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Abstract

We merge survey data on a sample of individual investors containing test-based measures of financial literacy with administrative records on their assets holding and trades before, during and after the financial crisis of September 2008. This dataset allows us to design three tests of the benefits of financial literacy by comparing the decisions actually taken by individuals with a dominated alternative. We find that high-literacy investors are better at timing the market, since conditional on exiting the stock market they are more likely to exit before rather than after the crash following the collapse of Lehman Brothers. High-literacy investors are also more likely to trade according to the prescriptions of normative models and to detect intermediaries' potential conflicts of interest. However, though statistically significant these effects are economically small. In fact, far too many investors, even among those with high literacy, tend to choose the dominated alternative along all dimensions of choice examined. This suggests that literacy may be a poor edge against financial mistakes.

JEL code: G11, E21.

Keyword: Financial literacy, household finance, individual investors.

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1. Introduction

A striking finding of recent work on financial literacy is that individuals seem to lack very basic knowledge of financial concepts that should in principle guide their financial decisions. When participants in the 2004 Health and Retirement Survey are asked how much money they would have after 5 years if they invested $100 in their savings account and the annual rate was 2%, half of them get it wrong, answering at most 102. Similarly, a large fraction of the respondents are unable to distinguish between real and nominal returns or to rank a single stock and a stock mutual fund according to riskiness (Lusardi and Mitchell, 2011a). Lack of financial literacy is not limited to the US but extends to other countries (Lusardi and Mitchell, 2011b) and to several other domains of financial knowledge, even including the ability to read a checking account balance. Because individuals seem to lack financial literacy universally and on such a large scale, this has attracted considerable policy attention on the consequences that lack of literacy may have for people ability to make sound financial decisions. In the wake of the Global Financial Crisis of 2007-2008 this debate has gained further momentum, as more vulnerable and less informed investors were probably more exposed to the crisis.

Several papers document a positive correlation between measures of financial literacy and "good" financial decisions on various domains. Yet, empirical identification of the causal effect of financial literacy on the quality of individual financial decisions is rather difficult. There are at least three reasons for why this is so. First, the positive correlation that has been documented may simply reflect reverse-causality: individuals with observed "better" financial outcomes, may have a stronger motive to acquire financial knowledge. Finding for instance a positive relation between participation in the stock market and an investor literacy (as in van Rooij et al , 20111 and Kimball and Shumway, 2006) is consistent with literacy helping alerting individuals about the excess returns on stocks which induces them to invest, but is also consistent with stock market participants having more to benefit from being able to possess basic financial knowledge which is accordingly acquired. Second, this positive correlation may reflect the fact that financial literacy is not distributed randomly in the population. Those who possess high levels of literacy are likely to have certain characteristics, often unobservable, such as talent, ability, or patience, that may lead also to "better" financial decisions. This is consistent with Meier and Sprenger (2010) who find that more far-sighted consumers are more likely to participate in financial education program; at the same time far-sighted consumers are likely to plan for retirement and accumulate more assets, which could explain the positive correlation between financial literacy and savings for retirement found by Ameriks, Caplin and Leahy (2003), Lusardi (2004) and Lusardi and Mitchell (2006). Importantly, both reverse causality and unobserved heterogeneity bias the relation between financial literacy and financial outcomes upwards, overstating the beneficial effects of financial literacy. To solve the problem one would need exogenous variation in financial literacy – an issue that has thus far found no convincing solution.

A third and less emphasized problem with empirical correlations between financial literacy and outcomes of financial decisions is that what is a "better" financial decision is often not clear. For instance, more savings for retirement is not necessarily a "better" decision than less savings – all depends on what is the optimal saving plan for the consumer, which is clearly unobserved. Similar considerations can be made for participation in the stock market or for the frequency of trading (that has been found to be positively correlated with financial literacy, Graham et al, 2009).

In this paper we focus on this third problem and try to address it by looking at choices that have a clearly dominated alternative. If literacy is of any help to the consumer, it should allow investors to disregard more frequently the dominated alternative – a minimum requirement for financial literacy to have a role in improving consumers' financial decisions. Needless to say, even contrasting a financial choice with a dominated alternative does not solve the reverse causality (or unobserved heterogeneity) problem that plagues studies of the effect of financial literacy on economic outcomes. However, this is less of a concern in our case because we find that financial literacy has a small effect of investor ability to dismiss the dominated alternative, while reverse causality (unobserved heterogeneity) would bias the effect upward. In so far the later is present, the true benefit of financial literacy is smaller than the already small one we find.

We look at the investment decisions of a panel of individual investors followed each month from January 2007 to October 2009, i.e. a period covering the Global Financial Crisis. The data inform about a sample of investors drawn from the clients of a large Italian bank. This sample was first interviewed in 2007 obtaining information on standard socio-demographic characteristics and test-based measures of financial literacy (among many other variables). For the same individuals we also have administrative records on their stocks and flows of many categories of investments at a monthly frequency from January 2007 to October 2009.

Looking at this particular period is interesting not only to evaluate whether financial literacy helped investors during the crisis, but also because during this period it is relatively simpler to identify a set of dominated investment strategies and test whether better financially prepared individuals were more likely to avoid them. We consider two margins over which literacy could improve financial decisions of individual investors: a) make them less likely to make financial mistakes by allowing them to get closer to the prescription of a normative model; b) increase their ability to make autonomous decisions, leaving investors less exposed to biased advice from financial intermediaries; alternatively, improve their ability – if they delegate decisions to financial experts – to detect possible conflicts of interest. We test three implications. The first two fall under a), the third under b). Each implication results in a comparison between a dominated choice and a better alternative: under the null that it matters, literacy should help follow the second and disregard the first.

First, conditional on trading stocks, investors with higher financial literacy could be better at timing the market by selling (buying) when the market is relatively high (low). We make this operational by looking at the decision of leaving the stock market during the financial crisis, distinguishing between those who leave the market when it is still high and those who leave after the market collapses. We interpret the time of exit as a signal of the ability of high literate investors to react promptly to changes in the financial markets.

Second, we look at the overall asset allocation of investors, involving not only stocks, as typically done in previous studies (see e.g. Calvet, Campbell and Sodini, 2009), but also corporate bonds and long-term government bonds. In particular, we test whether people with higher literacy are more likely to carry trades that are consistent with the implementation of the portfolio allocations recommended by a CAPM model at each month before and over the financial crisis.

Third, we look at the decision of investors to buy bonds issued by their own bank (i.e. the bank where investors had at least one checking account). We argue that after the collapse of Lehman Brothers selling their own bonds to the depositors was a cheap way for banks to obtain liquidity which became very hard to get in the market. At the same time investing in these bonds was a dominated strategy from the point of view of the investor as better alternatives – such as government bonds – were available. Indeed, Grasso, Linciano, Pierantoni and Siciliano (2011), show that during that period the risk adjusted returns on the bonds issued by the main Italian banks were *lower* than those on domestic government bonds. Accordingly, we test whether high literacy investors had a lower propensity to buy bonds of their bank when the bank access to the liquidity market was more difficult (proxied by the bank CDS) and the bank's incentive to promote its own bonds became stronger.

We find that during the financial crisis high literacy investors were more likely to leave the stock market before the crash than low-literacy investors. High-literacy investors were also statistically significantly more likely to follow trading strategies consistent with those implied by a basic CAPM. Finally, we find some evidence that, controlling for returns, high-literacy investors were less likely to buy bonds issued by their bank when the bank access to the liquidity market became more difficult and the incentive to procure liquidity by advising investors to liquidate other assets and invest in the bank bonds became stronger.

However, we also find that both types of investors tend to adhere very often to the dominated choices – that is to exit the market more intensely after it crashes, to depart often from the implication of CAPM portfolio composition and to buy bonds of their bank more intensively at the wrong time – suggesting that literacy offers limited edge against financial mistakes at least over the domain we looked at. Furthermore, though statistically significant, the differences that we find between the two groups are economically small. Among those who exit the stock market during the crisis the difference in the (normalized) expected loss due to late exit is only 2 percentage points lower for the high-literacy investors; similarly, after the Lehman default the probability of following the CAPM is only 1 percentage point higher for the high literacy investors, while the tempering effect of literacy against potentially distorted advices is even smaller.

Several papers, reviewed in Lusardi (2012) and Hastings, Madrian and Skimmyhorn (2012), find that measures of financial literacy correlate with individual financial decisions. Bernheim (1995, 1998) is one of the first to point out that most households lack basic financial knowledge and cannot perform very simple calculations and that the saving behavior of many households is dominated by crude rules of thumb. Hilgert, Hogarth and Beverly (2003) find a strong link between financial literacy and day-to-day financial management. Financial literacy has also been linked to a set of behaviors related to saving, wealth accumulation, and portfolio choice. For example, various papers have shown that individuals with greater numeracy and financial literacy are more likely to participate in financial markets, to invest in stocks (Christelis, Jappelli and Padula, 2010, Yoong, 2011; Van Rooij, Lusardi and Alessie, 2011) and to choose mutual funds with lower fees (Hastings and Tejeda-Ashton, 2008; Hastings and Mitchell, 2011). Similarly, Lusardi and Mitchell (2007a, 2011d) show that those who display high literacy are more likely to plan for retirement and, as a result, accumulate much more wealth (Lusardi and Mitchell, 2011c, Behrman, Mitchell, Soo, and Bravo, 2012, Gustman, Steinmeier, and Tabatabai, 2012). Finally, financial literacy is found to affect not only the assets side, but also the liability side of the balance sheet of households.[1]

Our contribution adds to this literature in two ways. First, we look at the association between financial literacy and some novel dimensions of financial decisions, in particular market timing and ability to avoid distorted advices. Second and most importantly, we focus on cases where the choice involves a dominated strategy. Hence, the advantage of high literacy is well defined: avoid the dominated choice. This, as we noticed, is not the case for most papers in the literature.

