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"ITALIAN HOUSEHOLD FINANCIAL INVESTMENTS DURING AND AFTER THE GREAT RECESSION"

RELATORE:

CH.MO PROF. GUGLIELMO WEBER

LAUREANDO: GIUSEPPE FLOCCARI

MATRICOLA N. 1106670

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Abstract

This work examines trends and developments of Italian household financial investments before, during and after the Great Recession. We first of all document the very low fraction of households that invest in the financial markets and how this fraction declined strongly during the last 15 years. In order to explain these patterns, we focus on the role of risk aversion, participation costs, trust and financial literacy in determining risky investment attitudes. We provide a theoretical discussion of how these factors can determine non participation and we address the issue empirically, by means of an econometric analysis. Coherently with the literature and the predictions of the theory, we find that poorer, lower educated and more risk averse households are less likely to hold risky financial assets. They are also more likely to have exited the stock market following the financial crisis of 2007-2008, possibly reflecting a loss in wealth, given the fixed participation cost. We also conjecture that a decrease in the level of trust following the financial crisis is a concurrent driver of the drop in participation and the main reason of the exit of richer and better educated households.

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Introduction

Household portfolios started drawing researchers' attention during the '90s. Since then, a large literature has developed, focused on understanding the drivers of household financial decisions. Campbell (2006) in his presidential address to the American Economic Association, coined the term "household finance" to define the branch of economics devoted to study how households use financial instruments to attain their objectives. The development of the field has been sustained by the increasing availability of household level comprehensive data on income, consumption, wealth and its composition. Moreover, interest in the topic has been driven by the significant expansion of the set of financial saving instruments available to households during the '90s. Households participation in the stock market, either directly or indirectly through managed investment accounts, increased significantly, both in Europe and the United States. Guiso et al. (2002b) refers to this as the "the phenomenon of the spread of the equity culture". They point out three factors that have been especially important: increasing competition in the financial sector, privatization of public utilities and pension reforms. In addition to these public policies, further incentives for the households to invest in the stock market came from the financial sector itself. Maybe due to the pressure of growing competition, and certainly thanks to technological innovations, financial intermediaries expanded the set of services offered in order to attract new customers. With the diffusion of mutual funds, even small investors could invest in a diversified portfolio, managed professionally. Lastly, we want to point out that the unprecedented stock market boom experienced during the '90s in almost all Western countries has probably been a further incentive to invest in equity, given that, at the same time, interest rates fell significantly, especially in Europe.

Such transformation of household portfolios has been very evident also in Italy. Guiso and Jappelli (2002) reports how the participation rate to the stock market of Ital-

ian households had traditionally been low, compared to other industrialized economies. The median household financial savings were typically in the form of transaction accounts and short term government bonds, and its portfolio poorly diversified. After the complete liberalization of capital movements, and the privatization of many public companies during the '80s and 90's the fraction of households holding stocks rose from 4.5% in 1989 to 7.3% in 1998. Similarly, participation rate in mutual funds increased from 2.8% to 10.6%. Such trends were so striking that Guiso and Jappelli (2002) in their analysis state that *"although some of these features* [regarding low participation] *remain, it appears that Italian households are now in the course of a transition that will lead to a configuration more closely resembling other advanced industrial economies"*. However, such trend stopped abruptly after the stock market crash of 2001. Between 2002 and 2014 there has been a steady decline in the fraction of households participating to the stock market, both directly and indirectly through mutual funds. Moreover, the gap in participation between Italy and other advanced economies has remained wide.

This thesis investigates Italian households attitude towards risky financial investment. In particular, there are two questions that we address: first, why investment in risky assets is so limited in Italy compared to other advanced economies? Second, which are the factors that have caused such a strong reversal in the upward trend of the late 1990s? The former question has been widely investigated in the literature. A large fraction of the households, indeed, do not own stocks neither directly nor indirectly. Such feature has been largely documented both in Europe and in the United States, and has become known as the stock market participation puzzle (Haliassos and Bertaut, 1995). The "puzzle" comes from the fact that, in the presence of a positive equity premium and in the absence of frictions, each expected utility maximizing investor should hold equity. In the literature, many different factors have been considered in order to explain the puzzle. A popular explanation relies on participation costs. In her seminal contribution, Vissing-Jørgensen (2004) shows that if investors face a fixed cost to invest in the stock market, such cost would determine a wealth threshold below which investing is not optimal. Thus, fixed costs are able to explain the strong correlation between financial wealth and stock market participation. However, only a fraction of households participate even at high levels of wealth. This issue can be partly addressed if we consider two components of participation cost: a monetary component, that may represent fees or other transaction costs, and an heterogeneous, non monetary component, cor-

responding to the time and efforts (opportunity costs) needed in order to acquire the knowledge and the information necessary to invest. In this way the participation cost explanation can also rationalize the correlation between stock market participation and financial literacy (van Rooij et al., 2011). Indeed, investors with a limited knowledge of financial markets and investment opportunities may need to spend more time and efforts in order to acquire the information they need. However, there are two features of the data that are difficult to reconcile with this explanation: first, even if these costs are heterogenous, to justify the non participation of rich and literate households they should be extremely high. Second, participation costs are unlikely to have increased during the last 15 years in Italy, thus they are unlikely to have caused the drop in the participation rate. A third evidence that cannot be explained considering only participation costs relates to the wide cross country heterogeneity in stock market participation. The fixed participation costs story cannot account for such differences, unless we assume that there are also extreme differences in the level of these costs by country. Such assumption seems clearly implausible.

In order to explain these patterns, the literature explored other hypotheses. A first one, on which we will focus in chapter two, is that many households do not participate due to a lack of trust in the financial system. The correlation between trust and stock market participation has been emphasized by Guiso et al. (2008). They develop a model in which trust is modelled as a subjective probability of being cheated in the stock market. Given fixed participation costs, a decrease in the level of trust increases the wealth threshold and decreases the optimal share upon investment. Hence, trust can explain the low participation rate of the wealthy, and at the same time, if it has changed during the years, it can also provide an explanation of the decline in the participation rate over the years. Guiso et al. (2008) show also that there is a high correlation between the level of trust measured by the World Value Survey and the participation rate observed at the country level. Thus, trust as a cultural factor can explain also the large differences in household risk taking behaviour in different countries.

However, we also analyze alternative explanations. In particular, we take into account the fact that households may have reduced their investment in risky assets as a consequence of an increase of the background risks to which they are exposed. Bottazzi et al. (2006) show how the long reformation effort of the public pension system has increased household expected retirement age and lowered expected replacement rate.

They also find a partial substitution effect of pension wealth and private wealth, and that households with lower expectations about future pension wealth tend to accumulate more wealth. In a second study, Bottazzi et al. (2011) focus on the portfolio effect of these pension reforms. Once again, they find that the response has been stronger among individuals that have lower expectations about their future. Overall, households responded by increasing their wealth invested in safe assets and real estates. However, Bottazzi et al. (2011) do not find significant effects on stock market participation. Overall, their results seem suggesting that background risk related to pension wealth expectations is unlikely to be the main cause of the reduction in risky investments. Another source of background risk can also be income uncertainty. As shown by Gollier (2002), income risk may lead to a larger share invested in the risk free assets. Taking into account income risk may explain the decline in participation after 2007, and especially after 2012, when unemployment increased dramatically. But, although between 2002 and 2007 unemployment was declining, we still see a decline in the participation rate in those years. A third source of background risk considered in the literature is the substantial share of wealth invested in housing. In most industrialized economies, home ownership rates exceed the 50%. Moreover, the main residence typically represents the bulk of household wealth, with average shares ranging from 50 to 70%. Since the seminal contribution by Grossman and Laroque (1990) many studies predicted that housing should reduce household demand for risky assets, since it increases household exposure to risk and illiquidity. Cocco (2005) proposes a life cycle model in which households optimize their expected utility from consumption and can invest in housing, risk-free and risky financial assets. In his framework, investing heavily in housing reduces financial wealth, thus lowering the potential benefit from stock market investing, and may lead to non participation. He finds also that house price risk crowds out stock holding, especially for what concerns households with low financial wealth.

One last factor that is worth mentioning in this discussion is the role of expectations about the stock market return and volatility. Clearly, lower expected return and higher volatility reduce the risk-adjusted equity premium, lowering the incentive to invest in risky assets. There has been significant recent work about measuring and interpreting household expectations about equity returns and stock market volatility[1]. Using sub-

[1]See Manski (2004) for a discussion about how to measure and interpret household expectations in a survey context. He shows that responses to probabilistic expectations questions are predictive for

jective probabilities of the likelihood of positive equity returns elicited in the Survey of Economic Expectations Dominitz and Manski (2011) postulate the presence of three different types of households, on the basis of their expectations. One is the random walk type, which assumes that returns are i.i.d. over time and uses the historical mean return to predict future returns. Then, they distinguish between a persistence type, who thinks that recent trends will persist over time, and, conversely, a mean reversion type, who predicts that recent trends will reverse in the future. Concerning the Italian case, expectations of persistence may explain the increased participation during the boom and the drop in participation that followed the 2001 and 2008 stock market crashes. Unfortunately, questions on expected returns have not been asked consistently throughout the years in the Survey on Household Income and Wealth that we use in this thesis and they are available only for the post-crisis period, that is, in 2008, 2010 and 2012. Moreover, there are issues with the quality of the data. Many households do not answer to the questions, or give inconsistent answers. We observe also a large fraction of households that report to attach a zero probability to a positive return of the stock market in the following years. We conjecture that this is due to a combination of poor understanding of the questions and a deep lack of trust in the stock market. Such issues, unfortunately, limit our possibilities of analysis; anyway, the role of expectations needs to be kept in mind.

Our empirical analysis addresses both the issue of the scarce participation in the stock market and the issue of the decline in participation over the years. Regarding the former, we estimate the likelihood of holding risky assets through a static logit specification. Given the availability of panel data, we employ different specifications in order to account for individual unobservable effects. Our approach is closely related to Miniaci and Weber (2002). We compare the results of a pooled logit model in which the unobservable heterogeneity is assumed negligible with those of two models in which such heterogeneity is treated as a fixed and a random effect. Consistently with their results, we find that poorer, lower educated and more risk averse households are less likely to participate in the stock market. Moreover, participation is hump shaped over the life cycle, and differs broadly by geographic area, with the likelihood of owning risky assets that is much lower for households resident in the south. Also the relationship between the three models is similar to what reported in Miniaci and Weber (2002).

behavior.

The coefficients estimated from the pooled logit model and the random effect model are similar in sign and magnitude, but a likelihood ratio strongly rejects the null hypothesis of zero serial correlation of the error term within households. Regarding the logit model with fixed effect, or conditional logit, we face the same difficulties they report in estimating the coefficients of variables that change little over time, such as age and family composition.

