offered in the retail market combine long-term savings contracts (e.g., for 5 or 10 years) with a life insurance policy. The interest rate offered is typically low, below government bond yields, but determining the effective rate requires numeracy and financial skills. Still, regardless of its poor investment return, life insurance products may attract risk averse people.

(v) Finally, the decision to diversify, which follows from basic understanding of risk, is measured in the simplest way in that we count the *number of different asset types* that an individual owns. We here use a regression model for count data.

In explaining these savings decisions, we find that financial literacy contributes to more informed decisions and thus appears to be beneficial (Table A3). The relationship between financial literacy and better savings behavior – as proxied by the variables in specification (i) to (v) – is mostly statistically significant and economically meaningful. Those that can score an additional point are about 7% more likely to hold an asset other than a savings account at the mean. Similarly, scoring an extra point increases the probability of having a fixed deposit account by about 6% at the mean. Moreover, an extra financial literacy point reduces the likelihood of having life insurance by only about 3%. At the same time, an extra financial literacy point increases the number of assets held by 0.11.

It is remarkable that the effect of financial literacy is significant alongside the many control variables which cover the main aspects discussed in the literature, such as numeracy, education and income. Most notable is that education and financial literacy are significant in (almost) all columns of Table A3, in addition to controls for income and having low assets. This indicates to us that financial literacy is not synonymous with education. One does not guarantee the other, and specific knowledge of finance is needed, in order to make good financial decisions. Numeracy is significant for three out of five savings variables, with the expected sign. Thus, financial literacy contributes to more informed financial decisions, even after controlling for the effect of simple numeracy skills and general education.

A2.3 Financial literacy and borrowing decisions

Less researched than savings decisions is borrowing behavior. A problematic policy issue in many emerging economies, such as in Thailand, is uninformed and excessive consumer credit. We analyze two dimensions: the use of credit cards and the total loan amount.

Credit cards promise easy access to credit, but also involve concerns of uninformed and excessive use of credit, for which we use two indicators:

(i) Consumers who do *not know the (high) interest rate* to be paid on credit card debt may underestimate the effective debt burden.

(ii) A full monthly repayment is rational as credit card debt is expensive, but is timely repayment a potential problem for consumers? Thus we ask people whether they regard *monthly repayment as difficult*.

Results for these two items are shown in columns 1 and 2 of [Table A4](#). Financial literacy is negatively linked to both of these indicators. In particular, one extra point on the financial literacy scale (0 to 4) increases the chance of knowing the interest rate on credit card debt by 12%, while it reduces the probability of finding it difficult to pay off credit card debt by 6%. Moreover, our results show that financial literacy is the only variable that has significant explanatory power for these indicators, apart from gender and an asset dummy; remarkably, numeracy, education and income are insignificant.

Another concern of policy makers refers to the level of debt for consumption purposes. Our data are arguably not perfect in this respect as some respondents do not give answers, or possibly do not always refer to consumption credit only. Nevertheless, with these qualifications, we examine three indicators of, possibly uninformed, borrowing decisions:

(iii) A large *number of credit cards* may signal a lack of spending control and excessive credit. We examine whether there is a link between the number of credit cards someone has and their level of financial literacy.

(iv) We also see if there is a link between *having debt at all* and financial literacy, as this will help us make the distinction between debt in itself and excessive debt.

(v) Another measure of uninformed or excessive borrowing is a high *debt to income ratio*, which is also a first indicator of credit bearing capacity.

Results for our indicators of borrowing do not show a direct relation with the degree of financial literacy. Rather, other variables better explain these borrowing indicators, such as age, income and having high assets. The non-linear relation between debt and age in columns (3), (4)

and (5) is a sign of income smoothing, as predicted by standard life-cycle models. For example, the estimates in column (4) imply that the probability of having debt is increasing from age 18 to 39 years and decreasing after the age of 40. In line with theory, younger people tend to borrow against future income, while older people pay off debt and draw down savings. Further, the importance of collateral and liquidity constraints for borrowing is apparent in column (3) and (5): respondents with high levels of assets tend to have more credit cards and are more likely to borrow in excess of their annual income. Finally, respondents with higher risk aversion and better numeracy skills are less likely to borrow more than their annual income, which is plausible.

