Due to item non-response, the SAVE data set is imputed using an iterative multiple imputation procedure based on a Markov-Chain Monte-Carlo method (Schunk (2008)). The goal of this procedure is to increase the efficiency of our estimates due to a larger number of observations and to reduce the item non-response bias that occurs if observations with and without missing values differ systematically. For our analysis, all five multiply imputed data sets are used and the results are derived using Rubin's method (Rubin (1987, 1996)). In the case of our explained variables (absolute and relative loss) and key explanatory variables (financial literacy and cognitive abilities), we do not use imputed values. Thus, our basic sample consists of 2,012 households. The socio-demographic characteristics of the sample are provided in Table C1 in the appendix.

All descriptive statistics are weighted and results are representative for the German population.[11] For the regression analyses no weights are used.[12]

3.2 Measuring Financial Losses

3.2.1 Reported Losses

Absolute Financial Losses. We measure losses due to the financial crisis by directly asking households. The question in SAVE 2009 was phrased in the following way: *Have you and /or your partner personally suffered losses in wealth due to the financial crisis? If yes, how high was your total loss in 2008 in Euros?*[13] At this point it is unclear if households reported paper or realized losses. However, we will elaborate on this in the course of our analysis.

About 79.5% of the households responded that they did not incur financial losses due to the crisis. 20.5% reported a loss. The average loss reported by households conditional on reporting a loss is 13,153 Euros. The median loss is 5,000 Euros. The distribution of losses is skewed to the right and is plotted in figure A1 in the appendix. The unconditional average loss of all households in Germany is 2,562 Euros. In comparison, the average loss of German households calculated on the basis of aggregate financial

[11] The reference statistic to calibrate weights according to income and age classes is the German Mikrozensus. For a detailed description see Börsch-Supan et al. (2009), pp. 48-52.

[12] Deaton (1997) mentions that "when the sectors [sub populations] are homogeneous, OLS is more efficient, and when they are not, both estimators are inconsistent. In neither case is there an argument for weighting." (p. 70).

[13] We do not compare households' balance sheets at the end of 2007 and 2008 as the net wealth position of households can also be influenced by consumption-saving decisions and bequests, etc.

account statistics of the Deutsche Bundesbank is 3,105 Euros.[14] The difference may at least partly be explained by the fact that some households have not reported paper losses.

In order to evaluate how well households estimate their losses we simulate financial losses on the basis of their portfolios at the end of 2007. We apply the approach taken by Börsch-Supan et al. (2010), i.e., we use households' portfolio composition at the end of 2007 and apply average realized returns of these assets during 2008. We deduct the simulated wealth level at the end of 2008 from the wealth level at the end of 2007 to obtain paper losses and gains during 2008. To construct our simulated loss variable we exclude gains as our direct question only covered losses. According to the simulation about 29.6% of households in Germany were affected by losses in financial wealth. The difference compared to reported losses can be due to two reasons: First, some of the households did not report their paper losses when asked directly and some households might be unaware of the fact that they were affected by the financial crisis. We will comment on this aspect after we introduce measures of financial literacy and cognitive abilities. Second, in SAVE we have information on rather broad classes of assets. We calculated the returns on asset classes using average returns of these assets as we do not have information of the precise composition of households' portfolios. Thus, for some households the simulated loss might not reflect their true situation very well.

The average simulated loss of households is 2,658 Euro. This is quite close to the reported average loss of 2,562 Euros.[15] Conditional on reporting a loss the average simulated loss is 10,692 Euros, i.e. the value is below the average reported loss of 13,153 Euros. We also analyze the difference between simulated and reported losses on the individual level and find that about 13% report losses below the simulated loss and about 22% report losses above the simulated loss. For 64% of the respondent reported and simulated losses both are zero. Again the deviations can be due to misreporting of the households as well as due to the imprecise estimation of simulated returns to wealth during 2008. Overall, we come to the conclusion that households on average seem to have a plausible notion of their losses during the financial crisis. We will comment on the deviation in more details below.

