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Financial literacy and stock market participation: The moderating effect of happiness

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ABSTRACT

This thesis examined the moderating role of happiness on the relationship between financial literacy and stock market participation. Using data from the 2005 DNB Household Survey and a financial literacy module added to said survey, Ordinary Least Squares (OLS) regressions and Logistic (Logit) regressions were performed. The results indicate some evidence supporting the positive moderating role of happiness and some evidence supporting the negative moderating role of the highest level of happiness, with none of the evidence found being consistent across models. These findings suggest that happiness does not moderate the effect that financial literacy has on stock market participation. Nevertheless, future researchers should explore other psychological factors instead of happiness that may serve as significant moderators.

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CHAPTER 1 Introduction

Financial literacy is defined by Hung et al. (2009) as: "The ability to use knowledge and skills to manage financial resources effectively for a lifetime of financial well-being." This is illustrated even more by Lusardi & Mitchell (2007), who show that those who are financially literate are more likely to plan for retirement and are more likely to do it successfully. A natural follow-up could be that being financially literate has an influence on the likelihood of stock market participation, or the purchasing of stocks as an investment since this is a way to plan for retirement. According to a Wall Street Journal article, about 58% of U.S. households owned stocks in 2022. This was a record according to the article, the number of American households who own stocks had never been so high. While the number of households that are purchasing stock is increasing, it begs the question why not every household holds stocks, which is also known as the stock-holding puzzle (Haliassos & Bertaut, 1995). A solution to this problem could be that households are simply scared to do something they do not know much about, since studies show financial illiteracy is common and that a lot of individuals do not have knowledge of simple economic concepts (Lusardi & Mitchell, 2011a).

Van Rooij et al. (2011) shows that households where the individual in charge of the household's finances is not financially literate, are much less likely to participate in the stock market. The researchers used data from DNB Household Survey and a module to determine financial literacy that the researchers themselves created, which they added to the main survey. Using a regression with data of over 1,100 households, the authors found that an increase of one standard deviation in advanced literacy increased the likelihood of participating in the stock market by 9 percentage points. The results remained the same, even after adjusting for guessing and improvement of financial literacy by past participation in the stock market. Other studies show that being financially literate positively influences your financial choices. Lusardi & Mitchell (2007) show that individuals who are financially literate are more likely to plan for retirement and that the effect of financial literacy on retirement planning tends to be underestimated. Jappelli & Padula (2013) found that being financially literate allows individuals to increase the return on wealth. A study also found that financial literacy changes financial behavior across five different topics: loans, financial advice, insurance, credit cards and investments (Allgood & Walstad, 2015).

Van Rooij et al. (2011) researched the influence of financial literacy on the probability of participating in the stock market. Closely related is the study done by Rao et al. (2014), who found that a household's chance of investing in the stock market increases with happiness. Happiness refers to the happiness of the individual that is in charge of their household's finances. Veenhoven (2017) defines happiness as "The degree to which an individual judges the overall quality of his/her own life-as-a-whole favorably. In other words, how much one likes the life one lives." The reasoning behind this correlation may be that happiness is linked to risk taking. Individuals who are happy will be more optimistic, which often makes them more

willing to take risks. This willingness to take risks may lead to a greater chance to participate in the stock market, since this always carries risk to some degree. This optimism also gives happy individuals a more positive look on the future. This can lead to being more likely to invest in the stock market, because a positive outlook on the future may result in a stronger belief that the stock market will give a positive return.

Happiness connects to financial literacy through financial wellbeing. Financial literacy was found to be connected to financial wellbeing in Taft et al. (2013), who explain their results with the reasoning that people with higher financial literacy will be more informed when making financial decisions. Happiness was found to be connected to financial wellbeing in Patel & Wolfe (2019). These authors argued that people with higher levels of happiness will have traits like optimism, confidence, and resilience. These traits lead to things like improved job performance and advancement of their career, which increases earning potential, leading to higher financial wellbeing. This means that there is an indirect link between financial literacy and happiness, because they were both found to be positively correlated with financial wellbeing. Therefore, there is motivation to research if happiness moderates the relationship between financial literacy and stock market participation. Thus, the goal of this thesis is to study: "How does happiness moderate the relationship between financial literacy and stock market participation in The Netherlands?".

To measure financial literacy and stock market participation, similar to Van Rooij et al. (2011), I will use the 2005 DNB Household Survey and the module that the authors of that paper created. The module was added to the main survey. Over 1,000 households in The Netherlands answered the module and the survey. The individuals who answered are the ones that oversee the household's finances, so they speak for the household. This module is used to determine an individual's financial literacy, by asking questions regarding multiple financial topics. Similarly, I will use questions from the 2005 DNB Household Survey to measure happiness and stock market participation. Stock market participation is measured by the ownership of individual stocks and/or mutual funds and a household is considered as not participating in the stock market when there is no ownership for either of these. For happiness, I will make a dummy variable, which equals one for those that answered either "very happy" or "happy" and zero for those that answered "neither happy nor unhappy", "unhappy" or "very unhappy". Finally, to find the moderating effect of happiness, I will do multiple OLS and Logit regressions, the main being as one that includes advanced literacy, happiness and an interaction term between the two. The regression equation for that is $Y = \beta 0 + \beta 1(\text{Advanced Literacy}) + \beta 2(\text{Happiness Dummy}) + \beta 3(\text{Advanced Literacy} * \text{Happiness Dummy}) + \textbf{Control Variables} + \varepsilon$, where the number in place of $\beta 1$ will be interpreted as the increase/decrease in percentage points for stock market participation for moving up one standard deviation in the advanced literacy index. $\beta 3$ will be used to measure the moderating effect that happiness has on the relationship between financial literacy and stock market participation. Relevant control variables such as income, education and a large number of demographic characteristics will be used to test the hypothesis of this thesis.

I hypothesize to find that happiness strengthens the effect of financial literacy on stock market participation. In my results, this should be made clear by the interaction effect between happiness and advanced financial literacy being positive and significant. This is expected, since both happiness and financial literacy have a positive correlation with financial wellbeing, indicating a possible indirect link between those variables. Combined with the fact that happiness is positively correlated with stock market participation, I expect happiness to moderate the effect in a positive way. Given the already found relationship between financial literacy and stock market participation by Van Rooij et al. (2011), I expect that this thesis will allow for a deeper and different look into that relationship and learn more about it in a way that has not been done before, by looking at the moderating effect of happiness on this relationship. This does not mean that this thesis will be the "final answer" or "the last piece of the puzzle" when it comes to this topic. While this thesis will let us learn more about the relationship between financial literacy and stock market participation, since it is impossible to include every variable in one regression, there will be unexplained variation since every household is unique. This allows for future researchers to look at this relationship in a separate way than done in this thesis.

The findings indicated that happiness does not moderate the relationship between financial literacy and stock market participation. While evidence was found in some models, the moderating role of happiness was not supported by the results, as the findings were not consistent across models. Some evidence was even found that suggested the highest level of happiness negatively moderates the relationship, however these findings were also not consistent across models. Future researchers are recommended to look at other psychological factors instead of happiness that may serve as a significant moderator of the relationship between financial literacy and stock market participation.

The remainder of this thesis follows the following structure. Chapter 2 discusses previous studies done on the topics of this thesis. Chapter 3 explains how the factors of this thesis were obtained and constructed, including the control variables, while providing summary statistics. Chapter 4 discusses the methodology used for the analyses. Chapter 5 presents the findings of all the regressions, starting with the regressions done with a combined version of happiness and ending with the regressions done with happiness split into two different levels. Chapter 6 discusses the results and compares them to previous literature. Chapter 7 summarizes the research of this thesis. Additional materials are provided in the Appendix.

CHAPTER 2 Theoretical Framework

2.1 Financial literacy

For this thesis, it is important to understand what exactly we are talking about when we talk about financial literacy. Hung et al. (2009) defines financial literacy as: "The ability to use knowledge and skills to manage financial resources effectively for a lifetime of financial well-being". To give an example, according to Lusardi & Mitchell (2007), if the person that oversees the household's finances is financially literate, they will be more likely to plan for retirement successfully. From the definition of Hung et al. (2009), it can be observed that financial literacy is a part of financial well-being. Being financially literate is often a part of having high financial well-being (Taft et al., 2013).

Goyal & Kumar (2020) did a systematic review on financial literacy. According to this study, research about financial literacy started getting popular around the late 1990s. One of the earliest studies done about financial literacy in this time is done by Voipe et al. (1996). The authors studied "personal investment literacy" among college students. The authors studied this topic, because according to them, the importance of personal investment decisions could not be overstated. Decisions about personal investments influence things such as "accumulating funds for a down payment for a home or an automobile, a child's education, personal goals/dreams, and retirement" (Voipe et al., 1996, p. 86) and doing these things poorly could result in serious economic problems. The authors studied personal investment literacy with the help of a questionnaire. This way, personal investment literacy can be measured in an objective way. There were 10 questions, which were obtained from the Money Forecast Issue of Money magazine (1993). Each question was worth 10 points. Based on how many were answered correctly, an "investing IQ" was assigned. This "investing IQ" was meant to represent a person's investment literacy.

