Macroeconomic Experiences and Risk-Taking of Euro Area Households[1]

Miguel Ampudia[2] and Michael Ehrmann[3]

August 2013

PRELIMINARY AND INCOMPLETE – PLEASE DO NOT CIRCULATE FURTHER

Abstract

We show that experienced stock market returns exert statistically significant and economically substantial effects on households' risk aversion and portfolio decisions: better experiences lower risk aversion and increase stock market participation along the intensive and the extensive margin. We find that more distant experiences receive a somewhat lower (but still substantial) weight than the corresponding findings for the United States. Furthermore, there are additional effects stemming from the experience of extreme stock market downturns. Households in countries that witnessed a particularly severe 2008 stock market crash give substantially more weight to the most recent experience, suggesting that in these countries an even more pronounced underinvestment in the stock market should be expected in the years to come. The paper follows the methodology used by Malmendier and Nagel (2011) and it applies it to a novel dataset on household finances covering European households.

JEL-codes: D03, D14,D83, G11

Keywords: risk aversion, household finance, learning, portfolio choice, rare disasters.

1 This paper uses data from the Eurosystem Household Finance and Consumption Survey. It presents the authors' personal opinions and does not necessarily reflect the views of the European Central Bank or the Eurosystem Household Finance and Consumption Network. We are grateful to Stefan Nagel for making his econometric code available, Tetti Tzamourani for help with some data, and thank Dimitris Christelis, Dimitris Georgarakos, Carlos García de Andoain and participants at seminars at the ECB, the Deutsche Bundesbank and the Household Finance and Consumption Network for useful comments.

2 European Central Bank, miguel.ampudia@ecb.europa.eu.

3 European Central Bank, michael.ehrmann@ecb.europa.eu.

1. Introduction

There is ample evidence that risk aversion has increased in the course of the global financial crisis, across a range of economic agents. Financial markets show a higher degree of risk aversion (Bekaert and Hoerova 2013), banks have become more risk averse in their lending practices (Basset et al. 2012), and also households have been found to be more risk averse following the experience of the financial crisis (Guiso, Sapienza and Zingales 2012). This suggests that risk aversion varies over time, and depends on the experiences that economic agents have made.

Time-varying risk aversion has been explored in a number of papers related to financial markets, and has been shown to allow matching several empirical facts, like the counter-cyclicality of asset return risk premia (Constantinides 1990; Campbell and Cochrane 1999). Also, Bekaert, Hoerova and Lo Duca (2013) illustrate that risk aversion in financial markets is responsive to monetary policy, with lax monetary policy leading to a substantial decline in risk aversion.

In contrast to the evidence for financial markets, much less is known with regard to possible time variations in the risk aversion of consumers or households. Guiso and Paiella (2008) show that risk aversion increases in response to heightened income uncertainty or if individuals become liquidity constrained. Guiso, Sapienza and Zingales (2012) study clients of banks, and find measures of risk aversion to have increased substantially after the crisis. Furthermore, these changes are correlated with changes in the clients' portfolio choices, suggesting that extreme negative events have substantial repercussions on risk aversion and household finances.

Beyond the immediate reaction to adverse events, a recent paper by Malmendier and Nagel (2011) has shown that consumers' risk taking is furthermore affected by the experience that they have made over longer time spans. They show that risk aversion of U.S. consumers decreases with the real stock market returns they have experienced over their lifetime, and that this pattern is also reflected in their portfolio decisions (as those with less favourable experiences are less inclined to hold stocks in the first place, and furthermore hold smaller amounts in case they participate in the stock market).

This evidence contradicts the assumption maintained in standard economic models that economic agents have stable risk preferences, and adds to a literature that studies the effect of the environment and personal experiences on the formation of preferences and economic behaviour. Several factors have been identified as important in that regard. Experiences of inflation, for instance, are relevant – having experienced higher inflation tends to lower happiness (Blanchflower 2007), increase inflation expectations (Lombardelli and Saleheen 2003, Malmendier and Nagel 2009), and inflation aversion (Ehrmann and Tzamourani 2012). Having grown up during recessionary times also matters for future

preferences: as Alesina and Giuliano (2011) and Guliano and Spilimbergo (2009) demonstrate, such individuals are more likely to hold the belief that success in life depends more on luck than on effort, and therefore have a more favourable attitude towards re-distributional policies. Beyond these macroeconomic factors, also an individual's experience of financial market performance shapes her behaviour: Kaustia and Knuepfer (2008) show that investors are more likely to subscribe to initial public offerings (IPO) on the stock market if their previous IPO investments have performed relatively well, and Choi et al. (2009) suggest that investors over-extrapolate from their personal experience when they make their savings decisions.

Of course, also the socio-economic background of an individual affects beliefs and behaviour. As reported in Dohmen et al. (2011), the educational background of an individual's parents affects her willingness to take risks. Guiso et al. (2004) measure social capital in a region by the electoral turnout and the willingness to donate blood, and find that in high social capital regions in Italy, more households invest in stocks, a pattern that even persists if the individual leaves the region. Finally, using data on German households, Alesina and Fuchs-Schündeln (2007) have identified persistent effects of communism on attitudes towards the role of the state in providing social services, insurance or redistribution.

If we are ready to believe that individual experiences shape beliefs and behaviour, another question is how long these patterns persist. As just mentioned, both the findings in Alesina and Fuchs-Schündeln (2007) and in Guiso et al. (2004) suggest that there is quite some persistence. Malmendier and Nagel (2011), estimating the impact of financial market experience on risk aversion and risk taking, find that more distant experiences are relatively less important than more recent ones, but that their impact remains noticeable for some decades. Their findings also suggest that young individuals are particularly affected by more recent events.

The current paper uses the methodology and the approach developed by Malmendier and Nagel (2011) and applies it to a novel dataset on household finances, the Eurosystem Household Finance and Consumption Survey (HFCS). This dataset provides information on self-assessed risk aversion and participation in financial markets, along with a large number of important control variables, in a harmonised fashion for several countries in the euro area. Our data cover more than 58,000 households in Austria, Belgium, Finland, France, Germany, Greece, Italy, Luxembourg, the Netherlands, Spain and Portugal, i.e. in eleven different countries of the euro area.[4]

[4] The HFCS also contains data for Cyprus, Malta, Slovakia and Slovenia. As we could not obtain sufficiently long historical data for the stock market performance of these countries, we had to discard them from the analysis.

The data show considerable variation in the experienced stock market returns both within and across countries. In contrast, our measure of self-assessed risk aversion varies relatively little, but still sufficiently to successfully identify effects of stock market experiences on risk aversion. Stock market participation is also widely different across countries, ranging from an average of 3% in Greece to 22% in Finland. Among stockholding households, the average share of stocks in total liquid assets is smallest in Germany and the Netherlands with 16%, and largest in Finland and Greece with 34%. This substantial cross-country variation is crucial for the current paper, as it allows the identification of experience effects separately from age effects despite the fact that only one wave of the survey is currently available.

Our estimates of the effects of life-time experiences on risk aversion and stock holdings among euro area households are fully in line with those identified in Malmendier and Nagel (2011). They are statistically significant and economically substantial. To give just a few examples, households at the 90th percentile of the distribution of experienced stock returns are 8 percentage points less likely to report a high level of risk aversion than households at the 10th percentile of the distribution of experienced stock returns. The corresponding effect for the United States identified in Malmendier and Nagel (2011) is 9 percentage points. For the propensity to hold stocks, the 90th-percentile household in the euro area is 12 percentage points more likely to be invested in the stock market than the 10th-percentile household, as compared to a 10 percentage point difference in the United States

While these estimates match those reported in Malmendier and Nagel (2011) very closely, our evidence for Europe suggests that experienced stock market become less relevant in determining household behaviour relatively more quickly than those in the United States. For instance, the results in Malmendier and Nagel (2011) imply that a 30-year old individual assigns a weight of 7.7% to the experience made in the preceding year, whereas the experience from 10 years ago would receive a weight of 4.7%. For Europe, we estimate an initial weight of 19.60%, and a weight of 2.7% after 10 years, i.e. a substantially larger weight for more recent experiences. Despite this quantitative difference, our results imply that the results hold qualitatively in the sense that stock return experiences matter for risk aversion and stock market participation for several years.

The paper then moves on to testing whether the experience of extreme events (by identifying how often an individual has seen nominal stock market returns decline by more than 20% in a given year) also has a bearing on stock market participation. Once more, we find these effects to be substantial – for each additional experienced stock market crash (or protracted decline), the tendency to hold stocks shrinks by 2 percentage point. Over the interdecile range, this amounts to a 9 percentage point difference in stockholdings.

These findings relate to a previous literature on rare disasters (like stock market crashes but also other events like wars) and financial markets. Rietz (1998) and subsequently Barro (2006, 2009) showed that models which take into account the probability of rare disasters can help explaining inter alia the equity premium puzzle. Taking this idea further, Alan (2012) studied whether household portfolio decisions can also be explained by the perceived risk of stock market crashes. She finds some evidence for this hypothesis among the less educated households, but rejects it for the better educated and wealthy households.

