Universiteit Leiden
Governance and Global Affairs

Financial Literacy and Wealth Accumulation

In the Netherlands

Rosa de Koning (s2208490)
01/03/2020

Supervisor: Eduard Suari-Andreu

MSc Public Administration: Economics and Governance

Content

1. Introduction

Ability to deal with financial matters is not only personally convenient, but it is also becoming even more important concerning the increasing complexity of financial matters. As illustrated by Dirk Brounen (2017), government policy has been directed towards independent decision making of household members which requires them to make informed financial decisions. With this shift of policy towards personal responsibility of financial matters in mind, it would be an understatement to say financial literacy is important (Brounen, 2017). Financial literacy, first of all, refers to the knowledge of financial concepts (Hung, Parker, & Yoong, 2009). Secondly, it refers to the ability to make informed and effective decisions with personal financial resources, this decision making aspect of financial knowledge covers the ability to make use of this knowledge to "manage financial resources effectively for a lifetime of financial well-being" (President's Advisory Council on Financial Literacy, 2008, p. 37) (Hung, Parker, & Yoong, 2009). Additionally, financial literacy becomes important when looking at economic theory on consumption and saving patterns.

Saving and consumption behaviour of individuals can be modelled by the life-cycle model. This life-cycle model assumes people to be making consumption and saving choices depending on the phase of their life. This is done by saving during working life, to be able to consume after retirement. However, to be able to make this decision, one should possess the skills and knowledge to understand their current and future financial situation. This is where financial knowledge comes into play, it is essential in planning (Borella & Rossi, 2014). Financial literacy could enable individuals and households to increase pension wealth and help overall wealth accumulation (Borella & Rossi, 2014).

To investigate the relationship between financial literacy and the accumulation of wealth, this thesis will look into the following research question: "what is the effect of financial literacy on differences in wealth?". Other studies have indicated the potential issues with regard to this link being causal. For example, impatience is illustrated to make someone less likely to save. but this same impatience could also make someone less financial literate (Behrman, Mitchell, Soo, & Bravo, 2012). To understand the relationship between financial literacy and differences in wealth accumulation, this thesis uses the LISS panel data set.

This thesis dives into the literature regarding financial literacy and the life-cycle model. Secondly, the institutional context with regard to financial literacy in the Netherlands is elaborated on. A pooled OLS regression with several controls is conducted to estimate the effect of financial literacy on total wealth. Leading to the high significance of financial literacy on total wealth. Researching the different channels through which this relationship could go has led to the conclusion that financial literacy affects wealth accumulation by increased participation in investments. To try to account for problems of reversed causality, this thesis investigates the possibility of including several instruments under which the Big Five Personality trait Intellect/Imagination and by this contributes to the literature. This instrument has led to an insignificant effect of financial literacy on total net wealth.

2. Literature

In order to gain background knowledge on the relationship between financial literacy and wealth, this section provides an overview of research done on this. In general, the literature on financial literacy has identified overall levels of financial knowledge to be very low (Lusardi & Mitchell, 2011). Additionally, literature has identified financial literacy to have varying effects on households' accumulation of wealth and it is considered to positively impact different financial outcomes (Bucciol, Manfre, & Veronesi, 2018). Households and individuals with higher levels of financial knowledge are more likely to plan for retirement and invest in stocks (Bucciol, Manfre, & Veronesi, 2018) (van Rooij, Lusardi, & Alessie, 2012). Besides market participation and retirement planning, the accumulation of wealth has also been of interest for several additional studies (Behrman, Mitchell, Soo, & Bravo, 2012) (van Rooij, Lusardi, & Alessie, 2012). Whether the financial illiterate are less likely to accumulate wealth is considered relevant to public policy since financial education could possibly enhance the accumulation of wealth for households. Furthermore, the role of financial literacy in explaining differences in consumption/savings patterns have been considered of importance in the context of retirement planning. This because it can serve as an explanation for deviations from traditional (micro)economic theory with regard to consumption and saving patterns; the life-cycle model. This model requires consumers to have financial literacy in order to behave that way (Lusardi & Mitchell, 2017), more on the life-cycle model is visible in the theoretical framework section.

Dinkova, Kalwij & Alessie (2016) link financial literacy with consumption patterns. This due to the relevance of spending/saving behaviour in retirement planning. Their main questions are whether different levels of financial literacy lead to different consumption profiles and additionally what the role of investing in stocks and bonds and other financial assets is. They use a simple life-cycle model as an economic theoretical framework, which provides consumption profiles for households depending on financial literacy: the more literate the steeper the consumption profile. Data is derived from the LISS data and merged with the 2011 august data on financial literacy. Their focus is on financial knowledge and return on investments and their study takes household consumption as the dependent variable and financial knowledge as the independent variable. Authors continue by examining the relationship between financial literacy and several factors: investments, household consumptions and percentage consumption growth. Firstly, authors identify a positive association between financial literacy and the likelihood to invest in financial assets. Secondly, consumption levels are found to have "suggestive evidence confirming the prediction of a positive association" (Dinkova, Kalwij, & Alessie, 2016, p. 26). So, the authors found some evidence that corresponds to their first two hypotheses on investment and household consumption levels.

A positive relationship between financial literacy and households net wealth levels are confirmed by Behrman, Mitchell, Soo & Bravo (2012) and Van Rooij, Lusardi & Alessie (2011). These studies are of importance due to the lack of adequate saving behaviour by individuals for retirement. To

ensure people have enough financial assets after retirement, it is essential to plan a pension during the life-cycle (Nolan & Doorley, 2019). The phenomena of an ageing population is an additional motivation for studies on the effect of financial literacy on wealth accumulation. Trends of an increase in a number of older persons in combination with a relative decrease of the working population are and will in the future cause fiscal pressure on the ability of governments to provide pensions (Feldstein, 2006). Both studies firstly conduct an OLS regression to investigate the relationship between financial literacy and wealth accumulation, which turns out to be significant and positive for both studies. For the study of Behrman et all (2012), microdata from the Chilean Social Protection Survey is used with an additional focus on schooling. Furthermore, they look at channels through which the effect runs, which are the "density of pension contribution" (Behrman, Mitchell, Soo, & Bravo, 2012, p. 8) and retirement planning. The study by Van Rooij et al. (2012) specifically focuses on the role of financial literacy as a determinant of wealth accumulation (i.e. examine the relationship between financial literacy and household saving behaviour). An OLS regression of net total worth and financial literacy indicates a positive and statistically significant relationship. Van Rooij et al. (2012) additionally look into the possible channels through which this relationship between financial literacy and wealth accumulation flow, which turns out to be stock market participation and retirement planning. Data is derived from the DHS (De Nederlandsche Bank Household Survey) in which the authors have included measurement of financial knowledge in 2005. Also, the study by Sekita (2013) deals with a similar research question by using micro-data from Japan and confirms the positive relationship between financial literacy and wealth accumulation.

Causality

The positive relationship between financial literacy and wealth is not necessarily a causal relationship. Both Van Rooij et al. (2012) and Behrman et al. (2012) find a significant and possible association between financial literacy and wealth accumulation. However, both studies also indicate it is hard to say whether these positive effects derived from the OLS regression are, in reality, a causal effect. Potentially the accumulation of wealth could increase financial literacy. By accumulating more wealth, one could also learn more about financial matters and therefore become more literate, which would make the effect endogenous due to reversed causality. Additionally, this approach could suffer from omitted variable bias since another variable could affect both the accumulation of wealth as financial literacy in a positive or negative way. An example of such a variable is *ability*, this could impact of the dependent as independent variables and thus upwardly bias the OLS estimation (Behrman, Mitchell, Soo, & Bravo, 2012) (Alessie, van Rooij, & Lusardi, 2011). To address the concerns of possible omitted variables and reversed causality, studies can, for example, use an instrumental variables method. Van Rooij et al (2012) aim to deal with this issue by firstly looking at subjective financial literacy because this will include overconfidence by creating a dummy for respondents which have lower financial literacy in comparison to their own assessment. Furthermore, authors continue by conducting an IV estimation

with economic education as an instrument for "advanced financial literacy" (van Rooij, Lusardi, & Alessie, 2012, p. 12). By using an IV with the instrument of economic education they aim at estimating a causal effect of financial literacy on wealth accumulation. This effect is achieved due to an effect of financial knowledge on stock investments and more adequate retirement planning. Since economic education has strong predictive power for advanced financial knowledge it is relevant. Furthermore, authors assume it does not correlate with the error term in the wealth equation but this criterion could potentially not been met. These IV estimations confirm that financial literacy is positively related to wealth accumulation. Following some additional controls and an alternative instrument (financial conditions of siblings and financial knowledge of parents) illustrate the robustness of the results. The study by Behrnman et al. (2012) discovers in their IV approach positive and significant coefficient estimates which are higher than the OLS approach. They use an extensive set of possible instruments, which I will discuss more later in this chapter. Besides the IV approach, both authors try to look for channels through which the relationship is channelled as an additional strategy to overcome reversed causality.

Financial literacy

After the importance of financial literacy for saving behaviour was highlighted by Bernheim (1995), ways to quantify financial literacy have been developed (van Rooij, Lusardi, & Alessie, 2012). The module developed by Lusardi and Mitchel (2011b) consists of three questions to test financial knowledge. The first question asks respondents what happens to their savings given a certain amount of interest rates, the second question combines interest rates with inflation and the final question concerns the knowledge of risk diversification. The first two questions relate to basic financial knowledge and the final question concerns more advanced knowledge necessary to make informed investment decisions (Lusardi & Mitchell, 2011b).

The study by van Rooij et al (2012) uses the module of Lusardi and Mitchel (2011b) and added some extra questions on basic financial literacy like the time value of money. For advanced financial literacy, the authors designed a large set of more complex concepts which all relate to financial investments and the choice of a portfolio (van Rooij, Lusardi, & Alessie, 2012). In total 5 questions on basic financial literacy are conduced and 10 more questions on advanced literacy. The answers to these questions are besides being correct or not, further distinguished if respondents indicate they do not know the answers (which is also done by Lusardi and Mitchel (2011b)). For subjective financial knowledge, van Rooij et al (2012) ask the respondent to rank their understanding of economics based on a 7-point Likert-scale. Respondents who have ranked themselves higher than the objective financial knowledge questions reveal are considered to be overconfident. Those who rank themselves lower than the objective value are underconfident (van Rooij, Lusardi, & Alessie, 2012).

The study by Berhnman et al. (2012) measures financial literacy by means of a set of 12 questions. Of which the first 3 are questions on core economic and finance knowledge, followed by 3

more advanced questions on for example risk diversification and compound interest. Additionally, they look at the knowledge of respondents on the retirement system in their country (Chile), which cover the last 6 questions. Since their approach covers more questions compared to other studies (like Lusardi and Mitchell 2007), they do not aggregate correct answers but use a PRIDIT approach. This approach consists of weighting the questions depending on how difficult they are. The difficulty is determined by how many of the other respondents were able to answer the questions correctly. Also, it gives a negative penalty to questions being answered wrong.