Goyal & Kumar (2020) also mention the earliest studies that were done on financial literacy. These were performed amongst school and college students (Bakken, 1967; Danes and Hira, 1987). Though both these studies do not explicitly use the words 'financial literacy', it is clear that the studies are examining the same concept. According to Goyal & Kumar (2020), a report in 1992 by the National Foundation for Educational Research marks the earliest defined meaning of the term (Noctor, Stoney, & Stradling, 1992). In earlier studies, terms related to knowledge about financial topics, such as "Money Management Knowledge" by Danes and Hira (1987), are used instead. However, the idea behind it is identical. These earlier studies have a similar design to Voipe et al. (1996). The standard is to measure financial literacy in an objective way. This is by asking questions with the help of a survey or questionnaire. Although these questions are often not the exact same, they follow the same concept of asking questions about financial topics. The number of questions that every person answered correctly represents their financial literacy. Much like Voipe et al. (1996), the reason that these studies were done was that the authors realized the potential economic

problems one could have without financial literacy. For instance, Bakken (1967) mentioned that significant financial problems could be caused by poor money management and Danes and Hira (1987) said that the money management knowledge of college students impacts the financial well-being of their families.

An overview of financial literacy was done by Lusardi & Mitchell (2011a). This study concluded there were a lot of patterns with financial (il)literacy. For instance, it showed that financial illiteracy was common when the financial markets are well developed, but also when the financial markets are quick to change such as in Russia. There are also demographic differences found in this study. Older individuals believe they have a lot of knowledge, even though they are actually less knowledgeable on average. Women are also less knowledgeable on average, but in contrast to older individuals are aware of this. In the United States, African Americans and Hispanics were found to be less financially literate compared to other races.

2.2 Stock market participation

It is essential for the results of this thesis to know what we count as stock market participation for households and what not. An academic definition will provide clear instructions on what to look for. Van Rooij et al. (2011) gives stock market participation the following definition: "stock ownership is defined as owning individual stocks and/or mutual funds" (p. 459). Participating in the stock market can be seen as a part of financial behavior. Xiao (2008) defined financial behavior as "any human behavior that is relevant to money management". Since participating in the stock market is a way of managing your money, this information will shine a bit of light on how households behave financially.

An early study about stock market participation was the study that is commonly recognized as the introduction of the stock-holding puzzle (Haliassos and Bertaut, 1995). This puzzle brings up the question of why so few households hold stocks, while historically a premium is received when holding stocks rather than risk free assets. Researching this puzzle was interesting, since that could help with learning to understand how stocks and similar assets are priced. The explanation behind this puzzle is also important, because it helps with ensuring that a wide range of different types of households participate in the stock market. Different households with different levels of incomes participating in the stock market helps with, for instance, researching the effect that tax rates on capital gains have (Haliassos and Lyon, 1993). The study was performed with the help of the 1983 Survey of Consumer Finance. This survey had data that was split into 12 groups based on income percentiles. This data contained information such as the percentage of households that hold stocks and riskless assets, which also included the dollar amount that both categories were worth on average for every group.

Haliassos and Bertaut (1995) mention multiple early studies about stock ownership, such as Blume et al. (1974), Blume and Friend (1978) and Crockett and Friend (1963), which is very similar to stock market

participation. In Blume et al. (1974), the characteristics of stock ownership in the United States were studied. One of the main results of this study was that households with a retired individual in charge of the households' finances and households in upper income groups were more likely to own stocks. An even earlier study falling into this category is done by Warshow (1924), who researched the distribution of stock ownership. The goal in Warshow (1924) was to examine the change in the number of shareholders in the first twenty-two years of the twentieth century. Although it is important to mention that this study looked at book stockholders rather than the number of individuals that hold stock, since there was an insufficient amount of data at this time about the number of individuals who hold stock. A book stockholder is defined in Means (1930) as "the name of an individual on the stock record books of a corporation". Data about book stockholders was easier to gain access to, since this could be obtained from financial reports, other similar public financial statements and questionnaires that were sent to companies. With this, the author could find out if more people were starting to own stocks, or if stock ownership remained dominated by the wealthiest. This research was hoping to contribute to understanding the effect of a changing distribution of stock ownership. The approach of this study is a different approach compared to this thesis. Here, households, or individuals in charge of their households' finances, are looked at instead.

2.3 Empirical studies on financial literacy and stock market participation

This thesis takes a lot of inspiration from Van Rooij et al. (2011). They collected survey data from an annual household survey done in the Netherlands with a financial literacy module added to the main survey that the authors designed themselves. The people responding to the module are the individuals that make the financial decisions in the household. Using a regression analysis, the authors show that being financially illiterate makes households less likely to participate in the stock market.

Van Rooij et al. (2011) designed the modules, such that five questions were used to determine basic financial literacy and eleven more questions were used for advanced literacy. While studies usually use questions used in previous studies, what study they choose to obtain the questions from is often different. To illustrate, Yoong (2011) used the same modules designed by Van Rooij et al. (2011). Yoong (2011) researched the effect of financial literacy on stock market participation in the United States. This study used data from the American Life Panel, which was modeled after the Dutch CentERpanel used in Van Rooij et al. (2011). The exact same questions were used to determine both basic and advanced literacy. However, by using questions only relevant to the stock market to compose a stock market illiteracy index, the author found a slightly stronger effect than Van Rooij et al. (2011) found with just advanced literacy.

Another instance of reusing the same survey questions for financial literacy happens in Bucher-Koenen et al. (2023). However, this study picked a different study and used the "Big Three" financial literacy questions designed by Lusardi and Mitchell (2011b) to research the effect of an individual's financial

literacy on stock market participation in Germany. This is in contrast to studies such as Van Rooij et al. (2011), who used eleven questions for their main financial literacy index. This seemingly could have had a big impact. While a significant effect was still found, it was significantly smaller than the effect found in Van Rooij et al. (2011) and Yoong (2011).

To fully illustrate the previous point, Thomas & Spataro (2018) picked another different study for their financial literacy questions by using Jappelli & Padula (2013). Thomas & Spataro (2018) studied the effect of financial literacy on stock market participation in nine different countries in Europe. A total of four questions were used for just one financial literacy score between one and five that was assigned to an individual. A significant effect was found in this study as well, with the magnitude roughly in between the results of the studies previously discussed.

Different approaches were taken such as in Kadoya et al. (2017), where an individual's basic financial literacy was used as their main approach for studying the effect of financial literacy on stock market participation, which was created with four questions. The authors also measured advanced financial literacy however, but only two additional questions were used for this. Kadoya et al. (2017) found a significant result with both ways of measuring financial literacy in Japan. They argued that the effect of financial literacy on stock market participation originates from reduced cost of participation, increased awareness and enhanced cognitive ability.

A similar relationship was studied in Xia et al. (2014). The authors studied the effect of financial literacy overconfidence on stock market participation. Financial literacy overconfidence was measured by the difference between an individual's subjective and objective financial literacy. The study found that financial literacy overconfidence was positively correlated with participating in the stock market, while financial literacy under-confidence was negatively correlated with participating in the stock market. It was also able to show that overconfident individuals had similar participation rates to those with both high objective and subjective literacy. This suggests that confidence in one's financial literacy is a driver of stock market participation, whether the confidence is justified by objective financial literacy or not.

In a similar fashion, the main relationship studied by Sivaramakrishnan et al. (2017) was the effect of both an individual's objective and subjective financial literacy on stock market participation. Just like Yoong (2011), data from the American Life Panel was used. The results indicated that both subjective and objective financial literacy influenced the intention to invest in the stock market, while only objective actually had influence on behavior.

This thesis builds on the work done by Van Rooij et al. (2011). Since the base relationship of financial literacy and stock market participation in this thesis will be obtained with the same data used in Van Rooij

et al. (2011), there is no need to speculate what the result of just this relationship will be. Van Rooij et al. (2011) found that increasing advanced literacy by one standard deviation raises the chance of a household participating in the stock market by nine percentage points in the Netherlands.

2.4 The moderating role of happiness

Veenhoven (2017) defines happiness as "The degree to which an individual judges the overall quality of his/her own life-as-a-whole favorably. In other words, how much one likes the life one lives." How happy someone is, is part of someone's mindset. It could influence what they think about when making decisions. For instance, happy people have been found to be more optimistic about the future (Piper, 2022). This could be a factor in a person's belief to get a positive return when participating in the stock market. Someone that is happy with their life has been found to make different financial decisions on average than individuals who are not (Delis, 2015).