In sum, our results suggest that income smoothing, liquidity constraints and collateral are the main drivers of having debt, in line with economic theory. Moreover, having lower risk aversion and worse numeracy skills are related to having relatively high debt compared to income, but financial literacy is insignificant.

However, there is also slight evidence that there may be a link between excessive debt and financial literacy. Recall that about one in five respondents refused to report their amount of debt. When regressing a dummy for not answering this question against financial literacy, we see a clear negative relationship whilst controlling for the usual socio-demographic variables (results not reported in Table A4). There are two possible reasons for this relation. Either respondents with low financial literacy simply do not know how much debt they have, and so they cannot answer the question. Or, alternatively, respondents with low financial literacy and high debt are embarrassed about this, and refuse to answer the question. Either way, this finding helps us better understand the lack of a relation between borrowing and financial literacy, as respondents engaged in uninformed or excessive borrowing may prefer not to report their debt amount.

Overall, we find that financial literacy has a clear effect on financial decisions in the expected way: higher financial literacy relates to informed savings, choosing more advanced financial products and better diversification, and it relates to informed borrowing, proxied here by the more informed use of credit cards.

To examine the causality of these reported associations, we have estimated instrumental variable regressions where we use childhood experiences as instruments for financial literacy in the first stage. We search for instruments that do not directly predict the outcome variable (passing an over-identifying restrictions test), while being highly correlated with financial literacy (passing a weak instruments test).

Without going into detail, the results in the [Appendix 3](#) show that the impact of financial literacy on financial decisions is causal. We often cannot reject that financial literacy is an exogenous variable, especially when explaining borrowing decisions and credit card use. Finally, “parents encouraged savings”, “bank account before 18” and “financial understanding of parents” most often make the short-list of good instruments for financial literacy. These three variables – when allocated to our timeline in Section 4 – stem from family background and early experiences with money.

Table A2: Savings and Borrowings Summary Statistics**Panel A: Assets**

	mean	stdev	min	max	count
Has a savings account	1.00	0.00	1	1	530
Owns fixed deposit accounts	0.41	0.49	0	1	530
Owns a government savings bank deposit	0.02	0.15	0	1	520
Owns bonds or bond mutual funds	0.11	0.32	0	1	529
Owns stocks or equity mutual funds	0.09	0.28	0	1	528
Owns gold	0.08	0.27	0	1	527
Owns life insurance	0.16	0.37	0	1	530
Assets < 100,000	0.53	0.50	0	1	530
100,000 < Assets < 500,000 Baht	0.22	0.41	0	1	530
Assets > 500,000 Baht	0.09	0.28	0	1	530
Did not provide asset amount	0.19	0.39	0	1	530
Owns >= 2 types of assets ^a	0.52	0.50	0	1	526
Number of asset types owned, apart from a savings account ^a	0.75	0.92	0	5	526

^a Includes fixed deposit accounts, government savings bank deposits, bonds or bond funds, stocks or stock funds, and gold. It excludes life insurance.

Panel B: Debt

	mean	stdev	min	max	count
Has any debt	0.47	0.50	0	1	512
Amount of debt in Baht	103,316	384,080	0	4,000,000	414
Amount of debt in Baht (conditional on having debt)	272,439	586,662	0	4,000,000	157
Debt larger than annual income	0.08	0.27	0	1	414
Debt larger than annual income (conditional on having debt)	0.20	0.40	0	1	157
Number of credit cards	0.61	1.09	0	7	530
Has at least one credit card	0.33	0.47	0	1	530
Finds it difficult to pay off credit card (conditional on having a credit card)	0.15	0.35	0	1	171
Does NOT know interest on credit card (conditional on having credit card)	0.57	0.50	0	1	173