Sekita (Sekita, 2013) uses four questions to measure financial literacy, the first three are derived from the module by Lusardi and Mithcell (2011b). The fourth question asks the relationship between interest rates and bond prices. Dinkova et al. (2016, select information on financial knowledge from the LISS dataset (the August 2011 questions on financial knowledge). The questions on financial literacy are grouped into basic and more advanced questions (questions 1-2 basic and 3-4 advanced) (Dinkova, Kalwij, & Alessie, 2016)

Additional variables

To be able to isolate the effect of financial literacy on wealth accumulation, the literature controls for a wide set of variables. Berhnman et al. (2012) control for the following: age, gender and some potential instruments which are not good instruments. Van Rooij et al. (2012) use several controls namely; age, gender, education, household composition (marital status and amount of children), net disposable income and whether the respondent is retired or not. Additionally, they included a dummy for self-employment. All control variables are categorized into different dummy variables. Sekita (2013) controls for age, gender, level of education, household income, number of children, marital status, self-control, risk-aversion, impatience and confidence. Confidence is determined by weighing the objective scores on financial literacy with subjective financial knowledge (more on this in the section on data).

Wealth

Behrman et al (2012) distinguish wealth into different categories; pension wealth, net housing wealth and other net wealth. Pension wealth includes the total amount of wealth which respondents had acquired by contributing to the Chilean pension system (employees are obliged to contribute 10 per cent of their salary to a pension fund). Net housing wealth includes the value of the estate minus the mortgage debt. Other net wealth includes wealth from a variety of sources like investments, business wealth and subtracting any possible debts. Adding these to the variable total net wealth.

Van Rooij et al. (2012) firstly focus on total net worth in their OLS regression. Authors also exclude the top and bottom 1% of the observation for wealth since wealth regression are sensitive to outliers (van Rooij, Lusardi, & Alessie, 2012, p. 453). Furthermore, they investigate the effect of financial literacy on stock market participation and retirement planning as channels through which the

relationship could flow. In both cases, the relationship is significant and positive. Behrnman et al. (2012) differentiate different components of wealth; pension wealth, housing wealth and other wealth.

Instruments

Several studies have made use of instruments in this area of research. For van Rooij et al. (2012), this variable was economic education. Behrman et al. (2012) test potential instruments in their study. If they show to violate the second condition for a good instrument (independence of the error term) they include it as a control variable. The study by Behrman et al (2010) used several possible instruments in their first stage and checked whether these were strong and exogenous. First of all, they looked at "age-related variables" (Behrman, Mitchell, Soo, & Bravo, 2012, p. 14) which refers to conditions specific to the time the respondent was born. These include macroeconomic conditions, the location of schooling (urban schools are considered better in Chile) and the marketing of pension information. These could potentially be strong since they are all exogenous since many factors are based on government policy and economic conditions beyond personal control. Furthermore, family background is mainly used as an instrument for the relationship between schooling attainment and wealth accumulation and not so much focussed on financial literacy, the main interest of this study. Finally, the study looks at several personality traits; risk aversion and self-esteem. Since personality is overall quite stable[1] over life and acquired either genetically and/or through early life experiences, they can be argued to be exogenous (Behrman, Mitchell, Soo, & Bravo, 2012). After testing the independence of instruments with regard to the error term by the Hansen J statistic, authors are left with several instruments, including risk-aversion.

Lusardi and Mitchell (2011b) have made use of the financial education in several districts in the United States as an instrument since this is done for political reasons it is exogenous and this exposure to this financial education is relevant for the level of financial knowledge (also Bernheim and Garret (2001) have used this type of instrument in their study). However, in the context of this study, this is information is missing in the dataset. In the Netherlands, schools are able to determine this aspect of education themselves and therefore this information is not traceable (more on this in the institutional context section). For their study, Klapper, Lusardi and Panos (2012) made usage of two different instruments: "(a) the number of newspapers in circulation per two-digit region (both regional and national) and (b) the total number of universities per two-digit region (both public and private)" (Klapper, Lusardi, & Panos, 2012, p. 19). Due to these two exposures to financial literacy, people can be more or less exposed to financial knowledge which is beyond their control. This exposure is relevant because exposure to others with financial knowledge can increase one's own literacy. Others have made usage of mathematical skills as an instrument (Sekita, 2013).

[1] This is confirmed by several studies on the stability of personality (McCrae & Costa, 1994). For more information on this assumption, see Behrman et al. (2012, p.17).

So, literature has linked financial literacy to several aspects of household behaviour ranging from investment, retirement planning, consumption and saving behaviour. The link between financial literacy and the accumulation of wealth can take several routes and it remains difficult to fully grasp the causal link it has. Whether financial knowledge is able to "increase wealth accumulation a priori" (Sekita, 2013, p. 5) remains difficult to show. Which makes the relationship between financial literacy and subjects like retirement planning difficult to establish turning to a chicken or eggs situation.

3. Theoretical framework

Household behaviour can be described by the life cycle framework, which is derived from theories of Modigliani (1986) and Friedman (1957). Milton Friedman (1957) developed the *permanent income hypothesis*, which shows that consumption can be explained by not only income but also the expected income of the future. This future income is the 'permanent income' and explains consumption patterns, assuming that people smooth consumption over time this results in the basis of the life-cycle model. Before Friedman's permanent income hypothesis, consumption patterns were explained by Keynesian consumption theory which states that consumption is determined by real income (Meghir, 2004). Friedman's theory aimed at explaining why policies that boos income will not have the expected effect on consumption patterns since consumption is not determined by current income levels (Meghir, 2004). Keynesian economics assigned consumption functions to have a central role in determining aggregated demand. Increasing consumption would, therefore, result in a positive effect on consumption and policy aiming to increase consumption would need to increase income. Consumption can be figured as a linear function of income (Modigliani F. , 1986).

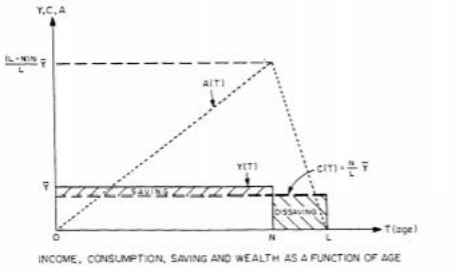

Figure 1: (Modigliani, 1986)

Following Friedman's hypothesis, Brumberg and Modigliani (1954) further developed the basis for the life-cycle model. Their work leads to the development of the *life cycle hypothesis of savings*, which describes behaviour in terms of "rational, utility-maximizing, consumers allocating optimally their resources to consumption over their life" (Modigliani F. , 1986, p. 299). This theory acknowledges the role of retirement in saving/consumption behaviour. This can be visualized in the following figure (figure 1), in which N represents the retirement time after which an individual will dissave and consume the income saved during a working lifetime.

These historical developments have laid the basis for the modern life cycle model. This model describes the behaviour made by individuals in order to achieve an optimum consumption pattern. In order to maximize their utility, consumption levels are to remain stable represented by the horizontal consumption path in figure 2. In the first stage of lifetime, individuals borrow money to make investments. Following the working period of life in which individuals save to use this after retirement.

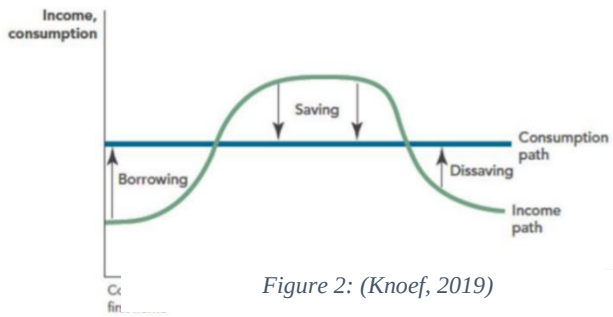

Figure 2: (Knoef, 2019)

The idea is that individuals will smooth consumption over the life-cycle. This because utility functions are concave, which means that the marginal utility of consumption is diminishing i.e. an extra unit of consumption will give less utility once consumption increases. So, consuming in a stable way over the life-cycle will give one more utility than consuming more in a certain period in life. This implies that individuals have to save when they work, a period in which they will have relatively high amounts of money available to consume or save, to be able to consume in similar ways after retirement. In order to smooth out consumption of lifetime, households/individuals are to plan their savings (Knoef, 2019).

So why do so many countries have pension systems if one would only simply have to save during working life and spent after retirement? The answer lies in the discussion between empirical and behavioural evidence and the life-cycle theory. Empirical work illustrates deviations from the life cycle model based on two phenomena. Firstly, "consumption appears to be excessively sensitive to income" (Thaler, 1990, p. 194), empirical evidence shows consumption during the pre-working and retirement period to be much lower than during working lifetime. Secondly, different types of wealth are not perfect substitutes. According to the life-cycle theory, total savings depend on lifetime wealth since the goal is to consume all of this during life with maximizing utility. However, empirical evidence suggests people are more likely to consume future income in contrast to pension wealth or home equity (Thaler, 1990, p. 199). These findings fit with additional evidence which illustrates consumption to sharply reduce after retirement, which is also referred to as "the retirement-consumption puzzle" (Blau, 2007, p. 1). The empirical evidence and the retirement-consumption puzzle pose questions on the relationship between the actual behaviour of individuals and the life cycle model. The critique of psychologists on the behavioural assumptions underlying the model is exactly what behavioural economics addresses.

The field of behavioural economics provides explanations of the factors that shape the economic decisions made by individuals. The new theories underlying behaviour in the life-cycle include for example the concept of *hyperbolic discounting*. Under this theory, people do not rank their consumption/savings pattern in according to different periods in life, but they attach different values on the future depending on where they are today (Deaton, 2005). This theory helps provide insights into the retirement-consumption puzzle and thus why there is in general not enough saved to continue the same consumption pattern after retirement. A behavioural life-cycle model has been developed by

Shefrin and Tahler (1988), which aims to make the life-cycle model a better fit with empirical evidence/data by integrating behavioural theory (Levin, 1998). This has led to the development of the Behavioural Life-Cycle hypothesis which incorporates three behavioural components into the life-cycle model; self-control, mental accounting and framing (Shefrin & Tahler, 1988). Self-control refers to the ability of someone to control tendencies to choose for current satisfaction instead of future satisfaction. In order to save in ways desirable according to the life-cycle model, and thus maximize total utility, the amount of self-control explains deviations of the model. Mental accounting deals with different behaviours depending on the type of wealth is concerned, people are more likely to consume current income and less likely to consumer future income. Metal accounts thus tell more on differences in behaviour depending on the type of wealth. This process of distinguishing between different wealth types of individuals is referred to as framing in this model (Shefrin & Tahler, 1988). It becomes clear when looking at the behavioural model, there are a wide variety of psychological theories which provide explanations in the ways people deviate from the rationality assumption of the traditional life-cycle model.

Besides the behavioural aspects[2], another explanation that has been proposed, in among others the literature above, is a lack of financial knowledge. The model requires individuals to be able to make quite extensive planning and make "complex economic calculations and to have expertise in dealing with financial markets" (Lusardi & Mitchell, 2014, p. 7). Indeed, it remains difficult for individuals to make reasoned and well-informed economic decisions like the life-cycle model suggest (Brounen, Koedijk, & Pownall, 2016). With regard to financial literacy; "differing levels of financial literacy are very likely to explain part of the variation of saving rates over income" (Brounen, Koedijk, & Pownall, 2016). Those not able to grasp concepts like interest rates, financial illiterates, would have a harder time planning their savings in an optimum way to maximize their welfare of the life span. Considering the low levels of financial literacy (Lusardi & Mitchell, 2014), this becomes of importance in the context of aspects of the life-cycle model (like retirement planning).