Research has shown that households with greater life satisfaction or happiness are more likely to invest or participate in the stock market. One of the clearest examples was done by Rao et al. (2014). This study researched the effect of happiness on stockholding for households in China. By using the China Household Finance Survey from 2011, they found that happiness was positively correlated with the chance of investing in stocks and/or mutual funds. Interesting to note is that they also found that households with higher happiness invested a larger share of their income in stocks and/or mutual funds on average. The authors argue that the positive correlation between happiness and stock market participation originates from happier people having higher trust and social capital, which makes them more likely to participate in the stock market.

A similar study was done in China (Cui & Cho, 2019). In this study, the relationship between a household's happiness and financial market participation was studied. The financial market researched here is more extensive than just the stock market from Rao et al. (2014), also including various risky financial assets. While the authors found that the probability of participating in the financial market and the proportion invested increased with happiness, it is worth noting that the results showed that the participation declined slightly at the highest level of happiness. The authors argued that this is due to households with the highest level of happiness having a tendency to maintain the status quo. This is worth taking into account for this thesis, since it could influence the results if this holds for households in the Netherlands as well. Splitting happiness into dummies for the answers "happy" and "very happy", "happy" may return a stronger effect or may become significant in comparison to the combined version of happiness.

Slightly different research was conducted about the relationship between happiness and financial preparation for adults in Japan (Mimura, 2023). It was observed that increased happiness leads to increased

investments. While this just mentions an increase in the proportion of wealth invested, the previous two studies showed that they are usually present together. The authors argued that this relationship originated from a future-oriented mindset, since happier individuals may be more likely to think about the future and assign value to long-term success rather than present fulfillment.

Happiness connects to financial literacy through financial wellbeing. Taft et al. (2013) found that higher financial literacy leads to higher financial wellbeing. This relationship exists because people with higher financial literacy will be more informed when making financial decisions. For example, they may know how to avoid common mistakes, manage the risk they take, or they may know about financial tools or services that people with lower financial literacy do not know about. These things allow them to make better financial decisions on average. This will on average return higher wealth (Van Rooij et al., 2012), leading to higher financial wellbeing. Happiness is positively correlated with financial wellbeing as well, as shown by Patel & Wolfe (2019) for self-employed individuals. The reasoning behind this can be that people with higher levels of happiness will have traits like optimism, confidence, and resilience. These traits lead to things like improved job performance and the advancement of their career, which increases earning potential. This eventually leads to higher financial wellbeing. Happiness can also improve an individual's social life, which gives the option of financial help, job opportunities and advice through networking. A great example of this is the study by Yeo & Lee (2019), which showed that social capital increases financial wellbeing through life satisfaction. This means that there is an indirect link between financial literacy and happiness, because they were both found to be positively correlated with financial wellbeing.

I hypothesize to find that happiness strengthens the effect of financial literacy on stock market participation. Both happiness and financial literacy have a positive correlation with financial wellbeing, indicating a possible indirect link between those variables. Combining this knowledge with the fact that previous studies showed that happiness is positively correlated with stock market participation, I expect happiness to moderate the effect in a positive way. This means that the hypothesis used in this thesis is the following:
H_1 : *Happiness moderates the relationship between financial literacy and stock market participation in the Netherlands in such a way that, when the level of happiness increases, the effect of financial literacy becomes stronger.*

CHAPTER 3 Data

3.1 Sample description

This thesis uses data from the 2005 De Nederlandsche Bank's Household Survey (DHS). The DHS is an annual household survey run by CentERdata (Tilburg University, The Netherlands). While this data contains over 2000 households from The Netherlands, we can only use data from the households that also answered the financial literacy module. It is important to note that the individual that responded to the module is the one in charge of their household's finances. The participants take the survey via the internet. However, it is not required for a household to have an internet connection to participate in the survey. Random recruitment was done by phone and households without an internet connection were provided with one. After adding the stock market participation data to the financial literacy module and combining it with the data for all control variables, the final sample size ends up at 976 observations. In this thesis, household weights provided with the DHS survey are used for all regressions and descriptive statistics, to make sure that they are representative of the population.

3.2 Variables

Financial literacy is measured using a module added to the DHS by Van Rooij et al. (2011). This module contains five questions to determine basic financial literacy, while advanced literacy was determined with eleven.[1] Around 43.4% of the sample answered all five basic literacy questions correctly, while only 7.1% got all advanced literacy questions correct. To assign a financial literacy index to each individual, a factor analysis on a dummy variable for each question needs to be performed. A factor analysis is done once for the basic literacy index and four times for the advanced literacy index. A more thorough explanation of this process is present in the Methodology chapter. The scores obtained from the factor analyses are standardized to a mean of 0 and a standard deviation of 1. This allows for the interpretation of results to be more intuitive. An increase of 1 in the literacy index has no clear meaning and thus the magnitude of the results of the regression are harder to interpret without standardization.

Stock market participation is measured by two survey questions from the DHS. Since this thesis considers a household to be participating in the stock market when it owns individual stocks and/or mutual funds, the data for stock market participation is obtained with two questions, one question for each possibility. To check for an individual stock holding, participants were asked "Did you, on 31 December 2004, own any SHARES?". It is important to note that participants were instructed to not include bonds through mutual funds nor shares of their own private limited company. The question "Did you, on 31 December 2004, have investments with MUTUAL FUNDS?" was used to check for ownership of mutual funds. Here, the

[1] For the exact questions used to determine both literacies, refer to Appendix A.

participants were instructed not to include individual stocks or bonds, savings through life-insurance nor investments in growth funds. Using this, stock market participation is constructed as a dummy variable that holds 1 if the participant answered yes to either question and 0 otherwise. Roughly 24.24% of the households in the sample are participating in the stock market.

Happiness is measured by one survey question obtained from the DHS. Participants had to answer the question "All in all, to what extent do you consider yourself a happy person?". Since the goal of this thesis is to find out the moderating effect of being a happy person, I will merge the five possible options into two categories. Happiness will equal 1 when the participant is deemed to be a happy person by answering either "very happy" or "happy". Otherwise, if the participant answered "neither happy nor unhappy", "unhappy" or "very unhappy", happiness will be 0 instead. By this definition a remarkable number of participants are considered happy people, with around 83% of participants fitting into this category. Since Cui & Cho (2019) found that stock market participation declined slightly at the highest level of happiness, it is worth doing regressions where happiness is split up to see if similar results will be found regarding whether happiness is moderating the effect of financial literacy on stock market participation. This would be done by splitting "Happiness" into two variables, one named "happy" that only is equal to 1 when "happy" is answered and "very happy" for the other, to separate the effect. There is not much use in splitting the variable into more categories, since there are almost no observations for participants that picked "unhappy" or "very unhappy" (12 and 3, respectively). Therefore, these categories will stay combined with "neither happy nor unhappy" for this thesis.

3.3 Control variables

To study the moderating role of happiness on the relationship of financial literacy on stock market participation, a great deal of control variables will be used in the regressions. A total of eleven control variables will be used: *age, education, male, married, number of children, retired, self-employed, household income, wealth, economics education* and *daily use of economics*. The data for all control variables comes from questions asked in the 2005 DHS survey.

First, I start by adding demographic control variables. *Age* is one of them and simply determined by asking the participants for their age. This variable will be split up into multiple dummies as follows. The base group will be all ages 30 or below, with the other dummies being 31 to 40, 51 to 60 and 61 and above. The mean age in the dataset is 51.5. *Education* will similarly be split up into multiple dummy variables. It was measured by asking the participants for their "highest level of education attended (regardless of certificate/diploma)". From these answers, all education below intermediate vocational (VMBO) is taken as the base group. Every other answer, which are intermediate vocational, secondary pre-university (HAVO

or VWO), higher vocational (MBO or HBO) and university (WO), are its own dummy variable. The most common answer was HBO, with 25.2% of the participants having this as their highest education level.

Male is a dummy variable for sex. The respondent was asked for their sex, with the possible answers being Male and Female. The variable takes the value 1 when the participant answered "Male" and 0 otherwise. Roughly 57.8% of the respondents are male. *Married* is another dummy variable. Participants were asked to answer the question "What is your marital status?". The variable is equal to one when the respondent indicated to be married or in a registered partnership. Roughly 40.5% of the sample is married, with 38.4% having no partner at all. *Number of children* is a similar control variable measured by asking the participants for the number of children that are in the household. While around 14% of respondents in this sample have two children, only 5.3% have three or more.

