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The effect of experienced economic conditions on asset market participation

Master thesis

MSc in Financial Economics

The views stated in this thesis are those of the author and not necessarily those of the supervisor, second assessor, Erasmus School of Economics or Erasmus University Rotterdam.

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Abstract

This paper investigates the low stock market participation rate – also known as participation puzzle – in the Netherlands. More specifically, it examines how past macroeconomic experiences - the performance of the Amsterdam Stock Exchange, the GDP growth rate, and the consumer confidence index affect the probability of participation. This was done using multiple instances of the DNB Household Survey, an annual survey carried out on a panel of Dutch households. First, the baseline results are established without the main variable of interests: the findings show that university education, financial literacy, wealth and income all have a positive effect on participation rate, while relying on peers for financial advice and risk-aversion both have negative effects. To sum up past experiences, a special formula was used that allowed different weighting for different stages of one's life and the weighting parameter was simultaneously estimated with the rest of the regression. In all three cases, there is a statistically significant relation. For stock returns, the effect is economically significant, substantially larger than in the case of the others, the weighting function shows that while early life experiences are not necessarily important to current decision-making, experiences many years prior can still have a significant effect. GDP growth was shown to have a small, but statistically significant effect with a steeper weighting function. Consumer confidence was an outlier, as it had a similarly small, but negative effect with a relatively even weighting function over time. The conclusion is that the effect of past experiences is likely exerted through altered expectations on stock returns.

Table of Contents

1. Introduction	4
2. Literature review	6
2.1 The participation puzzle	7
2.2 Subjective expectations	13
2.3 The effect of experiences on decisions.....	15
3. Data and methodology.....	17
3.1 Dataset.....	17
3.2 Variables and summary statistics	18
3.3 Methodology	21
3.4 Hypotheses	23
4. Analysis	23
4.1 Stock market participation puzzle	24
4.2 The effect of macroeconomic experiences.....	26
4.3 Robustness check	31
5. Discussion	32
5.1 The results	32
5.2 Limitations.....	35
6. Conclusion.....	36
7. References	39
8. Appendix	42

1. Introduction

People save money for a multitude of reasons. Be it for large purchases, leaving an inheritance, or just general consumption smoothing, so their spending power does not decrease after leaving work and going into retirement. Badarinza et al. (2016) examined the actual asset allocation of households in developed countries. According to their findings, on average, most household wealth is held in nonfinancial assets, such as vehicles and real estate, and the largest part of this is generally the main residence. In terms of financial assets, the greatest share is held in deposits or retirement assets depending on the country. Of course, wealth held in these assets are not necessarily savings besides retirement assets and the average wealth held in investments, such as real estate, stocks and bonds are rather low. Not only that, but the percentage of households that hold any stocks or bonds in their portfolios is low as well, which is unexpected considering economic theory.

Simple expected utility models with risky and risk-free assets predict that economic agents put at least a tiny fraction of their wealth into risky assets to maximize utility (Haliassos & Bertaut, 1995). However, the reality is different, as the measured direct stock market participation ranges from 4% to 41% in developed countries (Badarinza et al., 2016). This disparity between theory and practice was named the stock market participation puzzle and it continues to be an important area of research in the field of household finance. By not participating in the stock market, households miss out on the high average returns it offers over long periods of time. This can result in welfare losses for non-participants and create or widen the wealth gap, as research has shown that wealthier individuals are more likely to own stocks. For example, the MSCI World Index, a well-diversified stock index, has achieved average annualized net returns of 9.36% in the last 10 years¹. This means that €100 invested in it back then would have amounted to €244.67 today, which demonstrates the significant amount of wealth that could be generated in a relatively safe way.

This paper sets out to enrich the already existing literature on this phenomenon by analysing what kind of personal characteristics influence stock market participation. More specifically, how macroeconomic experiences throughout one's life affect the likelihood of participating in the stock market. The idea is that these experiences could alter either the risk preferences of individuals or their expectations for the future, e.g., if someone has lived through

¹ <https://www.msci.com/documents/10199/178e6643-6ae6-47b9-82be-e1fc565ededb> - Factsheet from 2023.02.28

mostly prosperous periods, they might feel as though the probability of (high) positive returns on the stock market is higher than it is in reality. Or potentially having lived through more economic downturns than most would make one more risk-averse, to be prepared for worse times, even if they are unlikely in current economic conditions.

The paper by Malmendier and Nagel (2011) serves as the basis for this research. They hypothesized that stock and bond returns observed throughout one's life have an effect on investment decisions. By experiencing lower or higher than average returns, people's expectations could be influenced, so they are less or more likely to invest in the respective asset classes. Their findings support the hypothesis, showing a significant effect of past experiences on the likelihood of participation.

The research method is borrowed from the paper above and applied to more recent data on the Netherlands. The research is also extended by including more macroeconomic indicators to test their effects on stock market participation as well, namely GDP growth and the consumer confidence index. The data comes from the De Nederlandse Bank (DNB) Household Survey, an annual survey that includes information on asset holdings and personal characteristics, such as age, income, education, etc. as well as answers to economic and psychological questions. With the compiled dataset, probit regressions will be run with control variables to see the relation between past experiences and owning stocks. The results will be used to answer the question: do experienced stock returns in the past have an effect on stock market participation? Furthermore, events experienced at different stages of life can have differing effects, e.g., events during formative years might leave a stronger impression. This prompts the next question: are returns experienced at different parts of one's lifetime affect the participation rate differently? The methodology on how this is answered will be detailed later.

The first paper to document the stock market participation puzzle was Haliassos and Bertaut (1995). In it, the authors have shown that around 75% of US households do not hold any stocks despite the predictions of expected-utility models. They ran regressions to see how participation is affected by age, occupation, wealth, etc. and based on their results, they hypothesized that participation is likely limited by entry cost, short sale constraints and a lack of information to work with. This research was followed up by a multitude of others, looking for other possible explanations for this phenomenon or testing the existing hypotheses. It has been shown that the lack of financial literacy is a large deterrent from participation (van Rooij et al., 2011) and the effect of intelligence on participation has also been examined, showing a positive effect (Grinblatt et al., 2011), both results are robust to controls. Lastly, being social,

so interacting with neighbours, religious and other communities, increases the likelihood of participation, especially so in areas where the participation rate is higher to begin with (Hong et al., 2004). These are just a few examples of the more well-known research in the area.

Such studies are important both for economic and financial research, as well as serving as a basis for the decisions of policymakers. By finding the reason(s) for the low participation rates, economic models can be adjusted to better represent reality. Asset pricing models could be adjusted to only account for the characteristics and preferences of the actual participants instead of the whole population, which could make the predictions more accurate. As for policy, if the reasons behind the low participation rates are unrelated to risk-aversion, policymakers could work on reducing the barriers households are facing. They could develop programs to educate people about the financial markets, as well as make information more easily accessible on returns and risks, work on lowering costs of entry or transactions costs. If such policies would be successful, the people would benefit from the higher welfare and it could have especially high impact on retirement savings, which could increase overall consumption and ease the burden on the pension systems.

The structure of the paper is as follows. Section 2 includes the literature review, in which papers on the participation puzzle and the effect of past experiences are summarized. In section 3, the dataset and the methodology are described. Both the baseline and the main regression results are presented in section 4. The discussion of the results, as well as the limitations of the research are included in section 5, and lastly, section 6 is the conclusion.

2. Literature review

The literature review covers three wider categories that are all vital to this research. First is a section on the participation puzzle, that includes the general findings of past papers regarding the determinants of stock market participation, such as financial literacy, cognitive abilities, or costs. Next is the role of subjective expectations in (financial) decision making. This is included, because the expectation is that the role of past experiences has an effect on the participation rate through the process of expectation setting on future returns. The last section discusses the literature about the effect of past experiences on risk taking, which includes participation in the stock market.

2.1 The participation puzzle

An important part of economic literature is and has been the consumption and resource allocation of households. One of the leading frameworks to describe this has been the life-cycle model. Simple and even more complicated versions of this model conclude that every household should hold at least an infinitesimal quantity of equity, regardless of their risk preferences (Campbell, 2006; Haliassos & Bertaut, 1995). Despite what the models suggest, the actual number of people owning stocks is relatively low (Badarinza et al. 2016), so there are aspects in real life that are not captured by these models. This puzzle has been at the forefront of the field of household finance spawning numerous research articles in the last decades searching for potential solutions. A number of explanations have been brought forward and have been tested multiple times on different datasets. This section presents the general findings of the existing literature.

Firstly, the effect of financial literacy and education is extensively documented. For the former, the idea is that people who have received substantial financial education, have studied business, finance or economics will have an advantage in making sound financial decisions. Better understanding the practicalities of participating in the equity market, the expected returns, and risks, as well as being able to create appropriate portfolios are all skills that could make them better suited to make the right financial decision, thus being more likely to participate in the stock market. Financial literacy has been shown to be generally low, even in countries that have a well-developed financial system (Lusardi & Mitchell, 2011). The paper by van Rooij, Lusardi and Alessie (2011) investigates this relation utilizing the DNB Household Survey, an annual survey data on a panel of representative Dutch households. They have extended the standard survey with their own modules, which were created to measure the participants' financial literacy in both basic and advanced financial knowledge. They ran ordinary least squares (OLS) and generalized method of moments (GMM) regressions with a large number of control variables, such as age, education, wealth, etc., as well as controls of economics education and the daily use of economics. They have found that the effect of advanced financial literacy on stock market participation rate is both statistically and economically significant, while basic literacy's effect was insignificant. Additionally, they have found that there is high correlation between one's self-assessed literacy level and their actual level of knowledge.

The previous authors have based their control variables related to economics on the work of Christiansen, Joensen and Rangvid (2008). Their hypothesis was that people holding

economics degrees would be more likely to participate in the stock market. The research is based on Danish panel data with financial information, education, and other personal characteristics, as well as information on the cohabitants/spouses. They have approached this research from multiple angles. Firstly, using Difference-in-Difference regressions, they have looked at whether becoming an economist, or an economist moving into the household influences the participation rate, and both does so, significantly. This latter result is also in favour of the peer or social interaction effects. Next, probit regressions are used, controlling for both observed and unobserved individual heterogeneity. The results are again significant and the marginal effect of being an economist on the likelihood of participation is 1.7 percentage points. Lastly, in order to have a case for causality, they included instrumental variable regressions using the opening of a new university as the instrument. The results of the instrumental variable (IV) regressions are evidence that economic education indeed has a causal effect on stock market participation.