The behaviour expected by the traditional life-cycle model does not always correspond to reality and insights from behavioural economics. Financial Literacy is, besides the psychological impacts, another important factor in explaining deviations from the behaviour expected in the life-cycle model. Whether it is problematic that there is a deviation from the model is another question but financial literacy can serve as an explanation for this. And consequently can serve as an explanation of why people do not save much for retirement for example

Hypotheses

Following the theoretical basis and literature, in combination with the research question on the relationship between financial literacy and the accumulation of wealth, has led to the development of

[2] See for more information on this see (Pahnke & Honekamp, 2010).

the following hypotheses. First of all, the question is whether financial literacy depends on several background variables.

H1: *(objective/subjective) financial literacy differs depending on age, gender, income, level of education, marital status, position within the household, number of children and working status.*

H0: *(objective/subjective financial literacy levels do not depend on background variables*.

Furthermore, to answer the research question this hypothesis and null hypothesis deal with the relationship between financial literacy and total net wealth. In this case, both objective and subjective financial literacy are included.

H2*: (objective/subjective) financial literacy predicts amounts of total net wealth.*

H0: *(objective/subjective) financial literacy cannot account for differences in total net wealth.*

In order to investigate the channels through which this relationship flows,

H3*: financial literacy predicts the amount of (risky) investments/endowments/housing wealth.*

H0: *financial literacy cannot account for differences in total (risky) investment/endowments/housing wealth.*

The first hypothesis on the relationship between different background variables will be tested in the section on descriptive statistics by illustrating this relationship. Furthermore, the methodology section will dive into the methods used to test these hypotheses.

4. Institutional Context

Financial literacy has become of increasing importance in explaining saving behaviour (van Rooij, Lusardi, & Alessie, 2012). Besides an interest in the subject on an academic level, as illustrated in the literature section, the context of the development of financial knowledge has received attention from several institutions. In order to implement academic results into existing policies, the context of financial education in the Netherlands is developed upon this section.

According to Dirk Brounen (2017), households require more financial knowledge due to the increased pressure from the government on independent decision making by households and individuals. Policy after the financial crisis has been directed towards improving the long term needs for households. The pulling back of the government has put higher pressure on individuals to make informed financial decisions (Brounen D. , 2017). This trend of government pulling back and therefore leaving financial decisions on the individual level and the increased abstraction and complexity of ‘money’ has made financial education more important (NIBUD, 2011). This political shift has caused increased importance of the ability of households to make financial responsibilities which will enable them to save for the future (Brounen, Koedijk, & Pownall, 2016). Besides the necessity of independent financial decision

making, financial literacy has also acquired some attention regarding pension systems. Furthermore, the phenomena present is various (European) countries regarding the ageing population poses challenges for the sustainability of (future) pension systems. As illustrated by Feldstein (2006), the ageing population poses fiscal pressures on governments due to increased health care and pension costs. With a relatively smaller working population for a bigger group of retired persons, pay-as-you-go types of pensions will result in substantial increases in government spending. In the Netherlands, the age someone receives an AOW (a type of pay-as-you-go pension system) was increased to deal with these costs (Eerst Kamer der Staten-Generaal, 2012).

What is the Dutch government currently doing to create and improve financial literacy? There is no specific compulsory course on financial literacy in Dutch education. However, there is a possibility for schools to spend time on this subject. In government curricula goals for secondary education, there are a few elements of financial literacy traced back but no clear reference to financial literacy is made. Therefore, attention to this subject depends on schools and teachers decide to spend time on this. Overall, attention to this subject is largely considered to be an issue to parents and not the educational system. As illustrated in the OECD report (2017), students receive the most financial knowledge from their family. There is not much information available on the financial literacy in the Netherlands which has been a reason to participate in the 2015 PISA study form the OECD (CITO, 2017).

The OECD test the levels of financial knowledge in their Programme for International Student Assessment (PISA), which is conducted every 3 years in a study for 15-year olds. The 2015 (OECD, 2017) edition highlights that students lack basic financial skills, only 12% of the students are able to grasp and tack difficult tasks and 22% has no basic financial skills. This is problematic because these skills are essential in dealing with student loans, personal finance and many more aspects. Also, financial skills are shown to be dependent on the socio-economic background[3] of the family. Which means students with a different socio-economic background score much lower in comparison to students with a more advantageous socio-economic background. Students from the Netherlands score above the OECD average. However, still, 19% of Dutch students lack basic financial skills and also differences depending on the socio-economic background are present in the Netherlands. Also, students who are foreign-born or have foreign-born parents score lower when compared to similar socio-economic groups. Interestingly, there is not much difference between boys and girls (OECD, 2017).. Financial education in the Netherlands is provided in primary and secondary education. Several organisations have been providing educational material for this (like Money Wise).

[3] The OECD (2017) report distinguished between socio-economic disadvantaged and advantaged students. Additionally, also students with an immigrant background (taking into account the socio-economic background) score lower on financial literacy. Socio-economic status is derived from variables related to the family background of the student, these include "parents' education, parents' occupations, a number of home possessions that can be taken as proxies for material wealth, and the number of books and other educational resources available in the home" (OECD, 2016, p. 205).

So, there lacks an existence of compulsorily government programs for schools to educate students on financial knowledge. Main knowledge is retrieved from the parents which explain the OECD results on socio-economic background and financial literacy. However, schools do have the option to make usage of methods form non-governmental organisations. The Dutch Institute for Budget education (NIBUD) provides several modules for schools (NIBUD, 2019). Money Wise (Wijzer in Geldzaker) is an initiative from the Dutch Ministry of Finance and connects stakeholders with a goal of improving responsible financial behaviour in the Netherlands (Money Wise, 2019).

5. Data

The data used comes from the LISS (Longitudinal Internet Studies for the Social Sciences) panel data set, a study conducted from 2007 onwards and consisting of around 5000 households and 8000 persons. Participants receive an online monthly survey and those without internet or computer will be provided one. The sample is representative of Dutch households (Knoef & de Vos, 2009). This longitudinal survey is distributed yearly to the panel including varying variables. Furthermore, several single wave studies have been conducted.

5.1 Variables

Sample selection and size

For this study, I have merged the 2011 single wave study on financial literacy with several other datasets. This survey was distributed to 6778 households members (all panel members aged 16 years or older), in total 4858 complete responses were collected (71.7%). The background variables, which are available for every respondent, are all merged for the individuals who responded in 2011 on the financial literacy questions and therefore contains all the information based on this year. In total, this data is available for 4858 participants.

For the data on the economic situation of respondents, the LISS data gives information in the study unit ‘Economic Situation: Assets’ for several periods: waves 1 to 6. Which have been conducted respectively in 2008, 2010, 2012, 2014, 2016 and 2018. In which the value of several assets is determined by the end of the previous year. For this study, I have merged waves 3 to 6, years 2012, 2014, 2016 and 2018 since these are all collected starting from the year financial literacy is collected. Housing wealth is derived from the study ‘Economic Situation: Housing’, for which also data in the years 2012, 2012, 2016 and 2018 are collected. Just like van Rooij et al. (2012) did, I excluded the top and bottom 1% of observations for total wealth. Merging these different waves results in a total sample of 8,943. After including background variables, the total sample is reduced to a size of 5,711.

Financial Literacy

For the measurement of financial literacy, the LISS conducted a onetime question set (single-wave study) in Augustus 2011 (see appendix A for a total overview of the questions and answers). The questions used in this set are similar to the module of Lusardi and Mitchell (2011b). The LISS set consists of 10 questions of which the first question focussed on subjective financial literacy by asking: *How would you score your understanding of financial matters?* The following questions (questions 2-5) test the ability to correctly answer questions on financial knowledge and thus measure objective financial knowledge. These questions can be distinguished into different categories based on the nature of the question. The first two questions test basic financial knowledge, the first testing knowledge on interest rates: *Suppose you have 100 euros on a savings account and the interest is 2% per year. How much do you think you will have on the savings account?* The second question testing knowledge of the concept inflation on purchasing power: *Suppose that the interest on your savings account is 1% per year and that inflation amounts to 2% per year. After 1 year, would you be able to buy more, exactly the same, or less than you could today with the money on that account?* Advanced financial knowledge is tested by firstly asking on return to investments: *Does a share in a company usually offers a more certain return than an investment fund that only invests in shares?* And the second question testing the inverse relationship between interest rates and bond prices: *If the interest rate goes up, what should happen to bond prices?* Finally, questions 6-10 ask the respondents opinion on the survey by asking whether they found them difficult, easy to understand and more (see appendix A.3).

So, financial literacy can be distinguished into subjective and objective financial knowledge. The first question asking respondents to value their financial knowledge on a scale from 1-7. Objective financial knowledge can be measured by 4 questions which can be either right or wrong. Overall financial knowledge can, therefore, take values of 0 – 4, depending on the total amount of answers which are correct. Financial knowledge can further be distinguished into the basis and advanced level of knowledge; the first two questions are basic and the last 2 questions deal with more advanced topics. For basic financial knowledge, I use the categories interest rates and inflation for the first and second questions. Advanced financial knowledge I categorize into return on investment (ROI) and bond prices.

Other studies have made usage of a "two-step weighting approach (PRIDIT)" (Behrman, Mitchell, Soo, & Bravo, 2012, p. 301) in which questions are weighted for difficulty and penalties are given when answers are incorrect. However, in these approaches, financial literacy is measured by means of a quite extensive set of questions. Since in this case, the questions are more concise, I decided to quantify financial knowledge based on the total amount of questions answered correctly. Which, as visible in the literature review, has been done by other studies as well. Sekita (2013) first derived three questions from Lusardi and Mitchell (2011b) and added a fourth question on bond prices into the questionnaire.

Background variables

Background variables are collected once participants join the panel, and the contact person is asked every month to tell changes. Variables include gender, position within the household, age, size of household, income (individual and household), owned or rented house, level of education and origin. For several variables, there is an additional variable derived from official data from CBS available. These background variables are of importance since they affect financial literacy and net total wealth and not including them would create omitted variable bias. The following variables are used in this thesis: gender (male/female), age (15-65+), education level with a diploma, position, personal gross monthly income in Euros, size of household, marital status, position within the household, working status and confidence. By combining the information on subjective financial literacy with the objective data it is possible to create dummies[4] for *underconfidence* and *overconfidence*, done in similar ways as the study of van Rooij et al (2012).

- *Age* (16-24, 25-34, 35-44, 45-54, 55-64 or 65+)
- *Gender* (Male or Female)
- *Level of education* (Primary education, Intermediate secondary education, Higher secondary education, Intermediate vocational education, Higher vocational education or University level)
- *Income per month* (0-100 per month, 1001-2500, 2501-4000 or 4001+)
- *Marital status* (Married, Separated, Divorced, Widow/widower or Never been married)
- *Position* (Head of household, Wedded Partner, Unwedded Partner, Parent, A child living at home, Housemate or A family member or boarder)
- *Number of Children* (0, 1, 2 or 3+)
- *Working status* (Employed, Self-employed/freelancer, Housework, Unemployed, Studying/too young to work)

Household wealth

To calculate the overall wealth of respondents, several questions are combined. Values are filled in by respondents, the questions relate to the 31st of December in the year before the questionnaire was distributed. Information is given on the following assets:

- The total balance on different bank accounts
- Guaranteed minimum pay-out/ endowment insurance
- Value of real estate
- Remaining mortgage debt
- Sales value of cars, motorcycles, boats, caravans

[4] These dummies are created by subcategorizing objective and subjective financial literacy into 3 different categories to make them comparable. One category being low (objective result of 0 or 1 and subjective 1,2 or 3 on the Likert scale). Second being average (object financial knowledge of 2 and subjective of 4). And finally, high financial knowledge (objective result of 3 or 4 and subjective of self-reported scores of 5,6 or 7).