Retired and *Self-employed* are dummy control variables for employment status and are self-explanatory. The answer selection as "Primary occupation of the respondent" determines these variables. *Retired* equals one when the respondent is 65 or more years old or chose retired as their most important occupation, which includes early retirement. Around 27.6% of the sample fits this category. *Self-employed* is 1 when the option "free profession, freelance, self-employed" was chosen as the primary occupation, which is just 3.4% of this sample.

Finally, some economic control variables are used. The first one is *Household income*, which represents the net disposable household income in a year. This variable was transformed by taking the natural logarithm. The median household income for the sample is €21,669. Another control variable about financial well-being is *Wealth.* This variable is measured by 27 different questions, where wealth will be the total sum of the checking and savings accounts, employer sponsored saving plans, cash value of life insurance, real estate such as home equity, and other financial assets minus the total debt. All the participants are then split into four wealth quartiles. The first quartile is used as the base group (wealth ≤ €2,650). The other three quartiles are each turned into a dummy variable, which is €2,650 < wealth ≤ €44,400 for the second quartile, €44,400 < wealth ≤ €198,700 for the third quartile and wealth > €198,700 for the last quartile. To reduce the effect of outliers, both household income and wealth are winsorized at 90%. Winsorization at 90% transforms the data such that all extreme values under the 5^{th} percentile and above the 95^{th} percentile are set to the value of the respective percentile. This allows the effect of the most extreme values to be reduced without completely removing them from the data.

Economics education is one of the last two economic control variables. The participants were asked "How much of your education was devoted to economics?" and could choose between the options "A lot", "Some", "Little" and "Hardly at all". "A lot" is taken as the base group, with the other three all becoming a dummy variable. Any "I don't know" answers were combined with "Hardly at all". Over half of the

sample indicated that at least some of their education was devoted to economics. Lastly, *Daily use of economics* was measured by asking the participants "How much of an understanding of economics do you need during your daily activities (job, hobbies, etc.)?". Similarly, they had the same options as for *Economics education*. Again, "A lot" was taken as the base group while the other three options were transformed into three dummy variables. Any "I don't know" answers and any refusal to answer was combined with the "Hardly at all" category. For *Daily use of economics*, over half of the participants chose "Some" as their answer.

3.4 Descriptive statistics

Table 1 contains descriptive statistics of all the variables that will be used in the statistical analysis later in this thesis. Basic and advanced literacy are both standardized, so they have a mean of 0 and a standard deviation of 1. Stock market participation has a mean of 0.242, showing that around 24.2% of the sample participates in the stock market. Nearly two-thirds of the participants answered "happy" to the question measuring happiness. Around 15% answered "very happy" and another 15% "neither happy nor unhappy", with unhappy and very unhappy almost never chosen (1,4% and 0,5%, respectively).

Age has a mean of 51.5 years and a standard deviation of 15.545, with a minimum and maximum value that are far apart (22-90). This broad range shows that the sample is quite diverse in terms of age. The mean of Male is 0.578, meaning there are slightly more men than women in this sample. This could be caused by the fact that this sample only includes individuals who handle (most of) the financial matters of the household, which may be slightly biased towards men. Household income has a mean of 24,206.71, with the whole sample being between 10,264.50 and 52,032.13 after winsorization. Wealth has a negative minimum value, meaning some households are in debt. The measurement of wealth in the DHS is inconsistent, possibly due to asking questions that a lot of individuals may not know the exact answer to. Using dummies for wealth quartiles means that the measurement of wealth does not have to be precise for it to still be useful. Economics education seems to be somewhat uniformly distributed, with Some and Little having roughly the same proportion of answers (0.342 and 0.297) and A lot and Hardly at all sharing around the same proportion as well (0.163 and 0.197). Daily use of economics does not have the same distribution. Over half of the participants use at least some economics daily, while only around 7.4% uses economics hardly at all on a given day.

Table 1
Descriptive statistics for the regression variables and the control variables. The table includes weighed mean, weighed standard deviation, minimum value and maximum value. Data from the 2005 DNB Household survey.

Variable	Mean	Std. Dev.	Min.	25%	Median	75%	Max.
Basic literacy	0	1	-3.989	-0.305	0.374	0.690	0.690
Advanced literacy	0	1	-3.087	-0.368	0.408	0.698	1.017
Stock m. participation	0.242	0.429	0	0	0	0	1
Happiness							
Very happy	0.168	0.013	0	0	0	0	1
Happy	0.659	0.016	0	0	1	1	1
Neither (un)happy	0.154	0.013	0	0	0	0	1
Unhappy	0.014	0.004	0	0	0	0	1
Very unhappy	0.005	0.003	0	0	0	0	1
Age	51.503	15.545	22	39	51	63	90
Male	0.578	0.494	0	0	1	1	1
Married	0.404	0.500	0	0	0	1	1
Number of Children	0.538	0.949	0	0	1	1	5
Retired	0.276	0.447	0	0	0	1	1
Self-employed	0.034	0.182	0	0	0	0	1
Household income	24,206.71	11,497.17	10,264.5	14,717.37	21,669.39	31,711.82	52,032.13
Wealth	117,754.6	147,086.6	-6,415	2,631	44,219.11	198,564	502,106
Pre-VMBO	0.053	0.224	0	0	0	0	1
VMBO	0.247	0.431	0	0	0	0	1
HAVO/VWO	0.142	0.349	0	0	0	0	1
MBO/HBO	0.432	0.496	0	0	0	1	1
University	0.127	0.333	0	0	0	0	1
Economics educ.							
A lot	0.163	0.370	0	0	0	0	1
Some	0.342	0.475	0	0	0	1	1
Little	0.297	0.457	0	0	0	1	1
Hardly at all	0.197	0.398	0	0	0	0	1
Daily economics							
A lot	0.128	0.334	0	0	0	0	1
Some	0.502	0.500	0	0	1	1	1
Little	0.296	0.457	0	0	0	1	1
Hardly at all	0.074	0.261	0	0	0	0	1
Observations	976						

Note: Means of dummies for a categorical variable may not add up to 1 due to rounding.

CHAPTER 4 Method

4.1 Finding the literacy indices

Before the data can be analyzed, the literacy indices need to be constructed first. Just taking the sum of all the correct answers to the survey questions is not the most accurate way to represent an individual's financial literacy. Not every question may contribute equally to determining financial literacy. Therefore, a factor analysis is performed with a dummy for every survey question, which checks if the participant answered correctly. By doing this, it is able to be observed how important a question is in constructing an individual's literacy index. Each question is given a number to resemble that importance, which is the factor loading. The factor loadings are displayed in Tabel B1 and Tabel B2 for basic and advanced literacy, respectively. These are used to calculate a factor score for every observation, which can then be standardized. The factor analyses are done with the Bartlett method (Bartlett, 1937). This method aims to estimate factor scores that are unbiased. The Bartlett method tries to this by to minimizing the sum of squared differences between the observations and the method's predictions. While the math used in this method is complicated, it can simply be done by using statistical software. One factor was meaningfully retained for the basic questions, which represents basic literacy. However, a factor analysis needs to be done four times for advanced literacy. This is because Van Rooij et al. (2011) found that the wording of question 15 and 16 significantly impacted the percentage of correct answers. Participants were randomly with equal probability given one of two wordings for each question. This means that the sample can be split into four subsamples, allowing for a factor analysis to be done on each one. The amount of "do not know" answers also increased heavily for the advanced literacy questions compared to the basic questions. Since incorrect answers may mean something different for an individual's literacy compared to "do not know" answers, incorrect and "do not know" answers are separated. This is done by creating an extra dummy variable for each question that indicates if a participant answered "do not know". This means that every factor analysis for the advanced literacy index is done on 22 variables, two for each question. One meaningful factor was retained in every subsample, which describes advanced literacy.

4.2 Analyzing the data

With the literacy indices constructed, the data can be analyzed. Since the base relationship of literacy on stock market participation is derived from Van Rooij et al. (2011), it is only fitting to use the same regression model used in that study. Since the authors used an Ordinary Least Squares (OLS) regression, I will use this as well. The main regression will be done on the following equation:

$$Stock\ Market\ Participation_i = \beta_0 + \beta_1 Advanced\ Literacy_i + \beta_2 Happiness_i + \beta_3 (Advanced\ Literacy_i \times Happiness_i) + \beta_4 \boldsymbol{Control\ Variables} + \varepsilon_i$$

In this equation, $Advanced\ Literacy_i$ is the individual's advanced financial literacy index measured by multiple survey questions, calculated using the factor analysis mentioned prior and then standardized. $Happiness_i$ is a dummy variable that is equal to 1 when the individual considers themselves a (very) happy person. $(Advanced\ Literacy_i \times Happiness_i)$ is an interaction term. This is what will measure if happiness significantly moderates the relationship between financial literacy and stock market participation. $\boldsymbol{Control\ Variables}$ is a brief way of mentioning all the control variables that will be used in the regression. What exact control variables will be used is mentioned earlier in this thesis. $Stock\ Market\ Participation_i$ is a dummy that takes the value of 1 when a household either holds stocks directly or indirectly through mutual funds. Since $Stock\ Market\ Participation_i$ is a dummy variable that can only be equal to 0 or 1, the OLS regression will be used as a linear probability model.