Financial literacy not only has an effect on the participation rate, but also a direct or indirect effect (through stock market participation) on wealth accumulation and retirement planning. Developing savings plans and planning for retirement is more common with those that are financially literate (Lusardi & Mitchell, 2011; van Rooij et al., 2012). It also has a significantly positive effect on wealth accumulation by choosing savings accounts with higher returns (Deuflhard et al., 2019) and it has been shown that the effect on wealth is larger than schooling (Behrman et al., 2012).

Related to this topic, the correlation between cognitive abilities and investments has also been a topic of research. While financial literacy can be measured with a few well-worded questions in a survey, measuring cognition is much more complicated. While standardized tests exist, linking the results with well-detailed financial and socioeconomic data is difficult. Regardless, there are a few examples.

Cole and Shastry (2008) look at the effect of education on financial market participation. Using U.S. census data and instrumental variable modelling, they find causal estimates for the effect of education on financial market participation. According to their results, an additional year of schooling increased the probability of having an investment income by 7.6%, as well as showing large differences in the investment income earned. Furthermore, they also tested whether mandated financial literacy programs had an effect on the participation rate, however, their findings show that it does not. Lastly, they looked at standardized test results as a measurement of cognitive abilities, while controlling for family background. Individuals with

higher test scores are more likely to participate in the financial markets, which suggests that both innate and learned abilities increase stock market participation.

Another measure for cognitive abilities is IQ. Grinblatt Kelohajrui and Linnainmaa (2011) have managed to merge multiple Finnish datasets to have data on general information, finances, and the intelligence of people. For the last one, they use the results of standardized tests that is administered to young adults before entering the armed forces for mandatory military duty. Their findings reveal a monotonic relation between one's IQ and the likelihood of participating in the equity market with a 20.5% difference between the lowest and highest stanines. The relation is further solidified by robustness checks, including instrumental variables and random effects probit regressions. It has also been shown that high IQ individuals make better choices when choosing between mutual funds, going with those with lower costs. Interestingly, IQ does not make a difference in the case of those that hold a business degree (Grinblatt et al., 2016). It has also been shown that higher IQ investors are less susceptible to the disposition effect in their trading behaviour, more likely to exploit tax-loss trading and show better stock-picking and market-timing abilities. This leads to higher returns on their portfolios, than the portfolios of low-IQ individuals (Grinblatt et al., 2012).

The effect of cognitive abilities and financial literacy on financial market participation could be attributed to easier, faster, or better information processing. While most theoretical models in finance assume that all investors are rational and possess all available information on the market, it is hardly the case in practice. Financial markets have become increasingly complicated, and it is difficult to process the available information, especially for the average person. In favour of this explanation, Christelis, Jappelli and Padula (2010) has found that while cognitive abilities influence stock market participation, the effect on the bond market is significantly lower. They attribute this to the information constraints that investors are facing, and which is better overcome by those with higher cognitive skills. Furthermore, Agnew and Szykman (2005) have set up an experiment in which participants were asked to choose between defined contribution plans. The number of plans available and the ease of access for information was varied between groups. The results show that the number of options, as well as the difficulty of accessing information is positively correlated with participants opting for the default option, however, this effect is less significant when controlling for financial literacy. These papers show evidence in favour of information overload that is plaguing many (potential) investors.

So far, the ability to collect and process information seems crucial to explain at least part of what encourages or deters people from taking part in the equity markets. One avenue through

which people can easily gather information is their social circles, this is the so-called peer effect. Gathering information through knowledgeable friends, family, neighbours, or colleagues could make it significantly easier to make decisions on more basic issues at least. Moreover, investments and related matters can be topics of conversation at social gatherings, making them more interesting, attracting people who would otherwise not be interested.

The famous paper by Hong, Kubik and Stein (2004) examines the possibility of social interactions influencing stock market participation. They develop a model in which there are social and non-social investors, and the idea is that there is a difference in implicit costs between the two groups. This could mean lower information costs or utility gains from interacting with their peers, discussing the stock market. To test their theory, they use U.S. survey data and have constructed social interaction measures from questions regarding how many of their neighbours they know, how often do they visit them and whether they attend church service. Furthermore, they collect supplementary information for control variables, including wealth, education, risk tolerance, race, computer proficiency and being depressed – proxy for pessimism. Their results confirm the idea behind their model, being a social household has an effect on stock market participation. Additionally, this effect is stronger in states with a higher participation rate and there is an increase in the effect over time.

Mark, Ivkovic, Smith, and Weisbenner (2008) build on this and subsequent literature to find causal community effects on stock market participation. In order to establish causality, they utilize an IV regression using U.S. data, examining the participation rates in the home states of each non-native in neighbourhoods. This way, they can isolate the effect of the community without the endogeneity problem other authors have struggled with, excluding background characteristics. The results indeed show strong community effects on the participation rate, when controlling for all factors, there is a 4-percentage point increase in the likelihood of participation of a single household for a 10-percentage point increase in community stock ownership.

Another paper that could be in favour of the social utility explanation is Kaustia, and Knüpfer (2010). In their paper, they look at the effect of peer performance on stock market entry. Using Finnish data, they compile the equally weighted average stock market returns for each zip code to account for peer performance and the stock market entry data is also available. According to their findings, positive returns are related to entry, negative returns however do not have the opposite effect, implying that people would be more likely to discuss their success, than losses. These results also work in favour of the subjective expectations channel, so hearing

disproportionately about (high) positive returns could (incorrectly) influence people's expectations regarding stock returns and thus making it more likely to participate.

Guiso, Sapienza, and Zingales (2004) have done similar research, finding that social capital influences stock market participation, however this effect is lessened with education and the quality of law enforcement in the area. The authors suggest that social capital could be a proxy for trust in this case and that social capital might only be a relevant explanatory variable for stock market participation for less developed regions or countries. While this latter conclusion might not hold given the previously detailed, more recent papers, the idea of trust is worth exploring.

The follow-up study of Guiso, Sapienza, and Zingales (2008) examines just this. They use Dutch and Italian micro-data, in the former, the measure of trust is general, as opposed to the latter, in which the question was about trusting a bank official or broker with financial advice. The results with the Dutch data, with general trust in people, show that trust increases the probability by 6 percentage points. In the case of the Italian data, they find that the effect is significant and large, those who trust their banker are 16 percentage point more likely to invest. The authors suggest that this could also explain the effect of race on the participation rate, because trust has a link to family background.

More recently, Giannetti, and Wang (2016) have explored the effect of trust through corporate scandals, specifically, corporate securities fraud. The dependent variable is not stock market participation, but equity demand, however the authors expect the effect of fraud to be larger for the participation rate. The results show decreased demand for stocks in the state of the firm following fraud revelations and this effect is present for the stocks of non-fraudulent firms as well. Furthermore, they find that those who have experienced more cases of fraud in their lifetime hold less equity in their portfolios, which could be case for the expectations channel again.

And finally, the last strand of literature for explaining the low stock market participations is related to the explicit costs of investing. While the explanations up until this point can be argued to be related to the implicit costs of investing, mainly through the information channel, so takes time and effort to gather and process the information needed to make sound financial decisions, or the perceived potential costs being higher in the case of trust. However, there exist explanations involving entry or transaction costs.

Paiella (2001) and Alan (2006) tackled this topic by trying to find the minimum cost that would explain the observed participation rate. Both papers used data from the US, and they have developed different models to replicate real life findings. Paiella worked out the minimum cost for people with different levels of risk aversion, arriving at an estimate of \$70 per year to arrive at non-participation and this decreases as the level of risk aversion grows. Alan has approached it differently; they have simulated a life cycle intertemporal portfolio choice model to be as close to observed values as possible while including fixed cost for participation. They estimated that an entry cost of 2.1% would explain the hump shape of participation rate as a function of age, as well as median zero stockholding.

Taking a different route, Peress (2005) investigates the effect of changing information and entry costs of participation on the participation rate in the US. They split participation costs into information costs and entry costs for the model they set up in the paper and change the levels of these costs separately to see how it affects participation. Interestingly, they find that lower information costs lead to overall lower participation levels. The explanation for this is that with active and passive investors on the market, the lower information cost introduces more active investors, which drives down the equity premium, leading to passive investors - who don't benefit as much from the lower cost - leaving the market altogether. If entry costs fall, their results show an overall increase in participation, mostly as a result of marginal non-stockholders entering the market, while the active investors' share in the market decrease.

To summarize the literature so far on the participation puzzle, explanations generally involve explicit and implicit costs. While the former provides convincing evidence, even theoretically for the general low participation rate, it does not explain the low participation in wealthy households, where these costs are less of an issue. In conjunction with the other explanations, it is possible to cover more areas where the theory seems to be lacking. Education, financial literacy, and cognitive abilities all contribute to the ease of information processing, which in turn has a positive effect on the participation rate. Peer effects are also relevant, be it through the information channel or otherwise, and trust also seems to play a role in the participation decision of many. While the effect of subjective expectations was touched upon through some of the listed papers, the following section will go into more detail, as it is an important aspect of this paper.

2.2 Subjective expectations

Subjective expectations could play a role in decision-making, such as the decision on the risky asset market participation. It could be the case that while people are aware of the objective probabilities of certain outcomes, such as earning positive returns on hand-picked investments, their personal biases (e.g., overconfidence) could lead them to believe that their odds are better than reality. On the other hand, it is possible that people are unaware of the actual probabilities and make assumptions on limited information, which makes them miscalibrate the likelihood of certain outcomes. For example, hearing about the success of peers could make it seem as though it is easier to gain positive returns, than it actually is.

Hurd (2009) provides elicited probabilities from the Health and Retirement Study (HRS), a survey conducted in the US, regarding survival beyond the age of 75, age of retirement and stock market returns. The survey was representative of the American population aged 51 and above. In case of living past the age of 75, 64% of the respondents thought they would live past that age, while 68% of people their age does, on average, which is quite close. There were a limited number of respondents, whose outcome could be observed, and it was found that 73% of that group that has lived past 75, so their predictions turned out to be pessimistic. As for the responses to whether one would be working full time at the age of 62 or not, the forecast of 52 and 53 years old was taken. The predictions were higher, than the actual value by 14 percentage points, 46% and 32% to be exact. This upward bias persists even if the sample of 60–61-year-olds was taken, forecasting just 1-2 years into the future, however the difference is smaller this way.