The models described above share the assumption that the idiosyncratic error terms are serially uncorrelated over time. Thus, they are static models and do not allow to consider the relationship of current ownership status and past ownership. In principle, this relationship could be taken into account in dynamic panel data models. However, the estimation of dynamic panel data models presents two crucial issues: it requires assumptions on the initial conditions of the process and it usually requires long time series in order to distinguish between true and spurious state dependence (Miniaci and Weber, 2002). In order to avoid these issues, we follow Bilias et al. (2010) and resort to a bivariate probit model to estimate jointly the probability of participating in two consecutive periods. The analysis estimates first of all a strong correlation between past and actual ownership status, on the order of 0.6, thus confirming the need to account jointly for both decisions. The results on the determinants of stockholding are in line with the predictions of the static models. We then focus on entry, exit and inertia in stock market participation. Using data from the Panel Study of Income Dynamics for the periods 1994-1999 and 1999-2004, Bilias et al. (2010) find a strong inertia in ownership status. We instead find that inertia is less prevalent in Italy, and that households at each level of wealth and education have significant probabilities to exit the stock market during the periods 2006-2010 and 2010-2014. Conversely, the probabilities of entering is very low. Thus, inertia is strongly prevalent among non participants, but much less common among participants. Consistently with the estimates in Bilias et al. (2010), we find that the probability of exit (entry) decreases (increases) with wealth, income and education.

We argue that a drop in wealth led to the decrease in participation of poorer households, given the fixed participation cost. We conjecture that the decline in the participation of richer and better educated households is due to a decrease in the level of trust. However, due to the scarcity of the data on trust and expectations, and the difficulty of measuring background risk, we cannot disentangle these factors, and assess their indi-

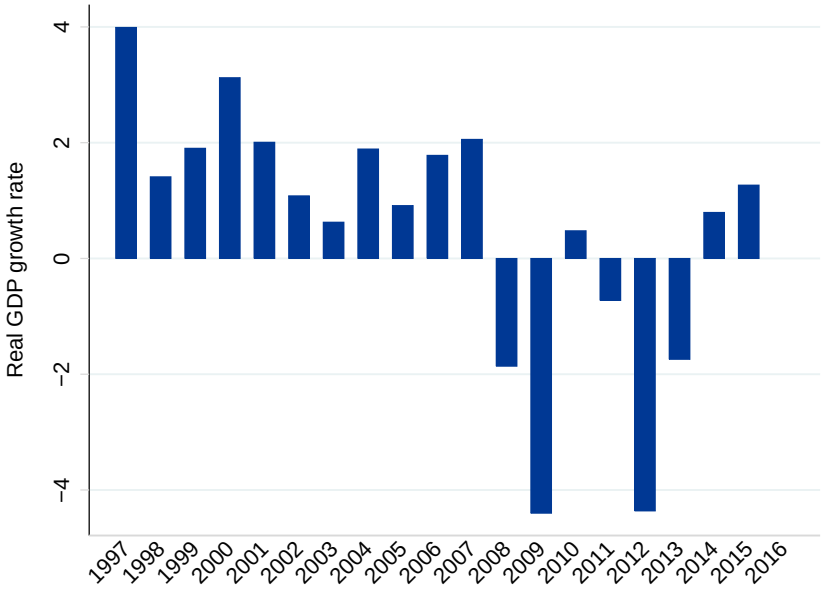
vidual importance.

The thesis is organized as follows. The rest of this introduction presents some macroeconomic trends as a background for the following analysis. Chapter one is devoted to the analysis of the evolution of household portfolios over time and their cross sectional features. It also includes an international comparison between Italian household portfolios and the evidence from other European countries and the United States. Chapter two introduces the stock holding puzzle, and presents the theoretically explanations developed by the literature. In particular, the focus is on participation costs and trust. We simulate a portfolio choice model that includes both factors, and we analyze the predictions of the model in terms of participation and share invested upon participation. Chapter three is devoted to the empirical estimations. In the last chapter four we draw our conclusions.

Macroeconomic developments in Italy

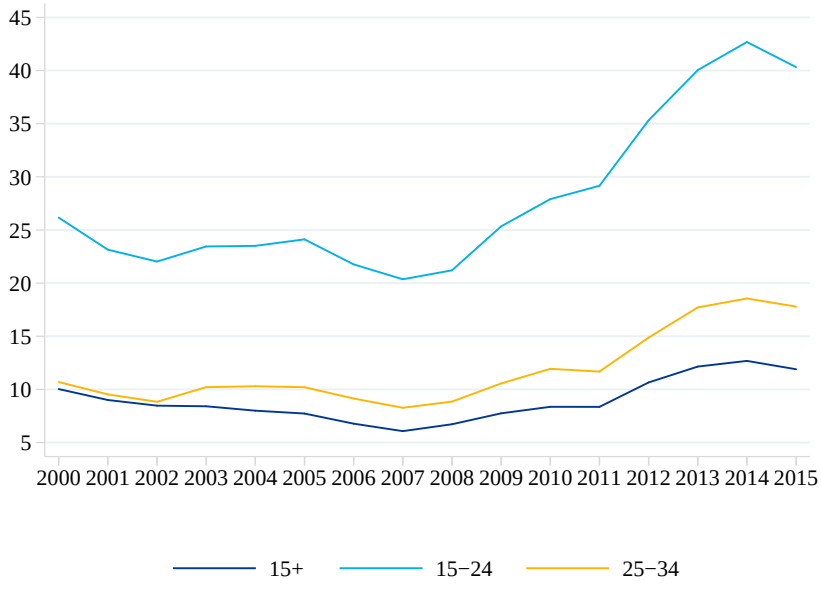
Before analysing the evidence from household level survey data, it may be useful to focus on the trends of the main macroeconomic indicators of the Italian economy during the last two decades. First of all, these years saw a very sluggish economic growth in Italy, and today the real GDP is very close to the value it had at the end of the last century. Figure 1 shows the annual real gross domestic product growth rate. As can be seen, growth has been relatively low between 1997 and 2006 and collapsed in the following ten years, in which the Italian economy has been hit by the financial crisis in 2007-2008 and by the sovereign debt crisis in 2011-2012. Italy has been particularly affected especially by the latter crisis due to the fragility of its banking system and its heavy burden of public debt. Years 2014 and 2015 saw a very mild recovery of the Italian economy, especially relative to the other Euro area economies. Households have been particularly hit during the 2011-2012 crisis. Figure 2 shows the unemployment rate in the period 2001-2015 for the whole working age population, and for the age classes 15-24 and 25-34 years old. The aggregate unemployment rate reached its lowest level in 2006, slightly above 6%, and then increased steadily between 2007 and 2014. It increased by two percentage points between 2007 and 2011. Afterwards, the increase has been about two percentage points per year in 2012 and 2013, and the unemployment rate reached 12.7%. Youngest households have been disproportionally affected, with the unemploy-

Figure 1: Annual Real GDP growth rate.



Source: Bank of Italy.

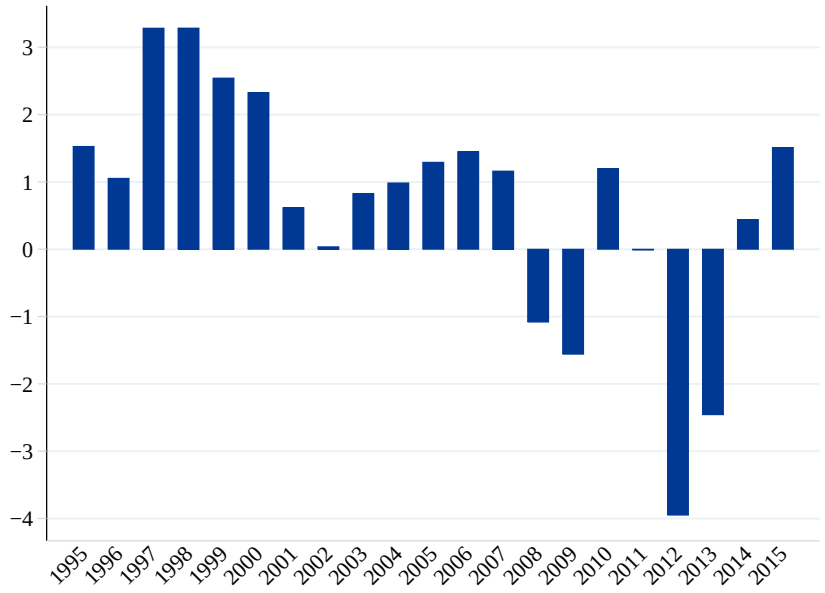
Figure 2: Unemployment rate by year.



Source: Istat.

ment rate in 2014 as high as 42.7% and 18.6% for workers in the 15-24 and 25-34 age groups, respectively. The surge in unemployment has been accompanied by a strong contraction of households aggregate expenditure, as can be seen in figure 3. Intuitively, aggregate consumption and GDP are closely correlated. The drop in consumption is particularly strong in 2008-2009, and especially in 2012, when it dropped by almost four percentage points.

Figure 3: Household final expenditure annual growth rate, in percent. Source: Istat.



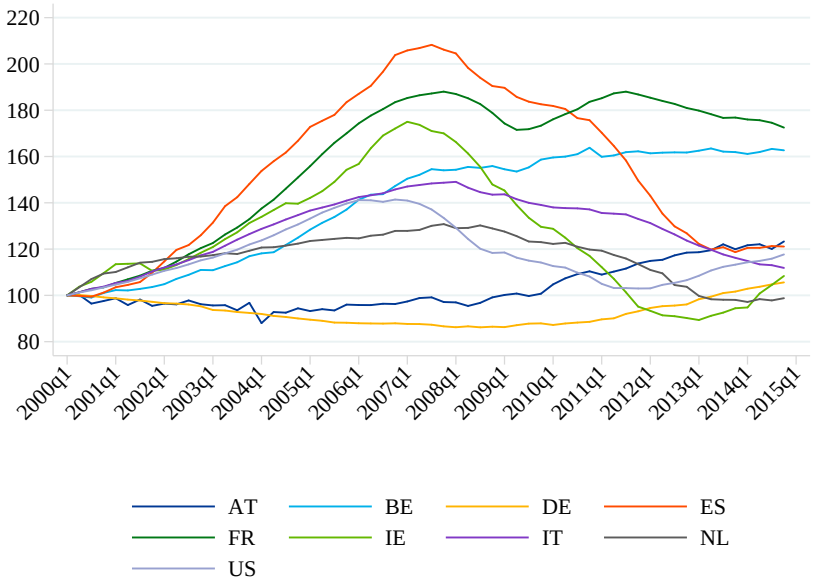
Source: Istat.

Celidoni et al. (2016) show that the drop in consumption has been particularly strong for younger households and it is only partially explained by the worsening of the labour market conditions.