The idea behind OLS is to try to find the line that fits the data points most accurately. This is calculated by minimizing the sum of the squared differences between the data points that were actually observed and the probabilities that the line predicted. This allows for the line that best fits the data to be found and the chance of predicted probabilities that are very far off to be reduced. The predicted probability can be interpreted as the chance of the outcome (which in this equation is participating in the stock market) happening. However, a linear probability model always has heteroskedastic errors. Therefore, the errors will be corrected for heteroskedasticity.

For comparison, all OLS regressions will also be replicated with the same variables using a logistic regression. A logistic regression, or logit for short, is a statistical method that is used when the outcome is binary. The outcome of this thesis is stock market participation, which can either be true (= 1) for a household or it can be false (= 0). Logit regressions work by calculating the logarithm of the odds (log-odds) of the outcome. This is helpful for multiple reasons. For instance, logit regressions do not assume a linear relationship. Since Cui & Cho (2019) found a relationship between happiness and stock market participation that was non-linear, this helps to make sure that this thesis does not miss this possibility. Logit regressions have another benefit, since the predicted probability returned by this model will never exceed 1 or fall below 0. This means that obtaining impossible probabilities with a Logit model is not possible. This contradicts with an OLS regression. This model can give impossible odds since it is a linear probability model, which is able to return a result above 1 or below 0.

CHAPTER 5 Results & Discussion

5.1 Interpretation

The goal of this thesis is to research the moderating effect of happiness on the relationship between financial literacy and stock market participation. Specifically, the effect on the probability of participating in the stock market is examined. OLS is therefore used as a linear probability model. For this reason, the interpretation of these regressions is as follows: a one unit increase in an independent variable, increases the probability to participate in the stock market by the percentage points indicated by the coefficient, while the other variables remain constant. Financial literacy is standardized, so one unit here is one standard deviation. Happiness is a dummy variable, so the coefficient indicates the increase when happiness is true instead of false, with everything else constant. Every OLS regression is done as a Logit regression as well. The coefficients in a Logit model represent the change in log-odds for a one unit increase in an independent variable. To make this interpretation more intuitive, the exponential function can be used to see how much a one unit increase in the independent variable increases the odds of participating in the stock market. For instance, for a coefficient of 0.5 the odds to participate in the stock market are ($e^{0.5} \approx 1.65$) 1.65 times higher for each one unit increase in the independent variable.

5.2 Combined happiness results

The main results of this thesis are displayed in Table 2 and 3. The three OLS regressions are in Table 2. Table 3 has the same variables but done with a Logit model instead of OLS. The first regression has happiness as the only independent variable on stock market participation. Happiness has the expected sign, indicating a positive association with stock market participation. However, happiness is insignificant, meaning that it does not provide any meaningful information to predict the probability of participating in the stock market in this model. This is further confirmed by the R-squared of this model, which is 0.002, with the adjusted R-squared being 0.001. The R-squared being essentially 0 is logical, since the only independent variable in this model, happiness, is not significant in predicting the probability to participate in the stock market. Performing this as a Logit regression instead of OLS reports the same result. While happiness has a positive coefficient, it is not significant.

The second model adds advanced literacy and an interaction term between literacy and happiness. While happiness still has a positive coefficient, it remains insignificant. Advanced literacy behaves exactly as anticipated. The coefficient is 0.108, which means an increase of one standard deviation of the advanced literacy index increases the probability of participating in the stock market by 10.8 percentage points in this model, with everything else remaining constant. Advanced literacy is significant at a p-value of 0.01, which means that this effect is highly significant. Similarly, the interaction term between advanced literacy and happiness has the anticipated positive sign as well. The coefficient of this term is 0.04, which means that

being a happy individual increases the effect that the advanced literacy index has on the probability of participating in the stock market increases by 4 percentage points in this model if everything else remains constant. This model suggests that happiness positively moderates the effect of financial literacy on stock market participation. However, while the interaction term is significant, the significance is weak, only being present at a p-value of 0.1. This means that drawing conclusions from this result is risky. The R-squared of this model is 0.110, meaning that the variables in this model explain 11% of the variance in stock market participation. Performing this regression as a Logit model changes the results, however. Happiness is still positive yet insignificant. Advanced literacy is highly significant again with a coefficient of 1.322, meaning that an increase of one standard deviation in the advanced literacy index, increases the log-odds of participating in the stock market by 1.322. This means that the odds of participating in the stock market are roughly 3.75 times higher in this model for each standard deviation increase in the advanced literacy index. However, while the interaction term still has a positive sign, the significance has disappeared.

The third OLS model is the model which examines the first hypothesis of this thesis, by now including all the control variables. Some control variables have an unexpected sign. The age dummy for age 51 up to and including 60 has an unexpected sign, but no conclusions can be drawn since all the age dummies are insignificant. University (WO) is the only education dummy with the expected sign, yet again no conclusions can be drawn since all education dummies are surprisingly insignificant.[2] Self-employed surprisingly has a negative sign, with a corresponding p-value below 0.05. The sign of happiness actually becomes negative in this model, with the coefficient now becoming -0.011. However, no conclusions can be drawn from this due to its insignificance. Advanced literacy is still highly significant, with a p-value below 0.01. The coefficient has slightly decreased to 0.080, which means an increase of one standard deviation of the advanced literacy index increases the probability of participating in the stock market by 8 percentage points in this model, with everything else remaining constant. Similar to the second OLS model, the interaction term still has a positive sign. However, the significance it had has disappeared. Performing this regression as a Logit model changes the results slightly. The corresponding p-value of self-employed, household income and two dummy variables for the answers “Some” and “Little” for the daily use of economics all increased and are only significant at a p-value of 0.1 instead of 0.05. Male lost all of its significance and the second wealth quartile became more significant, which is now significant at a p-value of 0.05 instead of 0.1. Happiness is still negative and insignificant and advanced literacy is still positive and highly significant. The coefficient slightly decreased to 1.221, however. This means that the odds of participating in the stock market are roughly 3.39 times higher for each standard deviation increase in the advanced literacy index. The sign of the interaction term flipped in this model compared to its OLS counterpart, yet it remains insignificant.

[2] This pattern with education remains throughout all the regressions. Separate regressions have been performed with non-university as base group and a dummy variable for university as control variable. This gave inconsistent significances, only being significant at a p-value of 0.1 in some models and did not change the results significantly.

Table 2
This table reports OLS analyses results of financial literacy, happiness, its interaction term and control variables on stock market participation. 'Interaction term' is Advanced literacy x Happiness. The base group for age is ≤ 30. The base group for education is all education below intermediate vocational (VMBO). The base group for the wealth quartiles is the first one. The base group for Economics education and Daily use of economics is "A lot". All base groups remain the same through the rest if the analyses. Data from the 2005 DNB Household survey.

	(1) OLS		(2) OLS		(3) OLS	
Happiness	0.048	(0.036)	0.039	(0.035)	-0.011	(0.037)
Advanced literacy			0.108***	(0.020)	0.080***	(0.022)
Interaction term			0.040*	(0.023)	0.011	(0.024)
Age dummies						
30 < age ≤ 40					0.029	(0.048)
40 < age ≤ 50					0.017	(0.047)
50 < age ≤ 60					-0.014	(0.047)
Age > 60					0.119	(0.078)
Education dummies						
VMBO					-0.071	(0.054)
HAVO & VWO					-0.051	(0.063)
MBO & HBO					-0.027	(0.055)
WO					0.057	(0.071)
Male					0.051*	(0.028)
Married					-0.059*	(0.032)
Number of children					0.015	(0.017)
Retired					-0.061	(0.067)
Self-employed					-0.132**	(0.063)
Household income					0.082**	(0.038)
2nd wealth quartile					0.057*	(0.035)
3rd wealth quartile					0.124***	(0.036)
4th wealth quartile					0.203***	(0.044)
Basic literacy					0.015	(0.012)
Economics education						
Some					-0.006	(0.045)
Little					-0.027	(0.047)
Hardly at all					-0.006	(0.051)
Daily use of economics						
Some					-0.093**	(0.046)
Little					-0.105**	(0.049)
Hardly at all					-0.017	(0.064)
Constant	0.201***	(0.033)	0.208***	(0.032)	-0.581	(0.367)
Observations	1022		1022		976	
R^2	0.002		0.110		0.198	
Adjusted R^2	0.001		0.107		0.175	

Note: Robust standard errors are reported in parentheses; ***p < 0.01, **p < 0.05, p* < 0.1.

