Financial Literacy and Peer Effects: Causes and Consequences

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Kurzfassung:

Finanzielle und ökonomische Entscheidungen können große Auswirkungen auf das Wohlergehen von Haushalten haben. Trotzdem wird das Können und das Wissen, dass man haben muss um solche Entscheidungen treffen zu können in klassischer ökonomischer Theorie oft nicht mit einbezogen. Es wurde gezeigt, dass viele Menschen finanzielle und ökonomische Fehler machen, die sich negative auf ihr persönliches Wohlergehen auswirken. Ein Grund hierfür ist fehlendes Wissen über Konzepte wie Zinsen und Inflation. Dies führt oft zu schlechten Finanzentscheidungen. Diese Art von Wissen wird allgemein als financial literacy bezeichnet. Gleichzeit werden viele Menschen von anderen in ihrer Umgebung beeinflusst, was zu weiterem finanziellem Fehlverhalten führen kann.

Diese Dissertation trägt zu der bereits bestehenden Literatur bei, indem sie den Effekt von financial literacy auf Finanzentscheidungen für zwei verschiedene Datensätze untersucht: einem aus dem ländlichen und einem aus dem städtischen Thailand. Außerdem, werden die Ursachen für hohe financial literacy untersucht, indem erstens, das Verhältnis von financial literacy und Kindheitserfahrungen, und zweites, das Verhältnis von financial literacy zum Geschlecht untersucht wird. Zum Schluss wird der Effekt von Leuten in der Umgebung auf das Individualverhalten angeschaut.

Diese Studie bringt drei Ergebnisse hervor: Erstens, financial literacy beeinflusst Finanzentscheidungen. Dieser Einfluss ist jedoch stärker, wenn das Finanzsystem gut entwickelt ist und der Zugang zu Finanzinstitutionen kein Problem darstellt. Zweiten wird gezeigt, dass die Ursachen für hohe financial literacy tiefer liegen als allgemein vermutet wird. Diese können auf Kindheitserfahrungen und die Rolle in der Gesellschaft zurück geführt werden. Das dritte Ergebnis ist, dass die Entscheidungen des Einzelnen klar von anderen in dessen Umgebung beeinflusst werden.

Schlagwörter: Financial Literacy, Haushalts Finanzentscheidungen, Kindheit, Geschlecht, Peer Effects

Abstract:

Financial and economic decisions can have great consequences for household welfare. Despite this, the skills and knowledge required to make good decisions are not considered in classic economic theory. It has been shown that many people make financial and economic mistakes or may not act in a way that maximizes their personal welfare. One reason for this is that individuals have poor understanding of concepts such as interest rates and inflation, and this often leads to poor financial decisions. Such understanding is referred to as financial literacy. At the same time, people may be influenced by those around them; this can also lead to decisions that do not maximize welfare.

This thesis contributes to the literature on financial literacy, by looking at and analyzing its consequences for two different samples, in urban and rural areas of Thailand. It further studies the causes of financial literacy, by firstly looking at the link between childhood and financial literacy and, secondly, by studying gender and financial literacy. Lastly this thesis examines the effect of peers on consumption choices.

There are three main findings: Firstly, financial literacy has an impact on financial decision making, however this effect is clearer and stronger when financial institutions are more developed. Secondly, the causes of good financial literacy lie deeper than is often assumed and can be traced back to childhood and someone's role in society. Thirdly, this thesis shows that individuals are clearly influenced by those around them.

Keywords: Financial Literacy, Household Financial Decisions Making, Childhood, Gender, Peer Effects.

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Content

Introduction and motivation

Most people have to make a large number of economic and financial decisions throughout their lifetime. These decisions can have great consequences for welfare. Traditional economic theory predicts that economic agents take rational financial decisions. This theory assumes that individuals are perfectly informed about their own preferences, financial situation as well as all borrowing and saving opportunities available to them. At the same time, it is assumed that they make consumption choices according to their budget, prices and personal preferences. This means that individuals save for retirement and borrow in order to maximise lifetime consumption.

However empirical evidence has shown that this is often not the case. Retirement savings have been found to be too low and at the same time excessive consumption often leads to high levels of debt. These problems apply to many people, but are becoming an increasing problem in emerging markets. In these markets financial development is very recent; this means that access to more sophisticated financial services is new for many people. This applies to both the urban middle class, who have financial products available to them that are equal to those in developed countries, as well as to the rural poor. For the rural poor access to even basic financial services such as bank accounts and credit is relatively new. These newly available financial products leave great room for mistakes in financial decision making.

One reason for these failures in financial decision making is a lack of financial literacy. Financial literacy is the extent to which individuals are familiar with financial concepts such as amongst others interest rate, inflations and risk diversification. Financial literacy has been shown to have an effect on a large number of financial decisions (Lusardi and Mitchell, 2014), however open questions still remain. A second potential reason for mistakes in decision making is peer effects, meaning that individuals behave in the same way as those around them and hence may deviate from their personal optimal decision.

This thesis contributes to the ongoing literature on financial literacy and peer effects in two ways. Firstly, it has a specific focus on emerging market and as a result provides a new perspective on financial literacy, peer effects and financial decisions made by people in these markets. Secondly, it aims to explore the reasons why certain people have higher financial literacy than others, something that has rarely been explored.

Studying the effects of financial literacy and peer effects on decision making is not only important as findings from these studies can improve individual and household welfare, but can also have an aggregated effect for the whole economy. Excessive personal debt, for example, can have destabilising effects on banks, whereas a lack of household savings can results in a strain on the welfare system.

Chapters 1, 2 and 3 of this thesis are based on data collected in Bangkok in 2012. This survey looks at middle class individuals living in an urban environment. This group has hardly been studied when it comes to their financial literacy and financial decisions making. Existing research either focuses on the general population in developed countries or on the very poor living in developing countries. This is surprising as financial literacy is especially important for the middle class in developing countries. In many of these countries the financial system has developed quickly, and at the same time income and life expectancy have risen sharply. This leads to increased demand for savings and sophisticated financial products. Similarly, the availability of credit has increased. All these factors have intensified the need for the middle class in developing countries to make good financial decision and at the same time, the number of sophisticated financial products available has risen.

Chapter 1 studies the relationship between financial literacy and financial decision making based on the data described above. We find that financial literacy has a positive impact on financial decision making; individuals with higher financial literacy hold more sophisticated savings products and make better use of credit cards. The link between financial literacy and financial decisions, however, comes with an endogeneity problem. It is possible that holding certain financial products provides training in financial literacy and so results may be due to reverse causality. We therefore, in addition to a simple OLS regression, employ an instrumental variable strategy to identify a causal relationship of financial literacy on financial outcomes.

Chapter 1 shows that financial literacy is of very high importance for financial decisions making, however the question that follows on from this finding is: where does financial literacy come from and who is financially literate? This question is examined in Chapter 2; there are certain findings that are common to the literature, such as that wealthy or higher income people have higher financial literacy. Furthermore, there is normally a hump shaped relationship between age and financial literacy. However, beyond these simple relationships, the roots of financial literacy have rarely been studied. One aspect that is

interesting is the role of childhood in determining the level of financial literacy. We look at the relationship between twelve childhood variables and financial literacy. We find that family variables are very important in determining financial literacy in adulthood. Both the education level of the mother and whether parents encouraged children to save have a positive impact on financial literacy. We further find that economics education at school has a more indirect impact on financial literacy by improving numeracy. The high importance of family factors in determining the level of financial literacy may give a hint into why many financial literacy trainings have been found to be ineffective.

Chapter 3 examines the relationship between women and financial literacy, and so provides further insights into where financial literacy comes from. It is a very common finding in the literature that women have lower financial literacy than their male counterparts. At the same time, it is also commonly found that women make worse financial decisions than men. Thailand provides one of three examples where women have the same level of financial literacy and make equally good financial decisions to men. The other two known examples are eastern Germany and Russia. The crucial difference between the Thailand data and that from East Germany and Russia is that, our middle class Thai sample performs relatively well on financial literacy tests. This chapter examines the relationship between financial literacy, financial decisions and gender in detail. We further try to find out why the Bangkok sample is different from other samples examined in the financial literacy literature. After looking at other countries and datasets we conclude that the missing gender gap is not caused by high incomes and education levels of our Bangkok sample, but that Thailand is culturally different from other countries studied. In Thailand women have a lot of financial responsibility, which lead to high financial literacy and good financial decision making.

Chapter 4 and 5 use a different dataset. The data in these studies was collected in Ubon Ratchathani in 2013 and is part of a wider project called "The Impact of shocks on vulnerability to poverty". The survey collects data from rural households in three provinces in Thailand and three provinces in Vietnam. The two chapters in this thesis use data from Ubon only. Respondents in this dataset are considerably poorer than those that are part of the survey in Bangkok. Financial products available in these areas are very simple. They consist of ordinary bank accounts and simple, often government sponsored, credit institutions. Informal financial interactions still persist on a large scale in the areas in which the survey was collected.

Chapter 4 examines the impact of financial literacy, numeracy and self-control on financial decision making for rural households. Financial literacy and numeracy may indicate the effect of skill in financial decision making, while self-control can be important for not using the financial products available, especially credit, excessively. We study a large number of characteristics of loans that were taken out with a productive purpose and loans taken out with non-productive purpose. Further, we look at some simple savings indicators. We find that socio-demographic variables play a more important role in loan decisions than financial literacy, numeracy or self-control. These results may indicate that access to financial products is still limited for certain groups within rural Thailand, which has an impact on financial decision making.

In Chapter 5, we look at the effect of peer observation on consumption choices. In traditional economic theory of what determines consumption choices, personal preferences, prices and budget are the only two things that are believed to be of influence. The choice of peers are not taken into consideration. This is despite buying something because someone else has it being a feeling familiar to many. The identification of peer effects comes with a number of problems previously described by Manski (1993). We tackle these problems by performing an experiment, where the only difference between treatment and control group is peer observation. We can therefore attribute the difference in outcomes directly to peer observation. We find that standard deviation in observing peer groups are smaller than in groups without peer observation and individuals are influenced by those in the group. Hence we find evidence of conformity in consumption decisions.

There are three main conclusions from this thesis. Firstly, financial literacy influences financial decision making significantly. This link between financial literacy is clearer in financially advanced markets when access to financial institutions is not a problem. Secondly, this thesis provides insights into the roots of financial literacy. Chapter 2 and chapter 3 show that financial literacy is deep rooted and is, at least in part, influenced by one's childhood and by society. Thirdly, this thesis shows that individual decision making is influenced by peer observation. This thesis therefore contributes to a growing literature on the causes and consequences of both financial literacy and peer effects by providing evidence based on two population groups that have hardly been examined so far.

Chapter 1:

Financial Literacy and Its Impact in the Emerging Middle Class[1]

1.1 Introduction

Individuals have to make many financial decisions during their life time; they have to borrow, to invest or to fund current consumption and at the same time, they have to save for retirement. Whereas this is true for almost all people, these decisions are of particular importance for the middle classes in emerging economies. These economies are characterized by rapid growth, heavy structural changes and the emergence of a larger middle class (e.g. Kharas, 2010, Ravallion, 2010). Increasing incomes allow higher savings, new risks require diversification, longevity in combination with social individualization asks for retirement precautions and sophisticated financial products are becoming newly available in these markets. In order to address challenges adequately and use sophisticated products rationally, individuals need to have a certain financial understanding (Campbell, 2006). Financial literacy is therefore of particular importance for the middle classes in emerging economies.

Somewhat surprisingly, this case has been almost neglected in the extant literature. Studies have focused either on advanced economies (see Lusardi and Mitchell, 2014), population-wide studies in developing countries (Behrman et al., 2010), or poorer areas in developing countries (Xu and Zia, 2012). Studies by Klapper and Panos (2011) in Russia and Beckman (2013) in Romania show that financial literacy is consistently higher in urban areas than in rural areas. In general, within a single developing country large differences tend to exist in wealth and access to finance, ranging from the rural poor without bank accounts to urban workers investing in retirement funds. Clearly, both groups need to be targeted by separate policies. While several studies cover financial literacy in poorer rural areas, research focusing on the middle class in emerging economies is lacking. Our study contributes to filling this gap in the literature.

There is another motivation to study financial literacy of the middle class in emerging economies: going beyond the individual perspective, we argue that financial literacy may usefully contribute to financial development, and thus potentially to economic growth. Financial sector development can lead to better use of resources (Levine, 2005), because it (i) mobilizes and pools savings, (ii) facilitates trading, diversification, and management of risk,

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[1] This chapter is based on a paper with Roy Kouwenberg and Lukas Menkhoff and has previously been published as a Kiel Working Paper, No.1943.

and (iii) eases the exchange of goods and services, amongst others. A developed financial system hence gives individuals the possibility to make better financial decisions. However, what happens if individuals are unable to use this improvement in information and investment opportunities effectively? We expect that not only the supply of sophisticated financial services is important for financial development, but that consumer demand for these services also plays an important role.

Our target group is the rapidly growing global middle class in developing countries, as defined by Kharas (2010) and Kharas and Gertz (2010).[2] The definition of Kharas (2010) tries to identify a class of "global consumers", people who do not just consume out of necessity, but who have sufficient income to demand differentiated goods and (financial) services with higher profit margins. Once a country has a sufficiently large number of these middle class consumers, their demand may help cover the fixed investment costs to develop new mass-produced goods and services. This in turn can spur further economic development, as in the growth model of Murphy et al. (1989).

The middle class in Bangkok provides the ideal platform to study the impact of financial literacy on financial behavior of middle class people in developing countries for a number of reasons. Firstly, Thailand belongs to the group of emerging economies where a sizable middle class with significant financial needs and wealth has developed, meeting the global middle class definition of Kharas (2010). This group is largely concentrated in the Bangkok area, where 23% of the Thai population lives, but which produces 44% of total GDP. Secondly, the financial sector grew quickly and the economy expanded significantly, meaning that the middle class had to adjust quickly to new financial products. Thirdly, as the financial sector is well developed and access to sophisticated financial products should not be a problem for members of the middle class in Bangkok, low take up of these products has non-supply side reasons.[3]

We design a specific survey during which we collect information for close to 500 middle class people in Bangkok. Our sample is relatively homogenous with respect to age, income and education, making it ideal for studying non-socio demographic factors such as financial literacy and their effects on financial behavior. To test the degree of financial literacy, we use standard items and find that basic financial knowledge for middle class people in Bangkok is at the same level as that found in representative studies in developed

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[2] Precisely: average household income per person between \$10 and \$100 per day in purchasing power parity terms, measured in 2005 US dollars.

[3] A dense network of bank branches providess access to consumer finance and saving products: see Section 2.1.

countries. However, the results also indicate that our respondents struggle with more advanced financial knowledge, as only 24% can answer the standard stock market diversification question correctly. At the same time, use of sophisticated financial products such as stocks and bonds is low (9% and 11% respectively), whereas bank accounts and deposits are the most common financial assets.

We further show that financial literacy explains a wide range of savings as well as borrowing decisions, all of which show that more financially literate individuals make better use of advanced financial products. However, the relationship between financial literacy and financial behavior suffers from potential endogeneity caused by potential measurement error or unobserved variable bias. Furthermore, reverse causality is also a potential problem; it is conceivable that holding advanced financial products such as stocks may provide some kind of financial literacy training. In order to address these problems, we use an instrumental variable approach. We collect several variables that refer to respondents' childhood. These are particularly suited as instruments as they are likely to be correlated with financial literacy, but uncorrelated with financial decisions in adulthood. The analyses with instrumental variables confirm our earlier findings.

Our main contribution to the literature is showing the beneficial causal impact of financial literacy for a sample representing the emerging middle class. As additional aspects, we consider a broader set of savings and borrowings decisions than typically covered in other studies. Finally, we show the robust role of instruments derived from the childhood of our sample participants in explaining their financial literacy as adults, and indirectly their financial decision making. In all of our analyses we control for numeracy, risk tolerance, education, income, financial assets and standard socio-economic variables.

The literature of financial literacy first developed to study the link between financial literacy and retirement planning (Ameriks et al., 2003, Lusardi and Mitchell, 2007, Bucher-Koenen and Lusardi, 2011, van Rooij et al., 2011b). Apart from better retirement planning, financially literate individuals are more likely to invest in stocks (Christiansen et al., 2008, van Rooij et al., 2011a) and have more diverse portfolios (Guiso and Jappelli, 2008, Abreu and Mendes, 2010). Regarding borrowing decisions, financially literate people have lower cost debt and are more likely to be aware of their optimal debt level (Lusardi and Tufano, 2009, Stango and Zinman, 2009). They have less high-cost consumer credit (Disney and Gathergood, 2013) and fewer problems with repaying credit card debt (Gathergood, 2012).

Financial literacy is also an important topic for developing countries: we refer to Xu and Zia (2013) for a recent review of the literature. Levels of financial literacy in developing

countries are lower than in developed countries (Hastings and Tejada-Ashton, 2008, Cole et al., 2011, Klapper and Panos, 2011, Beckman, 2013), especially in rural areas. At the same time, studies in developing countries confirm that better financial literacy is positively related to retirement planning (Klapper and Panos, 2011), to greater participation in financial markets, to greater use of formal sources of borrowing (Klapper et al., 2013), to higher savings and better diversification (Beckmann, 2013). However, the evidence is limited to population-wide studies or poorer areas in developing countries, while the emerging middle has been largely ignored, a gap that our paper aims to fill.

1.2 Data description
1.2.1. The financial-economic background of Thailand and Bangkok

With our financial literacy survey we specifically target the middle class in Bangkok, Thailand. Over the last 50 years, Thailand has rapidly developed from a relatively poor agricultural society with GDP per capita of 101 USD in 1965, to an "upper-middle income" economy with GDP per capita of 5,480 USD in 2012 (in current USD, source: World Bank).[4] Regional disparity is hiding behind this remarkable success story of economic transformation and development. Thailand has a population of 66 million people as of 2012, of which 15 million (23%) live in the capital city Bangkok and its direct vicinity.[5] Bangkok is the administrative, economic and financial center of the country, producing 44% of Thailand's GDP. As a result, GDP per capita in Bangkok is twice the national average, similar to Greece and the Czech Republic (corrected for purchasing power).[6]

Consumer finance services in Bangkok are modern and well developed, including a dense network of banks and ATM's, providing access to savings accounts, time deposits, investment funds (stock, bonds), credit cards, consumer loans and home mortgages. Insurance products are available at bank branches and also sold through a large direct sales network. In addition, offices of brokers are widespread, providing direct access to the local stock and bond markets.[7] A special feature in Bangkok are gold shops, present in most neighborhoods, where gold bars and jewelry are traded.

A worrisome recent trend is that in 2013 the ratio of household debt to GDP reached 82.3%, steeply rising from only 55.1% in 2008 (source: Bank of Thailand). This raises the

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[4] Real GDP per capita grew from 437 USD in 1965 to 3,353 in 2012 (in constant 2005 USD, World Bank).
[5] Source: National Economic and Social Development Board (NESDB).
[6] When considering GDP per capita in nominal USD, without correcting for purchasing power effects, Bangkok's GDP per capita in 2012 is similar to Turkey, Malaysia and Brazil.
[7] Like in developed countries, online banking and brokerage services are easily available.

question to what extent households fully understand the consequences of increasing debt service for their financial situation.

Similar to most developed countries, Thailand's has a rapidly ageing population, predicted to shrink from 2023 onwards. The number of retirees as a proportion of the population was 14% in 2012 and is expected to increase to 32% by 2050 (source: UN), above the global average. Although Thailand has a pension system with public and private pillars, both the coverage and the benefits are limited, due to a cap of public pensions and high levels of self or informally employed people. To counter the expected pension shortfall, the Thai government actively encourages individual retirement savings through tax-exempt equity funds and retirement funds, but this clearly requires some financial literacy.

1.2.2. Defining the middle class

Our objective is to study the financial literacy of people in Bangkok who are members of the rapidly growing global middle class in developing countries. Kharas (2010) and Kharas and Gertz (2010) define members of the global middle class as those who make between $10 and $100 per day in purchasing power parity terms, measured in 2005 dollars. This definition excludes those who are considered poor in the poorest advanced countries and those considered rich in the wealthiest advanced countries. Kharas (2010) chose this income range because the income elasticity of demand for consumer durables and financial services tends to be above one, indicating that consumption has moved beyond being just a necessity. Building domestic demand for differentiated (branded) goods and services with higher profit margins is considered an important driver for the development of middle income countries.

Alternative definitions of the middle class in the literature include those who have escaped poverty by developing country standards, often defined as making more than $2 per day in 2005 dollars (e.g., Ravallion, 2010). In our study we also analyze savings and investment decisions, which require regular income in excess of expenditures and thus considerably higher income than merely being out of poverty. So called "relative" definitions of the middle class usually take an income range from 75% to 125% of the median income. However, such a relative definition is local by default, just singling out people who are close to the median income in a particular country. For these reasons we prefer the absolute and global middle class definition of Kharas (2010).

1.2.3. Data collection by 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 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 and wealth 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. 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 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.[8] (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,

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[8] According to the Thai National Statistics Office (2011), 29% of the regularly employed in Bangkok earn 15,000 Baht or more.

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

The $10 per day threshold for belonging to the global middle class is per capita, and thus depends on total household income and the number of household members. Our street interception survey design required a simpler and quicker criterion to help screen potential participants and for this reason we chose a personal income threshold of 15,000 Baht per month, which is 745 USD in constant 2005 dollars converted at PPP. A family of two earners making 15,000 Baht each can support three more household members (e.g., two children and one elderly parent), while still making the $10 per day threshold. In our sample of 530 respondents only 30 have average household income per person below the $10 per day threshold (too poor), 8 are above the $100 per day upper limit (too rich), and one person failed to provide information about household composition. Hence, we have a sample of 491 respondents from Bangkok meeting the global middle class definition of Kharas (2010).

1.2.4. Description of socio-demographic variables

Table 1.5 shows summary statistics of key socio-demographic variables for the middle class sample of 491 people as defined above. Both average individual and household income are higher than the Bangkok average. For example, mean individual income (see Table 1.1, Panel A) is 26,467 Baht per month (827 USD), while the average income of an employee in Bangkok was 16,961 Baht per month (530 USD) in 2011 according to the Thai National Statistics Office. The standard deviation of income is also high at 19,023 Baht, so there is substantial heterogeneity within the sample as well.

The average age is 34.5 years and most respondents have a higher educational degree. The highest educational attainment of 66% 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 1.1, 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 47%, 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 2.9. 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.

Overall, our middle class sample is richer than the Bangkok average and also relatively highly educated. Indeed, the explicit purpose of the survey design was to exclude the poor and those just making enough to make ends meet, as both financial literacy and the demand for financial services in this group are substantially different due to lack of savings.[9] For example, among the 30 people excluded from the sample for having low income, only one person owns a fixed deposit account (3.3%) and four have a credit card (13%), while among the 491 respondents included in our middle class sample 42% have a fixed deposit account and 34% have a credit card. Table 1.A1 in Appendix 1 provides statistics on the 30 respondents who are too poor to meet the middle class definition and the 8 that are too rich.

1.2.5. 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 question first used by Lusardi and Mitchell in the 2004 US Health and Retirement survey (Lusardi and Mitchell, 2011), which have become standard in the literature. Regarding the first question we follow the slight adaption to a developing country as proposed by Cole et al. (2011). These questions test understanding of 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. By doing this, we try to expand the measure of financial literacy to include institutional knowledge, which has been shown to be of importance for financial outcomes (Gustman et al., 2012, Carpena et al., 2011). There are about ten foreign banks operating in the retail market in Bangkok, but they are far less widespread than familiar local banks. For this reason we use being able to name foreign retail banks as a proxy for 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

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[9] A recent financial literacy study of the Asian Development Bank (ADB, 2013) in Thailand explicitly targeted groups of urban poor living in Bangkok.

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 81% answering the first question correctly (Table 1.2, Panel A). Slightly fewer people seem to have a good grasp of inflation. Only 64% 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 about the stock market, or alternatively, because individuals do not grasp risk diversification. It is thus unsurprising that only 17.5% of the respondents answer all three questions correctly. Most respondents give two correct answers (43.0%), while a small minority does not give any correct answers (9.8%).

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 for first two questions; however, results are considerably worse on the risk diversification question (see Xu and Zia, 2012). This indicates that while basic financial knowledge of interest rates and inflation in Bangkok is good, the resident middle class here lacks more advanced financial knowledge, despite wide availability of advanced financial products. At the same time, our Bangkok middle class residents do considerably better on all questions compared to general population surveys in developing countries (Xu and Zia, 2012, Lusardi and Mitchell, 2014).[10]

When it comes to naming foreign banks, respondents name between zero and four foreign banks, with only one person being 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 2.25 (Table 1.2, Panel B), with 21.0% being able to name four and 6.5% being able to name none at all. Figure 1.1 shows the distribution of our

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[10] Interestingly, the low 24% proportion of correct answers on the stock market diversification question is comparable to *urban* sub-groups in Russia and Romania (Panos and Klapper, 2011, Beckmann, 2013).

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 median of 2.5, while only 1.2% get a score of zero.

1.2.6. 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 1.3, 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, a question on risk attitudes is included. The 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. We turn this measure of risk tolerance into a measure for risk aversion by reversing the scale to a score between zero and one.

1.2.7. Financial literacy by demographic group and correlates

Correlations between our measure of financial literacy, numeracy and risk attitude are shown in Table 1.3, Panel C. Further, Table 1.4 shows financial literacy by gender, age, education, as well as by income groups and financial assets. We find that our data mainly show the expected patterns, both for our new measure of financial literacy as well as the Lusardi and Mitchell measure of financial literacy. Financial literacy is higher for respondents with higher education, higher income and higher financial assets. We refer to Table 1.A2 in Appendix 1 for correlations between all main variables of this study.

Remarkable is the steep rise in the percentage of correct answers to the stock market diversification question as a function of income and financial assets, ranging from less than 20% correct in the lowest income and asset groups to more than 40% correct in the highest

groups. The evidence supports the model of Jappelli and Padula (2013) where financial literacy and wealth are endogenous variables, jointly determined over the life-cycle.

We find one surprising result in Table 1.4, namely that the women in our sample do not have lower financial literacy than the men. In additional OLS regressions explaining financial literacy with respondent characteristics in Appendix 1 (Table 1.A3), we find that demographic variables do not have the strongest relation with financial literacy, but rather numeracy, risk aversion and income, which is in line with recent findings by Meier and Sprenger (2013) and Fernandes et al. (2014).

1.3. Results
1.3.1. 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 1.5, Panel A. Penetration of basic financial services is wide among the urban middle class; every respondent has a bank savings account.

However, ownership of other financial assets is not as widely spread, as only 42% 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, 8% hold stocks or an equity mutual fund, and 16% have a life insurance policy. In total only 53% 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, 61% of the sample holds the largest proportion of their wealth in a savings account.

Due to reservations about passing on financial information, the survey asks respondents to indicate their total amount of financial assets in five pre-defined categories, instead of asking for the exact amount. The level of assets in our sample is relatively low, with 49% 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 8% hold assets in excess of 500,000 Baht. A further 20% refuse to answer the question. The low amount of financial assets reported may be partially explained by a preference for investing in real estate and the relatively young age of our sample, apart from reservations about sharing this information.

Our findings for investments in financial assets are similar to results reported in Guiso and Sodini (2013) for the lowest wealth deciles in the U.S.: the majority of financial assets is

held in cash, while participation in stock and bond markets is below 20%. As wealth increases, financial asset holdings become more diversified and the weight of cash decreases. In our sample we find exactly the same pattern: Figure 1.2 shows stock and bond market participation as a function of the reported amount of financial assets. In the group with more than 500,000 Baht (15,600 USD) of financial assets stock market participation is 55%, while 29% own bonds or bond funds. Hence, limited participation in financial markets among the emerging middle class may partially be explained by low wealth levels.

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 1.4), as credit cards can improve financial transactions considerably, but can also lead to problems if used irrationally. 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 77% reporting an exact amount of debt, and 23% not reporting the amount. Among respondents providing a positive debt amount, the average loan value is 256,300 Baht (8,010 USD), with a large standard deviation of 513,500. For 20% of those reporting a positive debt amount, the loan amount is larger than their annual income.

Only 34% of the sample have a credit card, showing that credit card use is not yet widely spread among the Bangkok middle class, most likely due to lack of sufficient monthly income.[11] Out of those with a credit card, 15% claim that they find it difficult to pay off their credit card debt every month. Further, 57% do not know the interest rate charged by the credit card company, which is worrisome as credit card debt is one the most expensive sources of consumer finance.

1.3.2. Financial literacy and saving decisions

We analyze two types of savings and investment decisions, namely the use of financial products beyond basic savings accounts and diversification. Both of these are indicators that individuals are using the advanced financial system that is available to them. 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

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[11] 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). In our sample, 43% of those in the group with self-reported financial assets between 100,000 and 500,000 Baht have a credit card, and 72% of those with high assets (more than 500,000 Baht).

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*.

(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 of return requires high 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.

Table 1.6 shows the regression results for explaining these savings decisions. We find that the relationship between financial literacy and better financial behavior – as proxied by the dependent variables in specification (i) to (v) – is mostly statistically significant and economically meaningful. Those that can score an additional point on the financial literacy measure are about 8 percentage points more likely to hold an asset other than a savings account at the mean, an increase of 15%. Similarly, scoring an extra point increases the probability of having a fixed deposit account by about 6 percentage points (+15%). Moreover, an extra financial literacy point reduces the likelihood of having life insurance by about 3 percentage points (-20%). At the same time, an extra financial literacy point increases the number of assets held by 0.11, an increase of 14% relative to the mean (0.75).

Financial literacy explains all dependent variables except for stock market participation, which seems to be driven mainly by asset and income levels. 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 1.5, 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 (weakly) 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.

1.3.3. Financial literacy and borrowing decisions

Less researched than savings decisions is borrowing behavior. A problematic policy issue in many emerging economies, such as Thailand, is uninformed and excessive consumer credit. Credit cards can have advantages for certain transactions and 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 1.7. Financial literacy is negatively linked to both of these indicators. In particular, one extra point on the financial literacy scale (0 to 4) reduces the chance of not knowing the interest rate on credit card debt by 12.5 percentage points (-22% relative to the mean), while it reduces the probability of finding it difficult to pay off credit card debt by 6 percentage points (-43%). Moreover, our results show that financial literacy is the only variable that has significant explanatory power for these indicators, apart from gender and a dummy for high assets; remarkably, numeracy, education and income are insignificant.

Credit cards are part of a developed financial system, but can also cause problems for this system if used unwisely. We have shown here that better financial literacy is associated with more informed use of credit cards. 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 an insignificant determinant.

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 1.7). There are two possible reasons for this relationship. 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 relationship

between borrowing and financial literacy, as respondents engaged in uninformed or excessive borrowing may prefer not to report their debt amount.

Overall, and considering savings and borrowings decisions together, we find that financial literacy has a clear effect on the financial decisions of the middle class in Bangkok, and in the expected way: higher financial literacy relates to choosing more advanced financial products and better diversification, and it relates to a more informed use of credit cards.

1.3.4. Causal relationships

Logic may suggest that causality runs from financial literacy to good financial decisions making, but the reverse is also conceivable (Jappelli and Padula, 2013). It is possible that investing in advanced financial products, such as stocks or fixed deposit accounts provides some kind of financial literacy training and so enables respondents to answer more questions correctly. At the same time, it is possible that OLS regression suffers from endogeneity, caused either by unobserved variable bias or by measurement error. The standard approach for dealing with these endogeneity problems in the literature is to analyze the impact of financial literacy with instrumental variables (IV) methods.

The main conclusion arising from other studies employing IV-methods is that financial literacy has a direct causal effect on wealth accumulation (Behrman et al., 2010, van Rooij et al., 2012), retirement planning (Lusardi and Mitchell, 2009, van Rooij et al., 2011b), stock market participation (van Rooij et al., 2011a) and having unspent income (Klapper et al., 2013). 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.[12]

To verify the causality of the associations reported so far, we have estimated instrumental variable regressions where we use childhood experiences as instruments for financial literacy. Following Behrman et al. (2010), 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). Hence childhood experiences with money are particularly suited for this, as they are highly correlated with financial literacy (see, e.g., Behrman et al., 2010, van Rooij et al., 2011b, 2012), but not necessarily correlated with financial behavior in adulthood.

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[12] Other papers have tried to solve the potential reverse causality problem by looking at the difference in financial outcomes between those who received financial training and those who did not (see, e.g., Bernheim et al., 2001). However, effects on financial outcomes are often negative, which may be due to ineffective training.

As the survey for this paper was designed especially for the purpose of studying financial literacy, we included a large number of potential instruments, all of which refer to the respondents' childhood. Our survey includes questions about the education level of the parents, a rating of the parent's financial understanding, whether the parents taught budgeting and encouraged savings during the respondent's childhood, whether the respondent had economics as a subject in school, and whether they had a bank account before the age of 18.

Table 1.8 reports results of two-stage instrumental variable regressions. All childhood variables collected were used as potential instruments for financial literacy in the first-stage regression. For each dependent variable separately, instruments were eliminated if the over-identification test rejected the null hypothesis of no direct relation between the instrument and the dependent variable. Further, weak instruments were deleted if they had low significance in the first-stage regression for explaining financial literacy. The final set of instruments is shown in the third row, and usually consists of only one or two variables. Parents encouraged savings and having a bank account before the age of 18 are most often selected as instruments, followed by the financial understanding of the parents. The first-stage regression results are shown in Table 1.A3 in the Online Appendix.

The first row in Table 1.8 shows the original marginal effect estimate from a standard probit or count data model, repeated from Table 1.6 and Table 1.7, respectively. The second row of Table 1.8 shows the marginal effect of financial literacy in a two-stage regression, with financial literacy instrumented. All regressions include a full set of socio-economic controls, but to save space the coefficient estimates are not shown. The results in Table 1.8 show that the impact of financial literacy on financial decisions is causal. Further, in line with the literature, the impact of financial literacy becomes stronger when using an instrumental variables approach. The only exception is the number of different assets owned, for which financial literacy is no longer significant after instrumentation. However, a Wald test also indicates that endogeneity of financial literacy is not an issue for this particular dependent variable.

Table 1.8 also provides detailed information on instrument validity. The fourth row of Table 1.8 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. None of the J-statistics are significant by default, as we have eliminated instruments not passing this test beforehand. Finally, the sixth row shows a chi-square statistic testing exogeneity of financial literacy. Significance implies that financial literacy is

endogenous and the use of IV methods is necessary. However, if exogeneity cannot be rejected, IV techniques are not required and can lead to inefficient standard errors.

We find that financial literacy is endogenous in some of the equations explaining asset ownership, as one would logically expect, because exposure to savings products can give rise to higher financial knowledge. But, financial literacy is mostly exogenous when explaining borrowing behavior, which is also plausible, as exposure to debt or credit cards in itself does not necessarily improve financial knowledge.

1.4. Robustness

We perform a number of robustness tests in order to demonstrate that our findings hold when using other measures of financial literacy, other middle class definitions, and more exclusive definitions of asset ownership. Tables with the results of these tests are shown in Appendix 1 and also shortly described below.

Other measures of financial literacy.   Table 1.A4 in Appendix 1 shows results of regressions which reproduce the main specifications of Table 1.6 and 1.7 with alternative measures of financial literacy: i) the number of correct answers on the three standard Lusardi-Mitchell financial literacy questions (from 0 to 3), ii) a dummy for answering all three standard Lusardi-Mitchell financial literacy questions correctly (0 or 1), and iii) the number of correct answers on the three standard Lusardi-Mitchell questions, plus an additional borrowing question from Cole et al. (2011) (from 0 to 4). The table shows the estimated marginal effects of the various financial literacy measures, plus the R^2s. In general, the results for most dependent variables are robust to changing the financial literacy measure.

Other middle class definitions.   All results reported in the paper are for a sample of 491 respondents whose family income per household member is between \$10 and \$100 in 2005 dollars, excluding 8 (30) persons whose income is too low (too high). We imposed this sample restriction to focus on the global middle class in developing countries defined by Kharas (2010) and to facilitate comparison with future studies in other countries. When calculating average household income per person, we counted each household member as one, following Kharas (2010). However, in studies analyzing household behavior additional household members and children usually receive lower weights, due to economies of scale. For example, the OECD-modified scale assigns a value of 1 to the household head, 0.5 to each additional adult and 0.3 to each child. Using this scale to estimate average income per weighted household member, only one person is too poor (< 10 USD per day) and 31 are too rich (>100 USD per day): see Table 1.A1 in Appendix 1. Table 1.A5 repeats the main

analysis of saving and borrowing behavior in this alternative sample of 497 middle class respondents: our findings are effectively the same as before (as in Table 1.6 and Table 1.7).

We have also repeated the main analysis in Table 1.6 and Table 1.7 with the full sample of 530 respondents, and found no substantial changes in the results or conclusions. Overall, the main lesson from these tests is that the exact definition of "middle class", and the exclusion of people on either side of the income scale, does not affect our conclusions.

Other dependent variable definitions.   We note that the zero outcome of the dependent variables for the ownership of fixed deposits, stocks and insurance in Table 1.6 does not rule out holding other kinds of high-yielding assets, which may bias the estimated effect of financial literacy downwards. For example, a person without a deposit account may actually invest in stocks or bonds. We have estimated the model for ownership of fixed deposits again, but now excluding 49 people who do not own a deposit account, but who do invest in other assets (stocks, bonds or gold): the estimated marginal effect of financial literacy increases from 0.064 to 0.078 (+22%). A similar analysis shows that the negative effect of financial literacy on life insurance ownership also becomes stronger, while the effect of financial literacy on stocks market participation remains unchanged and insignificant.

Controls for occupation and sampling location.   To mitigate potential omitted variable bias resulting from the survey design, we have added controls variables for survey location and the respondent's occupation to the regression model used in Table 1.6 and 1.7. The results, available upon request, show that the significance of financial literacy and its impact on saving and borrowing behavior is unaffected by the addition of these controls.

1.5. Conclusions

To our knowledge this is the first study that examines the impact of financial literacy among the middle class of an emerging economy. In contrast to the poor in developing countries, most middle class members have access to a wide range of saving products and channels of borrowing. However, little is known about how effectively the middle class uses these financial services, and to what extent a lack of financial literacy is an obstacle.

In this paper we first show that the average level of financial literacy of the middle class in Bangkok is similar to developed countries. However, knowledge about stock market diversification is lacking, with only 24% answering this question correctly. Moreover, we are able to show that financial literacy has two main benefits. First, financially literate individuals are more likely to own a fixed deposit account and diversify among a larger number of investment products. Second, they use credit cards in a more informed way: they

are more likely to know the interest rate on credit card debt and have less difficulty paying off credit card debt. Finally, these links from financial literacy to financial behavior are causal, as demonstrated through IV regressions.

In our sample we find no support for the expected positive link between financial literacy and stock market participation that is often found in developed markets. Taken together with the documented low knowledge of stock market diversification, our results suggest that building better understanding of stock markets may be among the important policy targets for raising the financial literacy of the middle class in developing countries.

As an avenue for future research, a relevant question is whether improving the financial literacy of the middle class in developing countries has benefits beyond improving individual welfare. We expect that financial literacy is an important component in three out of five channels though which financial development leads to growth (Levine, 2005): more efficient mobilization of savings, better risk management and improving the exchange of goods and services. Cross-country studies can investigate these potential macro-economic benefits.