Table A3: Savings, Assets and Financial Literacy

	(1) Assets other than savings account	(2) Fixed deposit	(3) Stocks	(4) Insurance	(5) Number of asset types owned
Financial literacy	0.072*** [0.020]	0.059*** [0.021]	0.008 [0.008]	-0.034** [0.015]	0.105*** [0.032]
Numeracy	0.056** [0.025]	0.040 [0.026]	-0.010 [0.009]	-0.051*** [0.014]	0.097** [0.046]
Risk aversion	-0.103 [0.095]	-0.171* [0.095]	0.044 [0.044]	0.175*** [0.060]	-0.124 [0.153]
Higher education	0.157*** [0.038]	0.119*** [0.041]	0.067*** [0.024]	0.091*** [0.031]	0.349*** [0.078]
Female	0.080** [0.035]	0.090** [0.037]	-0.020 [0.019]	0.025 [0.026]	0.159*** [0.058]
Age	0.034** [0.017]	0.022 [0.016]	0.002 [0.009]	0.008 [0.011]	0.102*** [0.025]
Age squared / 100	-0.039 [0.024]	-0.021 [0.022]	-0.001 [0.011]	-0.010 [0.014]	-0.114*** [0.031]
No of children in HH	-0.021 [0.019]	-0.035* [0.019]	-0.016 [0.010]	-0.039** [0.015]	-0.043 [0.029]
No of adults in HH	0.009 [0.012]	-0.009 [0.013]	0.012** [0.005]	0.011 [0.009]	0.029* [0.017]
Log of income	0.292*** [0.067]	0.230*** [0.054]	0.046** [0.023]	0.018 [0.037]	0.418*** [0.080]
Assets low dummy	-0.159*** [0.048]	-0.156*** [0.049]	-0.039* [0.023]	-0.197*** [0.034]	-0.434*** [0.087]
Assets high dummy	0.123 [0.096]	-0.117 [0.084]	0.110*** [0.025]	0.155*** [0.043]	0.169* [0.092]
Assets amount missing	-0.099* [0.057]	-0.067 [0.059]	-0.029 [0.031]	-0.075** [0.038]	-0.160* [0.091]
Pseudo-R ²	0.29	0.20	0.39	0.33	0.21
Observations	525	529	527	529	525

Notes: The table reports regression marginal effects, with robust standard errors in brackets.

***, ** and * denote significance at the 1%, 5% and 10% levels, respectively

Table A4: Borrowing Behavior and Financial Literacy

	(1) Does not know interest rate on credit card	(2) Has difficulty paying off credit card	(3) Number of credit cards	(4) Has Debt	(5) Has debt larger than annual income
Financial literacy	-0.120*** [0.039]	-0.063** [0.029]	0.033 [0.052]	0.013 [0.025]	0.002 [0.013]
Numeracy	-0.036 [0.069]	-0.055 [0.043]	0.114* [0.067]	-0.008 [0.027]	-0.029** [0.013]
Risk aversion	0.048 [0.185]	0.012 [0.127]	-0.447* [0.258]	-0.005 [0.105]	-0.138** [0.054]
Higher education	-0.138 [0.089]	-0.067 [0.057]	0.338** [0.132]	0.076 [0.049]	0.019 [0.030]
Female	0.098 [0.073]	-0.114** [0.055]	0.054 [0.098]	-0.007 [0.044]	-0.031 [0.024]
Age	-0.005 [0.033]	-0.036 [0.025]	0.111*** [0.041]	0.091*** [0.018]	0.033*** [0.013]
Age squared / 100	0.002 [0.041]	0.042 [0.032]	-0.134*** [0.051]	-0.116*** [0.024]	-0.040** [0.016]
No of children in HH	0.004 [0.037]	0.021 [0.026]	0.070 [0.058]	0.006 [0.023]	0.014 [0.012]
No of adults in HH	0.038 [0.024]	-0.011 [0.015]	0.016 [0.033]	-0.003 [0.014]	-0.007 [0.009]
Log of income	-0.112 [0.096]	0.081 [0.061]	0.369** [0.150]	-0.175*** [0.066]	-0.037 [0.033]
Assets low dummy	-0.041 [0.101]	-0.016 [0.076]	-0.076 [0.143]	-0.027 [0.063]	-0.057* [0.032]
Assets high dummy	0.211* [0.118]	-0.059 [0.088]	0.321** [0.162]	0.112 [0.097]	0.107*** [0.037]
Assets amount missing	0.035 [0.119]	0.009 [0.093]	-0.033 [0.146]	0.007 [0.071]	-0.029 [0.041]
Pseudo-R ²	0.11	0.12	0.08	0.05	0.21
Observations	172	170	529	511	413

Notes: The table reports marginal effects, with robust standard errors in brackets.