[1] Moore (2003) was one of the first to report that respondents with lower levels of financial literacy are more likely to have costly mortgages. More recently, Gerardi, Goette and Meier (2010) report that those with low literacy are more likely to take up sub-prime mortgages and to default on them. Stango and Zinman (2009) find that those who are not able to correctly calculate interest rates out of a stream of payments end up borrowing more and accumulating lower amounts of wealth. Campbell (2006) shows that individuals with lower incomes and lower education levels—characteristics that are strongly related to financial literacy—are less likely to refinance their mortgages during a period of falling interest rates. Finally, Lusardi and Tufano (2009 a, b) report that individuals with lower levels of financial literacy tend to transact in high-cost manners, incurring higher fees and using high-cost borrowing. The less knowledgeable also report that their debt loads are excessive or that they are unable to judge.

The rest of paper is organized as follows. In section 2 we describe our dataset. In section 3 we discuss the theoretical assumptions that we test. In section 4 we present our results. Section 5 briefly concludes.

2. The data

Our dataset combines data from a survey conducted by one Italian bank on its clients' with the bank's administrative data on the asset holdings and transactions of the same clients. The survey is conducted on a sample of around 1,600 clients, interviewed in the summer of 2007, selected among those with at least 10,000 euros of financial wealth.[2] (See the Appendix A for details).

The survey elicits detailed information on individuals and their households.[3] Together with standard socio-demographic characteristics (e.g. sex, age, educational attainment, employment) the survey includes (non-standard in household surveys) questions to elicit investors risk aversion, financial returns expectations, propensity to follow consultant advices (see Appendix A for details) and – importantly for the purpose of this paper - to measure investors' financial literacy. We calculate an index of individual financial literacy averaging out the correct answers to a set of eight simple, standard questions aimed at detecting basic financial knowledge, which are similar to those included in the 2004 US Health and retirement study and used by Lusardi and Mitchell (2006). The questions and the method to construct an index of financial literacy are reported in Appendix A. We define as "high literate" those with an index above the median and "low literate" the others.

Administrative data[4] on the same clients include cash and assets holdings and net monthly flows for each asset from December 2006 to October 2009. A positive net flow denotes a net purchase during the reference month; a negative flow denotes a sale. Assets are evaluated at market value at the beginning of the reference month. Flows are valued at market value at the time of purchase\sale. The availability of both stocks and flows allows us to calculate a proxy of investors' portfolio total return, equal to the ratio between: (1) the value of the assets at time $t+1$ minus the net flow between t and $t+1$ and (2) the value of the assets at time t.[5]

Data on assets are available for more than 20 distinct asset classes (see Appendix A). We focus primarily on risky assets and group asset classes into 3 aggregates: stocks, corporate bonds and long-term government bonds. The first includes stock-based mutual funds, ETF, directly owned stock (both Italian and foreign), and managed accounts, which we call "stocks" for brevity.

[2] The sample is stratified according to geographical area, city size and financial wealth.

[3] The survey includes more than 1.600 clients, but we have full administrative data only for 1.576 clients for all the period from December 2006-October 2009, because of some reporting error in the individual code used to link the survey and administrative data.

[4] Data are fully anonymous. The merge of the two datasets has been carried out by the bank itself and the company conducting the interviews.

[5] Since net flows are the sum of purchases and sales at the time they take place, while data on stocks are valued at the beginning of each month, this proxy does not capture sharp intra-month changes in the value of assets. Moreover, it does not include dividends or coupons paid cash to investors, as they are recorded as cash flows and cannot be separately distinguished from other cash.

The second, labelled as "corporate bonds" includes the bonds issued by the bank, other corporate bonds and corporate bond mutual funds. The last aggregate includes long-term government bonds. These three aggregates constitute the components of the investors' risky portfolio. The sum of the risky portfolio plus cash and investments in safe assets like short-term government bonds and money market mutual funds is what we define as total financial wealth. [6]

Table 1 reports descriptive statistics for the sample of 1,576 investors for which administrative records are available. "Low literacy" investors (defined as those with index below median) account for 43.3 per cent of the sample. In line with the results in the literature high literacy people are more frequently men, young and with higher educational attainment (see e.g. Lusardi and Mitchell, 2008).

High literacy investors have the same financial wealth of low literacy ones, but higher probability of having risky assets of any type. During the period January 2007-October 2009 the monthly total return on financial wealth was equal on average to -0.32 percent (-0.35 for the low literacy, -0.31 for high literacy). For comparison the table also reports the average total returns of some market indices: Morgan Stanley Index for the European stock market (in euro, MSCI Europe[7]); the Merrill Lynch Emu corporate bond index and the Citigroup government bond index 7-10 years. In some of the empirical exercises presented in Section 4 we use these indices as benchmarks for the corresponding asset classes and we denote them as B_s, B_c and B_g respectively.

3. Testable implications

We test the role of financial literacy along three different dimensions where financial sophistication may help individual investors in their day-by-day financial decision making. The three settings have all the property that what constitutes "better" behavior is well defined.

3.1. Market timing

The first test is aimed at evaluating whether financial literacy helps individuals to timely react to financial market fluctuations. We look at the sub-period going from the Spring of 2007 - universally viewed as the beginning of the US subprime crisis (see Appendix B) - to February 2009 when the stock market index hits its bottom and the volatility index (VIX) starts to revert back towards the pre-Lehman Brothers default values (Fig. 1).

Our test is based on the idea that literacy may help time the market better. Given the pattern of the market, if literacy helps, one should find that, *conditional on exiting the market*, high

[6] One drawback of our dataset is that the clients of this bank may also have accounts with in other banks However, from the survey we know that 2/3 of investors have only one account. We have also carried out some robustness checks of our main results on the subsample of those who have just one account. Our findings are fully confirmed.

[7] Converted in euro by the use of the monthly average euro/$ exchange rate.

financial literacy investors should be more likely than low literacy ones to exit it either when the index is at the peak or at the very early stage of its decline, rather than when it reaches its lows.

3.2 Portfolio rebalancing

Our second test relies on the optimal asset allocation prescription of a basic mean-variance CAPM over different intervals of our sample period. From the CAPM we obtain implications about the asset reallocation that investors should follow if they behaved according to the model. To obtain these allocations, we focus on a stylized risky portfolio composed of: (1) stocks, (2) corporate bonds and (3) long-term government bonds and estimate the optimal CAPM portfolio shares. The returns on the three assets are those of the benchmark indices B_s, B_c and B_g, reported in Table 1. We also assume that there is a safe asset whose return is equal to the monthly average of the overnight interest rate. For each risky asset we calculate the monthly mean excess return (relative to the safe asset) and the variance-covariance matrix of returns. We allow the latter to be time-varying: for each month t it is computed using data on the returns over the previous 12 months.

The pattern of the optimal shares is shown in Figure 2. Since we impose no-short selling constraints, in some cases there are corner solutions. Needless to say, we take the prescriptions of this model as qualitative indications of the direction of the trades and rebalancing behavior rather than as indications of the optimal shares for the individual (risky assets) portfolio. The CAPM recommends to have no stocks and invest all in corporate bonds from January to June 2008, and divest corporate bonds and invest in long-term government bonds from October 2008 to April 2009.

If financial literacy helps investors making "better" decisions one should find that high literacy individuals are more likely to conform to these predictions. To implement the test we interpret it as suggesting that investors should sell at least part of their stocks and buy some corporate bonds during the first period and sell corporate bonds and buy (some) long-term government bonds in the second.

Alternatively, investors whose behavior is closer to this optimal strategy should have more efficient portfolios. We check this by first calculating the portfolio Sharpe ratio of each investor and then testing whether high financial literacy individuals obtain higher portfolio Sharpe ratios over our sample period.

3.3 Avoiding biased advise

Even if a person lacks himself the ability to make financial decisions he can rely on the expertise of advisors he trusts and follow their suggestions. A third way financial literacy can benefit investors is by enhancing their skill to detect potential conflicts of interest of their financial advisors when investing their savings. Models of conflict of interest with financial advisors and sellers of financial investments (Inderst, 2010; Inderst and Ottaviani, 2009, 2012a, 2012b; Anagol, Cole and Sarkar, 2010) all rely on some limited investor "sophistication" assumption. In these models, sellers of financial products can face a conflict of interest between recommending a product that best fits the investor needs or can push for a product that maximizes the fees paid to the intermediary and that can be second best (or even harmful) from the point of view of the customer (Inderst and Ottaviani, 2012). Yet, if this is so, the ability required is that of detecting the trustworthiness of the advisors. Ability to know who to trust and ability to rely on those who are trustworthy may itself be augmented by a high level of literacy.