Table 1.1: Summary Statistics

Panel A: Demographics

	mean	median	stdev	min	max
Female (%)	47%	0	50%	0	100%
Age in years	34.49	32.0	9.50	18	60
Married (%)	46%	0	50%	0	100%
Personal income (Baht)[*]	26,467	20,000	19,023	15,000	200,000
Household income (Baht)[*]	58,457	50,000	42,222	15,000	300,000
Number of children in HH	0.75	0	0.97	0	6
Number of adults in HH	2.86	3.0	1.43	1	11
Daily income per household member in 2005 USD	28.99	25.0	15.18	10.0	83.5

The sample consists of N = 491 respondents who have daily income per household member in 2005 USD (at PPP exchange rates) between $10 and $100, meeting the global middle class definition of Kharas (2010).
[*] Monthly amount in Thai Baht

Panel B: Education

	Percent	N
No education	0.4%	2
Primary school	3.9%	19
Secondary school	12.8%	63
Vocational	14.1%	69
Bachelor degree	66.0%	324
Masters degree	2.6%	13
PhD	0.2%	1
Total	100.0%	491

Table 1.2: Financial Literacy

Panel A: Responses to Financial Literacy Questions

	Correct	Wrong	Don't Know	Refuse to Answer
Interest rate	80.9%	14.1%	4.9%	0.2%
Inflation	63.5%	24.2%	11.4%	0.8%
Diversification	23.8%	24.2%	50.3%	1.6%

Panel B: Financial Literacy Measures

	mean	median	stdev	min	max
Sum correct 3 basic questions (*Lusardi-Mitchell*)	1.68	2.00	0.87	0	3
Total number of foreign banks named	2.25	2.00	1.20	0	6
Score between 0 and 1 for naming foreign banks	0.56	0.50	0.30	0	1
Sum correct 3 basic questions and name banks score out of 4 (*Lusardi-Mitchell + Banks*)	2.24	2.50	0.99	0	4

Panel C: Correlations

	Interest Rate	Inflation	Diversification	Name Foreign Banks
Interest rate	1.00			
Inflation	0.19***	1.00		
Diversification	0.05	0.25***	1.00	
Naming foreign banks	0.06	0.18**	0.26***	1.00

***, ** and * denote significance at the 1%, 5% and 10% levels, respectively
The sample consists of N = 491 respondents who have daily income per household member in 2005 USD
(at PPP exchange rates) between $10 and $100, meeting the global middle class definition of Kharas (2010).

Notes: 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? Options: 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?
   Options: 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.
   Options: a) True, b) False
4. *Institutional knowledge:* Name foreign banks. Open answers

Table 1.3: Numeracy and Risk Aversion

Panel A: Numeracy Question

	Correct (%)	Wrong	Don't know	Refuse to Answer
35+82	84.7%	10.4%	2.2%	2.6%
4 friends, 4 sweets [a]	84.5%	12.0%	0.4%	3.1%
10% of 400	94.5%	1.4%	1.4%	2.6%
1000-370 [b]	95.3%	1.6%	0.2%	2.9%

[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	median	stdev	min	max
Numeracy score out of 4	3.59	4	0.85	0	4
Scale of risk taker	5.54	6	2.20	0	10
Risk aversion scale (0-1)	0.45	0.40	0.22	0	1

Panel C: Correlations

	Numeracy	Risk aversion scale	Financial Literacy (3+banks)
Numeracy	1		
Risk aversion scale	-0.25***	1	
Financial literacy *(3+banks)*	0.23***	-0.37***	1

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

Table 1.4: Distribution of Financial Literacy across Demographic and Income Groups

| | Obs. | Percent. in group | Financial literacy questions (Lusardi-Mitchell) | | | | Foreign banks (0-4) mean | Financial literacy (0-4) mean | Risk aversion (0-1) mean | Numeracy (0-4) mean |
			Interest correct %	Inflation correct %	Stock risk correct %	All three correct %				
Gender										
Male	259	53%	81%	64%	23%	16%	2.19	2.22	0.43	3.58
Female	232	47%	81%	63%	25%	19%	2.31	2.27	0.47	3.61
Age										
< 35 years	277	56%	82%	66%	25%	18%	2.26	2.30	0.44	3.68
35 - 50 years	173	35%	82%	58%	20%	15%	2.21	2.15	0.45	3.53
> 50 years	41	8%	71%	66%	34%	22%	2.37	2.30	0.49	3.24
Education										
Secondary or lower	84	17%	63%	51%	11%	2%	1.73	1.68	0.52	3.13
Vocational	69	14%	84%	61%	36%	26%	2.10	2.33	0.48	3.72
Bachelor or higher	338	69%	85%	67%	25%	20%	2.41	2.37	0.42	3.68
Income										
< 17,500	166	34%	77%	58%	17%	8%	2.08	2.03	0.49	3.49
17,500 - 22,500	150	31%	77%	59%	19%	14%	2.22	2.12	0.45	3.55
22,500 - 37,500	101	21%	87%	72%	30%	27%	2.39	2.48	0.39	3.74
> 37,500	74	15%	89%	73%	41%	34%	2.50	2.65	0.42	3.70
Financial assets										
Refuse/ don't know	100	20%	82%	50%	17%	12%	1.92	1.97	0.45	3.68
< 100,000	243	49%	79%	65%	21%	14%	2.34	2.25	0.44	3.63
100,000 - 500,000	110	22%	84%	68%	26%	24%	2.42	2.38	0.44	3.43
> 500,000	38	8%	79%	74%	50%	34%	2.08	2.55	0.47	3.61

The sample consists of N = 491 respondents who have daily income per household member in 2005 USD (at PPP exchange rates) between $10 and $100, meeting the global middle class definition of Kharas (2010).

Table 1.5: Savings and Borrowings Summary Statistics

Panel A: Assets

	mean	stdev	min	max	count
Has a savings account	100%	0%	1	1	491
Owns fixed deposit accounts	42%	49%	0	1	491
Owns a government savings bank deposit	2%	15%	0	1	491
Owns bonds or bond mutual funds	11%	31%	0	1	490
Owns stocks or equity mutual funds	8%	27%	0	1	489
Owns gold	8%	26%	0	1	488
Owns life insurance	16%	37%	0	1	491
Financial Assets < 100,000	49%	50%	0	1	491
100,000 < Financial Assets < 500,000 Baht	22%	42%	0	1	491
Financial Assets > 500,000 Baht	8%	27%	0	1	491
Did not provide financial assets amount	20%	40%	0	1	491
Owns >= 2 types of assets[a]	53%	50%	0	1	487
Number of asset types owned, apart from a savings account[a]	0.75	0.88	0	4	487

[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	47%	50%	0	1	473
Amount of debt in Baht	93,383	332,977	0	3,000,000	376
Amount of debt in Baht *(conditional on having debt)*	256,292	513,477	0	3,000,000	137
Debt larger than annual income	7%	26%	0	1	376
Debt larger than annual income *(conditional on having debt)*	20%	40%	0	1	137
Number of credit cards	0.62	1.09	0	7	491
Has at least one credit card	34%	47%	0	1	491
Finds it difficult to pay off credit card *(conditional on having a credit card)*	15%	36%	0	1	163
Does NOT know interest on credit card *(conditional on having credit card)*	57%	50%	0	1	165

Table 1.6: Savings, Assets and Financial Literacy

	(1) Assets other than savings account	(2) Fixed deposits	(3) Stocks	(4) Insurance	(5) Number of asset types owned
Financial literacy	0.078***	0.064***	0.009	-0.032**	0.106***
	[0.022]	[0.023]	[0.009]	[0.015]	[0.034]
Numeracy	0.052*	0.036	-0.013	-0.060***	0.077*
	[0.027]	[0.027]	[0.009]	[0.015]	[0.046]
Risk aversion	-0.088	-0.164	0.050	0.183***	-0.078
	[0.104]	[0.103]	[0.048]	[0.063]	[0.165]
Higher education	0.147***	0.128***	0.063**	0.101***	0.296***
	[0.041]	[0.044]	[0.025]	[0.033]	[0.076]
Female	0.085**	0.100**	-0.029	0.034	0.137**
	[0.038]	[0.039]	[0.020]	[0.027]	[0.060]
Age	0.036**	0.022	0.004	0.012	0.102***
	[0.018]	[0.017]	[0.009]	[0.012]	[0.025]
Age squared / 100	-0.041*	-0.019	-0.004	-0.015	-0.116***
	[0.025]	[0.023]	[0.011]	[0.015]	[0.031]
No of children in HH	-0.015	-0.019	-0.015	-0.036**	-0.031
	[0.022]	[0.021]	[0.011]	[0.016]	[0.030]
No of adults in HH	0.014	0.005	0.009	0.019*	0.011
	[0.014]	[0.014]	[0.007]	[0.010]	[0.022]
Log of income	0.296***	0.216***	0.067***	0.045	0.472***
	[0.072]	[0.061]	[0.024]	[0.037]	[0.082]
Assets low dummy	-0.148***	-0.144***	-0.032	-0.190***	-0.368***
	[0.051]	[0.052]	[0.024]	[0.035]	[0.087]
Assets high dummy	0.125	-0.102	0.104***	0.163***	0.153*
	[0.101]	[0.092]	[0.026]	[0.043]	[0.092]
Assets amount missing dummy	-0.098	-0.053	-0.026	-0.062	-0.154*
	[0.060]	[0.062]	[0.033]	[0.039]	[0.092]
Mean of dependent var.	0.53	0.42	0.08	0.16	0.75
Pseudo-R²	0.26	0.18	0.37	0.34	0.18
Observations	487	491	489	491	487

Notes: The table reports marginal effects, with robust standard errors in brackets. The dependent variable of the regression models is: (1) a dummy for owning assets other than a savings account, (2) a dummy for owning fixed deposit accounts, (3) a dummy for owning stocks or equity mutual funds, (4) a dummy for owning life insurance, and (5) the number of asset types owned (excluding savings accounts). Results in Column (1) to (4) use probit regression models, and Column (5) is based on a Poisson count data regression model. The row "Mean of dependent var." displays the sample mean of the dependent variable to facilitate the interpretation of marginal effect sizes. ***, ** and * denote significance at the 1%, 5% and 10% levels, respectively

Table 1.7: 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) Debt larger than annual income
Financial literacy	-0.125***	-0.063**	0.043	-0.006	-0.015
	[0.040]	[0.032]	[0.058]	[0.026]	[0.012]
Numeracy	-0.029	-0.048	0.113	0.001	-0.030**
	[0.070]	[0.045]	[0.069]	[0.028]	[0.012]
Risk aversion	0.009	0.038	-0.349	0.012	-0.136**
	[0.186]	[0.130]	[0.266]	[0.111]	[0.056]
Higher education	-0.107	-0.055	0.278**	0.061	0.014
	[0.090]	[0.059]	[0.132]	[0.051]	[0.030]
Female	0.107	-0.114**	0.078	-0.008	-0.038
	[0.073]	[0.056]	[0.100]	[0.045]	[0.024]
Age	-0.003	-0.037	0.119***	0.095***	0.034**
	[0.033]	[0.025]	[0.042]	[0.018]	[0.013]
Age squared / 100	0.004	0.045	-0.149***	-0.121***	-0.042**
	[0.041]	[0.032]	[0.054]	[0.025]	[0.017]
No of children in HH	0.019	0.023	0.086	-0.015	0.010
	[0.037]	[0.027]	[0.062]	[0.025]	[0.013]
No of adults in HH	0.058**	-0.006	0.040	-0.019	-0.017
	[0.024]	[0.017]	[0.038]	[0.017]	[0.013]
Log of income	-0.200*	0.036	0.424**	-0.120*	-0.009
	[0.103]	[0.067]	[0.169]	[0.070]	[0.035]
Assets low dummy	-0.043	-0.022	-0.035	-0.029	-0.065**
	[0.101]	[0.076]	[0.147]	[0.064]	[0.032]
Assets high dummy	0.271**	-0.058	0.388**	0.069	0.088**
	[0.120]	[0.093]	[0.165]	[0.102]	[0.035]
Assets amount missing dummy	0.054	0.009	-0.049	-0.017	-0.055
	[0.119]	[0.093]	[0.149]	[0.072]	[0.042]
Mean of dependent var.	0.57	0.15	0.62	0.47	0.07
Pseudo-R²	0.14	0.11	0.08	0.05	0.24
Observations	165	163	491	473	376

Notes: The table reports marginal effects, with robust standard errors in brackets. The dependent variable of the regression models is: (1) a dummy for not knowing the interest rate on credit card debt, (2) a dummy for respondents that indicate having difficulty paying off their credit card debt on time, (3) the number of credit cards the respondent has, (4) a dummy for having debt, and (5) a dummy equal to one if the amount of debt is larger than annual income. Results in Column (1), (2), (4) and (5) use probit regression models, and Column (3) is based on a negative binomial count data regression model. In Column (1) and (2) the sample is limited to respondents with credit cards only. The sample in Column (5) excludes respondents who did not provide the amount of debt (missing). The row "Mean of dependent var." displays the sample mean of the dependent variable to facilitate the interpretation of marginal effect sizes. ***, ** and * denote significance at the 1%, 5% and 10% levels, respectively.

Table 1.8: 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	0.078*** [0.02]	0.064*** [0.02]	0.009 [0.01]	-0.032** [0.02]	0.106*** [0.03]
Financial literacy: instrumented	0.171** [0.07]	0.225*** [0.05]	-0.022 [0.04]	-0.217*** [0.04]	0.109 [0.15]
Instrument set	encourage saving bank before 18	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	14.91[a]	14.75[a]	14.79[a]	14.75[a]	14.91[a]
Overidentification test (Hansen J)	1.35	0.123	0.187	0.016	3.58*
Wald exogeneity test (chi-square)	1.27	4.62**	0.54	13.43***	0.13
N	466	470	468	470	466

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) Debt larger than annual income
Financial literacy: original	-0.125*** [0.04]	-0.063** [0.03]	0.043 [0.06]	-0.006 [0.03]	-0.015 [0.01]
Financial literacy: instrumented	-0.211** [0.10]	-0.219*** [0.07]	0.584 [0.41]	0.158 [0.11]	0.031 [0.09]
Instrument set	fin.und. parents bank before 18	fin.und. parents bank before 18	encourage saving	encourage saving	encourage saving
F-test for weak instruments	9.29[b]	9.52[b]	15.56[a]	13.79[a]	11.36[a]
Overidentification test (Hansen J)	0.04	0.04	---	---	---
Wald exogeneity test (chi-square)	0.55	4.21**	2.02	1.47	0.26
N	155	153	477	459	366

Notes: The table reports instrumental variable (IV) probit estimation results with robust standard errors in brackets; for the number of assets owned and the number of credit cards owned the model is IV Poisson (estimated with GMM). The financial literacy measure is instrumented. The table reports the marginal effect 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.

Figure 1.1: Distribution of Financial Literacy

Panel A: Score on Lusardi-Mitchell Questions (0 – 3)
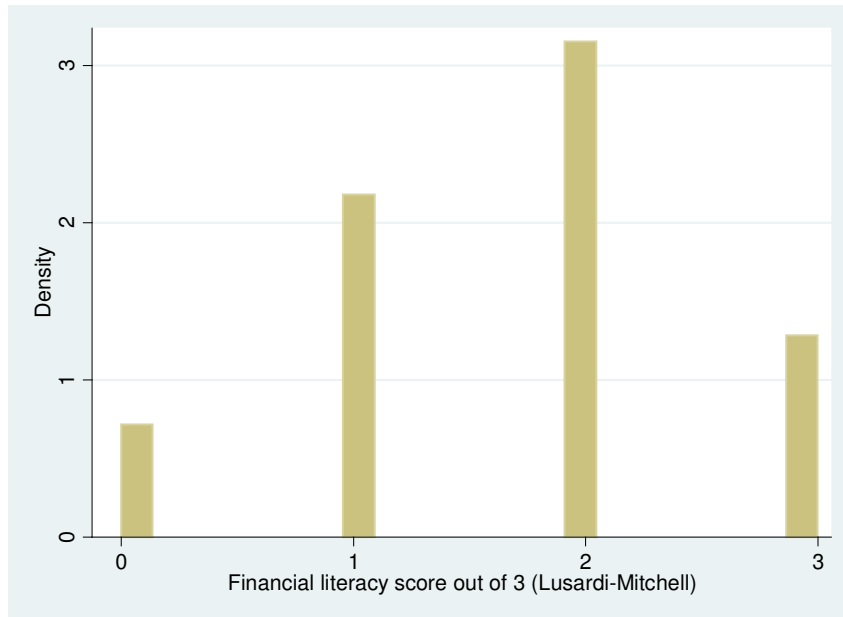
Panel B: Lusardi-Mitchell and Name Banks Score (0 – 4)
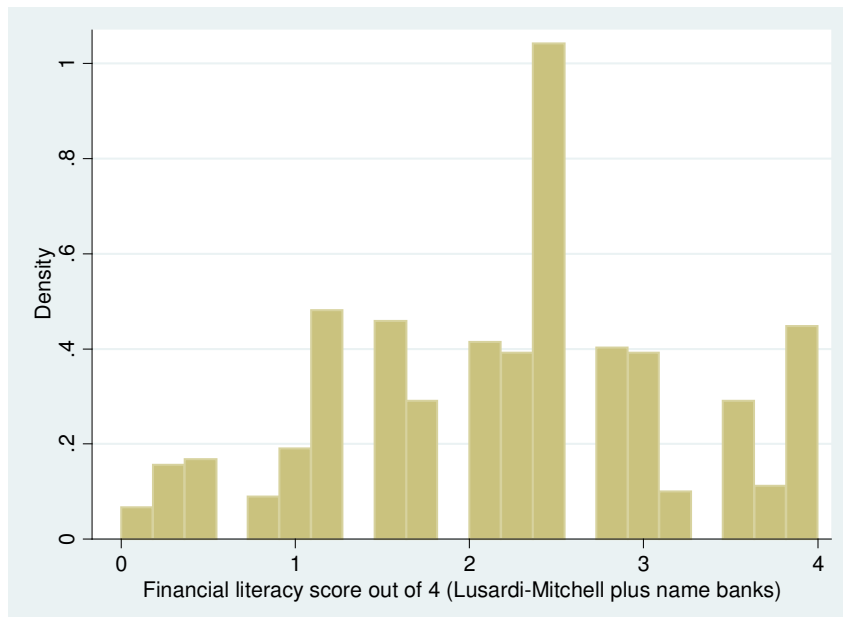
Figure 1.2: Stock and Bond Market Participation by Amount of Financial Assets
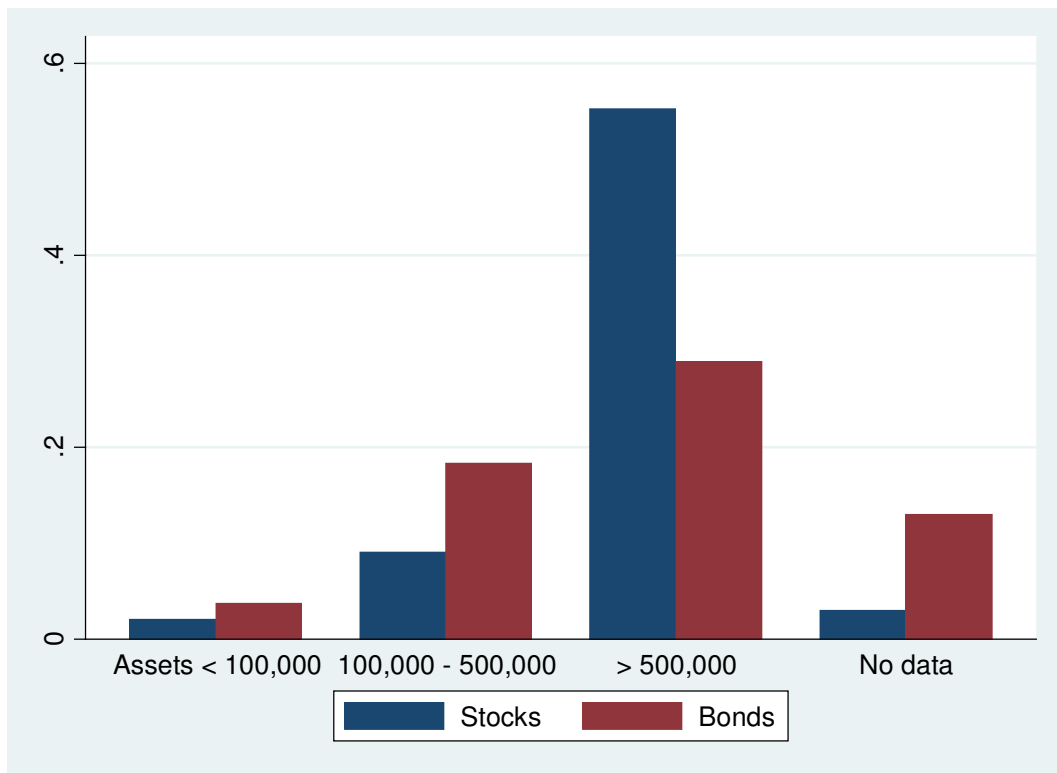
Appendix 1:
Table 1.A1: Mean of Key Variables for Samples based on Different Middle Class Definitions
Notes: The table reports the mean (average) of key variables for the full sample of 529 respondents in Column (1). Column (2) shows the mean for 30 respondents with family

		Middle class definition 1			Middle class definition 2	
	(1) All	(2) Poor	(3) Middle	(4) Rich	(5) Middle	(6) Rich
Household income and composition						
Personal income	26,794	17,890	26,467	80,250	23,835	74,613
Household income	63,908	33,500	58,457	512,500	51,283	267,903
Number of children in HH	0.83	2.13	0.75	0.50	0.82	0.84
Number of adults in HH	2.97	4.87	2.86	2.63	2.95	3.29
Avg. daily income per HH member	32.76	8.15	28.99	356.16	25.86	144.18
Avg. daily income per weighted HH member (using OECD-modified scale)	49.84	15.65	44.61	499.27	39.48	217.34
Financial assets low (< 100,000 baht)	50%	77%	49%	13%	53%	13%
Financial assets high (> 500,000 baht)	9%	3%	8%	88%	6%	58%
Fin. literacy, numeracy and risk aversion						
Financial literacy (score out of 4)	2.21	1.77	2.24	1.91	2.20	2.48
Numeracy (score out of 4)	3.56	3.10	3.59	3.63	3.55	3.71
Risk aversion (scale: 0 to 1)	0.46	0.63	0.45	0.46	0.46	0.42
Assets						
Owns assets other than a savings account	52%	17%	53%	88%	49%	87%
Owns fixed deposit accounts	40%	3%	42%	75%	38%	74%
Owns stocks or equity mutual funds	8%	3%	8%	50%	6%	39%
Owns life insurance	16%	7%	16%	50%	15%	35%
Number of asset types owned	0.75	0.33	0.75	2.38	0.66	2.13
Borrowing						
Has at least one credit card	33%	13%	34%	38%	31%	58%
Finds it difficult to pay off credit card debt	15%	0%	15%	33%	14%	17%
Does NOT know interest on credit card debt	57%	50%	57%	67%	56%	61%
Has any debt	47%	60%	47%	38%	48%	31%
Has debt larger than annual income	8%	10%	7%	13%	8%	7%
Number of respondents	529	30	491	8	497	31

income per household member below $10 in 2005 dollars, too poor for meeting the middle class definition of Kharas (2010). Column (3): our main sample of 491 middle class respondents whose family income per household member is between $10 and $100 in 2005 dollars. Column (4): the 8 persons whose income is too high to be in the middle class, above $100 per person per day. In Column (5) and (6) we weight the household members differently when calculating average income per person: the OECD-modified scale assigns a value of 1 to the household head, 0.5 to each additional adult and 0.3 to each child. This results in a sample of 497 middle class respondents with daily income per person between $10 and $100 in Column (5), 31 respondents who are too rich (> $100 per day) in Column (6), and 1 too poor (not shown).

Table 1.A2: Correlations among Main Variables

Variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
(1) Financial literacy	1.00									
(2) Numeracy	0.23	1.00								
(3) Risk aversion	-0.37	-0.25	1.00							
(4) Higher education	0.18	0.15	-0.16	1.00						
(5) Female	0.02	0.02	0.09	-0.01	1.00					
(6) Age	-0.03	-0.15	0.05	-0.07	-0.02	1.00				
(7) Number of adults in household	-0.04	0.02	0.04	-0.11	-0.01	0.00	1.00			
(8) Log of personal income	0.23	0.08	-0.11	0.12	-0.09	0.57	0.07	1.00		
(9) Assets low dummy	0.00	0.04	-0.00	-0.02	0.07	-0.35	0.03	-0.42	1.00	
(10) Assets high dummy	0.09	0.00	0.03	0.06	-0.03	0.33	0.02	0.50	-0.29	1.00
(11) Assets other than savings	0.28	0.15	-0.16	0.22	0.05	0.29	0.02	0.43	-0.25	0.23
(12) Has fixed deposit account	0.24	0.11	-0.16	0.18	0.07	0.27	0.00	0.37	-0.24	0.15
(13) Owns stocks	0.10	-0.04	0.03	0.12	-0.07	0.28	0.07	0.42	-0.22	0.51
(14) Owns life insurance	-0.12	-0.26	0.22	0.09	0.01	0.22	0.07	0.25	-0.31	0.37
(15) Number of asset types	0.25	0.10	-0.10	0.20	0.04	0.41	0.04	0.63	-0.37	0.44
(16) Number of credit cards (c.c.)	0.12	0.07	-0.10	0.13	0.01	0.23	0.07	0.35	-0.16	0.29
(17) Does not know interest on c.c.	-0.28	-0.07	0.17	-0.14	0.14	-0.01	0.12	-0.12	-0.03	0.11
(18) Has difficulty paying c.c.	-0.18	-0.09	0.05	-0.08	-0.17	-0.04	0.02	-0.00	-0.03	-0.01
(19) Has debt	-0.03	-0.02	0.01	0.05	0.00	0.05	-0.09	-0.05	-0.02	-0.00
(20) Has debt > annual income	-0.01	-0.10	-0.07	0.02	-0.09	0.15	-0.10	0.11	-0.17	0.23

Notes: The table reports pairwise Pearson correlation coefficients between the main variables. The sample is limited to 491 middle class respondents whose family income per household member is between $10 and $100 in 2005 dollars (at PPP).

Table 1.A3: Financial Literacy and Individual Characteristics

	(1) Lusardi and Mitchell	(2) Financial Literacy	(3) Financial Literacy	(4) Financial Literacy
Numeracy	0.134***	0.135***	0.101**	0.134***
	[0.043]	[0.047]	[0.049]	[0.046]
Risk aversion	-0.887***	-1.333***	-1.220***	-1.252***
	[0.180]	[0.199]	[0.194]	[0.196]
Higher education	0.042	0.141	0.104	0.088
	[0.085]	[0.092]	[0.093]	[0.094]
Female	0.081	0.131	0.111	0.142*
	[0.073]	[0.081]	[0.080]	[0.082]
Age	-0.011	-0.020	-0.010	-0.015
	[0.031]	[0.035]	[0.036]	[0.036]
Age squared	-0.008	0.005	-0.005	0.007
	[0.042]	[0.047]	[0.048]	[0.048]
Number of children in HH	-0.021	-0.010	-0.011	-0.009
	[0.040]	[0.045]	[0.045]	[0.045]
Number of adults in HH	-0.036	-0.040	-0.049*	-0.046
	[0.027]	[0.029]	[0.028]	[0.029]
Log of income	0.511***	0.566***	0.534***	0.537***
	[0.114]	[0.122]	[0.118]	[0.125]
Assets low dummy	-0.081	-0.066	-0.052	-0.107
	[0.105]	[0.116]	[0.113]	[0.116]
Assets high dummy	0.044	-0.080	0.109	-0.043
	[0.181]	[0.183]	[0.186]	[0.180]
Assets missing dummy	-0.305**	-0.402***	-0.369***	-0.479***
	[0.122]	[0.131]	[0.132]	[0.134]
Bank account before 18			-0.347***	
			[0.084]	
Parents encouraged saving			0.569***	0.461***
			[0.129]	[0.124]
R²	0.19	0.24	0.29	0.28
F-statistic regression	13.57***	10.29***	16.52***	17.28***
F-test for instruments	-	-	14.91***	13.79***
Observations	491	491	466	459

Notes: The dependent variable of the regression models is: (1) the number of correct answers to the three standard Lusardi-Mitchell (LM) financial literacy questions on a scale from 0 to 3, and in column (2), (3) and (4) our financial literacy measure on a scale from 0 to 4, which adds a 0-1 score for naming foreign banks operating in Thailand to the standard LM measure. Column (3) shows the first-stage regression results from the two-stage IV-probit model, when the indicator for "owning assets other than a savings account" is the dependent variable in the 2nd stage. The instruments for financial literacy are dummies for having a bank account before the age of 18 and parents encouraged savings. Column (4) shows the first-stage regression results when the dependent variable in the 2nd stage is a dummy for having debt, with parents encouraged savings as the instrument. All estimation results are based on OLS. ***, ** and * denote significance at 1%, 5% and 10% level, respectively.

Table 1.A4: Robustness of Main Results: Different Measures of Financial Literacy

Panel A: Savings and Assets

	(1)	(2)	(3)	(4)	(5)
	Assets other than savings account	Fixed deposits	Stocks	Insurance	Number of asset types owned
Financial Literacy	0.078***	0.064***	0.009	-0.032**	0.106***
(LM+banks)	[0.022]	[0.023]	[0.009]	[0.015]	[0.034]
Pseudo-R^2	0.26	0.18	0.37	0.34	0.18
Financial Literacy	0.062***	0.036	0.007	-0.021	0.104***
(LM score)	[0.024]	[0.025]	[0.010]	[0.016]	[0.039]
Pseudo-R^2	0.25	0.17	0.37	0.33	0.18
Financial Literacy	0.184***	0.167***	-0.014	-0.031	0.148**
(LM dummy)	[0.056]	[0.054]	[0.024]	[0.038]	[0.068]
Pseudo-R^2	0.25	0.18	0.37	0.33	0.18
Financial Literacy	0.051***	0.028	0.004	-0.033**	0.075**
(LM +Cole)	[0.019]	[0.021]	[0.007]	[0.014]	[0.034]
Pseudo-R^2	0.25	0.17	0.37	0.34	0.18

Panel B: Borrowing

	(1)	(2)	(3)	(4)	(5)
	Does not know interest rate on credit card	Finds it difficult to pay off credit card	Number of credit cards	Has debt	Debt larger than annual income
Financial Literacy	-0.125***	-0.063**	0.043	-0.006	-0.015
(LM+banks)	[0.040]	[0.032]	[0.058]	[0.026]	[0.012]
Pseudo-R^2	0.14	0.11	0.08	0.05	0.24
Financial Literacy	-0.122***	-0.074**	0.021	0.012	-0.008
(LM score)	[0.044]	[0.034]	[0.066]	[0.029]	[0.013]
Pseudo-R^2	0.13	0.12	0.07	0.05	0.23
Financial Literacy	-0.239***	-0.077	-0.045	-0.088	-0.038
(LM dummy)	[0.085]	[0.078]	[0.133]	[0.065]	[0.033]
Pseudo-R^2	0.13	0.09	0.07	0.05	0.24
Financial Literacy	-0.112***	-0.054*	0.072	0.016	-0.012
(LM +Cole)	[0.037]	[0.028]	[0.055]	[0.024]	[0.010]
Pseudo-R^2	0.13	0.11	0.08	0.05	0.23

Notes: The table reports regression results for savings and borrow behavior similar to Table 6 and Table 7 in the paper, but using different measures of financial literacy, as a robustness check. A full set of control variables is included, but not shown here. The table shows marginal effects from probit and count data models, with robust standard errors in brackets. ***, ** and * denote significance at the 1%, 5% and 10% levels, respectively.

Table 1.A5: Robustness of Main Results: Different Definition of Middle Class

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	0.071***	0.055**	0.011	-0.034**	0.089***
	[0.021]	[0.023]	[0.008]	[0.016]	[0.032]
Numeracy	0.060**	0.044	-0.010	-0.053***	0.087**
	[0.027]	[0.027]	[0.009]	[0.013]	[0.044]
Risk aversion	-0.085	-0.171*	0.022	0.179***	-0.237
	[0.101]	[0.100]	[0.044]	[0.059]	[0.145]
Higher education	0.168***	0.122***	0.061**	0.074**	0.342***
	[0.040]	[0.043]	[0.024]	[0.031]	[0.077]
Female	0.089**	0.106***	-0.030	0.028	0.163***
	[0.037]	[0.038]	[0.019]	[0.027]	[0.056]
Age	0.037**	0.029*	-0.007	0.007	0.092***
	[0.019]	[0.017]	[0.008]	[0.011]	[0.025]
Age squared	-0.042	-0.032	0.011	-0.009	-0.103***
	[0.026]	[0.024]	[0.010]	[0.015]	[0.032]
No of children in HH	-0.027	-0.036*	-0.012	-0.035**	-0.043
	[0.020]	[0.020]	[0.009]	[0.015]	[0.027]
No of adults in HH	0.009	-0.010	0.012**	0.008	0.025
	[0.012]	[0.013]	[0.005]	[0.009]	[0.015]
Log of income	0.338***	0.230***	0.066***	0.082**	0.428***
	[0.076]	[0.064]	[0.025]	[0.039]	[0.089]
Assets low dummy	-0.152***	-0.163***	-0.018	-0.165***	-0.343***
	[0.051]	[0.051]	[0.022]	[0.033]	[0.075]
Assets high dummy	0.096	-0.127	0.097***	0.182***	0.131
	[0.105]	[0.094]	[0.025]	[0.045]	[0.089]
Assets amount missing	-0.093	-0.073	-0.009	-0.053	-0.139*
	[0.061]	[0.062]	[0.029]	[0.038]	[0.084]
Pseudo-R²	0.27	0.18	0.39	0.33	0.19
Observations	493	497	495	497	493

Notes: The table reports regression results for savings behavior, similar to Table 6 in the paper, but with a different definition of household income per person to determine the sample of middle class respondents (average income between 10 and 100 USD per person per day). The OECD-modified scale is used to estimate average income per weighted household member: this scale assigns a value of 1 to the household head, 0.5 to each additional adult and 0.3 to each child. ***, ** and * denote significance at the 1%, 5% and 10% levels, respectively.

Panel B: Borrowing

	(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) Debt larger than annual income
Financial literacy	-0.118***	-0.061*	0.041	0.019	-0.000
	[0.043]	[0.033]	[0.056]	[0.026]	[0.015]
Numeracy	-0.003	-0.056	0.118*	-0.007	-0.029**
	[0.070]	[0.044]	[0.068]	[0.027]	[0.013]
Risk aversion	-0.051	0.051	-0.378	0.038	-0.141**
	[0.203]	[0.130]	[0.265]	[0.110]	[0.056]
Higher education	-0.122	-0.065	0.289**	0.058	0.016
	[0.093]	[0.058]	[0.128]	[0.051]	[0.030]
Female	0.089	-0.100*	0.088	-0.008	-0.029
	[0.079]	[0.057]	[0.101]	[0.045]	[0.025]
Age	-0.026	-0.027	0.116**	0.088***	0.030**
	[0.039]	[0.027]	[0.046]	[0.019]	[0.013]
Age squared	0.033	0.029	-0.147**	-0.111***	-0.036**
	[0.051]	[0.037]	[0.060]	[0.026]	[0.017]
No of children in HH	0.010	0.039	0.070	0.006	0.009
	[0.040]	[0.027]	[0.062]	[0.024]	[0.013]
No of adults in HH	0.044*	-0.017	0.013	-0.003	-0.006
	[0.027]	[0.016]	[0.034]	[0.015]	[0.010]
Log of income	-0.211*	0.100	0.523***	-0.142*	-0.022
	[0.123]	[0.080]	[0.180]	[0.079]	[0.041]
Assets low dummy	-0.066	0.006	-0.014	-0.006	-0.056*
	[0.107]	[0.079]	[0.147]	[0.065]	[0.032]
Assets high dummy	0.199	-0.026	0.396**	0.111	0.115***
	[0.130]	[0.093]	[0.172]	[0.111]	[0.038]
Assets amount missing	0.017	0.035	0.031	0.033	-0.031
	[0.126]	[0.095]	[0.150]	[0.074]	[0.041]
Pseudo-R²	0.11	0.12	0.08	0.04	0.21
Observations	154	152	497	481	385

Notes: The table reports regression results for borrowing behavior, similar to Table 7 in the paper, but with a different definition of household income per person to determine the sample of middle class respondents (average income between 10 and 100 USD per person per day). The OECD-modified scale is used to estimate average income per weighted household member: this scale assigns a value of 1 to the household head, 0.5 to each additional adult and 0.3 to each child. ***, ** and * denote significance at the 1%, 5% and 10% levels, respectively.

Chapter 2:
Childhood Roots of Financial Literacy[13]

2.1 Introduction

Many economic decisions require basic understanding of financial concepts, such as interest rates and 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 (e.g., Lusardi and Mitchell, 2014). Whereas these impacts of financial literacy have been frequently examined, what remains much less clear is: where does financial literacy come from?

Several factors have been found to influence a person's financial literacy. These factors include socio-demographic variables in the way that better education, higher age or higher incomes are related to higher financial literacy. Moreover, there are further individual characteristics, such as numeracy, self-control or (low) time preference which have been shown to be linked to financial literacy (Gathergood, 2012, Dick and Jarozek, 2013, Meier and Sprenger, 2013, Fernandes et al., 2014). Many of these factors seem to be at least partially shaped by childhood experiences of today's adults (see Lusardi et al., 2010, Shim et al., 2010). Indeed, several studies either study the impact of some childhood experiences on financial behavior (e.g., Webley and Nyhus 2013, Bucciol and Veronesi, 2014) or use a specific childhood variable as instrument for financial literacy (Behrman at al.,2010, van Rooij et al., 2011b). Thus many childhood variables have been considered in relation to financial literacy but how are they related to each other and which ones are particularly important for raising financial literacy?

We contribute to filling this gap in the literature by examining a large set of childhood characteristics while controlling for conventional socio-demographic characteristics. Overall, we find two channels by which childhood roots impact the degree of adults' financial literacy, the family-related channel and the schooling channel. The importance of family-related roots of financial literacy may explain to some extent why financial literacy trainings or counseling programs often deliver disappointing results (Bernheim et al., 2003, Cole and Shastry, 2009, Carlin and Robinson, 2012, Bruhn et al., 2014, Fernandes et al., 2014) and may moreover suggest directions for improving future policy measures.

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[13] This chapter is based on a paper that is joint work with Roy Kouwenberg and Lukas Menkhoff. A different version of this paper has been published in the Journal of Economic Psychology, 51, December 2015, 114-133.

Studying the effect of childhood factors comes with clearer identification than is normally given in cross sectional data. Looking at childhood experiences as potential determinants of adult financial literacy has the advantage that causality is straightforward for many variables. It is clear that, for example, education of the mother may have a causal impact on adult behavior of her children, whereas the possibility of reverse causality is not conceivable. However, for this research we require a wealth of specific information which is not available – to the best of our knowledge – in any existing dataset. Therefore, we had to compile a new questionnaire which is specifically designed for our research purpose, although we rely on standard items whenever possible. We survey more than 500 people from a broadly defined middle class in Bangkok, Thailand.