***, ** and * denote significance at the 1%, 5% and 10% levels, respectively.

APPENDIX 3

Table A5 reports results of two-stage instrumental variable regressions. All determinants of financial literacy in Table 5 were used as potential instruments for financial literacy in the first-stage regression. For each dependent variable separately, instruments were eliminated if the overidentification test rejected the null hypothesis of no direct relation between the instrument and the dependent variable. Further, instruments were deleted if they had low significance in the first-stage regression for explaining financial literacy, to avoid having weak instruments. The final set of instruments is shown in the third row, and usually consists of only one or two variables. For the dependent variables that are discrete count variables, namely the number of asset types owned and the number of credit cards owned, instrumental variable techniques are not readily available, and therefore no results are shown.

The first row in the table shows the original coefficient estimate from a probit model, repeated from Table A3 and Table A4, respectively. The estimate is a marginal effect, showing the impact of financial literacy on the predicted probability of the dependent variable being equal to one, while keeping all other explanatory variables (not shown) at their mean value. The second row of Table A5 shows the marginal effect of financial literacy in a two-stage probit regression, with financial literacy instrumented by the set of variables shown in the third row. All regressions include a full set of socio-economic controls, similar to Table A3 and A4, but to save space the coefficient estimates are not shown.

The fourth row of Table A5 shows the result of the Stock-Yogo F-test for weak instruments. Higher F-values indicate stronger instruments. The fifth row shows the Hansen J-statistic for overidentifying restrictions, testing the null hypothesis that the instruments do not directly predict the dependent variable. Significance is indicated with stars; none of the J-statistics is significant by default, as we have eliminated instruments not passing this test beforehand. Finally, the sixth row shows a chi-square test statistic for testing exogeneity of financial literacy in the second stage regression. Rejection of the null hypothesis of exogeneity, indicated with stars (*, **, ***), implies that financial literacy is correlated with the error term in the main equation for the dependent variable. In other words, if the chi-square test is significant, financial literacy is endogenous and the use of instrumental variable techniques is necessary. In other cases, when exogeneity cannot be rejected, instrumental variable techniques may not be necessary and can lead to inefficient standard errors.

Table A5. Instrumental Variable Regressions**Panel A: Savings and assets**

	(1) Assets other than savings account	(2) Fixed Deposits	(3) Stocks	(4) Insurance	(5) Number of asset types owned
Financial literacy: original	0.072*** [0.08]	0.059*** [0.07]	0.008 [0.01]	-0.034** [0.02]	0.105*** [0.04]
Financial literacy: instrumented	0.181*** [0.06]	0.215*** [0.05]	-0.034 [0.05]	-0.230*** [0.04]	--- ---
Instrument set	encourage saving bank before 18	encourage saving bank before 18	encourage saving bank before 18	encourage saving bank before 18	--- ---
F-test for weak instruments	12.69 ^a	12.55 ^a	12.59 ^a	12.55 ^a	---
Overidentification test (Hansen J)	1.17	0.021	0.145	0.211	---
Wald exogeneity test (chi-square)	1.93	4.50**	1.02	16.54***	---
N	501	505	503	505	525

Panel B: Borrowing

	(1) Does not now interest rate on credit card	(2) Has difficulty paying off credit card	(3) Number of credit cards	(4) Has debt	(5) Has debt more than one annual income
Financial literacy: original	-0.12*** [0.04]	-0.063** [0.03]	0.032 [0.05]	0.013 [0.025]	0.002 [0.013]
Financial literacy: instrumented	-0.22** [0.09]	-0.20*** [0.07]	--- ---	0.089 [0.13]	0.006 [0.08]
Instrument set	fin.und. parents bank before 18	fin.und. parents bank before 18	--- ---	encourage saving	encourage saving
F-test for weak instruments	7.92 ^b	8.18 ^b	---	12.72 ^a	10.16 ^a
Overidentification test (Hansen J)	0.14	0.14	---	---	---
Wald exogeneity test (chi-square)	0.75	3.41*	---	0.24	0.00
N	162	160	529	496	402

Notes: The table reports instrumental variable (IV) probit estimation results with robust standard errors in brackets. The financial literacy measure is instrumented. The table reports the coefficient estimate of financial literacy in the 2nd stage regression. A full set of control variables is included, but coefficients not shown to save space. Superscript ^a, ^b denotes passing the Stock-Yogo test for weak instruments at 15% and 25% maximal IV size, respectively. ***, ** and * denote significance at the 1%, 5% and 10% levels, respectively.