- Amount lent out to people
- Investments
- Investments in other sources (jewellery, antiques etc)
- Remaining debt of study grants
- The total amount of loans, credits and debts of respondent

Total wealth is calculated by adding the values of all of the above information, for debt and mortgage the values are subtracted. Furthermore, the different aspects of wealth can be further distinguished into total balance, housing wealth and investments. Investments can additionally be distinguished into risky investments (growth funds, share funds, bonds, debentures, stocks, options, warrants) and non-risky investments (money invested in antique, jewellery or others). Also, respondents firstly have to indicate for the different assets whether they possess any assets in this category.

Personality

In researching the source of financial knowledge, Pinjisakikool (2017) has looked at the influence of the Big Five personality traits. These traits consist of "extraversion, agreeableness, conscientiousness, emotional stability, and intellect (openness to experience or imagination)" (Pinjisakikool, 2017, p. 40). This study used the Dutch household survey (DNB) and established several personal traits which are associated with financial literacy. Extraversion is negatively related to financial literacy, while intellect (openness to experience or imagination) is positively associated with financial literacy. Other personality traits that have been investigated in the context of financial literacy are self-esteem and risk-aversion.

Behrman et all. (Behrman, Mitchell, Soo, & Bravo, 2012) have indicated the usefulness of self-esteem (as an instrument) in the relationship between financial decisions and financial knowledge. They use risk aversion and self-esteem as instruments in their study, I would aim to apply these variables potential instruments by testing them in the specific setting of my study. Additionally, I would aim to test whether any of the Big Five personality traits which have been proven to be associated with financial literacy and therefore could be potential instruments in the context of this study. This because finding a good (relevant and exogenous) instrument can help in accounting for the problem of reversed causality by isolating the effect through the usage of instrumental variables.

The LISS panel data has information available on self-esteem, risk-aversion and the Big Five personality traits. Personality is considered to be quite stable over time (Behrman, Mitchell, Soo, & Bravo, 2012), which makes it possible to use different time periods at which the LISS has conducted studies on personality. Furthermore, in 2010 panel members were asked for their risk aversion on financial matters, also a project was conducted on ambiguity attitudes which included a wide variety of experiment options (Dimmock, Kouwenberg, & Wakker, 2016). For self-esteem, see appendix A.4 for the wording of the questions. Risk-attitude is determined by first of all by answering the following question on general risk attitude "*Are you generally a person who is fully prepared to take risks or do*

you try to avoid taking risks?". Secondly, risk attitudes with regard to financial matters are determined by "*How would you rate your willingness to take risks concerning financial matters?*". Both questions are answered on a 0-10 point Likert scale. The big five personality variable can be categorized into the following 5 categories:

- Big Five Personality Test[5]
    - Extraversion (outgoing vs. reserved)
    - Agreeableness (cooperative/friendly vs. more distant)
    - Conscientiousness (organized vs. careless)
    - Emotional Stability/Neuroticism (emotionally instable/sensitive vs. secure)
    - Intellect/Imagination/Openness[6] (learn new things/imaginative vs. cautious)
- Self-esteem
- Risk-attitude (in general and with regard to financial matters)

5.2 Descriptive Statistics

Financial Literacy

The data is derived from the 2011 single wave LISS study on financial literacy, for a total of 4856 respondents. As illustrated in the section above, financial literacy can be distinguished in subjective and objective. Subjective financial knowledge consists of self-assessment of knowledge on financial issues, a 7 point Likert-scale indicates this, 1 being very poor and 7 very good. Objective financial knowledge consists of 4 questions which can be either correct (=1) or not (=0). Basic knowledge refers to the first two questions (Interest Rates and Inflation) and a maximum of 2 can be achieved if both are correct. For advanced goes the same, now referring to questions 3 and 4 (Return on Investment and Bond Prices). The total level of objective financial literacy can vary from 0 to 4. Table 1 gives a representation of the mean of these different variables.

Table 1: Descriptive financial literacy

Variable	No. of Observations	Mean
Subjective Financial Knowledge	4856	4.834
Interest Rates	4856	.886
Inflation	4856	.769
Return on Investment	4856	.42
Bond Prices	4856	.192
Basic Literacy	4856	1.655
Advanced Literacy	4856	.612
Total literacy	4856	2.266

[5] The Big Five Personality Test is based on the Five-Factor Model (FFM) developed by McCrae & Costa (1999). The five different categories represent dichotomies which are calculated based on answering 10 questions per category on a 1 to 5 point Likert scale.

[6] Since only Intellect/Imagination turned out to be a relevant instrument, appendix A.5 list the questions which determined the value of this variable.

The summary statistic indicates an overall above-average self-assessment on knowledge of financial literacy with a mean of 4,8. Objective financial knowledge illustrates a decreasing pattern as the difficulty of the questions increases, from a mean of 0.886 to 0.192. Basic financial knowledge is therefore on average much higher in comparison with advanced financial knowledge. For a more extensive illustration of the results see Appendix B table B.1 and B.2.

Distribution of correct answers

To gain more insight into levels of financial literacy and other explanatory variables, table 2 represents the distribution of correct answers to the questions on financial knowledge.

Table 2: Correct answers for background variables (in %)

	Percentage of correct answers				
	Interest	Inflation	Shares	Bond price	N
Male	91.25	84.12	53.97	25.89	2229
Female	86.26	70.80	31.90	13.44	2627
15-25 years	81.03	62.26	28.54	17.08	522
26-35 years	88.76	73.71	45.33	20.19	525
36-45 years	89.85	77.17	46.46	20.29	749
46-55 years	89.3	76.81	48.49	19.4	897
56-65 years	90.43	81.61	44.28	19.32	1066
65+ years	88.7	80.77	36.37	18.51	1097
Primary education	75.8	59.43	19.22	9.29	281
Intermediate secondary education	81.53	66.19	25.82	11.59	1251
Higher secondary education	90.13	82.41	45.6	21.54	557
Intermediate vocation education	90.6	76.13	42.58	18.61	1064
Higher vocational education	95.99	88.41	56.48	24.45	1096
University	95.71	93.18	68.94	36.11	396
0-1000 euro per month	85.2	73.12	29.47	16.42	811
1001-2500 euro per month	90.78	77.77	42.72	18.25	1030
2501-4000 euro per month	95.28	90.15	58.43	24.7	741
4001+ euro per month	96.98	96.07	77.95	37.76	331

The effect of these different variables on levels of financial literacy becomes apparent in this table. Females score on average much lower on all of the questions in comparison to males. Increase in age is associated with an increase in the percentage of correctly answered questions (with a small decline after 65 years), as does with an increase in net monthly income. For education, percentages of correctly answered questions increases as education moves from primary to more advanced secondary and vocational education with a peek at the university level.

A regression for financial literacy by all the different control variables used in this study illustrates their significance (see appendix B table B.3 for the regression results). Females score significantly lower on financial literacy, in total females score 0.24 points lower. Furthermore, age significantly increases the total level of financial literacy (only in the final two age categories). A higher

level of education results in a 0.26 to 0.51 points increase of total financial literacy scores, depending on the category. Finally, higher levels of income become statistically significant in the final category. For a more extensive overview of the significance of all the control variables for financial literacy and total net wealth, see table B.3 in Appendix B. Additionally, there is also information on the effect of the different background variables on subjective financial knowledge[7] in Appendix B.3. For subjective financial literacy, similar trends as in the case of objective financial knowledge are visible.

Description of wealth levels

An overview of the different aspects that can be summarized into the final outcome variable *total net wealth* is visible in Appendix C. As illustrated above, just like van Rooij et al. (2012) did, I have removed large outliers in the dataset on total net wealth. The table in Appendix C.1 gives different wealth outcomes depending on the score for financial literacy. From this, it already becomes apparent that higher financial literacy is associated with a higher mean for net total wealth, what the exact relationship is will be dealt with in the following chapters. For the different waves for which data on total net wealth was available, table on Appendix C.2 shows the different means. There are no significant differences between the different waves with regard to net total wealth.

Finally, for an overview of the summary statistics of all variables used in this study, see Appendix D table D.1.

6. Methodology

In order to answer the research question, I will first establish a simple OLS regression for financial literacy on wealth outcomes. However, there are some limitations to this approach which lead to alternative different methodologies. This section deals with these issues.

To establish the relationship of financial literacy on wealth accumulation, figure 3 illustrates the different variables of importance for the relationship between financial literacy and wealth accumulation. Both financial literacy and total net wealth are influenced by certain variables (which I refer to as control variables). These control variables impact

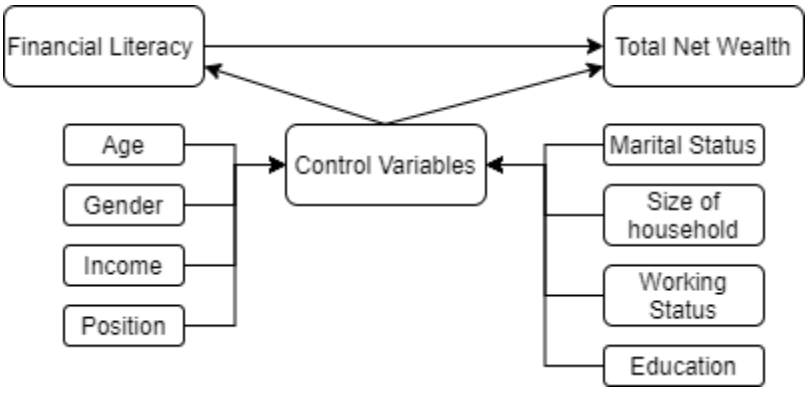

Figure 3: Relationship Variables

[7] Note subjective financial literacy is measured on a scale of 1-7, in contrast to objective financial literacy which takes values between 0 and 5.

both financial literacy as total net wealth and it is, therefore, necessary to control for these variables to avoid omittable variable bias.

OLS

In order to estimate the effect of X (financial literacy) on Y (wealth accumulation), I will conduct an OLS regression with several control variables. Financial literacy can be further distinguished into objective and subjective financial knowledge. Furthermore, the regression will control for gender, age, education, income categories, marital status, position within the household, number of children and working status.

(1) $Total\ Net\ Wealth_{i\ year} = \beta 0 + \beta 1 * Financial\ Literacy_i + \varepsilon_i$

(2) $Total\ Net\ Wealth_{i\ year} = \beta 0 + \beta 1 * FinancialLiteracy_i + \beta 2 * gender_i + \beta 3 * age_i + \beta 4 * education_i + \beta 5 * income_i + \beta 6 * martital\ status_i + \beta 7 * position_i + \beta 8 * children_i + \beta 9 * working\ status_i + \varepsilon_i$

The first formula is without controlling for other variables and, as becomes visible in figure 3 as well, the result from this regression will not capture the effect of financial literacy on total net wealth due to the interferences of several other variables. Therefore, there will be omitted variable bias in that the model from the first equation will estimate the effect of the other variables (like income, gender etc) on net wealth to come from financial literacy. While in reality, this effect is due to another variable like income and not due to financial literacy. Therefore, the second equation deals with this problem by including all variables which have been shown in the literature to be important in this context of avoiding omitted variable bias.