The choice of middle class people in Thailand has some advantages: (i) it selects respondents whose financial decisions involve a lot of potential variety, different to decisions of the poor (Xu and Zia, 2012). (ii) Respondents have a meaningful education allowing us to study its potential impact on financial literacy. (iii) The survey in an emerging economy brings a fast changing environment where financial literacy is more important as argued by Campbell (2006). (iv) The focus on the middle class ensures that the survey can be compared to most studies from advanced economies where the middle class, as it is defined in this paper, dominates the population.

We study childhood experiences that have been used in earlier literature as instruments for financial literacy. Thus these variables should be related to financial literacy but unrelated to financial outcomes. We pick up on this idea that childhood experiences may be a good predictor for financial literacy and organize twelve items on a timeline, starting with family background (including education of the mother), then parental teaching, education at school and children's financial experiences.

Our main finding is that we reveal two channels by which childhood experiences explain adults' degree of financial literacy, i.e. the family-related and the schooling channel. Family-related childhood variables are very important (see also Shim et al., 2010, Nyhus and Webley, 2013) and two of these variables are quite robust: (1) advanced education of the mother and (2) that parents encouraged their children to save. Any of these childhood variables improves the degree of financial literacy by about 10% (going up to 20% depending on exact specifications). 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 (e.g., Carneiro et al., 2013). 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 introduce good financial behavior (Bucciol and Veronesi, 2014), financial planning to the child (Ameriks et al., 2003, Fernandes et al., 2014) and to decrease time preference (Webley and Nyhus, 2006, 2013, Mischel et al., 2011), all of which are also linked to several desired life-time outcomes.

The second channel by which childhood experiences explain financial literacy is schooling. Here the impact is indirect as better education at school is linked to better numeracy, which in turn improves financial literacy by about 5% for a one standard deviation increase in numeracy. It may be reassuring to see that schooling helps also in the case of financial literacy, although rather indirectly.

These two channels which improve financial literacy can also be traced back to the single items composing the financial literacy score. Schooling (i.e. numeracy) impacts more basic components of financial literacy, those based on calculation, whereas the family-channel (parental education) impacts more knowledge based components of financial literacy. Another difference in the way that channels influence financial literacy is due to the socio-economic background: parental teaching is relatively more important for those with less educated mothers, whereas for those with an educated mother having economics education at school contributes more to building financial literacy.

Our research is clearly linked to the rapidly growing literature on financial literacy. Although we compile a new sample, we can safely reproduce stylized facts regarding relations between socio-demographic characteristics and financial literacy, and regarding the impact of financial literacy on financial behavior (see Grohmann et al., 2014). On this basis we collect a large group of childhood variables which are spread across earlier studies and use this information to systematically examine their impact on the degree of financial literacy. This approach is in line with the more general literature on influences early in life on later outcomes (e.g. Heckman, 2006, Cesarini et al., 2010, Agarwal and Mazumder, 2013) and also contributes to recent research studying broader influences on financial literacy, such as personality traits (Fernandes et al., 2014) and socialization (Bucher-Koenen and Lamla, 2014, Jappelli, 2010).

This study is organized in six sections following the introduction. Section 2.2 introduces the underlying dataset. In Section 2.3 we discuss potential childhood roots of financial literacy and show descriptive statistics of these variables. Section 2.4 gives the main results of our empirical research on the roots of financial literacy and Section 2.5 provides extended results. Robustness tests are documented in Section 2.6. Section 2.7 concludes.

2.2 Data

Section 2.2.1 describes the conduct of the survey and descriptive statistics about socio-demographic variables used. Section 2.2.2 informs about our measure of financial literacy and Section 2.2.3 reports about relations between socio-demographic variables, financial literacy and numeracy. The impact of financial decisions is just sketched in Section 2.2.4.

2.2.1 The survey data

We collect data in Bangkok, the capital of Thailand, an 'upper-middle income' country with GDP per capita of 5,480 US-Dollar (USD) in 2012. In Thailand a large middle class with significant financial needs and wealth has developed. This group is largely concentrated in the larger Bangkok area, a megacity with 15 million inhabitants, producing 44% of the country's GDP. Corrected for purchasing power, the GDP per capita level in Bangkok is similar to countries like Greece and the Czech Republic.[14] Further, the consumer finance services available to our middle class target group in Bangkok are well developed, similar to high income countries.

The data underlying this research was collected in face-to-face street interviews throughout Bangkok in December 2012. In preparation for these interviews a questionnaire was developed by the authors of this paper and a test run was conducted using participants similar to the sample group. Interviewers were trained on this specific questionnaire and it was then implementation by a Bangkok-based market research firm. Survey teams approached individuals at 28 different locations in Bangkok and at several different times of the day, in order to get a representative mixture of respondents, with all locations and times decided on before the start of the survey.

The target group, middle class people in Bangkok, was stratified along four criteria: The interviewer teams aim for a balanced sample regarding: (1) gender, (2) the age of participants has to be between 18 and 60 years, (3) people have to be responsible for their own or their household's financial affairs, and (4) participants have to earn at least 15,000 Baht per month (460 USD). This income level is chosen because it represents the minimum salary for an employee with a bachelor degree as determined by law. Fulfillment of these criteria was checked before the main survey using preliminary questions. The most common reason why

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[14] When considering GDP per capita in nominal USD, without correcting for purchasing power effects, Bangkok's larger area GDP per capita in 2012 is similar to Turkey, Malaysia and Brazil.

people were not included was low income. Overall, about 30% of people approached could not be included into the sample. The selection process obviously has an effect on the composition of the sample (see Table 2.1): the mean monthly individual income is about 840 US Dollar (27,000 Baht), which is 60% higher than the average income for employees in Bangkok. It follows that the large majority of our sample can be defined as belonging to the global middle class as defined in OECD studies (Kharas, 2010, Khara and Gertz, 2010). Hence, as intended, our survey excludes the urban poor who have completely different financial needs and constraints. Table 2.1 further shows that 48% of the respondents are women. The mean age is slightly below 35 years, with a standard deviation of 9.5 years.

Beyond this we collect the following information, also provided in Table 2.1: the mean monthly household income is 2,010 US-Dollar (64,000 Baht). On average each household has 2.5 earners, 3 adults live in the household, there are 0.8 children living in the household and 46% of respondents are married. The educational level is high by Thai standards, as 64% have a bachelor degree. Less than 5% have only visited a primary school, 28% have finished a secondary school or a vocational education, and 3% have a master degree.

We ask participants to respond to a simple question about their attitude towards risk: "Are you generally a person who is willing to take risks or do you try to avoid taking risks?" The answering scale runs from 0, meaning "unwilling to take risk" to 10 meaning "fully prepared to take risk".[15] In order to ease the interpretation of the risk aversion measure, the answers have been reversed and rescaled from 0 to 1, so that 1 represents someone stating to be unwilling to take risk. The mean value is 0.46, slightly leaning towards risk taking preferences.

Finally, it is to be expected that numeracy and financial literacy will be related. In order to measure numeracy, we ask four questions taken from Cole et al. (2011). The percentage of people that answered each questions correctly is between 83% and 95%, the average is 3.56 out of 4 (details in Table 2.A1). The coefficient of rank correlation between numeracy and financial literacy is highly significant, but its value of 0.25 confirms that the two measures do not capture the same skill.

2.2.2 The degree of financial literacy

We base our research on the use of a slightly extended version of the standard Lusardi and Mitchell (2014) financial literacy score. The Lusardi-Mitchell score is probably the most

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[15] This measure of risk attitude has previously been used for Germany by Dohmen et al. (2011) and for Thailand by Hardeweg et al. (2013). Both studies demonstrate a significant relation between this survey question and an experimental measure of risk aversion.

commonly used measure of financial literacy. It is based on the answers to three questions, measuring understanding of three basic financial concepts, that is, interest rates, inflation and diversification.[16] In line with other studies, we award one point for each correct answer. Hence the resulting score lies between 0 and 3.

In addition to these three items, we ask respondents a fourth question: to name foreign banks operating in Thailand, which we take as an indicator of institutional knowledge. The standard Lusardi-Mitchell questions have been subject to criticism for being too focused on numeracy skills (Carpena et al., 2011). There are ten foreign banks operating in the retail market in Bangkok. Respondents can name up to four foreign banks. Thus by awarding 0.25 points per named foreign bank, we construct a fourth financial literacy item, being scaled between 0 for not knowing any foreign bank operating in Thailand and 1 for knowing at least four foreign banks. Adding this 0-1 scale to the score for the three standard Lusardi-Mitchell items generates our measure of financial literacy, which varies between 0 and 4 and increases in steps of 0.25.

Responses of our sample population are presented in Table 2.2. Question 1 on interest rate appears to be the easiest to answer, where 79% answer correctly. With 62%, fewer answer the inflation question correctly. In contrast, the question on diversification seems to be difficult as only 24% give the correct answer. This poor outcome can be explained by the fact that only 8% of our middle class sample holds stocks or equity funds themselves. Finally, the mean score for naming foreign banks is 0.56, meaning that people know on average two foreign banks. In total, the mean score of our 4-item measure is 2.21.

The full distribution of financial literacy scores is shown in Figure 2.1, where we also show the result for the 3-item Lusardi-Mitchell score. There is not much difference between both measures but our 4-item score has more variation which may contribute to somewhat larger R-squares in later regressions (see robustness section). When we compare these results to earlier studies relying on the Lusardi-Mitchell score (see e.g. Xu and Zia, 2012) we find that the degree of financial literacy is similar to many developed countries. At the same time it is much higher than, for example, in rural India (Cole et al., 2011).

2.2.3 Socio-demographic relations with financial literacy and numeracy

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[16] For the interest rate question we follow Cole et al. (2011), who suggest a minor adjustment of the original question.

We find some common patterns as a higher degree of financial literacy is positively related to higher education, higher income and also lower risk aversion. These results provide information about possibly relevant covariates of financial literacy (see details in Table 2.A2).

Results for numeracy look similar; higher numeracy is associated with higher income and higher education. Similarly, numeracy seems to be higher for those with lower risk aversion and we also find a negative relationship between age and numeracy.

2.2.4 The impact of financial literacy on financial decisions

Any analysis of the determinants of financial literacy necessarily requires that the specific measure of financial literacy indeed predicts financial behavior. This has been confirmed for our dataset by Grohmann et al. (2014). The results are in line with earlier studies which have shown that financial literacy has a positive effect on long-term savings and retirement planning (Lusardi and Mitchell, 2007, Clark et al., 2012), stock market participation (van Rooij et al., 2011a), portfolio diversification (Guiso and Jappelli, 2008), wealth (Gustman et al., 2012, van Rooij et al. 2012, Jappelli and Padula, 2013), and informed use of debt (Lusardi and Tufano, 2009, Stango and Zinman, 2009).

2.3 Potential 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 highly correlated with financial literacy, but they should not be related to the outcomes of financial literacy. Some studies use regional variations as instruments for financial literacy (Christiansen et al., 2008, Bucher-Koenen and Lusardi, 2011, Klapper et al., 2013) but this limits the information given about the individual. Hence many studies use instruments taken from the childhood experiences of adults as shown in Table 2.3. Thus, it is interesting and important to assess how these variables compare against each other in determining financial literacy.

We discuss these variables in chronological order 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 hinder development of financial literacy. Descriptive statistics of these and further childhood variables are provided in Table 2.3. In stark contrast to the respondents themselves, their parents have comparatively poor education considering that only 28% of fathers and 22% of mothers received at least vocational training which we take as the minimum to be classified as better education. 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 assessed rather positively 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's parents taught them how to budget and, (2) whether the parents encouraged savings. Table 2.3 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 school 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 2.3 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 tab into the economic socialization literature that looks at how children are exposed to experiences with money. We ask if respondents had

an allowance as a 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 a child. This high proportion may be due to the ex ante sample selection, in particular the minimum income of 15,000 Baht, which largely excludes the poorest parts of the population. As a consequence, we have to drop this item from our further analysis because there is hardly variation in responses. Moreover, 57% of respondents say that they had a bank account before 18. 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 are college educated.

Correlations. Before our multivariate analysis of the determinants of financial literacy, we briefly inspect simple correlations of the childhood experience variables with our financial literacy measure, as shown in Table 2.3. We see that most childhood variables have a significant positive relation with financial literacy, especially mother's education, financial understanding of parents, parental teaching of finance and education at school. Exceptions are the father's education, having a poor economic background and indicators for early experiences with money. Somewhat surprisingly, having had a bank account before 18 is negatively correlated with financial literacy. Having a bank account early in life (different from job before age 15) is not related to one's economic background being poor, indicating that a job before turning 15 is rather due to necessity, whilst a bank account before 18 may signal a more comfortable upbringing.

As next preparatory step we examine correlations between childhood variables (available in Appendix Table 2.A3) and find that father's and mother's education are very highly correlated with a coefficient of 0.75, whereas all other variables have coefficients below 0.5. There is indication that variables within the four groups we had defined according to our timeline approach are indeed more correlated to each other than to variables from other groups. This becomes also obvious when we proceed with stepwise regressions where we explain financial literacy with various groups of childhood variables (see Maccini and Yang, 2009). Setting mother's education as the fundamental variable and adding others step by step we get a pattern about relative importance (Appendix Table A4) which confirms what we see in the multivariate approach in the next section.

2.4 Determinants of financial literacy

This section studies the above introduced childhood and standard socio-demographic variables as determinants of the degree of financial literacy. We proceed in three steps: (i) we

explain the individual's level of financial literacy considering of the four groups of childhood variables introduced in Section 2.3, (ii) we consider the set of socio-demographic variables and (iii) finally discuss issues of reliability and endogeneity.

Childhood variables as determinants. Table 2.4 column (1) shows all 11 childhood variables[17] in one regression and results show that one measure in each of the four groups remains significant: education of the mother, parents' encouragement to save, having economics as a subject at school (at the 10% level) and surprisingly "bank account before 18" with a negative coefficient sign. However, this negative sign probably results from multicollinearity with other factors (similar to the negative sign of education of the father); this variable becomes insignificant after adding socio-demographic controls as we show later. Overall, the adjusted R^2 of 0.11 does not seem too bad for cross-sectional data where many unobserved idiosyncratic influences will play a role. Finally, we stepwise exclude insignificant variables to better take account of the interrelations between variables. Results are shown in column (2). Whatever steps we take, the significant variables of specification (1) remain and almost keep the same level of explanatory power.

The economic interpretation of these regressions 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. Their economic importance is obvious as – based on specification (1) – better education of the mother increases the degree of financial literacy by 17%; the impact of parents encouraged savings is 18% and that of economics in school is 10%. 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 variables and risk aversion.

Adding socio-demographic variables. As a next step we include standard socio-demographic variables as controls for childhood variables, as well as risk aversion, numeracy, and monthly income. The results are shown in column (3) of Table 2.4 show that the adjusted R^2 increases considerably, from 0.11 to 0.20. The most important single 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 contribute to explaining this very robust correlation. Whatever the exact relations may

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[17] Out of the original 12 childhood variables, "Had an allowance as a child" is not included in the analysis because 99% of respondents in our sample answered yes to this question, leaving to little variation in the responses.

be, risk aversion is an important personal trait in financial affairs and thus it seems plausible that it is related to financial literacy.

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 risk aversion into account. Thus, among the set of childhood variables, only the family-related ones survive, whereas the others are dominated 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). Again, the variables have high economic importance in explaining financial literacy: the impact on financial literacy is 5% for a one standard deviation increase in numeracy and 11% for risk aversion, respectively.

The economic interpretation of these findings is clear cut: childhood experiences with money are not relevant, at least in the way being captured here. However, numeracy – being related to economics at school, as we show later on – survives, which is not surprising given the fact that correctly answering some of the financial literacy items requires basic mathematical skills. Thus formal education helps via improving numeracy. Striking is the role of family background – via mother's education and parents' encouragement of saving behavior – and low risk aversion. These three variables taken together explain most of the degree of financial literacy in our sample and are at the same time beyond the reach of conventional policy measures.

Discussion of childhood experiences versus memories. The source of information on childhood is the memory of our respondents. This should be without any major problem regarding the more factual variables, including parents' formal education degree, the three variables on education at school, and the three variables regarding early experiences with money (eight variables in total). We admit more noise in answers regarding the two variables on parental teaching because later experiences may bias memories. Successful respondents, for example, may argue that financial success in life is partially rooted in parents'

contribution so that responses to questions on parental teaching may have been biased. However, also the reverse effect may hold, that people want to claim that their success is due to own decisions and not rooted in any contribution by parents. Overall, we think that we can still trust the variables on parental teaching.

A more serious endogeneity problem applies to the variables "financial understanding of parents" and "considers economic background to be poor". It seems likely that answers are influenced by later experiences. For example, respondents who have become wealthy (which is related to more financial literacy), may regard their parents' financial understanding and economic background as relatively poor. As there is no way to circumvent this source of potential endogeneity, we can only highlight that these variables do not drive our findings.

2.5   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 2.5, 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 to understand the roots of financial literacy further. What becomes clear from Table 2.5 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 questions 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. These results indicate from another angle that formal education and parental teaching influence two different elements of financial literacy, one being able to do math, the other being a more knowledge based element of financial literacy.

Socio-economic background.   In order to analyze the possibility of our variables having different effects for people from different family backgrounds, we first add an interaction term for mother's education and economics at school; and secondly split our sample by two different criteria: we examine the determinants of financial literacy for those that have uneducated and educated mothers separately; and, 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 2.6. The interaction term shown in column 1 is significant and positive, while mother's education as well as economics at school turn insignificant. This result indicates that mother's education is complementary to formal economics education at school. Hence, having economics at school benefits the development of financial literacy among those growing up with an educated mother. For respondents whose mother has little or low education, economics education at school does not seem to contribute to higher financial literacy. This raises the question how those with poorly educated mothers acquire financial literacy, if not at school.

We study these relationships further by splitting the sample. In line with the findings above, economics at school only shows significant effects for those that have educated mothers. Conversely, parental encouragement to save has a stronger effect on the financial literacy of those with an uneducated mother. 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.[18] On the other hand, those from poorer backgrounds seem to benefit more from informal teaching at home.

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[18] Other possible channels are systematic differences in school quality among the two groups, or educated parents creating an environment at home that stimulates their children's learning at school.

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 test this, and the results are shown in Table 2.7. The model 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. Different from financial literacy, formal education has a very strong effect on numeracy. Both having attained the highest degree in Bangkok, which is a proxy for educational quality, and economics at school have a highly significant positive effect on numeracy in all specifications.[19]

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 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.

2.6 Robustness tests

This section documents results of two robustness tests: a factor analysis condensing information in the 11 childhood variables and a generalized sensitivity analysis. Finally, further exercises are mentioned but not documented in the paper but in Appendix 2.

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[19] For economics at school selection bias is a potential problem, as it is conceivable that those with high ability in numeracy self-select into economics education. However, since at least some basic economics education is not voluntary, this is less of an issue.

Factor analysis of childhood variables.   In order to further examine the different channels that influence financial literacy we perform a factor analysis using the 11 childhood variables. As most variables are binary in nature we use the polychoric matrix form. Results indicate that an analysis with three factors is preferable. The respective factor loadings are shown in Table 2.8. Factor 1 is dominated by parental teaching, whereas education of parents strongly loads on the second factor. Interestingly, having been born in Bangkok and having been educated in Bangkok, i.e. proxies for better education, clearly load onto the third factor. Table 2.9 shows OLS regression analysis with the three factors; we can see that each of these factors has a positive and significant effect on the degree of financial literacy, with the first (parental teaching) and the third factor (educational quality) having the strongest impact. This largely confirms our result that there are at least two different channels that influence the degree of financial literacy, i.e. family variables (parental teaching and parents' education) and formal education of the children.

Generalized sensitivity analysis.   The type of survey data we use is far from a controlled experiment as it is not possible, e.g., to randomly assign what parents teach their children. Hence there are a number of potential problems. Our data is self-reported and a number of events could have influenced levels of financial literacy since childhood. Despite having a large number of control variables, we recognize that potential unobserved factors could influence the interaction between financial literacy and the effect of mother's education and parental teaching. We therefore perform generalized sensitivity analysis (GSA) as developed by Harada (2013) and applied by Bucciol and Veronesi (2014) in our context.

Essentially, GSA generates a number of pseudo-random variables that make the coefficient on the treatment variable equal to zero. The correlation of the generated variables is then compared to the observed factors in the regression. The algorithm hence tests if the results are robust to unobserved confounders. For brevity, we only give test results for our two main findings, mother's education and parents encouraged savings. These are shown in Figure 2.2. Figure 2.2A presents results that treat mother's education as the treatment variables and Figure 2.2B for parental encouragement to save. For both variables an unobserved confounder would have to have a much larger correlation with financial literacy than any of the controlled variables in order to make the effect of encouragement to save and mother's education on financial literacy insignificant. This can be seen as all observed factors are far below the lines in the diagrams, which represent the correlation that an unobserved cofounder would have to have, in order to make the coefficient on the treatment variable equal to zero. We hence conclude that our results are robust to unobserved confounders.

Further robustness tests. The Appendix presents further tests indicating the robustness of our results. These tests include (i) the use of modified measures of financial literacy including the wide-spread Lusardi-Mitchell measure (based on three items), (ii) the use of ordered probit models, (iii) the explicit consideration of the lower income part of the sample in order to see whether financial literacy has a different effect there, (iv) a test to see if our significant variables in the timeline approach can be replaced by other variables from the same sections, and (v) examinations with modified definitions of mother education.

2.7 Conclusions

This paper contributes to deepen our understanding about the determinants of financial literacy. Whereas earlier literature has focused on the positive impact of financial literacy on financial decision making, a result that also holds in our sample, the disappointing outcomes of financial literacy training programs lead to a new question: what else determines financial literacy if trainings often have such limited impacts?

We contribute to this research by analyzing the potential role of childhood experiences. Childhood variables are generally known to have a lifelong impact on the behavior of adults. Therefore, we study 12 childhood variables in a systematic manner by ordering them along a timeline. Our starting point of all further analyses is the positive impact of good education of the mother on her children's degree of financial literacy. The second variable of highly robust impact is parents' encouragement to save. These two family variables show to be of high relevance for explaining financial literacy in adulthood.

Beyond these family factors, education at school is also helpful, in particular in the form of economics education. However, it is highly correlated with mother's education and seems to have a direct effect on financial literacy only for those from high education family backgrounds. Furthermore, economics education's impact on financial literacy is rather indirect via improving numeracy. Interestingly, numeracy seems to influence other aspects of financial literacy than family variables; moreover, numeracy is determined by other variables than financial literacy. All this indicates that there are two channels by which childhood experiences impact financial literacy. Firstly, family variables are important, in particular mother's education and parental teaching. Secondly, formal education at school does play a role, even though its effects vary with social background.

Among the socio-demographic control variables we find that risk tolerance also has a strong and robust positive impact on financial literacy. Whereas this variable reflects a personal preference, it seems also plausible in our context that risk tolerance captures an

element of cognitive ability. Overall, this shows that personality traits may play an important role and further research is needed to study their interplay with financial literacy.

Overall, these various influences – in particular the strong effect of childhood experiences – may at least partially explain why it is so difficult to train and improve financial literacy in specialized courses. It follows that when designing training courses, the family and educational background of the target group should be considered. One may speculate whether approaches that stimulate regular savings habits and higher risk tolerance, through easy to understand rules and advice may be worth considering. This could happen in addition to more conventional trainings which mostly address knowledge of financial concepts.

Table 2.1: Descriptives of socio-demographic variables

	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
Family status (married=1, other=0)	0.46	0.49	0	1	530
Education[a] (bachelor=1, other=0)	0.64	0.49	0	1	530
Risk aversion[b] (scale 0-1)	0.46	0.23	0	1	530
Numeracy	3.56	0.879	0	4	530

Notes: [a] Distribution of highest educational degree: "no education" or "primary school" (5%), "secondary school" or "vocational training" (28%), "bachelor degree" (64%), "masters degree" or "PhD" (3%)
[b] The answers to the question " Are you generally a person who is willing to take risk or do you try to avoid taking risk?" are given on a Likert-scale between 0 ("unwilling to take risk") and 10 ("fully prepared to take risk"). Answers have been rescaled to 0 to 10 and the scale has been reversed.

Table 2.2: Financial literacy questions and responses

The financial literacy questions are given 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.

Item 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

Item 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

Item 3: **Diversification:**
    Buying a single company's stock is safer than buying a stock mutual fund.
    a) True   b) False

Item 4: **Institutional knowledge**:
    Which foreign banks operate in Thailand? (open answer)

	Mean	Correct (%)	Wrong	Don't know	Refuse to answer
Item 1[a]	0.79	79.2	15.3	5.3	0.2
Item 2[a]	0.62	62.5	25.8	10.9	0.8
Item 3[a]	0.23	23.6	24.3	50.6	1.5
Item 4[b]	0.56				
Sum of items 1-3[c]	1.65				
Sum of items 1-4	2.21				

Notes: [a] For item 1-3 the additional answer options "I don't know" and "I refuse to answer" were offered.
[b] The number of foreign banks named varies between 0 and 4 and is divided by 4.
[c] This gives the Lusardi-Mitchell-measure of financial literacy.

Table 2.3: Family background, formal education and financial experiences

	Mean	Stdev	N	Corr. with fin. lit.	Previously used in
Family background					
Father has vocational degree or higher[a]	0.28	0.45	474	0.06	Behrman et al. (2010)
Mother has vocational degree or higher[a]	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)
Parental teaching					
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)
Education at school					
Had economics in school	0.67	0.47	519	0.11[**]	van Rooij et al. (2011a)
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[***]	/
Early experiences with money					
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)

Notes: [a] We classify vocational training, bachelor and master degree as better education vs. lower education consisting of no formal education, primary or secondary school only. The column 'Corr. with fin. lit.' shows the correlation of the childhood experience variables with our financial literacy measure. ***, ** and * denote significance at the 1%, 5% and 10% levels, respectively.

Table 2.4: Childhood and socio-demographic determinants of financial literacy

	(1) FL	(2) FL	(3) FL	(4) FL	(5) FL	(6) FL
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]	
R²	0.11	0.09	0.20	0.18	0.19	0.17
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 2.5: Determinants of each financial literacy item

	Item 1 Interest rate	Item 2 Inflation	Item 3 Diversification	Item 4 Foreign banks
Father has vocational degree	-0.202	-0.403*	-0.348	0.043
or higher	[0.235]	[0.236]	[0.236]	[0.077]
Mother has vocational degree	0.015	0.660***	0.822***	-0.021
or higher	[0.249]	[0.255]	[0.249]	[0.082]
Financial understanding of	0.093*	0.029	-0.021	-0.013
parents 1-6	[0.054]	[0.052]	[0.060]	[0.019]
Poor economic background	0.275	-0.166	-0.303*	-0.036
	[0.188]	[0.163]	[0.169]	[0.060]
Parents taught to budget	0.166	0.051	-0.228	0.112
	[0.219]	[0.219]	[0.214]	[0.084]
Parents encouraged saving	-0.020	0.194	0.814***	0.165*
	[0.235]	[0.234]	[0.261]	[0.093]
Economics in school	0.077	0.130	-0.286	0.136*
	[0.187]	[0.185]	[0.195]	[0.076]
Born in Bangkok	-0.206	-0.010	0.021	0.054
	[0.184]	[0.159]	[0.178]	[0.053]
Highest educational degree	0.195	-0.371	0.322	-0.036
in Bangkok	[0.268]	[0.269]	[0.298]	[0.094]
Bank account before 18	0.140	-0.260*	-0.279*	-0.064
	[0.159]	[0.149]	[0.162]	[0.053]
Job before age 15	0.150	-0.041	0.157	-0.062
	[0.163]	[0.150]	[0.163]	[0.056]
Numeracy score out of 4	0.150*	0.188**	0.004	-0.015
	[0.086]	[0.084]	[0.091]	[0.029]
Risk aversion	-0.602*	-0.778**	-0.997**	-0.670***
	[0.364]	[0.331]	[0.420]	[0.127]
Higher education	0.084	0.181	-0.329	0.049
	[0.205]	[0.191]	[0.211]	[0.081]
Log of income	0.108	0.423**	0.421**	-0.067
	[0.204]	[0.212]	[0.181]	[0.063]
Female	-0.029	-0.016	0.132	0.042
	[0.150]	[0.137]	[0.152]	[0.048]
Age in years	-0.087	0.024	0.027	0.008
	[0.059]	[0.057]	[0.060]	[0.020]
Age squared	0.118	-0.056	-0.043	-0.002
	[0.080]	[0.078]	[0.082]	[0.027]
Pseudo-R²	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 2.6: Determinants of financial literacy, split by two measures of family background

	Uneducated mother	Educated mother	Poor background	Non-poor background
Father has vocational	-0.206	-0.234	-0.124	-0.712	-0.170
degree or higher	[0.141]	[0.169]	[0.261]	[0.546]	[0.141]
Mother has vocational	-0.169			1.082**	0.269*
degree or higher	[0.281]			[0.517]	[0.151]
Financial understanding	0.030	0.045	-0.041	0.042	0.027
of parents 1-6	[0.035]	[0.040]	[0.077]	[0.069]	[0.041]
Poor economic background	-0.082	-0.120	-0.022		
	[0.103]	[0.119]	[0.223]		
Parents taught to budget	0.080	0.012	0.192	-0.160	0.181
	[0.142]	[0.166]	[0.285]	[0.239]	[0.170]
Parents encouraged	0.289*	0.344**	0.152	0.413*	0.356*
Saving	[0.157]	[0.168]	[0.391]	[0.234]	[0.190]
Economics in school	-0.065	-0.068	0.549*	-0.171	0.108
	[0.136]	[0.141]	[0.328]	[0.232]	[0.161]
Born in Bangkok	-0.010	-0.012	-0.121	-0.078	0.002
	[0.109]	[0.120]	[0.242]	[0.173]	[0.131]
Highest educational degree	-0.022	-0.133	0.494	-0.070	0.047
in Bangkok	[0.171]	[0.183]	[0.383]	[0.292]	[0.217]
Bank account before 18	-0.168*	-0.204*	0.049	-0.081	-0.131
	[0.099]	[0.115]	[0.221]	[0.189]	[0.114]
Job before age 15	0.063	0.039	0.103	0.124	0.013
	[0.101]	[0.117]	[0.225]	[0.185]	[0.123]
Numeracy score	0.108**	0.098	0.157	-0.141	0.151***
	[0.055]	[0.063]	[0.097]	[0.134]	[0.057]
Risk aversion	-0.999***	-0.954***	-1.162**	-1.956***	-0.705***
	[0.228]	[0.266]	[0.500]	[0.468]	[0.262]
Higher education	0.076	0.103	0.105	-0.318	0.160
	[0.136]	[0.155]	[0.345]	[0.267]	[0.162]
Log of income	0.262**	0.376**	-0.183	0.571***	0.129
	[0.128]	[0.146]	[0.346]	[0.186]	[0.171]
Female	0.063	0.097	-0.018	0.121	0.045
	[0.086]	[0.096]	[0.180]	[0.169]	[0.102]
Age in years	-0.002	0.025	-0.108	-0.123*	0.058
	[0.035]	[0.040]	[0.067]	[0.064]	[0.041]
Age squared	-0.003	-0.042	0.154*	0.133	-0.072
	[0.047]	[0.053]	[0.089]	[0.085]	[0.056]
Mother's education * economics	0.704**				
at school	[0.279]				
R2	0.22	0.19	0.35	0.34	0.24
Observations	408	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.

Table 2.7: Determinants of numeracy

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

Table 2.8: Factor loadings

Variables	Factor 1	Factor 2	Factor 3	Uniqueness
Father's education	0.0418	0.9836	0.1043	0.0198
Mother's education	0.0935	0.8740	0.2456	0.1670
Financial understanding of parents	0.4991	0.1562	0.0939	0.7177
Poor economic background	0.0499	-0.3990	0.0602	0.8347
Parents taught to budget	0.8241	0.0030	0.0137	0.3207
Encouraged to save	0.8922	0.0376	0.0638	0.1985
Economics at school	0.6993	0.1639	0.0224	0.4836
Born in Bangkok	-0.0707	0.1513	0.9985	-0.0250
Highest educational degree in Bangkok	0.2600	0.1568	0.8001	0.2676
Bank account before 18	0.3658	0.1176	-0.1168	0.8387
Job before 15	0.0434	-0.3814	-0.0037	0.8526

Notes: the table shows factor loadings based on a polychoric correlation matrix suited for binary variables, after extracting three factors.

Table 2.9: Factors and financial literacy

	(1) Financial literacy
Factor 1	0.758***
	[0.139]
Factor 2	0.181**
	[0.079]
Factor 3	0.341***
	[0.063]
Constant	1.344***
	[0.148]
R^2	0.09
P	0.00
Observations	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.

Figure 2.1: Distribution of financial literacy

Panel A: Score on Lusardi-Mitchell questions (0 – 3)
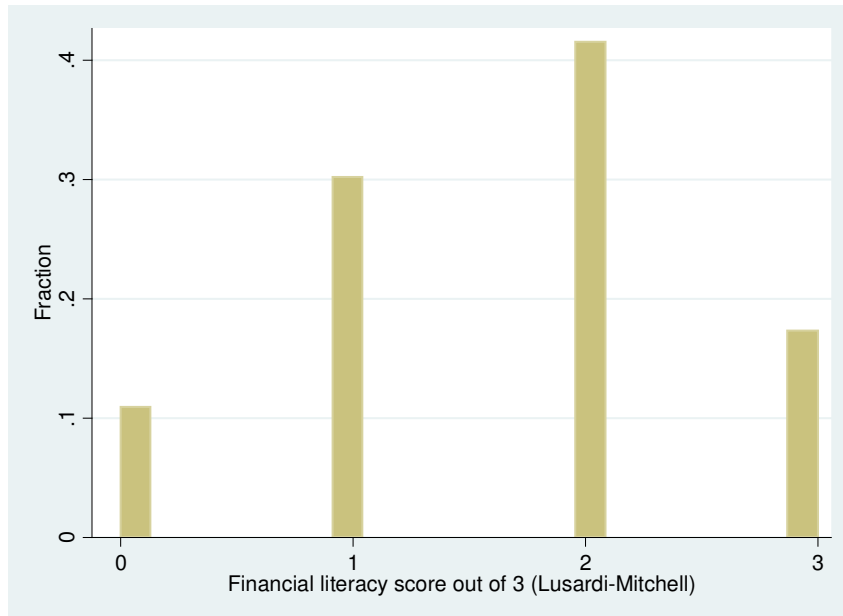
Panel B: Lusardi-Mitchell plus name banks score (0 – 4)
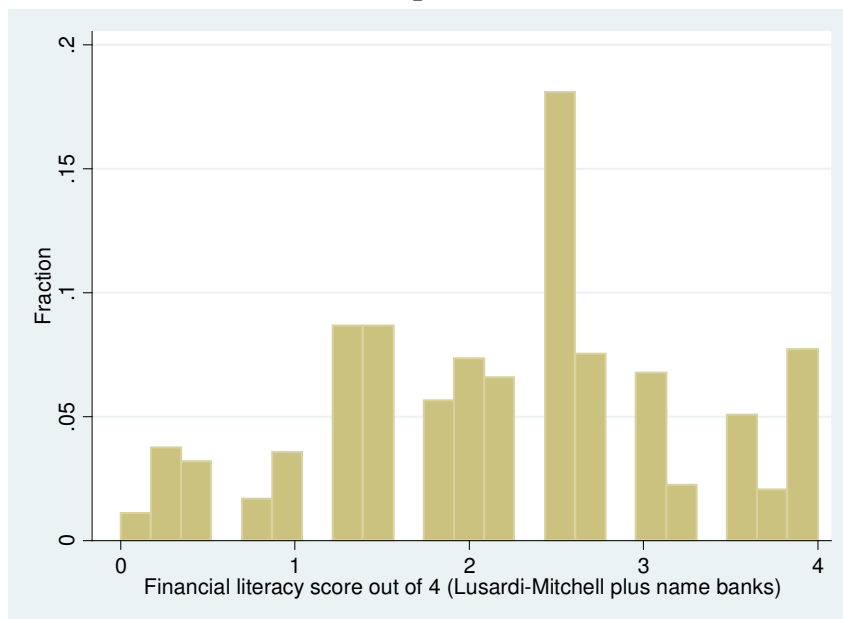
Figure 2.2: Generalized Sensitivity Analysis
Panel A: Mother's education
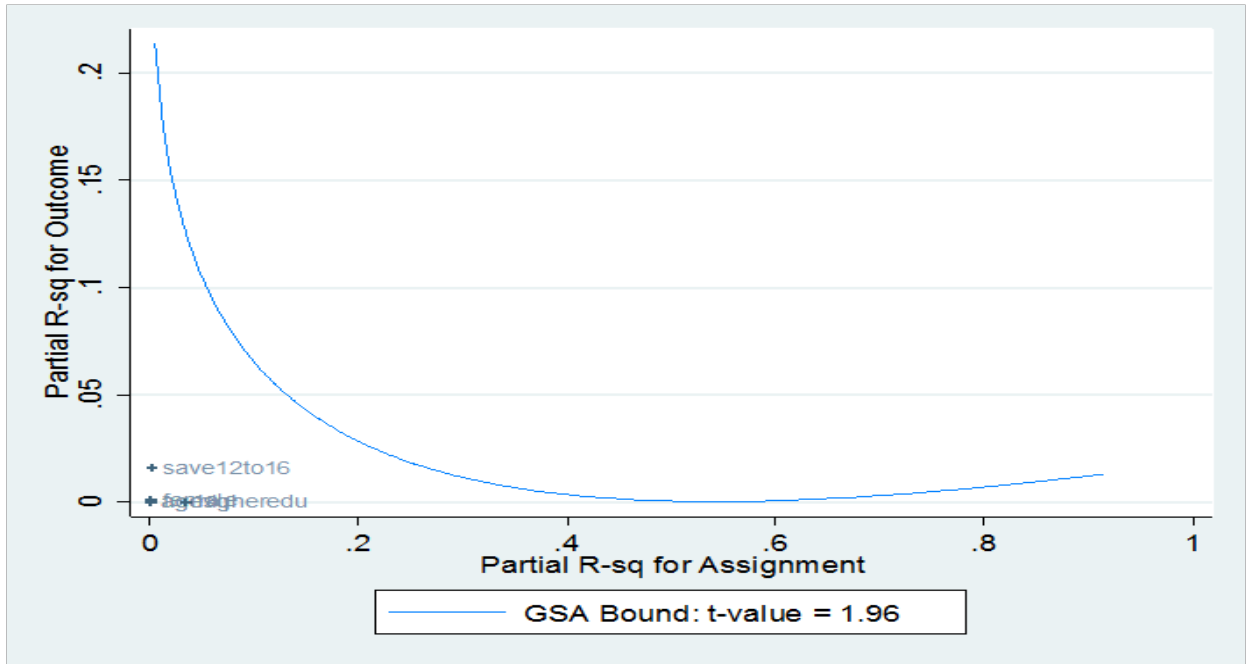
Panel B: Parents encouraged savings
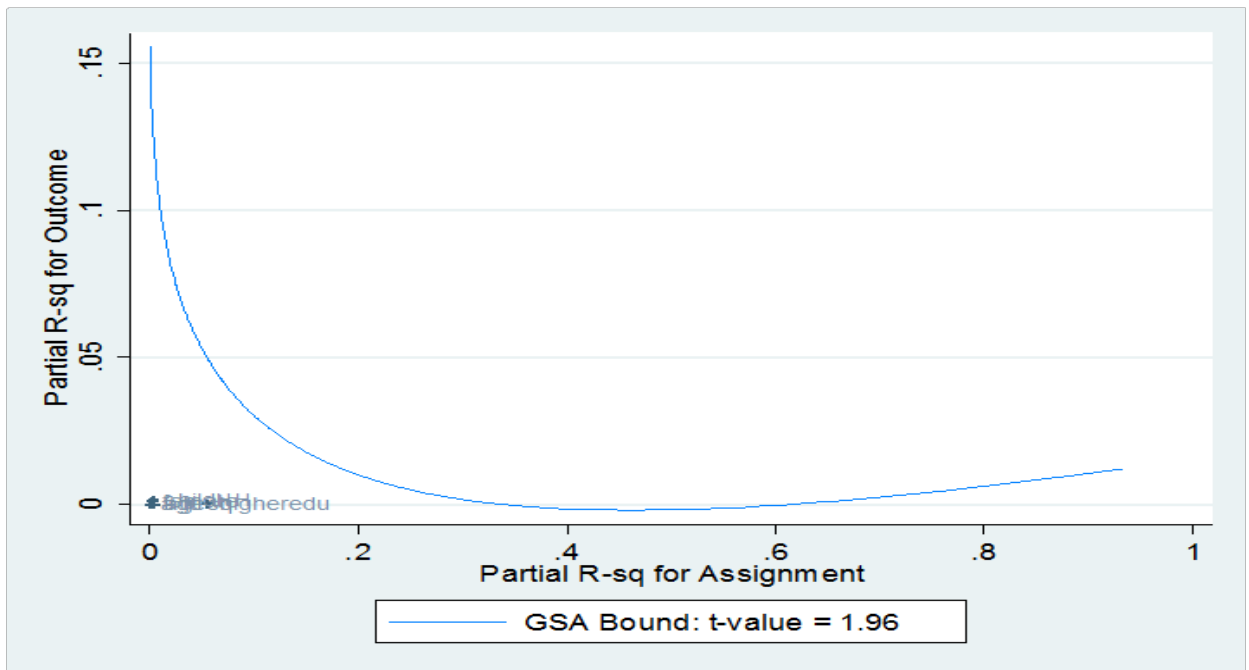
Appendix 2:

This Appendix further explores the relationship between the childhood variables in two Sections A and B. Thereafter the robustness of the main findings is further investigated and discussed in Sections C to G.