Our third test focuses on this channel. In general, it is difficult to identify a financial trade where the recommendation of the advisor is primarily beneficial to the intermediary but clearly conflicts with the interest of the investor is typically difficult, because financial decisions may be indeed influenced by the supply side, but may also reflect the investors' rational choices. Thanks to the turmoil caused by the crisis and the effect this had on Italian banks, we can more easily identify such a case. Following the collapse of Lehman Brothers many Italian banks faced a liquidity crisis and in some cases even a run on their deposits. The main problem faced by the banks' management was to obtain liquidity drawing on all possible sources. One way to get it was to push investors to liquidate mutual funds and advice them to invest in the bank's bonds. At the aggregate level, in Italy the share of banks bonds in households' portfolios went up from 25% of households financial assets at the end of 2007 to 31% at the end of 2008. Net purchases of bank bonds increased by more than 100% (see the Bank of Italy Annual Report, 2009).

Most likely, the interest of the investor was opposite: since the risk was sitting in the banking system, investing in the bonds issued by the bank where investors had also a checking account was definitely a poor diversification strategy. Hence, an undistorted advice would have recommended quitting bank bonds altogether. In fact, as Figure 2 shows, the CAPM recommends selling bonds. This conclusion is further strengthened if one considers that, as documented by Grasso et al. (2011) in a sample of Italian banks, even during this episode returns on bank bonds placed by banks directly to their depositors fall short of returns on government bonds of similar maturity (but higher liquidity and lower risk) – a fact that is instead consistent with banks exploiting their conflict of interest. Our test, explained in Section 4.3 below, relies on this episode.

4. Results

4.1. Market timing: Leaving the stock market

Figure 3 plots the share of individuals with a positive amount of stocks during the period from January 2007 to October 2009. Before the beginning of the financial crisis high literate investors are characterized by a higher probability of participating in the stock market – a feature that is consistent with evidence in van Rooij, Lusardi and Alessie (2011), Calvet, Campbell and Sodini (2007) among others. During the first part of 2007, high-literacy investors reduce their participation until the gap is closed at the beginning of 2008, when the fraction of stockholders is the same for both groups.

This first piece of evidence is consistent with the hypothesis that high literate investors better time the stock market. As mentioned in Section 3.1, to test it more formally, we focus on the sample of investors who had stocks in March 2007 and left the stock market at any time between April 2007 and February 2009. We then calculate the share of those leaving the market in each month separately for high and low-literacy investors, respectively. The (smoothed) plot of the distribution of the time of exit for the two groups is reported in Fig. 4.

Among stock market leavers, who amounted to 24 per cent of those who had stocks at the beginning of the period, high literate investors were more likely to leave the market at the very first signals of the crisis i.e. in the Spring of 2007 (see Appendix b) and in the first part of 2008 (after the Northern Rock nationalization and Bear Stearns acquisition, Appendix b). The distribution of the time of exit of low literacy investors carries instead more probability mass after the collapse of Lehman Brothers. The differences however appear to be small.

In Table 2 we run a formal test by estimating a set of Cox proportional hazard regressions on the same sample of investors, while controlling for individual specific characteristics in addition to a dummy for high literacy. The dependent variable is the number of months since April 2007 to stock market exit. We control for log-wealth at the beginning of the period (March 2007), sex, age, age squared and educational attainment (primary, secondary and tertiary education). The hazard ratios reported are marginal effects of a one-unit change of the corresponding variable. Coefficients in excess of 1 denote lower survival in the stock market and thus early exit. These estimates confirm that during the financial crisis people with high financial literacy were more likely to exit the stock market before it hit the bottom (the percentage change in the hazard being equal to +25% when considering high literacy investors). Using these estimates we compute that among the low-literacy investors 2.4% leave within one month from the stock market peak while this proportion is 3.1 among the high literacy; 36.1% of the low literacy liquidate before Bearn Stearns while the proportion is 43.6% among the high-literacy and the exit rate in all the months before Lehman and the stick market peak are 52.5% among the low literacy and 61.4% among the high literacy. Thus, literacy seems to convey some benefit.

There are however two points to notice. First, among investors who liquidate stocks a large fraction do so after the market collapses rather than before, independently of literacy, suggesting that the latter helps but this help is limited. Second, even if high-literacy investors exit earlier, the difference with the low literacy group is not large, particularly when comparing very early exit.

To provide additional insight on the size of the benefits of literacy in timing the market, we have computed the expected loss for high-literacy and low-literacy investors who liquidated stocks at different months between April 2007 and February 2009 as:

$$EL_i = \sum_{t=0}^{T} q_{lt} p_t$$

where q_{lt} is the probability, computed from the hazard estimates, that an investor with literacy *l=[high, low]* liquidates his stocks in month t when the stock price is p_t (setting $p_0 = 1$). Multiplying by the average value of stocks of the two groups in April 2007 and dividing by their financial wealth holdings, we find that among the low literacy the average loss is 14.0 per cent, while among the high literacy is 12.5 per cent.

Overall, we conclude that while literacy is conducive to avoiding the dominated choice more often its benefits are small.

4.2 *Following the CAPM model*

According to the results of the very simple normative CAPM model described in Section 3.2 we look at buy/sell decisions in two periods: (1) January - June 2008 and (2) October 2008 - April 2009. The CAPM recommends to sell stocks and buy corporate bonds during (1), and to sell corporate bonds and buy long-term government bonds during (2). For the first period we focus on investors who had stocks in December 2007; for the second period we focus on those who owned corporate bonds in September 2008. [8]

We define a dummy *C* equal to 1 if the investor follows the buy/sell prescription of the CAPM and zero otherwise. For each investment decision *C* we estimate the following models in each of the two periods:

$$C_i = \lambda_0 + \lambda_1 L_i + \lambda_2 Z_i + e_i \qquad [1]$$

$$C_i = \lambda_0 + \lambda_1 L_i + \lambda_2 Z_i + \lambda_3 W_i + e_i$$

where L_i is the index of financial literacy for the *i*-th individual and L_i are standard socio-demographic variables like sex, age, age squared and educational attainment (dummies for 3 educational attainments: primary secondary and tertiary education).[9] The second specification controls also for the log of total financial wealth at the beginning of each period (W_i), to account for differences across investors in incentives to liquidate assets due to the presence of (per period) asset market participation costs (wealthy investors, facing a fixed entry cost, should be less discouraged to sell). Estimates for the first period are reported in the upper part of Table 3. The bottom part refers to the second period. Columns *a*, *c* and *e* refer to the first equation in [1], columns *b*, *d* and *f* to the second.

[8] We are excluding those who had no stocks at the beginning of the period and trade them within the period.

[9] For these estimates we use the cross section dimension of our dataset.

All the results are in line with the idea that high literacy investors are more likely to follow the normative CAPM prescriptions. In the first period high literate investors were around 4 percentage points more likely to sell stocks or buy corporate bonds and 3 percentage points more likely to do both than the low literacy.

Effects are similar in the second period: on average high literacy investors sell corporate bonds at a rate that is 6 percentage points higher than low literacy investors. High literate investors are also more likely to buy government bonds, though the effect is not significant at standard levels. Finally, the probability of undertaking both strategies is just 1.5 percentage points higher among highly literate investors compared to the mean.[10]

Though differences between the two groups are statistically and sometimes even economically non-negligible, still a very large fraction of investors in both groups (well in excess of 90%) depart from the recommendation of the CAPM. This suggests that though the potential for overcoming a financial mistake is large, financial literacy can only provide limited help.

A higher probability of following the prescriptions of the CAPM should result in higher portfolio efficiency and thus in higher Sharpe ratio. Following Calvet, Campbell and Sodini (2007), for each investor we have first estimated the individual portfolio excess return[11] and then we have calculated the risky portfolio Sharpe ratio, S_i. We then estimate the following models:

$$S_i = \beta_0 + \beta_1 L_i + e_i \qquad [2]$$

$$S_i = \beta_0 + \beta_1 L_i + \beta_2 Z_i + \beta_3 W_i + e_i$$

where all the variables are defined as above.

Columns (a) and (b) of Table 4 report the OLS estimates of the two specifications in [2], based on the sample of investors who hold risky assets for all the period covered by our sample. Since these estimates may be affected by self-selection into the market of risky assets, the last two columns report the estimates of a Heckman selection model for the probability of positive risky asset holding. In column (c) the exclusion restriction is financial wealth in December 2006, because as discussed before, in the presence of fixed entry costs, wealthy investors may have higher probability to participate to the risky asset market. In column (d) we rely on a different exclusion restriction. We assume that individual preferences towards risk (measured with an index of risk

[10] We carried out also additional robustness checks by enlarging the two time windows by one month and two months. Results remain unchanged.

[11] For each individual we have calculated the risky portfolio excess return equal to the difference between the portfolio total return and the risk free rate, proxied by the overnight index. Then, for each individual we have regressed the total return to the excess return of benchmark indices B_s, B_c and B_g, as before equal to the difference between the monthly total returns and the risk free rate. The estimated betas allow us to get an estimate of the expected excess return of the risky portfolio, equal to the sum of the products of betas and the long-term average of the corresponding market indices (averages calculated over the period 2002-2010). The Sharpe ratio is equal to the ratio between the expected excess return and the observed portfolio standard deviation.

aversion derived from survey data and described in Appendix A) affect the probability of having risky assets, but not the composition of the risky asset portfolio. In this case too, the Sharpe ratio is higher for high literate investors.[12] Notice though that the difference is economically small, being 0.4 percentage points (between 5 and 10% of the sample mean).

4.3. *Avoiding biased advices*

Literacy may provide a better capability to understand the potential conflict of interest between the individual investor and the seller of financial products and may also discourage the intermediary from taking advantage of the investor. We test this prediction by looking at whether the placement of own bonds with bank's customers is more intense when the bank needs to raise liquidity and its access to the liquidity market is limited. Hence, pushing customers to liquidate investments in other intermediary assets (such as shares of mutual funds) and buy the own bond becomes an attractive alternative to obtain liquidity - de facto passing over risk to customers.