[14]Estimated on the basis of Deutsche Bundesbank (2009): Geldvermögen und Verbindlichkeiten der privaten Haushalte. Tabelle aus der Finanzierungsrechnung; http://www.bundesbank.de/statistik/statistik_wirtschaftsdaten_tabellen.php

[15]The correlation of simulated and reported losses is 0.52 (p-value 0.000).

Relative Financial Losses. We divide financial losses by households' total financial wealth at the end of 2007. Total financial wealth is constructed using deposits held in savings accounts, building savings contracts, fixed income securities, stocks, stock mutual and real estate funds, life insurance contracts, private and employer-based pension wealth as well as other financial assets. On average households lost about 3.6% of their gross financial wealth. Conditional on suffering a loss, households lost about 18.6% of their gross financial wealth. The median loss is 9.5%. Overall, about 9.2% of the households lost more than 10% and about 1.8% lost more than half of their financial assets. The average simulated loss relative to financial wealth at the end of 2007 is 3.7% which is again quite close to the reported one.

Additionally we relate losses to total wealth. Thus, we add housing and business wealth as well as other real assets (e.g. jewelery, antiques etc.) to our financial wealth variable. Related to their total gross wealth at the end of 2007, households on average lost 1.7% of their wealth. Conditional on reporting a loss, the fraction of total wealth lost is 8.9% with a median of 2.5%. 3.8% lost a fraction of wealth higher than 10% of all assets. Less than 1% of all households lost more than half of their total wealth.

3.2.2 Realized Losses

As a follow up question we asked respondents: *What did you do with the assets that lost in value? We kept the assets. / We sold some of the assets. / We sold all of them.*

This question was only asked conditional on reporting a loss. Thus, 458 households gave an answer to this question. 75.2% responded that they kept the loser assets in their portfolio. Thus, these households reported paper losses. 13.2% report that they sold all of the assets that lost in value and 11.6% sold at least some of them (see Table 1). For the analysis conducted later on we construct a variable equal to 1 if households sold some or all of their assets.

Table 1 also relates the absolute and relative losses of households to their reaction. We find that the average loss of households who kept their assets is little over 12,000 Euros. The average loss of households who sold some of the assets is almost twice as large (about 23,500 Euros). However, the loss of households who sold all their assets is only around 9,000 Euros. Investors who kept their assets on average lost 17.4% of their wealth which is about 23% less than the average relative losses of investors who sold some or all of their assets and who suffered an average relative loss of 22.5%.

Table 1: Households' Reaction to Financial Losses
This table contains the frequency and the proportion of respondents who gave the respective answers to the question "What did you do with the assets that lost in value?" Additionally the average loss and the average fraction of wealth lost are reported.

	Freq.	Percent	Mean Loss	Fraction of Wealth Lost
I/we kept the assets	344	75.2	12196	17.4%
I/we sold some of the assets	53	11.6	23518	22.5%
I/we sold all of them	61	13.2	9187	22.5%
Total	458	100.0	13153	18.7%

Source: SAVE 2009, data is weighted.

3.3 Measuring Financial Literacy

We measure financial sophistication using an "objective" —as opposed to a "subjective", i.e. self-assessed—measure of financial literacy. A set of three quiz-like questions was developed by Lusardi and Mitchell (2006) for the Health and Retirement Study in 2004. The questions are designed to assess the fundamental skills that are at the core of individual saving and investment decisions. In the meantime, the same (or very similar) questions were included in several household surveys around the world, including the German SAVE survey. Two of the questions are classified as measuring basic financial concepts (van Rooij et al. (2007)). The first question concerns the understanding of interest and requires the ability to calculate. The second question examines the understanding of the joint effects of interest and inflation. The third question is categorized as measuring advanced financial knowledge and deals with risk and diversification. The wording of the questions can be found in appendix D.

We use the answers to the financial quiz from the SAVE survey in 2007 because the financial crisis might have changed financial knowledge of households. The survey was conducted in the early summer of 2007 before the start of the financial crisis. In 2007 respondents were requested to answer financial literacy questions for the first time in SAVE.