A. Relations among childhood variables.   The starting point of our examinations is – in line with earlier literature – the education level of the mother because this is quite safely an exogenous variable with regards to financial literacy. It has also been shown more generally to be an important variable for behavior later in life. As it is to be expected, the education of the father is very highly positively correlated with mother's education, the coefficient of rank correlation at 0.75 being by far the highest in the total correlation matrix documented in Table A3. Mothers' education is also positively correlated with good financial understanding of parents and negatively with having a poor economic background.

Somewhat surprising is the fact that education of our participants' parents is unrelated to parental teaching, no matter if we are looking at mother's or at father's education. This indicates that mother education and financial teaching by parents may be independent in their potential influence on financial literacy of parents' children.

In contrast, all three schooling variables are positively and strongly correlated with mother's education. These variables are also mostly related to each other, with the exception of "economics at school" which is, however, closely related to parental teaching.

Among the financial experience variables, "having a bank account before age of 18" is again unrelated to mother education but related to parental teaching and economics at school. The last variable "having job before age of 15" is – as indicated in Section 3 above – mainly related to indicators of parents' low socio-demographic standard, such as low education, more poverty and little financial understanding.

Overall, these correlations provide some first understanding about the meaning and relations of potential childhood roots of financial literacy. This will be used when deciding about regression specifications in the following.

B. Interaction of childhood variables in regression analysis.   When examining the possible influence of childhood variables we stick to the timeline introduced in Section 3. Starting point is thus again the education of the mother. Its impact on the degree of financial literacy of the adults participating in our survey is shown as specification (1) in Table A4. The coefficient of more than 0.3 is statistically highly significant. This means, if the mother has more education, such as a bachelor degree, this improves her children's degree of financial literacy by about 15% (0.325 on a scale from 0 to 4 with a mean of 2.2). Starting with this

fundamental variable we add the other childhood variables step by step (see, e.g., Maccini and Yang, 2009).

Looking at the other three variables informing about family background (specification 2), we neglect the "education of the father" because inclusion of this variable just increases the coefficient of mother's education, leads to a negative sign for father's education and has virtually no impact on the other coefficients considered later on. However, specification (2) shows that "financial understanding of parents" seems to be important, whereas "poor financial background" does not provide additional explanatory power. It is to be considered here, however, that in particular the assessment of financial understanding of parents may be affected by the participants own level of financial sophistication.

In specification (3) we take education of the mother and the two parental teaching variables into account. This provides our strongest result as all three variables are highly significant and the R-square goes up to 8%. Interestingly, the coefficient of mother education is almost unchanged, indicating that parental teaching describes a different channel by which childhood experiences impact financial literacy.

The picture changes again, if we consider the three formal education variables in specification (4). They all contribute but only economics at school is statistically highly significant. Moreover, the coefficient of mother's education declines now by about one third, this indicates that there is some interrelationship between mother's education and economics at school. The relatively high R-square suggests that formal education is also an important channel for influencing financial literacy.

The remaining variables of financial experience during childhood are considered in specification (5). Despite the intuition that experience with a bank account and a job may provide financial experience and thus improve financial literacy, the contribution of financial experience as measured by these two variables is not statistically significant.

C. Different 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. Second, 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 measure only distinguishes those with very high financial literacy, merely 17.6% in our sample, from the rest. 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 literacy. Table A5 shows the determinants of financial literacy, using various financial literacy measures. Our results mostly hold, with the Lusardi-Mitchell based dummy showing slightly different determinants of financial literacy. This, however, is unsurprising since this measure only considers extremely high levels of financial literacy.

D. Ordered probit regressions.   Table A6 is analogous to Table 6 but instead of OLS uses ordered probit as the estimation method. Significance levels and signs do not change with this estimation method.

E. Above and below median income.   Table A7 shows the determinants of financial literacy for those from households below and above the median household income of 50,000 Baht per month. The results indicate that the effects we find are stronger in households with income below the median, whereas coefficients for the richer households keep signs but turn insignificant. This may be due to those with incomes above the median being a comparatively small and heterogeneous group.

F. Different variables in the timeline approach.   Table A8 shows some exercises where we "exchange" single variables within the groups of the timeline approach. Specifications (1) and (3) are repeated from Table 8 (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 8 indeed seem to be the best ones.

G. Modified definitions of an educated mother. Due to the high relevance of mother education we examine the consequences of using modified definitions. Our benchmark definition distinguishes more vs. less educated mothers, where primary and secondary school education are taken as less educated, but vocational training, bachelor degree and other higher degrees are seen as better education. In the group of parents, minimum primary schooling lasted often just four years and secondary education added a few years only; by contrast, a vocational training represents some years of job-related education and thus tentatively a better education. Nevertheless, it is debatable whether secondary school may be regarded as a better type of education or whether the consideration of various educational levels by an ordinal variable may be more appropriate. It is reassuring that choosing any of these two alternative definitions does not qualitatively influence most regression results (Table A9). There is just one exception, i.e. the joint consideration of mother's education and economics at school because here the coefficient of mother education turns insignificant (specifications 4 and 6). This results from the high correlation between these two variables and the specific setting.

Table 2.A1: Numeracy

Numeracy was measured using four questions. All were open answered and subjects had the choice of responding "I don't know" or "I refuse to answer":

Item 1: What is 35+82?

Item 2: If you have four friends and would like to give each of your friends four sweets, how many sweets do you need?

Item 3: What is 10% of 400?

Item 4: Suppose you want to buy a bag of rice that costs 370 Baht. You only have one 1000 Baht note. How much change will you get?

Panel A: Numeracy question

	Mean	Correct (%)	Wrong(%)	Don't know	Refuse to Answer
Item 1	0.83	83.4	11.3	2.5	2.8
35+82					
Item 2	0.83	83.8	12.5	0.6	3.2
4 friends, 4 sweets					
Item 3	0.94	94.2	1.5	1.5	2.8
10% of 400					
Item 4	0.95	94.7	1.7	0.4	3.2
1000-370					
Numeracy score	3.56				

Panel B: Correlations with financial literacy

	Item1	Item 2	Item 3	Item 4
Numeracy score	0.21***	0.19***	0.09**	0.27***

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

Table 2.A2: Socio-demographic characteristics, financial literacy and numeracy

	(1) Financial literacy		(2) Numeracy	
	Bivariate	Multivariate	Bivariate	Mulitvariate
Female	0.034	0.130	-0.014	0.037
	[0.087]	[0.079]	[0.076]	[0.074]
Age	-0.005	-0.013**	-0.014**	-0.024***
	[0.005]	[0.006]	[0.004]	[0.006]
Log of income	0.452***	0.494***	0.191**	0.334***
	[0.087]	[0.114]	[0.077]	[0.089]
Number of adults in HH	-0.023	-0.013	-0.005	-0.007
	[0.027]	[0.027]	[0.023]	[0.023]
Number of children in HH	0.014	0.035	0.037	0.073*
	[0.042]	[0.043]	[0.037]	[0.040]
Married	-0.210**	-0.125	-0.169**	0.011
	[0.087]	[0.107]	[0.076]	[0.086]
Better education	0.423***	0.156*	0.325***	0.181**
	[0.091]	[0.094]	[0.080]	[0.084]
Risk aversion	-1.66***	-1.456***	-1.022***	-0.836***
	[0.178]	[0.183]	[0.162]	[0.201]
R^2		0.21		0.14
Observations		529		529

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

Table 2.A3: Correlations among childhood experience variables

	Father's education	Mother's education	Finan. underst. parents	Back-ground poor	Taught to budget	Encoura. to save	Econ. school	Born in BKK	Educ. in BKK	Bank acc. 18	Job before 15
Father's education	1										
Mother's education	0.749***	1									
Financial understanding of parents	0.119*	0.138**	1								
Considers economic background poor	-0.187***	-0.120*	-0.036	1							
Taught to budget	0.034	0.034	0.403***	0.008	1						
Encouraged to save	0.043	0.042	0.328***	0.022	0.446***	1					
Economics at school	0.097	0.138**	0.277***	0.0257	0.323***	0.372***	1				
Born in Bangkok	0.168***	0.207***	0.020	-0.008	0.009	0.012	-0.047	1			
Educated in Bangkok	0.086	0.138**	0.190***	-0.015	0.067	0.140**	0.167***	0.454***	1		
Bank account before18	0.082	0.092	-0.016	-0.076	0.180***	0.209***	0.192***	-0.065	0.002	1	
Job before 15	-0.187***	-0.157**	-0.147**	0.250***	0.072	-0.012	-0.038	0.010	-0.075	0.110*	1

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

Table 2.A4: Determinants of financial literacy

	(1)	(2)	(3)	(4)	(5)	(6)
	FL	FL	FL	FL	FL	FL
Mother has vocational	0.325***	0.307***	0.295***	0.196*	0.282***	0.218**
degree or higher	[0.101]	[0.103]	[0.098]	[0.101]	[0.105]	[0.106]
Financial understanding		0.102***				0.034
of parents 1-6		[0.030]				[0.035]
Poor economic		0.051				0.045
background		[0.097]				[0.108]
Parents taught to budget			0.292**			0.189
			[0.137]			[0.145]
Parents encouraged			0.428***			0.371**
saving			[0.146]			[0.153]
Economics in school				0.375***		0.244**
				[0.105]		[0.120]
Born in Bangkok				0.101		0.048
				[0.100]		[0.106]
Highest educational				0.192		0.114
degree in Bangkok				[0.136]		[0.142]
Bank account before 18					-0.113	-0.208**
					[0.092]	[0.098]
Job before age 15					0.015	0.043
					[0.090]	[0.098]
Constant	2.081***	1.647***	1.490***	1.629***	2.157***	1.318***
	[0.049]	[0.147]	[0.146]	[0.122]	[0.082]	[0.196]
R^2	0.02	0.05	0.08	0.07	0.02	0.11
Observations	479	444	464	468	465	416

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

Table 2.A5: Determinants of financial literacy, different measures of financial literacy

	Financial literacy LM +banks	Financial literacy LM score	Financial literacy LM dummy	Financial literacy LM+Cole
Father's education	-0.218	-0.247**	-0.037	-0.247
	[0.139]	[0.124]	[0.048]	[0.150]
Mother's education	0.393***	0.408***	0.135**	0.338**
	[0.145]	[0.135]	[0.058]	[0.167]
Financial understanding of	0.023	0.030	-0.004	0.047
parents 1-6	[0.035]	[0.033]	[0.013]	[0.041]
Poor economic background	-0.081	-0.062	-0.028	0.040
	[0.104]	[0.094]	[0.040]	[0.110]
Parents taught how to budget	0.074	0.020	-0.008	0.213
	[0.143]	[0.134]	[0.047]	[0.170]
Parents encouraged saving	0.328**	0.252*	0.082*	0.273
	[0.156]	[0.149]	[0.046]	[0.181]
Economics in school	0.068	-0.004	-0.045	0.070
	[0.132]	[0.118]	[0.049]	[0.144]
Born in Bangkok	-0.002	-0.028	-0.006	0.013
	[0.109]	[0.099]	[0.040]	[0.117]
Highest educational degree in	-0.034	-0.010	0.112**	-0.090
Bangkok	[0.178]	[0.162]	[0.052]	[0.188]
Bank account before 18	-0.153	-0.119	-0.046	-0.096
	[0.098]	[0.093]	[0.041]	[0.114]
Job before age 15	0.045	0.077	0.029	0.156
	[0.102]	[0.096]	[0.040]	[0.115]
Numeracy	0.107*	0.113**	-0.005	0.193***
	[0.055]	[0.053]	[0.017]	[0.063]
Risk aversion	-1.047***	-0.701***	-0.220**	-0.977***
	[0.232]	[0.221]	[0.097]	[0.265]
Higher education	0.041	0.007	-0.056	-0.003
	[0.137]	[0.124]	[0.052]	[0.150]
Log of personal income	0.252*	0.293**	0.138***	0.267
	[0.134]	[0.136]	[0.051]	[0.166]
Female	0.050	0.026	0.052	0.035
	[0.088]	[0.081]	[0.034]	[0.098]
Age in years	-0.001	-0.004	0.006	0.013
	[0.036]	[0.034]	[0.015]	[0.043]
Age squared	-0.003	-0.004	-0.009	-0.027
	[0.048]	[0.047]	[0.020]	[0.058]
R2	0.20	0.16	0.09	0.21
Observations	408	408	408	408

Notes: The table reports OLS regression results with robust standard errors in brackets. The dependent variables are different measures of financial literacy. ***, ** and * denote significance at the 1%, 5% and 10% levels, respectively.

Table 2.A6: Determinants of financial literacy, ordered probit

	Financial literacy	Financial literacy	Financial literacy	Financial literacy
Father's education	-0.232		-0.246	
	[0.154]		[0.163]	
Mother's education	0.428***	0.271**	0.460***	0.282**
	[0.162]	[0.117]	[0.171]	[0.116]
Financial understanding of parents 1-6	0.051		0.030	
	[0.040]		[0.041]	
Poor economic background	0.017		-0.092	
	[0.125]		[0.123]	
Parents taught how to budget	0.195		0.095	
	[0.164]		[0.165]	
Parents encouraged saving	0.455**	0.598***	0.413**	0.466***
	[0.184]	[0.184]	[0.182]	[0.168]
Economics in school	0.250*	0.314**	0.059	
	[0.137]	[0.132]	[0.157]	
Born in Bangkok	0.057		-0.001	
	[0.118]		[0.127]	
Highest educational degree in Bangkok	0.119		-0.009	
	[0.159]		[0.208]	
Bank account before 18	-0.235**	-0.245**	-0.186	
	[0.112]	[0.108]	[0.116]	
Job before age 15	0.058		0.048	
	[0.115]		[0.122]	
Numeracy score out of 4			0.120*	0.136**
			[0.064]	[0.059]
Risk aversion			-1.268***	-1.366***
			[0.278]	[0.264]
Higher education			0.046	
			[0.163]	
Log of personal income			0.308**	0.259**
			[0.157]	[0.117]
Female			0.077	
			[0.103]	
Age in years			0.006	
			[0.043]	
Age squared			-0.013	
			[0.059]	
Pseudo-R2	0.02	0.02	0.04	0.04
Observations	408	408	408	408

Notes: The table reports ordered probit 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 2.A7: Determinants of financial literacy, above and below median household income

	Financial literacy *income<=50000*	Financial literacy *income>50000*	Financial literacy *income<=50000*	Financial literacy *income>50000*
Father's education	-0.241	-0.212	-0.255*	-0.242
	[0.147]	[0.282]	[0.150]	[0.294]
Mother's education	0.453***	0.237	0.474***	0.267
	[0.159]	[0.271]	[0.165]	[0.283]
Financial understanding of	0.071	0.011	0.062	-0.018
parents 1-6	[0.047]	[0.061]	[0.048]	[0.063]
Poor economic	0.004	-0.019	-0.022	-0.244
background	[0.134]	[0.200]	[0.128]	[0.202]
Parents taught how to	0.239	-0.106	0.117	-0.072
Budget	[0.173]	[0.304]	[0.176]	[0.288]
Parents encouraged saving	0.599***	0.164	0.496***	0.179
	[0.208]	[0.276]	[0.190]	[0.301]
Economics in school	0.187	0.263	0.055	0.013
	[0.150]	[0.240]	[0.156]	[0.251]
Born in Bangkok	0.044	0.046	0.009	-0.032
	[0.128]	[0.216]	[0.131]	[0.239]
Highest educational	-0.045	0.330	-0.122	0.272
degree in Bangkok	[0.151]	[0.472]	[0.172]	[0.523]
Bank account before 18	-0.224*	-0.199	-0.171	-0.152
	[0.119]	[0.176]	[0.126]	[0.171]
Job before age 15	0.133	-0.136	0.097	-0.090
	[0.124]	[0.181]	[0.126]	[0.190]
Numeracy score out of 4			0.077	0.176
			[0.067]	[0.109]
Risk aversion			-1.030***	-1.137**
			[0.294]	[0.436]
Higher education			-0.041	0.138
			[0.158]	[0.260]
Log of personal income			0.169	0.173
			[0.262]	[0.220]
Female			0.109	-0.064
			[0.109]	[0.169]
Age in years			0.049	-0.032
			[0.047]	[0.051]
Age squared			-0.077	0.048
			[0.063]	[0.066]
R2	0.17	0.06	0.25	0.16
Observations	264	144	264	144

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

Table 2.A8: Determinants of financial literacy, with different preferred RHS variables

	(1) Financial literacy	(2) Financial literacy	(3) Financial literacy	(4) Financial literacy
Father has vocational degree or higher	-0.215 [0.136]	0.050 [0.104]	-0.218 [0.139]	0.031 [0.103]
Mother has vocational degree or higher	0.388*** [0.142]		0.393*** [0.145]	
Financial understanding of parents	0.044 [0.035]	0.079** [0.035]	0.023 [0.035]	0.043 [0.035]
Poor economic background	0.011 [0.111]	0.063 [0.112]	-0.081 [0.104]	-0.049 [0.105]
Parents taught to budget	0.170 [0.148]	0.318** [0.141]	0.074 [0.143]	0.146 [0.133]
Parents encouraged saving	0.389** [0.163]		0.328** [0.156]	
Economics at school	0.238* [0.122]		0.068 [0.132]	
Born in Bangkok	0.051 [0.107]	0.050 [0.109]	-0.002 [0.109]	0.027 [0.111]
Highest educational degree in Bangkok	0.082 [0.143]	0.182 [0.141]	-0.034 [0.178]	-0.033 [0.177]
Bank account before 18	-0.203** [0.099]		-0.153 [0.098]	
Job before 15	0.055 [0.101]	0.017 [0.102]	0.045 [0.102]	0.029 [0.103]
Numeracy			0.107* [0.055]	0.130** [0.053]
Risk aversion			-1.047*** [0.232]	-1.086*** [0.237]
Highest educational degree			0.041 [0.137]	0.113 [0.129]
Log of income			0.252* [0.134]	0.236* [0.133]
Female			0.050 [0.088]	0.052 [0.088]
Age			-0.001 [0.036]	-0.008 [0.036]
Age squared			-0.003 [0.048]	0.007 [0.048]
R^2	0.11	0.06	0.20	0.17
Observations	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. In columns (3) and (4) other controls are included. ***, ** and * denote significance at the 1%, 5% and 10% levels, respectively.

Table 2.A9: Determinants of financial literacy, other definitions of mother's education

Panel A: Mother has secondary education or higher

	(1) Financial literacy	(2) Financial literacy	(3) Financial literacy	(4) Financial literacy	(5) Financial literacy	(6) Financial literacy
Mother has secondary	0.212**	0.183**	0.162*	0.075	0.170*	0.068
education or higher	[0.086]	[0.090]	[0.085]	[0.089]	[0.088]	[0.096]
R^2	0.01	0.04	0.07	0.06	0.01	0.10
Observations	479	444	464	468	465	416

Panel B: Mother has better education, coded from 1 to 5

	(1) Financial literacy	(2) Financial literacy	(3) Financial literacy	(4) Financial literacy	(5) Financial literacy	(6) Financial literacy
Mother's education	0.091**	0.076**	0.078**	0.040	0.075**	0.046
(coded from 1 to 5)	[0.036]	[0.037]	[0.035]	[0.036]	[0.037]	[0.039]
R^2	0.01	0.04	0.07	0.06	0.01	0.10
Observations	479	444	464	468	465	416

Notes: This table exactly reproduces Table 7 from the paper (i.e., including the full set of control variables), but with other definitions of mother's education in Panel A and B each. It only shows coefficients on the newly defined variable "education of the mother" and reports OLS regression results with robust standard errors in brackets. The dependent variable is the financial literacy score. ***, ** and * denote significance at the 1%, 5% and 10% levels, respectively.

Chapter 3:
Financial literacy and financial behavior:
Thai women do not lag behind[20]

3.1 Introduction

People have to make financial decisions with far reaching consequences in various domains of their life. They decide whether to save, how to invest their assets, whether and which kind of debt they take, which insurance to buy and how to deal with retirement savings (Campbell 2006). In some contrast to the importance and frequency of these decisions, many people do not seem to be well equipped to master these challenges. One widespread deficiency, of particular interest to us, is their limited financial literacy.

In their survey on financial literacy, Lusardi and Mitchell (2014) report results on the degree of financial literacy which covers many countries and population groups around the world. One of the most striking common patterns is the finding that there are "large sex differences in financial literacy" (Lusardi and Mitchell, 2014), with women being at a disadvantage. This finding also applies to studies with a focus on developing countries summarized as "women tend to have less financial literacy" in Xu and Zia (2012). Hence, Bucher-Koenen et al. (2014) coin this common finding the "gender gap" in financial literacy.

We complement the literature in this field by examining well educated middle class people in an emerging economy. Surprisingly, we do not find that women lag behind men regarding financial literacy. Whereas there are a few studies documenting an equal level of financial literacy among women and men, all of these studies cover populations with a generally low degree of financial literacy. By contrast, we are the first documenting robust equality at a higher level of financial literacy and thus complementing available evidence. This new evidence provides further insights into possible determinants of the gender gap and what policy could do about it.

It is important to remember, financial literacy is a skill that facilitates good financial decisions but does not guarantee them (Gathergood, 2012, Gustman et al., 2012, van Rooij et al., 2012, Fernandes et al., 2013). In line with some skepticism in the literature about the financial decision making skills of many women (Halko et al., 2012, Mahdavi and Horton, 2014), it seems possible that women make worse financial decisions than men despite having the same degree of financial literacy. Worse financial decisions may include, for example, forgiving risk-adjusted return opportunities or missing diversification opportunities. Whether women are really subject to this behavior is an empirical question which is of high importance

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[20] This chapter is based on a paper that is joint work with Roy Kouwenberg, Olaf Hübler and Lukas Menkhoff.

for welfare considerations. Thus it seems important and again somewhat surprising, that based on our sample and the financial decisions we observe, women do not make worse financial decisions than men. Summarizing both results, we do not find a gender gap: neither regarding financial literacy nor regarding financial behavior.

Obviously, our findings differ from the main literature which raises the question, why do we get this result? We see three possible explanations: a different study design, a different sample composition and a different country. Regarding the study design we are conventional by purpose, as we show below, so the explanation is unlikely to be found here. Regarding the sample composition, however, we differ from most studies which aim for samples which are representative of the adult population. In contrast, we cover relatively homogeneous middle-class people, characterized by good education, high income and responsibility for financial decisions. This means that we compare women and men with similar individual characteristics in order to reveal the pure role of gender. Finally, regarding the country, we base our study in Thailand, which is culturally different from Western societies, which have mostly been studied so far. Our result suggests that "the country" is the most likely explanation for our unusual finding: the missing gender gap in financial affairs in Thailand seems to be related to some striking facts of gender-equality in finance-specific aspects.

In order to enable an analysis of gender-specific financial literacy, we conduct a specifically designed questionnaire survey. This survey study covers 530 middle-class people from Bangkok and is described in detail in the data section below (Section 2). Crucially, this survey contains information about participants' socio-demographic situation, their biographical background, their financial literacy and financial decisions. This same survey has been used before by Grohmann et al. (2014) to examine the impact of financial literacy in the middleclass; however, that paper does not focus on gender issues or a gender gap.

We start our analysis with descriptive statistics and find that women and men in our sample are relatively equal regarding their socio-demographic characteristics. Next we report that there is no statistically significant difference in financial literacy between women and men, regardless of the measure we take. This pattern also holds for financial behavior which we analyze by observing six separate measures of sound financial decision making.

After documenting this pattern, we apply the recently developed statistical LARS-procedure (Efron et al., 2004) to derive an optimal empirical model explaining financial behavior. This procedure considers the wealth of individual characteristics available in our dataset and selects those most suited to explaining financial behavior. This procedure aids in finding a suitable instrument for later instrumental variable regressions. We conclude from

these results that financial literacy does explain financial behavior but gender does not, i.e. in our sample there never is a gender gap.

In order to test whether our result depends on the specific middle class data, we re-examine data sets from other countries by selecting individuals from these data sets as close to our sample as possible. We find, using data from the U.S., the Netherlands and Germany that middle class characteristics, such as being more educated, having higher income, urban living and being financially responsible all tend to contribute to higher financial literacy, but not necessarily to a smaller gender gap. In another test we examine whether the missing gender gap in our sample may be driven by people from Bangkok. Thus we use a sample of relatively poor rural Thais and also do not find the conventional gender gap in financial literacy, again indicating that our result is not the consequence of selecting a very specific group of people. However, the country seems to be important and in this respect Thailand is not a particularly gender-equal society in general. We conclude that our finding of a lacking gender gap is best explained by finance-specific country characteristics such as gender-equal numeracy, financial responsibility and high labor market participation rates of women.

This result has an obvious policy implication as the commonly found gender gap in financial affairs seems to be entrenched in country-specific norms (the relation between gender differences and cultural background is also touched upon in Croson and Gneezy, 2009). If indeed country characteristics are important, this suggests that addressing such background determinants of financial behavior can improve outcomes of financial literacy trainings, which have often been disappointing (Fernandes et al., 2014). One could argue that financial literacy trainings should not only transfer knowledge on finance, but also need to go deeper and awaken an interest in financial matters along with a sense of financial responsibility. The case of Thailand indicates that a society where women – relative to men – command over finance-specific abilities (i.e. numeracy) and are involved in financial affairs (due to financial responsibility in the household and labor market participation) contributes to reducing the gender gap in financial literacy and financial behavior.

This paper's focus on the gender difference is quite rare in the large literature on financial literacy. Typically, gender is just a control variable (Fernandes et al., 2014). Only a few papers specifically examine women, such as Lusardi and Mitchell (2008) who find that in particular older women show a severe lack of financial literacy. A study by Chen and Volpe (2002) also finds a gender gap among highly educated U.S. college students. Mahdavi and Horton (2014) show that even amongst the most educated women, financial literacy leaves room for improvement, while other studies focus on specific issues, e.g. the take-up of

mortgage loans with interest rate risk (Do and Paley, 2013). In contrast, few papers on Russia and East Germany (Klapper and Panos, 2011, Bucher-Koenen and Lamla, 2014) do not find a gender gap, indicating that former Eastern European societies may have something in common. However, different from our sample, the level of financial literacy is always low for both, women and men. Bucher-Koenen et al. (2014) stand out in the literature as they analyze possible explanations for the gender gap. However, a conclusive answer does not seem to exist yet as socio-demographic characteristics explain only part of the gap at best. We bring in fresh evidence indicating, first, another interesting exception to the general gender gap, second, that this gap can be non-existent at a high level of financial literacy, and, third, that it seems to be related to finance-specific country characteristics. These characteristics provide evidence on sources of the gender gap beyond Thailand and thus also starting points for proper policy measures in general.

3.2 Sample collection and characteristics

This section describes the data in general, that is, the conduct of the survey (3.2.1), participants' socio-demographic characteristics (3.2.2) and biographical characteristics (3.2.3). Characteristics are presented separately for women and men.

3.2.1 Conduct of the survey

The data used in this paper was collected during a survey in Bangkok at the end of 2012. The sample consists of 530 respondents and was collected using street interviews throughout Bangkok. The survey was conducted by a survey company, using a questionnaire designed by the research team. The questionnaire was pre-tested using respondents from the target group and the survey company gave feedback based on previous experience. As we aim to cover people with a number of different levels of wealth, income, employment status and family backgrounds, interviews were conducted in commercial as well as residential areas of Bangkok. Areas were chosen before the start of the survey and each area was covered by a team consisting of three or four interviewers. Interviews, however, were conducted on a one to one basis. Each interviewer had previous survey experience and was trained on this specific questionnaire.

In order to counteract potential sample bias problems with this form of surveying, a number of precautions were taken and respondents were pre-selected based on four different criteria. First, as this study explicitly aims to study the urban middle-class, income had to be over 15,000 baht a month, which is the starting salary for a recent graduate. According to the

Thai Office of National Statistics, 29% of Bangkok residents earn this amount or more. Second, respondents had to be at least 18 years and not over 60 as to be allowed to make their own financial decisions, but not to have started retirement. Third, respondents had to be resident in Bangkok and fourth, and most importantly for the purpose of this paper, they had to be responsible for their own or their household's financial decisions. If the person approached did not meet these four requirements, the interview was discontinued after the preliminary questions. Among these four criteria only the first one (too low income) led to a larger number of discontinued interveiws, so that about 31% of those approached failed initial screening. In addition to the pre-selection, we also aimed for a balanced sample with respect to gender and aimed for diversity regarding age.

3.2.2 Socio-demographic characteristics of women and men

As the survey focuses on the urban middle-class in an emerging economy it is unsurprising that our sample is young and well educated. The average age is 34 years and 64% of our respondents have a bachelor's degree and a further 15% have vocational training. Table 3.1 shows these and more summary statistics broken down by gender. The table's last column shows *p*-values for a *t*-test comparing men and women.

At an average income of just under 26,800 baht a month (approximately 600 US dollar), earnings of our sample are considerably higher than the Bangkok average, which was 17,000 baht a month in 2011 (source: National Statistics Office). About half of our respondents are married. The average number of three adults per households is typical for Bangkok as often two or three generations live together. Despite this somewhat traditional behavior, the low average number of less than one child per household reflects the modern life-style of middle-class people.

We complement standard socio-demographic characteristics with numeracy and risk attitude, two variables of particular interest when analyzing financial literacy as these may also influence financial behavior (Agarwal and Mazumder, 2013). When we turn to our measure of numeracy, which is compiled by answering four math questions (for details see in the Appendix Table 3.A1), we get average values at about 3.5. Regarding risk aversion, we rely on a survey based question (see Table 3.A1). This simple measure of risk attitude asks respondents to place themselves on a scale between zero and ten, with zero meaning "unwilling to take risk" and ten meaning "fully prepared to take risk". This measure has been used in previous studies and has been shown to be closely correlated with experimental measures of risk aversion (Dohmen et al. 2011, Hardeweg et al. 2013). In order to make

interpretation easier we reverse the scale and use a zero to one scale, which thus provides a measure of self-assessed risk aversion on a scale between 0 and 1.

Finally, Table 3.1 reports information about the amount of financial assets held by participants. Since we only required respondents to give their asset value in categories, we created three dummies for the value of assets, namely high, medium and low. Women are slightly more likely to be in the lowest asset group (54%, versus 47% for men).

As we can see, men and women in our sample are the same on average with respect to most socio-demographic variables, such as age, household composition, education and numeracy. However, there also are marked differences between the sexes: women show more risk aversion and also have lower incomes than men, despite requiring a minimum income of above 15,000 baht to participate in the survey.

3.2.3 Biographical characteristics of women and men

In addition to standard socio-demographic and financial information, we also collected a number of indicators designed to give biographical information. These indicators have been used in earlier studies as documented in Grohmann et al. (2014). They cover various aspects of education and early experiences with money. They enable us to look in more detail at differences in family background and early life experiences with money between men and women in the sample. Descriptive statistics, again broken down by men and women are presented in Table 3.2. Results of *t*-tests are presented in the right most column.

(1) The first group of biographical characteristics addresses *family background*. When looking at these results father's and mother's education of men and women in our sample is significantly different, standing out among all the variables covered here. The result indicates that women that are part of Bangkok's middle class where born to less educated parents than their male counterparts. In contrast to this strong difference, the self-assessment regarding parents' understanding of financial matters and the economic background being poor are at best borderline significantly different between women and men.

(2) The second group contains variables on *parental teaching*. Parents usually taught their children to budget and encouraged children's saving. The frequency of this behavior is slightly higher regarding boys than girls but the difference in percentage points is not high and also not statistically significant.

(3) Another important biographical characteristic is the education that children got at school. The subject "economics" is frequently taught as almost 67% of our participants had this subject at school. Women had economics in school more often than men, however, not to

a significant degree. More men than women were born in Bangkok (marginally significant), although slightly more women received their highest educational degree in Bangkok.

(4) Finally, *early experiences with money* cover different aspects. Almost all participants had an allowance as children, so we do not consider this variable in our further examination. Slightly more than half had a bank account before the age of 18, equally likely among women and men. The last difference is that men are more likely to have had jobs before the age of 15. As most of our sample is university educated these jobs were clearly part-time work. Again, since middle class men tend to have had more educated parents, this is surprising. Possible answers to this puzzle are either that men, having grown up in Bangkok, felt poorer and so felt the need to get a part-time job, or that boys were more often allowed by parents to work (part-time) than girls.

Overall, most biographical characteristics do not differ much between women and men. What stands out, however, is the clearly higher education of men's parents compared to women's parents.

3.3 Financial literacy and financial behavior of women and men

In this section we provide first results. We show that women in our sample are not less financially literate than men, irrespective of the financial literacy measure being used (Section 3.3.1). Moreover, women also do not seem to make worse financial decisions than men; if there is any difference, women tend to make overall better decisions than men (Section 3.3.2).

3.3.1 Financial literacy of women and men

The survey includes four questions designed to measure financial literacy. The first three questions were first used in the US Health and Retirement Survey in 2004 by Lusardi and Mitchell (2007) and now have become standard items to measure financial literacy. Hence these three questions have been widely used on a number of different groups from a large number of countries. This enables direct comparisons across countries and social groups. We supplement these three standard questions with a fourth question introduced by Cole et al. (2011). Exact questions can be found in Table 3.3.

A number of different ways have been used in the literature to form financial literacy scores. Here, we focus on two methods; firstly we simply award one point for each correct answer given, so that all questions are weighted equally. Secondly we use factor analysis and use the first factor as a measure for financial literacy. In addition to dummies that take the value of one for each correct question, we also include variables that are unity if the

respondent answers "I don't know" (van Rooij et al. 2011). Furthermore, a variable that counts the number of foreign banks that someone can name is also included in the factor analysis. We include this as an additional measure of financial literacy, as we argue that the original questions are too focused on mathematical ability. This argument has also been made by Carpena et al. (2011), who supplement questions on financial numeracy with questions on financial awareness, financial attitudes and perceptions. By asking about foreign banks we are including our own measure on institutional knowledge and are so expanding the concept of financial literacy.

Dummies for each question, along with the two aggregate scores are reported in Table 3.3, broken down by gender. From the *t*-test result we can see that there is no significant difference in the level of financial literacy between men and women. This holds for all six measures of financial literacy documented in Table 3.3. The share of correct answers is better than measured for the U.S. but below the share measured in either the Netherlands or Germany (Bucher-Koenen et al., 2014). The main shortcoming of the Bangkok sample is in the response to item three, which measures diversification, probably because the share of stock owners is below that found in advanced economies.

Finally, Bucher-Koenen et al. (2012) report that in surveys from many countries women tend to report that they do not know the answer on financial literacy items more often than men. We report at the bottom of Table 3.3 that there is no such difference in our sample. Moreover, the frequency of "do not know" responses in our sample is comparable to men other studies, and thus not unusually high.

3.3.2 Financial behavior of women and men

When comparing financial behavior of men and women, it becomes clear that women do *not* display worse financial behavior. The survey asks respondents to give information on the amount and structure of savings as well as debt. In particular, we ask what form assets are held in and ask for detailed information on credit card debt. Based on this data we use indicators of more or less informed financial behavior which have been introduced in this specific form by Grohmann et al. (2014). Among these indicators, four refer to the asset side and two to credit card debt:

- The first indicator "*assets other than savings account*" refers to the situation in Thailand that almost everyone has a savings account. Beyond that, however, the use of further kinds of assets decreases dramatically so that about half of the population sticks with just one or several savings accounts (details in Table 3.4). There is no gender specific

difference. Here we just present descriptive statistics, later on we also control for income and assets which naturally foster the use of other assets than savings accounts.

- The most common other asset is a "*fixed deposit account*", which in Thailand brings considerable tax benefits. Holding this kind of favorable asset is our second indicator of informed financial behavior. Interestingly, women tend to hold this kind of asset significantly more often than men, although the difference in absolute numbers with 44% to 38% is not too large.

- Thirdly, we look at the use of life-"*insurance*" products as a type of specific investment product. This savings product offers relatively low returns in Thailand compared to bonds, so that it cannot really be regarded as a good choice for informed customers. On the other hand life insurance offers payouts in case of early death and for this reason it can be interesting for risk averse people. Since women are in general rather more risk averse than men (e.g. Eckel and Grossman, 2008), buying life insurance may be particularly appealing to them, despite low financial returns.

- Turning to credit card debt, we ask whether one "*does not know the interest on credit*" (debt). Even though this is a knowledge question, and thus in a sense similar to knowing foreign banks, we here ask specifically about the interest paid on one's own credit card and not for abstract financial knowledge (32% of women and 33% of men own a credit card). Answers to this item are the sole case where women seem to be less informed than men.

- One reason may be the next indicator of informed financial behavior, i.e. whether one finds it "*difficult to pay off credit card*" (debt). Women are a lot less likely to feel that paying off their credit cards is a burden. It hence follows that women are less likely to incur interest rate costs which may contribute to explaining why they are less likely to know the interest rate on their credit card.