Table A6: Robustness Checks with Different Financial Literacy Measures
Panel A: Financial Literacy and Savings

	(1) Assets other than savings account	(2) Has fixed deposit account	(3) Holds stocks	(4) Insurance	(5) Number of different assets
Financial Literacy (<i>LM+banks</i>)	0.259*** [0.076]	0.195*** [0.072]	0.085 [0.092]	-0.209** [0.091]	0.141*** [0.044]
Pseudo-R ²	0.28	0.20	0.39	0.33	0.21
Financial Literacy (<i>LM score</i>)	0.213*** [0.082]	0.111 [0.078]	0.073 [0.107]	-0.145 [0.099]	0.147*** [0.048]
Pseudo-R ²	0.28	0.20	0.39	0.32	0.21
Financial Literacy (<i>LM dummy</i>)	0.639*** [0.191]	0.483*** [0.172]	-0.105 [0.246]	-0.209 [0.224]	0.224** [0.088]
Pseudo-R ²	0.28	0.20	0.39	0.32	0.21
Financial Literacy (<i>LM +Cole</i>)	0.175*** [0.065]	0.085 [0.063]	0.064 [0.082]	-0.201** [0.086]	0.115*** [0.041]
Pseudo-R ²	0.28	0.20	0.39	0.33	0.21

Panel B: Financial Literacy and Borrowing

	(1) Does not know interest rate on credit card	(2) Finds it difficult to pay off credit card	(3) Number of credit cards	(4) Has ≥ 2 credit cards conditional on having a credit card	(5) Has debt larger than annual income
Financial Literacy (<i>LM+banks</i>)	-0.347*** [0.122]	-0.312** [0.152]	0.078 [0.068]	-0.176 [0.116]	0.016 [0.113]
Pseudo-R ²	0.11	0.12	0.16	0.11	0.21
Financial Literacy (<i>LM score</i>)	-0.347*** [0.130]	-0.368** [0.163]	0.067 [0.075]	-0.145 [0.124]	0.059 [0.115]
Pseudo-R ²	0.11	0.13	0.16	0.11	0.21
Financial Literacy (<i>LM dummy</i>)	-0.802*** [0.265]	-0.419 [0.379]	0.040 [0.168]	-0.219 [0.268]	-0.059 [0.285]
Pseudo-R ²	0.12	0.10	0.16	0.11	0.21
Financial Literacy (<i>LM +Cole</i>)	-0.289*** [0.112]	-0.277** [0.129]	0.078 [0.062]	-0.003 [0.104]	0.021 [0.095]
Pseudo-R ²	0.11	0.13	0.16	0.11	0.21

Notes: The table reports regression results with robust standard errors in brackets. ***, ** and * denote significance at the 1%, 5% and 10% levels, respectively. * p<0.1, ** p<0.05, *** p<0.01

Table A7: Robustness Checks using OLS**Panel A: Financial Literacy and Savings**

	(1) Assets other than savings account	(2) Has fixed deposit account	(3) Holds stocks	(4) Insurance	(5) Number of different assets
Financial Literacy (<i>LM+banks</i>)	0.074*** [0.021]	0.060*** [0.022]	0.010 [0.010]	-0.031* [0.016]	0.094*** [0.033]
R ²	0.32	0.24	0.34	0.30	0.52
Financial Literacy (<i>LM score</i>)	0.063*** [0.023]	0.035 [0.025]	0.011 [0.012]	-0.024 [0.019]	0.098** [0.038]
R ²	0.32	0.25	0.34	0.30	0.52
Financial Literacy (<i>LM dummy</i>)	0.173*** [0.048]	0.162*** [0.056]	-0.018 [0.030]	-0.047 [0.040]	0.174** [0.087]
R ²	0.32	0.24	0.34	0.30	0.51
Financial Literacy (<i>LM +Cole</i>)	0.052*** [0.018]	0.027 [0.019]	0.007 [0.009]	-0.033** [0.015]	0.067** [0.030]
R ²	0.32	0.25	0.34	0.31	0.51