While these are not closely connected to stock market expectations, it shows that people are not necessarily good at making predictions, even if the subject in question is not as complicated or “strange” as the stock market. The author has pointed out that the frequency of focal point responses (0%, 50%, and 100%) is also a bias in responses, as they are much higher than they should rationally be. Responses of 50% were the most common and it is posited that when a person is unsure about the topic, they gravitate towards the middle of the scale.

While Hurd’s (2009) paper does touch on stock market expectations, it cites two other papers for that section, which are better explored in detail. Kézdi and Willis (2009) uses the same survey for their study. In one year of the survey, there were two questions regarding the stock market, first, what is the likelihood of the market going up, second, what is the probability of a growth of 10% or more. The answer to the former was 49% on average and 39% for the latter. These are both significantly lower than the historical return averages, which were 68%

and 49% respectively. However, the authors have found heterogeneity in answers between different groups, such as stockholders and non-stockholders. Stockholders generally put the likelihood of both scenarios around 10% to 15% higher than non-stockholders. Their empirical findings show that expectations are a strong predictor for stock ownership. Based on their results, they conclude that the deficit in the stockholdings of certain demographic groups, such as less educated Americans can largely be attributed to their lower expectations.

Similarly, Hurd, van Rooij and Winter (2011) has carried out a research on the subjective expectations of Dutch households. They have used the questions from the DNB Household Survey's 2004 and 2006 editions to assess the subjective expectations of the respondents regarding stock market returns. Participants were asked about the likelihood of having losses or returns of 0% to 30% and had to give a percentage to each of these. They have found that the Dutch population holds pessimistic views about the stock market, on average, they have given a 41.6% chance to having positive returns in 2004 and 50.1% in 2006. They attribute this increase in probability to the run-up of the stock market value between the two years. Probit regressions were included to see the effect of subjective probability on stock ownership and have found significant positive relations in both 2004 and 2006 with a larger effect in the latter. The paper also finds inconclusive, but suggestive evidence that entering the stock market was associated with above average increases in expectations.

Lastly, Malmendier and Nagel (2016) investigates how the experienced inflation rates throughout one's life effect their inflation expectations. Using US survey data with inflation predictions and a formula developed by them for aggregating experienced inflation, they were able to run regressions and have found that experienced inflation levels do explain some of the variation in their forecasts. Their results also show that people put a larger emphasis on more recent events, however earlier life experiences still play a role, as older individuals were less affected by recent events. To demonstrate real life implications, the authors have examined the effect of expectations on mortgage choices, finding that those with higher expectations are more likely to take out fixed rate mortgages.

2.3 The effect of experiences on decisions

The previous papers have shown that people generally underestimate the expected returns on equity, and this provides a partial explanation on why stock ownership is low. There also appears to be a connection between expectations and recent events or experiences. This relation and its effect on stock ownership and risk taking is to be discussed in this section.

As already mentioned, this thesis draws from the paper of Malmendier and Nagel (2011). They propose the hypothesis that the experiences throughout ones' life could experience their level of risk taking. They adapted the idea from psychology literature that personal experiences play a bigger role in decision making, than statistical summaries. Using US survey data, they find the financial holdings of individuals, including stocks and bonds. Based on their age, they find the returns of the US stock market and long-term bonds since their birth to use as a proxy for their personal experiences. These returns are then plugged into a formula developed by them, that gives different weights to returns from different parts of their lives, as it is believed that more recent events could matter more for decisions. Control variables are also included to strengthen the results. They find that higher experienced stock and bond returns do increase the likelihood of participating in their respective markets and vice versa. The effect is economically large, for example the 2008 recession lowered the probability of participation by 7 percentage points for a 30 years old and 3.5 percentage points for a 60 years old. Such large events' effect also linger for decades according to their estimates. Furthermore, they have found limited evidence that this effect works through the expectations of individuals, as lifetime experiences have a similar effect on return expectations as the participation rate. This matches the conclusion from the previously mentioned paper from the same authors about inflation expectations and even the weights for the importance of recent events despite using different datasets and looking at a different macroeconomic measure.

Following a similar concept, Malmendier, Tate and Yan (2011) have studied the effect of overconfidence and life experiences on the decision-making of managers. Using CEO data on option holdings, they measure overconfidence by checking if CEOs repeatedly exercise their stock options late. For life experiences they look at two specific characteristics: serving in the military and growing up during the Great Depression. Even when controlling for overconfidence, the findings show that those who have served in World War II follow more aggressive corporate policies, like high leverage ratios. On the other hand, those that grew up in the era of the Great Depression were a lot less likely to turn towards external financing. This is further proof that major experiences can have life-long consequences on decision-making.

Continuing with the theme of recessions, Knüpfer, Rantapuska, and Sarvimäki (2017) investigate the Finnish Great Depression's effects, which happened in the early 1990s. With the use of Finnish registry data, they are able to collect data on how much people were affected by the recession: having lost their job, having had difficulty finding a job or seeing job losses in social circles. They find that adverse labour market conditions had significantly reduced the likelihood of stock market participation even a decade after the depression. Second-hand experiences, so worsening labour market conditions of friends or family still had a significant effect, albeit much smaller. The results are robust, as the severity and abruptness of the event makes endogeneity issues unlikely, the variable of interest's coefficient is stable across specifications.

Andersen, Hanspal, and Nielsen (2016) were able to test the effect of past experiences with a unique research design. Using Danish registry data, they identified people with inheritances that included risky assets, such as stocks and observed how they managed the inherited portfolio. For personal experiences, they looked at the effect of the 2008 financial crisis, specifically investments in publicly traded banks that were lost in the crisis. People were put into four categories: those who have suffered personal losses on stocks, whose family members have experienced losses, being from an area where banks have defaulted, and the rest. Their results show strong effects for first-hand experiences, as this group has reduced their risky asset holdings significantly after the inheritance. The results for those with second- or third-hand negative experiences show little to no reaction, keeping the inherited portfolio as is on average. The results of this paper somewhat contradict the previous one regarding the effect of second-hand experiences.

Buccioli, and Zarri (2015) identified first-hand personal experiences as well, but not financial ones. Using American survey data from 2004 to 2010, they identify two negative events from one's life that are out of their control: having been physically attacked and losing a child. Their willingness to taking risk prior and post event is identified through portfolio choices in risky assets. For both events, the authors find a substantial reduction in risk taking, with the loss of a child being more significant and longer lasting. Both events result in lower risk taking than experiencing the 2008 financial crisis.

Quite recently, Shin (2020) has carried out an extended learning-to-forecast laboratory experiment that had participants forecast stock market returns, as well as giving them the choice to participate in that market. The experiment includes multiple treatment groups with different levels of participation costs, and one group that cannot participate, just observe. The author

finds that subjective expected returns are the main deciding factor in the participation decision. Furthermore, these expectations seem to be driven by the observed returns throughout the experiment and finds that there is also a difference in expectation between groups that experienced and those that only observed the stock returns.

In a similar vein, Choi, Laibson, Madrian, and Metrick (2009) studied the behaviour of individual investors in the US, specifically their investment patterns in 401(k) savings accounts. They show that investors experiencing higher-than-average returns or lower-than-average variance in their savings accounts are more likely to increase savings rate, and vice versa, even after controlling for a number of control variables. This is a sign of reinforcement learning in investments despite returns being random.

In conclusion, research on the topic suggests that past experiences significantly affect current risk-taking. People seem to take their lifetime experiences into consideration when making decisions, so even distant events can have an impact. Observing the effect of certain events on one's environment appears to have an effect on risky choices, however not nearly as much as first-hand experiences. Finally, it is not only financial, or economical events that make a difference in financial risk taking, but also random life events. Moving on from the literature review, the following section will detail the data and methodology of this research.

3. Data and methodology

3.1 Dataset

The main dataset used for the empirical research is the DNB Household Survey. It is an annual survey conducted by Centerdata on a panel of around two thousand Dutch households. The panel was chosen carefully to be a good representation of the population of the Netherlands, and it largely includes the same households each year. It suits the purpose of this research well, as the survey includes extensive information on all participants. It includes six modules: household information, work & pension, accommodation, income, wealth, and psychological concepts. The financial holdings are well detailed, there are a number of asset classes included in the survey, with questions about the value of holdings in each of them as well. Additionally, data like age, income, education level, etc. are also available to be used as control variables. In order to have a sufficiently large dataset, waves starting from 2001 were included in the study.

For the experienced stock returns, the returns from the AEX index will be used, which can be obtained from [Stooq.com](https://www.stooq.com/), which has daily data on prices starting from January of 1983. This

is a capitalization-weighted index that consists of the 25 most frequently traded Dutch companies that are listed on the Euronext Amsterdam stock exchange. This means that only people born in or after 1983 can be included in this analysis. The second variable that will be examined is GDP growth. Data for this is available from the World Bank starting from 1961, which means that a much wider group of people can be included in the analysis. Lastly, Consumer Confidence will be included as a measure of overall economic conditions. The source of which is the Centraal Bureau voor de Statistiek and the data starts from 1986.

3.2 Variables and summary statistics

The final dataset that was processed from the survey data with 6003 observations before trimming it for the respective economic experience variables. This includes the last observation of every participant, except those who have not answered the questions about their wealth, as that information is vital for the analysis. In the end, the variables include age at the time of the survey, a higher education dummy, which indicates finished university degree, gross income, financial wealth (cash, bank accounts, stocks, bonds, etc.). Both income and wealth were adjusted to account for the increase in prices and wages. The former was adjusted based on the Cao wages index², the latter with the Consumer Price Index³, both provided by the Central Bureau voor de Statistiek in the Netherlands. Furthermore, there is a measure of willingness to take risks. This was included by summing up the points given to 6 questions related to financial risk-taking, then placing every person into quartiles based on all the scores. There is a dummy for financially literate people, however this was self-assessed by the respondent. And lastly, there are dummies for those who ask for professional advice or advice from their peers about their finances. The summary statistics are visible in the table below.

As can be seen, there is a large spread of age, wealth and income with the latter unfortunately having lower observation count, as less people have answered questions related to that. Around 15.4% of people in the final dataset have investments in stocks. The number and percentage of respondents of the survey who own stocks in each of the waves are visible below on Figure 1. There has been a general decline in the percentage, as well as a slight overall decline the absolute value, however there was an uptick in both in the past few years.