Dominitz and Manski (2007) have documented that households' expectations of future stock market returns are very heterogeneous, and have an effect on participation and investment patterns. In this paper we argue that the beyond socio-demographic factors, households' experiences of disastrous events are an important factor in shaping their portfolio decisions, possibly via return expectations.

The paper therefore provides further evidence supporting the relevance of time-varying risk aversion of households, which has repercussions on their actual behaviour. These findings have important policy implications. It is a well-known fact that households are generally underinvested in the stock market, a phenomenon that has been dubbed the "stock-holding" puzzle (Haliassos and Bertaut 1995: Campbell 2006). The puzzle is particularly pronounced in Europe, where household stock market participation is even lower than in the United States. This is especially problematic given that households have been made more and more responsible for their own finances after retirement (van Rooij et al. 2011). The findings in the current paper imply that stock market participation will likely be further depressed due to the recent experience of the 2008 stock market crash, suggesting an even more pronounced underinvestment of European households in the stock market in the times to come.

The paper proceeds as follows: Section 2 provides more detail on the underlying data and the econometric methodologies that we employ. Section 3 reports the main findings regarding the effect of individuals' stock market experiences on risk aversion and stock market participation, and provides the results of several robustness tests. Section 4 expands the evidence by focusing on the consequences of extreme events. Section 5 concludes.

2. Data and Methodology

2.1 Data

In order to conduct our analysis we will combine household-level data from the HFCS and historical data for stock returns. The HFCS provides ex-ante comparable data for 15 euro area countries (all euro

area countries with the exception of Estonia and Ireland).[5] As we could not obtain sufficiently long historical data for the stock market performance of Cyprus, Malta, Slovakia and Slovenia, we had to discard them from the analysis. Our data cover more than 58,000 households in 11 euro area countries, namely Austria, Belgium, Finland, France, Germany, Greece, Italy, Luxembourg, the Netherlands, Spain and Portugal.

The HFCS contains information regarding socio-demographic variables, assets, liabilities, income and consumption for a sample of households that is representative both at the national and the euro area level. A set of population weights is provided in order to ensure the representativity of the sample. All our calculations use these population weights. In section 4 we perform unweighted calculations as part of our robustness checks.

Another important feature of the HFCS is that missing observations (i.e. questions that were not answered by the respondent households) are multiply imputed – as a matter of fact, five datasets are provided, an issue that we will take into account when assessing the statistical significance of our estimates.[6] The first wave of the HFCS was conducted around 2010, but it is important to note that the reference periods have not been fully harmonised. In particular, the reference period for the Spanish data is 2008/2009, whereas it is 2009 for Greece. We account for these differences when calculating respondents' life-time experiences. It is important to notice, however, that all the households in our sample have lived through the 2008 financial crisis.

From the HFCS we are going to retrieve our dependent variables and a set of control variables. In particular, the variables of interest are the household's self-reported risk aversion, whether it participates in the stock market or not, and the share of liquid assets invested in stocks. For determining the household's risk aversion we use the following question: *"Which of the following statements comes closest to describing the amount of financial risk that you (and your husband/wife/partner) are willing to take when you save or make investments?"* The respondent can choose one of the following options: *1. Take substantial financial risks expecting to earn substantial returns, 2. Take above average financial risks*

[5] For more details on the survey, see http://www.ecb.europa.eu/home/html/researcher_hfcn.en.html. The results from the first wave are described in detail in Household Finance and Consumption Network (2013a).

[6] Variables necessary to construct wealth and income aggregates are multiply imputed in each country. Some countries imputed other variables, too. For more information see section 6 and subsection 9.2.7 of Household Finance and Consumption Network (2013b), which describes the most relevant methodological features of the survey, including information on sampling design and weighting.

expecting to earn above average returns, 3. Take average financial risks expecting to earn average returns or 4. Not willing to take any financial risk.[7]

For the stock market participation decision, we consider that a household participates in the stock market if it holds any stocks directly or it is invested in mutual funds which invest predominantly in equity. For the share of liquid assets invested in stocks we define liquid assets as the sum of sight accounts, savings accounts, mutual funds, bonds, ownership of non self-employment private businesses, shares and managed accounts.[8]

In all our model specifications we will control for age, income, education, the stock of liquid assets, whether the reference person[9] is married, retired, has children or works in the financial sector.[10] The exact list of variables used can be found in the appendix. Again, the controls follow Malmendier and Nagel (2011), with the exception of the financial sector affiliation, which we added because it might affect the household's tendency to hold stocks. Finally, we also control for country-fixed effects, given that the literature has found differences in stock ownership to be primarily linked to differences in economic environments between European countries (Christelis et al. 2013).

In order to construct the stock market experiences which the households in our sample have lived through, we use long-term historical time series obtained from Global Financial Data.[11] We use real stock returns (deflated with consumer prices) from 1930 until the year prior to the survey. Since the data do not go back further in time than 1930 (1932 in Portugal), we treat all households born before 1930 as if they were born in 1930 (1932 in Portugal).[12]

We furthermore generate a variable that measures how often a household has experienced a substantial drop in stock prices, which we define as an annual return of below -20%. Such a decline could come

---

7 Unfortunately, this question has not been asked in France and Finland. Also, it has not been imputed for all countries, which somewhat restricts the available sample size. Note that the HFCS variable asks for risk *aversion*, in contrast to the variable used in Malmendier and Nagel (2011), which relates to risk *tolerance*. Both variables are measured in discrete steps from 1 to 4, but high values for the U.S. variable correspond to low values for our variable and vice versa.

8 Malmendier and Nagel (2011) also include stocks held in retirement accounts, a variable that is not available for the HFCS. In the robustness section, we will include households that have invested in voluntary pension schemes to get closer to the definition of Malmendier and Nagel (2011).

9 The household reference person is chosen according to the international standards of the so-called Canberra Group (UNECE 2011). This definition uses the following sequential steps to determine a unique reference person in the household: i) household type, (ii) the person with the highest income, (iii) the eldest person.

10 Throughout the paper "household" and "reference person" should be seen as interchangeable concepts. For example, when we talk about the age of the household it is understood that we are referring to the age of the reference person.

11 For Greece, the series by Global Financial Data do not extend back to 1930. Accordingly, we expanded the sample using data provided to us by the Bank of Greece.

12 This affects 3636 households. Dropping them from the sample does not change the results in any relevant manner – as we will see, experiences before 1930 would anyway get a negligible weight in determining household behaviour in the present times.

about due to a genuine stock market crash, or alternatively through a sustained but more gradual decline. Since our data are annual, we cannot distinguish between the two. Of course, we will subject the results to a robustness test where the definition of a stock price drop is altered. Note that we base this variable on nominal returns, whereas the overall stock market experiences were calculated using real returns. The reason is that for smaller movements in the stock market, what matters for consumers is the real return they can make with their investment, whereas stock market crashes are typically defined using nominal returns. A robustness test using real returns to define crashes does not alter our results.

2.2 Methodology

We are interested in studying the effect of past experiences on the attitude towards risk and the portfolio-choice decisions of households. Following Malmendier and Nagel (2011), we synthetise the life-time experienced returns of a household using a weighted average of these returns conditional on a weighting parameter λ. The weighting scheme is flexible enough to allow households to give either higher or lower weights to more recently experienced returns . In particular, for each household i in country c, the experienced return is constructed as follows:

$$A_{ic}(\lambda) = \sum_{k=1}^{age_{ic}-1} w_{ic}(k,\lambda)\, R^{c}_{T-k} \tag{1}$$

$$w_{ic}(k,\lambda) = \frac{(age_{ic}-k)^{\lambda}}{\sum_{k=1}^{age_{ic}-1}(age_{ic}-k)^{\lambda}} \tag{2}$$

R^{c}_{T-k} denotes the stock market return in year T-k (where T is the reference period of the survey) in country c. The weights $w_{ic}(k,\lambda)$ depend on the age of the household and a weighting parameter λ which determines the shape of the weighting function (in particular whether the slope is positive, negative or flat), and the steepness of the slope.

To understand the form of the weighting function, Figure 1 depicts possible weights for the example of a 50-year-old household, using different values of λ: -0.2, which corresponds to an increasing weighting function (where the distant past matters more than the more recent past); 1, which implies linearly decreasing weights; and 5, a concavely decreasing weighting function. Generally, a negative λ implies that the household places higher weight on more distant experiences, whereas a positive λ indicates that more recent returns are given a higher weight. As λ increases, the effect of past returns fades away more quickly and more recent returns are given a relatively higher weight.