Table 3
This table reports Logit analyses results of financial literacy, happiness, its interaction term and control variables on stock market participation. The base groups remain the same as the ones in the OLS results. Data from the 2005 DNB Household survey.

	(1) Logit		(2) Logit		(3) Logit	
Happiness	0.276	(0.036)	0.043	(0.350)	-0.076	(0.354)
Advanced literacy			1.322***	(0.400)	1.221***	(0.423)
Interaction term			0.471	(0.503)	-0.011	(0.482)
Age dummies						
30 < age ≤ 40					0.364	(0.437)
40 < age ≤ 50					0.238	(0.428)
50 < age ≤ 60					-0.028	(0.428)
Age > 60					0.828	(0.577)
Education dummies						
VMBO					-0.415	(0.472)
HAVO & VWO					-0.275	(0.500)
MBO & HBO					-0.138	(0.454)
WO					0.222	(0.497)
Male					0.170	(0.206)
Married					-0.393*	(0.214)
Number of children					0.075	(0.104)
Retired					-0.418	(0.403)
Self-employed					-0.889*	(0.503)
Household income					0.477*	(0.258)
2nd wealth quartile					0.889**	(0.377)
3rd wealth quartile					1.156***	(0.355)
4th wealth quartile					1.480***	(0.380)
Basic literacy					0.158	(0.136)
Economics education						
Some					0.103	(0.264)
Little					-0.065	(0.287)
Hardly at all					0.150	(0.328)
Daily use of economics						
Some					-0.491*	(0.263)
Little					-0.580*	(0.298)
Hardly at all					0.083	(0.389)
Constant	-1.381***	(0.203)	-1.760***	(0.294)	-6.969***	(2.557)
Observations	1022		1022		976	

Note: Robust standard errors are reported in parentheses; ***p < 0.01, **p < 0.05, p* < 0.1.

5.3 Split happiness results

The combined happiness results of this thesis are displayed in Table 4 and 5. The OLS regressions are in Table 4, with four Logit regressions on the same variables in Table 5. The first OLS model only has the independent variables "very happy" and "happy" on stock market participation. While the variables have the expected signs, neither of them is significant. The same result is found in the Logit version of the model. Logically, the R-squared of the model is consequently very low, at 0.002.

The second OLS model looks at "happy", advanced literacy, an interaction term between advanced literacy and happy and all control variables. Advanced literacy is still highly significant, although the coefficient decreased to 0.065. This means that an increase of one standard deviation of the advanced literacy index increases the probability of participating in the stock market by 6.5 percentage points in this model, with everything else remaining constant. Happy still has the expected sign, yet again it is not significant. Interestingly, the weak significance at a p-value of 0.1 found in the second OLS model in Table 2 when no control variables were included, returns in this model. The coefficient is also roughly the same at 0.039, meaning that in this model being a happy individual increases the effect that the advanced literacy index has on the probability of participating in the stock market by 3.9 percentage points, with all other variables constant. Note again that this does not include participants that answered "very happy". The R-squared of this model is 0.201, meaning that this model explains 20.1% of the variance in stock market participation. Similar to the second model in Table 3, while the interaction term keeps the right sign, the weak significance disappears when the same variables are used in a Logit model. Advanced literacy is still highly significant, although in this model the coefficient also dropped noticeably, this time to 0.852. This means that the odds of participating in the stock market are roughly 2.34 times higher in this model for each standard deviation increase in the advanced literacy index. The sign of "happy" in this model flipped but is still not significant.

The third OLS model replaces "happy" with "very happy" and thus the interaction term used is the interaction between literacy and being "very happy". This model is very similar to the previous OLS model, but the results contain a few big differences. Advanced literacy is still highly significant, but its coefficient increased significantly, to 0.097. This means that an increase of one standard deviation of the advanced literacy index increases the probability of participating in the stock market by almost 10 percentage points in this model with everything else remaining constant, which is a noticeable difference. Very happy is significant in this model with a negative sign, which is the first model where a variation of happiness itself is significant. It is significant with a p-value below 0.05. It has a coefficient of -0.075, indicating that an individual being "very happy" instead of "happy" or worse decreases the probability of stock market participation by 7.5 percentage points, with all other variables constant. The interaction term between advanced literacy and being "very happy" is also negative and significant at a p-value below 0.05 with a 0.050 coefficient. This indicates that, in this model, being a very happy individual compared to happy or worse decreases the effect that the advanced literacy index has on the probability of participating in the

stock market by 5 percentage points, with all other variables constant. The R-squared of this model is almost identical to the previous OLS model, with the R-squared in this model being 0.203. In contrast to the last model however, when using the same variables in a logit regression model, the significance of this interaction term does not disappear. The term is still significant at a p-value below 0.05 with a negative coefficient of -0.842. Thus, being a very happy individual negatively moderates the effect that the advanced literacy index has on the probability of participating in this model, with it decreasing the odds 2.32 times, with all other variables constant. While the significance of the interaction term remained, even though "very happy" kept the anticipated sign, the significance disappeared completely in this model. The coefficient of advanced literacy also increased significantly compared to the last Logit model, now being 1.411. This means that in this model, the odds of participating in the stock market are roughly 4.10 times higher for an increase of one standard deviation in the advanced literacy index.

The last OLS model has both "happy", "very happy", an interaction term between advanced literacy and being happy and an interaction term between advanced literacy and being very happy, to isolate these effects. While compared to the last OLS model only "happy", and an interaction term between advanced literacy and being happy were added and the R-squared is close to identical at 0.204, there are a few noticeably different results. The significance of very happy present in the last OLS model disappeared. While it kept the negative sign, no conclusions can be drawn since there is no significance. The interaction term between advanced literacy and being "very happy" also kept its negative sign, but it lost significance as well, suggesting being very happy does not moderate the effect advanced literacy has on stock market participation. The interaction term between advanced literacy and being "happy" has the hypothesized positive sign yet lost any significance it had in the second OLS model. Happy remains positive and insignificant. Advanced literacy remains positive and significant, with the coefficient only decreasing slightly to 0.080. Besides a flipped sign of the "happy" variable, the Logit model with the same variables returns the same results. While advanced literacy is still highly significant with a slightly decreased coefficient of now 1.217, the four variables related to happiness are insignificant. With this information, the hypothesis, which predicted happiness to positively moderate the relationship between financial literacy and stock market participation, is rejected.[3]

[3] Several different regressions have been performed, such as winsorizing advanced literacy at different levels as an attempt to find consistent results. Other attempts include dividing literacy in quartiles and replacing the previous interaction variable with interaction variables between each literacy quartile and happiness. However, the results of both combined and split happiness remain mixed, meaning that the models do not provide any new information.

Table 4

This table reports OLS analyses results of financial literacy, happiness, its interaction term and control variables on stock market participation. Happiness is split up into dummies for the answers "happy" and "very happy". Interaction term (VH) is Advanced literacy x "Very happy" and Interaction term (H) replaces "Very happy" with "Happy". Data from the 2005 DNB Household survey.

	(1) OLS		(2) OLS		(3) OLS		(4) OLS	
Very happy	-0.002	(0.045)			-0.075**	(0.035)	-0.073	(0.047)
Happy	0.061	(0.037)	0.038	(0.027)			0.001	(0.037)
Advanced literacy			0.065***	(0.016)	0.097***	(0.014)	0.080***	(0.022)
Interaction term (VH)					-0.050**	(0.024)	-0.033	(0.030)
Interaction term (H)			0.039*	(0.020)			0.022	(0.025)
Age dummies								
30 < age ≤ 40			0.038	(0.049)	0.037	(0.048)	0.037	(0.048)
40 < age ≤ 50			0.024	(0.047)	0.019	(0.047)	0.020	(0.047)
50 < age ≤ 60			-0.002	(0.047)	-0.014	(0.047)	-0.011	(0.047)
Age > 60			0.123	(0.078)	0.118	(0.077)	0.119	(0.077)
Education dummies								
VMBO			-0.069	(0.053)	-0.077	(0.053)	-0.074	(0.054)
HAVO & VWO			-0.047	(0.062)	-0.060	(0.063)	-0.056	(0.063)
MBO & HBO			-0.024	(0.055)	-0.031	(0.055)	-0.028	(0.055)
WO			0.057	(0.071)	0.050	(0.071)	0.053	(0.071)
Male			0.051*	(0.028)	0.052*	(0.027)	0.050*	(0.028)
Married			-0.063*	(0.032)	-0.057*	(0.032)	-0.058*	(0.032)
Number of children			0.015	(0.016)	0.017	(0.016)	0.017	(0.016)
Retired			-0.061	(0.067)	-0.057	(0.067)	-0.056	(0.067)
Self-employed			-0.136**	(0.063)	-0.136**	(0.063)	-0.136**	(0.063)
Household income			0.081**	(0.038)	0.085**	(0.038)	0.086**	(0.038)
2nd wealth quartile			0.052	(0.035)	0.054*	(0.035)	0.053*	(0.035)
3rd wealth quartile			0.118***	(0.037)	0.119***	(0.037)	0.118***	(0.037)
4th wealth quartile			0.197***	(0.044)	0.203***	(0.044)	0.201***	(0.044)
Basic literacy			0.013	(0.012)	0.015	(0.012)	0.015	(0.012)
Economics education								
Some			-0.010	(0.045)	-0.004	(0.045)	-0.005	(0.045)
Little			-0.029	(0.047)	-0.025	(0.047)	-0.025	(0.047)
Hardly at all			-0.003	(0.051)	-0.004	(0.051)	-0.002	(0.051)
Daily use of economics								
Some			-0.095**	(0.046)	-0.101**	(0.045)	-0.100**	(0.046)
Little			-0.108**	(0.048)	-0.113**	(0.049)	-0.113**	(0.049)
Hardly at all			-0.027	(0.064)	-0.035	(0.063)	-0.035	(0.064)
Constant	0.201***	(0.033)	-0.603*	(0.366)	-0.596	(0.366)	-0.611*	(0.368)
Observations	1022		976		976		976	
R^2	0.002		0.201		0.203		0.204	
Adjusted R^2	0.001		0.178		0.180		0.179	