Figure 5, panel A reports the fraction of people who hold the bonds issued by the bank in each months covered by our sample, distinct by high and low financial literacy. Panel B reports the bank's Credit Default Swap (CDS). There are three noteworthy features. First, until the beginning of 2008, the fraction of bondholders is roughly stable and not different between high and low literacy investors. During 2008, a somewhat higher fraction of high literacy investors buy the bonds issued by the bank, which is consistent with the recommendation of the CAPM model (see Section 3.2). After the collapse of Lehman Brothers the fraction of those who hold bonds issued by the bank increases sharply. This is precisely the time when the bank incentive to place bonds becomes strongest while the investor interest to divest in this instrument is highest.[13] At first glance, during this phase, there seems to be relatively little difference between the two types of investors, except perhaps for a slightly flatter trend for the highly financially literate. Hence, it seems that financial literacy offers little protection against potentially biased advices.

However, a more formal test of whether investors that score higher on financial literacy understand better the advisor's potential conflict of interest, requires a measure of the latter. Since the incentive to exploit the conflict of interest becomes stronger as the bank access to the market for liquidity worsens, we proxy it with the bank CDS which starts increasing sharply after the Lehman default (Figure 5, panel B). Accordingly, we estimate the following models:

$$A_{it} = \delta_0 + \delta_1 CDS_t + \delta_2 L_i \times CDS_t + \delta_3 r_t + f_i + e_{it} \qquad [3]$$

[12] From the estimated expected excess return we have also calculated the portfolio idiosyncratic risk, equal to the variance of the error term, and corresponding to the share of portfolio returns which is not explained by the market indices (see also Calvet, Campbell and Sodini, 2007). We have regressed this measure of idiosyncratic risk on financial literacy. Our results confirm that, compared to low literate investors high literate people have more diversified portfolios and lower idiosyncratic risk (by around 15 percent).

[13] In terms of portfolio shares, in our sample the fraction of financial wealth invested on average in the bank's bonds has increased by around 10 percentage points after the Lehman default.

$$A_{it} = \delta_0 + \delta_2 L_i \times CDS_t + \delta_4 T_t + f_i + e_{it}$$

where A_{it} is a dummy variable =1 if in month *t* the investor i purchases the bank's bonds, CDS_t is the bank's Credit Default Swap in month *t*, L_i investor's *i* financial literacy dummy, r_t represents an index of the total return on the bonds issued by the bank, f_i and T_t are investor and time fixed effects, respectively. The difference between the two models is that in the second we capture the direct effects of the CDS and the return on the bond with the time dummies which also pick up any other time-varying common effect. If CDS captures the strength of the incentive to take advantage of conflict of interest its effect should be positive, once we control for the return on the bank's bonds. Obviously since literacy only varies across individuals any effect it may have on the investor decision to buy the bank's bonds is absorbed by the fixed effect f_i. The null that financial literacy helps consider the possibility of a conflict of interest entails $\delta_2 < 0$.

We estimate models [3] with a linear probability model and report the results in Table 5. In columns (a) and (b) the sample is composed of all individuals, observed each month from January 2007 to October 2009. Controlling for the return on the bank's bond, the CDS has a strong positive effect on the probability of buying the bank's bonds implying that investors are more likely to invest in bonds issued by their bank when the probability of default of that bank increases. This is consistent with investors being pushed to buy by the seller rather than by their own choice. In fact, controlling for the bond return, investors should be *less* likely to invest in the bond when the probability of default as incorporated in the CDS increases.[14] Interestingly, the interaction between the CDS and the level of financial literacy is negative and statistically significant (*p*-value 0.021) but its effect is economically very small. This suggests that financial literacy is likely to offer poor protection against potentially distorted advice. In columns (c) and (d) the sample is composed of investors who also had mutual funds[15] in January 2007. The variable A_{it} is now equal to 1 if in the same month *t* the investor i both purchases the bank's bonds and sells mutual funds. This investor not only buys bonds when the associated (uncompensated) risk increases, but also, by selling mutual funds, reduces the degree of diversification on his portfolio. The results are in the same ballpark of the previous ones and confirm the small effect of financial literacy in protecting investors against potentially distorted advices.

To further investigate this issue we estimate a second model where we use information available in the bank's survey on how much investors delegate their financial investment decisions to the intermediary/advisor. In particular we specify and estimate:

[14] Our control for bond return is the total return on one of the main bond issue available to individual investor during that period. As a robustness check we have run regressions using returns on different issues. Findings are similar to those reported.

[15] We include also those who sell EFT and managed accounts.

$$A_{it} = \lambda_0 + \lambda_1 L_i \times D_i + \lambda_2 L_i + \lambda_3 D_i + \lambda_4 Z_i + \lambda_5 L_i \times CDS_t + \lambda_6 D_i \times CDS_t + \lambda_7 D_i \times CDS_t \times L_i + \lambda_8 T_t + e_{it}$$

$$A_{it} = \lambda_0 + \lambda_5 L_i \times CDS_t + \lambda_6 D_i \times CDS_t + \lambda_7 D_i \times CDS_t \times L_i + \lambda_8 T_t + f_i + e_{it} \qquad [4]$$

where D_i is individual i level of delegation of financial decisions to the advisor/intermediary and the other variables are defined as before. More precisely, D_i is defined as a dummy equal to 1 if the investor delegates totally or partially his investment decisions to the financial intermediary, as reported in the survey (see also Appendix A), and to 0 if he only extracts information from the advisor or does not seek advices. Individuals who delegate their decisions are potentially even more exposed to the exploitation of conflicts of interest than people who only extract information from the advisor and then decide by their own whether to use it or not. Yet, this incentive may be tempered when the advisor faces a high literacy investor as he anticipates that the investor may find it out (Inderst and Ottaviani, 2012). We capture this effect with the interaction between the level of delegation and the bank incentive to exploit conflicts of interest as measured by the bank CDS, as well as with a third-level interaction between literacy, delegation and the CDS, Hence we would expect that $\lambda_6 > 0$ (those who delegate are more exposed to conflicts of interest) and $\lambda_7 < 0$ (this risk is tempered if the investor has a high financial literacy, e.g. because he could anticipate the incentives of the intermediary to sell its own bonds when the CDS increases). The first specification of the model allows for a direct effect of delegation, literacy and their interactions, as well as for the interaction between literacy and the CDS (as in Table 5) and for a vector of individual variables Z_i. The second specification adds individual fixed effects and hence drops all terms that only vary across individuals. Notice that all models include time effects and thus we do not need to control for the return on the bonds issued by the bank.

Results are shown in Table 6. As before, columns (a) and (b) refer to all the sample. Focusing on the variables of interest the first columns indeed shows a positive coefficient on the interaction between delegation and the CDS, significant at the 5%. Thus, as the bank CDS increases, investors who delegate decisions are more likely to buy the bonds issued by their bank than investors who do not delegate, consistent with delegators being more exposed to the potentially distorted advices of the intermediary. However, this effect is tempered by financial literacy as the negative coefficient on the three-way interaction term between delegation, literacy and the CDS shows. Columns (c) and (d) of Table 6 report the results for those who both sell mutual funds and buy bank's bond. The results confirm that delegators are more likely to follow this investment strategy and that the effect is tempered for high-literacy investors. Also in this case however the effect of literacy is very small.

5. Conclusions.

Over the past decade the participation of households to financial markets increased considerably. This has raised concerns about the ability of the median household to cope with increasingly complex financial decisions, backed by sound evidence that many households fail in basic financial literacy tests. While there has been considerable improvement in the measurement of financial literacy, the progress made in showing whether literacy is really helpful in mitigating financial mistakes is much less satisfactory. One reason is that in many instances it is not clear what is the "right" financial decision. For instance, showing that high-literacy investors are more likely to participate in the stock market is surely consistent with the idea stock market participants conform to the prediction of Mertonian normative portfolio models predicting that utility maximizing agents should all invest in stocks. But it is also consistent with low-literacy investors facing higher (unobserved) participation costs. Yet, progress along this dimension is crucial in order to assess the basis for financial education programs that several policy bodies are starting to launch (see e.g. OECD, 2009).

In this paper we move a step in this direction by testing the benefits of financial literacy looking at three financial decisions where there is a clearly dominated alternative and thus a well defined financial mistake, i.e. choosing the dominated alternative when an unambiguously better option is available. We find that along the dimensions that we consider – selling stocks when the market is high rather than when it is low (ability to time the market), rebalancing according to a CAPM prescription (ability to manage one's investment) and avoiding distorted advice (ability to detect potential conflicts of interest) – financially literate investors do better than those with lower levels of literacy. But differences between the two groups are economically small, while in both groups the fraction of investors choosing the dominated alternative is large. Both features suggest that gains from increasing financial illiteracy may be modest.