Figure 1 here

When calculating life-time experiences in this manner, we impose a number of assumptions. First, we assume that the relevant horizon extends back to the year of birth. This assumption turns out not to be critical, as we will show by using stock market returns even further back, i.e. 10 years prior to birth, as well as by using stock market returns starting 10 years after birth. A second assumption is that all households "experience" stock market returns, whether they are actually holding stocks or not. Third, we assume that it is the national stock market returns that matter, and thereby implicitly that the reference person did not live abroad or experienced stock market returns in another country by some other means, e.g. by holding an internationally diversified portfolio. We think of the latter as a realistic assumption due to the well-known home bias in portfolios, and will subject the former to a robustness test by excluding all households that were not born in the country of residence.

We are going to estimate λ from the data. In general, our regression models will have the following form:

$$y_{ic} = \alpha_c + \beta A_{ic}(\lambda) + \delta x_{ic} + \varepsilon_{ic}, \tag{3}$$

where y_{ic} denotes the measure for risk aversion, the variable indicating whether or not a household participates in the stock markets, or the share of stocks in liquid assets. α_c are the country fixed effects, x_{ic} the various control variables, and ε_{ic} is a residual. Note that $A_{ic}(\lambda)$ is a non-linear term, such that we have to use non-linear estimation techniques, irrespective of the remaining model specification. [13]

We first look at the effect of experiences on the self-assessed risk aversion of the household. Since the dependent variable takes four values ordered according to the degree of financial risk willing to take, we use an ordered probit model for the estimation. When our dependent variable is the stock market participation decision we use a probit model, and when we look at the share of the portfolio invested in stocks we use a tobit model.

When the experienced return is our independent variable of interest, we first estimate the model on a tight grid of lambdas and then we use the results of this estimation as the initial values for further non-linear optimization. As we mentioned before, once λ is set, the non-linearity introduced by the weighted return disappears (there is still non-linearity due to the probit, ordered probit or tobit). This procedure ensures avoiding local maximums, apart from substantially reducing computation time.

Our other independent variable of interest is the number of stock market crashes experienced. We define a stock market crash as a year in which the nominal stock market return was less than -20%.[14]

[13] Note that this model achieves identification of the effect of experiences given that these vary not only over age, but also across countries. In the paper by Malmendier and Nagel (2011), identification was achieved by using several waves of the U.S. SCF, such that experiences vary over age and across waves.

[14] In the robustness checks section we also test for larger declines of -40%, and find substantially stronger effects.

For the model specifications dealing with this independent variable we do not include a weighting function, thereby implicitly assuming that the effects of crashes persist and accumulate. Therefore, it is important to allow for a non-linear effect, which we will do by using a quadratic term. The model is therefore estimated as follows:

$$y_{ic} = \alpha_c + \beta_1 S_{ic} + \beta_1 S_{ic}^2 + \delta x_{ic} + \varepsilon_{ic}, \quad (4)$$

All variables are described as in equation (3), and S_{ic} is the number of experienced stock market crashes.

When estimating our econometric models, like Malmendier and Nagel (2011) we use weights to account for the fact that the survey does not always represent the same fraction of the overall population across countries. Our weights re-adjust each observation to reflect their relative importance for the euro area as a whole. In so doing, we also follow Faiella (2010) and Magee et al. (1998), which recommend the use of weights for two similar surveys, namely the Italian SHIW and the Canadian SCF. They argue that in surveys with complex survey design the use of weights protects against the omission of relevant information, which otherwise would have to be modelled explicitly by incorporating all available geographic and operational variables that determine sampling rates. Another reason for using weights is due to the possibility of endogenous sampling (Solon et al. 2013), as the HFCS oversamples wealthy households, and given that stock market participation varies with wealth.

2.3 Descriptive statistics

Table 1 provides descriptive statistics for risk aversion and households' stock market participation. Self-assessed risk aversion shows little variation, both within and across countries. In eight of the nine countries where this variable is available (remember that this question was not asked in Finland and France), the median household reports the highest level of risk aversion (coded as 4). Italy is the only exception with a median of 3. The mean figure is 3.6 for the euro area as a whole, and it varies from 3.3 in Italy to 3.9 in Portugal. Overall, these results are not very different from what was found for U.S. households in Malmendier and Nagel (2011) – putting their variable on the same scale as ours would result in a mean value of 3.2. Still, as we will see subsequently, despite the low variability of this variable, it is sufficient to estimate meaningful results.

Table 1 here

Participation rates in stock markets are very low (see the second panel of Table 1) –only 13% of households report some stock holdings. Importantly, however, there is considerable variation across countries, with participation rates ranging from 3% in Greece to 22% in Finland. Conditional on stock-market participation, euro area households keep 23% of their liquid assets in stocks. This figure, displayed in the third panel of Table 1, shows considerable variation across countries. The mean ranges from 16% in Germany and the Netherlands to 34% in Finland and Greece. Interestingly, there is also a substantial amount of variation within countries. There are many household with very small amounts of stocks in their portfolios, as shown by the tiny numbers for the 10th percentile, whereas the 90th percentile household in several countries holds substantial amounts in stocks (e.g. above 80% in Spain, Greece and Finland).[15]

Table 2 here

Table 2 provides a first look at our main explanatory variables. In the upper panel, we report summary statistics for the experienced stock market returns of households, A_{ic}. They are calculated using a weighting factor of λ=4.5, which is close to the estimates that we will report below. There is substantial variability in the experiences across and within countries: they range from 4% in Italy to 13% in Finland. The variation with countries is largest in Greece where the 10th percentile of the return distribution is 3% and the 90th percentile is 13%.

These figures suggest that there is substantial variability in real stock market returns. Importantly, this variation is largely due to differences in nominal returns, and only to a small extent explained by differences in inflation rates. Table 3 shows the correlations between each country's nominal stock market return for the whole sample 1930-2010. Correlations are rarely higher than 0.5, and in a few cases they even take negative values.

Table 3 here

When we look at the number of protracted stock market declines or genuine stock market crashes that households have experienced (reported in the second panel of Table 2), we once more see substantial variability across and within countries. The mean number of stock market downturns that households have experienced ranges from 3.4 in Austria to 11.6 in Portugal. In most countries, the difference between the 10th and 90th percentiles of the distribution is larger than 6 events.

[15] Note that the dependent variable in our regressions will not be conditional on stock holdings, i.e. we include also households that do not hold stocks in our sample.

To summarise, the descriptive statistics show that there is substantial variation in our dependent and explanatory variables both across and within countries. We will now turn to studying how an individual's experience affects risk aversion and stock market participation.

3. The effect of experiences on risk aversion and stock market participation

3.1 Benchmark results

Table 4 provides the first set of results. It reports the estimated coefficients of the ordered probit model explaining self-reported risk aversion. Note that the standard errors take account of the multiply imputed nature of the data, thereby properly reflecting the uncertainty of the imputed values. Several of the control variables are relevant. Higher income and a higher stock of liquid assets tend to increase risk aversion, even though for both variables there are important non-linearities as suggested by the statistical significance of the squared terms. The retired are somewhat more risk averse than other households, an effect that is found on top of an increasing risk aversion with age (the latter has already been documented in the literature, see Dohmen et al. (2011)). Education also seems to matter, with higher levels of education being associated with a lower reported risk aversion. Our control for respondents who are working in the financial sector is highly statistically significant, and suggests that these individuals are less risk averse. Finally, also the country fixed effects appear to be relevant, with Italians being less risk averse than Germans, and respondents in Belgium, Spain, Luxembourg, the Netherlands and Portugal reporting a higher level of risk aversion than their counterparts in Germany.

Table 4 here

Moving to the two main parameters of interest, β and λ, the estimated coefficients suggest that both are relevant and point into the expected direction. The weighting parameter λ is estimated to be 4, considerably larger than the corresponding estimate for the United States, which was provided by Malmendier and Nagel (2011) as 1.8, and therefore pointing to a higher decay factor in Europe. To take the example of a 30-year old individual, a European would assign a weight of 15.8% for the previous year's experience, whereas a U.S. household would give it only a weight of 8.1%. Despite this large initial difference, memory is still rather persistent also for the European household, who is estimated to assign a weight of 3.6% to experiences made 10 years ago (whereas the number in the United States amounts to 4.7%). Taking the example of an individual with a longer life history, the relevance of past experience becomes even more apparent: according to our estimates, a 50-year old person would weigh the most

recent year with 9.7%, and the experience made a decade ago with 4.3%. Even the stock market returns experienced 20 years ago would enter the weighting function with 1.4%.

As expected, the coefficient estimate for β indicates that higher experienced returns tend to lower risk aversion. To get a feeling for the economic magnitudes, Table 4 also reports average marginal effects, and shows that an increase in experienced returns by 1 percentage point makes households 1.4 percentage points less likely to be very risk averse. Comparing the average of the fitted probabilities at the 90th percentile of the distribution of experienced returns with the average of the fitted probabilities at the 10th percentile yields a difference of 7.9 percentage points. This effect is substantial in magnitude, and matches closely the 8.8 percentage points that were identified by Malmendier and Nagel (2011) for the United States.[16]

The next question to study is whether there are any repercussions on actual stock market participation. This is taken up in Table 5, which reports the results from the probit model explaining the households' participation decision. Once more, a number of control variables appear to be significant. Participation is found to increase for households with high liquid assets, high education and working in the financial sector. Compared to Germany, stock market participation is higher in Belgium and France, and lower in Austria, Luxembourg and Portugal.