For what concerns asset prices, which play an important role in generating fluctuations in household wealth, figure 4 show the evolution of real property prices in various Euro area countries and in the United States. As can be seen there is wide heterogeneity in the dynamics of house prices across countries. The boom-bust cycle in some Euro area country is much stronger than in the United States. The magnitude of the increase in real house prices in Spain and, to a lesser extent, in France and Ireland is striking. We notice also that the bust has been very strong in Ireland and Spain, while prices remained

at very high levels in France. Although with different magnitudes, such boom-bust pattern is common to almost all countries, with the exception of Germany and Austria, in which we do not observe an increase in the first half of the 2000s, and Belgium, in which instead prices continued to grow even during and after the crises. We notice also that in 2007 house prices started to decline some quarters earlier in the U.S. than in Europe. Moreover, for some countries such as Italy and the Netherlands, the drop in house prices has been only mild before 2011-2012, and it became larger afterwards.

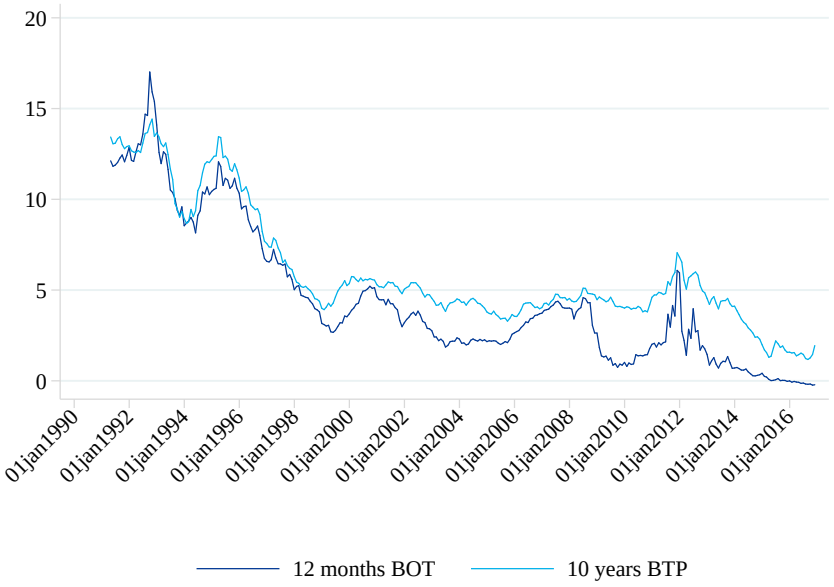
Figure 4: Real residential property price indexes by country.



Source: OECD house price indexes. 2001q1=100.

We want to conclude this section presenting some statistics relative to the financial markets. Figure 5 shows the interest rate paid on government Treasury Bills with 12 months maturity and bonds with 10 years maturity, starting from 1991. We first of all notice the strong decline in the interest rates occurred during the '90s. At the beginning of the '90s, interest rates were very high in Italy. Combined with the heavy burden of government debt, they made the country very vulnerable. The country entered a monetary crisis, and the interest rates went up in response to strong devaluation pressure on the lira. Italy was in the end unable to keep the fixed exchange rate, and the monetary crisis led to the exit from the European Monetary System, that since 1979 had estab-

Figure 5: Rate of return of government securities with different maturities.



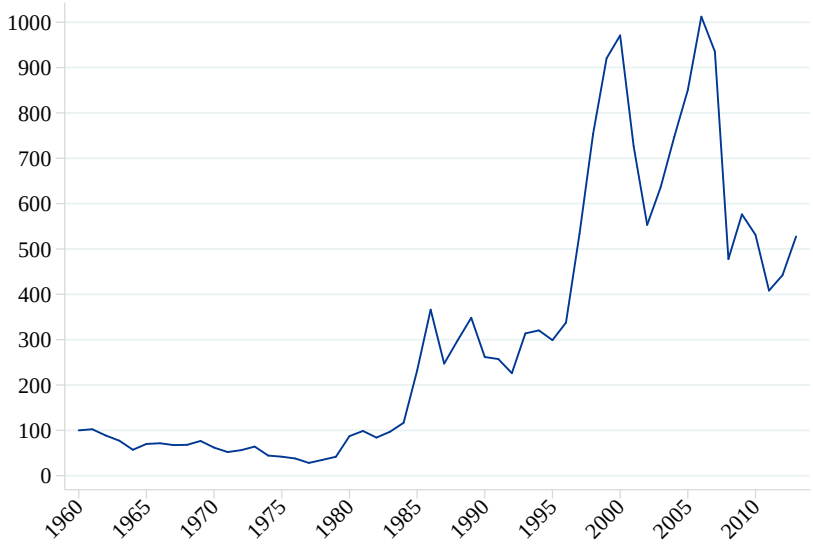
Source: Bank of Italy. In percent.

lished a fixed regime for the exchange rates. In the second half of the ’90s, thanks to the efforts to stabilize public finance, and the establishment of the monetary union, interest rates declined substantially.

From the figure we can gauge the magnitude of the sovereign debt crisis in Italy. The interest rate paid on 12 months treasury bills peaked at 6.08% in November 2011, while it was just 1.97% in April. After that, in the chart it is very evident the effect of the loose monetary policies conducted by the ECB, and in particular after January 2015, with the beginning of quantitative easing and the monthly purchase of public (and, in a following phase, also private) bonds. Since March 2015 the rate paid by the Italian government has been below 1%, and it became negative after November 2015.

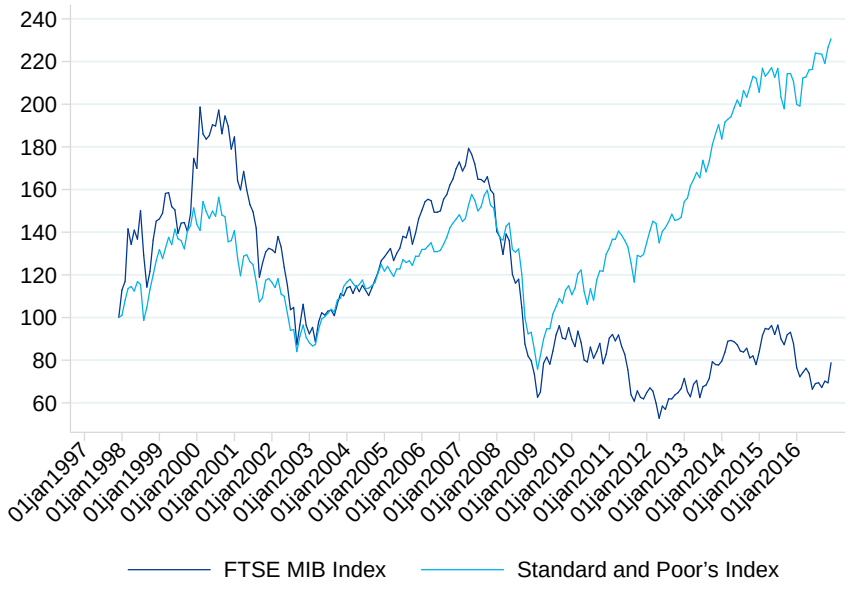
Finally, we look at the stock market performance. The stock market in Italy has been traditionally thin and relatively illiquid compared to other advanced economies. However, since the ’80s it underwent a process of development and transformation, partly as a consequence of the process of privatization of public companies that started in the ’80s, with their subsequent listing on the market. Then, after 1995, it boomed:

(a) Annual series of the Italian nominal stock index.



Source: Jordà, Schularick and Taylor Macrohistory Database. 1960=100.

(b) Monthly FTSE MIB and Standard and Poor's indices.



Source: Datastream. December 1997=100.

as can be seen in figure 6a[2] at the beginning of the new millennium the value of the stock index was almost 10 times its value in 1980. Guiso and Jappelli (2002) show that between 1989 and 1998 the fraction of people investing directly in stocks almost doubled, while the number of households investing in mutual funds or holding corporate bonds increased from 2.84% to more than 10%, and from 1 to 6%, respectively. After the burst of the "dot-com" bubble in 2001-2002, another period of very high growth started, and the FTSE MIB index reached its historical peak in 2007, before the collapse that followed the financial crisis.

Figure 6b compares the monthly series of the FTSE MIB index with the Standard and Poor's index for the U.S. for the last twenty years. Both series are normalized to 100 at the beginning in December 1997. From the figure it is clear that the two indices have been strongly correlated until 2009, even though the Italian index presents a higher volatility. After 2010, however, the paths of the two series do not seem to be correlated anymore, with the Standard and Poor's that recovered and reached historical maxima, while the FTSE MIB is even today far below the level it was in 1997.

[2]Information on the dataset can be found in Jordà et al. (2016).

1

The microeconomic environment

This chapter will present evidences on household portfolios from three main sources of data: the Survey of Household Income and Wealth (SHIW) conducted by the Bank of Italy, the Eurosystem Household Finance and Consumption Survey[1] (HFCS) conducted by the European Central Bank (of which also the SHIW is part) and the Survey of Consumer Finance (SCF) run by the Federal reserve Board of Governors. The three datasets share a similar structure, and provide detailed information on sociodemographic characteristics, income and wealth composition. The SHIW began in 1960s, but single waves are available on a consistent basis since 1987. In our study, we focus on nine waves collected with biannual frequency from 1998 to 2014. On average, the SHIW collect information on 8,000 households in each wave and has a panel component whose size increased throughout the years. We will exploit it in our empirical application. Faiella and Gambacorta (2007) provide an in depth description of the survey design and the weighting process. The sample is drawn in two stages, municipality and households. In the first stage, municipalities are stratified by region and size and are divided into self representing units if the number of inhabitants exceeds 40,000 people, and non self representative units. Then, households are drawn randomly within the municipalities. Weights are adjusted in order to accounts for different features of the survey. First of all, weights account for the survey design, and represent the inverse of the probability to be drawn, for each household. Secondly, non response is not random in the SHIW and is more frequent among wealthy households. This is a well known issue that arises

[1] An in depth description of the survey methodological aspects can be found in Eurosystem Household Finance and Consumption Network (2016a) while a presentation of the second wave results is given in Eurosystem Household Finance and Consumption Network (2016b)

in survey context. The set of weights provided in the SHIW account also for the non response process. Thirdly, some corrections are needed for panel households. Weights are corrected in order to consider attrition in the panel and the autocorrelation in income and wealth observed for panel households. Finally, weights are adjusted to replicate the same characteristics as the population in terms of sex, age, municipality size and geographical area.

Section one and two of this chapter focus on Italian households, and describe the main trends over time in household portfolios as well as their main cross sectional features. Section three provides an international comparison, in which we exploit two other data sources: the second wave HFCS dataset and the 2013 SCF. The HFCS is an harmonised survey coordinated by the European Central Bank and it is representative at the Euro area level. Two waves have been collected so far, with reference periods corresponding to approximatively 2009-2010 and 2013-2014. The second wave is available since December 2016, and provides detailed data on demographic characteristics, income and wealth for more than 80,000 households in all the Euro Area countries except Lithuania, plus Hungary and Poland. There are still differences across countries regarding the reference periods[2] and especially the degree of oversampling of wealthy households. Such differences are due to the fact that, when possible, the HFCS exploited already established surveys, such as the Italian SHIW (in which no ovesampling takes place) or the Spanish EFF (in which, instead, oversampling is extensive) [3]. Yet, it is a unique data source for researchers and policymakers, that allows to study Euro area households as a whole. The only survey comparable in terms of coverage is the Survey on Health, Ageing and Retirement in Europe (SHARE), that however includes only households aged more than 50.