- Beyond single products, we also consider diversification by simply counting the "*number of different assets*" a person owns. As before, obviously one needs to control for wealth. Nevertheless, the raw descriptive statistic is surprising because women hold significantly more different assets than men, despite lower income and assets.

In summary, we find that in three cases women demonstrate more informed behavior than men, according to our indicators. In one case women behave inferior and in two cases equal to men. All this does not show that women would lag behind men regarding the quality of financial behavior.

3.4   The role of financial literacy and gender for financial behavior

This section builds on Section 3.3 and advances by going from description to explanation. Section 3.4.1 describes the empirical approach by which we analyze financial behavior and Section 3.4.2 shows the result when applying this approach to explain various kinds of financial decisions by instrumental variable (IV) regressions. Section 3.4.3 mentions robustness checks.

3.4.1 Econometric approach

Research has developed over the last ten years or so that is designed to increase our understanding of the role of financial literacy. Over the last years potential endogeneity of explanatory (right-hand-side) variables has been addressed by relying on instrumental variables which are often derived from childhood experiences of today's adults (Behrman et al. 2012). This leads to a wealth of variables which may be relevant when examining the role of financial literacy and raises the question of how to organize these variables.

So far, research either uses a limited number of variables (possibly determined by data availability) or imposes a two-step structure on the data. This structure distinguishes between variables that are seen as controls when the impact of financial literacy is analyzed, whereas other variables are used as instruments for financial literacy. There are good economic reasons for imposing such a structure and of course there are statistical tests to see whether conditions for the structure are fulfilled. Nevertheless, given the many potential influences, potential multicollinearity and possible endogeneity, we propose here a purely statistical-econometric procedure to decide which variables to use for which purpose.

In this paper we aim to explain financial behavior by relying on individual characteristics, in particular available socio-demographic information (Table 3.1) and biographical information (Table 3.2), and by also considering measures of financial literacy. In the presence of a long list of potential variables, but in the absence of clear theory on what the relevant variables for financial decisions are, we start the econometric analysis with the selection of individual characteristics that are relevant in a statistical sense. For this purpose least angle regression (LARS) is applied (Efron et al., 2004). This approach provides a compromise between forward and backwards regressions producing too small standard errors and, for example, the least absolute shrinkage and selection operator (LASSO, Tibshirani, 1996) where OLS coefficients are shrunk towards zero.

According to the LARS-approach, among a collection of m available covariates a parsimonious set for the efficient prediction of response variables is selected. Only m steps

are required. Each step adds one covariate to the model so that after k steps just k coefficients are nonzero. The procedure starts with all coefficients being equal to zero and finds the one predictor being most correlated with the response variable, say $x1$. The largest step in the direction of this predictor is taken until some other predictor - say $x2$ - has as much correlation with the current residual. LARS proceeds in a direction equiangular between the two predictors, $x1$ and $x2$, until a third predictor, $x3$, earns its way into the "most correlated" set. LARS proceeds equiangularly between $x1$, $x2$ and $x3$, that is, along the "least angle direction" until a fourth variable $x4$ enters, and so on. Mallows' Cp (Mallows, 1973) is applied to find the best model involving a subset of all available predictors. Following the Cp criterion as the usual stopping rule within the LARS-approach, there are no more regressors incorporated when Cp reaches its smallest value. As Cp is an unbiased estimator of prediction error, the Cp minimization can be regarded as an unbiased estimator of the optimal stopping point.

The result of applying this LARS procedure to our data is presented in Table 3.5, using the "number of different assets" as the dependent variable to be explained, as a proxy for informed financial behavior. Table 3.5 shows the stepwise outcomes of the LARS procedure, where the first variable being included is log of income, followed by asset variables and then already followed by financial literacy, whereas gender comes considerably later in step 11. Variables are included until step 18, i.e. 17 variables help to improve the estimation. The inclusion of further variables leads, however, to increasing Cp values. Following the LARS procedure these variables will not be included as control variables in the estimations.

As mentioned above, we present results here using the "number of different assets" as dependent variable. We argue that this variable is more representative for financial behavior than examining decisions about single assets or behavior towards credit card debt. Thus, if one prefers to consistently work throughout the research with one set of variables (as we do), the one from Table 3.5 seems to be the most appropriate. In robustness checks we have calculated specific variable sets for each individual dependent variable, without major changes.

3.4.2 Explaining financial behavior

Having revealed the set of useful variables that help our understanding of financial behavior, we now show regressions explaining all considered kinds of financial behavior by an instrumental variable (IV) approach. IV-regressions seem advisable here as it is possible that financial literacy does not determine the choice and diversity of assets directly but rather

causality works the other way around. Furthermore, bias caused by measurement error is also a possibility that can be addressed using IV regressions.

We hence look for variables that are correlated with the causal variable of interest, but uncorrelated with the error term, i.e. we need determinants that ensure the exclusion restriction. For this purpose we exploit the available biographical information (see Table 3.2). Some of these variables are not only indirectly correlated with the choice of asset types via financial literacy but also via other channels. In this event, the causal effect is not correctly recognized. We have found that allowance during childhood (ALLOW), persons who had a job before 15 (JOB), bank account before 18 (ACC), parents' understanding of financial matters (FIN), persons were taught to budget by their parents (BUDGET) and numeracy (NUM) can be used as identifying instruments as they do not directly affect our measures of financial behavior. These variables are excluded by the LARS procedure (see Table 3.5), and so do not influence the dependent variable directly, while economics as subject at school (ECO), saving between the ages of 12 to 16 (SAVE), poor economic background (POOR), mother's and father's education (EDU_m, EDU_f) are directly correlated with financial behavior. Among the six identifying instruments ALLOW and JOB are the only two that are excluded by LARS of financial literacy (not presented in the tables). From this view ALLOW and JOB could be suppressed as instruments. However, we prefer the approach with rather more than less instruments following Andrews (1999) and thus searching for the largest set of valid instruments.

The resulting second step-estimations are presented in Table 3.6 and cover only coefficients of the financial literacy variable and the gender variable in order to save space. The coefficients of FL and FEM change only slightly if ALLOW and JOB are excluded as instruments (not presented in the tables). The Sargan-Hansen tests do not reject the validity of instruments. We do not show coefficients of the other 15 (control) variables in the second-stage regression (for information we also provide results of the first-stage regression to the main NoASS equation in Table 3.A2 explaining financial literacy). Results in Table 3.6 show that financial literacy is a very important variable in explaining financial behavior: the coefficient signs are always as expected and statistically significant except for one case, the variable INT_rate (knowing the interest rate on one's credit card). In contrast, gender of a person does not seem to be as important in explaining financial decision making, as coefficients are mostly insignificant. In one case women make worse decisions, they are more likely to buy life insurance (INSUR) and in another case they make better decisions, i.e. they diversify more (NoASS). Hence we do not claim – as one might conclude from simple

descriptive statistics (see Table 3.4) – that women show more informed financial behavior than men, but that they make equally good financial decisions.

3.4.3 Robustness checks

We shortly mention two robustness checks: First, for completeness, we explain financial behavior within our general approach but without using the IV-regressions. Results in Table 3.A3 show the coefficients of financial literacy and gender variables, whereas the other coefficients are hidden in order to save space. All of the financial literacy coefficients have the expected sign and three out of these six coefficients are statistically significant. Regarding the relationship between gender and informed financial behavior, women do not seem to make worse financial decisions than men, but ones in one case even better (ASS).

Second, we simply split the sample into women and men and then estimate the above introduced IV regression for both groups separately. The intention of this procedure is to consider that the gender variable also may have indirect effects via other characteristics like education or risk aversion on financial activities, which cannot be examined in the regressions in Table 3.6. Thus we allow for the slope coefficients of financial literacy and the control variables to be different in the groups of men and women, which may be seen as a generalization of Table 3.6. Results for the six observed kinds of financial decisions are shown in Table 3.A4. We find that the coefficients on the financial literacy variable are mostly statistically significant and if so, they have the theoretically expected sign except for the PAY_off estimates of men. We see that the impact of financial literacy is not stronger for women than for men, reinforcing the earlier suspicion that it is not just financial literacy driving women's reasonable financial behavior.

3.5 Explaining the missing gender gap

Summarizing our results so far, we find that women do not lag behind men regarding their degree of financial literacy and are as good at making financial decisions as men are. As this finding is at odds with the gender gap generally found for financial literacy, this raises the question: why is there no gender gap in our case? We here discuss and investigate this in more detail, analyzing our sample composition and country characteristics: regarding sample composition we look at further sample splits within our dataset (3.5.1) and select groups similar to ours from other datasets (3.5.2). Regarding country characteristics we consider general cross-country evidence (3.5.3), we consider information focusing on finance-specific

country evidence (3.5.4), and we compare our Bangkok-group with a rural sample from Thailand's poor North-Eastern region (3.5.5).

3.5.1 Sample composition: further splits of our sample

Our sample is different from most in the literature, because the sample is not representative for the adult population but selective on purpose. Thus, people in our sample are, relative to Thailand or even Bangkok, well educated and economically well off. Relative to the rest of the world, our sample is young. All of these characteristics may contribute to reducing the gender gap in financial literacy and behavior. Thus we turn our attention to these differences and address them one by one.

Regarding *education*, *income* and *age*, earlier studies do not really show large differences in a gender gap between groups that are different along these lines, such as uneducated versus well educated people, etc. (Bucher-Koenen et al., 2014). Nevertheless, we split our sample in the three mentioned dimensions to see whether this makes a difference. We find that none of these splits reveal a systematic and significant influence on the gender gap (available on request). This suggests that the examined characteristics of the Bangkok middle-class sample are not driving the result.

3.5.2 Sample composition: selecting groups from other countries' data sets

Next we take other samples from the U.S., the Netherlands and Germany and aim for a selection of people which is close to ours. Then we analyze whether such a selection contributes to reducing the measured gender gap. A first step into this direction is already implicitly provided by Bucher-Koehnen et al. (2014) who note that the gender gap regarding the degree of financial literacy in the German SAVE data set is roughly reduced by half when controlling for socio-demographic characteristics. This is certainly interesting because our sample is more homogeneous than theirs, which probably contributes to the fact that socio-demographic characteristics do not play a major role.

In order to examine these effects more systematically across three additional datasets, we aim for largely identical regressions explaining the degree of financial literacy. The control variables in these regressions include gender, age, education, income and risk aversion. We find useful variables for these items in all three data sets being considered. In detail, age is also added as a squared term, we use a dummy variable for education distinguishing advanced from basic education (the definition varies between databases), income is measured in logs and as we aim to study people with higher incomes the exact cut-

offs vary between countries. Finally, risk aversion is controlled for but measured differently, depending on the specific risk attitude question(s) available in the dataset. Results show that the gender gap remains basically unaffected by any effort to shape the underlying sample for the three countries where we have access to data sets:

United States. For the U.S. we take survey data from the American Life Panel (ALP), provided by the RAND Corporation. Our ALP sample with financial literacy data covers more than 3,200 persons and shows a clear and highly significant gender gap at the disadvantage of women (Table 3.A5). When we reduce the sample to make it more similar to our Thai data by reducing age and increasing minimum income, the gender gap remains unaffected. A maximum age of 60 years equals the Thai case but a reduction to even 50 years is necessary to get a similar average age as in the Thai case.

Netherlands. For the Netherlands we rely on the Longitudinal Internet Study for the Social Sciences (LISS), a household survey conducted by CentERdata at Tilburg University. We use a module from the LISS database with financial literacy data for more than 1,800 persons. Similar to the U.S. case, there is a significant gender gap which does not disappear by cutting down the sample in order to make it similar to our Thai sample (Table 3.A6).

Germany. Finally, we consider the German SAVE dataset, collected by the Munich Centre for the Economics of Aging (MEA). We look at 2007 because that wave contains more cases (2,900) than the more recent waves. Again, we find that the gender gap in financial literacy is quite robust to variation in sample composition (Table 3.A7).

Thailand. For better comparability we also show in Table 3.A8, specification (1), a regression in line with the three others just discussed. The gender coefficient in our Bangkok sample is insignificant.

Overall, we see that the socio-demographic regressions always show well-known relationships with financial literacy: older age, better education and higher income are associated with higher financial literacy, whereas the relationship with risk aversion is unclear. We conclude that the socio-demographic characteristics of our sample from Bangkok cannot explain the missing gender gap, not even partly.

3.5.3 Country characteristics: general cross-country evidence

As sample composition does not seem to be the driver of the missing gender gap in Thailand, we analyze characteristics of Thailand, i.e. cultural or institutional characteristics, which may help understand the gender issue (see Prince, 1993). In this Section 5.3 we look at cross-country evidence which may refer to the situation of women in general, whereas more

finance-specific evidence is examined in the following Section 3.5.4 (see Bertrand, 2011, on culture and gender stereotypes). In both sections we compare data for Thailand with the three above mentioned countries showing a clear gender gap, i.e. the U.S., the Netherlands and Germany.

We also consider Russia in these cross-country analyses because this is the only known full country, except Thailand, where women and men show financial literacy at an equal level (see Lusardi and Mitchell, 2014; this does not hold for Romania, see Beckmann 2013, p.8). We do not consider the Eastern part of Germany, however, because there is no data that focuses on just East Germany in the cross country statistics used below. Remarkably, in these two cases of gender equality, financial literacy is at a lower level, which nullifies the advantage of equality. Therefore, our case is different in the sense that the degree of financial literacy is not low when compared to, for example, the U.S.

Nevertheless, the commonality of a missing gender gap raises the question whether there is an aspect in which Russia, East Germany and Thailand may be similar to each other, and whether Thailand differs from most other countries. One may speculate that specific cultures or their societal norms, which emphasize equality between women and men, reduce the gender gap. We consult two of such types of information:

First, a less masculine society may be related to more equal roles of men and women in family and work-life, including a more equal responsibility for financial affairs. Taking the Hofstede (1980, 2001) index of the masculinity of a society, we see that Thailand does indeed score low with a value of 34 on a range between 0 and 100. The U.S. and Germany score higher with 62 and 66 respectively, and both countries show a clear gender gap in financial literacy. Russia scores similarly to Thailand at 36. Information on East Germany is missing. However, the Netherlands scores low with 14 and also have a clear gender gap.

Second, another relatively general source of information is provided by the World Economic Forum's Gender Gap Index. One may hypothesize that a large general gap coincides with a large gender gap in financial literacy. In fact, this is not the case as Thailand performs worse in general gender equality (ranked 65) in comparison to Germany (ranked 14), the Netherlands (ranked 13) and the U.S. (ranked 23). The only worse performer in our set of country is Russia (ranked 75).

Overall, the (missing) gender gap in financial literacy does not seem to be explained by broad indices of masculinity or a general gender gap. Thus we search for more finance-specific information.

3.5.4 Country characteristics: finance-specific cross-country evidence

Regarding finance-specific country characteristics we distinguish three kinds of information: (i) numeracy as an established basis for financial literacy because it seems difficult to understand financial concepts without solid mathematical foundations, (ii) financial responsibility in various fields (see, e.g., Fonseca et al., 2012) and (iii) financial implications of labor market participation (see Bucher-Koenen et al., 2014).

Numeracy. Regarding numeracy, the recent PISA cross-country study provides information on our countries of interest (OECD, 2013). As numeracy is a precondition for financial literacy, we hypothesize that countries with a smaller gender gap in numeracy will have a smaller gender gap in financial literacy (see Japelli, 2010, on economic literacy). Indeed, Table 3.7 shows in column (2) for our small group of countries that Thailand stands out as girls perform even better in the math test than boys. Moreover, Thailand is one of two countries out of about 30, where girls do better than boys in all dimensions during the surveys in 2003 and 2012. In a related study, Guiso et al. (2008, p.1165) conclude "In more gender-equal societies, girls perform as well as boys in mathematics and much better than them in reading" which is the case in Thailand. This indicates that girls' good math performance has a direct positive effect on financial literacy, and it also indicates towards a certain type of gender-equality in the Thai society (despite the less favorable information from the World Economic Forum's measure mentioned above).

Financial responsibility. Regarding the characteristic of financial responsibility, one can plausibly assume that it is relevant for the degree of financial literacy. Reasons for such a relation may be self-selection of people with interest and ability into taking financial responsibility but also that financial literacy may be improved through exposure to financial issues (see Fonseca et al., 2012). It is revealing in this respect that during our sample screening questions, no one was rejected on the grounds of not being responsible for their own finances, demonstrating the strong role of Thai women regarding financial issues.

Another piece of evidence in this direction is women's role in financial asset management companies (Beckmann and Menkhoff, 2008). Compared to the U.S., Germany and Italy, the share of female asset managers is much higher in Thailand (46% compared to between 10% and 21% in the three other countries). Even more remarkable, these women are equally represented in leading positions in asset management firms in Thailand, whereas they are underrepresented in the three other countries studied in the paper, in two countries to a statistically significant degree. This picture is completed by the facts that female asset managers in Thailand – and only in Thailand – have the same level of responsibility for assets

under management and work as many hours as their male counterparts. Overall, this provides evidence that Thai women have financial responsibility at home and in the professional domain.

Labor market participation. A final aspect of finance-related country characteristics stems from the labor market where gender equality has not been fully materialized yet (Goldin, 2014). Here we hypothesize that stronger participation of women leads to more responsibility for personal financial affairs, in line with the argument by Bucher-Koenen et al. (2014) that experience and learning seems to have an impact on financial literacy and its gender gap. Table 3.7 columns (3) to (5) show that female labor force participation stands at 64.3%, which is considerably higher than in the U.S., the Netherlands and Germany. Similarly, women in Thailand are more likely to be in full-time employment compared to their counterparts in other countries.

At the same time, Thailand scores high on the wage equality for similar work scale. Youngsamart et al. (2010, p.426) conclude from their interviews with managers that the "consensus view was that there were no real barriers to promotion based on gender" and "little difference in the salaries paid to women or men". All this indicates that women have a relatively equal position in the Thai labor market.

Finally, we note that Russia, which is the only known country except Thailand with a missing gender gap in financial literacy, does show indicator values in Table 3.7 which position this country – compared to the others – relatively closer to Thailand. All this suggests that women's role regarding finance-specific country characteristics, such as numeracy, financial responsibility and labor market participation helps to explain the gender gap in financial literacy.

3.5.5 Comparing urban and rural people

If indeed some country characteristics are an important influence on the gender gap, the gap should be similar within a country across various groups. We confirm this hypothesis by comparing our results on the Bangkok middle class to financial literacy in the rural population of Northeast Thailand. There the median monthly income is about 4,000 baht compared to a minimum of 15,000 baht and a median of about 20,000 baht in the urban sample.

Information about financial literacy in rural Thailand is based on a panel household survey whose general characteristics are described in Hardeweg et al. (2013), amongst others. The most recent wave in 2013 includes the three basic Lusardi and Mitchell-items on financial literacy in the modified form as suggested by Cole et al. (2011). For the rural areas

of the province Buri Ram, 745 households are covered and so form a representative sample for this area. The outcome of the financial literacy score is 1.56 for women and 1.61 for men, the difference being far from statistically significant. Scores are similar to those from our urban population as the "diversification" question is relatively simple and adjusted to the rural population which would not know much about stock investments. Regarding the two questions on "interest rates" and "inflation" the rural scores are below the urban ones, as expected for a less educated population. Finally, there is also no gender gap when we control for conventional socio-demographic characteristics as can be seen from the specifications (2) to (4) in Table 3.A8.

This equality between men and women in financial literacy seems remarkable as the rural participants do not share the experiences of the urban middle-class, which lives in a rapidly growing and changing environment where traditional gender roles are questioned. This again indicates that some country characteristics are important, whereas socio-demographic characteristics (such as age or education) are less relevant for understanding the gender gap in financial literacy.

3.6   Conclusions

The gender gap in financial literacy is a common finding in the literature (e.g., Lusardi and Mitchell, 2014). Many country studies have shown (with just two exceptions) that the degree of financial literacy among women is lower than among men, and this finding holds no matter whether being controlled for socio-demographic characteristics or not.

Compared to these studies, we present a new and surprising finding. In our sample of 530 middle-class people in Bangkok, we do not find a gender gap. Instead, women show the same high level of financial literacy as men, whatever specific measurement of financial literacy we choose. Moreover, this result is strengthened by the finding that women also show the same degree of informed financial behavior as men when we analyze their decision making. As our procedure is quite conventional for this literature and as the missing gender gap also seems to hold in rural Thailand, we regard the data as credible. Therefore, there must be other reasons for our unconventional finding. Learning about these reasons provides information about possible ways to reduce the gender gap in other countries.

Regarding sample composition our analyses show that this does not help to explain the missing gender gap. Also regarding general country characteristics neither the degree of masculinity (see Hofstede, 1980, 2001) nor the World Economic Forum Gender Gap Index point towards a particularly small gender gap for Thailand. The case is different when we

consider more finance-specific country characteristics, namely numeracy, financial responsibility and labor market participation. In all these regards Thai women have a strong role compared to women in the U.S., the Netherlands and Germany.

This finding for Thailand indicates general lessons about the roots of a gender gap in financial affairs, in particular that the gender gap is embedded in broader societal norms. One may hypothesize that a society where women relative to men command over an equal degree of numeracy, have the same degree of financial responsibility and participation in the labor market also will be a society with a smaller gender gap in financial literacy and financial behavior. It follows that financial literacy is to a large extent the consequence of gender role models in society.

Whereas such role models seem difficult to influence, our study also indicates more optimistic aspects: first, the Thai case suggests that high levels of competency of women in financial affairs can be reached without achieving gender equality in all respects. Second, studies show that financial literacy can be trained and learned to some extent (Lusardi and Mitchell, 2014), so that the gender gap in financial literacy can also be reduced by such concrete measures.

For further research with a direct policy focus one may think about comprehensive cross-country studies to investigate which country factors can explain the often observed gender gap in financial literacy. Also studies examining the effectiveness of financial trainings with an emphasis on gender may provide helpful insights.

Table 3.1: Descriptive Statistics, Socio-Demographic Variables, Broken Down by Gender

	acronym	women mean	women s.d.	men mean	men s.d.	t-test p-value
Age (in years)	AGE	34.36	(9.22)	34.78	(9.74)	0.31
Education[1]	EDU	3.44	(1.00)	3.50	(0.89)	0.25
Income (in Baht)	Y	25935	(1332)	27591	(1191)	0.18
Log of income	lnY	3.10	(0.49)	3.17	(0.49)	0.04
Married (yes=1, others=0)	MAR	0.46	(0.50)	0.47	(0.50)	0.44
Number of children in HH	CHILD	0.89	(1.07)	0.77	(1.00)	0.10
Number of adults in HH	ADULT	3.03	(1.68)	3.91	(1.50)	0.20
Numeracy[2]	NUM	3.55	(0.87)	3.57	(0.89)	0.42
Risk aversion	RISK	0.48	(0.23)	0.43	(0.22)	0.01
Low assets	ASS_l	0.54	(0.50)	0.47	(0.50)	0.07
Medium assets	ASS_m	0.20	(0.03)	0.23	(0.03)	0.15
High assets	ASS_h	0.09	(0.29)	0.09	(0.28)	0.45
N		255		275		

Notes: [1] Education in categories 0 meaning no education,1 primary school, 2 secondary school, 3 vocational training, 4 bachelor, 5 master, 6 PhD; [2] Numeracy is a score between 0 and 4 (definition of items is described in Appendix Table A1). 19% of the respondents did not answer the question about their amounts of assets.

Table 3.2: Descriptive Statistics of Biography Information, Broken Down by Gender

	acronym	women mean	women s.d.	Men mean	Men s.d.	t-test p-value
Family Background						
Father has vocational training or higher	EDU_f	0.23	(0.03)	0.33	(0.03)	0.01
Mother has vocational training or higher	EDU_m	0.18	(0.03)	0.25	(0.03)	0.04
Financial understanding of parents (1 -6)	FIN	4.31	(1.59)	4.46	(1.48)	0.14
Considers economic background to be poor	POOR	0.25	(0.43)	0.30	(0.46)	0.10
Parental Education						
Parents taught to budget (0-1)	BUDGET	0.81	(0.39)	0.84	(0.36)	0.19
Parents encouraged saving (0-1)	SAVE	0.84	(0.36)	0.88	(0.33)	0.14
Education at School						
Had economics at school	ECO	0.69	(0.47)	0.65	(0.48)	0.19
Was born in Bangkok	BBKK	0.60	(0.49)	0.67	(0.47)	0.06
Highest educational degree in BKK	EDU_BKK	0.88	(0.33)	0.86	(0.35)	0.29
Early Experiences with Money						
Had allowance as a child	ALLOW	1.00	(0.06)	0.99	(0.10)	0.18
Had a bank account before 18	ACC	0.57	(0.50)	0.58	(0.49)	0.37
Had a job before 15	JOB	0.44	(0.50)	0.50	(0.50)	0.09

Notes: Tables show data on early life experiences, broken down by gender.

Table 3.3: Descriptive Statistics of Financial Literacy Variables, Broken Down by Gender

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. **Borrowing choice:**
   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 loan b)The second loan
5. **Institutional knowledge:**
   Name foreign banks. Open answers

		women		men		t-test
	acronym	mean	s.d.	mean	s.d.	p-value
Question 1	FL1	0.78	(0.41)	0.80	(0.40)	0.33
Question 2	FL2	0.63	(0.48)	0.62	(0.49)	0.55
Question 3	FL3	0.25	(0.43)	0.23	(0.42)	0.28
Question 4	FL4	0.72	(0.45)	0.75	(0.44)	0.27
Question 5	FBname	2.19	(0.07)	2.27	(0.07)	0.21
Financial Literacy *Score out of 3*	FL3score	1.66	(0.05)	1.65	(0.05)	0.44
Financial Literacy *Score out of 4*	FL_sum	2.39	(0.07)	2.38	(0.07)	0.44
Financial Literacy *Combination score*	FLnew	2.23	(1.05)	2.20	(0.97)	0.35
Financial Literacy *Factor score*	FL	0.01	(1.02)	-0.01	(0.99)	0.41
Number of times said "I don't know"	FL_DK_sum	0.71	(0.05)	0.73	(0.05)	0.40

Note: We generate the "combination score" by awarding one point for each of the three Lusardi and Mitchell questions answered correctly and 0.25 points for each foreign bank named, hence naming four foreign banks (the maximum) is weighted the same as getting one question right.

Table 3.4: Descriptive Statistics of Financial Behavior, Broken Down by Gender

	acronym	women		men		t-test
		mean	s.d.	mean	s.d.	p-value
Fixed deposit	DEPO	0.44	(0.50)	0.38	(0.49)	0.09
Insurance	INSUR	0.17	(0.38)	0.15	(0.36)	0.23
Assets other than savings account	ASS	0.54	(0.50)	0.49	(0.50)	0.12
Does not know interest in credit card	INT_rate	0.65	(0.48)	0.51	(0.50)	0.03
Finds it difficult to pay off credit card	PAY_off	0.08	(0.27)	0.21	(0.41)	0.01
Number of different assets	NoASS	0.82	(0.98)	0.69	(0.86)	0.06

Notes: Number of different assets counts the number of asset types, apart from a savings account, that the respondent holds, including fixed deposit accounts, government savings bank deposits, bonds or bond funds, stocks or stock funds, and gold. It excludes life insurance. Assets other than savings account is a dummy that is one if the respondent holds an asset type other than a savings account (see previous list), excluding life insurance. All other indicators are dummies that are one if the respondent holds a certain asset, and zero otherwise.

Table 3.5: Selection of Covariates by Least Angle Regression

Step	Cp	R-square	action	Step	Cp	R-square	action
1	441.6103	0.0000		15	32.0953	0.5186	+ SAVE
2	243.5519	0.2371	+ lnY	16	24.0764	0.5305	+ POOR
3	167.5351	0.3296	+ ASS_h	17	23.7685	0.5332	+ CHILD
4	113.1416	0.3965	+ ASS_l	18	21.8348 *	0.5379	+ MAR
5	98.1509	0.4166	+ FL	19	22.1296	0.5399	+ EDU_f
6	81.5810	0.4386	+ EDU_h	20	22.6294	0.5417	+ EDU_BKK
7	76.4345	0.4471	+ AGE	21	24.3385	0.5420	+ JOB
8	71.7338	0.4550	+ BBKK	22	26.1342	0.5423	+ ALLOW
9	69.2867	0.4603	+ ECO	23	27.9304	0.5425	+ BUDGET
10	65.2648	0.4674	+ RISK	24	29.1753	0.5434	+ FEM*RISK
11	50.7685	0.4870	+ FEM	25	29.0459	0.5459	+ NUM
12	45.3234	0.4958	+ EDU_m	26	29.7668	0.5475	+ FIN
13	38.7300	0.5060	+ ASS_m	27	31.5191	0.5478	+ ACC
14	36.4903	0.5110	+ ADULT	28	28.0000	0.5543	+ AGEsq

Notes: The table shows Mallows Cp, R^2 and the independent variables selected to explain the dependent variable, the number of different assets held (NoASS). The independent variables selected to explain NoASS are referred to as "actions" of the least angle regression. In the following tables all variables from step 2 to 18 are incorporated as regressors. * indicates the smallest value for Cp. The acronyms are explained in Tables 1-4. The following additional variables were considered here: EDU_h (=1 if education is high, bachelor degree or higher), FEM (=1 if female), FEM*RISK (interaction variable between FEM and RISK) and AGEsq is AGE^2.

Table 3.6: IV Regressions Explaining Financial Behavior with Financial Literacy (FL) and Gender (FEM)

	ASS	DEPO	INSUR	INT_rate	PAY-off	NoASS
FL	0.840**	0.771*	-1.242***	-0.177	-1.373***	0.758*
	(0.386)	(0.444)	(0.064)	-1.449	(0.331)	(0.435)
FEM	0.273	0.234	0.187*	0.298	-0.462	0.284***
	(0.195)	(0.190)	(0.112)	(0.273)	(0.351)	(0.010)
Observations	412	414	414	128	126	412
Sargan/Hansen test	0.308	1.385	2.440	4.689	2.990	0.418
	(0.998)	(0.926)	(0.786)	(0.455)	(0.702)	(0.995)

Notes: The table reports coefficients and robust standard errors in parentheses. We use an IV Poisson regression model for NoASS, while all others estimates are from IV probit models. ***,** and * denote significance at the 1%, 5% and 10% levels, respectively. Control variables – explained in Tables 1-5 - are lnY (log of income), ASS_h (high assets), ASS_m (medium assets), ASS_l (low assets), EDU_h (high education), RISK (risk aversion), BBKK (born in Bangkok), FEM (female), AGE, MARRIED, ECO (economics at school), EDU_m (mother has vocational training or higher), ADULT (number of adults in the household), SAVE (parents encouraged saving), POOR (economic background is poor), CHILD (number of children in the household). FL (financial literacy) is instrumented. Identifying instruments are ALLOW (allowance as a child), JOB (job before 15), BUDGET (parents taught to budget), FIN (financial understanding of parents), NUM (numeracy), and ACC (had a bank account before 18). The Sargan test proves the validity of instruments (H_0) applied in column ASS to PAY-off. The Hansen statistic is the GMM equivalent of the Sargan test used in column NoASS. Line Sargan/Hansen displays the test statistics. In parentheses the prob.value is presented. If H_0 is rejected this can be interpreted as indicating that at least one of the instruments is not valid. None of the six tests rejects H_0.

Table 3.7: Cross Country Evidence on Math Scores and Labor Market Indicators

	PISA Girls Math Score[1]	PISA Boys Minus Girls Math Score[1]	Female Labor Force Participation (% females aged +15)[2]	Part Time Employment (% of all part time employed people)[4]	Wage Equality of Similar Work (rank)[3]
Thailand	433	-14*	64.3	48.6	4
Russia	483	-2	57.1	64.5	52
U.S.	479	+5	56.3	66.4	47
Netherlands	518	+10*	58.5	71.7	56
Germany	507	+14*	53.6	78.7	80
Average	489	+11*	51	68.4	71

Sources: [1] OECD (2013), Tables I.2.3a and 3c, average is OECD average; [2] ILO data, taken from World Bank Gender Database; [3] Executive Opinion Survey by World Economic Forum; [4] World Bank Gender Database (regarding Thailand the last available data point is from the year 2000).

Appendix 3:

Table 3.A1: Numeracy and Risk Questions

Numeracy Questions:
1. What is 35+82?
2. If you have four friends and would like to give each of your friends four sweets, how many sweets do you need?
3. What is 10% of 400?
4. Suppose you want to buy a bag of rice that costs 370 Baht. You only have one 1000 Baht note. How much change will you get?

Risk Question:
Are you a person who is prepared to take risk, or do you avoid taking risk?
Please choose a number on a scale from 0 (meaning unwilling to take risk) to 10 (meaning fully prepared to take risk)

	female		male		t-test
	mean	sd	mean	sd	p-value
Risk aversion	0.478	(0.23)	0.434	(0.22)	0.013
Numeracy	3.553	(0.87)	3.567	(0.89)	0.426

Table 3.A2: First-stage Estimation of NoASS Equation in Table 6 Explaining Financial Literacy

	Coef.	Std.Err.	z	P>|z|
lnY	0.191	0.156	1.22	0.221
ASS_h	0.507	0.213	2.38	0.017
ASS_m	0.370	0.158	2.34	0.020
ASS_l	0.257	0.129	1.99	0.047
EDU_h	0.045	0.110	0.41	0.685
RISK	-1.131	0.217	-5.20	0.000
BBKK	0.025	0.094	0.26	0.792
FEM	0.111	0.082	1.34	0.181
AGE	-0.001	0.006	-0.13	0.898
MAR	-0.149	0.103	-1.44	0.150
ECO	0.117	0.122	0.96	0.338
EDU_m	0.056	0.036	1.52	0.128
ADULT	-0.059	0.028	-2.06	0.039
SAVE	0.280	0.135	2.07	0.038
POOR	0.046	0.093	0.50	0.619
CHILD	0.029	0.045	0.65	0.519
ALLOW	0.042	0.787	0.05	0.958
JOB	-0.005	0.094	-0.05	0.957
BUDGET	0.110	0.144	0.76	0.446
FIN	0.012	0.032	0.36	0.719
NUM	0.127	0.055	2.31	0.021
ACC	-0.096	0.093	-1.02	0.306
_cons	-1.194	0.970	-1.23	0.218

Notes: The table reports coefficients, robust standard errors, z statistics and prob.values. The acronyms are explained in Tables 1-4.

Table 3.A3: Explaining Financial Behavior with Financial Literacy (FL) and Gender (FEM)

	ASS	DEPO	INSUR	INT_rate	PAY_off	NoASS
Expected sign of FL coefficient	+	+	-	-	-	+
F L	0.227***	0.153	-0.273**	-0.366	-0.256	0.222**
	(0.085)	(0.104)	(0.127)	(0.237)	(0.240)	(0.098)
Female	0.396***	0.424	0.171	0.815	-0.485	0.325
	(0.151)	(0.357)	(0.349)	(0.784)	(0.776)	(0.254)
Pseudo-R²	0.335	0.225	0.368	0.162	0.221	0.242
Observations	433	435	435	135	133	433

Notes: The table reports coefficients and robust standard errors in parentheses. We use a Poisson count regression model for NoASS, while all others estimates are from probit models. ***,** and * denote significance at the 1%, 5% and 10% levels, respectively. Control variables – explained in Tables 1-5 - are lnY (log of income), ASS_h (high assets), ASS_m (medium assets), ASS_l (low assets), EDU_h (high education), RISK (risk aversion), BBKK (born in Bangkok), FEM (female), AGE, MARRIED, ECO (economics at school), EDU_m (mother has vocational training or higher), ADULT (number of adults in the household), SAVE (parents encouraged saving), POOR (economic background is poor), CHILD (number of children in the household), FL (financial literacy).

Table 3.A4: IV Regressions Explaining Financial Behavior with Financial Literacy (FL) for Women

	ASS	DEPO	INSUR	INT_rate	PAY_off	NoASS
FL	1.024***	1.049***	-1.304***	0.372	-0.528	0.634
	(0.339)	(0.198)	(0.098)	(1.232)	(2.963)	(0.521)
Observations	194	195	195	61	52	194

Table A4: Continuation - for Men

	ASS	DEPO	INSUR	INT_rate	PAY_off	NoASS
FL	1.075*	1.197***	-1.223***	-1.864***	1.735***	0.360
	(0.665)	(0.218)	(0.088)	(0.189)	(0.237)	(0.347)
Observations	218	219	219	67	73	218

Notes: The table reports coefficients and robust standard errors in parentheses. We use a GMM Poisson estimation for NoASS, while all others estimates are from IV probit models. ***, ** and * denote significance at the 1%, 5% and 10% levels, respectively. Control variables - explained in Tables 1-5 – are lnY (log of income), ASS_h (high assets), ASS_m (medium assets), ASS_l (low assets), EDU_h (high education), RISK (risk aversion), BBKK (born in Bangkok), AGE, MARRIED, ECO (economics at school), EDU_m (mother has vocational training or higher), ADULT (number of adults in the household), SAVE (parents encouraged saving), POOR (economic background is poor), CHILD (number of children in the household. FL (financial literacy) is instrumented. The identifying instruments are ALLOW (allowance as a child), JOB (job before 15), BUDGET (parents taught to budget), FIN (financial understanding of parents), NUM (numeracy), and ACC (had a bank account before 18).

Table 3.A5: Financial Literacy and Gender in the U.S.

	(1) Financial Literacy All	(2) Financial Literacy Age <= 60 Inc. >= 55,000	(3) Financial Literacy Age <= 60 Inc. >= 71,250	(4) Financial Literacy Age <= 50 Inc. >= 55,000	(5) Financial Literacy Age <= 50 Inc. >= 71,250
Female	-0.223***	-0.286***	-0.279***	-0.338***	-0.330***
	(-7.979)	(-7.323)	(-6.355)	(-6.388)	(-5.001)
Age	0.019**	0.051***	0.059**	0.042	0.068
	(2.344)	(2.801)	(2.558)	(1.156)	(1.427)
Age squared	-0.000	-0.000**	-0.001**	-0.000	-0.001
	(-0.608)	(-2.171)	(-2.095)	(-0.682)	(-1.076)
College education Dummy	0.369***	0.343***	0.371***	0.414***	0.469***
	(12.125)	(7.984)	(7.198)	(6.982)	(5.989)
Log of income	0.231***	0.231***	0.150***	0.267***	0.226***
	(13.649)	(5.885)	(3.358)	(4.756)	(3.263)
Risk aversion	0.079**	0.089*	0.066	-0.021	-0.083
	(2.293)	(1.683)	(1.049)	(-0.295)	(-0.902)
Constant	-1.271***	-1.852***	-1.061	-2.138**	-2.136*
	(-5.654)	(-3.459)	(-1.526)	(-2.507)	(-1.892)
R^2	0.24	0.16	0.16	0.17	0.18
Observations	3212	1292	848	778	477

Table 3.A6: Financial Literacy and Gender in the Netherlands

	(1) Financial Literacy All	(2) Financial Literacy Age <= 60 Inc. >= 2400	(3) Financial Literacy Age <= 60 Inc. >= 2800	(4) Financial Literacy Age <= 50 Inc. >= 2400	(5) Financial Literacy Age <= 50 Inc. >= 2800
Female	-0.379***	-0.603***	-0.498***	-0.505***	-0.449***
	(-8.024)	(-4.750)	(-3.498)	(-3.360)	(-2.705)
Age	0.013*	-0.067	-0.099	-0.150	-0.155
	(1.700)	(-1.181)	(-1.506)	(-1.241)	(-1.090)
Age squared	-0.096	0.614	0.936	1.747	1.682
	(-1.290)	(0.958)	(1.274)	(1.141)	(0.932)
Education more than high school	0.408***	0.328**	0.173	0.323	0.331
	(8.329)	(2.249)	(1.025)	(1.614)	(1.382)
Log of income	0.029***	0.221	0.050	0.356	0.193
	(2.617)	(0.998)	(0.235)	(1.099)	(0.565)
Risk aversion	0.244***	0.106	0.132	0.164	0.194
	(6.267)	(0.994)	(1.020)	(1.156)	(1.132)
Constant	0.598***	1.261	3.738*	1.672	3.437
	(3.721)	(0.615)	(1.692)	(0.547)	(0.975)
R^2	0.13	0.12	0.09	0.09	0.10
Observations	1840	294	212	189	138

Notes: All respondents are responsible for the household's financial decisions.
In columns (2) and (4) respondents need to have monthly income of 2,400 euro or more as a condition for inclusion in the sample, while in columns (3) and (5) the lower income limit is 2,800 euro. The table reports OLS estimated coefficients and t-statistics in parentheses. Age squared is divided by 1,000 here. ***, ** and * denote significance at the 1%, 5% and 10% levels, respectively.