Table 5 here

As before, the parameter λ is significantly estimated, and at 5.3 larger than what was found for the United States (1.3). Once again, however, the parameter still implies that memories persist – for the 30-year old, experiences had 10 years ago receive a weight of 2.7%, for a 50-year old, it amounts to 4.1%.

Also β is statistically significant. Based on the marginal effect and the interdecile range reported in Table 5, it is apparent that the magnitude is economically important – a one percentage point higher experienced stock return increases the propensity to hold stocks by 2 percentage points, and the difference in stock market participation along the interdecile range of the stock market experiences amounts to 11.5 percentage points, which is rather close to the 10 percentage points estimated by Malmendier and Nagel (2011).

The third test is conducted on the share of liquid assets invested in stocks, with results provided in Table 6. These results are based on a tobit model, such that the coefficients are now directly

[16] The difference between the 90th and the 10th percentile are broadly comparable between the euro area and the United States. At the respectively estimated λ, it amounts to (11.9%-6.2%=5.7%) for the United States, and to (9.3%-4.2%=5.1%) in the euro area.

interpretable. The share of stocks in the liquid assets held by financial sector employees is 23 percentage points higher than among other households. Furthermore, the share of stocks rises with the stock of liquid assets and education (college graduates have a 19 percentage point higher share of stock investments than households with less than a high school degree).

Table 6 here

As previously, we estimate statistically significant parameters for λ and β.[17] Comparing households on the interdecile range suggests that those at the 90th percentile of the distribution invest 4 percentage points more in stocks than those at the 10th percentile (once more, these numbers are comparable with those for the United States).

3.2 Robustness tests

We have subjected our results to a large number of robustness tests. First of all, in analogy to Malmendier and Nagel (2011), we have also tested whether similar results can be obtained for bond market experiences and their effects on bond holdings. The corresponding results are reported in Table 7, for the bond market participation decision and for the share of bonds in liquid assets.[18] Judging from the descriptive statistics, there is much less variability in bond market returns than in stock market returns. In large parts, this is of course due to the near complete convergence of government bond yields in the euro area in between 1999 and 2010 (Ehrmann et al. 2011). For instance, average experienced returns range from 1.44% in Greece to 5.53% in Finland, and the difference between the 10th and the 90th percentile of the return distribution within a country does not exceed 2 percentage points in any case. Accordingly, we would expect our results to be weaker than for stock holdings. Still, for the bond market participation decision, we estimate a rather similar coefficient for λ, at 3.99 (compared to 5.34 for stocks). The coefficient is similarly large in the regression for the share of bonds in liquid assets, and in both cases estimated to be statistically significant. The parameter β, in contrast, is only marginally significant for the participation decision, and just insignificant in the shares regression.

Table 7 here

[17] Note that our estimates of λ are quite different for the effect of experiences on risk aversion, stock market participation and the share of stocks in liquid assets, whereas they are rather similar across these three models in Malmendier and Nagel (2011). Conceptually, however, we do not see any reason why they would need to be similar across the three specification, given that they measure very different concepts, which might be affected by previous experiences differently.

[18] Bond returns are calculated for long-term bonds. As bond returns for Luxembourg are not available prior to 1947, we exclude Luxemburgish households born before 1947. The bond holdings are defined in analogy to the stock holdings as directly held bonds or investments in mutual funds that themselves predominantly invest in bonds.

Returning to the effect of stock market experiences, Table 8 reports the coefficients of interest, β and λ, on stock holdings for a number of robustness tests. The first one explores to what extent experienced stock market volatility also affects stock holdings. For that purpose, we added the experienced stock market volatility (calculated as the weighted standard deviation of the respondents' life time experience, using the previously estimated λ as weighting parameter) to the regression. It is apparent that our results remain robust. While the experienced volatility itself lowers stock market participation in a statistically significant manner, the effect of the experienced returns and the weighting parameters are basically unaltered.

Table 8

Results are also stable for the second robustness test, where we changed the definition of the stock holding variable to not only include direct stock holdings and investments in mutual funds that themselves predominantly invest in stocks, but furthermore also include households with investments in voluntary pension plans. This change in definition raises the stock market participation rate of euro area households from 13% to 39%. Still, all results go through.

For the third robustness test, we reran our estimations without using population weights. Here, results do not change qualitatively, but quantitatively. The experienced stock returns exert a smaller effect on stock holdings, and the weighting parameter is substantially larger, indicating that the more recent experiences matter more. Where do these differences come from? The new set of results treats each observation equally, whereas before observations reflected the countries' population shares in the euro area. Looking at Table 1, it is evident that countries like France and in particular Finland receive much more prominence in the new estimation (as they have by far the largest samples in the survey, exceeding their population share), whereas the relevance of the German observations diminishes when using an unweighted regression (as the around 3,500 households representing Germany in the HFCS make up for 6% of the overall sample, whereas the German households effectively account for around 29% of the euro area household population). The change in coefficients does therefore point to differences in the economic significance of the effects across the various countries. As we will see below, these differences are tightly related to how severely the countries were hit by the 2008 stock market crash. Finland and France, for instance, were among the more strongly affected countries compared to, for instance, Germany, and in the countries with more severe stock market crashes, the most recent experience receives a rather strong weight.

The fourth robustness included an additional regressor, namely the bond returns that households have experienced over their lifetimes (keeping the weighting parameter from the robustness test provided in

Table 7, i.e. when explaining bond market participation with experienced bond returns). As one would expect, this somewhat diminishes the quantitative importance of the experienced stock returns, but does not change the picture qualitatively. The next two rows of Table 8 show how our results change if we vary the experience horizon of respondents, by either including 10 years prior to birth, or by starting 10 years after birth. In both cases, the magnitudes of our parameters changes somewhat, but without affecting the overall results in any meaningful manner.

We also show that including risk aversion as an additional regressor has barely any impact on the results. The degree of risk aversion is clearly a determinant of the decision whether to hold stock or not, but we do no not include it in our baseline specification to avoid any endogeneity issues.

The ninth row of the table shows the result for a regression in which we exclude immigrants from the sample. Specifically, we drop all households who were borne in a country different from the one they have been interviewed. With this specification we reassure that households have not been exposed to other returns than their country of residence ones. We exclude Fance, Spain and the Netherlands since we do not have information on the country of birth of the household. Again, all our results hold[19].

As a way to test for spurious correlations we run a placebo experiment.[20] For that purpose, we randomly assigned a different nationality to each cohort in a given country (for instance, all 35 year-old households in France were randomly allocated a nationality other than the French one. All 36-year old French households were independently assigned a random nationality, etc.). With this placebo allocation of nationalities, we then re-ran our estimations. As can be seen from the last row of Table 8, the pseudo lifetime experiences are not found to significantly affect stock market participation.

4. Any difference for extreme events?

The experience of the stock market crash in 2008 is bound to still be vividly remembered by stock market participants. Many of these have lost substantial amounts of wealth, which in turn has been shown to affect risk-taking (Necker and Ziegelmeyer 2013). A natural question is therefore whether

[19] As it can be seen in table 8 the coefficients for this robustness check differ from the ones in the baseline specification, but this is do to the different samples used. When we run the baseline specification excluding France, Spain and the Netherlands the results are almost identical.

[20] We are grateful to Dimitris Georgarakos for suggesting this idea.

extreme events like stock market crashes influence beliefs and behaviours in a more persistent manner than less extreme experiences. Related evidence supporting this hypothesis is provided by Ehrmann and Tzamourani (2012), who show that the effect of experienced inflation on inflation aversion fades away in general, whereas memories of hyperinflation tend to stay in people's minds and affect attitudes in a much more persistent manner.

Table 9 here

Table 9 reports the estimates of the effect of stock market crashes – or protracted stock market declines – on risk aversion. Note that this specification does not contain a λ factor, i.e. we simply count the number of such experiences the individuals have made over their lifetimes and enter this as an explanatory variable (thereby already assuming that these experiences remain an important factor in influencing risk aversion and stock market participation, and that they are additive). The results indicate that for each additional such experience, the propensity to report a high level of risk aversion increases by 1 percentage point. Looking at the interdecile range, this amounts to a difference of 3.4 percentage points. While this number might not sound overly large, it is important to note that many of the stock market declines were experienced a considerable time ago (more than 70% before 1990, 45% before 1970). These numbers take into account a non-linearity in the effects: the squared number of experienced events enters with a significant negative sign, suggesting that with increasing numbers of experienced stock market downturns the increase in risk aversion becomes less pronounced.