Total Net Wealth represents wealth for each time period (2012, 2014, 2016 and/or 2018) for which this data is available for respondents. Data for wealth is not available for each individual for each time period which makes this an unbalanced panel (Stock & Watson, 2015, p. 397). To conduct an OLS regression with panel data I make usage of pooled OLS estimator. I include a dummy for the different time periods for which wealth data is available and cluster standard errors to take into account the panel data structure. For investigating the channels through which the relationship between financial literacy and net total wealth flows, the same method will be applied by replacing net total wealth by the several variables of components of wealth.

IV

However, as illustrated in the literature, there is a potential problem in establishing a causal relationship between financial literacy and wealth due to reversed causality and financial literacy potentially being an endogenous variable. From the literature, it becomes clear there are some possibilities for

instruments. The following equations represent the method for conducting instrumental variables regression in this thesis.

(3) $\widehat{FinancialLiteracy_i} = \gamma 0 + \gamma 1 * Personality_i + \gamma 2 * gender_i + \gamma 3 * age_i + \gamma 4 * education_i + \gamma 5 * income_i + \gamma 6 * martital\ status_i + \gamma 7 * position_i + \gamma 8 * children_i + \gamma 9 * working\ status_i + v_i$

(4) $Total\ Net\ Wealth_{i\ year} = \beta 0 + \beta 1 * \widehat{FinancialLiteracy_i} + \beta 2 * gender_i + \beta 3 * age_i + \beta 4 * education_i + \beta 5 * income_i + \beta 6 * martital\ status_i + \beta 7 * position_i + \beta 8 * children_i + \beta 9 * working\ status_i + v_i + hoi^2$

Developing upon the OLS regression in equation (2), equation (3) computes the estimation of financial literacy given the instrument (Personality). Equation (4) plugs in the value that is calculated by the regression in equation (3). The error term is v_i since this one is a different error term than in the previous equations. The instrument Personality refers to the different variables that will be used as potential instruments. To be able to check whether the possible instruments are actually valid, they have to meet two conditions. First of all, the instrument should be relevant and secondly, it should be exogenous. To check whether instruments are relevant, I will check whether they are strong enough by conducting the F-statistic of the first stage. This F-statistic has to be larger than 10[8] in order for the instrument to be considered strong. Secondly, endogeneity has to be tested once instruments turn out to be strong.

7. Results

7.1 OLS

Pooled OLS Regression

An OLS regression is computed on the effect of financial literacy on total wealth. Firstly, the regression is conducted for objective financial knowledge for the years 2012, 2014 and 2016. The dependent variable is total net wealth for the 31st of December 2011, 2013 and 2015. The explanatory variables are objective financial literacy (value between 0 and 4), a dummy for gender, age categories, education levels (lower, middle and higher levels of education) followed by income categories, marital status, size of household and the working status of the respondent.

[8] For an explaining of this see (Stock & Watson, 2015, pp. 516-519).

Table 3: Pooled OLS

VARIABLES	(1) Total Net Wealth
Objective Financial Literacy	34,119***
	(7,182)
2014	-18,313***
	(5,470)
2016	-16,716
	(12,493)
2018	-27,572***
	(10,325)
Female	-6,940
	(10,761)
26-35 years	-14,177
	(9,647)
36-45 years	-13,315
	(14,080)
46-55 years	18,828
	(16,863)
56-65 years	93,454***
	(21,150)
65+ years	106,143***
	(31,054)
Intermediate secondary education	49,038***
	(17,888)
Higher secondary education	40,357***
	(15,398)
Intermediate vocation education	39,917***
	(13,957)
Higher vocational education	59,687***
	(15,906)
University	93,821***
	(26,889)
1001-2500 euro per month	17,901
	(25,069)
2501-4000 euro per month	48,115*
	(28,418)
4001+ euro per month	167,984***
	(42,284)
Overconfidence	1,270
	(12,114)
Underconfidence	-20,792
	(14,558)
Separated	344,106
	(240,099)
Divorced	-16,908
	(35,594)

Widow/Widower	-13,278
	(29,723)
Never been married	-17,495
	(16,566)
Wedded Partner	31,305*
	(18,786)
Unwedded Partner	23,192
	(21,370)
Parent	19,599
	(23,269)
Child	17,172
	(19,956)
Housemate	7,870
	(14,724)
A family member or broader	-49,185
	(44,268)
1 child	4,838
	(16,375)
2 children	5,893
	(19,994)
3 or more children	96,494
	(63,363)
Self-employed/freelancer	143,940***
	(43,678)
Retired	47,606
	(33,057)
Housework	72,231*
	(37,533)
Unemployed	15,786
	(21,394)
Studying	33,510
	(20,619)
Constant	131,737***
	(33,362)
Observations	5,711
R-squared	0.098
Robust standard errors in parentheses	
*** p<0.01, ** p<0.05, * p<0.1	

Financial literacy turns out to be a statistically significant effect on total wealth. As is being female leading to lower levels of wealth. Age categories illustrate a small but insignificant decrease after 25, but starting at the age of 45 it becomes a significant estimator for total wealth. Level of education is further distinguished into lower, middle and higher education. Higher education is significant for total wealth. However, middle education does not become significant.

Subjective financial knowledge

For subjective financial knowledge, results show a similar pattern. See Appendix E table E.1 for the results. In this case, financial literacy (subjective) is defined on a scale from 1-7, 1 being very poor understanding of financial issues and 7 having a very high self-reported understanding of financial issues. From this results, it becomes apparent that an increase of 1 in self-reported scores on financial literacy, results in an increase in net total wealth of 26,302, which has a p-value of 0.00 and thus is highly significant.

Channels

The positive relationship between financial literacy and total wealth is in accordance with the literature. However, it is of interest to discover the channels through which financial literacy can result in higher levels of wealth. To find out through which channels the effect that has been established by the model above runs, an OLS regression for the different components of wealth is conducted. Total net wealth can be distinguished into the following categories: investments (risky and non-risky), housing wealth (value housing minus remaining mortgage), debt (study debt and other debt) and total balance (bank and saving accounts).

For risky investments, financial literacy becomes insignificant. Also, the total sample decreases to 906 since it only looks at the total value of risky assets and there are only 906 observations for the value of risky assets. So financial literacy cannot predict the amount of money invested. However, since so few respondents actually have risky investments, it might be interesting to look at the effect of financial literacy on the likelihood of having risky investments in general (independent of how much). Since for each assets category respondents had to indicate whether they have this or not, data on whether someone has risky assets are available. From the regression on whether or not one has risky investments, it becomes clear that an increase in financial literacy results in an 8,33% increase in likelihood someone has risky assets (see Appendix E.2 for the results from the regression). Interesting, when conducting the same methods for other non-risky types of investments[9], this relationship becomes significantly negative (see Appendix E.2). An increase in financial literacy would lead to a 1,57% decreased likelihood of having other types of investments (non-risky types).

For debts there is no significant relationship found just as for housing wealth. Finally, for total balance[10], there is a significant relationship visible. Financial literacy increases the amount of the total balance on several accounts by 8,96% (see Appendix E.2).

[9] These include growth funds, share funds, bonds, debentures, stocks, options and warrants.
[10] Total balance refers to the total balance on banking account or giro (current accounts), savings accounts, term deposit accounts, savings bonds or savings certificates and bank savings schemes.

Robustness checks

Finally, to check the robustness of my estimators, I have conducted some robustness checks. For this, I made usage of a method developed by Barslund, Chiconela, Rand & Tarp (2007). Appendix F table F.1 illustrates this robustness check. This method has run a set of regressions for total net wealth including all the possible combinations of additional variables (the set of control variables), it consequentially lists the minimum, maximum, average value (mean) and standard deviation of the coefficients. Additionally, table F.1 list how many times the coefficient is significant, positive and/or negative. Also, the average t-value and the total amount of observations is given. From these checks

7.2 Results IV

In order to deal with some of the potential issues with regard to the relationship between financial literacy and net total wealth, as established above, an IV approach could be a good addition. As illustrated in the literature section, other studies have also conducted an OLS regression followed by an IV regression.

First, an IV regression with the several potential instruments from the Big Five Personality traits, self-esteem and risk aversion was conducted. Followed by testing the F-statistic in the first stage estimation. Unfortunately, all the big five personality instruments turned out to have very low F-statistics (lower than 10). Also for the variables on self-esteem and risk-attitude, the F-statistic was in all cases lower than 10. Additionally, for risk-attitude, the sample became very low (274) because this information was only available for one time period since this was a one-time study. Personality data for the Big Five and self-esteem is available for several years (2010, 2011, 2012 and 2013), which made the total sample respectively 5,693. So it is not possible to crease IV estimates for financial literacy on net total wealth since the instruments are all weak.

However, perhaps the instruments are strong when looking at a component of objective financial knowledge or when looking at subjective financial knowledge. In the context of both basic, advanced and subjective financial literacy the instrument of self-esteem is still weak ($F<10$). Also for risk-attitude, the F-statistics are still too low. However, for a particular aspect of the Big Five Personality, there is a large F-statistic. In this case, Intellect/Imagination turns out to be a strong instrument for subjective financial knowledge (F-statistic of 45,06). Assessing the exogenous of this instrument becomes difficult since there are fewer instruments than endogenous regressors. Leaving out the endogenous regressors would not make sense since these control variables are of importance in the relationship between financial literacy and wealth. Since there is only one instrument which has survived the relevance condition, it is not possible to test overidentifying restrictions (Stock & Watson, 2015). Since personality is overall quite stable over a lifetime it makes sense that this instrument contains information about a variation on levels of subjective financial literacy without affecting the accumulation of wealth. In the discussion session more on this. The results of the two-stage IV regression are visible in Appendix E.3.

As becomes visible, the effect of subjective financial literacy on total net wealth becomes insignificant after being instrumented by Imagination/Intellect[11]. This would mean there is no longer a significant effect of financial literacy visible on net total wealth. As visible in the literature section, this contradicts the findings of other studies which have made usage of IV method in this context. In the discussion, I will further elaborate on this. For now, the relevance condition in the IV estimation is met, however, the exogeneity condition might be one to look further into.

8. Discussion

Stability of financial literacy

For this study, I have assumed financial literacy to be stable over the years. Regressions were conducted for several years while financial literacy was only available for 2011. Besides the unavailability to additional data on financial literacy in the LISS dataset, this poses the question of how stable financial knowledge actually is. According to Lusardi & Mitchel (2011), financial literacy follows "an inverted U-shaped pattern" with regards to age. Young people and older groups score relatively low and a peak in financial literacy is visible in the middle of the life-cycle. This suggests there is some variation in financial literacy with regards to age. Also, working experience (and schooling) can contribute to the attainment of financial literacy (Lusardi & Mitchell, 2011). Since respondents are only included after the age of 16, the effect of schooling will be present however not very large since a large part of the sample will already have left school. In appendix E table E.4 I have included the pooled OLS regression when those who indicated they are too young to work or study are excluded from the sample. Results do not differ after this group is excluded. However, it is not possible to find out whether and which panel members have acquired improved financial knowledge due to several reasons, for example in the work place. Also, it becomes imaginable that there are many other (personal) reasons why someone would decide to improve their understanding of financial matters. However, these are not traceable in the data available.