Table 3.A7: Financial Literacy and Gender in Germany

	(1) FL3sum All	(2) FL3sum Age<=60 Inc.>=2000	(3) FL3sum Age<=60 Inc.>=3500	(4) FL3sum Age<=50 Inc.>=2000	(5) FL3sum Age >=50 Inc.>=3500
Female	-0.132***	-0.121***	-0.180***	-0.107**	-0.154*
	(0.027)	(0.040)	(0.063)	(0.048)	(0.079)
Age	0.001	-0.003	-0.020	0.037	0.049
	(0.005)	(0.017)	(0.029)	(0.032)	(0.054)
Age squared	-0.000	-0.000	0.000	-0.001	-0.001
	(0.000)	(0.000)	(0.000)	(0.000)	(0.001)
Log of income	0.189***	0.169***	-0.027	0.129*	-0.089
	(0.022)	(0.059)	(0.104)	(0.072)	(0.124)
Higher education	0.217***	0.193***	0.074	0.253***	0.110
	(0.030)	(0.041)	(0.061)	(0.049)	(0.076)
Financial risk tolerance	0.010*	0.019**	0.020*	0.024***	0.024*
	(0.005)	(0.008)	(0.011)	(0.009)	(0.014)
Constant	1.106***	1.308**	3.593***	0.892	2.861*
	(0.182)	(0.561)	(1.075)	(0.822)	(1.527)
R²	0.09	0.06	0.08	0.08	0.12
Observations	2921	1090	317	775	207

Notes: Column (1) shows results for the full sample. In Column (2) and (4) respondents need to have monthly income of 2,000 euro or more as a condition for inclusion in the sample, while in Column (3) and (5) the lower income limit is 3,500 euro. The table reports OLS estimated coefficients and robust standard errors in parentheses. Definition of FL3sum see Table 3. ***, ** and * denote significance at the 1%, 5% and 10% levels, respectively.

Table 3.A8: Financial Literacy and Gender in Urban and Rural Thailand

	(1) Financial Literacy Bangkok All	(2) Financial Literacy Buri Ram All	(3) Financial Literacy Buri Ram Age<=60	(4) Financial Literacy Buri Ram Age<=50
Female	0.118	-0.049	-0.038	0.100
	(0.077)	(0.073)	(0.094)	(0.128)
Age	-0.0251	0.022	-0.003	0.073
	(0.0311)	(0.019)	(0.040)	(0.072)
Age squared	0.000	-0.000	-0.000	-0.001
	(0.000)	(0.000)	(0.000)	(0.001)
Log of income	0.537***			
	(0.097)			
Household assets		0.000	-0.000	-0.000
		(0.000)	(0.000)	(0.000)
Higher education	0.222**			
	(0.0856)			
Years of education		0.035**	0.027*	0.032
		(0.014)	(0.016)	(0.019)
Risk aversion	-1.481***	-0.293**	-0.321**	-0.333
	(0.175)	(0.123)	(0.156)	(0.208)
Constant	- 0.496	1.195**	1.891**	0.489
	(0.696)	(0.564)	(0.920)	(1.374)
R²	0.23	0.05	0.02	0.04
Observations	530	697	448	269

Notes: The table reports OLS estimated coefficients and robust standard errors in parentheses. ***, ** and * denote significance at the 1%, 5% and 10% levels, respectively. Column (1) reports results based on the Bangkok sample, variable definition see Table 5. Columns (2)-(4) report results based on the rural sample. We substitute income by household assets as the income measure sometimes has negative values. Regarding education, there would be hardly any "higher education" (i.e. minimum of a bachelor degree) in the rural area, thus we use years of education (the median here is about five years).

Chapter 4:

Financial Literacy, Cognitive Ability and Self Control in Rural Northeast Thailand

4.1   Introduction

Most people have to make complex financial decisions. This statement is becoming increasingly true even for those living in rural areas in developing countries. Access to finance has been increasing over the last few years (Beck et al., 2009), but with this increased access comes an increasing need for good financial understanding and good financial decisions making. Hence increasing access to finance in developing countries brings with it an increasing need for financial literacy. This paper therefore aims to study financial literacy in a province in rural Northeast Thailand and looks at the relationship between good financial literacy and good financial decision making.

Studying financial literacy in combination with access to financial institutions is very important and has high political relevance. A lack of access to credit and savings institutions has often been named as a reason for persistent poverty in many developing countries. Hence there has been a surge of microfinance institutions designed to serve the poor and so to reduce poverty. The question that leads on from here is, are the poor, especially the rural poor, equipped to deal with the new access to finance. Is financial literacy a crucial component of poverty alleviation through access to finance?

As financial literacy measures knowledge of financial institutions, but also requires a certain level of cognitive ability, it is useful to examine financial literacy together with cognitive ability. In this paper we therefore also measure and control for the effect of cognitive ability, which here is a combination of numeracy and word fluency.

Alongside this increased access to financial services comes the possibility to misuse these financial services. This can be the case if credit is used to finance excessive spending. Excessive spending, in turn, may not just be caused by poor financial understanding but also by a lack of self-control. In this paper we therefore study the effect of self-control in combination with financial literacy, cognitive ability and their effect on financial decision making.

The data in this study is part of a long running household survey that has been conducted in the rural parts of three provinces in Thailand and three provinces in Vietnam. For this study we only look at data that was collected in Ubon Ratchathani, the largest and poorest province in Thailand that is part of the study. In this province information on financial literacy, cognitive ability and self-control was collected in addition to other household

information that was gathered in all six provinces. The sample consists of 788 individuals and is representative of rural households in Ubon.

The survey that collects this data is very extensive; we therefore have very detailed information on household financial decision, occupational background, household composition and educational backgrounds amongst others. This allows us to control for a large number of factors that could influence financial decisions making.

The link between financial literacy and good financial decision making is well established in the literature. A number of different studies based on representative data from developed countries have found a link between financial literacy and retirement savings (Lusadi and Mitchell, 2007), stock ownership (van Rooij et al., 2011), household wealth (van Rooij, 2011b, Behrman et al, 2010), debt (Lusardi and Tufano, 2009, Disney and Gathergood, 2013), returns to savings (Deuflhard et al., 2014) and asset diversification (Guiso and Japelli, 2008). All these studies focus on a specific financial behavior and therefore do not have information on complete household financial portfolios. Furthermore, these studies are all based on developed countries that have long established financial systems. Individuals in these countries face very different challenges to individuals in developing countries, especially those that live in rural areas.

The very large majority of studies that are based in developing countries examine financial literacy by looking at interventions and financial literacy trainings. The large majority of these studies further focused on a specific behavior, such as bank account ownership (Cole et al., 2011), savings (Bruhn, et al, 2014, Doi et al., 2014, Sayinzoga et al., 2014), financial literacy levels (Carpena et al., 2011), borrowing (Sayinzoga et al., 2014), budgeting (Doi et al., 2014) and financial business management (Drexler et al., 2014). To the best of our knowledge there are no studies that look at the effects of financial literacy for the rural population in a developing country based on survey data that include a large number of household financial decisions. In this study we are hoping to fill this gap in the literature by looking at the performance of rural households on financial literacy tests and link financial literacy to a broad number of financial decisions.

The link between cognitive ability and financial decisions making, especially mistakes in financial decision making has also been studied previously in the literature. Christalis et al. (2010) show that there is a link between cognitive ability and portfolio diversification. Agarwal et al. (2013) establish a link between cognitive ability and two different financial household decisions. Grohmann et al.(2014) and Cole et al. (2011) look at financial literacy as

well as cognitive ability and their interactions, however including both into regression analysis is still relatively rare.

Even fewer papers look at the interaction between financial literacy and self-control; and their effect on financial decision making. Gathergood (2012) and Dick and Jaroszek (2013) stands out here. Gathergood (2012) looks at a sample based in the UK, he shows that self-control dominates financial literacy in regressions that explain whether an individual holds consumption credit. Jarozsek and Dick (2013) study financial literacy in combination with three cognitive reflection questions.

This study hence aims to fill an important gap in the literature; it examines financial literacy, cognitive ability and self-control in a representative survey of a poor area in a developing country. At the same time we are able to look at broad variety of financial decisions as we have information on a vast number of financial decisions made by each household. As this study is part of an extensive household survey we are able to control for a large number of household and individual characteristics.

We find that financial literacy in rural Thailand is lower than in most developed countries and lower than in Bangkok but higher than in rural India or Indonesia. Financial Literacy is mostly related to variables that have been established in the literature. Cognitive ability and self-control on the other hand, are explained by other factors. Higher education levels are linked to higher cognitive ability and better self-control, as well as to higher financial literacy.

When it comes to explaining financial outcomes and financial behavior, established socio demographic variables have higher explanatory power than financial literacy, cognitive ability or self-control. Higher living standards, for which we use consumption levels as a proxy, age, marital status as well as being part of a certain occupational group have higher explanatory power. This applies to both the debt as well as the savings side of household decision making.

This indicates to us that financial decision making is not driven by behavioral factors, but instead that access still is an important determinant of financial decision making in rural Thailand. At the same time, this may indicate that access to finance is not based on geography, but rather that some populations groups are still not served by financial institutions. However, further research is needed to make more definite statements about access to finance and its relationship with financial literacy.

The paper proceeds as follows: Section 4.2 introduces the data collection procedure and sample. Section 4.3 looks at financial literacy, cognitive ability and self-control and what

drives these. Section 4.4 looks at their link to financial decision making and Section 4.5 concludes and discusses further research.

4.2   Data

4.2.1 Sampling

The data in this paper was collected in two different surveys in 2013 in Ubon Ratachani, a province in Northeast Thailand, on the border to Cambodia and Laos. The first survey is part of a long running panel data series that started in 2007 and following this collected data in 2008, 2010 and 2013. This panel survey consists of a questionnaire that has been fielded in a similar form in all waves. This questionnaire is very extensive; it contains a large amount of information on the household and its individual members. We have information on individual members concerning their health and education. There is a section on business activities such as farming and other self-employment activities. In additional information on wealth, consumption and household income is collected. Additionally, there is a large section on financial decisions made by the household, such as savings, lending and borrowing.

The second survey followed the first survey and is considerably shorter. It contains different types of information mostly focusing on behavioral questions. This survey asks questions designed to test financial literacy, cognitive ability, risk attitude as well as believe on one's own self-control.

This first part of this study was conducted in three provinces in Thailand and three provinces in Vietnam, whereas the second part of this study was fielded in Ubon Ratachani only. In each of the provinces sampling was conducted in the following way: As this project is designed to study the rural poor, the urban areas were excluded from the sampling procedure. In the remainder of the province, out of each district, two sub-districts were chosen with probability corresponding to their population weights. Out of each of these two sub-districts, two villages were chosen with probability corresponding to their population. In each of these two villages ten households were selected at random. This method leads to a sample that is representative for rural households in Northeast Thailand.

Both surveys were written by the research team and translated from English into Thai and reverse translated. Prior to the surveys each of the questionnaires was tested in villages in the same province that are similar to those villages that the main survey would be conducted in.

4.2.2 Descriptive statistics

The survey aims to interview the household head, if the household head is not available, the next best representative is chosen. This person is often the wife of the household head. This can be seen when looking at the descriptive statistics displayed in <u>Table 4.1</u>. 58% of our respondents are women and the average age is 54 years. Considering this, it is unsurprising that 81% of our respondents are married. Northeastern Thailand is still relatively poor, which explains the low level of education, which is just less than 6 years on average. This can also be seen in the average per capita household consumption, which provides a more telling measure of living standards than income in this sample; It is low at 2381 2005 US$ PPP per capita and 8640 2005 US$ PPP per household annually. Compared to urban areas, household sizes is large with over 5 members on average and a dependency ration of 1.61 dependents for every working person. As the study was conducted in rural areas only, at 68% a very large proportion of our respondents name farming as their main employment activity. The rest are made up of other forms of self-employment, government employees, students and unemployed individuals.

4.3   Financial literacy, cognitive ability and self-control
4.3.1 Descriptive statistics on financial literacy, cognitive ability and self-control

In addition to standard socio demographic information, a number of financial literacy questions were included into the second survey. These questions include two standard financial literacy questions as have been asked in a large number of studies. We here used a modification as previously fielded by Cole et al. (2011) as this form is more suitable in a developing country context. The first question tests knowledge of interest rates, the second tests knowledge of inflation. The third standard financial literacy question is not suitable for rural areas with little access to sophisticated financial products. This question was therefore substituted with a question that tests whether respondents are able to calculate the expected outcome from a lottery. The lottery is a big part of Thai culture.

In addition we included three further questions. The fourth question has been used in previous studies and was introduced into the literature by Cole et al. (2011) and asks respondents to choose between two loans for which the cost is displayed in different forms. The fifth and sixth questions were introduced by the author of this paper and are designed to test financial knowledge without testing mathematical ability at the same time. These financial literacy questions have often been criticized for being too based on mathematical

ability (see Carpena et al. 2011). Instead, these two question test knowledge on financial institutions. Question 5 is a true or false question whether a money lender or the Village Fund (a very large microfinance institution that operates throughout Thailand) offers the lower interest rate. Question 6 asks if it is safer to keep money at home or at the bank. Full questions are shown in Table 4.2.

Table 4.2 further shows results. Knowledge on interest rates and inflation is relatively weak. Only 55% of respondents get question 1 right and 60% answer question 2 correctly. Questions 3 and 4 seem to be of similar difficulty as 59% and 52% of respondents answer these correctly, respectively. Conversely to knowledge of more complex financial issues, simple institutional knowledge seems to be a lot better as 94% and 92% answer question 5 and 6 correctly.

To measure financial literacy as a concept, scores can be formed. The average score out of the first three questions is 1.73 and 2.26 out of four questions, meaning that the average score on these question is just over half. The high number of correct answers on questions 5 and 6 mean that the average score is higher at 4.11 out of six.

As a number of these questions have been used in previous literature, it is possible to compare financial literacy across different population groups. The first two questions and the fourth question have been used by Grohmann et al. (2014) in a survey on middle class people living in Bangkok. Respondents that live in Bangkok and can be considered members of the middle class perform substantially better on financial literacy. The difference in performance on question 1 is 20 percentage points, as in the urban middle class over 80% know the answer to question 1. The difference is less severe on question 2 as 63% amongst the urban middle class can answer this question correctly. Similarly, 73% of the respondents in Bangkok get question 4 correct, again showing that the rural population studied in the paper has considerably worse financial literacy than their urban, wealthier counterparts.

For easy interpretation in regressions we build two financial literacy factor scores. A similar method has previously been used by von Gaudecker (2014) and Behrman et al. (2011) amongst others. The first factor contains a dummy that is one if the answer is correct for each of the six questions, as well as a dummy that is 1 if the respondents answered "I don't know" to the question. The second factor is the same as the first, however it includes the answers and "I don't know" for the first four questions only, as these have the highest explanatory power due the greater variation in responses. In the analysis below, we use the second factor as this shows more variation.

As financial literacy measures both mathematical ability as well as knowledge of financial institutions and concepts it is useful to be able to distinguish between numeracy and financial literacy. For this purpose, questions that measure numeracy were also included into the second questionnaire. Six numeracy questions were asked, all of which require the respondents to perform calculations. Two of the questions are multiple choices whereas the first four are open answer. Exact questions are shown in Table 4.3. All of these questions have been previously used in the literature. Questions 1-4 correspond to the hardest four out of eight questions used in Cole et al. (2011). The last two have been previously used by Christalis et al. (2010) and are part of the European SHARE survey.

The average score on these questions is 3.6 out of 6. As can be seen in Table 4.3 there is great variation in the percentage that was able to answer each question. Only 14% can name the original price if the current price at 12000 Baht is two thirds of the original price. On the other hand 95% can calculate half of 3000 Baht. The total numeracy score displays a near normal distribution.

As mentioned above, four out of the questions were introduced by Cole et al. (2011) and were also used by Grohmann et al. (2014). Respondents have higher numeracy then rural populations in India and Indonesia on average, but lower numeracy than respondents in Bangkok. Due to a slightly different method of asking numeracy questions in the SHARE survey, a direct comparison with our data on the last two questions is not possible.

In addition to the numeracy questions above, respondents were also asked to name as many animals as they can in 60 seconds. This question is designed to measure word fluency, which is argued to be a more innate form of cognitive ability and not as strongly influences by education. Dohmen et al. (2010) have previously used this question in order to measure word fluency. The average number of animals named here is 17.38, with standard deviation that is relatively large at 6.2. In later analysis, instead of including the score for numeracy and word fluency separately we form a cognitive ability factor. Dohmen et al. (2010) follow the same strategy in their analysis.

As it is part of the aim of this paper to study the effect of self-control in combination with financial literacy, two questions that are designed to measure self-control were included. These questions measure self-control by asking two questions which are answered using a 1 to 6 Likert scale. The first question asks respondents whether they are an impulsive shopper. The mean answer is 3.55, with most respondents slightly leaning towards agreeing that they are impulsive shoppers. The second question is a statement where respondents have to state whether they are likely to spend money now and not worry about the future. Here the average

choice is 2.51, which indicates that respondents tend to disagree rather than agree. Questions and results are shown in Table 4.4. These two questions have been used previously by Gathergood (2012), who studies the link between self-control, financial literacy and debt. Here 9.2% tend to agree strongly or tend to agree strongly with the impulsiveness question, which is considerably less than in our sample were 15% name a 5 and 23% name a 6 with 6 meaning strongly agree with the statement. Answers to these two questions are included into all regressions.

4.3.2   Who has high financial literacy, cognitive ability and self-control?

Table 4.5 show results of regressions of the behavioral variables described above against standard socio demographic variables. The first three columns regress standard socio demographic variables on the three financial literacy scores. The results show some interesting patterns that have also been found in previous studies (see Lusardi and Mitchell, 2014 for an overview). Higher consumption, which is the best measure of living standards available to us in this dataset, is clearly linked to higher financial literacy. Hence individuals with higher consumption also have higher financial literacy. It is important to remember here, that as our sample is relatively poor, consumption is simply a measure of living standards and therefore is synonymous with results found in previous literature namely that financial literacy is linked to higher income and wealth. This holds for all three measurements of financial literacy.

Another common finding in the financial literacy literature that holds for two out of three scores is that higher levels of education are linked to higher levels of financial literacy. The third established finding in the literature is that there is a humped shaped relationship with age, where financial literacy increases with age but decreases again in old age as cognitive function declines. This can also be seen for this sample.

A common finding that is not found here is that women tend to have lower financial literacy than men. In our results, although the sign on the coefficient is negative, women do not seem to have significantly lower financial literacy than men. This finding is very unusual in the literature and has only been found for Russia (Klapper et al., 2013), eastern Germany (Bucher-Konnen and Lamla, 2014) and Thailand (Grohmann et al. , 2014).

The next two columns look at the relationship between cognitive ability and socio-demographics. Unsurprisingly, education has a positive impact on cognitive ability. More years of schooling increase both the number of animals named and the number of numeracy questions answered correctly. Interestingly, especially in the light of women not having lower

financial literacy than men, women seem to display lower numeracy. On naming animals, however, they perform as well as men. It is also interesting, that married individuals score better on both numeracy scores and word fluency.

Lastly, the two self-control measures are explained by hardly any of the explanatory variables. Only more years of schooling has a negative effect on being impulsive and wanting to spend money now. This makes sense, as a certain degree of self-control is needed in order to achieve higher degrees of education. At the same time it is possible that a certain amount of discipline which is present in schools, teaches self-control more generally. Apart from this, the lack of a link between self-control and socio-demographic variables indicates that self-control is a personal characteristic that is not linked to any particular group in society.

From these tables, one can see that the three behavioral variables have different roots and are liked to different socio-demographic variables. Neither numeracy nor self-control are linked to consumption levels, however financial literacy is. This may indicate an element of learning about finance as a result of higher spending and incomes.

4.4   Financial behavior

4.4.1   Descriptive statistics on debt and savings

As it is the aim of this paper to study household financial decision making, we look at credit at the household level instead of at the credit level. Summary statistics are displayed in Table 4.6. Borrowing is an important part of household decision making, especially since most of our households are rural farmers, which requires large investments on an annual or semi-annual basis. Out of 788 respondents, 560 report at least one loan. On average each household has just over 1 loan. The average total loan amount is 8,510 PPP 2005 US$, given that a household has a loan. The standard deviation of loan amount is very high at 18,284 PPP US$. It is worth noting that this is close to the average annual household consumption, the average loan to consumption ratio is 0.90. 24% of households have higher loans than their annual consumption.

The average interest rate that a household has to pay across all its loans is notably high at just over 15%. This variable also displays considerable variation. Most households hold a number of different loans from a number of different institutions; hence it makes sense to look at the spread of interest rates paid by respondents. The average highest interest rate that a household pays is slightly higher than the average across all loans at 18%. The average minimum interest rate that a household pays is given at 12%; this is despite the Village Fund

charging and interest rate of 8% for its loans, showing that the lowest interest loan for many respondents is not the Village Fund. The average loan duration is 2.8 years; however when looking at the data it becomes clear that a large proportion of loans (43%) are given for one year only.

From these statistics we can see that there is considerable variety in loan choices amongst households. The question that leads on from here is, whether these variations are, at least in part, caused by financial literacy, numeracy or self-control.

We also briefly look at savings, shown in Table 4.7. Despite rural Thailand still being relatively poor 85% of respondents report having some saving. 75% of those that have savings were able to save at least some money during the year prior to the survey. When looking at savings amounts however it becomes clear that respondents are only able to save very small amounts. The average amount saved is just above 2000 2005 US$ PPP. The largest amount saved is just over 32000 2005 US$ PPP. None the less, these results indicate that many households hold savings and debt as the same time. More information on the type of loan is needed. However holding debt and savings at the same time could indicate a mistake in financial decision making, especially when considering that many loans charge a high interest rate.

In rural Thailand most respondents only hold very simple savings products, such as bank accounts or are members of savings clubs. The more sophisticated financial decisions are therefore taken when people that live in these areas take out debt. The largest part of the analysis undertaken in this paper therefore focuses on borrowing decisions.

4.4.2 Behavior towards debt

Table 4.8 shows regression results of the borrowing behaviors described above regressed against financial literacy, numeracy and self-control. In this table we look at all loans across households. It is the aim of this paper to study the effect of financial literacy, cognitive ability and self-control on financial decision making. These variables are specific to an individual person. Hence, it makes sense to only study those that are responsible for financial decisions taken in the household. Therefore all regressions displayed from here on exclude respondents that are not the household head or his or her spouse. We exclude respondents that are siblings, parents or children of the household head.

Column 1 looks at the number of loans that a household has. Households that do not report any loans are denoted as having zero loans. Columns 2 and 3 report the loan amount, i.e the sum of all loans that a household holds. In column 2 households that do not report any

loans are included with a total amount of 0, whereas in column 3 households that do not report loans are excluded from the regression. Columns 4 and 5 look at the loan to consumption ratio. Column 4 looks at the ratio itself, whereas in column 5 the dependent variable is a dummy that takes the value of 1 if the household has a loan to consumption ratio larger than 1.

The next three columns study interest rates paid by the household. Columns 6 studies the average interest rate paid by the household across all loans. Columns 7 looks at the maximum interest rate paid by the household on any of its loans, whereas column 8 looks at the minimum interest rate that a household pays on any of its loans. Column 9 looks at average loan duration across all loans that a household has.

All these variables above can be seen as an indicator for misinformed financial decisions making. Poor understanding of financial concepts and numeracy may mean that an individual takes out excessively high loan amounts, as he does not understand the consequences of this. At the same time, high interest rates may be caused by poor understanding of interest rates and how these compound over time. This is particularly important in rural areas as money lenders that charge excessively high interest rates are still very prominent.

At the same time, poor financial decisions making can also be the result of a lack of self-control. Excessive spending can be financed by high amounts of debt. This may also be reflected in the interest rate paid for loans as spending may be financed by loans taken out at the money lender.

From Table 4.8 it is clear that financial literacy, cognitive ability and self-control have little impact on any of the loan decisions taken by the households, except for loan duration. There is a clear link between both financial literacy and cognitive ability with this outcome variable. Individuals with higher financial literacy and higher cognitive ability hold loans with higher loan durations on average. As a very large proportion of loans that are given out in rural Thailand are given by either the BAAC or a Village Fund, which give out short term loans designed mostly for farmers and small business owners, longer loan duration is an indicator for holding a more sophisticated loan, probably taken out at a commercial financial institution.

This significant link, however, does not mean that financial literacy leads to individuals taking out credit at commercial financial institutions. Instead it is likely that holding credit at a commercial bank acts as training in financial literacy. At the same time financial literacy could have been measured with error further more unobserved variable bias

could lead to further endogeneity problems. To solve this potential endogeneity problem, instrumental variable regressions would have to be employed.

All the other indicators for loan choices are better explained by socio-demographic variables than by financial literacy, cognitive ability and self-control. Both the number of loans held by a household and the total amount of loans held by a household seem to be explained by age and whether the respondent is married. Additionally the amount of debt that a household holds is also explained by the years of education, where more years of schooling lead to more debt held by the household. Loan to consumption ratio and loans being larger than household consumption are explained by the same variables as total loan amount. It is surprising that here education has more explanatory power than education levels as this is contrary to what is normally found in the literature (Lusardi and Mitchell, 2014). However this results indicates that some kind of skill is needed in order to make good financial decisions.

Unsurprisingly, higher consumption is linked to higher debt. However, from these regressions it is not clear whether this is an income effect, as those with higher income are able to borrow more and also consume more. Alternatively, this could be an indicator for overconsumption, and debt being a consequence of this overconsumption.

The three interest variables, on the other hand seem to be driven by other socio-demographic variables than the amount of debt and number of loans. Here the regression results show that self-employed individuals pay lower interest rates than individuals with other employments. Additionally, the results show that women pay higher interest on their loans. From these results, as neither being female nor being self-employed is significantly linked to financial literacy, it is possible to deduce that self-employed individuals are given lower and women are given higher interest rates by borrowing institutions and therefore have better/ worse access to finance.

From these results, we conclude that choices on loans made by an individual are more likely to be driven by individual characteristics and possibly by access to credit rather than by information or behavioral biases.

As previously mentioned, there is a wide variety of lending institutions in rural Thailand. Government funded or sponsored institutions such as the BAAC and the Village Fund hold a very large share of the market. These are mostly aimed at farmers and small business owners and provide credit for business investment. As these lending institutions are linked to the government, their interest rate and amount lent out are relatively fixed. On the other hand, there are commercial banks and money lenders. These also lend for non-

productive purposes and have more autonomy over interest rate and loan amounts. It is hence useful to look at household lending in relation to two different types of loans, loans that were taken for a productive purpose and those that were taken with a non-productive purpose. Table 4.9 and Table 4.10 are synonymous to Table 4.8, but show regressions for loans broken down into those with non-productive and productive purposes respectively.

From Table 4.9 it is clear that decisions towards loans that have a non-productive purpose such as consumption are explained but slightly different variables to productive loans. Column 1 in Table 4.9 shows that farmers hold a lower a number of non-productive loans. But also individuals with lower reported self-control hold a larger number of loans.

When looking at loan volume, socio demographic factor still play a more important role than behavioral variables. Better off individuals hold higher loan volumes, at the same time married people have a larger loan volume. Older people hold more loans and hold a larger loan amount, however the effect levels off as age increases beyond a certain point. The two loan to consumption ratio variables show the same patter as above, however here a higher ratio is also linked to being risk tolerant, as measured by the Eckel-Grossman risk experiment (Eckel and Grossman, 2008). This makes sense as a certain amount risk tolerance is needed in order to deal with the possibility of getting into repayment problems caused by excessive amount of debt.

As we examine interest rates a similar pattern emerges, although there is slight evidence that individuals with low financial literacy pay a higher interest rate at least on the highest interest rate loan that they hold. Otherwise interest rate decisions are still dominated by non-behavioral variables. Women seem to pay higher interest rates, whilst those that are self-employed pay lower interest rates.

Only loan duration shows a clear link with financial literacy and cognitive ability. Those that are more financially literate and have higher cognitive ability hold loans with longer loan duration on their non-productive loans. Interestingly, no other variables have an effect on loan duration of non-productive loans.

As a counterpart to the loan decision towards non-productive loans, we look at what influences loan decisions on productive loans. Results are displayed in Table 4.10. When looking at the number of loans held by the household and the total loan volume, the same variables explain these decisions as above. Older and married people are more likely to hold more productive loans and hold a larger amount of productive loans. Unsurprisingly, farmers hold a larger number of productive loans, although they do not hold a larger loan

volume. Loan to consumption ratio is also explained by tending to spend money now. It is not clear why this only applied to loans with a productive purpose.

Interestingly, being female does not seem to have a negative effect on the interest rate paid on productive loans, different to non-productive loans. One reason here could be that loans with a productive purpose tend to be given out by financial institutions that are linked to the government. This could be mean that women have worse access to finance and therefore have to pay higher interest rates at informal institutions such as money lenders. Richer people pay lower interest rates on productive loans, probably because lending to them involves less risk as these can secure loans with more collateral. There is slight evidence that self-employed people pay higher interest rates on productive loans, probably because lending to their business activities involves more risk.

Loan duration is again the only loan characteristic that is strongly linked to financial literacy, but not to cognitive ability. For productive loans loan duration is also explained by some socio-demographic variables, such as age and self-employment.

One further interesting finding emerges from this exercise of looking at loans with non-productive and productive purposes separately. The sign of the financial literacy coefficient is opposite for these two types of loans in six out of nine cases. This shows that taken out a loan with a non-productive purpose is a different type of decision to taking out a loan with a non-productive purpose for our sample of rural households.

4.4.3   Behavior towards savings

In this section, we are briefly look at savings decisions made by households in our sample. Use and access to more sophisticated savings products is still very limited in rural Northeast Thailand. Most households only have simple savings accounts and a significant proportion of our sample, 12.3%, save money at home. At the same time, 8.3% are part of a savings club. Only three households report holding any kind of sophisticated savings product such as shares or deposits.

In Table 4.11, we do not study savings behavior in as much detail as borrowing behavior was studies above, but instead look at more simple indicators for good financial behavior. Column 1 shows what explains whether a household has any savings at all. Column 2 show results for the household having been able to save in the year prior to the survey. Column 3 looks at total savings across all forms of savings that the household has. Holding savings is an essential part of good financial behavior. Especially in developing countries with

limited socio security systems, savings can play an important role in old age and in case of emergency.

There is a weak link (10%) between having any savings and financial literacy. This relationship does not hold for having saved during the last year. In addition, whether a household has saved or not is further explained by age. Farmers seem more likely to have savings than other occupation groups. The amount of savings does not seem to be explained by behavioral variables nor by socio-demographic variables. This poses an interesting question of what causes savings behavior amongst the poor.

4.5 Discussion and conclusion

This paper looks at a broad set of household financial behaviors and links these to financial literacy, cognitive ability and numeracy. In addition to this we also control for a large number of socio demographic variables.

The results of this study are based on 766 respondents that took part in two surveys that were conducted in rural Thailand in 2013. Standard financial literacy items were asked and results indicate that many respondents have a poor understanding of financial concepts such as inflation or interest rates. Respondents in rural Thailand have worse financial literacy than respondents in developed countries (Lusardi and Mitchell, 2014) and worse financial literacy than their Thai counterparts in Bangkok (Grohmann et al, 2014), but better financial literacy than rural populations in Indonesia and India (Cole et al., 2011).

The links between financial literacy and socio-demographic variables are similar to what has previously been found in the literature, with the exception of women having lower financial literacy. Numeracy and self-control are explained by expected variables, such that both numeracy and self-control increase with more years of education and higher living standards.

Even though financial literacy, numeracy and self-control all show commonly found relationships with socio-demographic variables, their power in explaining financial behaviors studied here is weak. All these regressions shown in this paper indicate that the relationship between financial literacy, cognitive ability and self-control is not easy in this sample of a rural population in Northeast Thailand. The only robust link exists between financial literacy and loan duration. As a large proportion of loans in Northeast Thailand are given out by either the BAAC or the Village Fund, both of which are government backed and give out loans on a one year basis, this may indicate that financial literacy is linked to holding more sophisticated loans at commercial banks. On the savings side, there is very weak evidence that savings may

be linked to cognitive ability. Interestingly, when looking at productive and non-productive loans separately the coefficient on financial literacy displays the opposite sign for most variables.

All other financial behaviors are better explained by socio-demographic variables rather than by financial literacy, cognitive ability and self-control. When looking at socio demographic variable, we see commonly found relationships. This indicates that financial decision making amongst the rural poor is not just driven by poor understanding of finance or a lack of self-control as has been shown for a number of developed countries (Lusardi and Mitchell, 2014, Gathergood, 2012), but rather some groups display better financial behavior than others. The reason for this may be access to finance, especially because there are many different forms of financial institutions operating alongside each other. It is conceivable that access to financial institutions is not the same for all members of the rural population. The results in this study indicate that access to finance is still a critical factor in determining financial decision making in rural Northeast Thailand.

However, this study is far from complete and further research is needed before definite conclusions can be drawn. Firstly, data on where a loan was taken out is needed in order to make clearer judgments about borrowing decisions. Secondly, a further look at the relationship between access to finance and poor financial literacy can be taken by examining the location of financial institutions in relation to the respondent. However this would only control for a lack of access caused by physical distance, not for a lack of access cause by being a member of a certain socio-demographic group that is not being served by financial institutions.

Lastly, to circumvent the problem caused by unequal access to finance a matching procedure could be utilized. Here two individuals that are very similar in regards to socio-demographic characteristics but have different levels of financial literacy or cognitive ability could be matched to each other. In this case, differences in financial decision making between the two individuals can be attributed to their difference in financial literacy or cognitive ability and not to socio-demographic factors.