The SCF is one of the most intensively used household level dataset and it is available in a consistent format since 1983. It is run with a three year frequency by the

[2]Reference period in the HFCS is mainly 2013-2014, with the exception of Spain for which data refer to 2011. Specifically, the reference period is 2014 for Belgium, Germany, Austria, Italy and France. Data for the Netherlands and Ireland refer to 2013.

[3]Vermeulen (2014) provides an overview on the *differential* under reporting within the HFCS, given the substantial cross country differences in the methods used to oversample wealthy households. Further work by Vermeulen (2016) estimates the top tail of the wealth distribution in different countries and provide insights on the magnitude of this problem in different countries. Italy, Austria and Germany are the countries in which the wealth of the top 1% is more underestimated. Moreover, he shows that under reporting is much stronger for financial than real assets.

Federal Reserve Board of Governors and is probably the best data source on American household portfolios. With respect to other sources, such as the PSID or the HRS, the SCF is characterized by the high oversampling of wealthy households, that allows it to be representative also of the very rich households [4]. Both the HFCS and the SCF resort to multiple imputation to estimate missing answers; hence, in computing statistics, we will take this into account following the methodologies in Rubin (2004).

1.1 Household portfolios over time

This first section is devoted to the description of he evolution of Italian household portfolios over time. In first place, it is useful to look at how the socio demographic characteristics changed in the SHIW during the last decades. The entire following discussion will be based on variables aggregated at the household level. It is straightforward that family structure is crucial for decisions regarding consumption, wealth allocation and labour supply. Thus, demographic changes have a strong effect in shaping the evolution of household wealth, income and consumption.

In table 1.1 we present the summary of the sample demographic characteristics throughout the years. All the information at the individual level (sex, age, education, work status) are referred to the reference person. To have more homogeneity we always consider the husband or male partner as reference person, in order to reduce spurious variability in household head's characteristics over time, since the recording practices changed over time.

During the last decades, fertility rate in Italy decreased dramatically and population ageing is very evident in the sample: there is a steady increase in the proportion of households with reference person aged 70 or more and an almost proportional decrease of young households, younger than 40 years old. At the same time, average household size decreased during the observed period, with a rise in the number of single households and couples. Throughout the years we can observe a strong reduction in the percentage of households whose head has no formal education or less than the compulsory level of schooling. Indeed, this share goes from 37.9 % in 1998 to 24.0% in 2014. At the same time, we observe an increase in the fraction of households with secondary or

[4] For a description of the SCF and the oversampling that takes place in it, see Kennickell (2005)

Table 1.1: Household composition and demographic characteristics, in percent.

Year	1998	2000	2002	2004	2006	2008	2010	2012	2014
All Households	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Sex									
Male	77.7	77.6	77.0	75.7	75.8	75.0	74.2	71.9	70.9
Female	22.3	22.4	23.0	24.3	24.2	25.0	25.8	28.1	29.1
Age									
<25	4.5	4.4	3.6	4.6	4.1	4.6	4.0	3.8	3.6
26-40	28.1	28.8	28.7	28.9	28.3	27.5	26.1	25.2	22.7
41-55	29.7	28.5	28.2	28.0	28.4	27.7	28.9	28.5	30.1
56-70	26.9	26.2	26.6	25.4	24.5	25.6	25.7	26.2	26.1
70+	10.8	12.1	12.9	13.0	14.7	14.7	15.3	16.4	17.5
Education									
No education/Primary	37.9	37.1	36.2	33.1	29.8	28.3	25.6	25.1	24.0
Secondary	54.4	54.8	56.1	58.7	61.3	62.1	63.3	63.7	63.3
Tertiary	7.7	8.2	7.7	8.2	9.0	9.7	11.1	11.2	12.7
Household size									
1	19.5	20.2	22.1	24.6	24.9	26.4	24.9	28.3	29.3
2	26.0	27.5	26.2	28.0	28.4	29.2	30.4	27.9	27.3
3	23.6	23.0	22.1	21.2	21.5	20.1	19.5	19.4	19.3
4	22.3	21.4	21.8	19.6	18.5	18.0	18.7	17.7	17.8
5+	8.7	7.9	7.7	6.6	6.7	6.3	6.5	6.7	6.3
Number of income recipients									
1	44.0	46.0	47.8	49.6	48.3	48.8	47.8	53.1	53.2
2	41.9	40.8	40.0	39.4	40.6	41.0	43.0	38.6	38.0
3+	14.0	13.2	12.2	11.0	11.1	10.2	9.1	8.2	8.8
Housing status									
Owner outright	60.7	62.7	61.9	59.6	60.9	58.7	58.3	56.6	58.2
Owner with mortgage	5.7	6.3	7.1	8.5	8.2	10.7	10.4	10.9	10.1
Renter	22.8	20.9	20.9	21.7	20.9	21.3	21.1	21.8	20.7
Usufruct or free	10.8	10.1	10.1	10.2	10.0	9.3	10.2	10.8	11.1
Work status									
Employee	36.9	38.0	38.2	40.7	41.6	41.6	41.2	40.5	39.5
Self Employed	14.4	13.8	13.9	12.7	12.2	11.8	12.2	10.8	10.6
Retired	41.9	42.3	42.3	40.9	41.3	42.0	40.7	40.5	40.4
Other not working	6.8	5.8	5.6	5.7	4.9	4.6	5.9	8.1	9.5
Region of residence									
North	48.0	46.8	46.6	47.7	48.4	48.1	48.4	48.7	47.4
Center	19.1	19.6	19.9	20.3	19.9	21.0	19.9	18.9	20.2
South and islands	32.9	33.5	33.5	32.0	31.7	30.8	31.6	32.4	32.4

Individual characteristics refer to the household head. Statistics computed using survey weights.

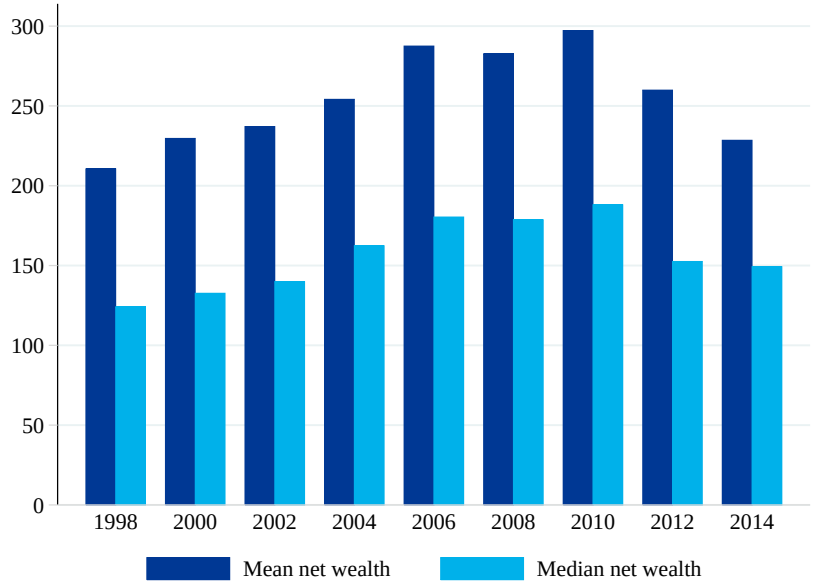
compulsory schooling (63.3% in 2014) and in particular in the share of those with a university degree, from 7.7% in 1998 to 12.7% in 2014.

In table 1.1 is very evident the huge unemployment shock that hit Italian households during and after the 2011-2012 recession following the sovereign debt crisis. Indeed, in 2012 and 2014 we observe an increase in the share of families with only one source of income, that peaks in 2014 at 53.2%. However, it should be remembered that this is in part due to the decrease in average household size, a trend reflected in the steady reduction of the families with three or more income recipients. The magnitude of the unemployment shock can also be gauged from the statistics relative to the working status of the reference person. The fraction of not working (and not retired) decreased steadily from 1998 to reach 4.6% in 2008, but then it rose up to 9.6% in 2014. Another striking evidence regards the number of self employed household heads, which were 14.4% of the sample in the 1998 wave and just 10.6% in 2014.

Finally, table 1.1 presents the statistics related to the status of the main residence. First of all, as we will see later, Italian households have typically been characterize by a high home ownership rate by international comparison. The fraction of homeowners (as the sum of owners outright and with mortgage) has changed slightly throughout the years observed, between 67 and 69%. However, the composition of this group changed: the share of outright home owners decreased, reaching 56.6 % in 2012, while at the same time, there has been a strong rise in the number of households with a mortgage on their main residence. Such share almost doubled during the period observed, from 5.7% in 1998 to almost 11% in 2012. There are at least two reasons that may help in explaining such pattern in the share of indebted home owners. First of all, as we will discuss more in depth in the following, it may be seen in the light of the long run trend of financial development and increasing availability of financial products already highlighted by Guiso and Jappelli (2002) in their analysis on the SHIW waves of the '90s. Second, as we have seen in figure 5 the low interest rates that followed the entrance in the monetary union reduced the burden of interest payments, making it more convenient to buy a house through debt.

Figure 1.1 shows the level of median and mean real net wealth over the years. From the chart it is evident how wealth increased steadily up to 2006 and then it slightly decreased in 2008. Then it peaked in 2010 and subsequently drop significantly in 2012 and 2014, almost going back to the values of early 2000s. It is especially evident the

Figure 1.1: Mean and median net wealth.



Values deflated by the consumer price index (2014 = 1, source: Istat) and computed using survey weights. Thousands of euros.

difference in the magnitude of the impact of the two crises, the financial crisis of 2007-2008 and the sovereign debt crisis of 2011-2012. As we have seen before, the effects of the latter have been much stronger.

In the literature it is well known that household portfolios are very simple and not much diversified (see (Guiso et al., 2002a), (Campbell, 2006) or more recent evidences from (Campbell, 2016), among others). Table 1.2 shows the participation rate for detailed categories of debt and real and financial assets. As one would expect, deposits in the form of checking and saving accounts are the most widespread item, with a participation rate increasing throughout the years reaching 93.2% in 2014. Such increase highlight the process of financial development and access to financial instruments that took place in Italy in the last decades. Remarkably, however, even in 2014 there is almost a 7% of households that do not own an account. It is interesting to note that at the end of the '90s the most participated items were government bonds and life insurance. Guiso and Jappelli (2002) show that government bonds, especially with a short maturity, traditionally represented the most common saving instruments for Italian households, and they report that in 1989 the participation rate in this category was higher than 25%.

This was also due to the high interest rates paid by the government during the '80s. During our sample period the participation to government bonds decreased steadily, and in 2012 only 4.3% of households hold short term government bonds.