² <https://www.cbs.nl/en-gb/figures/detail/82838ENG>

³ <https://opendata.cbs.nl/#/CBS/en/dataset/70936eng/table?ts=1679833925310>

Variable	# Observations	Mean	Minimum	Maximum
Age	6003	50.38	16	97
Financial wealth (€)	6003	35730	-49211	3147544
Gross income (€)	3937	32047	0	582476
Stock owner dummy	6003	0.154	0	1
University degree dummy	6003	0.133	0	1
Financial literacy dummy	5054	0.317	0	1
Peer advice dummy	5223	0.321	0	1
Professional advice dummy	5223	0.195	0	1

Table 1. The main independent variables used in the analysis. Data compiled from the DNB Household Survey's 2001 to 2022 waves.

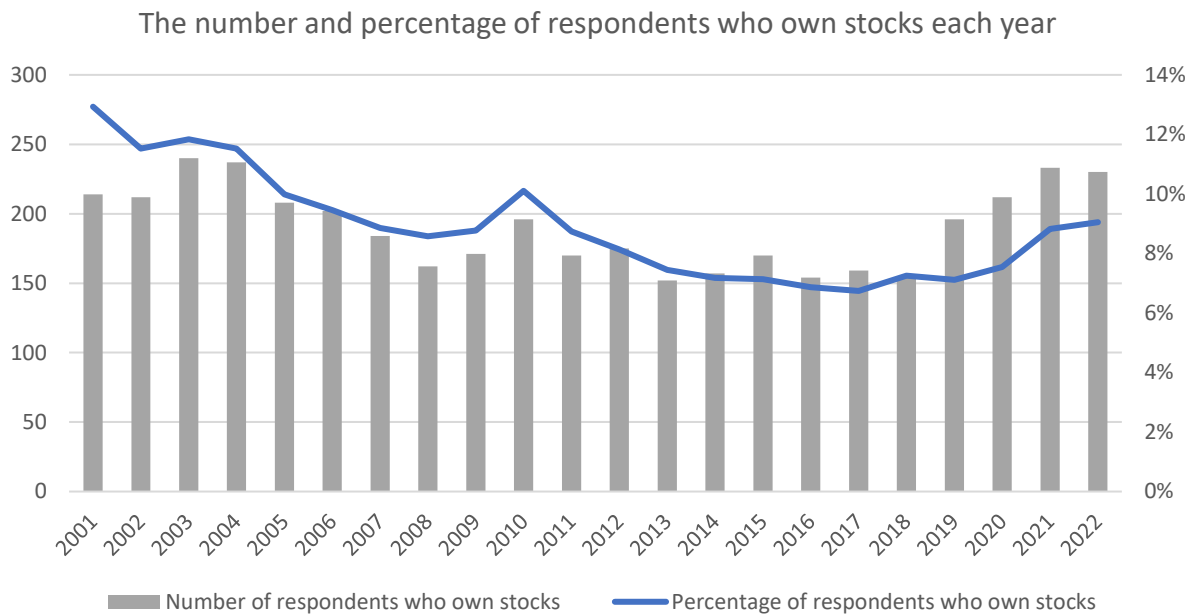


Figure 1 The number and percentage of respondents who own stocks in the DNB Household Survey from 2001 to 2022

The three economics measures of past experiences are presented in the graphs below in the following order: stock returns as the index of the Amsterdam Stock Exchange starting from 1984, the 10-year government bond returns of the Netherlands and the GDP growth rate of the Netherlands, both starting from 1961.

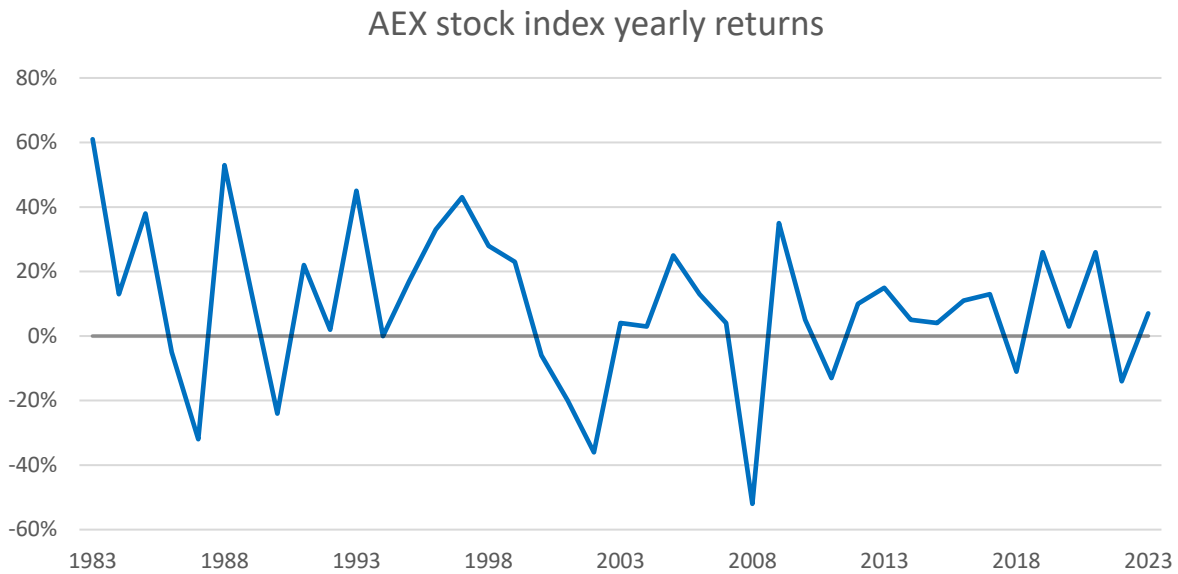


Figure 2. The year-on-year returns of the Amsterdam Exchange index. Data taken from [Stooq.com](https://www.stooq.com).

From the figure above, it is apparent that the AEX index has been very volatile throughout the last decades. There haven't been longer periods of exceptional growth, nor have there been long-lasting downturns. This volatility might mean that the performance of the index will not be an accurate predictor of future stock market participation for the purpose of the study.

Next, the historical changes in GDP are visualized below on Figure 3. Data is available starting from 1961. As it is visible from the graph, the country had long periods of growth with some recessions. Three recessions can be seen here, one in the early 1980s, then the 2008 financial crisis is clearly visible and lastly the recent coronavirus resulted in a year with negative GDP growth. A period that stands out is the 1960s, when the growth was exceptional, so people born during or before could be more likely to participate in the stock market.

Lastly, the consumer confidence index is included as a proxy for past experiences. This is a useful measure because it more directly measures how people have felt about the state of the economy throughout the years, so it encapsulates more than just one measure, such as GDP growth or stock market performance, and it is more subjective. The data is available from 1986 and it is visible below, on Figure 4. Clear trends of growths and declines are visible, there have been longer periods of positive, as well as negative consumer confidence.

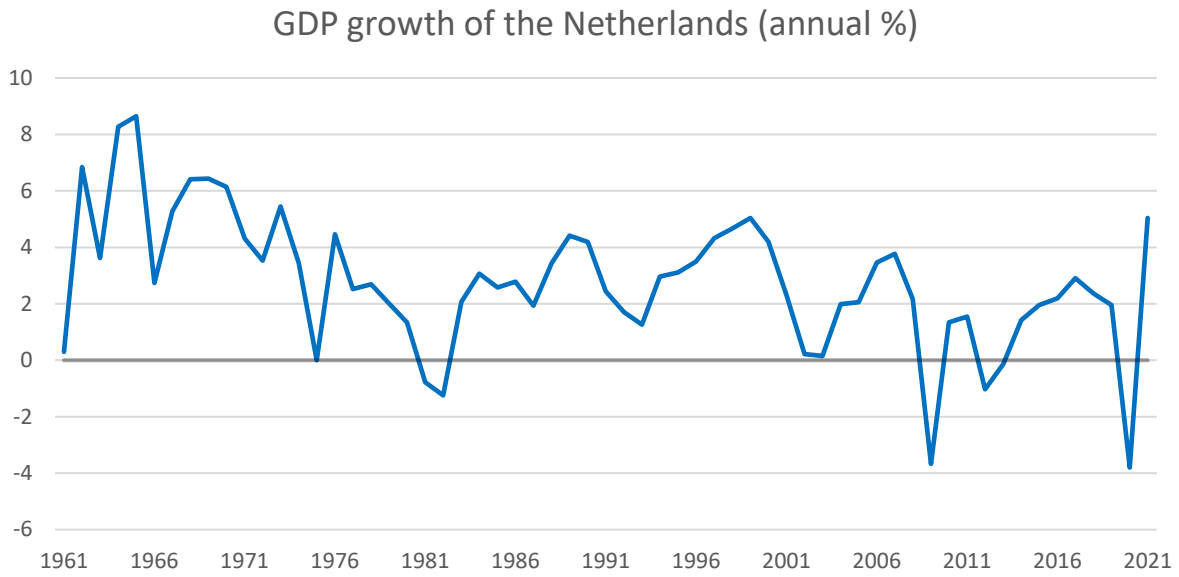


Figure 3. Real GDP growth of the Netherlands. Data taken from the [World Bank](#).