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Table 1

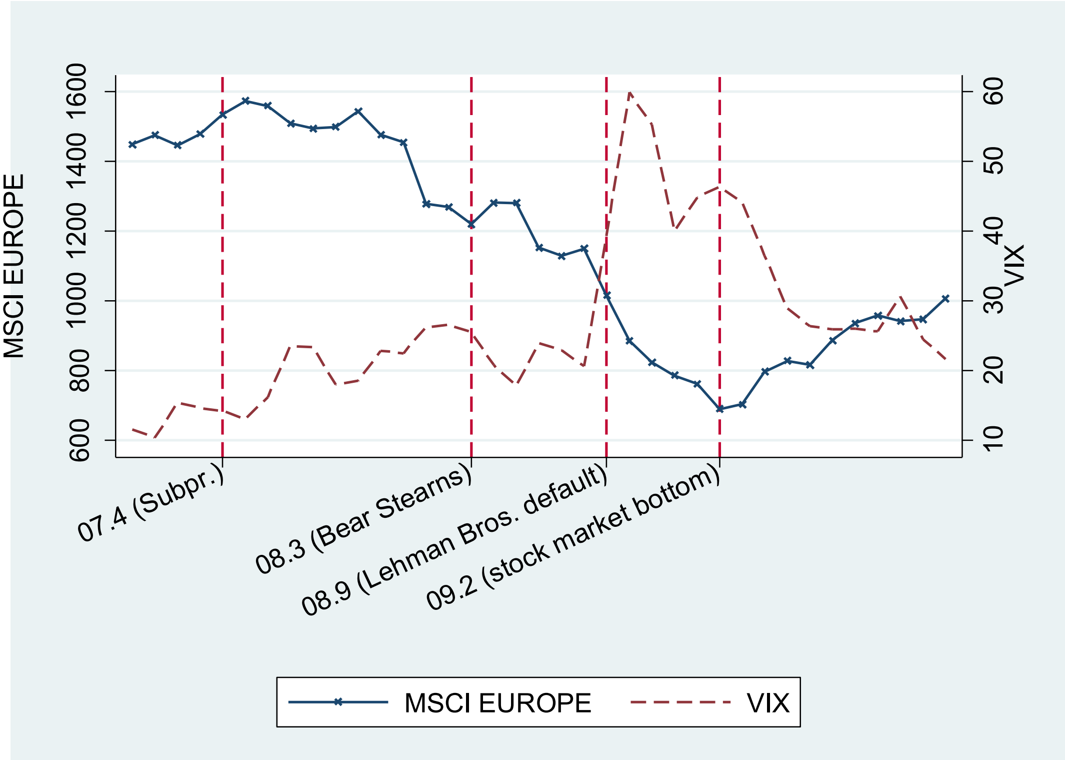
Sample descriptive statistics for high and low financial literacy and for the whole sample

	Low fin. literacy	High fin. literacy	Total sample
%	43.2	56.8	100.0
Males (share)	67.0	71.4	69.5
Has university degree or higher (share)	23.0	29.2	26,5
Has high school degree (share)	43.9	45.3	44,7
Has compulsory education (share)	33.1	25.6	28,8
Age (sample mean)	55.4	53.8	54.5
Age (standard error)	[12.1]	[12.4]	[12.3]
High risk aversion (share)	32.6	34.8	33.9
Delegation (share)	35.1	32.7	34.1
Wealth (sample mean)	119,369	120,830	120,199
Wealth (standard error)	[129,368]	[117,211]	[122,604]
Risky asset ownership (all assets)	78.2	81.9	71.0
--Stock holder	53.3	54.2	53.9
--Corporate bonds holder	53.3	53.8	53.6
--Long-term government bonds holder	11.9	13.0	12.5
Risky assets values (sample mean, euro)	100,595	100,035	100,277
Risky assets values (standard error, euro)	[106,261]	[90,189]	[97,350]
--Stock holder (sample mean, euro)	61,377	58,370	59,669
--Stock holder (standard error, euro)	[67,067]	[62,928]	[64,742]
--Corporate bonds holder (sample mean, euro)	60,073	61,703	60,999
--Corporate bonds holder (standard error, euro)	[79,114]	[60,285]	[69,000]
--Long-term govern. holder (sample mean, euro)	55,542	62,070	59,250
--Long-term govern. holder (standard error, euro)	[62,305]	[69,900]	[66,969]
Total return on risky assets (per month, sample mean)	.0035	.0031	.0032
Total return on risky assets (per month, standard err.)	[.0394]	[.0356]	[.0373]
Memo: --MSCI Europe (in euro) *(B_s)*	-.0109	-.0109	-.0109
--Emu corporate index *(B_c)*	.0030	.0030	.0030
--Citigroup gov. bonds 7-10 *(B_g)*	.0050	.0050	.0050
Observations			
--individuals	682	894	1,576
--all (full period Dec. 06-Oct 09)	23,870	31.332	55,202

Survey and administrative data of the bank and market indices. Percentages, sample means (in euro) and standard errors within squared brackets. High literate people are those who answered correctly to at least 5 out of 8 questions on financial literacy in the questionnaire (see Appendix A). Low literate people are defined symmetrically. Risk aversion is a dummy equal to 1 if investors are classified as risk averse according to the two sets of questions on risk aversion included in the survey (see Appendix A). Delegation is a dummy equal to 1 if an investor declares that she delegates her investment decisions to her bank consultant. Wealth is equal to the sum of cash, safe assets and risky assets. Risky assets include stocks, corporate bonds and long-term government bonds. The total returns on risky assets are calculated on the basis of the monthly value of assets and net purchases/sales occurred between two consecutive months.

Fig. 1

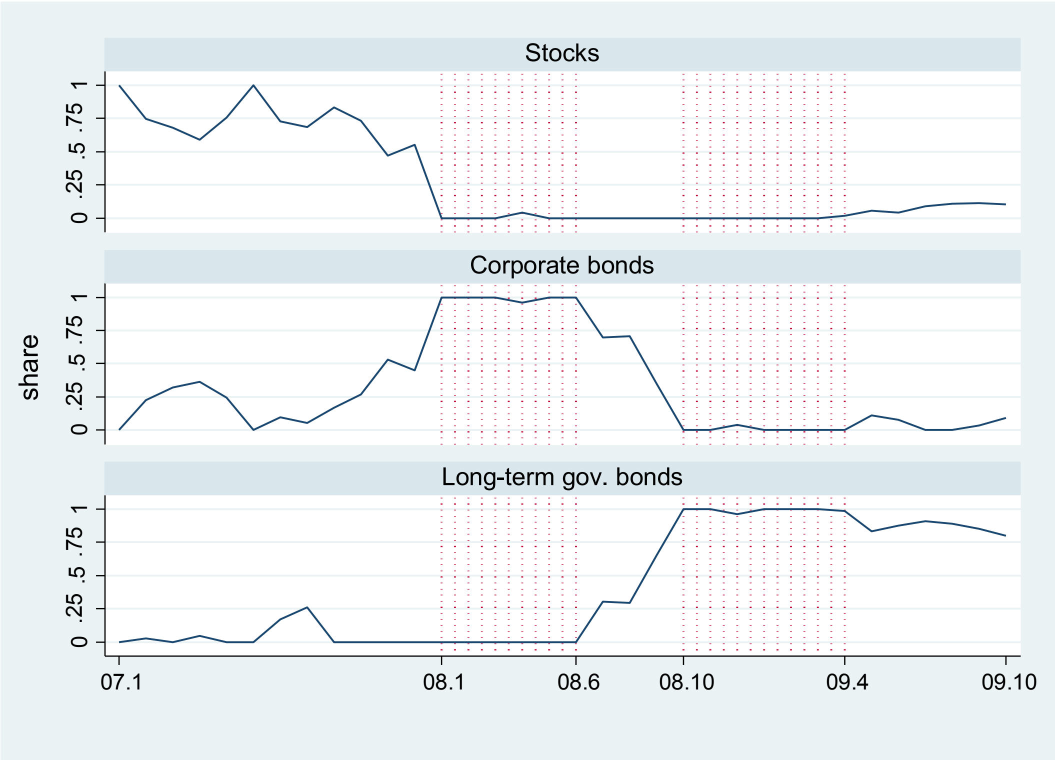
Stock market returns and volatility: MSCI Europe and VIX.



Values of the MSCI-Europe in the left-hand scale, values of the VIX in the right-hand. Monthly averages. MSCI Europe expressed in euro by the use of the monthly average of the euro/$ exchange rate.

Fig. 2

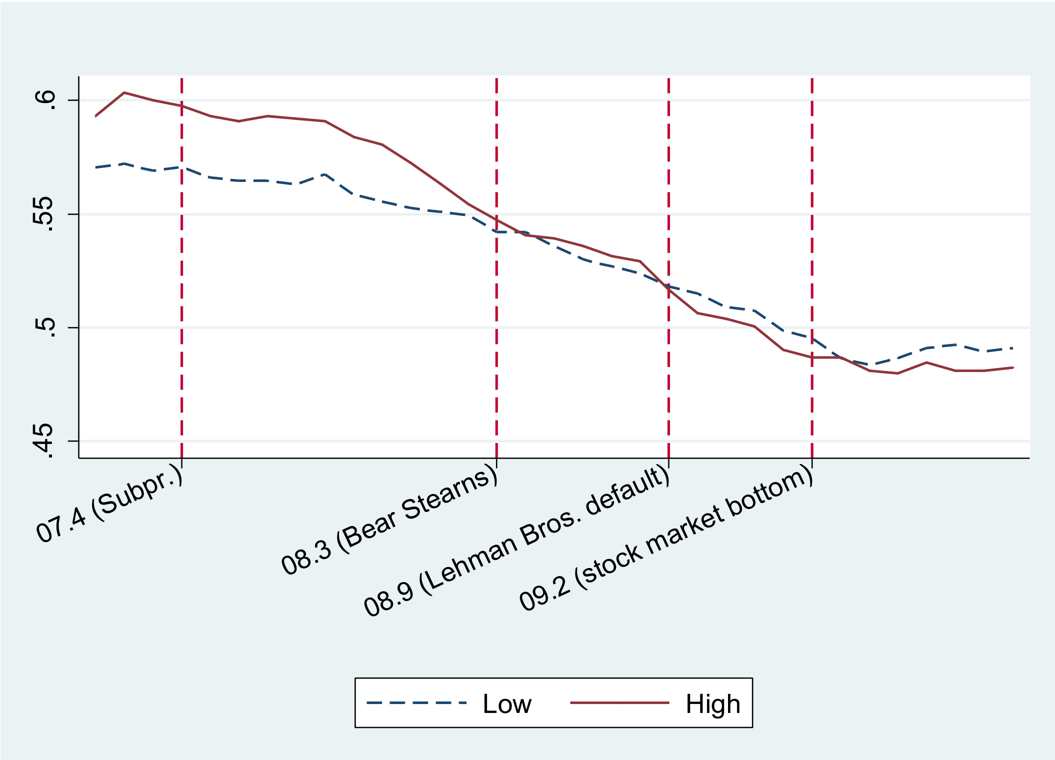
Optimal portfolio proportions according to a mean-variance efficiency criterion.