Head of household

Other studies have only looked at heads of the household (those who deal with financial matters). In this study, I have controlled for the position. To check whether my results differ if I would have looked at heads only, I have conducted the same regression only for these respondents. In appendix E table E.4 these results are visible and illustrate results remain similar. So my results do not change when only looking at heads of the household. Since the sample already excludes those with age lower than 16, there automatically are not many children included in the sample.

[11] In Appendix A.5 section the set of questions that determine Intellect/Imagination are listed.

Problem of Causality

Finally, as illustrated above, there might be issues with regards to omitted variable bias and reversed causality. To deal with omitted variables I have conducted OLS regression with several control variables. By conducting a pooled OLS for the channels through which financial literacy impact net total wealth and an IV approach, I have aimed to get closer to causality. This because there are problems in claiming causality out of the pooled OLS model due to reversed causality. In the channel section, I have illustrated the effect to run though the likelihood of investing in several forms. However, one could still raise similar concerns. Perhaps those who engage in risk investment decisions are automatically inclined to think about financial matters and consequentially acquire higher financial literacy scores. Since one of the questions is specifically on returns on investments this argument could make sense. The results in the IV analysis suggest this relationship becomes insignificant when using Intellect/Imagination as an instrument. However, the exogeneity assumption cannot be tested in a statistical package and has to be based on expert knowledge. One could claim Intellect/Imagination to have some effects on total net wealth which does not depend on financial literacy.

9. Conclusion

To sum up, in this thesis I have aimed to answer the research question on the effect of increased financial literacy on the accumulation of wealth. With the absence of national educational policy with regards to improving financial literacy and the literature on this topic, it becomes clear that there are potential effects of improving financial literacy in a variety of domains. In combination with policy shifting to individual financial responsibility and ageing population, it becomes of importance to seek solutions. Whether financial literacy can be one, I have tried to illustrate.

Improving levels of financial literacy could lead to an increase in net total wealth. The channel through which this relationship flows is the likelihood to invest in risky assets. However, there might still be issues with regards to reversed causality. Those who participate in risky investments might also become more financial literate. To deal with this issue I have tried to look for instruments in order to conduct instrument variable analysis. By looking at several instruments in the category of personality, I have contributed to the existing literature on IV analysis in the context of financial literacy. One aspect of the Big Five Personality Test turned out to be a strong instrument in the context of *subjective* financial literacy and the accumulation of wealth. After applying this variable, Intellect/Imagination, as an instrument, the effect of subjective financial literacy on net total wealth became insignificant. Whether this means the effect of subjective financial literacy is not present remains a question since one can debate the exogeneity condition of this instrument. Overall, this thesis confirms the relationship between financial literacy and total net wealth in similar ways the literature did. Additionally, it poses suggestions for researching the potential usage of Intellect/Imagination as an instrument.

10. Bibliography

Alessie, R., van Rooij, M., & Lusardi, A. (2011). Financial Literacy, Retirement Preparation and Pension Expectations in the Netherlands. *DNB Working Paper No. 289*.

Barslund, M., Chiconela, J., Rand, J., & Tarp, F. (2007). Understanding Victimization: The Case of Mozambique. *World Development Vol. 25*, 1237-1258.

Behrman, J. R., Mitchell, O. S., Soo, C. K., & Bravo, D. (2012). How Financial Literacy Affects Household Wealth Accumulation. *American Economic Review*, 300-304.

Bernheim, D. (1995). Do Households Appreciate Their Financial Vulnerabilities? An Analysis of Actions, Perceptions, and Public Policy. *Tax policy and economic growth*, 1-30.

Bernheim, D. B., Garret, D. M., & Maki, D. M. (2001). Education and saving:: The long-term effects of high school financial curriculum mandates. *Journal of public Economics 80.3*, 435-465.

Blau, D. (2007). Retirement and Consumption in a Life Cycle Model. *The Institute for the Study of Labor (IZA)*.

Borella, M., & Rossi, M. (2014). Asset accumulation over the life cycle. The role of financial literacy. *Netspar Panel Papers*.

Brounen, D. (2017). Huishoudfinanciën: meer financiële geletterdheid vereist. *Economisch Statistische Berichten (ESB)*. Retrieved from https://esb.nu/kvs/20034797/huishoudfinancien-meer-financiele-geletterdheid-vereist

Brounen, D., Koedijk, K. G., & Pownall, R. A. (2016). Household financial planning and savings behavior. *Journal of International Money and Finance*, 95-107.

Bucciol, A., Manfre, M., & Veronesi, M. (2018). The Role of Financial Literacy and Money Education on Wealth Decisions. *Working Papers 05/2018, University of Verona, Department of Economics*.

Campbell, J. Y. (2006). Household Finance. *Journal of Finance 61[4]*, 1553-1604.

CITO. (2017). *Investeren in de toekomst: De financiële geletterdheid van 15-jarigen in PISA-2015.* Arnhem: Stichting Cito Instituut voor Toetsontwikkeling.

Deaton, A. (2005). Franco Modigliani and the life-cycle theory of consumption. Retrieved from Available at SSRN: https://ssrn.com/abstract=686475

Dimmock, S. G., Kouwenberg, R., & Wakker, P. P. (2016). Ambiguity Attitudes in a Large Representative Sample. *Management Science, 62(5)*, 1363–1380.

Dinkova, M., Kalwij, A., & Alessie, R. (2016). Know more, spend more? The impact of financial literacy on household consumption. *Netspar*.

Eerst Kamer der Staten-Generaal. (2012). Wet verhoging AOW- en pensioenrichtleeftijd. Retrieved from https://www.eerstekamer.nl/wetsvoorstel/33290_wet_verhoging_aow_en

Feldstein, M. (2006). The Effects of the Ageing European Population on Economic Growth and Budgets: Implications for Immigration and Other Policies. *NBER Working Paper No. 12736*.

Friedman, M. (1957). The Permanent Income Hypothesis. *A Theory of the Consumption Function*, 20 - 37.

Hung, A. A., Parker, A. M., & Yoong, J. K. (2009). Defining and Measuring Financial Literacy. *Work. Pap. WR-708, Rand Corp., Santa Monica, CA.*

Klapper, L., Lusardi, A., & Panos, G. (2012). Financial Literacy and Financial Crisis. *Netspar*.

Knoef, M. (2019, September 23). Pensions and savings. Universiteit Leiden. Retrieved from https://blackboard.leidenuniv.nl/bbcswebdav/pid-4685752-dt-content-rid-7536348_1/courses/29043012-MPA-1920FGGA/WSE%20Pensions%202019_def.pdf

Knoef, M., & de Vos, K. (2009). The representativeness of LISS, an online probability panel. *CentERdata*.

Levin, L. (1998). Are assets fungible? Testing the behavioral theory of life-cycle savings. *Journal of Economic Behavior & Organization Vol. 36*, 59-83.

Lusardi, A., & Mitchell, O. S. (2011). Financial literacy around the world: an overview. *Journal of Pension Economics and Finance 10*, 497-508.

Lusardi, A., & Mitchell, O. S. (2011b). Financail Literacy and Planning: Implications for Retirement Wellbeing. *Financial Literacy: Implication for Retirement Security and the Financial Marketplace*, 17-39.

Lusardi, A., & Mitchell, O. S. (2014). The Economic Importance of Financial Literacy: Theory and Evidence. *Journal of Economic Literature, Vol. 52, No. 1*, 5-44.

Lusardi, A., & Mitchell, O. S. (2017). How Ordinary Consumers Make Complex Economic Decisions: Financial Literacy and Retirement Readiness. *Quarterly Journal of Finance (QJF), World Scientific Publishing Co. Pte. Ltd., vol. 7(03)*, 1-31.

McCrae, R. R., & Costa, P. T. (1994). The Stability of Personality: Observations and Evaluations. *Current directions in psychological science 3.6*, 173-175.

McCrae, R. R., & Costa, P. T. (1999). A Five-Factor theory of personality. *Handbook of personality: Theory and research*, 139–153.

Meghir, C. (2004). A Retrospective on Friedman's Theory of Permanent Income. *Institute for Fiscal Studies*.

Modigliani, F. (1986). Life Cycle, Individual Thrift, and the Wealth of Nations. *The American Economic Review, Vol. 76*, 297-313.

Modigliani, F., & Brumberg, R. (1954). Utility Analysis s and the Consumption Function: An Interpretation of Cross-Section Data. *Post-Keynesian Economics*.

Money Wise. (2019, November 7). Retrieved from https://www.wijzeringeldzaken.nl/english/

NIBUD. (2011). *De rol van financiële educatie in het basisonderwijs.* Utrecht: Nationaal Instituut voor Budgetvoorlichting.

NIBUD. (2019, November 6). Financiële educatie. Retrieved from https://www.nibud.nl/beroepsmatig/kennisgebieden/financiele-educatie/

Nolan, A., & Doorley, K. (2019). Financial Literacy and Preparation for Retirement. *IZA DP No. 12187*.

OECD. (2016). PISA 2015 Results (Volume I): Excellence and Equity in Education. *PISA, OECD Publishing*. Retrieved from https://www.oecd.org/education/pisa-2015-results-volume-i-9789264266490-en.htm

OECD. (2017). *PISA 2015 Results (Volume IV): Students' Financial Literacy.* Paris: OECD Publishing.

Pahnke, L., & Honekamp, I. (2010). Different Effects of Financial Literacy and Financial Education in Germany. *MPRA Paper No. 22900*.

Pinjisakikool, T. (2017). The effect of personality traits on households' financial literacy. *Citizenship, Social and Economics Education*, 39-51.

President's Advisory Council on Financial Literacy. (2008). 2008 Annual Report to the President. Retrieved December 30, 2019, from https://www.treasury.gov/about/organizational-structure/offices/Domestic-Finance/Documents/PACFL_Draft-AR-0109.pdf

Sekita, S. (2013). Financial Literacy and Wealth Accumulation: Evidence from Japan. *Kyoto Sangyo University Discussion Paper Series*.

Shefrin, H. M., & Tahler, R. H. (1988). The Behavioral Life-Cycle Hypothesis. *Economic Inquiry*, 609-643.

Stock, J. H., & Watson, M. W. (2015). *Introduction to Econometrics.* Essex: Pearson Education Limited.

Thaler, R. (1990). Anomalies: saving, fungibility and mental accounts. *Journal of Economic Perspectives—Volume 4, Number 1*, 193-205.

van Rooij, M., Lusardi, A., & Alessie, R. J. (2012). Financial Literacy, Retirement Planning, and Household Wealth. *Economic Journal 122*, pp. 449-478.

11. Appendix

Appendix A: Wording of Questions

A.1. Subjective Financial Literacy

Question 1

How would you score your understanding of financial matters?

1 – 7 (7-point Likert scale)→ 1 very poor and 7 very good

A.2. Basic Financial Literacy

*Question 2 (**Interest Rates**)*

Suppose you have 100 euros on a savings account and the interest is 2% per year.