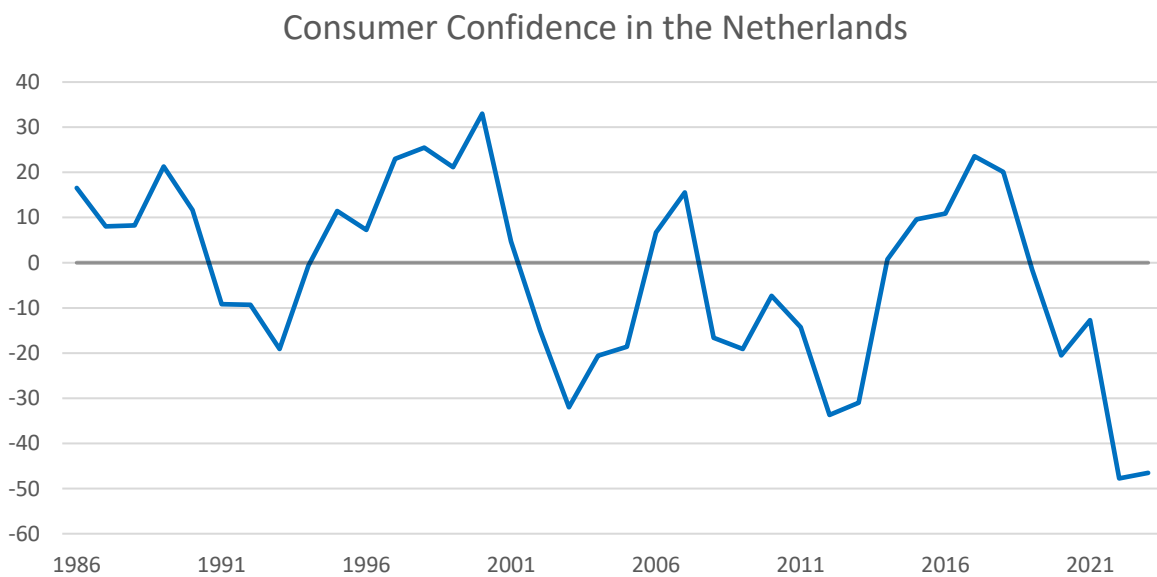


Figure 4. Historical Consumer Confidence measure in the Netherlands. Data taken from [Centraal Bureau voor de Statistiek](#).

3.3 Methodology

With the main dataset compiled, only the measure of past experiences remains. To be able to include it in the analysis, an average of the stock market returns, and GDP growth needs to be calculated. Though this is not as simple as taking the average returns or growth over a person's lifetime, because previous literature has shown that people put different weights on experiences that happened at different parts of their lives. It might be the case that one's earlier

life experiences matter more in their decision making, as those are considered formative years, they could heavily influence people's thinking far into their lives. It could also be the case that more recent experiences are weighed heavier when making decisions, simply because they are fresher in their memories. To be able to account for these possibilities and everything in-between, the formula of the weighted average of past asset returns from Malmendier & Nagel (2011) would be used, which is the following:

$$A_{it}(\lambda) = \sum_{k=1}^{age_{it}-1} w_{it}(k, \lambda) R_{t-k},$$

where the weighting function, $w_{it}(k, \lambda) = \frac{(age_{it}-k)^\lambda}{\sum_{k=1}^{age_{it}-1} (age_{it}-k)^\lambda}$, and

- i denotes individuals
- t is the year of observation
- k is the year at which the return was experienced, so $t - k$ is time lag
- R_{t-k} is the return in year $t - k$
- λ is the weighting parameter

As it can be seen from the formula of $w_{it}(k, \lambda)$, λ controls the shape of the weighting function. If λ would be positive, that would mean that recent events would be weighted more heavily in decisions, and vice versa for negative values. Additionally, weights can increase or decrease nonlinearly, but only monotonically. For the regression itself, the following model is used:

$$\Pr(y_{it} = 1 | x_{it}, A_{it}(\lambda)) = \Phi(\alpha + \beta A_{it}(\lambda) + \gamma' x_{it} + \varepsilon_{it}),$$

where $A_{it}(\lambda)$ is the previous formula of experienced returns, x_{it} is a vector of control variables, α, β, γ are the coefficients. The above formula describes a probit regression equation, which is used in cases when the dependent variable, y_{it} is binary, in this case a person either participates or does not participate in the stock market. Due to the weighting function's nonlinear nature, β and λ need to be simultaneously estimated, this can be done with maximum likelihood estimation.

3.4 Hypotheses

There will be two hypotheses tested in this paper, regarding past experiences and stock market participation.

- Hypothesis 1: Past macroeconomic experiences have a significant impact on stock market participation.

This hypothesis suggests that a person's past experiences with macroeconomic events, such as recessions, stock market crashes, or economic booms, have a meaningful impact on their likelihood of participating in the stock market. To be more specific, those who have experienced positive macroeconomic events may be more likely to participate in the stock market, while those who have experienced negative events may be less likely to participate.

- Hypothesis 2: The impact of past macroeconomic experiences on stock market participation varies across different stages of an individual's life.

This hypothesis suggests that the influence of past macroeconomic experiences on stock market participation differs throughout a person's lifetime. More recent events might be more meaningful towards current decision-making, than experiences early on in life, and vice versa.

Both hypotheses will be tested in the next section using the previously detailed methodology. The coefficient and p-value of the past experiences variables will be the test for H1, and H2 will be tested by analysing the results for λ .

4. Analysis

The analysis section consists of three parts. First, baseline results are established without the main variable of interest. This demonstrates how well the variables explain stock market participation prior to the main specification, so there will be a basis for comparison. In the second part, the main analysis is conducted using the previously explained methodology, now including past experiences as the variable of interest. The relevant variables from the first part will be used as control variables to make the results more robust. After that, there will be some robustness checks.

4.1 Stock market participation puzzle

The methodology becomes much simpler when past experiences are excluded from the analysis. In this case, all the independent variables are easily defined, the following are included in the regression: age, higher education, income, wealth, financial literacy, professional and peer advice, and risk-taking measures. The regression equation is defined as follow:

$$\Pr(Y = 1|X_1, X_2 \dots X_k) = \beta_0 + \beta_1 X_1 + \beta_2 X_2 \dots \beta_k X_k,$$

where Y is the dependent variables, X_i are the independent variables. So, the probability of a person participating in the stock market is a linear function of the independent variables with the coefficients representing the relationship and magnitude between the given variable and stock market participation.

The results are presented below in Table 2. University education has an economically and statistically significant effect on the probability of stock market participation. Unfortunately, the survey does not have ways to assess the respondent's financial knowledge objectively, however according to Rooij, Lusardi and Alessie (2011), there is a high correlation between self-assessed and objective financial literacy. In this case, self-assessed financial literacy returns a statistically significant positive coefficient, meaning that those who (think that they) have good financial understanding are more likely to invest in the stock market. The effect of this variable is smaller than university education's however, which could partly be due to errors in self-assessment. A peer dummy was included to potentially capture the peer effect detailed in the literature review; however, the results are different than expected: the coefficient is negative and statistically significant. This could mean that the peer effect works the other way around here, however there can be another reason. The dummy is based on the answer of who the respondent asks for financial advice, which is not quite the same as the peer effect detailed in literature, as that was more so about socialising, rather than specifically asking for financial advice, which could range from basic to advanced topics, such as the stock market. The professional advice dummy is only significant at the 10%-level and negative, implying that financial professionals do not advise people to invest in the stock market, at least not for those whose main source of financial advice is them. Nevertheless, it is difficult to conclude anything in certainty considering its low significance. Finally, there are the income and wealth dummies. The coefficients grow with the growing income and wealth quartiles and every variable is statistically significant. Both income and wealth are economically significant with the wealth effect even outweighing the income effect by a significant margin.

Dependent variable: Stock owner dummy	I	II
Independent variables	Coefficient (Standard error)	Coefficient (Standard error)
University degree dummy	0.315 *** (0.073)	0.216 *** (0.081)
Financial literacy dummy	0.273 *** (0.058)	0.138 ** (0.065)
Professional advice dummy	-0.123 * (0.070)	-0.087 (0.077)
Peer advice dummy	-0.445 *** (0.073)	-0.465 *** (0.082)
Gross income quartile 2	0.210 ** (0.100)	0.393 *** (0.121)
Gross income quartile 3	0.219 ** (0.097)	0.372 *** (0.117)
Gross income quartile 4	0.466 *** (0.091)	0.566 *** (0.112)
Wealth quartile 2	0.7946 *** (0.160)	1.109 *** (0.229)
Wealth quartile 3	1.139 *** (0.155)	1.501 *** (0.224)
Wealth quartile 4	1.885 *** (0.152)	2.283 *** (0.222)
Risk-aversion quartile 2	-	-0.496 *** (0.081)
Risk-aversion quartile 3	-	-0.859 *** (0.087)
Risk-aversion quartile 4	-	-1.281 *** (0.100)
Constant	-2.499 *** (0.161)	-2.322 *** (0.236)
Number of observations	3,579	3,076
Pseudo R2	0.2333	0.2954

Table 2. The table reports the results of the baseline probit regressions on the effect of individual characteristics on their probability of investing in stocks. The dependent variable takes up the value of either 1 or 0, as an indication on whether a person holds stocks in their portfolio. In specification I, the independent variables include university degree, financial literacy, professional advice, and peer advice dummies, as well as dummies for the gross income and wealth quartiles grouped based on the sample data. Specification II also includes dummies for risk-taking behaviour, also split into quartiles. The coefficients are displayed in their respective columns. Next to the coefficient is the result's statistical significance (where *** denotes significance at the 1% level, ** indicates significance at the 5% level and * indicates significance at the 10% level) and below the coefficients are the standard errors.

Overall, all the relations that can be tested from this dataset match what has been described in the literature review with the exception of the peer effect. It was important to check this however, to see if the dataset used here is consistent with the ones from previous papers and it is also useful to see the relative sizes of the coefficients.

There is one more aspect that is possible to test for with this dataset. Included are answers to questions regarding financial risk taking, such as “*If I think an investment will be profitable, I am prepared to borrow money to make this investment*”. Summing up the points the respondents have given to these questions and splitting them into quartiles allows for testing how risk aversion affects the likelihood of stock market participation. The results after including the risk-taking measures are available above in Table 2, in the second specification. The higher quartiles represent more risk-averse groups. The coefficients are all negative, with higher values in the higher quartiles, implying that the more risk averse a person is, the less likely they are to own stocks. The coefficients are large as well, being in just the second quartile in terms of risk aversion almost offsets the effect of being in the highest income quartile. This result was in line with expectations, however it was interesting to check, as risk-aversion could be affected by past experiences, which would in turn affect stock ownership.

Because the professional advice dummy is not statistically significant, it will be excluded from the main analysis. Also, while the risk dummies were shown to have a significant effect on the variable of interest, they will not be included either, because including both those and the macroeconomic experience measure could lead to multicollinearity if past experiences indeed influence risk-preferences, which would bias the results.

4.2 The effect of macroeconomic experiences

As mentioned previously, there will be three proxies used for past experiences in this paper: the yearly returns of the AEX index, the GDP growth rate of the Netherlands, and the Consumer Confidence index in the Netherlands. The first analysis includes the yearly returns of the AEX index to serve as the indicator of past experiences. The methodology here is the one described earlier in its respective section, so the returns experienced throughout one’s life is summed up using a specific formula, which allows different weighting for earlier and later events in life.