Also the propensity to hold stocks is affected in a similar fashion, as can be seen from Table 10. Here, the fitted probabilities along the interdecile range generate a difference in stockholding propensities of 8.5%, i.e. nearly as much as the differences generated by the interdecile range in the experience of stock market returns themselves. In contrast, the share of liquid assets invested in stocks does not seem to be affected by the number of experienced stock market downturns (given that the parameter estimates reported in Table 11 are statistically insignificant), suggesting that the effect is more on whether or not to hold stocks than on how much to hold in stocks

Tables 10 and 11 here

We extended the analysis in several dimensions, focusing in particular on stock market participation, in line with the literature on rare events and household finance. First, we combined regression models (3) and (4) by including both S_{ic}, the number of experienced stock market downturns, and A_{ic}, the experienced returns. The results, reported in Table 12, show that the effect of experienced returns and the weighting parameter λ barely change in the new specification compared to the previous results,

whereas that number of experienced downturns exerts an additional effect on the participation decision.

We have furthermore extended equation (4) by allowing for a separate effect of stock market booms (which we defined in analogy to downturns as nominal annual returns in excess of 20%). We find that booms are much less relevant than downturns (the coefficient, not shown in the table, is not significant). Even though one might expect that more households are inclined to invest in the stock market during boom times, this effect is not evident in the data. In contrast, the coefficient estimates for the effect of downturns remains basically unaltered.

Due to the fact that the survey was conducted just after the 2008 stock market crash, all households in our sample have experienced at least one crash. To get at the importance of the most recent crash on household portfolios, we made use of the fact that the 2008 crash was hitting the various countries in our sample in rather different ways. Based on the analysis in Bekaert et al. (2012), we split the countries into those that were affected by the crisis least (namely Austria, Belgium, Germany, Spain, Luxembourg and the Netherlands, which on average saw their stock markets decline by 36%), and those where stock markets were severely hit (i.e. Finland, France, Greece, Italy and Portgual, with an average drop of 52%), and then repeated the analysis of Section 3 separately for each country group. The results are provided as the two bottom rows of Table 8. There are remarkable differences across the two groups: whereas our results are robust for the countries that got hit less badly, the weighting parameter λ in the more strongly affected countries is estimated at 10.9, whereas the experienced returns themselves are not found to have significant effects. This implies that in these countries the experience of the recent crisis overshadows the earlier experiences, which receive much smaller weight in households' decisions. It also helps explaining why λ is estimated to be so much higher for Europe than in the United States (given that Malmendier and Nagel (2011) used several waves of the SCF, therefore also covering the years prior to the recent crisis).

Table 12 here

Finally, we also subjected our findings in this section to a number of robustness tests, by i) changing the definition of a downturn to cases where annual nominal stock returns were below -40%, ii) including voluntary pension plans in our definition of stock holdings,iii) estimating the models without using population weights, iv) including the household's self-reported risk aversion as an additional regressor, and v) excluding immigrants from the sample. Results are reported in rows 4 to 8 of Table 12. This table shows that for more extreme events, the effects are substantially larger, as well as when we broaden the definition of stock holding to include those households with pension plans. The Average Marginal Effect

becomes insignificant if we run the regression unweighted and if we drop the immigrants from the sample (which also implies dropping France, Spain and the Netherlands because of data availability).

We also conduct a placebo experiment analogous to the one explained in the previous section. Once we randomly assign the number of crashes experienced, the effect of this placebo variable is not significant. This supports the validity of our results.

5. Conclusions

This paper has studied to what extent the experiences of households shape their risk aversion, their inclination to participate in stock markets and the amounts that they are willing to invest in stocks. It has applied the approach developed by Malmendier and Nagel (2011) and extended the evidence to Europe, using the Eurosystem Household Finance and Consumption Survey, a novel dataset on household finances covering more than 58,000 households in eleven different countries of the euro area.

The data show considerable variation in the experienced stock market returns, stock market participation and the invested amounts both within and across countries. Our estimates show that experienced stock market returns exert statistically significant and economically substantial effects on households' risk aversion and portfolio decisions, even if we find that more distant experiences receive a somewhat lower (but still substantial) weight than the corresponding findings for the United States. This evidence adds to the literature on time-varying risk aversion of households and its determinants, as well as on the factors that shape households' portfolio decisions, emphasising the importance of personal experiences on the formation of preferences and economic behaviour.

The paper then moved on to testing whether the experience of extreme stock market downturns also has a bearing on risk aversion and stock market participation. Also here, the effects are substantial and – importantly – come on top of the experienced average stock market returns. Rietz (1998), Barro (2006, 2009) and Alan (2012) have demonstrated that expectations of rare disasters can help explaining financial market behaviour and partially also household decisions. Our evidence suggests some heterogeneity in this pattern, in the sense that households' experiences of disastrous events are an important factor in shaping their portfolio decisions.

These findings have important policy implications. Households are known to be generally underinvested in the stock market (and even more so in Europe than in the United States), especially because they have been made more and more responsible for their own finances after retirement. The

recent experiences are most relevant for young households and in those countries where the stock market crash in 2008 was particularly severe, which implies an even more pronounced underinvestment in the stock market among these European households in the times to come.

References

Alan, S. (2012). Do Disaster Expectations Explain Household Portfolios? *Quantitative Economics* 3, 1-28.

Alesina, A., Giuliano, P., 2011. Preferences for Redistribution, in: Bisin, A., Benhabib, J. (Eds.), *Handbook of Social Economics*. North Holland, Amsterdam, 93-132.

Alesina, A. and N. Fuchs-Schündeln (2007). Goodbye Lenin (or Not?): The Effect of Communism on People. *American Economic Review* 97(4), 1507-1528.

Barro, R.J. (2006). Rare Disasters and Asset Markets in the Twentieth Century. *Quarterly Journal of Economics* 121(3), 823-866.

Barro, R.J. (2009). Rare Disasters, Asset Prices, and Welfare Costs. *American Economic Review* 99(1), 243-264..

Bassett, W., M. Chosak, J.C. Driscoll and E. Zakrajsek (2012). Changes in Bank Lending Standards and the Macroeconomy. FEDS Paper No. 2012-24, Board of Governors of the Federal Reserve System.

Bekaert, G., M. Ehrmann, M. Fratzscher and A. Mehl (2012). Global Crises and Equity Market Contagion. NBER Working Paper 17121.

Bekaert, G. and M. Hoerova (2013). The VIX, the Variance Premium and Stock Market Volatility. NBER Working Paper No. 18995.

Bekaert, G., M. Hoerova and M. Lo Duca (2013). Risk, Uncertainty and Monetary Policy. Forthcoming, *Journal of Monetary Economics*.

Blanchflower, D.G. (2007). Is Unemployment More Costly than Inflation? NBER Working Paper No. 13505.

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

Campbell, J. and J.H. Cochrane (1999). By Force of Habit: A Consumption-Based Explanation of Aggregate Stock Market Behavior. *Journal of Political Economy* 107(2), 205–251.

Choi, J.J., D.I. Laibson, B.C. Madrian and A. Metrick (2009). Reinforcement Learning and Savings Behavior. *Journal of Finance* 64, 2515–2534.

Christelis, D., D. Georgarakos, and M. Haliassos (2013): Differences in Portfolios across Countries: Economic Cnvironment versus Household Characteristics. *Review of Economics and Statistics*, 95(1), 220-236.

Constantinides, G. (1990). Habit Formation: A Resolution of the Equity Premium Puzzle. *Journal of Political Economy* 98(3), 519–543.

Dohmen, T., A. Falk, D. Huffman, U. Sunde, J. Schupp, and G. G. Wagner (2011). Individual Risk Attitudes: Measurement, Determinants, and Behavioral Consequences. *Journal of the European Economic Association* 9 (3), 522–550.

Dominitz, J. and C.F. Manski (2007). Expected Equity Returns and portfolio Choice: Evidence from the Health and Retirement Study. *Journal of the European Economic Association* 5(2-3), 369-379.

Ehrmann, M., M. Fratzscher, R. Gürkaynak and E. Swanson (2011). Convergence and Anchoring of Yield Curves in the Euro Area. *Review of Economics and Statistics* 93, 350–364.

Ehrmann, M. and P. Tzamourani (2012). Memories of High Inflation. *European Journal of Political Economy* 28(2), 174-191.

Faiella, I. (2010). The Use of Survey Weights in Regression Analysis. Banca d'Italia Working Paper No. 739.

Giuliano, P., Spilimbergo, A. (2009). Growing up in a Recession: Beliefs and the Macroeconomy. NBER Working Paper No. 15321.

Guiso, L., P. Sapienza and L. Zingales (2004). The Role of Social Capital in Financial Development. *American Economic Review* 94(3), 526-556.

Guiso, L., P. Sapienza and L. Zingales (2012). Time Varying Risk Aversion, Working Paper.