Calculation based on monthly financial market total return indices. MSCI Europe (in euro), for the stock market; the Merril Lynch Emu corporate bond index for the corporate bond market and the Citigroup government bond index 7-10 years for the government bond market. Optimal shares maximize the excess return of the portfolio at the lowest variance, under the constraint of non-negative shares. Excess returns are calculated with respect to the monthly average of the overnight interest rate. Each month the variance-covariance matrix of excess returns refers to the previous 12 months.

Fig. 3

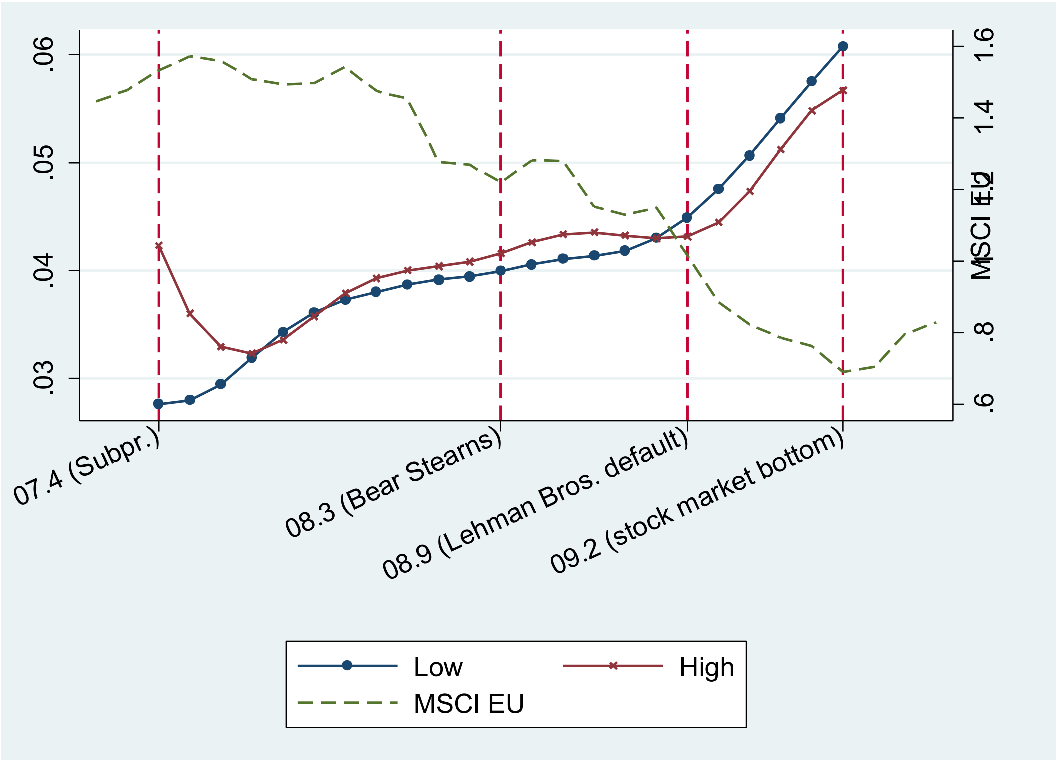
Timing the market. Probability of participating to the stock market for high and low financial literacy investors



The figure shows the pattern of the probability of selling all stocks in the portfolio. Stocks include directly owned stocks, mutual funds and segregated accounts with prevalence of stocks.

Fig. 4

Timing the market. Stock market leavers. Distribution of the time of exit from the stock market during the period April 2007-Febryary 2009 for investors with high and low financial literacy



Right scale: MSCI Europe (in euro). Left scale: Distribution of the time of exit for investors with low and high financial literacy for each month from April 2007 to February 2009. The sample is composed of investors who had positive stocks in March 2007 and exit the market at any time between April 2007 and February 2009.

Table 2

Stock market leavers, financial literacy and the time of exit.

(Cox proportional hazard model. P-values within brackets.)

	(a)	(b)	(c)	(d)
High financial literacy	1.247	1.253*	1.260*	1.274*
	[0.105]	[0.100]	[0.093]	[0.077]
Financial wealth (logs)			0.860**	0.887*
			[0.040]	[0.096]
Socio-demographic characteristics	No	Yes	No	Yes
Observations	216	216	216	216
Probability of exit before or at time *t*				
Low literacy				
t= 1 month after the stock market peak	2.4	3.0	2.4	2.0
t= Bear Stearns	36.1	43.2	35.9	31.7
t= Lehman	52.5	61.2	52.3	47.3
High literacy				
t= 1 month after the stock market peak	3.1	3.8	3.0	2.6
t= Bear Stearns	43.6	50.7	42.9	38.5
t= Lehman	61.4	69.5	60.6	55.8

The upper part of table shows the estimates of a Cox proportional hazard models for the period April 2007 (US subprime crisis)-February 2009 (stock market bottom). Coefficients larger than 1 correspond to a positive effect of the variable on the hazard and a shorter survival time (i.e. earlier exit from the stock market). Models (b) and (d) include also sex, age, age squared, dummies for high school and university degree education attainment. Investors' financial wealth in March 2007 (in logs). Robust standard errors. *P*-values in brackets; (**) significant at 5%, (*) significant at 10%. The bottom part of the table reports the 1-survival function. Low literacy individuals correspond to the baseline case, where all independent variables are set equal to zero. The survival function for high literacy individuals is calculated by setting all covariates equal to zero with the exception of financial literacy.

Table 3

Probability of following the prescriptions of the CAPM.

(Probit model, marginal effects, p-values within brackets)

	Period 1: January – June 2008. Selling stocks and buying corporate bonds					
	Buy bonds		Sell stocks		Do both	
	(1.a)	(1.b)	(1.c)	(1.d)	(1.e)	(1.f)
High literacy	0.043*	0.044*	0.042*	0.041*	0.026*	0.026*
p-values	[0.076]	[0.071]	[0.084]	[0.080]	[0.098]	[0.075]
Socio-demographic var.	Yes	Yes	Yes	Yes	Yes	Yes
Portfolio shares	No	Yes	No	Yes	No	Yes
Sample size	869	869	869	869	869	869
Estimated probabilities (1)						
Low literate	11.9	11.8	12.0	10.7	4.1	3.3
High literate	16.2	16.2	16.2	14.8	6.9	6.1

	Period 2: October 2008 – April 2009. Selling corporate bonds and buying long-term government bonds					
	Sell corp. bonds		Buy gov. bonds		Do both	
	(2.a)	(2.b)	(2.c)	(2.d)	(2.e)	(2.f)
High literacy	0.060*	0.059*	0.012	0.009	0.015*	0.010*
p-values	[0.026]	[0.026]	[0.261]	[0.321]	[0.055]	[0.068]
Socio-demographic var.	Yes	Yes	Yes	Yes	Yes	Yes
Portfolio shares	No	Yes	No	Yes	No	Yes
Sample size	843	843	843	843	843	843
Estimated probabilities (1)						
Low literate	14.0	13.2	1.7	1.4	0.4	0.2
High literate	20.1	19.2	2.9	2.2	1.9	1.2

Socio-demographic characteristics included in the models are sex, age, age squared and dummies for the highest educational attainment (compulsory education, high school, university degree). In period 1 the sample includes those who owned stocks in December 2007. In period 2 the sample includes those who owned corporate bonds in September 2008. Predicted probabilities are calculated at the average of all independent variables; *p*-values in brackets; (**) significant at 5%, (*) significant at 10%. (1) Calculated at the average of all the independent variables with the exception of financial literacy.