Table 1.2 reports also the statistics related to the participation to the stock market. First of all, such participation may be direct or indirect, through mutual funds and managed accounts. Participation to the stock market (direct or indirect) peaked in 2000-2002, with more or less 9% of households directly holding shares of listed companies and 11% holding stocks indirectly through mutual funds. Afterwards, these rates declined substantially, and in 2014 only 3.6% of Italian families holds stocks of listed Italian firms. Similarly, only 6.8% of households participates in mutual funds in 2014. However, investment in mutual funds may be characterized by very different degrees of riskiness, as the availability of funds ranges from monetary and liquidity funds to more aggressive equity funds.

Turning to more illiquid forms of savings, the evolution of participation rates in life insurance products and voluntary pension funds is one of the most evident transformations occurred to Italian household portfolios during the sample period. Indeed, in 1998 life insurance policies were surprisingly widespread, with more than 20% of the sample owning one or more of such policies. Such rate declined fast, especially between 2002 and 2004, and reached 8.5% in 2014. For what regards pension plans, instead, the pattern is opposite, with an increase over the years. Particularly significant is the increase between 2008 and 2010, when the participation rate almost doubled. In order to explain such evolution, it is necessary to refer to the process of reformation that interested the Italian pension system, started in 1992 with the Amato reform and continued throughout the year with the Dini reform (1995) and, finally, the Monti reform in 2011. Such reformation effort was mainly due to public finance consideration. The Italian pension system was traditionally very generous, based on a defined benefit structure and featuring high replacement rate and substantial benefits and generous provisions for early retirement. Such generosity, combined with a population that was ageing, made the social security system clearly unsustainable at the end of the '90s. The reforms were thus aimed to reduce the burden for public finance and to ensure long term stability to the system. Such process imposed a substantial reduction of expected replacement rates and increased the need for saving for retirement of Italian households. Attanasio and Brugiavini (2003) estimate how indeed the 1992 reform has been followed by an

Table 1.2: Participation rates in percent. Statistics computed using survey weights.

Year	1998	2000	2002	2004	2006	2008	2010	2012	2014
Financial assets									
Transaction and savings accounts	85.6	85.0	85.7	85.9	89.2	89.0	91.6	92.8	93.2
Certificates of deposits	3.7	2.0	1.2	1.0	1.3	1.8	2.5	1.6	1.8
Postal saving certificates	5.9	5.4	4.8	5.7	5.9	6.0	5.3	5.6	5.4
Short term government bonds [1]	9.0	9.8	7.5	5.3	6.8	7.5	6.1	4.3	5.2
Long term government bonds [2]	5.6	4.4	3.5	3.4	3.3	3.3	3.1	3.3	3.6
Other bonds	5.1	5.7	6.0	5.7	6.4	7.0	8.2	7.1	6.8
Mutual funds	9.6	11.6	10.8	8.1	7.7	6.3	6.2	4.6	5.9
Listed shares	7.1	9.2	9.0	6.8	5.8	5.6	4.5	3.9	3.6
Non listed shares	1.5	1.2	1.0	0.7	0.9	0.9	0.9	0.8	0.8
Managed accounts	2.7	2.9	2.0	1.8	1.4	1.3	1.5	2.2	0.9
Life insurance	23.6	19.9	18.0	12.6	13.8	13.5	11.4	9.7	8.5
Voluntary pension	7.9	12.0	8.6	8.1	8.3	8.7	15.7	13.2	13.2
Other financial assets [3]	2.0	2.2	2.3	2.6	2.3	2.0	2.1	2.5	1.7
Real assets									
Main residence	66.4	69.0	69.0	68.1	69.0	69.2	68.7	67.5	68.2
Other real estate	26.4	24.6	22.5	22.2	21.9	23.1	25.3	26.6	23.3
Private business	13.1	11.9	12.7	15.3	13.7	13.9	12.4	12.7	13.0
Valuables	78.3	86.1	88.3	88.7	87.4	89.2	85.6	84.1	83.9
Vehicles	78.1	79.6	80.8	83.0	82.3	82.6	83.3	80.8	79.2
Debt[4]	25.7	24.1	22.1	24.6	26.1	27.8	27.7	26.1	23.0
Safe financial assets [5]	86.7	86.0	86.3	86.5	89.6	89.4	91.8	92.9	93.2
Liquid risky financial assets [6]	19.2	22.1	21.4	18.2	17.2	15.7	16.4	14.7	14.4
Risky financial assets[7]	24.4	28.2	26.4	23.5	22.7	22.1	28.0	24.9	24.8
Total risky assets (1) [8]	32.0	34.7	33.9	33.7	32.0	31.0	35.4	33.0	33.5
Total risky assets (2) [9]	45.6	46.1	44.1	43.9	42.7	41.9	46.7	45.0	44.0

[1] Include BOT and zero coupon bonds.
[2] Include CCT, BTP, BTPI and other government bonds.
[3] Include foreign assets, loans to cooperative and other financial assets as options, futures, royalties ecc.
[4] Include debt towards banks and financial institutions, commercial debt (net) and debt towards other households.
[5] Safe assets include transaction and saving accounts, certificates of deposits, postal saving certificates, short term safer government bonds and life insurance.
[6] Risky liquid financial assets comprise long term government bonds, other bonds, listed shares, mutual funds and managed accounts.
[7] Risky financial assets include risky liquid assets plus non listed shares, other financial assets and defined contribution pension plan and other financial assets.
[8] Total risky assets (1) are risky financial assets plus private business.
[9] Total risky assets (2) are risky financial assets plus private business and other real estate.

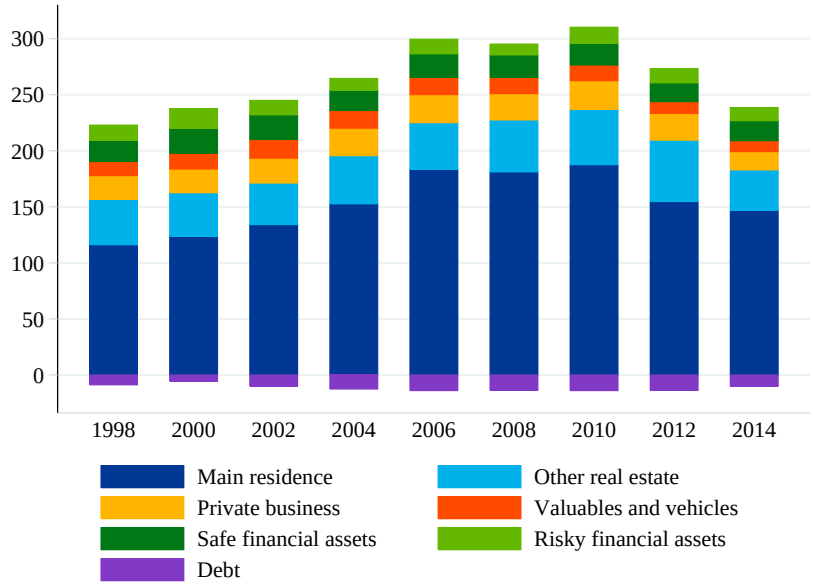
increase in the saving rate, in line with the already mentioned evidences from Bottazzi et al. (2006).

At the same time, the reforms aimed to develop the so called "third-pillar" of the previdential system, based not on public provision but on private saving and accumulation in pensions funds. A fundamental step, in this sense, was the 2005 reform (decree law n. 252/2005) of the severance pay regime, or "trattamento di fine rapporto" . It consists in a form of deferred remuneration, which is paid to employees when the employment contract ends for reasons like pensioning or dismissal, that takes form as a loan from the employee to the employer. The reform provided a new scheme for the severance pay, demanding all workers to choose before July 2007 to retain the severance pay within the firm, and maintain the pre-reform regime, or to transfer it to a form of complementary pension. In particular, the choice was based on the "silenzio-assenso" rule, that is, in case of no choice by the worker, the severance pay would have been transferred by the employer to a pension fund referring to the contract type of the employee. Moreover, investment in these long term saving instruments is stimulated by tax advantages. The contributions to complementary pension plans deductible from the worker personal income up to the amount of 5,164 euros per year. As can be seen in table 1.2, in 2010 the share of participants in such funds almost doubled, above 15%. It is surprising however that the increase is not observed in 2008, probably indicating that many workers became aware of the change in the regime after 2008.

We find it useful to classify financial assets in terms of their degree of riskiness and liquidity. Safe financial assets include transaction and saving accounts, certificates of deposits, postal saving certificates, short term government bonds and life insurance, while risky financial assets include all the other kind of financial assets. By looking at participation rates in risky financial assets, however, we cannot observe a clear trend. This is due to the pattern of participation in voluntary pension schemes, that, as we highlighted before, grows significantly after 2008. Focusing on liquid risky financial assets only, that is, long term government and corporate bonds, stocks and shares, mutual funds and managed accounts, we see that there have been overall a strong decline in the participation rate, which dropped from 22.1% in 2000 to 14.4% in 2014. It is striking also that such a decrease is very steady over time. The years in which the drop has been more pronounced are 2004, 2008 and 2012. For completeness, we present the figures relative to broader classifications of risky assets, that includes not only financial

assets but also private business and real estate. As before, however, we clearly see that the strong increase in participation in voluntary pension schemes is the principal reason for the increase that we observe between 2008 and 2010.

Figure 1.2: Mean net wealth composition.



Values deflated by the consumer price index (2014 = 1, source: Istat) and computed using survey weights. Thousands of euros.

Figure 1.2 shows the composition of household mean wealth. As it is well known from the literature, the bulk of household wealth is held in real assets. In particular, the main residence has the largest share, followed by other real estate and private business. Financial assets and debt have a very small share in Italian household wealth. The results presented in figure 1.2 can be seen in more detail in table 1.3, where we present the composition of financial and real asset in terms of their components. First of all, we see that real assets accounted for more than the 85% of total gross wealth (except in 2000). The figures for debt are small, not only for what concerns participation, as we noted previously, but also in terms of its magnitude, since it accounts for less than the 5% of total assets.

For what regards financial assets, transaction and savings accounts have the highest share, ranging from 36% to 45% of financial wealth, depending of the year. The share of other individual assets are much smaller. The highest is mutual funds, which ranges

Table 1.3: Asset shares in household portfolios, in percent. Statistics computed using survey weights.