Guiso, L. and M. Paiella (2008). Risk Aversion, Wealth and Background Risk. *Journal of the European Economic Association* 6, 1109-1150.

Haliassos, M. and C. Bertaut (1995). Why Do So Few Hold Stocks? *Economic Journal* 105, 1110-1129.

Household Finance and Consumption Network (2013a). The Eurosystem Household Finance and Consumption Survey – Results from the First Wave, ECB Statistics Paper No. 2.

Household Finance and Consumption Network (2013b). The Eurosystem Household Finance and Consumption Survey – Methodological Report for the First Wave, ECB Statistics Paper No. 1.

Kaustia, M. and S. Knüpfer (2008). Do Investors Overweight Personal Experience? Evidence from IPO subscriptions. *Journal of Finance* 63(6), 2679-2702.

Lombardelli, C., Saleheen, J. (2003). Public Expectations of UK Inflation. *Bank of England Quarterly Bulletin* 43, 281-290.

Magee, L., A. Robb, and J. Burbidge (1998). On the Use of Sampling Weights When Estimating Regression Models with Survey Data. *Journal of Econometrics* 84, 251–271.

Malmendier, U., Nagel, S. (2009). Learning from Inflation Experiences. Mimeo, UC Berkeley and Stanford University.

Malmendier, U. and S. Nagel (2011). Depression Babies: Do Macroeconomic Experiences Affect Risk-Taking? *Quarterly Journal of Economics* 126(1), 373-416.

Necker, S. and M. Ziegelmeyer (2013). Risk Taking after the Financial Crisis. Mimeo, University of Freiburg.

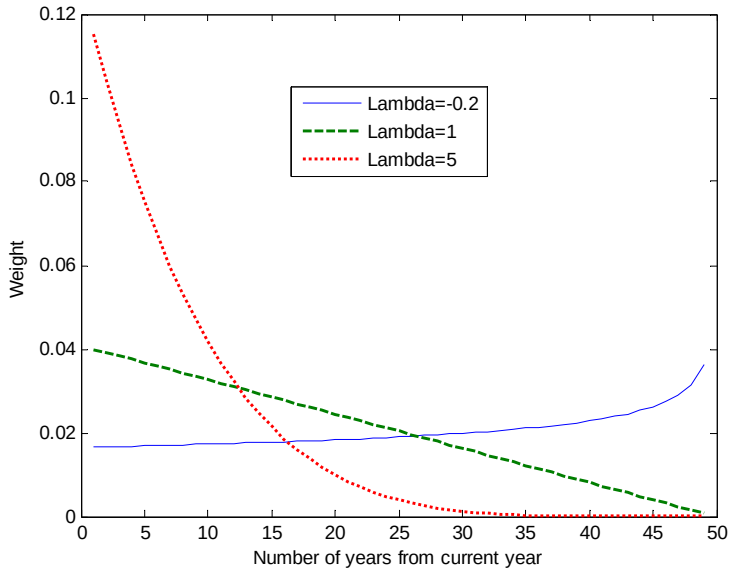
Rietz, T.A. (1988). The Equity Risk Premium. A Solution. *Journal of Monetary Economics* 22, 117-131.

Solon, G., S.J. Haider and J. Woolridge (2013). What are We Weighting For? NBER Working Paper No. 18859.

UNECE (2011). *Canberra Group Handbook on Household Income Statistics*. Second Edition. United Nations.

van Rooij, M., A. Lusardi and R. Alessie (2011). Financial Literacy and Stock Market Participation. *Journal of Financial Economics* 101(2), 449–472.

Figure 1: Examples of weighting functions for a 50-year old household



Note: The figure plots weighting functions for a 50-year old household according to equations (1) and (2), for different value of λ.

Table 1: Summary statistics: risk aversion and stock market participation

Country	Mean	Std. deviation	p10	Median	p90	Observations
Self-assesed risk aversion						
Austria	3.52	0.71	3	4	4	2340
Belgium	3.67	0.60	3	4	4	2307
Germany	3.61	0.56	3	4	4	3467
Spain	3.81	0.47	3	4	4	6197
Finland	.	.	.	.	.	0
France	.	.	.	.	.	0
Greece	3.69	0.66	3	4	4	2971
Italy	3.30	0.79	2	3	4	7951
Luxembourg	3.72	0.53	3	4	4	950
Netherlands	3.69	0.52	3	4	4	1253
Portugal	3.90	0.38	4	4	4	4365
Euro Area	3.59	0.64	3	4	4	31801
Stock market participation						
Austria	0.08	0.28	0	0	0	2380
Belgium	0.20	0.40	0	0	1	2327
Germany	0.16	0.37	0	0	1	3565
Spain	0.11	0.31	0	0	1	6197
Finland	0.22	0.41	0	0	1	10989
France	0.16	0.37	0	0	1	15006
Greece	0.03	0.17	0	0	0	2971
Italy	0.06	0.23	0	0	0	7951
Luxembourg	0.18	0.39	0	0	1	950
Netherlands	0.15	0.36	0	0	1	1301
Portugal	0.05	0.22	0	0	0	4404
Euro Area	0.13	0.34	0	0	1	58041
Share of liquid assets invested in stocks						
Austria	0.18	0.25	0.00	0.05	0.55	209
Belgium	0.22	0.27	0.00	0.12	0.63	592
Germany	0.16	0.22	0.00	0.06	0.48	864
Spain	0.32	0.30	0.00	0.21	0.83	1441
Finland	0.34	0.30	0.03	0.23	0.84	2996
France	0.29	0.29	0.00	0.20	0.77	3546
Greece	0.34	0.32	0.00	0.28	0.91	84
Italy	0.28	0.28	0.00	0.21	0.74	518
Luxembourg	0.18	0.28	0.00	0.01	0.64	225
Netherlands	0.16	0.24	0.00	0.07	0.48	255
Portugal	0.26	0.28	0.00	0.14	0.75	238
Euro Area	0.23	0.27	0.00	0.13	0.69	10967

Note: The table shows summary statistics for risk aversion (top panel), for whether or not households hold stocks (middle panel), and for the share of stocks in liquid assets, conditional on stock ownership (bottom panel). Note that in the econometric estimation of the share of stocks in liquid assets, we do not condition on stock ownership. Rather, we include all households that do not hold stocks with a zero value, and estimate a tobit model to account for censoring at zero. Source: Eurosystem Household Finance and Consumption Survey, own calculations.

Table 2: Summary statistics: lifetime experiences

Country	Mean	Std. deviation	p10	Median	p90	Observations
Experienced average real stock return (λ=4.5)						
Austria	10.62	0.37	10.09	10.65	11.16	2380
Belgium	6.85	1.12	5.11	7.16	8.05	2327
Germany	8.06	0.15	7.84	8.06	8.26	3565
Spain	7.93	1.65	5.64	8.52	9.41	6197
Finland	12.95	2.81	8.28	14.07	15.57	10989
France	7.48	1.26	5.44	7.83	8.84	15006
Greece	8.84	3.83	3.19	10.15	12.73	2971
Italy	3.86	1.39	1.93	4.16	5.38	7951
Luxembourg	10.39	0.37	9.82	10.41	10.86	950
Netherlands	7.50	1.11	5.87	7.67	8.84	1301
Portugal	8.86	0.91	7.60	8.92	10.12	4404
Euro Area	7.32	2.27	4.24	7.94	9.33	58041
Number of stock market crashes experienced						
Austria	3.39	2.55	1	3	8	2380
Belgium	4.96	1.49	3	5	7	2327
Germany	5.62	1.98	3	6	8	3565
Spain	6.68	2.06	4	6	10	6197
Finland	6.75	2.17	4	6	10	10989
France	7.82	2.49	5	7	12	15006
Greece	10.19	2.69	8	9	14	2971
Italy	10.97	2.49	8	11	14	7951
Luxembourg	4.40	1.82	3	4	8	950
Netherlands	5.06	1.31	3	5	7	1301
Portugal	11.62	2.01	9	12	13	4404
Euro Area	7.37	3.14	3	7	12	58041

Note: The table shows experienced stock returns (calculated according to equations (1) and (2) with a λ of 4.5 (upper panel), and the number of experienced stock market crashes or prolonged downturns (defined as annual nominal returns below -20%).

Table 3: Correlations between nominal stock market returns, 1930-2010

	AT	BE	DE	ES	FI	FR	GR	IT	LU	NL	PT
AT	1.00	0.42	0.44	0.39	0.11	0.44	0.42	0.46	0.40	0.36	0.10
BE		1.00	0.47	0.49	0.42	0.58	0.18	0.46	0.75	0.57	0.14
DE			1.00	0.27	0.32	0.36	0.03	0.30	0.46	0.60	0.08
ES				1.00	0.40	0.46	0.28	0.45	0.37	0.37	0.28
FI					1.00	0.34	-0.05	0.12	0.50	0.39	0.17
FR						1.00	0.25	0.44	0.47	0.52	0.05
GR							1.00	0.39	-0.08	-0.06	0.02
IT								1.00	0.38	0.33	0.24
LU									1.00	0.51	0.25
NL										1.00	0.13
PT											1.00

Note: The table shows correlations between annual national nominal stock market returns, 1930-2010.