The result of the regression is visible below in Table 3, the full regression results can be found in the first table of the appendix. The main variable, experienced stock returns is significant at the 1% level with a large coefficient, although it is difficult to compare the coefficients between different variables. Regardless, the coefficient can be considered economically significant as well. The control variables have also stayed statistically significant after the addition of stock market returns. It is important to note however that the number of observations in this regression is relatively low at just 644 because the sample had to be cut to people born in or after 1983. While this does not make it outright invalid, it can bias the results with inaccurate estimates. Nevertheless, it will be assumed that the results are accurate.

Dependent variable: stock owner dummy	$\lambda = 3.953$
Experienced stock returns	10.079 *** (3.053)
Controls: university degree, financial literacy, peer advice, income, wealth	
Number of observations	644
Pseudo R2	0.2731

Table 3. The table reports the result of the main probit regression on the effect of experienced stock market returns on their investments in stocks. The dependent variable takes up the value of either 1 or 0, as an indication on whether a person holds stocks in their portfolio. Besides the main variable of interest, the regression uses the listed control variables. Next to the coefficient is the result's statistical significance (where *** denotes significance at the 1% level, ** indicates significance at the 5% level and * indicates significance at the 10% level) and below the coefficient is the standard error in parenthesis.

The weighting parameter, λ is equal to 3.953 in this case, meaning that more recent returns are much more heavily weighted than earlier ones, however experiences from earlier life still matter in the decision to invest in stocks. The weighting function with the given parameter is visualized on Figure 5 below, taking a theoretical 50-year-old at the time of observation. Combined with the regression result, this suggests that experienced stock market returns do indeed affect the decision to invest in stocks. Furthermore, the shape of the weighting function indicates that even stock returns up to 20-25 years prior can have a significant effect in this case, although it is apparent that more recent experiences are much more heavily weighted.

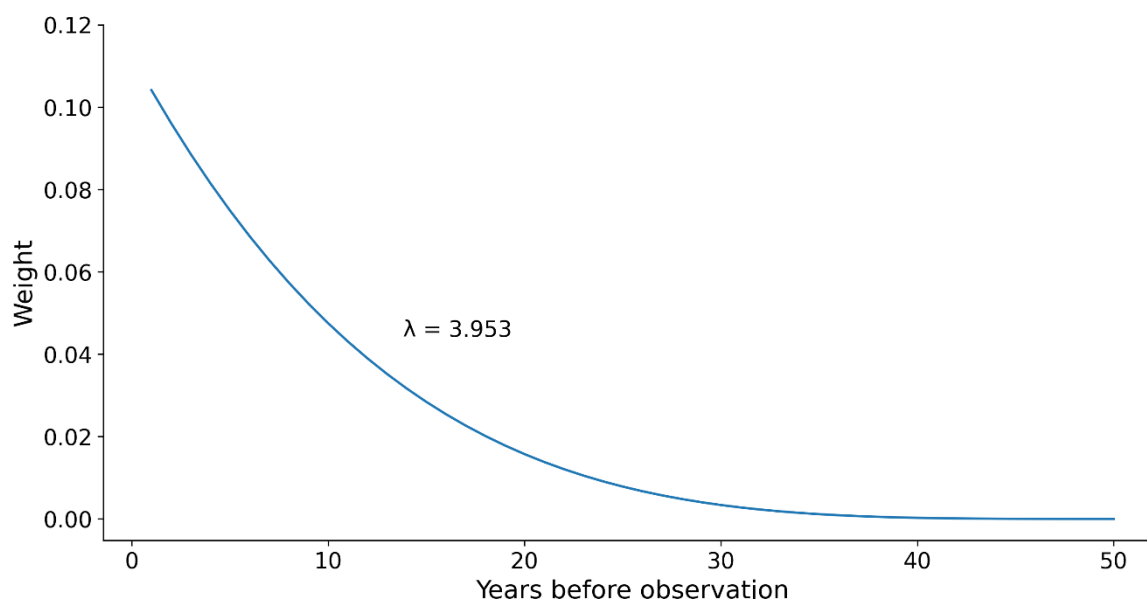


Figure 5. The figure shows the shape of the weighting function in the case of past stock returns for the estimated level of lambda for a theoretical 50-year-old person.

Moving forward, the next measure that is being tested here is the GDP growth rate of the Netherlands. The methodology is identical; however, the result is quite different to the prior regression. It is visible below, in Table 4 with the full table in the appendix. The number of observations is considerably higher in this case due to GDP data being available over a much longer period. All the control variables have stayed statistically significant and experienced GDP growth is also statistically significant, however the coefficient is substantially lower than it was previous specification, equalling 0.206 in this case and 10.079 for stock returns.

Dependent variable: stock owner dummy	$\lambda = 5.458$
Experienced GDP growth	0.206 ***
	(0.055)
Controls: university degree, financial literacy, peer advice, income, wealth	
Number of observations	2040
Pseudo R2	0.1713

Table 4. The table reports the result of the main probit regression on the effect of experienced GDP growth on their investments in stocks. The dependent variable takes up the value of either 1 or 0, as an indication on whether a person holds stocks in their portfolio. Besides the main variable of interest, the regression uses the listed control variables. Next to the coefficient is the result's statistical significance (where *** denotes significance at the 1% level, ** indicates significance at the 5% level and * indicates significance at the 10% level) and below the coefficient is the standard error in parenthesis.

The value of λ is significantly larger on the other hand, equalling 5.458, so the slope of the weighting function is steeper. Compared to the previous weighting function, more recent memories are more even more heavily weighted, which also means that GDP's effect rolls off more quickly with time. Combined with the coefficient, it seems that while GDP does influence stock market participation, it is relatively low and historical economic performance does not play as big of a role as recent economic development.

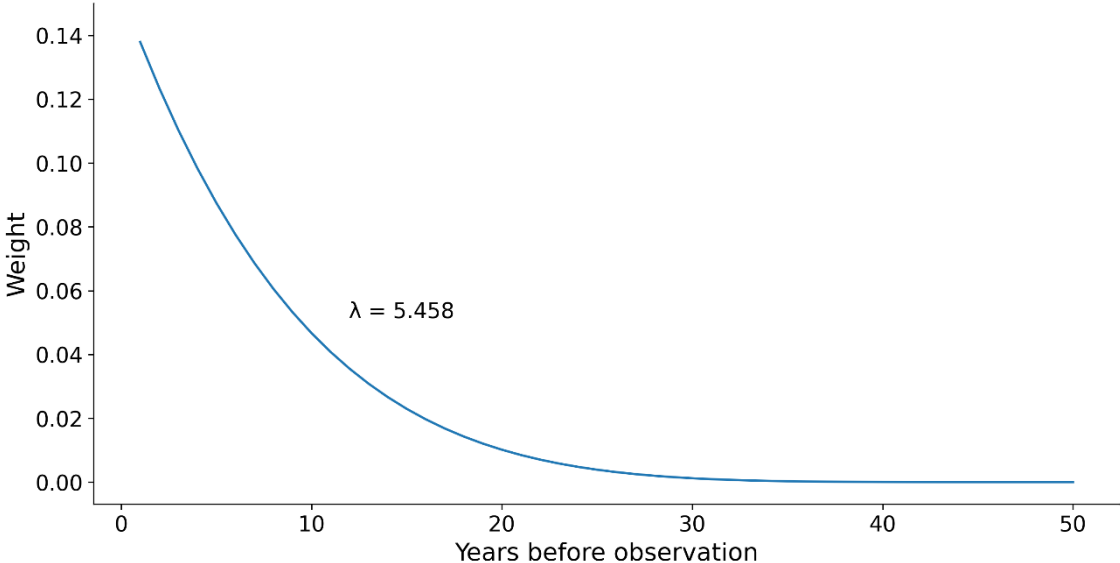


Figure 6. The figure shows the shape of the weighting function in the case of experienced GDP growth for the estimated level of lambda for a theoretical 50-year-old person.

Lastly, there is consumer confidence. It was expected to bring interesting results, as consumer confidence can be impacted by a number of economic indicators. This includes the health of the economy, so GDP growth, wages, unemployment rate and inflation would all theoretically be captured by consumer confidence. Even stock market performance and interest rates could play a role, the former signals good economic times, as well as high possible earnings on investments, while the latter increases borrowing and spending. Moreover, government and local policies, as well as international political stability and relations could influence this measure. All in all, one would expect consumer confidence to be positively correlated with stock market participation, even just considering the results so far with market performance and GDP growth and how they also affect consumer confidence.

Dependent variable: stock owner dummy	$\lambda = 0.328$
Consumer Confidence	-0.154 ** (0.062)
Controls: university degree, financial literacy, peer advice, income, wealth	
Number of observations	499
Pseudo R2	0.3124

Table 5. The table reports the result of the main probit regression on the effect of experienced stock market returns on their investments in stocks. The dependent variable takes up the value of either 1 or 0, as an indication on whether a person holds stocks in their portfolio. Besides the main variable of interest, the regression uses the listed control variables. Next to the coefficient is the result's statistical significance (where *** denotes significance at the 1% level, ** indicates significance at the 5% level and * indicates significance at the 10% level) and below the coefficient is the standard error in parenthesis.

The results can be seen above in Table 5. Despite the aforementioned reasons, the results indicate a negative relation between consumer confidence and stock market participation. All the control variables are statistically significant again and so is the effect of experienced consumer confidence at the 5%-level. Not only is the negative coefficient unusual in this regression result, but also the fact that the λ is equal to 0.328, visualized below on Figure 7, which means that even events far in the past have a significant influence on stock market participation, nearing equal weighting throughout one's life ($\lambda = 0$).