Table 4

January 2007- October 2009: Sharpe ratio and financial literacy

(OLS and Heckman selection model, p-values within brackets)

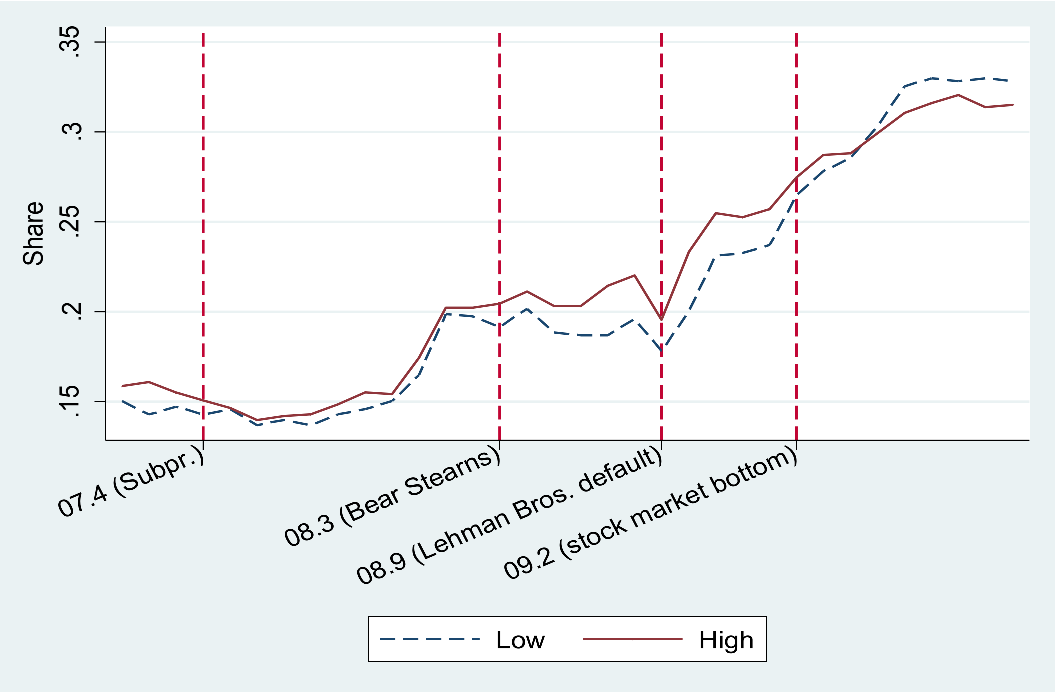
	(a)	(b)	(c)	(d)
High financial literacy	0.005**	0.004*	0.004*	0.004*
	[0.038]	[0.063]	[0.063]	[0.069]
Wealth at the beginning of the period		0.001		-0.00001
		[0.517]		[0.790]
Socio-demographic characteristics	No	Yes	Yes	Yes
(c) Selection process (Heckman)				
Wealth in December 2006			0.003**	
			[0.000]	
Mill's ratio			-0.004	
			[0.515]	
(d) Selection process (Heckman)				
Degree of risk aversion				-0.118*
				[0.096]
Mill's ratio				-0.012
				[0. 674]
Sample size	969	969	1,530	1,530
Estimated Sharpe ratio (1)				
Low literacy	0.049	0.049	0.052	0.066
High literacy	0.054	0.053	0.056	0.070

Socio-demographic characteristics included in the models are sex, age, age squared and dummies for the highest educational attainment (compulsory education, high school, university degree). Selection process for the probability of having risky assets. Degree of risk aversion is defined as a dummy equal to 1 if the person declares to be risk adverse both in case of gain and in case of loss at the hypothetical lottery and zero otherwise (see Appendix a). The predicted probability is calculated at the average of all independent variables; *p*-values in brackets; (**) significant at 5%, (*) significant at 10%. (1) Calculated at the average of all the independent variables with the exception of financial literacy.

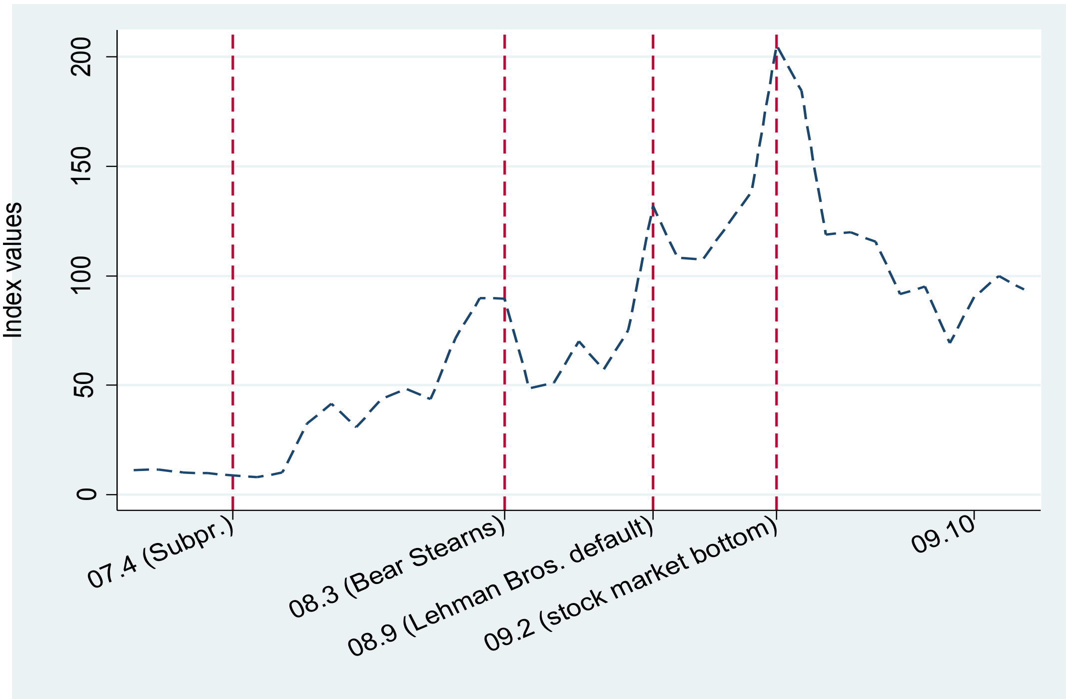
Fig. 5

Probability of holding bonds issued by the bank and bank's CDS

A. Fraction holding the bank's bonds



B. Bank's CDS



Calculations based on the survey and market index data. (a) Probability of positive share of bank's bonds in total wealth of investors (b) Bank's CDS 5 year senior.

Table 5

Probability of buying the bank's bonds each month between January 2007 and October 2009, as function of the bank CDS.

(Linear probability model; p-values within brackets)

	Probability of buying bonds issued by the bank		Probability of buying bonds issued by the bank and selling mutual funds	
	(a)	(b)	(c)	(d)
CDS ('00)	0.0073***		0.0028*	
	[0.000]		[0.098]	
High financial literacy *CDS('00)	-0.0043**	-0.0043**	-0.0036**	-0.0036**
	[0.021]	[0.020]	[0.045]	[0.042]
Bank Bond total return	0.0059***		0.0038***	
	[0.0000]		[0.000]	
Individual fixed effects	Yes	Yes	Yes	Yes
Time dummies	No	Yes	No	Yes
Observations	52,064	52,064	26,260	26,260
Estimated probabilities (1)				
Low literate	1.3	1.3	0.7	0.7
High literate	0.9	0.9	0.4	0.4

In columns (a) and (b) the dependent variable is a dummy =1 if the investors buys the bank's bonds in a given month, that is he has a positive net flow into bank's bonds. In columns (c) and (d) the dependent variable is a dummy =1 if the investors buys the bank's bonds in a given month (a positive net flow into bank's bonds) and sell mutual funds, ETF and/or segregated accounts in the same month or the previous month (negative net flow). Models (a) and (c) include the total return on a bank's bond (fixed rate 4% 2006-2014). *p*-values in brackets; (**) significant at 5%, (*) significant at 10%. (1) Calculated at the average of all the independent variables with the exception of financial literacy.

Table 6

Period January 2007-October 2009.
Delegation and monthly probability of buying bonds issued by the bank, by financial literacy.

(p-values within brackets)

	Probability of buying bonds issued by the bank		Probability of buying bonds issued by the bank and selling mutual funds	
	(a)	(b)	(c)	(d)
High literacy	0.0018		0.0002	
	[0.319]		[0.888]	
Delegation	0.0018		0.0037	
	[0.588]		[0.195]	
High fin. literacy*Delegation	0.0004		0.0038	
	[0.931]		[0.363]	
High literacy*CDS('00)	-0.00004	-.0025	-0.0022	-0.0020
	[0.112]	[0.215]	[0.235]	[0.296]
Delegation*CDS('00)	0.0079**	0.0080**	0.0072**	0.0078**
	[0.035]	[0.030]	[0.027]	[0.022]
Delegation*High Literacy *CDS('00)	-0.0116**	-.0117**	-0.0078*	-0.0086
	[0.031]	[0.027]	[0.099]	[0.087]
Socio-demographic charact.	Yes	No	Yes	No
Time dummies	Yes	Yes	Yes	Yes
Individual fixed effects	No	Yes	No	Yes
Sample size	52,156	52,156	26,260	26,260
	Probability of buying bank's bonds for those who delegate, by financial literacy (in percentage points) (1)			
Low literate investors	1.1	1.1	1.5	1.5
High literate investors	1.0	1.0	0.6	0.6

In columns (a) and (b) the dependent variable is a dummy =1 if the investors buys the bank's bonds in a given month, that is he has a positive net flow into bank's bonds. In columns (c) and (d) the dependent variable is a dummy =1 if the investors buys the bank's bonds in a given month (a positive net flow into bank's bonds) and sell mutual funds, ETF and/or segregated accounts in the same month or the previous month (negative net flow). The variable delegation is a dummy equal to 1 if the person declares that he/she fully delegates his/her investments to the bank's consultant and 0 otherwise. The predicted probability is calculated at the average of all independent variables; *p*-values in brackets; (**) significant at 5%, (*) significant at 10%. (1) Calculated at the average of all the independent variables with the exception of financial literacy and delegation, the last being equal to 0.