Table 4a: The effect of experienced stock market returns on risk aversion

Self-reported risk aversion

	Coefficient	Std. error	t-statistic
Experienced return	-4.967	1.472	-3.374
Weighting parameter	3.977	0.618	6.440

Average Marginal Effect

	Coefficient	Std. error	t-statistic
Risk aversion = 1 (low)	0.100	0.031	3.227
Risk aversion = 2	0.475	0.142	3.344
Risk aversion = 3	1.004	0.298	3.366
Risk aversion = 4 (high)	-1.580	0.469	-3.369

Average of fitted probability at 90th pct. minus prob at 10th pct.

	Coefficient	Std. error	t-statistic
Risk aversion = 1 (low)	0.005	0.000	27.305
Risk aversion = 2	0.022	0.001	29.797
Risk aversion = 3	0.045	0.001	31.154
Risk aversion = 4 (high)	-0.072	0.002	-30.682

Note: The table shows (i) estimated coefficients for the variables of interest of the ordered probit model according to equation (3), (ii) average marginal effect of experienced return for each category of the ordered probit (iii) average of fitted probability at 90th percentile minus average fiited probability at 10th percentile for each category of the ordered probit.

Table 4b: The effect of experienced stock market returns on risk aversion (control variables).

Self-reported risk aversion			
	Coefficient	Std. error	t-statistic
Experienced return	-4.97	1.47	-3.37
Weighting parameter	3.98	0.62	6.44
Log Income	0.20	0.09	2.18
Log Income squared	-0.01	0.01	-2.79
Children	0.04	0.04	1.02
Children squared	-0.00	0.01	-0.33
Log Liquid assets	0.12	0.02	8.10
Log Liquid assets squared	-0.01	0.00	-11.26
Retired	0.07	0.04	1.73
College	-0.32	0.04	-7.51
High School	-0.20	0.04	-5.24
Age	0.02	0.01	2.39
Age squared	-0.00	0.00	-0.32
Married	0.04	0.03	1.10
Financial sector	-0.23	0.06	-4.08
Austria	-0.02	0.06	-0.40
Belgium	0.20	0.05	3.79
Spain	0.43	0.05	8.36
Greece	0.08	0.08	0.93
Italy	-0.94	0.07	-12.90
Luxembourg	0.58	0.07	8.15
Netherlands	0.20	0.06	3.42
Portugal	0.71	0.06	12.46
Pseudo R squared		0.11	

Note: The table shows estimated coefficients of the ordered probit model according to equation (3),

Table 5: The effect of experienced stock market returns on stock market participation

Stock market participation			
	Coefficient	Std. error	t-statistic
Experienced return	15.17	3.76	4.04
Weighting parameter	5.33	1.41	3.77
Average Marginal Effect	0.02	0.00	5.89
Fitted prob at p90 - p10	0.11	0.00	52.17
Log Income	-0.14	0.31	-0.46
Log Income squared	0.01	0.01	0.95
Children	-0.01	0.04	-0.20
Children squared	-0.00	0.01	-0.14
Log Liquid assets	0.30	0.12	2.38
Log Liquid assets squared	0.01	0.01	1.25
Retired	-0.04	0.05	-0.79
College	0.39	0.05	8.09
High School	0.21	0.04	4.62
Age	0.01	0.01	0.47
Age squared	-0.00	0.00	-1.52
Married	-0.03	0.04	-0.71
Financial sector	0.66	0.08	8.21
Austria	-1.01	0.12	-8.59
Belgium	0.20	0.09	2.19
Spain	0.13	0.17	0.77
Finland	-0.20	0.35	-0.58
France	0.33	0.08	3.91
Greece	-0.45	0.34	-1.32
Italy	0.20	0.14	1.50
Luxembourg	-0.74	0.14	-5.46
Netherlands	0.09	0.10	0.91
Portugal	-0.34	0.10	-3.51
Pseudo R squared		0.31	

Note: The table shows estimated coefficients of the probit model according to equation (3), explaining households' participation in stock markets.

Table 6: The effect of experienced stock market returns on the share of stocks in liquid assets

Share of liquid assets invested in stock			
	Coefficient	Std. error	t-statistic
Experienced return	3.20	1.49	2.15
Weighting parameter	8.35	3.72	2.24
Fitted prob at p90 - p10	0.04	0.00	12.67
Log Income	0.07	0.22	0.30
Log Income squared	0.00	0.01	0.07
Children	-0.01	0.02	-0.70
Children squared	0.00	0.01	0.67
Log Liquid assets	0.23	0.06	4.09
Log Liquid assets squared	-0.00	0.00	-0.85
Retired	-0.01	0.02	-0.29
College	0.19	0.03	7.05
High School	0.14	0.02	5.85
Age	0.01	0.01	1.69
Age squared	-0.00	0.00	-2.26
Married	-0.01	0.02	-0.34
Financial sector	0.23	0.03	6.68
Austria	-0.32	0.06	-5.26
Belgium	0.14	0.05	2.79
Spain	0.31	0.10	3.02
Finland	0.35	0.14	2.53
France	0.30	0.04	7.14
Greece	0.11	0.16	0.67
Italy	0.09	0.07	1.26
Luxembourg	-0.26	0.06	-3.94
Netherlands	0.07	0.06	1.30
Portugal	0.03	0.04	0.66
Sigma	-4.13	1.14	-3.62
Pseudo R squared		0.28	

Note: The table shows estimated coefficients of the tobit model according to equation (3), explaining the share of stocks in liquid assets.

Table 7: The effect of experienced bond market returns on bond market participation and the share of bonds in liquid assets

Bond market participation

	Coefficient	Std. error	t-statistic
Experienced return	27.78	14.92	1.86
Weighting parameter	3.99	0.33	12.18
Average Marginal Effect	2.07	1.12	1.85
Fitted prob at p90 - p10	0.05	0.01	4.76
Log Income	0.19	0.43	0.43
Log Income squared	-0.01	0.02	-0.25
Children	-0.07	0.07	-1.14
Children squared	0.01	0.02	0.65
Log Liquid assets	1.65	0.29	5.71
Log Liquid assets squared	-0.05	0.01	-4.04
Retired	0.08	0.07	1.12
College	-0.02	0.07	-0.31
High School	0.06	0.05	1.14
Age	-0.01	0.03	-0.49
Age squared	0.00	0.00	0.43
Married	-0.05	0.06	-0.85
Financial sector	0.24	0.11	2.30
Austria	-0.27	0.09	-2.92
Belgium	-0.14	0.13	-1.12
Spain	-0.33	0.12	-2.81
Finland	-1.27	0.26	-4.86
France	-0.75	0.16	-4.61
Greece	0.17	0.45	0.37
Italy	0.90	0.09	10.43
Luxembourg	0.01	0.28	0.05
Netherlands	0.09	0.09	0.97
Portugal	-0.98	0.14	-7.04
Pseudo R squared		0.36	

Share of liquid assets invested in bonds

	Coefficient	Std. error	t-statistic
Experienced return	16.60	10.35	1.60
Weighting parameter	3.84	0.31	12.41
Fitted prob at p90 - p10	0.03	0.01	3.86
Log Income	0.24	0.29	0.85
Log Income squared	-0.01	0.01	-0.72
Children	-0.05	0.04	-1.28
Children squared	0.01	0.01	0.72
Log Liquid assets	1.19	0.18	6.57
Log Liquid assets squared	-0.04	0.01	-4.83
Retired	0.05	0.05	1.10
College	-0.03	0.04	-0.73
High School	0.02	0.03	0.60
Age	-0.01	0.02	-0.26
Age squared	0.00	0.00	0.26
Married	-0.04	0.04	-1.17
Financial sector	0.12	0.06	2.03
Austria	-0.17	0.06	-2.91
Belgium	-0.04	0.09	-0.50
Spain	-0.19	0.08	-2.35
Finland	-0.80	0.18	-4.45
France	-0.49	0.11	-4.40
Greece	0.09	0.32	0.28
Italy	0.62	0.06	10.26
Luxembourg	0.02	0.19	0.13
Netherlands	0.06	0.06	0.90
Portugal	-0.63	0.09	-7.05
Sigma	-10.99	1.49	-7.40
Pseudo R squared		0.35	

Note: The table shows estimated coefficients of the probit model according to equation (3), explaining households' participation in bond markets (upper panel) and of the tobit model according to equation (3), explaining the share of bonds in liquid assets (lower panel).