Year	1998	2000	2002	2004	2006	2008	2010	2012	2014
Total financial assets [1]	14.6	16.8	14.3	10.9	11.4	10.1	10.9	10.8	12.4
Transaction and savings accounts	37.7	39.7	43.6	41.9	40.4	45.5	39.0	36.8	39.5
Certificates of deposits	2.3	1.1	0.8	1.1	1.1	1.5	1.5	2.0	1.6
Postal saving certificates	1.5	1.9	1.7	2.6	2.3	2.5	2.3	2.8	2.7
Short term government bonds [2]	6.3	7.6	5.0	5.0	5.2	6.4	5.4	4.0	5.2
Long term government bonds [3]	4.8	5.4	3.5	3.7	4.2	3.8	3.9	5.6	4.9
Other bonds	4.6	4.3	6.0	5.5	8.2	9.2	8.8	9.8	8.1
Mutual funds	11.7	13.3	10.5	9.6	8.2	7.9	8.2	10.0	12.0
Listed shares	5.9	8.2	5.7	6.7	6.4	3.9	4.0	2.6	2.4
Non listed shares	1.6	1.4	0.9	1.5	1.1	1.1	3.6	1.0	1.7
Managed accounts	8.5	6.1	4.6	4.4	3.3	3.0	4.4	7.0	4.5
Life insurance	10.1	5.0	11.7	11.2	12.1	10.7	8.0	7.8	6.7
Voluntary pension	3.5	4.6	4.9	5.1	6.1	3.7	9.4	8.7	9.1
Other financial assets [4]	1.6	1.4	1.0	1.6	1.5	0.9	1.4	1.9	1.6
Total real assets [5]	85.4	83.2	85.7	89.1	88.6	89.9	89.1	89.2	87.6
Main residence	61.0	62.6	63.8	64.7	69.1	68.2	67.8	63.4	70.3
Other real estate	21.2	19.6	17.7	18.2	15.7	17.5	17.9	22.5	17.3
Private business	11.2	10.7	10.6	10.4	9.4	8.8	9.2	9.8	7.8
Valuables	2.2	2.6	3.2	2.4	2.1	2.0	1.7	1.6	1.6
Vehicles	4.4	4.5	4.7	4.3	3.7	3.5	3.4	2.8	3.1
Debt [6]	5.6	3.4	3.2	4.0	4.0	4.3	4.2	5.0	4.3
Safe financial assets [7]	57.9	55.4	62.9	61.8	61.0	66.5	56.2	53.3	55.7
Liquid risky financial assets [8]	37.5	39.3	31.9	31.8	31.5	28.8	32.1	33.8	29.9
Risky financial assets [9]	42.1	44.6	37.1	37.6	38.4	32.9	42.4	43.6	40.0
Total risky assets (9) [10]	15.7	16.4	14.4	13.4	12.7	11.3	12.9	13.5	11.8
Total risky assets (10) [11]	33.8	32.8	29.5	29.6	26.7	27.0	28.8	33.5	26.9

[1] Total financial assets as a percentage of total assets. Financial assets categories are expressed as a fraction of total financial assets.

[2] Include BOT and zero coupon bonds.

[3] Include CCT, BTP, BTPI and other government bonds.

[4] Include foreign assets, loans to cooperative and other financial assets as options, futures, royalties ecc.

[5] Total real assets as a percentage of total assets. Real assets categories are expressed as a fraction of total financial assets.

[6] Debt as a fraction of total assets. It includes debt towards banks and financial institutions, commercial debt (net) and debt towards other households.

[7] Safe assets as a percentage of total financial assets. Include transaction and saving accounts, certificates of deposits, postal saving certificates, short term safer government bonds and life insurance.

[8] Risky liquid financial assets as a percentage of total financial assets. Comprise long term government bonds, other bonds, listed shares, mutual funds and managed accounts.

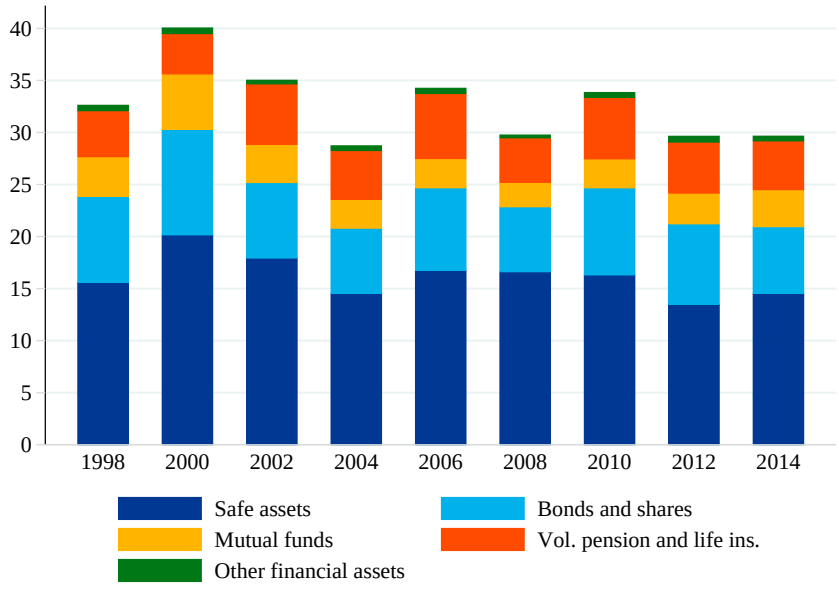
[9] Risky financial assets as a percentage of total financial assets. Include risky liquid assets plus non listed shares, other financial assets and defined contribution pension plan and other financial assets.

[10] Total risky assets (1) are risky financial assets plus private business. Expressed as a percentage of total assets.

[11] Total risky assets (2) are risky financial assets plus private business and other real estate. Expressed as a percentage of total assets.

between 8% and 13% of financial assets. Long term illiquid form of savings like life insurance and pension schemes instead, account together for around 15% of financial assets. Those shares, however, must be interpreted with caution, since the values are in large part results of the imputation process described in the appendix. The very low value of the share of life insurance in 2000, only 5%, seems particularly unreliable. Looking at broader aggregate, we have a more stable picture. The share of safe assets in total financial assets ranges between 55% and 66%. As before, however, we are interested in considering the changes in the share of liquid risky assets, rather than total risky financial assets. As can be seen, such share decreased over time. Figure 1.3 graphically shows the average financial portfolio composition throughout the years. In order to interpret the figures of table 1.3 correctly, it must be kept in mind that changes in the shares are the results of changes in asset prices and household allocation decisions, including participation. By looking at these aggregate figures it is not possible to discern between the two.

Figure 1.3: Average financial portfolio composition.



Values deflated by the consumer price index (2014 = 1, source: Istat) and computed using survey weights. Thousands of euros.

1.2 The cross section of household portfolios

In the previous section, we focused on aggregate figures, and we presented their trends during the years. However, the key feature of household level micro data is that they allow to analyse the wide cross sectional heterogeneity in asset allocation and portfolio choice. It is a well known fact that the wealth distribution is very skewed, and that

Figure 1.4: Net wealth distribution in selected years.

Values deflated by the consumer price index (2014 = 1, source: Istat) and computed using survey weights. Thousands of euros.

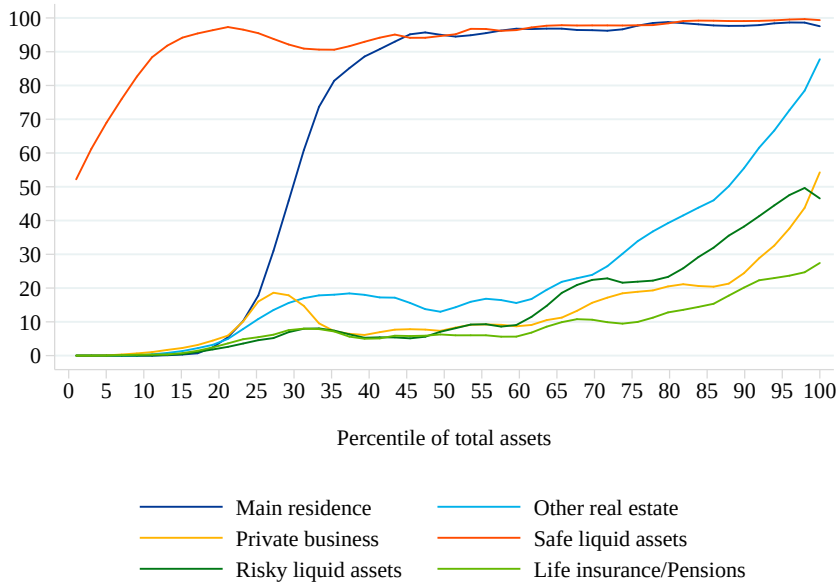
wealth is concentrated in the hands of a few households at the top. Figure 1.4 shows the distribution of net wealth for the 2000, 2006, 2010 and 2014 waves. For a matter of readability, the top 5 percentiles are excluded in the chart. Table 1.4 presents the Gini index and the share of the top 5 and 10% for income and wealth for each wave in the sample. Such measures, however, needs to be interpreted with caution, since, as we have already mentioned, the SHIW is not well suited to describe the top tail of the wealth distribution. Non random non respone and under reporting are likely to be very important at high levels of wealth, and the survey design does not account for that by oversampling wealthy households, as it is done in comparable surveys. Hence, our computations presented in table 1.4 are likely to underestimate the true magnitude of

Table 1.4: Inequality measures for net wealth and income. Statistics computed using survey weights.

	Net wealth			Income		
Year	Gini index	Share top 5%	Share top 10 %	Gini index	Share top 5%	Share top 10 %
1998	0.625	0.324	0.456	0.175	0.275	0.375
2000	0.612	0.332	0.461	0.167	0.266	0.362
2002	0.599	0.301	0.434	0.163	0.263	0.356
2004	0.587	0.288	0.419	0.169	0.267	0.353
2006	0.600	0.306	0.434	0.167	0.264	0.348
2008	0.599	0.306	0.432	0.164	0.264	0.353
2010	0.607	0.318	0.444	0.162	0.261	0.351
2012	0.629	0.328	0.459	0.163	0.263	0.356
2014	0.601	0.295	0.427	0.154	0.253	0.350

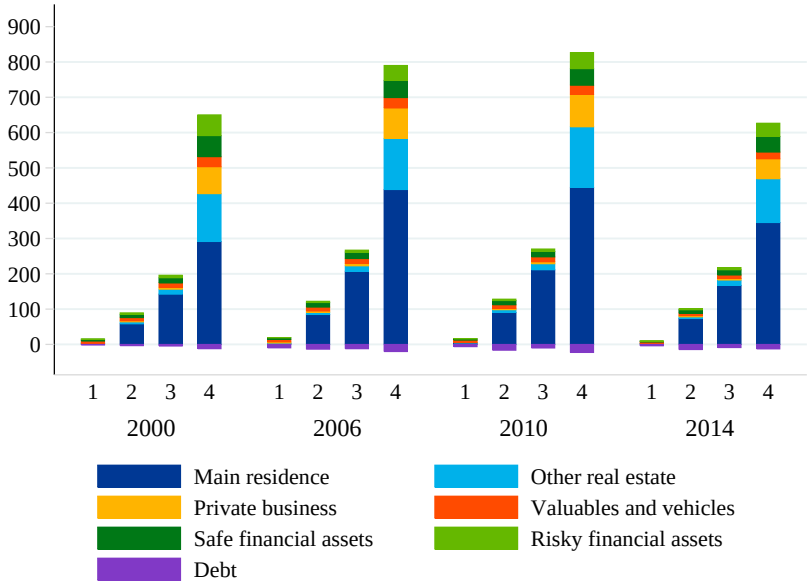
inequality in Italy, especially for what concerns net wealth. As can be seen, income inequality moves much less than wealth inequality, and income is much less concentrated. Obviously, this is related to the fact that wealth is accumulated over time. For what regards income, we can observe a slight decline in inequality over the years, across all of the three measures. Especially in 2014 with respect to 2012, the decline has been substantially. Also concerning wealth, table 1.4 shows that inequality declined with respect to the early 2000s, with the exception of 2012. In particular, wealth concentration seems to become lower after stock market downswings, and asset price collapses in general. Such phenomenon can clearly be explained by looking at the portfolio composition across the wealth distribution. Indeed, as can be seen in figure 1.5, many financial instruments are owned almost only by wealthy households. The figure present ownership rates for various asset categories in 2014 by percentiles of total assets. We present the figure for the 2014 wave only for a matter of readability, but very similar figures can be obtained from the other waves in the sample. The wide heterogeneity in household portfolios along the wealth distribution is immediately evident. First of all, it is striking that at the lowest percentiles of the total assets distribution, there is a significant fraction of households that do not hold any asset at all. These households are likely to hold cash only. Moreover, with the exception of safe assets and main residence, all the other assets show very low participation rates in the first half of the distribution. Stock ownership and private business ownership are strongly correlated with wealth. Ownership of other real estates is more widespread, and reach participation rates above 75% for the top 5 percentiles. From figure 1.6 we see however that in each net wealth quartile household

Figure 1.5: Asset participation by percentiles of total assets in 2014.