Table 4.1: Socio-Demographic Summary Statistics

	Mean	s.d	Min	Max	Obs.
Female	0.58	0.49	0	1	778
Age (years)	54.74	13.75	11	86	788
Years of education	5.64	3.24	1	19	748
Married	0.81	0.39	0	1	788
Farming	0.68	0.47	0	1	788
Self Employment	0.03	0.16	0	1	788
Unemployed	0.14	0.34	0	1	788
Government	0.02	0.13	0	1	788
Student	0.01	0.10	0	1	788
Consumption per capita 2005 US$ PPP	2381.84	1962.35	180.62	30667.9	788
HH Consumption 2005 US$PPP	8640.59	6627.58	541.87	92003.7	788
Observations	788				

Table 4.2: Financial Literacy Summary Statistics
Financial Literacy Questions:

1. 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. 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 you can buy today
   b. More than you can buy today
   c. Exactly the same as today

3. For the same amount of money, a person can enter either one these two lotteries. Lottery A pays a prize of 2000 Baht, and the chance of winning is 5%. Lottery B pays a prize of 100 Baht, and the chance of winning is 10%. Which Lottery pays the higher average amount?
   a. Lottery A
   b. Lottery B
   c. These two Lotteries pay the same average amount

4. 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 loan
   b. The second loan

5. Generally speaking, which of these financial institutions offers the lower interest rate when borrowing money for a short amount of time?
   a. The village fund
   b. A money lender

6. Please indicate if the following statement is true of false. "It is safer to keep cash at home than to bring it to a bank and put it in a savings account."
   a. True
   b. False

	mean	sd	min	max	count
Financial Literacy 1	0.55	0.50	0	1	788
Financial Literacy 2	0.60	0.49	0	1	788
Financial Literacy 3	0.59	0.49	0	1	788
Financial Literacy 4	0.52	0.50	0	1	788
Financial Literacy 5	0.94	0.25	0	1	788
Financial Literacy 6	0.92	0.28	0	1	788
Score out of 3	1.73	0.86	0	3	788
Score out of 4	2.26	1.00	0	4	788
Score out of 6	4.11	1.11	0	6	788
Observations	788				

Table 4.3: Cognitive Ability Summary Statistics
Cognitive Ability Questions:

1. I would like you to name as many different animals as you can in 60 seconds
2. What is 45+72
3. If you have four friends and would like to give each of your friends four sweets, how many sweets do you need?
4. What is 5% of 200?
5. Suppose you want to buy a bag of rice that costs 270 Baht. You only have one 1000 Baht note. How much change will you get?
   a. 1500 Baht
   b. 4500 Baht
   c. 6000 Baht
6. A second-hand motorbike dealer is selling a motorbike for 12000 Baht. This is two thirds of what it costs new. How much did the motorbike cost new?
   a. 9000 Baht
   b. 16000 Baht
   c. 18000 Baht
   d. 24000 Baht

	mean	sd	min	max	count
Animals named in 60 sec.	17.38	6.20	4	73	787
Numeracy 1	0.70	0.46	0	1	788
Numeracy 2	0.84	0.37	0	1	788
Numeracy 3	0.35	0.48	0	1	788
Numeracy 4	0.62	0.49	0	1	788
Numeracy 5	0.95	0.21	0	1	788
Numeracy 6	0.14	0.35	0	1	788
Numeracy out of 6	3.60	1.33	0	6	788
Observations	788				

Table 4.4: Self Control Summary Statistics:
Self-Control Questions:

On a scale between 1 and 6 how much do you agree with the following statement:
"I am impulsive and tend to buy things even when I can't afford them"
"I rather spend now and let the future take care of itself"

	mean	sd	min	max	count
Impulsive shopper	3.55	1.91	0	6	786
Likes to spend money now	2.51	1.70	1	6	786
Observations	786				

Table 4.5: Who has Financially Literate, Numerate and has Self-Control

	(1) Financial Literacy 3 Score	(2) Financial Literacy 4 Score	(3) Financial Literacy 6 Score	(4) Cognitive Ability Animals	(5) Cognitive Ability Numeracy 6	(6) Self-control Impulsive	(7) Self-control Spend now
Female	-0.05	-0.03	-0.09	-0.01	-0.23**	-0.05	-0.09
	[0.07]	[0.08]	[0.09]	[0.45]	[0.09]	[0.15]	[0.13]
Married	-0.03	0.11	0.04	2.05***	0.32**	0.35*	-0.15
	[0.09]	[0.11]	[0.11]	[0.58]	[0.14]	[0.20]	[0.18]
Age	0.02	0.02	0.05**	0.21*	0.00	0.01	0.01
	[0.02]	[0.02]	[0.02]	[0.12]	[0.02]	[0.03]	[0.03]
Age Sq.	-0.20	-0.24	-0.51**	-2.58**	-0.19	-0.03	-0.05
	[0.15]	[0.18]	[0.21]	[1.08]	[0.20]	[0.31]	[0.27]
Years of Education	0.02**	0.01	0.03**	0.55***	0.12***	-0.11***	-0.06***
	[0.01]	[0.01]	[0.01]	[0.12]	[0.01]	[0.02]	[0.02]
Farming	0.14**	0.08	0.15	-0.39	0.08	-0.23	-0.10
	[0.07]	[0.08]	[0.09]	[0.54]	[0.10]	[0.16]	[0.14]
Self Employed	-0.07	-0.05	-0.18	-0.03	0.26	0.54	-0.20
	[0.18]	[0.22]	[0.26]	[0.92]	[0.29]	[0.45]	[0.41]
Consumption	0.05***	0.05***	0.05***	0.12	0.04	-0.02	-0.08
	[0.01]	[0.02]	[0.02]	[0.10]	[0.02]	[0.11]	[0.01]
Consumption	1.13**	1.61***	2.85***	9.25***	3.13***	3.97***	3.19***
	[0.46]	[0.56]	[0.67]	[3.47]	[0.63]	[1.22]	[1.08]
Pseudo-R²	0.04	0.03	0.06	0.17	0.20	0.05	0.03
Observations	748	748	748	747	748	746	746

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

Table 4.6: Borrowing Summary Statistics

	mean	sd	min	max	count
Number of loans	1.17	1.13	0	8	686
Loan amount	5937.71	16209.90	0	248000	686
Loan amount *Conditional on having loan*	8510.02	18284.03	124	248000	550
Loan to consumption ratio *Conditional on having loan*	0.90	1.35	0.02	12.53	550
Loan to consumption >1	0.24	0.42	0	1	550
Average interest across all loans	15.17	43.15	0	496	551
Max interest across all loans	18.97	50.00	0	496	551
Min interest across all loans	12.35	42.07	0	496	551
Mean loan duration across loans	2.76	4.00	0	35	551

Table 4.7: Savings Summary Statistics

	mean	sd	min	max	count
HH has savings	0.85	0.36	0	1	787
HH saved last year	0.75	0.43	0	1	684
Total savings	2532.31	12630.37	0	326864	788
Observations	788				

Table 4.8: Borrowing Decisions All Loans

	(1) Number of loans	(2) Total loan volume	(3) Total loan if has loan	(4) Loans to cons.	(5) Loans to cons. <1	(6) Aver. interest	(7) Maximum interest	(8) Minimum interest	(9) Loan duration
Financial	-0.04	-450.13	-420.99	-0.01	-0.04	-0.39	-1.14	0.11	0.86***
Literacy	[0.09]	[500.14]	[609.45]	[0.03]	[0.10]	[2.07]	[1.8]	[2.26]	[0.20]
Cognitive	-0.05	64.57	302.57	0.09	0.04	1.54	2.08	1.20	0.42**
Ability	[0.05]	[694.38]	[986.42]	[0.08]	[0.08]	[1.87]	[2.20]	[1.79]	[0.17]
Impulsive	0.05***	228.64	-168.04	0.02	-0.01	-0.61	-0.68	-0.63	0.06
	[0.02]	[259.91]	[399.33]	[0.04]	[0.04]	[1.41]	[1.63]	[1.34]	[0.09]
Spend now	0.00	-416.85	-459.44	-0.05	0.02	-0.31	0.22	-0.73	0.02
	[0.02]	[262.86]	[360.41]	[0.03]	[0.05]	[0.91]	[1.06]	[0.87]	[0.11]
Risk	-0.01	356.35	885.61	0.08*	0.05	1.71	2.05	1.23	0.02
	[0.02]	[487.71]	[688.71]	[0.04]	[0.04]	[1.23]	[1.45]	[1.18]	[0.12]
Female	-0.041	516.20	990.03	-0.02	0.01	7.90**	11.11**	6.23*	-0.32
	[0.082]	[1354.44]	[1693.83]	[0.13]	[0.14]	[3.53]	[4.60]	[3.62]	[0.35]
Married	0.26**	3940.88***	5669.13**	0.27*	0.57**	-16.37	-14.40	-17.70	0.41
	[0.12]	[1472.126]	[2180.88]	[0.14]	[0.28]	[11.72]	[11.84]	[11.69]	[0.52]
Age	0.08**	1278.83***	1988.42***	0.13***	0.08	2.01	2.25	1.94	0.30**
	[0.03]	[483.18]	[727.51]	[0.04]	[0.07]	[1.47]	[1.58]	[1.54]	[0.12]
Age Sq.	-0.88***	-1.1e+04***	-1.6e+04***	-1.13***	-0.73	-18.01	-20.87	-16.78	-2.41**
	[0.27]	[3792.81]	[5826.768]	[0.33]	[0.58]	[13.74]	[14.43]	[14.23]	[1.02]
Years of	0.01	1232.92*	1702.82**	0.10**	0.08***	0.17	1.10	-0.28	0.13
education	[0.01]	[623.03]	[812.35]	[0.04]	[0.03]	[1.02]	[1.39]	[0.95]	[0.09]
Farming	0.02	-2781.30*	-4519.63*	-0.08	-0.05	-6.24	-6.03	-5.68	-0.45
	[0.09]	[1585.14]	[2383.65]	[0.15]	[0.16]	[5.88]	[6.94]	[5.70]	[0.44]
Self	0.48*	-1960.93	-1437.72	0.42	0.66	-9.80	0.49	-14.97**	-0.75
employed	[0.27]	[2384.24]	[2985.46]	[0.46]	[0.48]	[7.82]	[14.03]	[6.98]	[1.24]
Log	0.05	4806.41***	6753.96***	0.04	-0.03	-2.87	-6.90	-0.57	0.61**
Consum.	[0.06]	[1196.68]	[1425.72]	[0.08]	[0.11]	[3.46]	[5.03]	[3.20]	[0.26]
Constant	-2.16**	-7.49e+04***	-1.1e+05***	-3.94**	-3.35	-4.89	14.24	-18.38	-11.68***
	[0.90]	[21766.09]	[31005.021]	[1.51]	[2.06]	[39.22]	[46.47]	[40.20]	[4.10]
Ps.-R²/ R²		0.13	0.18	0.08	0.06	0.04	0.04	0.04	0.08
Observations	661	661	462	462	462	463	463	463	463

Notes: The table reports regression results with robust standard errors in brackets. ***, ** and * denote significance at the 1%, 5% and 10% levels, respectively. Column 1 shows results for poisson regression. Columns 2-9 show OLS results, except for column 5 which shows results to a probit regression. Columns 3-5 are condition on having a loan.

Table 4.9: Borrowing Descisions Non-Productive Loans

	(1) Number of loans	(2) Total loan volume	(3) Total loan if has loan	(4) Loans to cons.	(5) Loans to cons. <1	(6) Aver. interest	(7) Maximum interest	(8) Minimum interest	(9) Loan duration
Financial	0.05	-256.36	-646.64	-0.04	-0.57	-3.97	-4.430*	-3.50	0.94***
Literacy	[0.06]	[380.94]	[945.25]	[0.06]	[0.53]	[2.41]	[2.345]	[2.54]	[0.13]
Cognitive	-0.04	333.80	987.84	0.03	-0.04	5.38	5.453	5.17	1.33***
Ability	[0.08]	[363.10]	[1283.60]	[0.09]	[0.13]	[4.98]	[5.265]	[4.85]	[0.36]
Impulsive	0.03	-130.38	-1070.39	-0.06	-0.08	1.24	0.890	1.49	0.05
	[0.03]	[178.07]	[778.31]	[0.05]	[0.06]	[3.20]	[3.197]	[3.25]	[0.17]
Spend now	0.07	-12.93	-396.12	-0.04	0.04	-1.92	-1.649	-2.15	0.12
	[0.04]	[175.24]	[558.77]	[0.04]	[0.07]	[2.11]	[2.165]	[2.11]	[0.22]
Risk	-0.03	534.60	1958.10*	0.17**	0.17***	3.41	3.781	3.03	0.22
	[0.05]	[424.34]	[1129.95]	[0.07]	[0.06]	[2.32]	[2.634]	[2.17]	[0.22]
Female	0.12	1435.10	4732.51	0.26	0.24	19.22**	22.157**	17.27**	-0.02
	[0.12]	[1172.15]	[3512.28]	[0.21]	[0.22]	[7.98]	[9.211]	[7.40]	[0.57]
Married	0.22	2339.48**	7596.57**	0.55**	0.84**	-31.32	-28.497	-33.41	0.07
	[0.19]	[1063.10]	[3642.33]	[0.24]	[0.37]	[22.88]	[22.807]	[22.99]	[1.20]
Age	0.10*	745.74*	2730.79*	0.20**	0.21*	2.15	2.215	2.52	0.20
	[0.05]	[422.25]	[1467.27]	[0.08]	[0.11]	[3.31]	[3.466]	[3.26]	[0.21]
Age Sq.	-1.13**	-6446.21*	-2.2e+04*	-1.72**	-1.88*	-12.56	-13.868	-14.80	-1.81
	[0.50]	[3278.26]	[11582.98]	[0.66]	[0.96]	[29.06]	[30.529]	[28.39]	[1.85]
Years of	-0.00	600.13	1516.34	0.07	0.03	2.58	2.779	2.38	-0.045
education	[0.02]	[572.86]	[1331.89]	[0.06]	[0.04]	[2.37]	[2.469]	[2.35]	[0.17]
Farming	-0.46***	-2141.45	-2599.49	0.00	-0.01	-5.66	-5.970	-5.49	-0.75
	[0.13]	[1409.81]	[3300.37]	[0.20]	[0.21]	[11.97]	[12.918]	[11.60]	[0.65]
Self	0.59	-475.62	2991.92	0.82	0.96	-37.59***	-36.770***	-37.95***	0.15
employed	[0.38]	[1847.91]	[3132.03]	[0.70]	[0.64]	[13.52]	[13.565]	[13.72]	[1.61]
Log	0.01	612.04***	1159.73*	0.05	0.04	-1.73	-2.159	-1.31	0.11
Consum.	[0.03]	[205.85]	[664.93]	[0.14]	[0.16]	[1.59]	[1.688]	[1.570]	[0.07]
Constant	-3.13**	-2.5e+04	-8.9e+04*	-6.48**	-8.08**	-56.85	-57.446	-69.77	-3.06
	[1.56]	[16693.08]	[52210.42]	[2.91]	[3.72]	[94.70]	[97.366]	[95.14]	[6.06]
Ps.-R²/ R²		0.06	0.17	0.13	0.10	0.10	0.09	0.10	0.15
Observations	661	661	200	200	200	201	201	201	201

Notes: The table reports regression results with robust standard errors in brackets. ***, ** and * denote significance at the 1%, 5% and 10% levels, respectively. Column 1 shows results for poisson regression. Columns 2-9 show OLS results, except for column 5 which shows results to a probit regression. Columns 3-5 are condition on having a non-productive loan.

Table 4.10: Borrowing Decisions Productive Loans

	(1) Number of loans	(2) Total loan volume	(3) Total loan if has loan	(4) Loans to cons.	(5) Loans to cons. <1	(6) Aver. interest	(7) Max. interest	(8) Min. interest	(9) Loan duration
Financial	-0.19	-274.71	-320.11	0.04	0.11	1.88	1.30	2.52	1.10**
Literacy	[0.14]	[379.33]	[769.51]	[0.07]	[0.14]	[3.56]	[3.44]	[3.74]	[0.46]
Cognitive	-0.04	275.69	913.16	0.15	0.11	-0.03	0.33	-0.39	0.29
Ability	[0.04]	[363.87]	[684.84]	[0.10]	[0.10]	[1.40]	[1.52]	[1.37]	[0.24]
Impulsive	0.05**	-118.79	297.05	0.06	0.04	-0.07	-0.11	-0.06	0.03
	[0.03]	[180.91]	[395.22]	[0.05]	[0.04]	[0.75]	[0.82]	[0.70]	[0.13]
Spend now	-0.02	-42.23	-601.24*	-0.08**	-0.01	0.50	0.45	0.43	-0.01
	[0.03]	[180.76]	[359.53]	[0.04]	[0.06]	[0.90]	[1.00]	[0.88]	[0.13]
Risk	0.01	538.02	78.67	0.01	-0.01	-0.05	-0.32	0.23	0.03
	[0.03]	[427.72]	[552.03]	[0.04]	[0.06]	[0.98]	[1.07]	[0.99]	[0.18]
Female	-0.12	1364.99	-478.36	-0.16	-0.09	2.90	3.67	2.09	-0.58
	[0.11]	[1170.57]	[1268.38]	[0.15]	[0.18]	[4.34]	[4.48]	[4.39]	[0.45]
Married	0.33*	2299.19**	2594.60	0.11	0.59	0.10	1.81	0.52	0.22
	[0.18]	[1093.58]	[1924.09]	[0.14]	[0.36]	[2.87]	[3.16]	[2.91]	[0.63]
Age	0.04	735.97*	958.95**	0.08*	0.09	1.58	1.89	1.36	0.29*
	[0.04]	[412.84]	[454.49]	[0.04]	[0.07]	[1.08]	[1.24]	[1.08]	[0.15]
Age Sq.	-0.51	-6323.05*	-7743.11**	-0.68**	-0.84	-16.25*	-19.59*	-14.08	-2.24*
	[0.36]	[3188.54]	[3641.32]	[0.33]	[0.66]	[9.39]	[10.77]	[9.38]	[1.24]
Years of	0.01	600.02	641.11	0.04	0.06**	-0.40	-0.41	-0.45	0.10
education	[0.02]	[564.04]	[453.47]	[0.03]	[0.03]	[0.62]	[0.67]	[0.61]	[0.12]
Farming	0.44***	-2263.21	-2555.56	-0.07	-0.16	-0.61	-0.40	-1.26	-0.92
	[0.15]	[1413.56]	[2817.79]	[0.16]	[0.23]	[3.49]	[3.74]	[3.40]	[0.74]
Self	0.38	-782.25	-858.70	-0.04	0.64	11.77*	29.94	1.46	-2.36***
employed	[0.44]	[1880.36]	[3101.08]	[0.22]	[0.67]	[6.91]	[20.28]	[5.03]	[0.87]
Log	0.10	2061.38**	4388.31**	-0.02	-0.18	-3.13*	-4.62**	-2.00	0.50
Consum.	[0.08]	[794.21]	[1722.64]	[0.10]	[0.14]	[1.73]	[2.17]	[1.66]	[0.38]
Constant	-2.36*	-3.9e+04**	-5.9e+04**	-1.48	-2.9	-0.91	4.78	-4.59	-9.62
	[1.29]	[18939.67]	[22766.77]	[1.50]	[2.27]	[35.89]	[39.75]	[34.96]	[5.83]
Ps.-R²/ R²		0.06	0.10	0.04	0.06	0.02	0.03	0.01	0.06
Obs.	661	661	325	325	325	325	325	325	325

Notes: The table reports regression results with robust standard errors in brackets. ***, ** and * denote significance at the 1%, 5% and 10% levels, respectively. Column 1 shows results for poisson regression. Columns 2-9 show OLS results, except for column 5 which shows results to a probit regression. Columns 3-5 are condition on having a productive loan.

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Table 4.11: Savings Decisions

	(1) Has any savings b/se	(2) Saved last year b/se	(3) Total Savings b/se
Financial Literacy	-0.002 [0.066]	0.009 [0.058]	-535.256 [474.866]
Cognitive Ability	0.116* [0.067]	0.024 [0.066]	981.145 [768.547]
Impulsive	-0.020 [0.038]	-0.009 [0.033]	-134.165 [188.374]
Spend now	0.030 [0.040]	0.048 [0.040]	-227.336 [192.950]
Risk	-0.024 [0.040]	0.010 [0.038]	227.789 [215.627]
Female	-0.021 [0.140]	-0.021 [0.126]	1603.054 [1615.757]
Married	0.045 [0.181]	-0.014 [0.188]	1400.782 [1377.908]
Age	0.062 [0.039]	0.080* [0.046]	124.179 [130.475]
Age Sq.	-0.502 [0.322]	-0.712* [0.389]	10.070 [1393.852]
Years of education	0.029 [0.027]	0.043* [0.025]	-33.445 [174.599]
Farming	0.306** [0.154]	0.335** [0.137]	1415.436 [885.050]
Self employed	0.076 [0.412]	0.444 [0.396]	-1410.825 [1115.521]
Log Consum.	0.367*** [0.120]	0.148 [0.098]	2761.163* [1647.102]
Constant	-3.850*** [1.457]	-3.168** [1.570]	-2.81e+04* [15760.454]
R²	0.06	0.03	0.03
Observations	660	571	661

Notes: The table reports regression results with robust standard errors in brackets. ***, ** and * denote significance at the 1%, 5% and 10% levels, respectively. Column 1 and 2 show probite regression results, Column 3 shows OLS regression results.

Chapter 5:

The Effect of Peer Observation on Consumption Choices:

Experimental Evidence[21]

5.1   Introduction

The feeling of buying something just because someone else has it is a feeling familiar to many. Despite this familiarity with this feeling of peers exerting a very powerful influence over one's consumption behavior, there has been a surprising lack of empirical or experimental research on this topic. In traditional economic theory consumption choices are regarded as a function of budget, price and personal preferences. The effect of those around us is rarely considered. In this study we aim to change this and hence define peer effects as the simple effect that leads individuals to behave in a similar way to those around them.

The study of peer effects in consumption choices is not just crucial in advancing further understanding of human decision making, but at a second look, can also have an important effect on policy. Peer effects may influence the success of cash transfer programs. If peer effects are prevalent they could have an effect on consumption decisions taken with cash grants. At the same time, policy makers who are interested in increasing uptake of certain good such as health services or innovative technology could use peer effects in order to increase consumption of such goods.

One reason why economists have largely ignored peer effects on consumption choice is that identifying peer effects comes with a number of challenges. Measuring the extent to which peers affect decision making is challenging because social group formation is usually endogenous and hence individuals within a group are more similar to each other than other individuals leading to unobserved variable bias. This problem is known as contextual effects. At the same time, groups that have formed naturally are normally subjected to common shocks causing individuals to behave in a similar fashion, giving the appearance of peer effects; this is known as correlated effects. In addition, since individuals may make simultaneous decisions affecting each other it makes it difficult to determine causal behavior. This is commonly known as the reflection problem (Manski, 1993, 2000).

It is hence, extremely difficult to identify peer effects from observational data. We solve this problem by performing an experiment. We use a novel approach and a lab-in-the-field experiment to provide clear evidence of peer effects on consumption choices in a fully controlled

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setting where no possible confounding factors can hinder identification. To the best of our knowledge, no experiment of peer effects in consumption decisions has been conducted so far. Our experimental setting allows us to overcome the Manskian problem of contextual effects and correlated effects. Hence, in this paper, we aim to (i) identify the existence of peer effects in terms of consumption decisions; (ii) try to investigate some mechanisms through which peer effects operate and (iii) test whether certain groups are more susceptible to peer effects than others.

We are able to control for personal and local confounding factors because our experimental results are complemented with a large household survey containing a wide-range of socio-economic information of the respondents and the village in which they live. We perform the experiment in rural Thailand because of the prevalence of close-knit communities. Our respondents live in relatively small villages and have often lived there for many generations. Hence, even though assignment to a group is random; groups are made up of people that actually know each other (Mangyo and Park, 2011).

The design of our experiment is very simple; we test consumption choices by offering respondents the choice between a combination of sweet and salty snacks, i.e. the temptation good (called the tasty treat from here on) and money. The control group makes this choice alone, while respondents in the treatment group observe each other. The only difference between treatment and control group therefore is peer observation. A difference in outcome can hence be attributed to peer observation. Our experimental study has a number of advantages since it tackles problems described by Manski (1993, 2000). The experimental design provides a clear counterfactual. At the same time we are able to control for a large number of person, groups and village characteristics.

We focus in particular on the effect of peer observation on temptation goods[22], since consumption choices for temptation goods are particularly susceptible to the influence of peer effects as has been shown, especially for young people, in social psychology (Gunter and Furnham, 1998). Another reason for choosing temptation goods was that there is no real economic or welfare need for the temptation goods that are offered. The idea behind this is that playing the game with goods that are necessities may have confounding effects on the demand for the good compared to the money offered.

In order to support our experimental analysis, we develop a theoretical framework. We adjust a standard model of consumer choice with a cost imposed on the decision maker when deviating from the group's choice. We argue that this cost represents a social cost caused by not

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[22] Temptation goods are defined as goods that provide the current self with positive utility, but negative utility to any future self, for instance alcohol, cigarettes or unhealthy foods (Banerjee and Mullainathan, 2010).

conforming to the group. We can show from this model that under the peer treatment extreme choices are more costly and therefore, the demand curve for the tasty treat is flatter under peer treatment.

Our experimental data confirms the prediction of the model. Specifically, we find that observing groups - those that sit in close proximity to each other - have a higher group minimum and a lower group maximum. Consequentially, the standard deviation for those observing groups is lower than for those groups that simply played at the same time, but without peer observation. In further analysis, we confirm this finding by showing that the group average, excluding the individual herself, has a positive and significant influence on the decisions made by the individual respondent; however only when the experiment is performed with peer observation. The fact that the effect is only present in the observing groups shows us that it can be attributed to the presence of peers and not to other possible effects.

Next, we aim to explore the mechanisms behind the peer effect. There are two possible reasons for this; either the respondents feel that the others in a group have better information or they are gaining some kind of benefit from conforming to others. We find evidence that unfamiliarity with a product is counteracted by peer observations, indicating some evidence for the first mechanism.

Following this, we look at treatment heterogeneities to analyze whether there is a different magnitude of peer effects for individuals with different background characteristics. We show that those with the highest cognitive ability are less susceptible to peer effects. Using the same technique, we do not find any effect for overconfidence, underconfidence or higher income respondents.

To sum up, we are able to show using a lab-in-the-field experiment that the observation of peers has a significant impact on consumption choices. We find evidence of convergence in consumption choices when overserving one's peers. Our results contribute to the literature on conformity and herding behavior where conformity is defined as an intrinsic taste to follow others (Goeree and Yariv, 2010), driven by factors such as popularity, observational learning, esteem and respect (Bernheim, 1994).

A number of experimental studies use a similar experimental design to ours; Falk and Ichino (2006) randomly assign participants either to a group or work alone in order to study the effect of peers on productivity. Another study by Baecker and Mechtel (2014) use a similar design in order to study the effect of peers on cheating behavior. These studies have the advantage that they provide a clear counterfactual and control for local factors, thus providing the cleanest evidence on peer effects.

The interrelation of social interaction and consumption decision has previously only been studied along two lines (i) 'conspicuous consumption' (Veblen, 1899) and (ii) 'keeping up with the Joneses' (Luttmer, 2005). Evidence here either comes from theoretical models or from large scale surveys.

Empirical evidence on peer-group phenomena and its effects on a number of other outcome variables is more common. Peer effects have been studied in the context of other economic behaviors. Peer effects have been shown to have a positive impact, for instance, on workers' productivity (Guryan et al., 2009; Mas and Moretti, 2009; Bandiera et al., 2010), education (Sacerdote, 2001, Imberman et al., 2012), technology adaptation (Munshi , 2004, Oster and Thornton , 2012), and saving and investment decisions (Duflo and Saez, 2003; Viscusi et al., 2011).

Previous research on peer effects relies mostly on observational data which does not solve any of the Manskian problems described above. Recent papers, however, try to measure peer effects using natural experiments to overcome these problems. Such natural experiments are the random assignment of college students to their respective dorms (Sacerdote, 2001) or the exogenous influx of students in neighboring schools after the hurricane Katrina (Imberman et al., 2012) in order to study peer effects in education.

Another recent strand of literature uses the existence of partially overlapping groups of peers to solve issues related to both reflection and correlated effects. The intuition is that partially overlapping groups generate peers of peers (or excluded peers) who act as exclusion restrictions in the simultaneous equation model of social interactions and, thus, solve the reflection problem (De Giorgi et al., 2010).

Something that has been rarely attempted so far when looking at peer effects is to distinguish between the different reasons that cause individuals to behave in a similar way to their peers. To our knowledge, this distinction has so far only been attempted by using carefully designed field experiments. Cai et al. (2009), who look at an experiment with two treatments in a restaurant setting in order to distinguish the effect of social learning from the effect of salience. Burszytyn et al. (2012) study the demand for a complex financial fund, using a brokerage firm in Brazil. The authors aim to distinguish between wanting what others have and the information effect of knowing what the other person thinks.

The remainder of this article is organized as follows. In Section 2, we present our data and experimental design. Section 3 presents the model and discussed the econometric strategy. We discuss descriptive statistics, inferences and results in Section 4. In Section 5, we provide further robustness tests while Section 6 concludes.

5.2   Data

Our peer experiment was conducted as part of a larger household survey that is part of the research project "Impact of shocks on the vulnerability to poverty: Consequences for development of emerging Southeast Asian economies" funded by the German Research Foundation. This survey has been conducted in three Northeastern provinces of Thailand since 2007. The household survey contains detailed information on many aspects of households' living standards, including: household demographics, recurrent and durable expenditures, credit and savings, landholdings, agriculture, employment, health, and education. It also includes materials concerning village characteristics such as the number of village institutions or infrastructure (i.e. irrigation system, access to electricity, nursery etc.), migration in and out of a village, inhabitants, but also the number of shocks occurring in a village. This data provides a representative sample of rural households in the Northeastern part of Thailand.

Our peer experiment was conducted in the largest of the three provinces, Ubon Ratchathani where the main source of livelihood is subsistence agriculture and seasonal labor. In addition to standard socio-demographic variables from the household survey, we also collected a number of variables that are designed to measure cognitive abilities. We collected two types of questions (details are reported in Appendix 5.2). Firstly, we collected a number of math based questions. In total there were six questions, the first four are based on the hardest four out of eight math questions in Cole et al. (2011), the last two questions are based on question used in the Survey of Health, Ageing and Retirement in Europe (SHARE). In addition to this we, included a question that asks respondents to name as many animals as they can in 60 seconds. This is a measure of word fluency and has the advantage that it is related to more innate forms of intelligence and especially measures processing speed. This test for word fluency has also been used in a number of other studies as part of cognitive ability measures such as Dohmen et al. (2010).

Finally, we ask respondents to judge how many of these questions they answered correctly to measure overconfidence. Overconfidence results in unrealistically positive self-evaluations. In other words, people are unrealistically optimistic and overestimate personal success probabilities. Our primary measure of confidence is the difference between the predicted math score and the achieved score. Thus, a subject whose prediction is higher than her actual score is called overconfident, and a subject whose prediction is below her actual score is called underconfident.

The sampling procedure of rural households for the peer experiment conducted in Ubon Ratchathani follows a three-stage stratified sampling procedure. It is important to know that we exclude the urban area around the provincial capital city and confine the sample to the remaining

rural areas. In the first stage sub-districts within the province were chosen with probability proportional to size and implicit stratification by population density. In the second stage, from each sampled sub-district, two villages were sampled randomly with probability of selection proportional to size. In the last step, in each of those villages a systematic random sample of ten households was drawn to be interviewed from the household lists of the rural census ordered by household size. Therefore, villages as well as respondents were randomly sampled for our peer experiment.

5.2.2   Experimental design

The peer experiment was conducted in August 2013 with a total of 521 respondents from 66 villages in Ubon Ratchathani. We link experimental results with the large household survey that provides us with individual-level demographic information.

The experiment was carried out by local enumerators with one of the co-authors being present at all times. Instructions were translated from English into Thai and back, and were cross-checked by a Thai economics professor to avoid semantic difficulties. Instructions were kept as simple as possible (Appendix 5.1). The interviewers were trained in sessions that together lasted a total of five days. During these five days, a pilot study was conducted in three villages.

We randomly assigned the villages to their respective treatments. The experiment was conducted by visiting two villages per day; one in the morning and one in the afternoon. For neighboring villages experiments were usually carried out simultaneously. The distance between villages was on average 18 km and respondents had to stay at the experimental site until the completion of the survey. There were two experimental sessions conducted in each village, with up to five respondents in one session at the same time. All experimental sessions took place in the village hall.

The experiment consists of a very simple choice task that required no previous knowledge. It was easy to implement and to measure in the field with the rural sample (see Appendix 5.1).

Before the experiment, however, respondents were asked to estimate the price of the tasty treat. After their prediction, all respondents were told that the tasty treat costs 40 Baht in order to avoid information asymmetries concerning the value of the product. Another important component of our pre-experiment data collection was that they could receive the tasty treat right after the experiment while they would receive the money at the end of the survey, thus enhancing temptation. Time-discounting factors can largely be ignored since the experiment including post-experiment questions only took between one to two hours to complete. Respondents were also

reminded that they had to stay and answer further questions (risk attitude, financial literacy, overconfidence and cognitive ability) after the experiment.

The tasty treat consists of very popular items that are widely known across the country - a can of coke, a piece of custard cake, a small package of lays classic crisps, a bar of chocolate, and a small pack of candies. It had a value of 40 Thai Baht (THB) (approximately 1 Euro). We made sure that it not only included sweet but also savory items so that it appeals to a wider range of tastes. During the experiment, we made sure that the respondents did not get any food or sweet beverages to drink. Furthermore, we made the tasty treat visible for the respondents whilst playing the choice task in order to increase temptation. Each respondent was able to look and touch the tasty treat.

In the choice task, the respondent has to choose between the tasty treat (TT) and a certain amount of money. In total, every respondent has to make this decision seven times. In the first round, the respondent has to choose between the TT and 10 THB. Once the respondent makes the decision, the amount of money is increased by 10 THB. Since we have seven rounds, in the last round the respondents have to choose between the TT and 70 THB. In round four there is no price difference between the two choices. After round four, it becomes increasingly unreasonable to choose the TT because of the significant price difference. The enumerator marks the decision in each round. We did allow switching back and forth. There were 24 respondents who switched twice and were dropped later in our analysis.

Once all seven choices have been made, one decision was randomly played out by picking a number between 1 and 7 from a non-transparent bag . In case the respondent picked number 3 and choose the TT in row 3, she received the TT immediately. In case, the respondent picked money in that row, the respondent would receive 30 Baht at the end of the survey with an additional 50 Baht for participating in the survey. After the experiment, respondents were asked how much he/she would be willing to pay at most to receive the TT.

In the control group, the TT game was played individually and was conducted with 261 individuals in 60 groups. To avoid peer observation, we made sure that respondents were separated across the town hall so that they could neither hear nor see the choices of the other respondents. Furthermore, it is unlikely that the decision of one respondent affects other respondent in the control group because individuals respond at different speeds.

The peer treatment was conducted with 260 individuals in 66 groups. The size of the group ranges from three to five people. The procedure of the treatment is the same as the individual treatment with the sole exception that decisions were conducted with peer observation. Each respondent is still responsible for their own decision, but respondents had to sit next to each other and perform the experiment. As in the control group, all the instructions

were read out loud and show cards were used to demonstrate the choices between TT and money in each round. In the first round, for instance, the principal enumerator asks all respondents whether they would like to choose the TT or 10 THB. Respondents have to express their choices to their assigned enumerator out loud so that other participants could hear and see their choices. Everybody makes his/her own decision but in close proximity with each other. Once everyone has decided, the principal enumerator moves to the second round and the same procedure follows.

Given our experimental design, we cannot observe an order in which participants answer, as we wanted to keep choices as natural as possible. What we can observe, however, is whether the spatial and social proximity of the peers in conjunction with their announcement of the decision into the group affects consumption choices of individual. The difference between the treatment and the control group is simply that choices are observable to peers.

5.3 Conceptual framework and identification strategy

5.3.1 Conceptual framework

In this section we present a conceptual framework that explores the relationship between the choice of money m, the choice of the tasty treat tt and the group's choice of $\overline{tt}$. We ignore the effect of individual preferences as denoted by x and $\bar{x}$ in the next section. We can justify this with our experiment and that personal preferences are the same across treatments. Hence each participant's utility function is defined as:

$$U(tt, m; D, \overline{tt}) = u(tt, m) - Dc(tt - \overline{tt})$$

The first component $u(tt, m)$ is both increasing and concave in both tt and m. It represents the utility that an individual receives from choosing the tt or m, whereas the choice in $tt \in \{0,1\}$ and $m \in (10, \ldots, 70)$. Because individuals have to decide between tt and m, $tt = 1$ implies $m=0$, and $m > 0$ implies $tt = 0$. Also note that the difference in $u(0, m) - u(1,0)$ is increasing in m. This implies that as m increases the probability of choosing tt declines i.e. the smaller the share of people that prefers tt to m.

$$\frac{\partial \mathrm{Pr}(tt > m | D)}{\partial m} < 0$$

The utility function above also includes a conformity cost function where $c(tt - \overline{tt})$. This cost function is increasing the larger the difference between own choice tt of the respondent and average consumption of the peers $\overline{tt}$.

$$c(tt - \overline{tt}) \begin{cases} > 0 \; if \; tt \neq \overline{tt} \\ = 0 \; if \; tt = \overline{tt} \end{cases}$$

In this model we do not go into the source of this cost. In our view there could be a number of reasons behind this, which we do discuss later on. More importantly note that this conformity cost only applies to those individuals that play in a group. In this case D=1 and for individuals in the control group D=0, hence the conformity cost function does not play a role in their decision making.

In the single treatment, the *tt* is preferred if

$$u(1,0) > u(0, m)$$

In the group treatment, *tt* is preferred if

$$u(1,0) - c(1 - \overline{tt}) > u(0, m) - c(0 - \overline{tt})$$

As peers possess the same utility function $U()$, as described above, average peer tasty treat choice $\overline{tt}$ must also be decreasing in *m*. Therefore, $\frac{dc(1-\overline{tt})}{dm} > 0$ and $\frac{dc(0-\overline{tt})}{dm} < 0$.

It should be noted that $\overline{tt}$ also depends on *tt* and is therefore endogenous, this is the reflection problems as denoted by Manski (1993),

Since choosing the *tt* is synonymous with not choosing *m* it is easier to think of one cost function that looks at the cost of choosing *tt* at different levels of *m*. In this case the cost of choosing *tt* would be positive for high values of *m*, but negative for low *m*.

Figure 1 shows the relationship between *m*, *Pr(tt)* and $c(1 - \overline{tt})$.
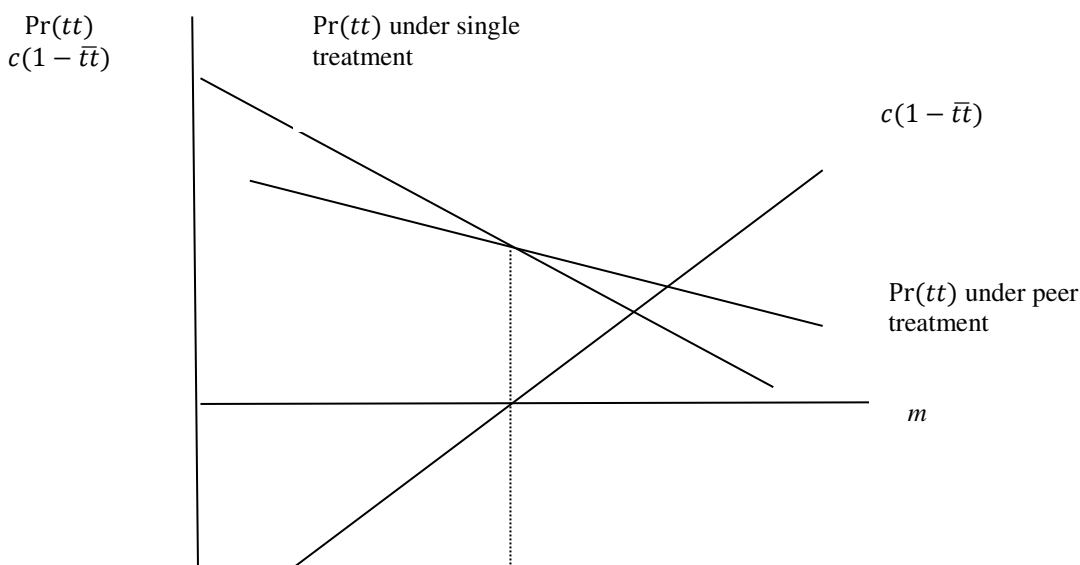
From this it becomes clear that the respondents under peer treatment react more strongly to a change in *m* than respondents under the single treatment.

$$\frac{\partial \Pr(tt > m | D = 0)}{\partial m} < \frac{\partial \Pr(tt > m | D = 1)}{\partial m}$$

Intuitively, this seem logical as there in an extra benefit from choosing the *tt* when *m* is small and an extra cost in choosing *tt* when *m* is large. This means that hence in the peer treatment, we expect that fewer people switch from *m* to *tt* very early or very late. In turn we expect this to lower standard deviation within a group.

So far we have shown the different reactions of *tt* to a change in *m*, between the peer and the single treatment. We are now left to show that this conformity cost that we introduced above leads to a positive relationship between *tt* and $\overline{tt}$, which can be defined as peer effects.

From the original utility function we can see that

$$\frac{\partial \Pr(tt > m | D = 0)}{\partial \overline{tt}} = 0$$

Hence there is no change in tt as $\overline{\boldsymbol{tt}}$ change in the single treatment. Whereas under peer treatment,

$$\frac{\partial \Pr(tt > m | D = 1)}{\partial \overline{tt}} > 0$$

There is a positive relationship between the number of people that choose *tt* and the average peer decision $\overline{tt}$.

5.3.2   Identification strategy

We are interested in identifying causal peer effects and understanding whether and how much consumption is affected by the observation of peers. The identification of peer effects, however, suffers from a number of econometric issues (Manski 1993, Moffit 2001) which can be summarized into three categories: (a) contextual effects, (b) endogenous effects, and (c) correlated effects.

Contextual effects in consumption choices may emerge if socially-related individuals under study share preferences and characteristics that make them more likely to select in a peer and these characteristics are important determinants of the dependent variable. Correlated effects may emerge if individuals share common environments and unobserved shocks (i.e. rainfall in

the village) that make their consumption move simultaneously, independently of any genuine peer effects. Finally, endogenous effects represent the phenomenon where the group affects individual behavior through social interaction (i.e. is the individual's consumption choice are positively or negatively affected by the group consumption choice?). It is the third effect what we are trying to separate in this study.

Much of the literature following Manski has focused on the econometric issue of separating the causal peer effect from that of correlated unobservables (Conley and Udry, 2010; Miguel and Kremer, 2004; Bandiera and Rasul, 2006). Two ways of disentangling these effects are to (1) randomize the peers (Sacerdote, 2001; Duflo and Saez, 2003) or (2) randomize an intervention or new technology (Oster and Thornton, 2012; Godlonton and Thornton, 2012; Kremer and Miguel, 2007). We follow the first approach.

The double randomization in our experimental design, that is, first randomly selecting households to perform the experiment given the sampling procedure and second randomizing peer and control treatments according to villages, circumvents the problem of correlated and contextual effects. Given our random assignment of individuals to play the game alone or in a group, we are able to create counterfactual groups out of those individuals that played the game at the same time as their peers, however, without directly observing their peers. We have two types of groups, those that performed the experiment directly observing each other and those that played the game at the same time in the same room, but not directly observing each other. Hence, the only difference between our treatment and control group is that the treatment group observed their peers and the control group did not.