How much do you think you will have on the savings account after five years, assuming that you leave all your money on this savings account: more than 102 euros, exactly 102 euros, less than 102 euros?

1 more than 102 euros

2 exactly 102 euros

3 less than 102 euros

4 I don't know

5 I would rather not say

*Question 3 (**Inflation**)*

Suppose that the interest on your savings account is 1% per year and that inflation amounts to 2% per year. After 1 year, would you be able to buy more, exactly the same, or less than you could today with the money on that account?

1 more than today

2 exactly the same as today

3 less than today

4 I don't know

5 I would rather not say

A.3. Advanced Financial Literacy

*Question 4 (**Return on Investment**)*

A share in a company usually offers a more certain return than an investment fund that only invests in shares.

1 true

2 not true

3 I don't know

4 I would rather not say

*Question 5 (**Bond Prices**)*

If the interest rate goes up, what should happen to bond prices?

1 they should increase

2 they should decrease

3 they should stay the same

4 none of the above

5 I don't know

6 I would rather not say

A.4. Self-esteem

Please indicate to what extent you agree or disagree with the statements below.

1. I feel that I'm a person of worth, at least on an equal plane with others
2. I feel that I have a number of good qualities
3. All in all, I am inclined to feel that I am a failure
4. I am able to do things as well as most other people
5. I feel I do not have much to be proud of
6. I take a positive attitude towards myself
7. On the whole, I am satisfied with myself
8. I wish I could have more respect for myself
9. I certainly feel useless at times
10. At times, I think I am no good at all

1 – 7 (7-point Likert scale)→ 1 very poor and 7 very good

A.5. Intellect/Imagination

Please use the rating scale below to describe how accurately each statement describes you.

1. Have a rich vocabulary.
2. Have difficulty understanding abstract ideas.
3. Have a vivid imagination.
4. Am not interested in abstract ideas.
5. Have a vivid imagination.
6. Am not interested in abstract ideas.
7. Have excellent ideas.
8. Do not have a good imagination.
9. Am quick to understand things.
10. Use difficult words.
11. Spend time reflecting on things.
12. Am full of ideas.

1 – 5 (5-point Liker scale) → 1 very inaccurate and 5 very accurate

Appendix B: Results Financial Literacy

Table B.1 Financial Literacy: percentages of the total number of respondents (N=4856)

	Correct	Incorrect	Do not know
Interest Rates	88.55%	5.52%	5.93%
Inflation	76.92%	10.46%	12.62%
Return on Investment	42.03%	15.18%	42.79%
Bond Prices	19.16%	32.42%	48.42%

Table B.2: Values for financial literacy: percentage of all respondents (N=4856)

	Total number of questions correct						
	0	1	2	3	4	Mean	Std Dev
Basic Financial Literacy	7.60%	19.34%	73.06%	-	-	1.65	0.61
Advanced Financial Literacy	52.14%	34.53%	13.32%	-	-	0.61	0.71
Total Financial Literacy	6.86%	14.35%	36.41%	30.05%	12.34%	2.27	1.07

Table B.3: Values for financial literacy

	(1)	(2)	(3)
VARIABLES	Objective Financial Literacy	Subjective Financial Literacy	Total Net Wealth
Female	-0.240***	-0.198***	-14,965*
	(0.0249)	(0.0317)	(7,681)
26-35 years	0.0782	-0.0893	-13,952*
	(0.0875)	(0.0967)	(7,972)
36-45 years	0.136	-0.0445	-10,414
	(0.0895)	(0.102)	(10,604)
46-55 years	0.141	-0.0360	21,144*
	(0.0893)	(0.102)	(12,328)
56-65 years	0.146*	0.0298	94,594***
	(0.0880)	(0.101)	(18,030)
65+ years	0.187**	0.0242	104,032***
	(0.0939)	(0.110)	(26,011)
Intermediate secondary education	0.256***	0.314***	55,239***
	(0.0533)	(0.0712)	(15,111)
Higher secondary education	0.480***	0.543***	53,339***
	(0.0558)	(0.0734)	(11,521)
Intermediate vocation education	0.419***	0.552***	50,257***
	(0.0525)	(0.0702)	(10,404)
Higher vocational education	0.401***	0.506***	69,782***
	(0.0519)	(0.0698)	(11,680)
University	0.519***	0.526***	107,206***
	(0.0553)	(0.0738)	(17,831)
1001-2500 euro per month	-0.0360	0.0368	17,194
	(0.0375)	(0.0473)	(23,625)
2501-4000 euro per month	0.0442	0.114**	49,095*
	(0.0423)	(0.0537)	(26,240)
4001+ euro per month	0.247***	0.299***	175,656***
	(0.0468)	(0.0598)	(32,437)
Overconfidence	-1.203***	0.198***	-39,741***

	(0.0204)	(0.0276)	(9,173)
Underconfidence	-0.124***	-2.056***	-24,832**
	(0.0273)	(0.0335)	(11,036)
Separated	0.133	0.208	348,867**
	(0.122)	(0.201)	(144,352)
Divorced	-0.0567*	-0.0287	-19,416
	(0.0311)	(0.0425)	(21,909)
Widow/Widower	-0.0902*	-0.0930*	-15,929
	(0.0473)	(0.0557)	(21,235)
Never been married	-0.0108	-0.119***	-19,605*
	(0.0299)	(0.0398)	(11,358)
Wedded Partner	0.00427	-0.0965**	30,825**
	(0.0335)	(0.0437)	(13,614)
Unwedded Partner	0.106**	0.160**	26,378
	(0.0531)	(0.0651)	(18,702)
Parent	0.199	0.375*	27,033
	(0.165)	(0.217)	(26,820)
Child	-0.125	-0.276***	14,894
	(0.0806)	(0.0959)	(16,923)
Housemate	-0.118	-0.382**	4,663
	(0.113)	(0.166)	(13,455)
Family member or broader	0.441***	0.0991	-28,015
	(0.153)	(0.191)	(47,380)
1 child	0.0266	0.0367	4,389
	(0.0251)	(0.0330)	(14,602)
2 children	-0.00422	0.0611	4,573
	(0.0378)	(0.0505)	(17,022)
3 or more children	0.172	0.215	100,821*
	(0.119)	(0.155)	(57,820)
Self-employed/freelancer	0.223***	0.275***	152,001***
	(0.0402)	(0.0588)	(30,740)
Retired	0.0621	0.0932*	51,907**
	(0.0383)	(0.0503)	(25,907)
Housework	-0.000738	0.000314	72,498**
	(0.0460)	(0.0600)	(34,535)
Unemployed	0.0339	0.101*	17,227
	(0.0390)	(0.0523)	(18,489)
Studying	0.0192	-0.00752	35,937*
	(0.0952)	(0.103)	(18,786)
Constant	2.523***	4.841***	-51,561**
	(0.104)	(0.127)	(23,250)
Observations	5,711	5,711	5,711
R-squared	0.489	0.475	0.093
Robust standard errors in parentheses			
*** p<0.01, ** p<0.05, * p<0.1			

Appendix C: Results Total Net Wealth

Table C.1 Total Net Wealth for Financial Literacy Score

	Total Net Wealth		
Financial Literacy	Mean	SD	Frequencies
0	11750.987	35190.363	230
1	65462.798	319506.33	870
2	84157.696	334003.9	3,201
3	133477.9	442201.14	3,187
4	201537.59	437945.57	1,455
Total	117150.33	391051.96	8,943

Table C.2 Total Net Wealth per year

	Total Net Wealth		
Wave	Mean	SD	Frequencies
2012	118658.3	419393.14	2,739
2014	107733.26	306010.74	2,405
2016	120439.72	504438.5	2,061
2018	123904.25	280035.16	1,738
Total	117150.33	391051.96	8,943

Appendix D: Summary statistics

Table D.1: Summary statistics

Variable	Obs	Mean	Std.Dev.	Min	Max
Total Financial Literacy	8943	2.533	.961	0	4
Basic Financial Literacy	8943	1.794	.475	0	2
Advanced Financial Literacy	8943	.739	.734	0	2
Interest Rates	8943	.934	.248	0	1
Inflation	8943	.86	.347	0	1
Return on Investment	8943	.503	.5	0	1
Bond Prices	8943	.236	.425	0	1
Subjective Financial Literacy	8943	5.005	1.204	1	7
Gender	8943	1.46	.498	1	2
Age	8943	5.493	1.487	2	7
Education	8943	2.756	1.48	0	5
Income	5711	1.453	.973	0	3
Confidence	8943	.639	.734	0	2
Marital Status	8943	2.283	1.693	1	5
Position	8943	1.549	1.006	1	7
Children	8943	.402	.631	0	3
Working Status	8943	1.476	1.518	0	5
Total Net Wealth	8943	117000	391000	-119000	1.50e+07
Risky Investments	1200	64741.82	158000	-3691	1800000
Total Investments	124	154000	350000	144	2450000
Other Investments	607	15501.43	59706.18	1	800000
Other Debts	1070	-23500	45871.82	-480000	-1
Study Debt	235	-13800	12255.75	-55000	-90
Housing Wealth	193	261000	311000	-354000	2420000
Total Balance	6060	39949.86	179000	-425000	8390000
Intellect/Imagination	12831	35.885	4.873	17	50
Self-esteem	12826	4.453	.386	1	7
Risk-attitude	535	1.364	.764	0	2
Financial Risk-attitude	535	1.52	.721	0	2

Appendix E: Results Regressions

Table E.1: OLS regression

VARIABLES	(1) Net Total Wealth	(2) Net Total Wealth
Financial Literacy	34,119***	
	(7,182)	
sub		25,282***
		(6,025)
2014	-18,313***	-18,538***
	(5,470)	(5,459)
2016	-16,716	-16,455
	(12,493)	(12,522)
2018	-27,572***	-27,627***
	(10,325)	(10,330)
Female	-6,940	-10,129
	(10,761)	(11,077)
26-35 years	-14,177	-9,245
	(9,647)	(9,256)
36-45 years	-13,315	-7,547
	(14,080)	(13,614)
46-55 years	18,828	24,542
	(16,863)	(16,360)
56-65 years	93,454***	97,665***
	(21,150)	(20,931)
65+ years	106,143***	111,896***
	(31,054)	(31,049)
Intermediate secondary education	49,038***	49,838***
	(17,888)	(17,482)
Higher secondary education	40,357***	42,975***
	(15,398)	(15,556)
Intermediate vocation education	39,917***	40,248***
	(13,957)	(14,409)
Higher vocational education	59,687***	60,567***
	(15,906)	(16,726)
University	93,821***	98,221***
	(26,889)	(26,790)
1001-2500 euro per month	17,901	15,745
	(25,069)	(25,083)
2501-4000 euro per month	48,115*	46,734
	(28,418)	(28,578)
4001+ euro per month	167,984***	168,865***
	(42,284)	(42,869)
Overconfidence	1,270	-44,760***
	(12,114)	(12,178)
Underconfidence	-20,792	26,959
	(14,558)	(17,144)
Separated	344,106	343,373