Statistics computed using survey weights.

Figure 1.6: Average portfolio composition by net wealth quartiles.



Values deflated by the consumer price index (2014 = 1, source: Istat) and computed using survey weights. Thousands of euros.

portfolios are dominated by real assets. In particular the main residence has the largest share at any level of wealth, though also other real estates and private business have a significant share for the top quartile. The magnitude of debt (shown as negative in the figure) is very low in each quartile. We have to remember however, that there are important differences within wealth quartiles, and especially in the first. Indeed, the first net wealth quartile includes two very different kinds of households: on the one side, the "true" poor, that is, those who do not own almost any asset at all; on the other side, there are some households that actually may own assets for an important values, but since they are highly indebted, their net wealth is very low. It is straightforward that such households are very different, in terms of behaviour, needs, and reaction to shocks.

In the following of the section we want to focus on risky asset ownership in order to understand which are the factors that influence households decision to invest in risky assets or not. We will focus on liquid risky financial assets instead of total risky assets, in order to avoid the comparability problems due to the change in complementary pension plans regulation. We will deal more in detail with this issue in the next chapter. Table 1.5 shows the participation rate and the mean share invested in risky liquid financial assets, conditional on participation. Risky liquid assets are defined as the sum of stocks, mutual funds, managed accounts, corporate bonds and long term government bonds. In line with what has been already highlighted in the literature, participation is highly correlated with wealth and income. In the first quartile of the wealth distribution, participants were only the 3.9% in 2000 and the 0.9% in 2014. We observe that the decline in participation has been strong in all the quartiles: for example, participation rate in the top net wealth quartile decreased from 47.5% in 2000 to 35% in 2014. A similar pattern is observed looking at the breakdown by income quartiles, with strong declines in participation for every quartile. For what regards the level of the conditional share, the picture is much more homogenous, ranging between 57 and 70% across wealth quartiles and the four waves presented in the table. As previously noted, we need to keep in mind that the issue of measurement error may affect our estimates of the shares. From the table it is difficult to recognize any systematic difference in the share invested conditional on participation across the various breakdowns.

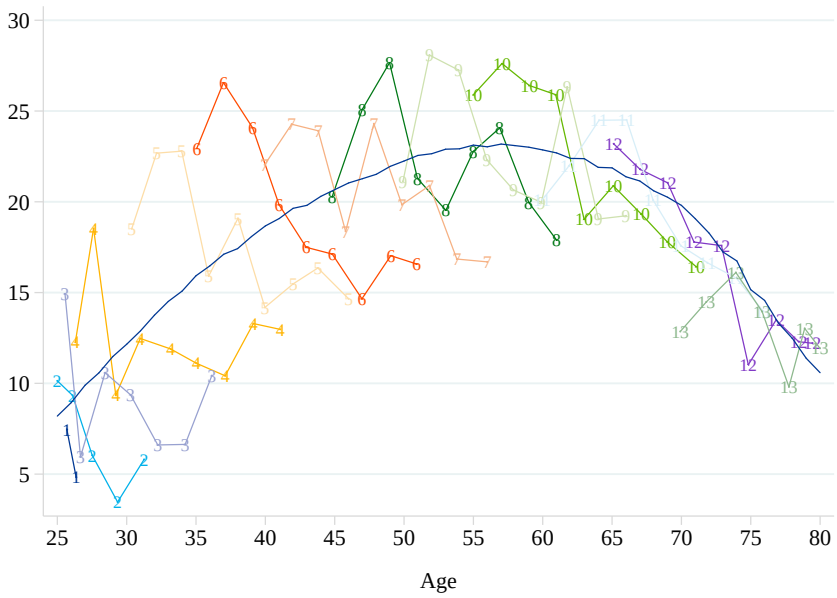
A second takeaway from the table is that the age profile of participation is hump shaped. It is interesting to note that in 2000 and 2006 the highest participation rates are those of people aged between 46 and 60. In 2010 and 2014, instead, participation peaks

Table 1.5: Participation rate and mean conditional share in risky liquid financial assets invested by household characteristics, in percent. Individual characteristics refer to the household head. Statistics computed using survey weights.

	2000		2006		2010		2014	
	Part.	Share	Part.	Share	Part.	Share	Part.	Share
Net wealth quartiles								
I	3.9	62.4	3.8	57.5	1.3	58.1	0.9	63.0
II	13.6	65.0	9.4	54.1	9.1	59.0	6.2	57.3
III	23.3	60.8	16.6	66.2	15.9	57.6	15.7	61.6
IV	47.5	68.3	38.9	66.5	39.2	70.2	35.0	62.8
Income quartiles								
I	4.0	73.0	3.2	48.7	2.0	60.8	1.3	74.9
II	12.8	61.8	8.7	59.4	8.1	61.7	5.8	67.2
III	24.3	66.8	20.1	55.3	17.0	60.7	14.1	64.7
IV	47.2	67.7	36.7	68.7	38.3	70.0	36.5	61.6
Age group								
Under 30	19.3	83.8	9.5	65.6	4.7	55.7	4.4	67.9
31-45	25.1	60.0	17.0	64.4	13.0	55.0	12.0	54.5
46-60	26.8	70.0	21.5	67.8	20.0	64.2	15.7	56.5
61-75	18.9	69.0	19.0	64.5	20.2	72.2	17.7	68.3
Over 75	11.7	62.5	8.4	63.0	11.9	76.8	12.4	67.7
Geographic area								
North West	32.6	72.9	25.1	63.8	21.0	69.0	20.2	64.4
North East	36.1	58.0	28.3	63.1	26.3	68.5	22.1	62.7
Center	19.5	69.5	14.1	74.7	17.0	68.4	15.6	63.4
South	6.7	68.5	4.6	61.1	3.4	50.1	3.1	43.5
Islands	7.3	50.8	5.8	44.9	7.9	66.7	6.5	61.5
Municipality size								
Under 20,000	22.1	72.3	17.6	59.8	16.9	66.0	13.5	54.7
20,000-40,000	20.5	67.8	15.8	66.1	14.1	64.8	13.4	64.1
40,000-500,000	24.1	54.0	17.6	65.2	16.9	67.3	15.9	65.1
Over 500,000	19.4	76.7	16.3	73.8	15.5	76.9	15.8	75.7
Education								
No education/Primary	9.7	46.5	7.2	63.3	7.5	61.6	6.6	69.8
Secondary	26.9	68.3	19.0	64.5	17.2	67.2	13.7	57.9
Tertiary	46.3	74.9	37.7	67.7	31.9	70.6	32.7	67.3

within the 61-75 age group. Analysing the changes occurred over time, participation rates dropped more strongly for young people, under 45 years old. In particular among younger households, the fraction of participants was 19.3% in 2000, and it substantially declined to 9.5% in 2006, to reach only 4.4% in 2014. A similar pattern is observed for households whose age is between 31 and 45. Participation rate in this group more than halved between 2000 and 2014, dropping to 12% from 25.1% in 2000. In table

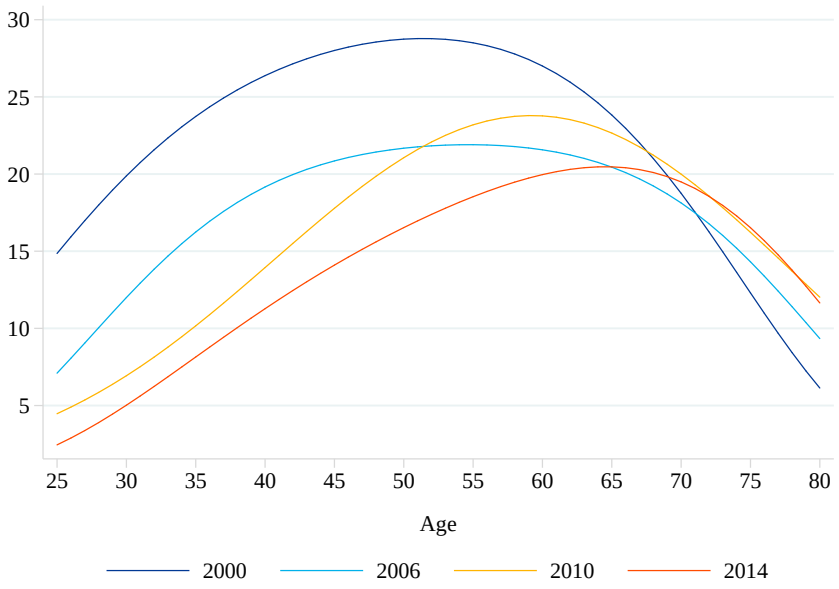
Figure 1.7: Fraction of stock market participants by age and cohort, in percent.



1.5 we present participation rates in terms of age and time. Given the well known problem of collinearity between age, time and cohort, using repeated cross sections we can identify only two of these effects at the time. In depth explanation of this issue and of the possibilities available to deal with it can be found in Ameriks and Zeldes (2004). In practice, there are two feasible alternatives: the first is to describe the data in terms of cohort and age effects, disregarding time effects, the second is to explain the data combining age and unrestricted time effects. Portfolio theory suggests that time effects are important, given that sample moments are used as proxies for the moments of the distribution of asset returns. Also age effects are predicted to be important: younger investors, with a longer investment horizon, should invest more in risky assets than older investors. Instead there are not very strong reasons for including cohorts effects.