Finally, we define two measures of financial literacy. We construct an index taking values 0 to 3 according to the number of correct answers given by each respondent. The answers given by the respondents are displayed in Table 2. The second variable is a dummy, which takes the value 1 if all questions were answered correctly and 0 otherwise. In our sample 53.2% of the respondents were able to answer all three financial literacy questions correctly, whereas 46.8% had a least one incorrect answer or "do not

know".[16] A comparison of these responses with results from earlier studies like Lusardi and Mitchell (2006) and van Rooij et al. (2007) is difficult due to the missing "do not know" option in SAVE. We compare the answers across countries on the basis of SAVE 2009 in Bucher-Koenen and Lusardi (2010).

Table 2: Financial Literacy 2007

This table contains the frequency and the proportion of respondents who were able to answer zero to three questions on the financial literacy task.

no. of correct answers	Freq.	Percent	Cum.
0	138	6.9	6.9
1	178	8.8	15.7
2	626	31.1	46.8
3	1070	53.2	100.0

Source: SAVE 2007, data is weighted according to sample weights 2009, N= 2012.

Previous analysis of financial literacy among SAVE respondents revealed that financial literacy is relatively low among women, individuals with low education, low income and individuals living in east Germany (Bucher-Koenen and Lusardi (2010)).

3.4 Measuring Cognitive Abilities

Cognitive abilities are measured using the cognitive reflection test (CRT) developed and tested by Frederick (2005). To our knowledge, SAVE is the first representative sample which contains this measure. The CRT consists of three quiz-like questions. All questions have an intuitive but incorrect answer and a correct answer that is a little more tricky to find. The CRT has been found to be a very efficient way to estimate cognitive abilities of individuals in questionnaires. It correlates well with more comprehensive intelligence tests. The wording of the questions can be found in appendix D.

The CRT was only introduced in the SAVE survey in 2009. However, there is no reason to assume that the crisis influenced cognitive abilities of our respondents. Thus we do not see any difficulty in using this data.

Similar to our measures of financial literacy we define a measure of cognitive abilities. We construct an index taking the values 0 to 3 corresponding to the number of correct answers given. The results can be found in Table 3. 43% of our respondents gave no correct answer. Around 20% gave one and 21% two correct answers. 15% of the

[16] In the questionnaire 2007 the interest and the inflation question did not have a "do not know" option. For this reason we treat missing answers as "do not know" and do not drop them from the sample.

respondents were able to answer all three questions correctly. Moreover, we construct a dummy variable which takes the value 1 if all questions were correctly answered. The percentage of individuals with three correct responses in the study by Frederick (2005) ranges between 48% (sample of 61 students at Massachusetts Institute of Technology) and 5% (sample of 138 students at the University of Toledo). On average around 17% of the participants—mostly young university students—in his samples give three correct answers.

Table 3: Cognitive Reflection Test

This table contains the frequency and the proportion of respondents who were able to answer zero to three questions on the cognitive abilities task.

no. of correct answers	Freq.	Percent	Cum.
0	871	43.3	43.3
1	434	21.6	64.9
2	403	20.0	84.9
3	303	15.1	100.0

Source: SAVE 2009, data is weighted, N= 2012.

There is a significantly positive correlation (spearman rank correlation: 0.2899, p-value 0.000) between our measures of financial literacy and cognitive abilities. About 4.3% of the respondents answer none of the questions correctly and 11.2% give six correct answers. Financial literacy increases with cognitive capacity: Among those with low cognitive abilities (0 correct answers) 37% give three correct answers on the financial literacy task whereas among those with high cognitive abilities (3 correct answers) the probability of correctly answering all financial literacy questions is roughly 75%.

4 Empirical strategies and results

4.1 Who is affected by financial losses due to the crisis?

4.1.1 Model to test hypothesis 1

In section 2.1 we argued that the probability of incurring a financial loss during the crisis depends on whether the household invested in risky assets, which in turn depends on factors like participation cost, income volatility, and risk preferences. In order to test *hypothesis 1* we substitute the determinants of risky asset investment into the equation