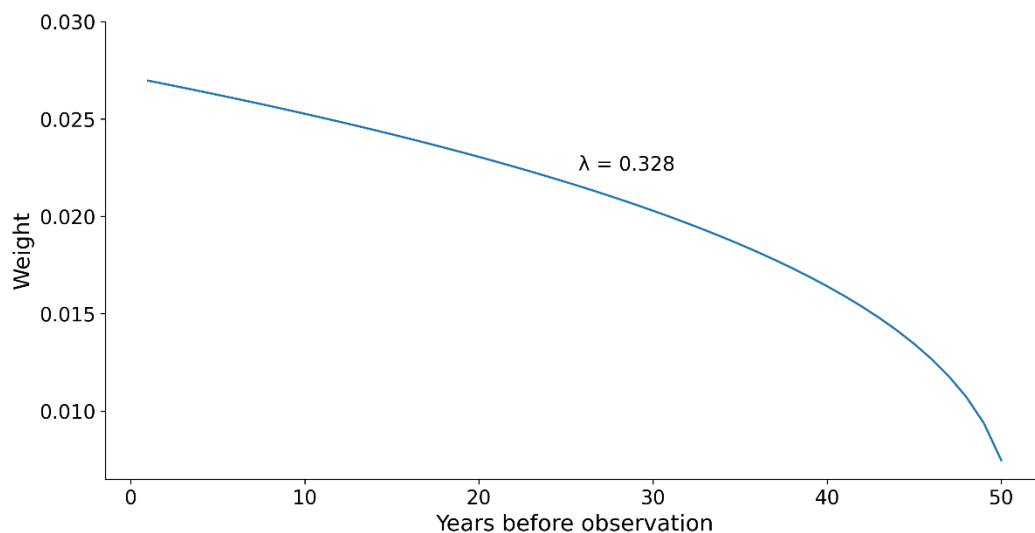


Figure 7. The figure shows the shape of the weighting function in the case of past stock returns for the estimated level of lambda for a theoretical 50-year-old person

It is important to note that the number of observations is even lower than it was in the first regression, just 499, as the cut-off point for year of birth was 3 years later, in 1986. The results of all three regressions, as well as the limitations of the paper will be discussed after the robustness checks.

4.3 Robustness check

To check the robustness of the main specifications, the regressions were re-run with logit and Limited Probability Models (LPM). By doing this, it is possible to check if the results are consistent across different models, so they are not sensitive to the assumptions of any of them. Both logit and LPM are used in cases where the dependent variable is binary, just like probit regression. The main difference between probit and logit is that the former uses the standard normal cumulative function, while the latter uses the logistic function to transform the linear relation of the independent variables on the dependent variable into a probability, and thus the exact interpretation also differs. LPM on the other hand does no transformation, so the linear relation directly translates to the probability. LPM is not as widely used because of this, as the predicted probabilities can fall outside of the valid range e.g., below 0 and over 1, even though probabilities cannot actually take up those values.

The results of the logit regressions are visible in Appendix Table 2. There are no major differences between this and the original specification. The weighting factors barely differ, all the coefficients are statistically significant at the 1%-level, including the main predictors which are similar in magnitude to their counterparts in the original regressions. The effect of past stock returns is still the largest by far, while the effect of GDP growth and consumer confidence both are close to 0, with the former being positive and the latter negative.

As for the LPM, those results can be seen in Appendix Table 3. The main difference from the other models is that here the effect of wealth is statistically insignificant in the case of stock returns and GDP growth due to the high standard errors. The weighting factor also differs more in this case, it is even closer to 0 for consumer confidence. Nevertheless, all the main variables are statistically significant, and their coefficients are similar to their counterparts in the other models in both their sign and relative magnitude.

5. Discussion

5.1 The results

The results of each regression differ from the expectations considerably, each in different ways. In the case of experienced stock returns, the unexpected part is the shape of the weighting function. In Malmendier and Nagel (2011), regressing stock market participation on experienced stock market returns has resulted in a λ of around 1.3-2 depending on the exact specification. The lower end of the estimate indicates that recent experiences hold more significance, but even events from infancy can leave a lasting impact throughout one's life. In contrast, for values around 2, the significance of events drops off faster with time. However, experiences from 30+ years prior can still yield a significant effect in the case for a 50-year-old, which contrasts markedly with the λ value of approximately 4 obtained in the first regression of the main analysis here. This result indicates that macroeconomic experiences early on in one's life are practically irrelevant to their current decision-making and even experiences from the midpoint of one's life and beyond are inconsequential. Nevertheless, the findings show that the people can be affected by macroeconomic experiences (many) years prior, and even in cases when the weighting function assigns low values to certain events, large shocks can still make a significant impact. The coefficient of experienced stock returns is positive with a large size, so the relation between that and stock market participation aligns with the theory.

Similarly, the effect of experienced GDP growth also has a positive coefficient, which in itself does align with the underlying theory, but the coefficient is significantly smaller than expected and the weighting function is even steeper than in the case of experienced stock returns. This means that GDP growth's effect is even more sensitive to the passage of time, and it is not as sizable even for recent events. With these results in mind, it is difficult to claim that the general performance of the economy has a substantial effect on stock market participation, but there is an impact.

Taking these two outcomes together, it could be argued that past macroeconomic experiences influence risk taking through subjective expectations as opposed to altering risk preferences, or it is potentially both, with the latter playing a smaller role in this. If it was solely about risk preferences, GDP growth would have a similarly large effect on stock market participation as stock returns have, possibly even higher, as GDP reflects the general health of the economy, thus fluctuations are more acutely felt by the general population. There could be explanations as to why there is a positive relation regardless. Firstly, it might be because it

affects investor sentiment. Longer periods of weak or strong economic performance might lead to less or more confidence in the market, which is also related to subjective expectations. Secondly, it could be related to wealth effect, as people tend to have higher incomes, possibly lower interest rates on borrowing in good times of the economy, which could lead to a higher inclination to invest, potentially in stocks. If both of these are considered, then it would also partly explain why the weighting function is so steep, although the latter explanation would suggest an even steeper function, as only the very recent/current performance would play a role.

The outcome of the regression with consumer confidence is more difficult to explain. One possible explanation is that the result is not actually due to a real effect between experienced consumer confidence levels and stock ownership, just a spurious result owing to the low number of observations. It is “only” significant at the 5%-level unlike the other results and the coefficient is even smaller, than it is in the case of the regression with GDP growth. The shape of the weighting function being so different from the other results, as well as the results of Malmendier and Nagel (2011) could also indicate that the regression results might be biased. The dataset is also skewed towards younger people – the highest age included in this analysis is just 36 due to consumer confidence data only being available from 1986, although the regression with the stock returns suffers from this problem as well. This will be further discussed in the limitations section. Furthermore, it could be the case that consumer confidence is not an accurate enough measure of the economy, potentially because other aspects that go into consumer confidence, e.g., government policies, have impacted it more, or people simply do not feel accurately about economic development.

If the results are considered unbiased, the meaning behind them might be that those who have lived through times of better overall consumer confidence, are less likely to save in general, possibly because those people would feel less inclined to have a “rainy day funds”, or they could just be more inclined to make large purchases as opposed to save their money. It might be that they have different saving preferences, so they would rather invest their money in other assets. It is difficult to draw a definite conclusion from these results.

Despite the last regression’s unusual results, the two hypotheses set out earlier in the paper can be considered to be answered. Hypothesis 1 stated that past macroeconomic experiences have an effect on stock market participation, which is definitely true, as all three measures used have resulted in statistically significant coefficients with stock returns having a substantial effect. Hypothesis 2 have stated that the impact of past macroeconomic experiences varies

across one's life and it indeed does, as measured by the λ values. Not only does it differ across one's lifetime, but it also differs between different macroeconomic indicators.

Overall, the results are interesting. In general, the decision to hold stocks as investments depends on a number of factors, some of which was potentially out of the scope of this paper. The findings here specifically confirm that university education, as well as financial literacy positively affect stock market participation. Similarly, income and wealth both increase the likelihood of a person participating, the latter especially so. Even with these included as controls, there is an apparent relation between experienced stock returns (or macroeconomic experiences) and the participation decision. This is noteworthy because for example even though one might be sufficiently literate financially, they could still be substantially affected by their subjective perception of potential stock returns. This could be partially explained by the problem detailed in the literature review: information overload, as proposed by Agnew and Szykman (2005). People can get overwhelmed by the complexity of the stock market, making them ignore it for the most part. Nonetheless, they can see or hear about the performance of certain stocks or indexes in passing, which creates the subjective expectations for them, which is not necessarily representative of the full picture, the fundamentals of the market.

Regardless of how this effect works on stock market participation, it is important to mention that there could also be reverse causality to some extent. If past stock returns were high, they would also raise the participation rate, and the higher demand would raise the prices even further, etc. This could theoretically result in a positive feedback loop, like it can be seen with speculative bubbles, where the demand comes from the anticipation of higher returns, as opposed to fundamentals. Because recent returns are weighted significantly higher, this effect could be prevalent during times of large stock market runups.

The results have several implications. Firstly, following the previous line of thought, if people are indeed put off by the implicit (or potentially explicit) costs of staying informed in the stock market, it could be beneficial to bring these costs down. Be it through easier and cheaper access to the conceptual basics and the most important metrics of the stock market could boost the stock market participation rate. This in turn would lead to higher welfare, as people could earn better returns on their savings and it would also boost the performance of the market, as demand would grow. It would also ease the burden on the growingly overwhelmed pension systems, as there would be less reliance on pension. Secondly, there are consequences for asset pricing and theoretical economic models. Both can be updated to use agents that are not completely rational, but their choices and actions depend on their subjective expectations

and experiences to arrive at more accurate results. Lastly, it highlights the importance of behavioural economics/finance, as it was shown here and, in the papers mentioned in the literature review that reality is not as simple as rational agents making judgments, but there are a number of psychological factors that go into every decision.

5.2 Limitations

While the results are useful, there are a number of limitations to this research that need to be discussed as well. Most importantly, the regressions were run on relatively low number of observations. This is somewhat true for all three main regressions, even the observation count of 2033 in the one with GDP growth was not particularly high, but this is especially a problem for the one with consumer confidence. Fortunately, the results did not lack statistical power, but the results could be biased regardless because of this issue.

Closely related to this is the problem that the datasets, especially the ones with the stock returns and consumer confidence measure had to be trimmed heavily based on the respondents' year of birth due to limited data availability. Besides the fact that this limits observations, this also means that the data does not include higher age groups. On the higher end of this spectrum, the regression with GDP included people up to 61 years old, which is significantly more representative of the whole population than the maximum age of 36 in the regression with consumer confidence. Using such a young sample of people can bias the results because the overall population trends can differ significantly. In general, there are several differences in the savings habits of younger and older groups of people. For example, young adults are likely barely starting to save up, as their income starting out is relatively low, there are high potential expenses as they start their independent lives. Furthermore, they have different time horizons, risk tolerances and goals, which means that they likely invest differently than older groups, which means that the results might not be generalizable for the whole population.