Table 8: The effect of experienced stock market returns on stock market participation, robustness tests

	Experienced Stock Return			
	Coefficient	Std. error	t-statistic	Pseudo R-squared
Benchmark model	15.17	3.76	4.04	0.31
Volatility	16.78	3.79	4.42	0.31
Pensions	15.22	2.74	5.56	0.24
Unweighted	4.68	0.81	5.76	0.34
Bond returns	10.85	2.31	4.69	0.31
Start minus 10 years	10.54	1.95	5.40	0.31
Start plus 10 years	21.10	3.49	6.04	0.31
Risk aversion	13.34	2.84	4.70	0.35
No immigrants	6.57	0.95	6.94	0.33
Placebo experiment	-0.35	0.62	-0.57	0.31
Group mild	16.02	3.27	4.90	0.29
Group severe	1.81	1.57	1.16	0.34

	Weighting parameter		
	Coefficient	Std. error	t-statistic
Benchmark model	5.33	1.41	3.77
Volatility	5.09	0.93	5.45
Pensions	5.31	0.50	10.58
Unweighted	10.05	1.49	6.75
Bond returns	6.11	0.25	24.88
Start minus 10 years	3.87	0.35	11.16
Start plus 10 years	6.49	0.21	30.76
Risk aversion	5.83	0.49	11.84
No immigrants	10.04	0.57	17.70
Placebo experiment	5.33	[fixed]	[fixed]
Group mild	5.52	0.92	5.98
Group severe	10.90	1.12	9.69

Note: The table shows estimated coefficients β and λ of the probit model according to equation (3), explaining households' participation in stock markets. Row (1) repeats the benchmark results. Row (2) adds the experienced stock market volatility. Row (3) is based on a broader definition of stock holdings, also including investments in voluntary pension plans. Row (4) provides unweighted results. Row (5) additionally includes the bond returns that households have experienced over their lifetimes. Rows (6) and (7) vary the experience horizon of respondents, by either including 10 years prior to birth, or by starting 10 years after birth. Row 8 adds risk aversion as additional regressor, row (9) excludes immigrants from the estimation. Row (10) reports results from a placebo experiment. Rows (11) and (12) contain split sample estimates, once for countries with relatively mild stock market declines in 2008, and once for the severely hit countries.

Table 9a: The effect of stock market downturns on risk aversion

Self-reported risk aversion

	Coefficient	Std. error	t-statistic
Crash	0.118	0.048	2.490
Crash squared	-0.009	0.003	-2.609

Average Marginal Effect

	Coefficient	Std. error	t-statistic
Risk aversion = 1 (low)	-0.000	0.000	-0.907
Risk aversion = 2	-0.002	0.002	-1.190
Risk aversion = 3	-0.006	0.004	-1.409
Risk aversion = 4 (high)	0.009	0.007	1.317

Average of fitted probability at 90th pct. minus prob at 10th pct.

	Coefficient	Std. error	t-statistic
Risk aversion = 1 (low)	-0.002	0.000	-10.866
Risk aversion = 2	-0.010	0.001	-11.463
Risk aversion = 3	-0.022	0.002	-11.817
Risk aversion = 4 (high)	0.034	0.003	11.657

Note: The table shows (i) estimated coefficients for the variables of interest of the ordered probit model according to equation (4), (ii) average marginal effect of experienced return for each category of the ordered probit (iii) average of fitted probability at 90th percentile minus average fiited probability at 10th percentile for each category of the ordered probit.

Table 9b: The effect of stock market downturns on risk aversion (control variables).

Self-reported risk aversion			
	Coefficient	Std. error	t-statistic
Crash	0.12	0.05	2.49
Crash squared	-0.01	0.00	-2.61
Log Income	0.20	0.09	2.19
Log Income squared	-0.01	0.01	-2.77
Children	0.04	0.04	0.96
Children squared	-0.00	0.01	-0.28
Log Liquid assets	0.12	0.02	8.07
Log Liquid assets squared	-0.01	0.00	-11.26
Retired	0.08	0.04	1.92
College	-0.32	0.04	-7.34
High School	-0.20	0.04	-5.09
Age	0.00	0.01	0.62
Age squared	0.00	0.00	0.96
Married	0.04	0.03	1.10
Financial sector	-0.23	0.06	-3.99
Austria	-0.01	0.08	-0.14
Belgium	0.25	0.05	5.21
Spain	0.43	0.05	9.15
Greece	0.01	0.05	0.12
Italy	-0.77	0.07	-11.09
Luxembourg	0.49	0.06	7.96
Netherlands	0.30	0.07	4.26
Portugal	0.71	0.11	6.52
Pseudo R squared		0.11	

Note: The table shows estimated coefficients of the ordered probit model according to equation (4),

Table 10: The effect of experienced stock market downturns on stock market participation

	Stock market participation		
	Coefficient	Std. error	t-statistic
Crash	-0.31	0.07	-4.41
Crash squared	0.02	0.01	3.71
Average Marginal Effect	-0.02	0.00	-4.30
Fitted prob at p10 - p90	0.08	0.00	70.08
Log Income	-0.16	0.28	-0.58
Log Income squared	0.01	0.01	1.09
Children	-0.01	0.04	-0.23
Children squared	-0.00	0.01	-0.06
Log Liquid assets	0.29	0.12	2.34
Log Liquid assets squared	0.01	0.01	1.33
Retired	-0.07	0.05	-1.32
College	0.38	0.05	8.03
High School	0.19	0.04	4.46
Age	0.04	0.01	4.51
Age squared	-0.00	0.00	-4.24
Married	-0.03	0.04	-0.77
Financial sector	0.65	0.08	8.13
Austria	-1.01	0.12	-8.14
Belgium	-0.05	0.07	-0.67
Spain	-0.00	0.06	-0.03
Finland	0.47	0.05	9.57
France	0.27	0.05	5.72
Greece	-0.41	0.09	-4.80
Italy	-0.32	0.09	-3.69
Luxembourg	-0.47	0.08	-5.71
Netherlands	-0.31	0.10	-2.94
Portugal	-0.14	0.14	-1.00
Pseudo R squared		0.31	

Note: The table shows estimated coefficients of the probit model according to equation (4), explaining households' participation in stock markets.

Table 11: The effect of experienced stock market downturns on the share of stocks in liquid assets

Share of liquid assets invested in stock			
	Coefficient	Std. error	t-statistic
Crash	-0.314	0.071	-4.411
Crash squared	0.020	0.005	3.710
Average Marginal Effect	-0.019	0.004	-4.301
Fitted prob at p10 - p90	0.085	0.001	70.077
Log Income	-0.16	0.28	-0.58
Log Income squared	0.01	0.01	1.09
Children	-0.01	0.04	-0.23
Children squared	-0.00	0.01	-0.06
Log Liquid assets	0.29	0.12	2.34
Log Liquid assets squared	0.01	0.01	1.33
Retired	-0.07	0.05	-1.32
College	0.38	0.05	8.03
High School	0.19	0.04	4.46
Age	0.04	0.01	4.51
Age squared	-0.00	0.00	-4.24
Married	-0.03	0.04	-0.77
Financial sector	0.65	0.08	8.13
Austria	-1.01	0.12	-8.14
Belgium	-0.05	0.07	-0.67
Spain	-0.00	0.06	-0.03
Finland	0.47	0.05	9.57
France	0.27	0.05	5.72
Greece	-0.41	0.09	-4.80
Italy	-0.32	0.09	-3.69
Luxembourg	-0.47	0.08	-5.71
Netherlands	-0.31	0.10	-2.94
Portugal	-0.14	0.14	-1.00
Pseudo R squared		0.31	

Note: The table shows estimated coefficients of the tobit model according to equation (4), explaining the share of stocks in liquid assets.

Table 12: The effect of experienced stock market downturns on stock market participation, extensions and robustness tests

	Number of crashes experienced			
	AME	Std. error	t-statistic	Pseudo R-squared
Benchmark	-0.019	0.004	-4.301	0.31
With return	-0.011	0.004	-2.417	0.31
Booms	-0.017	0.004	-3.980	0.31
Cutoff 40%	-0.062	0.012	-5.119	0.31
Pensions	-0.075	0.006	-11.613	0.24
No weights	-0.003	0.002	-1.282	0.34
Risk aversion	-0.014	0.005	-2.649	0.34
No immigrants	-0.009	0.007	-1.361	0.36
Placebo experiment	-0.000	0.004	-0.124	0.31

Note: The table shows estimated Average Marginal Effects of the probit model according to equation (4), explaining households' participation in stock markets. Row (1) repeats the benchmark results. Row (2) adds the experienced stock market returns. Row (3) adds stock market booms. Row (4) changes the definition of a downturn to cases where annual nominal stock returns were below -40%. Row (5) includes voluntary pension plans in the definition of stock holdings. Row (6) provides unweighted results. Row (7) adds risk aversion. Row (8) reports results for an estimation that excludes immigrants. Row (9) shows the results for a placebo experiment where the number of crisis have been assigned randomly across the distribution of households.