Panel B: Financial Literacy and Borrowing

	(1) Does not know interest rate on credit card	(2) Finds it difficult to pay off credit card	(3) Number of credit cards	(4) Has ≥ 2 credit cards conditional on having a credit card	(5) Has debt larger than annual income
Financial Literacy (<i>LM+banks</i>)	-0.118*** [0.041]	-0.072** [0.034]	-0.000 [0.047]	-0.063 [0.042]	0.003 [0.014]
R ²	0.15	0.11	0.17	0.14	0.12
Financial Literacy (<i>LM score</i>)	-0.118*** [0.043]	-0.090** [0.038]	-0.025 [0.057]	-0.054 [0.045]	0.008 [0.016]
R ²	0.14	0.12	0.17	0.14	0.12
Financial Literacy (<i>LM dummy</i>)	-0.284*** [0.097]	-0.103 [0.070]	-0.124 [0.132]	-0.084 [0.100]	0.006 [0.039]
R ²	0.15	0.09	0.18	0.13	0.12
Financial Literacy (<i>LM +Cole</i>)	-0.097*** [0.037]	-0.071** [0.033]	0.019 [0.042]	-0.002 [0.038]	0.002 [0.012]
R ²	0.14	0.11	0.17	0.13	0.12

Notes: The table reports regression results with robust standard errors in brackets. ***, ** and * denote significance at the 1%, 5% and 10% levels, respectively.

Table A8: Financial Literacy at Household Incomes below Median**Panel A: Savings, Assets and Financial Literacy**

	(1) Assets other than savings account	(2) Fixed deposit	(3) Stocks	(4) Insurance	(5) Number of asset types owned
Financial literacy	0.530*** [0.130]	0.297*** [0.105]	0.074 [0.128]	-0.215 [0.141]	0.123** [0.051]
Numeracy	0.245 [0.188]	0.255 [0.157]	-0.214 [0.181]	-0.397* [0.206]	0.045 [0.080]
Risk aversion	-1.184* [0.633]	-0.753 [0.509]	0.607 [0.601]	1.865*** [0.588]	-0.218 [0.233]
Higher education	0.501* [0.263]	0.511** [0.245]	0.810** [0.330]	0.657** [0.322]	0.306** [0.135]
Female	0.394 [0.251]	0.264 [0.205]	-0.235 [0.270]	0.374 [0.265]	0.241*** [0.091]
Age	0.080 [0.137]	-0.010 [0.088]	0.024 [0.135]	-0.033 [0.106]	0.066* [0.040]
Age squared	-0.060 [0.185]	0.039 [0.114]	-0.017 [0.165]	0.031 [0.134]	-0.070 [0.048]
No of children in HH	-0.045 [0.103]	-0.065 [0.089]	-0.176 [0.147]	-0.305** [0.142]	-0.004 [0.049]
No of adults in HH	-0.067 [0.094]	-0.117 [0.078]	0.131 [0.087]	0.234*** [0.090]	-0.005 [0.032]
Log of income	0.044 [0.351]	0.316 [0.270]	0.393 [0.313]	0.060 [0.356]	0.290** [0.118]
Assets low dummy	-0.781** [0.330]	-0.634** [0.282]	-0.800** [0.405]	-1.523*** [0.388]	-0.577*** [0.167]
Assets high dummy	0.000 [.]	-0.236 [0.373]	1.338*** [0.361]	1.268*** [0.413]	0.390*** [0.144]
Assets amount missing	0.097 [0.387]	0.241 [0.375]	0.258 [0.440]	-0.863* [0.520]	0.093 [0.151]
Constant	-3.121 [2.869]	-2.229 [2.070]	-3.915 [2.865]	-0.266 [2.406]	-2.997*** [0.988]
Pseudo-R ²	0.29	0.22	0.41	0.44	0.17
Observations	164	202	201	202	201

Notes: The table reports regression results with robust standard errors in brackets. ***, ** and * denote significance at the 1%, 5% and 10% levels, respectively.