Similarly, the paper has only focused on the Netherlands, which also limits its generalizability. Other countries with different cultural norms, economic conditions, education can all have a different attitude towards the stock market or the financial system in general. The financial systems can also differ significantly, in other countries it might be less or more difficult to invest in stocks. These aspects can all make it so that it is difficult to apply the findings in the same way as they were here.

Lastly, it is important to mention that working with survey data can bring its own set of issues. While Centerdata carefully constructs its panel of households each year to be as widely representative of the Dutch population as possible, there could still be some sampling biases. For example, the wealthiest of the Netherlands are not represented in the data. Response bias can be another issue: respondents might answer dishonestly on purpose because they feel like it is socially desirable to answer in a certain way. People also tend to choose extremes or the midpoint on scales if they feel unsure about the answer, as well as rounding to “nice” round numbers. Besides these, there could be bias in the way people answer questions about themselves, as they cannot be fully objective, might under- or overestimate their capabilities. The order of the questions can also have an effect on the responses, as they might influence the respondent’s interpretation, thinking.

6. Conclusion

Not enough people are investing in stocks. At least not nearly as many as theory would suggest. This paper tries to enrich the wide range of available literature that deals with this topic, trying to find the reasons behind this discrepancy. There are various directions researchers have taken, including explanations about the implicit and explicit costs, cognitive abilities, education, risk preferences and subjective expectations. The last two were the potential avenues through which past macroeconomic experiences could have an effect on stock market participation.

In order to investigate this effect, this paper has utilised multiple years of the DNB Household Survey datasets, an annual economic research survey in the Netherlands. With the information on the respondents’ education, income, assets, etc. it was possible to compile a dataset on which it could be tested how personal characteristics affect the likelihood of stock market participation. For the baseline results, probit regressions were run with stock ownership as the dependent variable and university education, financial literacy, peer and professional advice, income, wealth, and risk-aversion. The results have mostly confirmed what previous literature has established: higher education, financial literacy have positive effects on the probability of participation, this probability grows with income and wealth, and becomes lower with risk-aversion. The only unusual finding was that those who ask peers for financial advice

are less likely to own stocks, which does go against the findings of other papers, but it could be capturing a different effect in this case.

As for the main regressions, the yearly returns of the AEX, the index fund of the Amsterdam Stock Exchange, yearly GDP growth, and yearly consumer confidence data were used to investigate how the macroeconomic environment throughout one's life affects stock market participation. To measure this, the yearly measures were summed up using a formula developed by Malmendier and Nagel (2011), which allows the weighting to change with time. Because historical data on these measures are not available far back, the dataset had to be trimmed, so that only people born in or after the year of the first datapoint. While this reduced the number of observations substantially, the regression results were all statistically significant. Experiencing historical stock market, as well as GDP growth have a positive effect on stock market participation, with the former having a larger, economically significant coefficient. GDP growth had a steeper weighting function, meaning experiences further in the past are less relevant to current decision-making in that case. Regardless, both results show that experiences many years back still have a significant effect on current decisions. Consumer confidence was an outlier, as it seems to have a negative effect on stock market participation with a relatively even weighting function. Based on the results I did not reject either of the hypotheses, as firstly, past macroeconomic experiences do have a significant effect on stock market participation, especially so in the case of stock returns. Secondly, their impact does differ throughout different stages of life, as demonstrated by the slope of the weighting functions.

This paper's added value comes from the fact that it applies the aforementioned methodology to a new country and uses different macroeconomic indicators. It is useful to test existing findings on different populations because there can be significant differences in culture, economy, and government policy. The original paper was using American data, where a significantly larger part of the population has investments in stocks, close to 50% in the US and only around 19% in the Netherlands for direct and indirect stockholdings (Badarinza et al., 2016). Including three macroeconomic indicators has helped highlight how the stock returns specifically have a significantly larger effect than other macroeconomic experiences. The conclusion from this is that the effect likely works through altered expectations as opposed to altered risk-preferences.

There is room for further research, however. The final dataset used in the cases of stock returns and consumer confidence had relatively low observation counts, especially in the case of the latter. Further testing with larger datasets would be useful to consolidate the results here,

moreover, testing on more countries would also be valuable. Furthermore, following along the lines of this research, it would be worth researching how, or if past experiences of different macroeconomic indicators affect different financial decisions, like buying real estate, starting businesses, and taking out loans. A similar analysis could be done on the entry and exit decisions of the stock market, it could be especially interesting at times when asset bubbles are formed, as the feedback loop of entries mentioned in the discussion could be examined. With such an analysis, it would be possible to compare how those with different experiences react to large shocks in the market. Lastly, the effect of personal losses and gains, as well as its effect on the social circle, how it might offset or change the effect found here would be interesting, although quite difficult because it requires complex data.

7. References

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8. Appendix

<u>Probit model</u>			
Dependent variable: Stock owner dummy	I AEX returns	II GDP growth	III Consumer confidence
Independent variables	Coefficient (Standard error)	Coefficient (Standard error)	Coefficient (Standard error)
Lambda	3.953	5.458	0.328
Macroeconomic experiences	10.079 *** (3.053)	0.206 *** (0.055)	-0.154 ** (0.062)
University degree dummy	0.561 *** (0.155)	0.326 *** (0.088)	0.671 *** (0.183)
Financial literacy dummy	0.369 ** (0.152)	0.268 *** (0.075)	0.396 ** (0.177)
Peer advice dummy	-0.562 *** (0.153)	-0.462 *** (0.082)	-0.507 *** (0.182)
Gross income	9.288e-06 *** (3.11e-06)	4.863e-06 *** (1.1e-06)	1.171e-05 *** (3.86e-06)
Financial wealth	1.275e-05 *** (2.69e-06)	6.064e-06 *** (6.03e-07)	2.361e-05 *** (4e-06)
Constant	-2.590 *** (0.316)	-1.763 *** (0.117)	-2.520 *** (0.324)
Number of observations	644	2,040	499
Pseudo R2	0.2731	0.1713	0.3124

*Appendix Table 1. The table reports the results of the main probit regressions on the effect of past experiences and other individual characteristics on their probability of investing in stocks. The dependent variable takes up the value of either 1 or 0, as an indication on whether a person holds stocks in their portfolio. All regressions use the following controls: university degree, financial literacy, peer advice dummy, wealth, and income. Specification I uses the AEX index's yearly returns, specification II uses GDP growth and specification III uses the consumer confidence index as the main independent variables. The coefficients are displayed in their respective columns. Next to the coefficient is the result's statistical significance (where *** denotes significance at the 1% level, ** indicates significance at the 5% level and * indicates significance at the 10% level) and below the coefficients are the standard errors.*

<u>Logit model</u>			
Dependent variable: Stock owner dummy	I AEX returns	II GDP growth	III Consumer confidence
Independent variables	Coefficient (Standard error)	Coefficient (Standard error)	Coefficient (Standard error)
Lambda	3.837	5.518	0.304
Macroeconomic experiences	21.337 *** (6.293)	0.387 *** (0.100)	-0.307 *** (0.117)
University degree dummy	1.076 *** (0.283)	0.533 *** (0.162)	1.328 *** (0.341)
Financial literacy dummy	0.727 *** (0.289)	0.479 *** (0.138)	0.737 *** (0.340)
Peer advice dummy	-1.053 *** (0.288)	-0.838 *** (0.160)	-0.990 *** (0.343)
Gross income	1.67e-05 *** (5.73e-06)	7.808e-06 *** (2.27e-06)	2.183e-05 *** (7.12e-06)
Financial wealth	2.347e-05 *** (5.38e-06)	1.356e-05 *** (1.42e-06)	4.155e-05 *** (7.36e-06)
Constant	-4.917 *** (0.662)	-3.129 *** (0.221)	-4.601 *** (0.628)
Number of observations	644	2,040	499
Pseudo R2	0.2748	0.1774	0.3128

*Appendix Table 2. The table reports the results of the robustness checks of the main regressions using logit function on the effect of past experiences and other individual characteristics on their probability of investing in stocks. The dependent variable takes up the value of either 1 or 0, as an indication on whether a person holds stocks in their portfolio. All regressions use the following controls: university degree, financial literacy, peer advice dummy, wealth, and income. Specification I uses the AEX index's yearly returns, specification II uses GDP growth and specification III uses the consumer confidence index as the main independent variables. The coefficients are displayed in their respective columns. Next to the coefficient is the result's statistical significance (where *** denotes significance at the 1% level, ** indicates significance at the 5% level and * indicates significance at the 10% level) and below the coefficients are the standard errors.*

<u>Linear Probability Model</u>			
Dependent variable: Stock owner dummy	I AEX returns	II GDP growth	III Consumer confidence
Independent variables	Coefficient (Standard error)	Coefficient (Standard error)	Coefficient (Standard error)
Lambda	3.390	5.747	0.178
Macroeconomic experiences	1.374 *** (0.365)	0.041 *** (0.012)	-0.016 *** (0.006)
University degree dummy	0.115 *** (0.039)	0.079 *** (0.024)	0.111 *** (0.037)
Financial literacy dummy	0.080 *** (0.029)	0.065 *** (0.018)	0.060 ** (0.031)
Peer advice dummy	-0.109 *** (0.032)	-0.092 *** (0.016)	-0.089 *** (0.034)
Gross income	2.239e-06 ** (9.1e-07)	1.49e-06 *** (5.66e-07)	2.093e-06 *** (8.16e-07)
Financial wealth	1.134e-06 (1.98e-06)	9.301e-07 (5.95e-07)	4.647e-06 *** (9.69e-07)
Constant	-0.040 (0.038)	-0.018 (0.027)	-0.020 (0.036)
Number of observations	644	2,040	499
Adjusted R2	0.195	0.139	0.252

*Appendix Table 3. The table reports the results of the robustness checks of the main regressions using LPM function on the effect of past experiences and other individual characteristics on their probability of investing in stocks. The dependent variable takes up the value of either 1 or 0, as an indication on whether a person holds stocks in their portfolio. All regressions use the following controls: university degree, financial literacy, peer advice dummy, wealth, and income. Specification I uses the AEX index's yearly returns, specification II uses GDP growth and specification III uses the consumer confidence index as the main independent variables. The coefficients are displayed in their respective columns. Next to the coefficient is the result's statistical significance (where *** denotes significance at the 1% level, ** indicates significance at the 5% level and * indicates significance at the 10% level) and below the coefficients are the standard errors.*