Appendix A

The Survey

The survey used in this paper draws on the population of clients of one Italian bank and collects data on around 1,600 individuals. Interviews are conducted by the use of CAPI.

The sample is representative of the eligible population of customers, excluding customers less than 20 years old or older than 80, and those who hold accounts of less than 10,000 or more than 2.5 million euro. The sample is stratified by geographical area of residence (North-East, North-West, Central and Southern Italy), city size (less that 30,000 inhabitants and more), and financial wealth. The survey goal is to collect information useful to study retail customers' financial behavior and expectations.

The survey has detailed information on households' demographic structure, individuals' financial assets holding (both within and outside the bank), real wealth components and income. It has data relevant for financial decision taking such as financial literacy, but also trading experience and practice, assets knowledge and confidence in markets, attitudes towards saving and financial investment, propensity to take financial risk, retirement saving and life insurance.

In this study we use a set of questions aimed at measuring financial literacy. We calculate an index of financial literacy obtained by combining the answers to 5 questions which test the financial capability of the sample in different domains.

The questions are:

1. Suppose that in the next 6 months the interest rate will go up. Is it a good idea to buy fixed interest rate bonds today?
2. Suppose that a saving account earns 2 percent per year, net of costs and taxes. Assume that the inflation rate is equal to 2 percent. After 2 years, do you think you could buy (more/less/the same) than today?
3. What does the concept "financial diversification" mean? Possible answers are: (1) to hold stocks and bonds; (2) Do not hold too long the same asset; (3) To invest in as many as assets as possible; (3) To invest simultaneously in many assets to limit risk exposure coming from a single financial product; (4) To do not invest in risky assets.
4. Among the following portfolios what is the most diversified? (i) 70% invested in government bonds and 30% in a European equity fund; (ii) 70% in government bonds, 15% in a European equity fund and 15% in 2 or 3 stocks; (iv) 70% in government bonds and 30% in 2 or 3 stocks; (v) 70% in government bonds and 30% in 1 stock that I know very well.
5. Can you order the following financial products according to their riskiness? Bonds, transaction accounts, stocks, equity mutual funds, housing. We detect a correct answer when the ranking of the respondent satisfies the following inequalities (4 possible correct answers): (i) bonds are at least as risky as transaction accounts; (ii) stocks are at least as risky as bonds; (iii) equity mutual funds are at least as risky as bonds mutual funds; (iv) housing is riskier than transaction accounts.

From the questions 1-5 we obtain a set of 8 answers. Correct answers are identified by a dummy =1 (=0 otherwise). The index of financial literacy is the sum of the 8 dummies and ranges from 0 (all answers were incorrect), to 8 (all answers were correct).

Survey data are used also to get additional control variables. The first is aimed at capturing investors' risk aversion and it is based on two questions on hypothetical lotteries. The first regards an investment opportunity. Investors are asked to declare how much they would be willing to receive with certainty to avoid the participation to a lottery which allows them to gain 10,000 euro or nothing with probability ½. They have to choose among 10 possible answers ordered by increasing risk aversion. Possible answers are: (1) 100 euro; (2) 500; (3) 1,500; (4) 3,000; (5) 4,000; (6) 5,000; (7) 5,500; (8) 7,000; (9) 9,000, (10) 10,000. The second is about an investment loss.

Investors have to state how much they would be willing to pay to avoid a lottery where they loose 10,000 or nothing with probability ½. Possible answers are the same of the previous question but in descending order. We construct a dummy equal to 1 if they answer from 1 to 4 to both questions (i.e. they are adverse to risk).

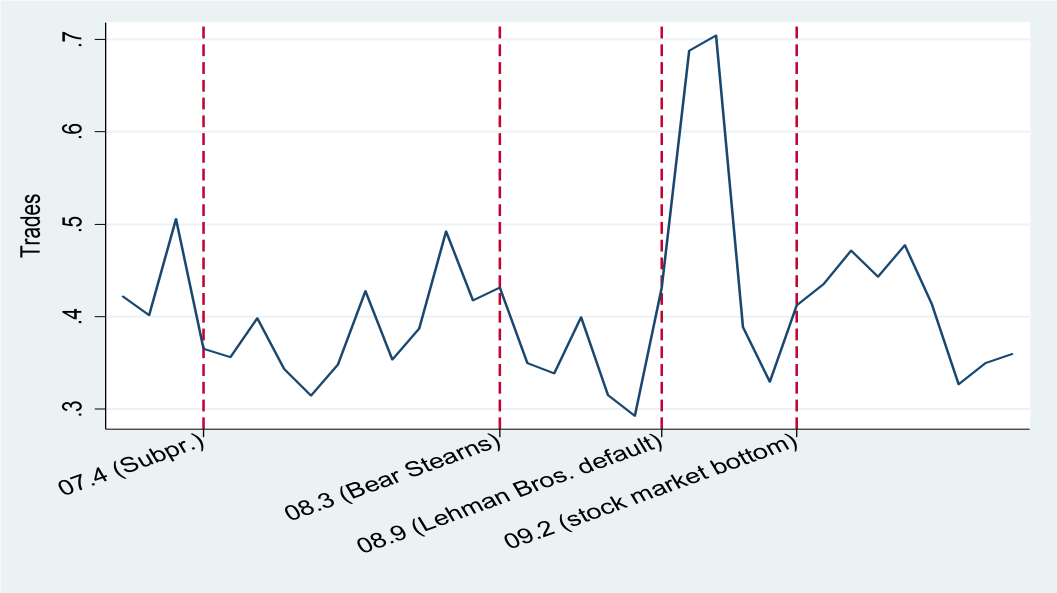
The second variable that we use captures the degree of delegation of individuals when taking investment decisions. In the survey individual investors are asked whether and to what extent they delegate decisions to their bank consultants, or are totally autonomous. Possible answers are: (1) Fully autonomous, (2) Autonomous, but ask for advices; (3) Ask for advices and choose among proposed alternatives (4) Mainly delegating (5) Fully delegating. We set a dummy equal to 1 if the person is fully dependent on the advices of bank consultants and 0 otherwise.

The administrative records

For the same sample of clients participating to the survey we have administrative data containing information on the stocks and on the net flows of several assets categories, available at monthly frequency from January 2007 to October 2009 (also data on stocks in December 2006 are also available). Stocks are valued at the market value at the end of the month. A positive net flow between month t and month $t+1$ records an asset purchase, a negative net flow an asset sale. A zero value of the flow signals that the investors made no net trade in that month and that changes in the value of the asset between time t and $t+1$ are only due to price changes. The administrative data are available for around 1,500 investors instead of 1,600 participating to the 2007 survey. This loss of information is partly due to the fact that some households left the bank after the interview, and partly due to some reporting error in the investor identifier. Since the administrative record registers both the stock of each asset category at the end of the period as well as the net trading flow into that category, we can directly identify trading decisions. Trades are defined as a positive (negative) net flow recorded for an asset category between time t and time $t+1$. Elementary asset categories are: cash, monetary mutual funds, short-term government bonds (*Buoni Ordinari del Tesoro, BOT*), repos, directly owned stock (both Italian and foreign), stock-based mutual funds, ETF, and managed accounts, bonds issued by the bank, other corporate bonds (both Italian and foreign) and corporate bond mutual funds, long-term government bonds (*Buoni Pluriennali del Tesoro, BTP*) and other government bonds. Fig. a1 reports the average number of trades undertaken each month by the sample of investors. For each elementary asset category, as well as for the main aggregates (stocks, corporate bonds and long-term government bonds) we can also get a proxy of the asset return, equal to the change in the value of the asset from the beginning to the end of the period, plus/minus the amount eventually traded (sell/purchase) during the same period.

Fig. a1

Average number of trades in risky assets per month



Full sample. Trades are defined as positive/negative net flows recorded in a given month for any of the elementary components of risky asset (i.e. national and foreign stock, ETF, stock mutual funds, segregated accounts, corporate bond issued by the bank, other corporate bonds, corporate bond mutual funds, long-term government bonds).

Appendix B

The Global Financial Crisis timeline

February 2007	HSBC announces losses linked to US subprime mortgages. New Century Bank, based in California and specialized in subprime declares that it would delay reporting due to the need to restate 2006 earnings. New Century Bank is often considered as the "zero patient" of the Global Financial Crisis.
April 2007	New Century Bank files for Chapter 11 bankruptcy protection and cuts half of its workforce.
June 2007	Problems in mortgage and credit markets spill over into interbank money markets.
August 9, 2007	The US subprime mortgage market crisis reaches Europe. Two hedge funds owned by Bear Stearns collapse. BNP Paribas announces that it was ceasing activity in three hedge funds specialized in US mortgage debt.
February 2008	In UK Northern Rock is nationalized.
March 16, 2008	Fallout of Bear Stearns. JP Morgan agrees to buy Bear Stearns in a transaction facilitated by the US government.
September 6, 2008	Fannie Mae and Freddie Mac placed into conservatorship by the US Treasury.
September 15, 2008	Lehman Brothers files for Chapter 11 bankruptcy protection
November, 2008- January 2009	The US authorities agree to support Bank of America through a preferred equity stake and guarantees for a pool of troubled assets. During these months the US authorities also present several plans for comprehensive measures in support of the financial sector. G7 Finance Ministers and central bank Governors in many circumstances affirm their commitment to use the full range of policy tools strengthen the financial sector and to support growth and employment.
February 2009	The stock market hit bottom. The MSCI Europe (in euro) was around -60% than in May 2007 (the peak).