Panel B: Borrowing Behavior and Financial Literacy

	(1) Does not know interest rate on credit card	(2) Has difficulty paying off credit card	(3) Number of credit cards	(4) Has Debt	(5) Has debt larger than annual income
Financial literacy	-0.378** [0.182]	-0.213 [0.185]	-0.030 [0.088]	-0.056 [0.103]	-0.005 [0.175]
Numeracy	-0.440 [0.294]	-0.301 [0.297]	-0.054 [0.151]	0.040 [0.166]	-0.287 [0.227]
Risk aversion	1.017 [0.722]	0.911 [0.817]	-0.601 [0.452]	0.189 [0.429]	-1.346 [0.953]
Higher education	-0.341 [0.451]	-0.200 [0.452]	0.853** [0.359]	0.621** [0.267]	0.353 [0.500]
Female	0.145 [0.307]	-0.211 [0.380]	-0.052 [0.187]	-0.059 [0.200]	-0.697** [0.349]
Age	0.046 [0.141]	-0.290* [0.175]	0.192** [0.083]	0.304*** [0.092]	0.399** [0.184]
Age squared	-0.053 [0.169]	0.347 [0.212]	-0.212** [0.099]	-0.393*** [0.120]	-0.492** [0.227]
No of children in HH	-0.002 [0.139]	0.035 [0.161]	0.034 [0.102]	-0.182** [0.091]	0.013 [0.124]
No of adults in HH	-0.006 [0.085]	-0.051 [0.125]	0.076 [0.058]	0.084 [0.070]	0.081 [0.123]
Log of income	-0.716* [0.395]	0.517 [0.478]	0.273 [0.256]	-0.192 [0.259]	-0.058 [0.420]
Assets low dummy	-0.272 [0.412]	0.156 [0.456]	0.097 [0.305]	0.017 [0.279]	0.042 [0.544]
Assets high dummy	0.565 [0.415]	-0.920* [0.547]	0.369 [0.280]	0.314 [0.337]	1.433*** [0.492]
Assets amount missing	0.610 [0.512]	0.060 [0.763]	0.157 [0.320]	0.070 [0.326]	0.960* [0.576]
Constant	4.191 [3.442]	4.554 [4.021]	-5.742*** [2.032]	-5.856*** [2.158]	-8.299* [4.288]
Pseudo-R ²	0.19	0.13	0.07	0.09	0.26
Observations	93	92	202	195	164

Notes: The table reports regression results with robust standard errors in brackets. ***, ** and * denote significance at the 1%, 5% and 10% levels, respectively.

Table A9: Determinants of Financial Literacy - Robustness Checks

	(1) Financial Literacy	(2) Financial Literacy	(3) Financial Literacy	(4) Financial Literacy
Father has vocational degree or higher	-0.215 [0.136]	0.097 [0.101]	-0.218 [0.139]	0.073 [0.100]
Mother has vocational degree or higher	0.388*** [0.142]		0.393*** [0.145]	
Financial understanding of parents 1-6	0.044 [0.035]	0.081** [0.034]	0.023 [0.035]	0.039 [0.034]
Poor economic background	0.011 [0.111]	-0.005 [0.106]	-0.081 [0.104]	-0.119 [0.100]
Parents taught to budget	0.170 [0.148]	0.309** [0.135]	0.074 [0.143]	0.136 [0.127]
Parents encouraged saving	0.389** [0.163]		0.328** [0.156]	
Economics in school	0.238* [0.122]		0.068 [0.132]	
Born in Bangkok	0.051 [0.107]	0.046 [0.108]	-0.002 [0.109]	0.014 [0.109]
Highest educational degree in Bangkok	0.082 [0.143]	0.230 [0.143]	-0.034 [0.178]	0.037 [0.171]
Bank account before 18	-0.203** [0.099]		-0.153 [0.098]	
Job before age 15	0.055 [0.101]	0.082 [0.099]	0.045 [0.102]	0.072 [0.098]
Numeracy score out of 4			0.107* [0.055]	0.128** [0.052]
Risk aversion			-1.047*** [0.232]	-1.128*** [0.229]
Higher education			0.041 [0.137]	0.061 [0.121]
Log of income			0.252* [0.134]	0.264** [0.131]
Female			0.050 [0.088]	0.071 [0.085]
Age in years			-0.001 [0.036]	-0.022 [0.034]
Age squared			-0.000 [0.000]	0.000 [0.000]
R ²	0.11	0.07	0.20	0.18
Observations	408	435	408	435

Notes: The table reports OLS regression results with robust standard errors in brackets. The dependent variable is the financial literacy measure. In columns (2) and (4) previously significant childhood variables are excluded. ***, ** and * denote significance at the 1%, 5% and 10% levels, respectively