	(240,099)	(242,958)
Divorced	-16,908	-18,120
	(35,594)	(35,513)
Widow/Widower	-13,278	-14,007
	(29,723)	(29,697)
Never been married	-17,495	-14,867
	(16,566)	(16,666)
Wedded Partner	31,305*	33,887*
	(18,786)	(18,967)
Unwedded Partner	23,192	22,737
	(21,370)	(21,609)
Parent	19,599	16,879
	(23,269)	(23,042)
Child	17,172	19,885
	(19,956)	(19,542)
Housemate	7,870	13,474
	(14,724)	(16,098)
Family member or broader	-49,185	-36,613
	(44,268)	(45,819)
1 child	4,838	4,820
	(16,375)	(16,272)
2 children	5,893	4,208
	(19,994)	(19,979)
3 or more children	96,494	96,915
	(63,363)	(60,678)
Self-employed/freelancer	143,940***	144,624***
	(43,678)	(43,669)
Retired	47,606	47,371
	(33,057)	(33,078)
Housework	72,231*	72,203*
	(37,533)	(37,420)
Unemployed	15,786	14,397
	(21,394)	(21,579)
Studying	33,510	34,375*
	(20,619)	(20,162)
Constant	-131,737***	-168,040***
	(33,362)	(35,465)
Observations	5,711	5,711
R-squared	0.098	0.098
Robust standard errors in parentheses		
*** p<0.01, ** p<0.05, * p<0.1		

Table E.2 Channels

VARIABLES	(1) Risky Investments	(2) Other Investment	(3) Total Balance
financialliteracy	0.0833***	-0.0157**	8,956***
	-0.0101	-0.00658	(2,237)
2014	-0.0415***	0.000397	902.2
	-0.00975	-0.00935	(1,861)
2016	-0.0501***	0.0159	2,566
	-0.011	-0.0099	(4,367)
2018	-0.0353***	0.0134	-915.6
	-0.0129	-0.0107	(2,787)
Female	-0.0356*	0.0162	514.0
	-0.0195	-0.0122	(3,187)
26-35 years	-0.0218	0.0815**	58.02
	-0.0293	-0.0371	(2,975)
36-45 years	0.0433	0.0979**	5,815
	-0.0388	-0.0398	(4,118)
46-55 years	0.105***	0.0947**	16,271***
	-0.0394	-0.0396	(4,837)
56-65 years	0.146***	0.0998**	32,895***
	-0.0394	-0.0397	(5,142)
65+ years	0.166***	0.0742*	39,041***
	-0.0463	-0.0423	(9,964)
Intermediate secondary education	0.0624**	-0.00195	9,059
	-0.0246	-0.021	(7,302)
Higher secondary education	0.0744**	-0.0134	4,618
	-0.0312	-0.025	(6,106)
Intermediate vocation education	0.0493**	-0.00762	9,554
	-0.0247	-0.0215	(6,329)
Higher vocational education	0.111***	0.00394	13,348*
	-0.0264	-0.0209	(6,996)
University	0.173***	-0.025	19,693**
	-0.0386	-0.0274	(8,216)
1001-2500 euro per month	0.0228	0.0126	-7,281
	-0.0217	-0.0161	(6,589)
2501-4000 euro per month	0.039	-0.00588	4,299
	-0.0276	-0.0178	(7,198)
4001+ euro per month	0.120***	-0.0236	15,320*
	-0.0364	-0.0243	(8,970)
Overconfidence	0.00728	-0.0132	861.5
	-0.0185	-0.0129	(4,540)
Underconfidence	-0.0179	0.0055	-3,727
	-0.0223	-0.0141	(4,076)
Separated	0.00292	0.0849***	19,256
	-0.134	-0.0146	(21,187)
Divorced	0.00172	-0.00205	-20,106***
	-0.0288	-0.0162	(4,816)
Widow/Widower	0.0219	-0.0298	-1,987
	-0.0357	-0.0254	(12,992)
Never been married	0.0734***	-0.00627	-427.9
	-0.027	-0.0148	(6,585)
Wedded Partner	0.0256	-0.0168	-388.1
	-0.025	-0.0154	(5,422)
Unwedded Partner	-0.0511	0.00744	20,694
	-0.034	-0.0216	(20,852)
Parent	0.261	-0.16	-14,212**

	-0.17	-0.142	(5,643)
Child	-0.00416	-0.0119	8,265
	-0.0401	-0.0355	(5,393)
Housemate	0.0486	0.00994	1,969
	-0.092	-0.0799	(5,510)
Family member or broader	0.0482	-0.0631	-18,505**
	-0.275	-0.143	(7,896)
1 child	0.0122	0.0191*	-7,055*
	-0.0198	-0.0109	(3,637)
2 children	0.0555*	0.00729	-6,546
	-0.0334	-0.0207	(5,056)
3 or more children	-0.0372	0.0685**	14,404
	-0.076	-0.032	(22,702)
Self-employed/freelancer	0.0957**	-0.0423	9,367
	-0.0451	-0.0285	(8,405)
Retired	-0.0234	-0.00441	3,302
	-0.0312	-0.0184	(9,994)
Housework	0.0291	-0.023	15,812*
	-0.029	-0.0202	(9,193)
Unemployed	-0.027	-0.0212	-1,819
	-0.0249	-0.0179	(5,057)
Studying	-0.0245	-0.0863*	-427.4
	-0.0333	-0.0452	(4,249)
Constant	-0.234***	1.873***	-21,548**
	-0.0525	-0.0489	(10,060)
Observations	5,663	5,663	4,059
R-squared	0.116	0.023	0.070
Robust standard errors in parentheses			
*** p<0.01, ** p<0.05, * p<0.1			

Table E.3 IV

VARIABLES	(1) Net Total Wealth
Subjective Financial Literacy	-21,522
	(39,222)
2014	-18,950***
	(5,490)
2016	-17,203
	(12,618)
2018	-27,186***
	(10,315)
Female	-19,156
	(13,576)
26-35 years	-13,518
	(9,743)
36-45 years	-9,900
	(13,884)
46-55 years	22,804
	(16,625)
56-65 years	98,767***
	(20,886)
65+ years	112,532***
	(31,483)

Intermediate secondary education	65,021***
	(21,886)
Higher secondary education	68,683**
	(26,731)
Intermediate vocation education	66,273***
	(25,161)
Higher vocational education	84,582***
	(26,948)
University	123,347***
	(31,694)
1001-2500 euro per month	17,280
	(25,462)
2501-4000 euro per month	51,953*
	(29,441)
4001+ euro per month	183,628***
	(46,418)
Overconfidence	-35,277**
	(13,915)
Underconfidence	-68,993
	(81,222)
Separated	353,034
	(241,088)
Divorced	-18,696
	(35,384)
Widow/Widower	-18,393
	(30,283)
Never been married	-20,754
	(16,336)
Wedded Partner	29,197
	(19,126)
Unwedded Partner	29,944
	(21,182)
Parent	34,436
	(36,723)
Child	6,996
	(23,773)
Housemate	-4,620
	(21,980)
A family member or broader	-31,876
	(55,278)
1 child	6,712
	(16,778)
2 children	7,242
	(20,966)
3 or more children	106,990*
	(64,061)
Self-employed/freelancer	157,105***
	(43,143)
Retired	51,779
	(34,485)
Housework	72,486*

	(38,009)
Unemployed	19,015
	(22,356)
Studying	34,139*
	(20,550)
Constant	58,661
	(188,924)
Observations	5,693
R-squared	0.084
Robust standard errors in parentheses	
*** p<0.01, ** p<0.05, * p<0.1	

Table E.4: OLS for household heads and excluding students

VARIABLES	(1) Net Total Wealth (only heads of household)	(2) Net Total Wealth (excluding students)
Financial Literacy	36,286***	38,190***
	(10,200)	(7,649)
2014	-19,468***	-19,707***
	(7,193)	(5,654)
2016	-31,606***	-19,334
	(9,158)	(13,047)
2018	-32,514**	-29,070***
	(14,325)	(10,798)
Female	-13,080	-12,439
	(13,229)	(11,487)
26-35 years	-13,884	-7,315
	(15,994)	(10,778)
36-45 years	-13,129	176.1
	(21,136)	(15,180)
46-55 years	19,437	35,145*
	(24,547)	(18,013)
56-65 years	89,007***	116,922***
	(25,043)	(17,480)
65+ years	107,213***	152,889***
	(37,425)	(18,176)
Intermediate secondary education	41,310*	55,501***
	(22,473)	(18,898)
Higher secondary education	29,219	46,867**
	(21,571)	(18,252)
Intermediate vocation education	30,235	42,904***
	(19,497)	(15,736)
Higher vocational education	56,141***	69,894***
	(21,699)	(17,437)
University	97,491***	107,041***
	(33,251)	(29,498)
1001-2500 euro per month	20,969	-8,472
	(22,529)	(16,063)

2501-4000 euro per month	54,376**	13,376
	(22,753)	(18,174)
4001+ euro per month	176,263***	134,991***
	(38,088)	(33,698)
Overconfidence	199.5	4,955
	(15,837)	(12,866)
Underconfidence	-21,129	-23,641
	(17,054)	(14,952)
Separated	377,804	346,414
	(254,905)	(238,510)
Divorced	-8,527	-15,356
	(38,955)	(35,462)
Widow/Widower	-37,636	-5,625
	(30,097)	(30,132)
Never been married	-10,442	-14,234
	(17,365)	(16,550)
Wedded Partner		35,998*
		(18,878)
Unwedded Partner		20,717
		(21,400)
Parent		25,347
		(18,919)
Child		14,831
		(21,360)
Housemate		6,889
		(19,273)
A family member or broader		-61,447
		(60,041)
1 child	-5,958	3,355
	(14,166)	(17,057)
2 children	-11,544	3,094
	(26,241)	(21,032)
3 or more children	114,754*	102,109
	(58,517)	(66,533)
Self-employed/freelancer	183,461***	
	(51,959)	
Retired	73,873**	
	(36,482)	
Housework	128,325*	
	(70,999)	
Unemployed	39,091*	
	(21,386)	
Studying	47,139**	
	(22,222)	
Constant	142,205***	121,440***
	(42,698)	(30,980)
Observations	3,819	5,533
R-squared	0.147	0.087

Robust standard errors in parentheses

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

Appendix F: Robustness

Table F.1: Robustness checks

Variables	Max	Min	Mean	AvgSD	PercSigni	Perc+	Perc-	AvgT	Obs
Financial Literacy	48116.59	36299	42134.4	5097.265	1	1	0	8.321545	1024
Gender	18215.4	-20486.7	-1176.52	10007.78	0.023438	0.460938	0.539063	0.934244	512
Wave	-9.13799	-39.7014	-24.0011	16.99214	0.28125	0	1	1.412526	512
Age	50684.84	33778.21	40210.61	3793.861	1	1	0	10.66989	512
Education	16014.64	1637.276	10123.51	3366.406	0.65625	1	0	3.044189	512
Income	61726.83	33958.68	47589	6143.455	1	1	0	7.744631	512
Confidence	-5196.96	-11880.2	-8224.763	6361.648	0	0	1	1.281071	512
Marital Status	-4951.35	-21339.709	-11558.9	2791.467	0.875	0	1	4.163285	512
Position	19402.39	-14695.7	3366.091	6133.68	0.375	0.613281	0.386719	1.54522	512
Children	6320.081	-38884.5	-13914.7	7504.16	0.5	0.242188	0.757813	2.072864	512
Working Status	34620.37	-358.709	15814.87	3619.301	0.75	0.945313	0.054688	4.343246	512