Note: Robust standard errors are reported in parentheses; ***p < 0.01, **p < 0.05, p* < 0.1.

Table 5

This table reports Logit analyses results of financial literacy, happiness, its interaction term and control variables on stock market participation. Happiness is split up into dummies for the answers "happy" and "very happy". Interaction term (VH) is Advanced literacy x "Very happy" and Interaction term (H) replaces "Very happy" with "Happy". Data from the 2005 DNB Household survey.

	(1) Logit		(2) Logit		(3) Logit		(4) Logit	
Very happy	-0.015	(0.284)			-0.084	(0.299)	-0.184	(0.405)
Happy	0.343	(0.223)	-0.061	(0.282)			-0.129	(0.378)
Advanced literacy			0.852***	(0.250)	1.411***	(0.301)	1.217***	(0.422)
Interaction term (VH)					-0.842**	(0.388)	-0.648	(0.496)
Interaction term (H)			0.630	(0.417)			0.253	(0.533)
Age dummies								
30 < age ≤ 40			0.432	(0.443)	0.407	(0.442)	0.411	(0.443)
40 < age ≤ 50			0.293	(0.430)	0.248	(0.432)	0.251	(0.435)
50 < age ≤ 60			0.055	(0.431)	-0.029	(0.432)	-0.022	(0.433)
Age > 60			0.862	(0.573)	0.831	(0.576)	0.835	(0.574)
Education dummies								
VMBO			-0.380	(0.458)	-0.481	(0.457)	-0.467	(0.459)
HAVO & VWO			-0.226	(0.492)	-0.364	(0.494)	-0.348	(0.493)
MBO & HBO			-0.109	(0.446)	-0.185	(0.445)	-0.176	(0.444)
WO			0.244	(0.492)	0.152	(0.491)	0.163	(0.491)
Male			0.153	(0.205)	0.159	(0.204)	0.156	(0.205)
Married			-0.424**	(0.212)	-0.399*	(0.213)	-0.402*	(0.214)
Number of children			0.073	(0.103)	0.078	(0.104)	0.079	(0.104)
Retired			-0.431	(0.395)	-0.409	(0.399)	-0.413	(0.398)
Self-employed			-0.916*	(0.518)	-0.928*	(0.508)	-0.928*	(0.511)
Household income			0.482*	(0.254)	0.506**	(0.257)	0.512**	(0.259)
2nd wealth quartile			0.813**	(0.380)	0.848**	(0.378)	0.843**	(0.378)
3rd wealth quartile			1.095***	(0.359)	1.124***	(0.357)	1.117***	(0.357)
4th wealth quartile			1.416***	(0.383)	1.486***	(0.377)	1.476***	(0.378)
Basic literacy			0.144	(0.134)	0.152	(0.136)	0.151	(0.136)
Economics education								
Some			0.074	(0.265)	0.113	(0.266)	0.110	(0.266)
Little			-0.084	(0.289)	-0.064	(0.291)	-0.066	(0.290)
Hardly at all			0.170	(0.328)	0.169	(0.331)	0.167	(0.331)
Daily use of economics								
Some			-0.523**	(0.263)	-0.550**	(0.264)	-0.553**	(0.264)
Little			-0.631**	(0.296)	-0.647**	(0.298)	-0.654**	(0.299)
Hardly at all			-0.007	(0.390)	-0.024	(0.385)	-0.030	(0.386)
Constant	-1.105***	(0.083)	-7.034***	(2.540)	-7.242***	(2.556)	-7.197***	(2.563)
Observations	1,022		976		976		976	

Note: Robust standard errors are reported in parentheses; ***p < 0.01, **p < 0.05, p* < 0.1.

5.4 Discussion

This thesis finds that advanced literacy has a significant positive effect on stock market participation. This supports previous research, such as Lusardi and Mitchell (2011b), Yoong (2011) and Van Rooij et al. (2011). This is unsurprising however, since the dataset used in this thesis overlaps for the most part with Van Rooij et al. (2011), since the same survey was used to collect data. Since the significance and coefficient of advanced literacy is very similar in all my models to the one found in Van Rooij et al. (2011) (a p-value below 0.01 and a coefficient between 0.075 and 0.09 in OLS models), this does support the validity of the construction of my dataset.

However, I found different results compared to previous literature regarding happiness. In this thesis, a plethora of regressions were done that included some variation of happiness. First happiness was combined as people who answered "happy" or "very happy", which turned out as insignificant in all of the regressions this was used in. Then, the answer "happy" and "very happy" were split up into two individual dummy variables. However, "happy" was still insignificant in every model this was used in. This contrasts with studies such as Rao et al. (2014). In this study, happiness was found to be a significant and positive predictor of stock market participation. This was tested with constructing happiness as both the answers "happy" and "very happy", yet this resulted in no significant results in this thesis. Another contrast was the study done on the effect of happiness on saving and investing in Japan (Mimura, 2023). This study found that higher levels of happiness were associated with investing. The authors argued that this relationship originated from a future-oriented mindset, since happier individuals may be more likely to think about the future and assign value to long-term success rather than present fulfillment. Nevertheless, this thesis could not recreate these results. Another study researching happiness on financial market participation was done in China (Cui & Cho, 2019). In this study, the relationship between a household's happiness and financial market participation was studied. This study also found a relationship between happiness and financial market participation, where the probability of participating in the financial market increased with self-reported happiness. The authors claimed that this study contributed to the theory that an individual's well-being is a significant determinant of financial behavior.

While results for happiness were contradicted, some similar results were found for the highest level of happiness. While Cui & Cho (2019) found that happiness increased the probability of participating in the stock market, they found that the probability declines slightly for the highest level of happiness. The authors suggested that this may be caused by wanting to maintain the status quo, being reluctant to make any major decisions that may disrupt their high level of happiness. This thesis partially finds similar results. In one of the models where the highest level of happiness, "very happy", and the answer "happy" were split in separate variables, the highest level of happiness was found to have a significant negative effect of stock market participation. The interaction term between the highest level of happiness and advanced literacy was also significant and negative, suggesting that having the highest level of happiness moderates the

relationship between financial literacy and stock market participation, such that obtaining the highest level of happiness decreases the effect of financial literacy on stock market participation. However, this effect disappeared just by adding the dummy variable for answering "happy" and its interaction term with advanced literacy in the model.

This thesis was the first to examine the moderating role of happiness on the relationship between financial literacy and stock market participation. I hypothesized based on economic reasoning and previous studies, that happiness would positively moderate the relationship, such that the effect of financial literacy on stock market participation increases when an individual considers themselves a happy person. However, close to no evidence was found in the results to support this hypothesis. In most of the models, the interaction term between happiness and advanced literacy was insignificant. A weak significance of the interaction term between answering "happy" and advanced literacy was found in one of the OLS models where the two levels of happiness were separated, however this significance disappeared by simply performing a Logit regression model on the same variables or by adding "very happy" and its interaction term to the OLS model. A potential limitation of this thesis is that it is only able to look at one part of an individual's emotional state. Since the base relationship between financial literacy and stock market participation is recreated as done in van Rooij et al. (2011), this thesis is limited to questions that were asked in survey used in that study, which are the questions asked in the 2005 DNB Household survey. While this survey had a question regarding how happy the participants are with their life, the survey does not cover everything. Since an individual's psychological factors influence their decision making, there may be other psychological factors that may moderate the relationship between financial literacy and participating in the stock market. With completely new data, other examples such as an individual's optimism, anxiety or other psychological factors could be tested as a moderator for this relationship.