As a check of the randomization, in Table 5.2 and Table 5.3 we present individuals' characteristics for the observing and non-observing groups, as well as tests of equality of characteristics across groups. As expected from the random assignment into each group, the sample is well balanced across the baseline variables. We try to overcome the reflection problem by the identification of endogenous peer effects with the so-called leave-out mean. We use this as the regressor in our main analysis to identify the effect of the group average consumption on the individual consumption choice.

To identify the effects peer observation, we will estimate the main regression model in the following form using least squares estimation:

$$y_{ij} = \beta \bar{y}_{-i,j} + \gamma \bar{x}_{-i,j} + \delta x_{i,j} + u_{i,j}$$

In our framework, y_{ij} is the consumption choice of TT for individual i who has group affiliation j (observing or non-observing group). In our main analysis y_{ij} will be the last row in

which they choose the TT before switching to money. However, we also run similar regressions using an indicator variable if they always chose TT over money or if they decided not to choose TT at all. The coefficient of interest is β which is the mean of the group outcomes, net of individual i's outcome, a quantity commonly referred to as the leave-out mean

In many peer studies, researchers would use the group mean inclusive of the individual i, $\overline{y}ij$. However, outcome-on-outcome peer effects are vacuous, because regressing $\overline{y}ij$ on y_{ij} results in a coefficient of 1, entering unity. Therefore, any peer group measure must vary within groups in order to satisfy the rank condition. This would rule out taking the average outcome of the group as the regressor. Instead taking the leave-out mean allows inter-group correlation coefficients since there is a different group average for each respondent, calculated from the decision of the other group members. There is hence an unique group mean for each respondent, calculated from all other members of the group. This approach has previously been used by Townsend (1994), Guryan et al. (2008), Duflo et al. (2011), Carrell et al. (2012) and advocated by Angrist (2014).

Following this, we also include the variable $\overline{x}_{-i,j}$ which is the vector of average individual's socio-economic characteristics in group j, excluding the individual i. The variable x_{ij} includes individual characteristics only. Individual characteristics that we control for are gender, age, schooling, log consumption, household size, dependency ratio, algebra knowledge and BMI as these could affect consumption decisions. In the robustness section, we also include specific village characteristics such as the travel distance to the district town, the provincial capital, the average number of shocks a village experienced in the last two years and the number of households living in the village.

The error term is clustered u_{ij} on the village level. Hence, $\beta\overline{y}_{-i,j}$ measures the endogenous effect (i.e. the peer effect). If β is > 0, positive peer effects persist in a group, $\beta=0$ implies absence of peer effects, while these effects are negative if $\beta<0$. From the conceptual framework above, we expect that β is positive if the experiment is performed with peer observation, while we expect β to be negative if the game is played without peer observation. The parameter $\gamma\overline{x}_{ij}$ implies the contextual effect, u_{ij} is the correlated effect.

As we assign respondents randomly into peers groups, we assume $E(uij \mid xij) = 0$, i.e., no correlated effects or self-selection into groups. In our particular case, the randomization of individuals into observing and non-observing groups rules out correlation between the individual effect and any endogenous or exogenous effect, thus satisfying the condition, Cov($E(\overline{y}_{-i,j} \mid uij)$) $\neq 0$. In other words, since uij is not correlated with $\overline{y}_{-ij}$, we can avoid the classical problems described above and infer a causal relationship between y_{ij} and $\overline{y}_{-ij}$. Thus, if we observe a

difference in outcomes between observing and non-observing groups we can attribute this directly to the (on average) only difference between these groups - peer observation.

5.4   Results

5.4.1 Descriptive Statistics

Table 5.1 shows individual characteristics of our sample. First, we have significantly more women in our sample (60%). As we are deliberately sampling the household head, the average age is relatively high at 54 years and 82% of respondents are married. Socio-demographic characteristics of our sample are typical for rural northern Thailand; education levels are still relatively low with less than six years on average. The average household has more than four members with a dependency ratio of 1.45 dependents for every working member. The vast majority of respondents name farming as their main occupation, with the rest being made up of government officials, business owners, students and housewives. As this study uses eatable goods to examine the consumption of temptation goods, it is interesting to look at BMI, a standardized measure of weight to height ratio. The average in our sample is 23 which is the normal BMI range according to the WHO. In terms of village characteristics, the average distance to the next district capital is 16 km and to the provincial capital, Ubon, it is 60 km. This is important to know and to control for because the demand for the temptation good may be larger the larger the distance of the village to the nearest town. The average number of shocks in our 66 villages was 1.45 ranging from 1 to 3 shocks in total. The number of households in a village varies significantly from 813 households close to the provincial capital to 55 households for villages furthest away from Ubon. Peer effects may be larger the smaller the village is because people may know each other better. The Table highlights the variation across villages in their proximity to markets. Despite considerable growth in rural Thailand over the last decades, the north east is still relatively poor which is reflected in the average rate of consumption and average household wealth.

In addition to standard socio-demographic variables we also collected a number of variables that are designed to measure cognitive abilities. This allows us to study peer effects and how these interact with cognitive ability. Firstly, we collected a number of math based questions. In a first step, we awarded one point for each question answered correctly. The average score achieved is 3.6 out of six. Numeracy shows a near normal distribution with 1.99% scoring no point and only 4.81% scoring full six points. Second, we asked respondents to name as many animals as they can in 60 seconds. The average number of animals named is 17.29; however the standard deviation for this measure is rather large at 5.86. The correlation between the two cognitive ability measures, numeracy test and word fluency is 0.355 (Spearman; p-value<0.001).

Thus, the two tests capture a similar underlying trait but also distinct aspects of cognitive ability. Third, we follow the same procedure as Dohmen et al. (2010) and use a single combined measure of cognitive ability.

Finally, we also measure overconfidence of our respondents to see whether over or underconfident respondents are more susceptible to peer effects. We define a subject whose math prediction is higher than her actual score as overconfident, and a subject whose prediction is below her actual score is called underconfident. Using this measure, 40% of our sample are overconfident while 33% are underconfident. We find a positive correlation between cognitive ability and over/underconfidence. Overconfidence is positively correlated with scoring in the lowest 10% of cognitive tests (0.26, p-value<0.001). In contrast, the correlation between high cognitive skills (highest 10%) and underconfidence are 0.09 with a p-value of 0.001.

Table 5.2 shows results of our paired T-test and Wilcoxon rank-sum test to check for differences between treatment and control groups on an individual bases. This shows that randomization was mostly successful and that there is hardly any significant differences in observables between those that performed the experiment alone and those that played the game with peer observation. The only difference that can be seen is that those that played in a group on average have more children which is statistically significant in the t-test and Wilcoxon rank-sum test. The distance to Ubon, the provincial capital, is also larger in the control group, according to both tests. We will hence control for this difference in any further analysis.

As this study does not only compares the behavior of individuals but also looks at the behavior of groups, it is important to check that group composition is the same between those that played in observing and those that played in non-observing groups. There are 126 groups in total. 60 groups are observing group, while the rest are non-observing group. Table 5.3 shows that group composition stays mostly same on average when looking at measured observables. In line with Table 5.2, Table 5.3 shows that on average respondents assigned to the treatment group have a higher number of children, which is significantly different for both the t-test and the Wilcoxon –rank-sum test. This difference is also controlled for in further analysis.

5.4.2   Comparing groups

We begin our analysis of the effects of peer observation by studying the difference between those groups that played the game observing each other and those that played the game at the same time and under the same conditions but not observing each other. T-tests and Wilcoxon rank test compare decisions between the two types of groups in Table 5.4. Most striking at first is that there is no difference in the mean of the last row that was chosen in each experimental situation. Hence, the average last row chosen in observing as well as non-observing

groups is the same. However, we can see a difference between the standard deviation between those groups that played together and those that did not. The standard deviation of groups that observed each other is significantly lower than for those groups that did not observe each other. Those that play in a group are less likely to switch either very early or very late. This can also be seen when looking at the group minimum and the group maximum. The group minimum is the lowest switching point within the group, i.e the earlist that anyone in a group switched, whereas the group maximum is the highest switching point within a group. We can see that the group minimum is significantly higher and the group maximum is significantly lower when the game is played with peers observing each other. In other words, we find evidence for converging consumption choices when respondents observe each other. This finding is in line with Falk and Ichino (2006) who find that the standard deviation of output from subjects who have been allocated to pairs is statistically different from those in the single treatment.

We further test this finding using a regression analysis with results shown in <u>Table 5.5</u>. The relationship between peer observation and the outcome variables stay the same as above. Peer is a dummy that is unity if the group that played with peer observation. In these regressions we control for group level characteristics. When the experiment is played with peer observation, standard deviation of choices within the group is lower. The same can be seen when looking at the group minimum and maximum. The coefficient on the peer dummy is positive in the regression estimating the group minimum and negative and significant in the regression estimating the group maximum.

Interestingly, group composition seems to otherwise only have a limited influence on the tasty treat choice. Groups with more women switch from tasty treat to money earlier. Similarly, there seems to be an effect of groups that are richer i.e. that have higher average consumption.

5.4.3   Peer observation

As a next step we look at peer effects in detail. We are coming to our main result, namely that we find an effect of the group average on individual decision-making in consumption choice. We investigate an endogenous peer effect by calculating the group average by excluding the individual herself. We employ the empirical strategy discussed in section 3.2. Results are presented in Table 6, Panel A. We are only present the coefficients of interests, but we control for both individual and group characteristics (Full results are available upon request). In the first two columns we look at the full sample. We find that there is a significant and positive relationship between the average switching point in the group and individual's switching point. When looking at these results only, it is conceivable that this relationship may be caused by correlated or contextual effects as described by Manski (1993).

In the next four columns however, we split out sample into those that played the game in observing groups and those that played in non-observing groups (denoted as Peer and Single). In columns 3 and 4 we show results for those individuals that played in observing groups with and without control variables. We can see that the effect here is significant and stronger than for the full subject pool. Columns 5 and 6 show the same regression but for respondents that play the game without peer observation. Here the effect of the average peer choice on the individual's switching row is zero. We can clearly see that the effect observed in columns 1 and 2 is caused by peers observing each other directly and not caused by unobserved correlated variables. Similarly, in columns 7 we introduce an interaction term between the group average and a dummy that is one if the game was played in an observing group. The interaction term is positive and significant and so we can conclude that the relationship between the group average and the point of switching is not the same between observing and unobserving groups.

In Table 6 Panel B and Table 6 Panel C we perform the same exercise, but with different dependent variables to see whether individuals consumption decision is still affected by the group for those that made extreme choices. In Panel B we use a dependent variable that is 1 if the respondent chose to the TT in every round. In Panel C we also use a variable that is 1 if the respondent never chose the TT and hence prefers the money in every row 1. Both tables exhibit the same pattern as the previous table. The group's average consumption choice does influence the individual's choice in both tables. Panel B shows that when the group consumption average increases in the peer treatment, the more likely the respondent is to choose the TT in every round. This effect is highly significant at the 1% significance level even when controlling for observable factors. Conversely in Table C, we find that if the group average is higher it is less likely the respondent never chooses the TT. Most importantly, this relationship only holds if the decisions are made under peer observation and does not hold if the game is played at the same time but without observation.

Noticeable is also the relative high R^2 in all peer-observation regressions. The individual characteristics plus the group average excluding the individual seem to explain a significant share of the variation in the dependent variable. Hence, we find that observability of the behavior of peers matters and leads to conforming behavior. These results confirm the prediction made by the model in section 3.1.

5.4.4 Mechanisms

So far we have shown that the standard deviation of choices in groups is smaller, as the maximum switching row in groups is lower and the minimum switching point is higher if the experiment is conducted with peer observation. At the same time, we were able to show that

individuals are clearly influenced by their groups, as group averages have an influence on the individual decision.

In this section, we will now attempt to look into the mechanism that operates these observed effects. In the literature a number of reasons behind peer effects are discussed (Cai et al., 2009, Bikhchandani et al., 1998). We here attempt to look at two factors. Firstly, peers effects have been argued to be caused as respondents believe that others have better information. Secondly, individuals could simply follow their peers because they are gaining some kind of network externality from doing the same as others in their group. Due to the set up of our experiment, we are unable to provide definite answers. None the less, these results provide some interesting insights into the mechanisms that are behind out observed peer effects.

We will here discuss the effect of information since peer effects have been extensively examined in the context of informational spillovers (Conley and Udry, 2010; Miguel and Kremer, 2004; Foster and Rosenzweig, 1995; Oster and Thornton, 2012). As described above, we asked respondent to estimate how much the tasty treat costs to buy in a shop. We use this response as a proxy for how familiar the respondents are with the product. We create a dummy that is unity if the respondent wrongly estimates the price. We introduce this dummy, together with an interaction term between the dummy and the leave-out-mean into the regression as described above. Results are shown in Table 7. Interestingly, unfamiliarity with the tasty treat makes the respondent less likely to choose the tasty treat, but only in the single treatment. Not knowing the price of product has no effect on the on the choice likelihood to choose the tasty treat in the peer treatment.

These results indicate to us, that peer observations counteract the effect of a lack of information on a product. Gaining information from peers, therefore, seems to play a role in peer effects observed in our experiment. At the same time we find evidence of people following each other. However, we cannot draw definite conclusions about the mechanism behind peer effects. Network externalities could be at play here in addition to information effects.

5.4.5 Treatment Heterogeneity

In this section, we test whether certain personality types are more likely to succumb to peer effects. It is conceivable that high (low) cognitive ability individuals within their group are able to resist (succumb) to peer effects. To the best of our knowledge, this is so far the first study looking into the interplay between peers effects and certain personality types. Yet, there is a growing literature linking cognitive ability and financial literacy to better behaviors and outcomes (see for instance Agrawal and Mazumder, 2013; Bertrand and Morse, 2011). We

hypothesize that high cognitive ability individuals should be less susceptible to peer pressure while the opposite should be true for low skilled respondents.

As discussed above we included a number of question designed to study cognitive ability. We created a dummy for those that score the highest and lowest cognitive ability score compared to their peers within the group. As before standard errors are adjusted for clustering at the village level. Table 5.8 shows results. We find slight evidence that the high cognitive ability individuals are less susceptible to peer effects. The result is statistically significant (p-value<10%) but does not hold when we control for socioeconomic characteristics. We do not find statistically significant results for having the lowest cognitive ability in the group.

We further would like to investigate whether overconfidence has an interplay with peer effects. We hypothesize that those who are overconfident may be less susceptible to peer pressure. Similar to the procedure performed with cognitive ability, we created a dummy for those in the group who are overconfident. We do not find a statistically significant result. Hence, we do not find is that overconfidence matters in terms of peer decisions (Details upon request).

The same analysis as in Table 8 has been performed for higher and lower consumption individuals within the groups. We generate a dummy for the highest and lowest consumption individual compared to their peers in the group and do not find any effect (Details upon request).

5.5 Robustness and sample splits

Strictly speaking it is conceivable that the peer effects that we observe in section 5.4.2 are not caused by peer effects since our randomization took place on the village level rather than the individual level. For this to happen the randomization would have had to work in a way that means that those that played in observing groups are more alike than those that played in non-observing groups. Since the number of groups is fairly large and we are also able to control for a large number of observable factors, we believe that such concern can be neglected. However, to further exclude doubt, we test whether standard deviations of observed variables, are the same between observing and non-observing groups. Results are shown in Table 5.A1. From the T-test in this table we can see that standard deviations are the same for observing and non-observing groups. We therefore reject the idea that our results are caused by observing groups being more similar to non-observing groups.

Furthermore, we check whether in addition to the distance of the villages to Ubon, the provincial capital city, distance to the nearest district capital has an impact on the demand for temptation goods since it is possible that villages that are close to urban areas could get the tasty treat more easily. This could determine the impact of peer effect. We do not find that the distance

to the provincial capital or the district capital has any impact on the peer effects and results found in Table 5.6 stay the same.

We check if there is an effect of higher food consumption on the likelihood of choosing the TT. We find no effect of food consumption.

Next, we also check if the main results hold when we change the way the dependent variable is coded. In order to do this, we create two dummies. The first takes the value of one if the respondent either switched before the money amount increased to 40 Baht, the second takes the value of one of the respondent switches after the money amount is increased to 40 Baht. We run all the regressions again and find that the results do not change. Table 5.A2 reports results. The group average still has a significant effect on these outcome variables.

In the next step, we would like to see whether the timing of the experiment matters. First, we test whether peer effects are more pronounced at the beginning of the month than at the end since it may be related to income-related effects although many of the respondents are farmers. We do not find any change in results for the first half or last half of the month. Results reported in Table 5.6 remain unchanged.

In the next step, we investigate whether morning or afternoon sessions would have a confounding effect observed peer effects. We create an dummy variable for morning and afternoon session and an interaction terms with the group average excluding the individual and include this in our regression analysis described in section 3.2. We find that there is no difference between results played in the morning or afternoon sessions. However, when we further split the sample of observing peer groups that played in the morning and those that played in the afternoon, we can see that the results of peer observation are mostly driven by those that played in the morning. It seems that peer effects on consumption decision are especially pronounced in the morning (0.74, p-value=0.01), however, in the afternoon they are less strong (0.35, p-value=0.11). Results are available upon request.

In each village, we played two sessions. It is important to see whether the first or the second session influences results. We focus particularly on the session with regard to the peer treatment. We find that whether individuals were part of the first or the second session does not make a difference in results. Taking the entire or merely the observing groups, we find that regardless whether one group played before the other, peer observation seem to have an impact on the consumption choice of the individual.

Further it would be interesting to know what peer effects are stronger. We look at whether villages with fewer households have a stronger magnitude of peer observation. When we introduce an interaction term between small village (147 households or lower, which is below the median) and the group average excluding the individual this remains insignificant, indicating

that peer effects are not stronger in small or large villages. However when we split the sample into those that live in small villages and those that live in large villages, we find that the effect of the peer observation is mostly driven by those living in small villages. In villages with fewer households, peer observation seems especially pronounced (0.627, p-value=0.00). The magnitude and significance vanishes when we use only large villages - those having above 147 households (0.010, p-value=0.98), hence our results seem to be driven by those that live in small villages. Results are available upon request. In addition, it seems that women in small villages tend to opt for the tasty treat more than in the larger villages. It is statistically significant at the 1% level. It seems that in small villages where people are more likely to know each other better, peer effects are stronger than in large villages.

However when we do these sample splits it is important to remembers that the number of observations in each regression becomes rather small of just around 100 people or fewer.

5.6   Conclusion

In a standard economic model of consumption choice, the effect of peers is largely ignored. Our study shows that peers observation has an effect on the individual consumption choice of temptation goods.

We start off with introducing a conceptual framework that introduces a cost if the individual makes a decision that deviates from that of the group. From this framework we can see that the demand function of the temptation good is less steep under peer observation. Hence extreme choices are less likely under peer observation. We can also derive a positive relationship between the average group choice and the individual choice.

In a clean experiment conducted in rural Thailand, we ask participants to choose between a temptation good and an increasing amount of money. In the control group, respondents perform the experiment at the same time as their peers but without observing each other. In the treatment group peers still make individual choices, but observe each other whilst doing it.

Due to the experimental nature and the large number of control variables, we can circumvent the identification problems normally associated with studies on peer effects. We find that standard deviations of those groups that observe each other are higher than for those groups that do not observe each other. At the same time, we show that individual choices are higher when the leave out group mean is higher. Most importantly, we only observe this when the experiment is performed with peer observations. We hence show clean evidence of peer effects and conclude that peer observation leads to conformity between peers.

This result is in line with theoretical models of herding (Banerjee 1992, Bikhchandanu, Hirschschleifer, and Welch 1992). Experimental evidence for conformity is found for example in

Cai et al. (2009) where customers of a Chinese restaurant learn from the information contained in the choices of others and behave in the same way. It also is in line with the experimental finding of Bolton and Ockenfels (2000) and Fehr and Schmidt (1999) who find possible explanations for herding behavior such as the reduction in expected inequality or inequality aversion among subjects. The direction of our effects is in line with those of Bandiera et al. (2010), Bursztyn et al. (2014) and de Giorgi (2010) for positive and significant peer effects on individual behavior

We further study the effect of familiarity with the product and find that peer observation can counteract the effect of a lack of knowledge of a product. Looking into treatment heterogeneities, we find that individuals with high cognitive ability, compared to their group, are less susceptible to peer effects, while the same effect is not to be found for low income, overconfident or high-income individuals. We also test for the timing of the peer effects and find no significant changes in results.

Despite these findings, a lot of open questions remain that call for further research into peer effects and their effect of consumption choices. So far, there is no consensus on the "best" method for identifying peer effects, in part because models and methods must necessarily be case-specific. However, understanding the complexity of peer effects seems yet to be sufficiently explored. While initial estimates of such effects have been made, existing studies can and should be supplemented with spatial or non-linear analysis accounting for heterogeneous impacts. Furthermore, more research is needed that looks into the mechanisms behind peer effects. In more detail, a more structured experiment may be able to disentangle the effect of information and network externality and so explain why we find this conformity when peers observe each other. In addition, research could be done into the effect of key individuals within a group, that is to investigate who leads a group and who in a group follows. Another open question is how long peer effects may persist.

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Table 5.1: Summary Statistics of Individual and Village Characteristics

	Mean	Std. Dev	Min	Max	Count
Individual Characteristics					
Female	0.60	0.49	0	1	543
Age	54.21	13.84	14	86	543
Married	0.83	0.38	0	1	541
Years of education	5.63	3.10	1	17	529
Household size	4.05	1.72	1	12	502
Number of children	1.13	1.06	0	7	513
Dependency Ratio	1.48	0.67	0	6	491
Farmer	0.69	0.46	0	1	502
Own business	0.06	0.23	0	1	502
Government official	0.02	0.14	0	1	502
Body Mass Index	22.99	3.77	12	37	494
Consumption per capita	2397.42	1881.06	396	15638	547
Wealth per capita	18279.79	31418.43	201	365995	502
Numeracy	3.55	1.39	0	6	555
Number of animals named	17.22	6.04	4	44	553
Overconfident	0.36	0.48	0	1	298
Cognitive ability, pca	-0.03	1.40	-4	5	553
Village Characteristics					
Travel distance to district town	15.96	9.68	2	40	550
Travel distance to provincial capital	59.44	35.49	2	145	550
Number of village shocks	1.45	0.63	1	3	265
Number of households	167.01	89.45	55	813	535
Observations	555				

Notes: The Table reports descriptive statistics. Household size is the headcount of persons living in the household for at least 180 days. Body Mass Index is computed weight/height². Numeracy is the score out of six math questions (Details can be found in Appendix B). Number of animals named is the number of animals that someone can name in 60 seconds. Overconfident is a dummy that is unity if the respondent is overconfident. Cognitive Ability Measure is a PCA generated by performing principal component analysis on the numeracy score and the number of animals named in 60 seconds. Distance to district town/provincial capital is the average distance of the village to the provincial capital in kilometers.

Table 5.2: Comparing Individual Treatment and Control Group

	Control	Treatment	T-Test p-value	Wilcoxon-Rank p-value
Individual Characteristics				
Female	0.57	0.62	0.28	0.27
Age	54.17	54.11	0.96	0.89
Married	0.80	0.85	0.13	0.13
Years of education	5.61	5.61	0.85	0.56
Household size	4.08	4.01	0.64	0.84
Number of children	1.22	1.01	0.06	0.06
Dependency Ratio	1.51	1.41	0.20	0.34
Farmer	0.69	0.69	0.98	0.98
Own business	0.05	0.06	0.60	0.59
Government official	0.03	0.01	0.28	0.28
Body Mass Index	23.03	22.93	0.77	0.75
Consumption per capita	2299.92	2507.79	0.20	0.48
Wealth per capita	10699.97	11095.22	0.81	0.20
Numeracy	3.55	3.57	0.85	0.58
Number of animals named	17.22	17.20	0.97	0.94
Overconfident	0.40	0.43	0.53	0.53
Cognitive ability, pca	-0,025	-0,029	0.96	0.95
Village Characteristics				
Travel distance to district town	16.16	15.67	0.55	0.76
Distance to provincial capital	65.05	53.68	0.00	0.00
Number of village shocks	1.47	1.41	0.48	0.76
Number of households in village	163.23	171.78	0.27	0.82
N (Individual)	552			

Notes: The Table reports t-test and Wilcoxon ran sum test between treatment and control groups. Household size is the headcount of persons living in the household for at least 180 days. Body Mass Index is computed weight/height². Numeracy is the score out of six math questions (Details can be found in Appendix B). Number of animals named is the number of animals that someone can name in 60 seconds. Overconfident is a dummy that is unity if the respondent is overconfident. Cognitive ability, pca, is the score generated by performing principal component analysis on the numeracy score and the number of animals named in 60 seconds. Distance to district town/provincial capital is the average distance of the village to the provincial capital in kilometers

Table 5.3: Comparing Observing and Non-Observing Groups

Group averages	Non-observing Groups	Observing Groups	T-Test p-value	Wilcoxon-Rank p-value
Female	0.58	0.63	0.30	0.24
Age	54.32	54.18	0.91	0.50
Married	0.81	0.85	0.14	0.12
Years of Schooling	5.55	5.68	0.69	0.86
Household size	4.09	4.02	0.65	0.64
Number of Children	1.23	1.02	0.03	0.03
BMI	23.09	23.07	0.95	0.82
Log consumption	7.57	7.63	0.26	0.22
Feeling	2.22	.226	0.64	0.52
Overconfident	0.43	0.43	0.95	0.98
Cognitive ability	-0.03	-0.02	0.94	0.76
N (Groups)	126			

Notes:

The Table reports T-Test and Wilcoxon Rank test between observing and non-observing peer groups. Control Variables stay the same with the exception of feeling which asks how the respondent feels today before the start of the experiment. It is coded from 1(very good) to 5 (very bad).

Table 5.4: Comparing Outcome for Observing and Non-Observing Groups

Pay TT	Single	Peer	T-Test p-value	Wilcoxon-Rank p-value
Mean	2.94	2.93	0.91	0.70
Standard Deviation	2.26	1.70	0.00	0.00
Group maximum	5.74	4.93	0.01	0.04
Group minimum	0.68	1.21	0.03	0.11
N(Groups)	126			

Notes:

The data here compares observing and non-observing groups. There are 60 observing groups and 66 non-observing groups.

Table 5.5: Group level effects of peer treatment

	(1) Mean row	(2) Standard Deviation	(3) Maximum last row in group	(4) Minimum last row in group	(5) Maximum number that switch at any one point
Peer observation	0.04	-0.48***	-0.11*	0.64**	0.03
	[0.29]	[0.17]	[0.07]	[0.28]	[0.03]
Mean Female	-1.35**	-0.69**	-0.41***	-0.48	-0.05
	[0.56]	[0.34]	[0.14]	[0.51]	[0.07]
Mean Consumption	0.74	-0.29	0.06	1.19**	0.16**
	[0.54]	[0.31]	[0.11]	[0.57]	[0.06]
Mean Age	-0.01	-0.02	-0.00	0.00	0.00
	[0.02]	[0.01]	[0.00]	[0.02]	[0.00]
Mean Cognitive Ability	-0.11	-0.12	-0.05	0.09	-0.02
	[0.21]	[0.11]	[0.05]	[0.18]	[0.03]
Mean married	-0.83	-0.74	-0.32**	-0.37	0.12
	[0.78]	[0.46]	[0.16]	[0.78]	[0.09]
Mean No of Children	0.04	0.03	0.06	0.26	0.03
	[0.31]	[0.17]	[0.07]	[0.27]	[0.04]
Mean Schooling	0.07	0.08	0.03	-0.08	-0.01
	[0.09]	[0.06]	[0.02]	[0.09]	[0.01]
Mean Household Size	0.02	-0.06	-0.00	0.03	0.01
	[0.18]	[0.09]	[0.04]	[0.16]	[0.02]
Mean Feel	-0.20	-0.03	-0.01	-0.13	0.06
	[0.28]	[0.18]	[0.07]	[0.24]	[0.04]
Mean Overconfident	0.40	-0.19	-0.06	0.71	-0.08
	[0.65]	[0.36]	[0.14]	[0.62]	[0.09]
Mean BMI	-0.01	0.04	-0.01	-0.06	0.00
	[0.07]	[0.04]	[0.02]	[0.05]	[0.01]
Constant	-0.41	5.17**	2.03**	-7.83	-1.21**
	[4.48]	[2.42]	[0.89]	[5.12]	[0.56]
R²	0.08	0.18			0.13
Observations	126	126	126	126	126

Notes:

The table reports regression results with clustered standard errors in brackets. ***, ** and * denote significance at the 1%, 5% and 10% levels, respectively. Peer observation is a dummy that is 1 if the game is played with peers observing each other. Columns 3 and 4 show poisson results.

Table 5.6 Panel A : Peer observation and individual consumption choice

	Last row TT All	Last row TT All	Last row TT Peer	Last row TT Peer	Last row TT Single	Last row TT Single	Last row TT All
Group av. ex.individual	0.44***	0.40***	0.67***	0.63***	0.01	-0.02	0.30**
	[0.08]	[0.10]	[0.07]	[0.13]	[0.18]	[0.20]	[0.12]
Peer *group av. ex. Ind.							0.16**
							[0.08]
Group characteristics (excluding individual)	No	Yes	No	Yes	No	Yes	Yes
Individual characteristics	No	Yes	No	Yes	No	Yes	Yes
R²	0.08	0.12	0.25	0.30	0.00	0.12	0.14
N	537	435	256	197	278	235	432

Notes:
The table reports OLS regression results with clustered standard errors in brackets. ***, ** and * denote significance at the 1%, 5% and 10% levels, respectively. The dependet variable is the last row that a respondent chose the tasty treat. Column 1 and 2 show results for the full sample, columns 3 and 4 show results for those that played with peer-observation. Columns 5 and 6 report results for those that performed the experiment alone. The last column shows the full sample, but includes an interaction term between Peer observation and mean excluding the individual. All regression in even columns include a full set of control variables or individual characteristics and group characteristics excluding the individual.

Table 5.6 Panel B : Peer observation and individual consumption choice

	Always TT All	Always TT All	Always TT Peer	Always TT Peer	Always TT Single	Always TT Single	Always TT All
Group av. ex. individual	0.16**	0.19**	0.26***	0.47***	-0.01	0.07	0.14**
	[0.05]	[0.06]	[0.06]	[0.12]	[0.09]	[0.09]	[0.07]
Peer *group av. ex. individual							0.07
							[0.05]
Group characteristics (excluding individual)	No	Yes	No	Yes	No	Yes	Yes
Individual characteristics	No	Yes	No	Yes	No	Yes	Yes
Pseudo R²	0.03	0.13	0.11	0.37	0.00	0.17	0.13
N	537	435	256	197	278	235	432

Notes:
The table reports Probit regression results with clustered standard errors in brackets. ***, ** and * denote significance at the 1%, 5% and 10% levels, respectively. The dependent variable is 1 if the respondent always chose the tasty treat. Column 1 and 2 show results for the full sample, columns 3 and 4 show results for those that played with peer-observation. Columns 5 and 6 report results for those that performed the experiment alone. The last column shows the full sample, but includes an interaction term between Peer observation and mean excluding the individual. All regression in even columns include a full set of control variables or individual characteristics and group characteristics excluding the individual.

Table 5.6 Panel C : Peer observation and individual consumption choice

	Never TT All	Never TT All	Never TT Peer	Never TT Peer	Never TT Single	Never TT Single	Never TT All
Group av. ex. individual	-0.15**	-0.15**	-0.25***	-0.28**	0.02	-0.00	-0.12*
	[0.05]	[0.06]	[0.07]	[0.09]	[0.08]	[0.09]	[0.07]
Peer *group av. ex. individual							-0.07
							[0.05]
Group characteristics (excluding individual)	No	Yes	No	Yes	No	Yes	Yes
Individual characteristics	No	Yes	No	Yes	No	Yes	Yes
Pseudo R²	0.02	0.07	0.08	0.20	0.00	0.11	0.07
N	537	435	256	197	278	235	432

Notes:
The table reports Probit regression results with clustered standard errors in brackets. ***, ** and * denote significance at the 1%, 5% and 10% levels, respectively. The dependent variable is a dummy that is 1 if the respondent never chooses the tasty treat. Column 1 and 2 show results for the full sample, columns 3 and 4 show results for those that played with peer-observation. Columns 5 and 6 report results for those that performed the experiment alone. The last column shows the full sample, but includes an interaction term between Peer observation and mean excluding the individual. All regression in even columns include a full set of control variables or individual characteristics and group characteristics excluding the individual.

Table 5.7 : Peer observation and familiarity with product

	Last row TT All	Last row TT All	Last row TT Peer	Last row TT Peer	Last row TT Single	Last row TT Single
Group av. ex. individual	0.44***	0.33*	0.83***	0.76***	-0.38*	-0.48*
	[0.15]	[0.17]	[0.13]	[0.17]	[0.22]	[0.26]
Unfamiliarity	-0.12	-0.45	0.92	1.05	-2.10***	-2.59***
	[0.58]	[0.66]	[0.58]	[0.86]	[0.74]	[0.92]
Group av.* Unfamiliar with product	-0.01	0.08	-0.20	-0.16	0.48**	0.55*
	[0.16]	[0.18]	[0.18]	[0.25]	[0.22]	[0.29]
Group characteristics (excluding individual)	No	Yes	No	Yes	No	Yes
Individual Characteristics	No	Yes	No	Yes	No	Yes
R²	0.08	0.13	0.26	0.31	0.02	0.15
Observations	537	442	256	203	278	235

Notes:
The table reports OLS regression results with clustered standard errors in brackets. ***, ** and * denote significance at the 1%, 5% and 10% levels, respectively. The dependent variable is the last row that the respondent chooses the tasty treat. Coloumn 1 and 2 show results for the full sample. Column 3 and 4 show results for those that played with the peer observation. Columns 5 and 6 show results for those that played without peer-observation. In even columns full controls are included.

Table 5.8 : The effect of highest and lowest cognitive ability in group

	Last row TT Peer	Last row TT Peer	Last row TT Peer	Last row TT Peer	Last row TT Peer	Last row TT Peer
Group av. Ex. individual	0.68*** [0.06]	0.78*** [0.08]	0.69*** [0.14]	0.67*** [0.07]	0.67*** [0.07]	0.65*** [0.12]
Highest CA in group	-0.79* [0.38]	0.38 [0.58]	-0.25 [0.77]			
Highest CA* Group av. ex. individual		-0.38* [0.16]	-0.20 [0.19]			
Lowest CA in group				-0.24 [0.39]	-0.30 [0.61]	-0.06 [0.95]
Interaction lowest CA* Leave out mean					0.02 [0.18]	-0.16 [0.31]
Group characteristics (excluding individual)	No	No	Yes	No	No	Yes
Individual characteristics	No	No	Yes	No	No	Yes
R²	0.27	0.27	0.32	0.26	0.26	0.31
Observations	256	256	197	256	256	197

Notes:

The table reports OLS regression results with clustered standard errors in brackets. ***, ** and * denote significance at the 1%, 5% and 10% levels, respectively. All regressions show results for those that played under peer treatment only. The dependent variable is the last row that the respondent chose the tasty treat.

Appendix 5.1

Instructions:

We would now like to play a game with you in which you have to choose between some tasty goods or money. At the end of the game you can keep either the tasty goods or the money.

We will ask you to choose between the two options 7 times. Each time we ask you, we increase the amount of money. The amount of tasty goods will always be the same. The enumerator will write down your choice each time we ask you.

After the game, we will draw a number from a bag. This determines which of the two options you get. The tasty good will be given to you straight after the game. The money, however, will be given to you at the end of the whole survey.

You will only receive one option. Either money or tasty good.

Example: No.3 is drawn from the bag. For the third decision you chose the tasty treat, so you will get the tasty treat immediately.
Enumerator put tasty good on the table.

1 Enumerator will present the tasty good and ask the following question. Please estimate the price of the tasty treat in the market.
Price of tasty treat_____ (THB)

Enumerator tells respondent that the price of the tasty present is THB 40 and put up the sign that shows the price.

2 Please choose!

Tasty Good	Tick Box	Money
1 Tasty Good		10 THB
2 Tasty Good		20 THB
3 Tasty Good		30 THB
4 Tasty Good		40 THB
5 Tasty Good		50 THB
6 Tasty Good		60 THB
7 Tasty Good		70 THB

3. What is the maximum you would to pay for the tasty good?_____THB

4. Now chance will decide! Please draw a number. Number drawn:_____

Appendix 5.2

Word fluency: I would like you to name as many different animals as you can in 60 seconds.

Numeracy Question 1:   What is 45 + 72?

Numeracy Question 2:   You have 4 friends and you want to give each friend sweets. How many sweets do you need?

Numeracy Question 3:   What is 5% of 200?

Numeracy Question 4:   You want to buy a bag of rice that costs 270 Baht, You only have one 1000 Baht note. How much change will you get?

Numeracy Question 5:   In a sale, a shop is selling all items at half price. Before the sale a mattress costs 3000 Baht. How much will the mattress cost in the sale?

Numeracy Question 6:   A second-hand motorbike dealer is selling a motorbike for 12000 Baht. His is two thirds of what it costs new. How much did the motorbike cost new?

Overconfidence: How many of the 6 math's questions above, do you think you have answered correctly?

Appendix 5.3:

Robustness excercises:

Table 5.3A1: T-test comparing standard deviations of observing and non-observing groups

Standard deviation	Control	Treatment	t	p
Female	0.42	0.42	0.17	0.87
Consumption	0.54	0.58	-0.90	0.37
Age	12.79	12.23	0.54	0.59
Cognitive ability	1.28	1.19	1.05	0.29
Married	0.31	0.25	1.33	0.18
Number of children	1.03	0.85	1.96	0.05
Schooling	2.24	2.22	0.06	0.95
Household size	1.51	1.52	-0.07	0.94
Feel	0.79	0.77	0.36	0.72
Overconfident	0.46	0.42	0.99	0.32
BMI	3.32	3.51	-0.61	0.54
N(Group)	126			

Table 5.3.A2 Panel A: pay overprice

	(1) overprice	(2) overprice	(3) overprice	(4) overprice	(5) overprice	(6) overprice	(7) overprice
Group av. ex. individual	0.16*** [0.04]	0.16*** [0.05]	0.28*** [0.05]	0.30*** [0.07]	-0.05 [0.09]	-0.04 [0.09]	0.09* [0.05]
Peer*group av.							0.11*** [0.04]
Group characteristics (excluding individual)	No	Yes	No	Yes	No	Yes	Yes
Individual Characteristics	No	Yes	No	Yes	No	Yes	Yes
R²							
Observations	554	456	264	209	287	244	453

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

Table 5.3.A2 Panel B: pay underprice

	(1) underprice	(2) underprice	(3) underprice	(4) underprice	(5) underprice	(6) underprice	(7) underprice
Group av. ex. individual	-0.22*** [0.04]	-0.21*** [0.05]	-0.35*** [0.05]	-0.33*** [0.07]	-0.01 [0.08]	-0.01 [0.09]	-0.15*** [0.05]
Peer*group av.							-0.10** [0.04]
Group characteristics (excluding individual)	No	Yes	No	Yes	No	Yes	Yes
Individual Characteristics	No	Yes	No	Yes	No	Yes	Yes
R²							
Observations	554	456	264	209	287	244	453

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

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