CHAPTER 6 Conclusion

The goal of this thesis was to examine the moderating effect of happiness on the relationship between financial literacy and stock market participation in the Netherlands. The importance of this topic comes from trying to gain an understanding of the factors that influence stock market participation. Despite the returns obtainable from participating in the stock market in the long-term, many households refrain from purchasing stocks. Understanding what factors influence stock market participation can help with developing strategies to increase financial well-being. By examining how happiness interacts with financial literacy, this thesis tries to provide insight into what motivates or discourages individuals to purchase stocks. The research question for this was the following: "How does happiness moderate the relationship between financial literacy and stock market participation in the Netherlands?".

To find the answer to this research question, I used data from the 2005 DNB Household Survey, combined with a module added to the survey that was designed to measure financial literacy. I used Ordinary Least Squares (OLS) regressions and Logistic (Logit) regressions to test financial literacy, happiness and its interaction on stock market participation, including numerous control variables. While the significant effect of financial literacy unsurprisingly was replicated, the hypothesis that happiness positively moderates the effect of financial literacy on stock market participation was not accepted. While there was some weak evidence found in a few regressions, there were no consistent findings across models. There was even some evidence found that the highest level of happiness moderates the relationship negatively, however these findings were not consistent either.

Other researchers interested in studying the factors that influence the participation in stock markets can learn from this thesis. While the results found were not consistent across models, the importance of studying behavioral factors such as happiness on stock market participation is emphasized. This thesis was not able to provide evidence for the moderating role of happiness, however I recommend future researchers to still study a similar topic. Since the data used to replicate the base relationship between financial literacy and stock market participation came from Van Rooij et al. (2011), I was restricted to testing happiness as the only psychological factor as a moderator on the relationship between financial literacy and stock market participation. While happiness was not found to be a significant moderator, other parts of an individual's emotional state may moderate this relationship significantly. Other psychological factors that were not included in the DNB Household survey, could be researched as a moderator for this relationship with completely new data. This presents an opportunity for future researchers, where this thesis did not find evidence to support happiness as a significant moderator, to explore other psychological factors that may serve as a significant moderator instead.

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APPENDIX A. Basic and Advanced literacy questions

Table A1
Survey questions used to construct basic literacy. Data from the 2005 DNB Household survey.

(1) *Numeracy*: Suppose you had €100 in a savings account and the interest rate was 2% per year. After 5 years, how much do you think you would have in the account if you left the money to grow? (i) More than €102; (ii) Exactly €102; (iii) Less than €102; (iv) Do not know; (v) Refusal.

(2) *Interest compounding*: Suppose you had €100 in a savings account and the interest rate is 20% per year and you never withdraw money or interest payments. After 5 years, how much would you have on this account in total? (i) More than €200; (ii) Exactly €200; (iii) Less than €200; (iv) Do not know; (v) Refusal.

(3) *Inflation*: Imagine that the interest rate on your savings account was 1% per year and inflation was 2% per year. After 1 year, how much would you be able to buy with the money in this account? (i) More than today; (ii) Exactly the same; (iii) Less than today; (iv) Do not know; (v) Refusal.

(4) *Time value of money*: Assume a friend inherits €10,000 today and his sibling inherits €10,000 3 years from now. Who is richer because of the inheritance? (i) My friend; (ii) His sibling; (iii) They are equally rich; (iv) Do not know; (v) Refusal

(5) *Money illusion*: Suppose that in the year 2010, your income has doubled and prices of all goods have doubled too. In 2010, how much will you be able to buy with your income? (i) More than today; (ii) The same; (iii) Less than today; (iv) Do not know; (v) Refusal.

Table A2

Survey questions are used to construct advanced literacy. Both possible wordings for question 15 and 16 are displayed. Data from the 2005 DNB Household survey.

(6)	*Which of the following statements describes the main function of the stock market?* (i) The stock market helps to predict stock earnings; (ii) The stock market results in an increase in the price of stocks; (iii) The stock market brings people who want to buy stocks together with those who want to sell stocks; (iv) None of the above; (v) Do not know; (vi) Refusal.
(7)	*Which of the following statements is correct? If somebody buys the stock of firm B in the stock market:* (i) He owns a part of firm B; (ii) He has lent money to firm B; (iii) He is liable for firm B's debts; (iv) None of the above; (v) Do not know; (vi) Refusal.
(8)	*Which of the following statements is correct?* (i) Once one invests in a mutual fund, one cannot withdraw the money in the first year; (ii) Mutual funds can invest in several assets, for example invest in both stocks and bonds; (iii) Mutual funds pay a guaranteed rate of return which depends on their past performance; (iv) None of the above; (v) Do not know; (vi) Refusal.
(9)	*Which of the following statements is correct? If somebody buys a bond of firm B*: (i) He owns a part of firm B; (ii) He has lent money to firm B; (iii) He is liable for firm B's debts; (iv) None of the above; (v) Do not know; (vi) Refusal.
(10)	*Considering a long time period (for example 10 or 20 years), which asset normally gives the highest return?* (i) Savings accounts; (ii) Bonds; (iii) Stocks; (iv) Do not know; (vi) Refusal.
(11)	*Normally, which asset displays the highest fluctuations over time?* (i) Savings accounts; (ii) Bonds; (iii) Stocks; (iv) Do not know; (v) Refusal.
(12)	*When an investor spreads his money among different assets, does the risk of losing money*: (i) Increase; (ii) Decrease; (iii) Stay the same; (iv) Do not know; (v) Refusal.
(13)	*If you buy a 10-year bond, it means you cannot sell it after 5 years without incurring a major penalty. True or false?* (i) True; (ii) False; (iii) Do not know; (iv) Refusal.
(14)	*Stocks are normally riskier than bonds. True or false?* (i) True; (ii) False; (iii) Do not know; (iv) Refusal.
(15a)	*Buying a company stock usually provides a safer return than a stock mutual fund. True or false?* (i) True; (ii) False; (iii) Do not know; (iv) Refusal.
(15b)	*Buying a stock mutual fund usually provides a safer return than a company stock. True or false?* (i) True; (ii) False; (iii) Do not know; (iv) Refusal.
(16a)	*If the interest rate falls, what should happen to bond prices?* (i) Rise; (ii) Fall; (iii) Stay the same; (iv) None of the above; (v) Do not know; (vi) Refusal.
(16b)	*If the interest rate rises, what should happen to bond prices?* (i) Rise; (ii) Fall; (iii) Stay the same; (iv) None of the above; (v) Do not know; (vi) Refusal.

APPENDIX B. Constructing indices for basic and advanced financial literacy

Table B1
Factor loadings for each basic literacy question with data from the 2005 DNB Household survey.

Basic literacy questions	Factor loadings
Numeracy	0.6501
Interest compounding	0.4523
Inflation	0.5007
Time value of money	0.4098
Money illusion	0.2056

Table B2
Factor loadings for each advanced literacy question for four subsamples. DK stands for "do not know". Data from the 2005 DNB Household survey.

Advanced literacy questions		Factor loadings			
		15a, 16a	15a, 16b	15b, 16a	15b, 16b
Question 6	Correct	0.5497	0.6750	0.5181	0.6089
	DK	-0.7521	-0.7711	-0.6743	-0.7290
Question 7	Correct	0.4439	0.4211	0.4316	0.4833
	DK	-0.6518	-0.6522	-0.6276	-0.5791
Question 8	Correct	0.6186	0.6754	0.6399	0.6872
	DK	-0.7699	-0.8308	-0.7562	-0.7261
Question 9	Correct	0.5381	0.6262	0.5618	0.6517
	DK	-0.6932	-0.7721	-0.7384	-0.7243
Question 10	Correct	0.4588	0.4668	0.5723	0.5650
	DK	-0.6262	-0.7647	-0.8046	-0.7221
Question 11	Correct	0.6334	0.6679	0.6311	0.6867
	DK	-0.7404	-0.8193	-0.7991	-0.7705
Question 12	Correct	0.5313	0.5218	0.5329	0.6410
	DK	-0.7568	-0.7323	-0.6818	-0.7668
Question 13	Correct	0.4781	0.4184	0.4827	0.5518
	DK	-0.4939	-0.4741	-0.5557	-0.5790
Question 14	Correct	0.5753	0.6329	0.5864	0.6408
	DK	-0.7120	-0.7933	-0.6838	-0.7844
Question 15	Correct	0.6952	0.4211	0.6097	0.4698
	DK	-0.7621	-0.8198	-0.7110	-0.7409
Question 16	Correct	0.3478	0.3642	0.3696	0.4171
	DK	-0.6449	-0.6914	-0.7016	-0.6920