However, cohorts effects may matter if early life conditions are important in order to determine how households evaluate investment opportunities. For example, Malmendier and Nagel (2011) find a significant effect of the stock market performance experienced during the lifetime on ownership probabilities. Using data on household portfolios from the U.S. Survey of Consumer Finances, they find that individuals who experienced low stock market returns are less willingness to invest in risky assets and their self reported risk aversion is higher. Work by Ampudia and Ehrmann (2017b) extend their analysis to many Euro area countries, using data from the Eurosystem Household Finance and Consumption Survey. They find also evidences that households weight more recent than past events, and that the memory of stock market crashes is more persistent than the one of booms. In figure 1.7 we aggregated households into five years of birth cohorts, based on the birth data of the reference person. The broken lines connect the raw data for each cohort, while the blue line is the estimated age profile of risky asset ownership. We

Figure 1.8: Estimated age profiles for risky asset ownership using different SHIW waves.

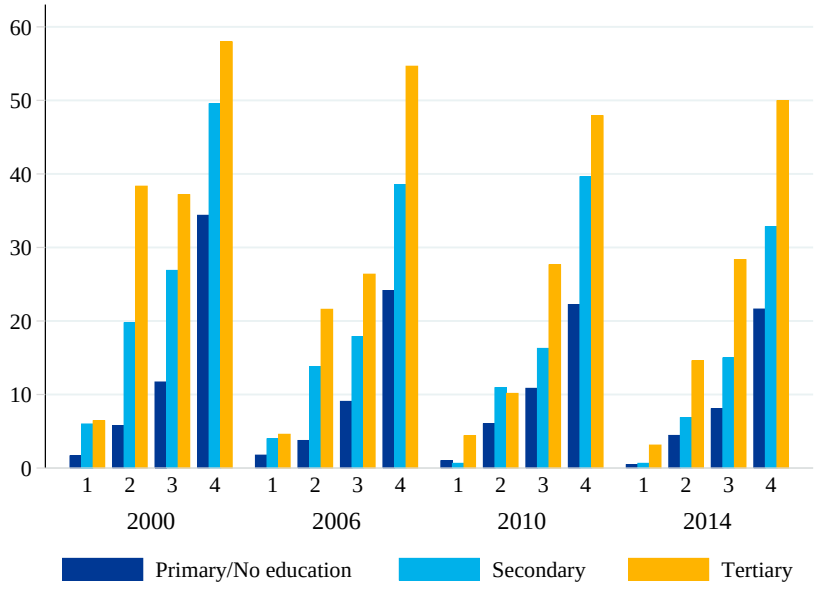


Statistics computed using survey weights.

restrict the sample to include only individuals aged between 25 and 80; cohort one (the youngest) thus includes household whose head was born between 1986 and 1990 and is considered only for the 2012 and 2014 waves, while the oldest cohort refers to indi-

viduals born between 1926 and 1930. Figure 1.7 shows also the estimated age profile of risky asset ownership. The estimation comes from a logit regression of the binary ownership variable on an age polynomial and unrestricted time effects. Equity ownership is clearly hump shaped over the life cycle, however, the drop in participation rates has been stronger for younger households than for the older ones. In figure 1.8 we estimate the age profile using only a wave at the time (clearly, time effects are not included and the independent variable in the regression is age only, in a polynomial form). The drop in estimated participation rates for the young is very pronounced. Interestingly, the curves moved towards the right: while participation peaks between ages 50 and 55 in 2000, in 2014 it peaks around 65 years old. Hence, the drop in participation rates is mainly due to the lack of participation of young households. At the same time, especially in 2014 we observe a strong decline in the probability of participating also for what regards households whose head is aged between 45 and 60.

Figure 1.9: Participation rates in risky assets by year, net wealth quartile and education attainment of the reference person, in percent.



Statistics computed using survey weights.

The last evidence from table 1.5 is the positive relationship existing between education and investment in risky assets. Indeed, more educated households are more likely

to own risky assets at every level of wealth, as can be seen in figure 1.9. To explain such correlation, previous work in the literature focused on financial literacy, or the capacity of households to understand and correctly evaluate the investment opportunities available. We will review this literature in the next chapter. Figure 1.9 shows that the decline in participation has been particularly strong among poor and low educated households. In the first quartile of net wealth, the participation rates for low educated households are almost zero in 2014. Interestingly, it seems that investors with a different educational background react differently to changing macroeconomic conditions. For example, let us focus on the change in participation between 2010 and 2014: participation of high educated households increased, while in the rest of the population the fraction of households holding risky assets decreased. At first, it may be argued that, given the positive relationship between education and wealth, it is possible that the decline in wealth made a limited resource constraint binding for lower educated (and thus poorer) households. However, figure 1.9 show that this is not (at least entirely) the case: indeed, we see that this divergent pattern across education classes is present even for households within the top wealth quartile.

1.3 An international comparison

In this section we want to provide a brief overview on household portfolios in different European countries and in the United States. We exploit two different datasets: for what concerns Europe, data are from the Eurosystem Household Finance and Consumption Survey (HFCS), an harmonised survey coordinated by the European Central Bank, for the U.S., instead, data come from the Survey of Consumer Finances (SCF) run by the Federal Reserve Board of Governors.

In the following, we choose to focus on eight Euro Area countries: Austria, Belgium, Germany, Spain, France, Ireland, Italy and the Netherlands. Table 1.6 presents the participation rates by asset categories for each country, while table 1.7 shows the shares of each asset in household portfolios. With respect to the tables for the SHIW only, here asset definitions are broader, in order to have harmonised data for each country. It is immediately evident that there are important cross country differences, both in the participation rates and in composition of the portfolio. Christelis et al. (2013) find that such differences largely depend on the economic environment, rather then on differences

Table 1.6: Participation rates by country, in percent. Statistics computed using survey weights.

	AT	BE	DE	ES	FR	IE	IT	NL	U.S.	EA
Financial assets										
Transaction and savings accounts [1]	99.7	97.5	99.0	99.6	99.6	93.9	93.2	98.6	92.4	96.9
Bonds [2]	4.0	7.8	4.2	2.1	1.2	4.5	13.0	3.8	1.4	4.6
Mutual funds	10.0	21.0	13.1	5.7	8.5	3.3	5.9	13.3	8.2	9.4
Listed shares	5.4	11.0	9.6	11.0	11.7	13.1	3.7	8.0	13.8	8.7
Non listed shares	0.4	1.0	0.6	2.1	1.9	0.6	0.8	0.1	1.3	1.3
Managed accounts	0.1	0.6	0.2	0.3	0.1	0.4	0.9	0.8	5.2	0.3
Life insurance/Voluntary pension	19.7	47.6	51.8	26.5	40.4	23.3	17.1	35.3	56.5	34.3
Other financial assets [3]	9.1	8.1	25.0	11.7	12.7	5.9	2.1	11.5	7.7	13.1
Real assets										
Main residence	47.7	70.3	44.3	83.1	58.7	70.5	68.2	57.5	65.2	61.2
Other real estate	12.1	18.5	20.2	40.3	23.3	23.0	23.1	8.1	13.3	24.1
Private business	7.0	8.5	9.3	14.3	8.5	20.2	16.0	2.7	9.6	10.9
Valuables	16.2	12.6	15.1	22.6	100.0	61.0	83.9	11.5	6.6	44.5
Vehicles	76.6	76.2	73.0	78.4	80.0	82.5	79.2	85.9	86.3	76.7
Debt [4]	34.4	48.4	45.1	49.3	47.1	56.8	21.2	63.1	74.5	42.4
Safe financial assets [5]	99.7	97.5	99.0	99.6	99.6	93.9	93.2	98.6	92.4	96.9
Liquid risky financial assets [6]	15.2	29.2	19.1	15.2	17.9	17.7	17.9	18.7	18.8	17.5
Risky financial assets [7]	35.3	62.8	66.6	42.1	51.0	36.6	31.0	49.2	62.6	48.0
Total risky assets (1) [8]	38.8	64.0	67.7	46.9	53.6	43.2	38.6	50.0	64.5	51.7
Total risky assets (2) [9]	43.6	67.5	71.8	63.2	59.3	48.8	47.6	52.9	65.9	59.8

Country codes: AT Austria, BE Belgium, DE Germany, ES Spain, FR France, IE Ireland, IT Italy, NL Netherlands, U.S. United States, EA Euro area. Euro area includes all 19 eurozone countries except Lithuania.

[1] Include certificates of deposit.

[2] Include government and corporate bonds.

[3] Include foreign assets, loans to cooperative and other financial assets as options, futures, royalties ecc.

[4] Include mortgages, unsecured credit lines and credit card debt.

[5] Safe assets include transaction and saving accounts.

[6] Risky liquid financial assets comprise bonds, listed shares, mutual funds and managed accounts.

[7] Risky financial assets include risky liquid assets plus non listed shares, other financial assets, defined contribution pension plan and life insurance.

[8] Total risky assets (1) are risky financial assets plus private business.

[9] Total risky assets (2) are risky financial assets plus private business and other real estate.

in individual household characteristics in different countries. On the other side, Guiso et al. (2008) find that a cultural factor such as trust is an important determinant of risk taking in household portfolios. It is clear that both explanations hold: a huge literature analyze the interactions between culture and institutions and it is likely that the two are related each other, and together drive the outcomes observed in the data. From table 1.6 we first of all see that in Italy, Ireland and in the U.S. there is a sizable fraction of "unbanked" households. Ampudia and Ehrmann (2017a) report that the fraction of such households excluded from the financial system was 3% in the Euro Area as a whole, using data from the first wave of the HFCS. They find that these households are mainly low income, unemployed and poor educated, and that there exists a substantial gap in net wealth between these families and their "banked" counterpart: they estimate it to be around 70 thousands euros in the Euro Area and 45 thousands dollars in the United States. They also find that such households are much less likely to own their residence and to be indebted. Transaction and saving accounts' share in total financial assets ranges from 36.2% in France to 45% in Italy, with two big exceptions: Austria, in which they make up to more than the 60% of financial assets, and the United States, in which, instead, they represent only 14.7% of financial wealth.

Bonds are much more widespread in Italy (13.0%) and in Belgium (7.8%) than in the other countries. In particular in France and in the US, the fraction of households that own bonds is lower than 1.5%. However, it must be noted that in the SCF 10% of households declare to own saving bonds and 7.8% own certificates of deposits (these categories are not reported in the tables and included in transaction and saving accounts). By looking at the shares is even more clear that investing in bonds is a peculiarity of Italian households only: bonds represent 19.2% of financial assets, while in all the other countries this share does not exceed 3.5%. For what regards stock market participation, direct holdings of listed stocks are much more common in the US (13.8%) than in Europe (Euro area average: 8.8%) where, however, we register substantial cross country heterogeneity: direct stock market participation rates range from 3.7% in Italy, to participation rates around and above 10% in Germany (9.6%), Belgium (11%), Spain (11%) and Ireland (13.1%). Direct stock holdings have a share of 14.6% of financial wealth in the US, while in none of the eight European countries considered this share exceed the 10%. It is important to notice that the participation rate in Italy is comparable with the one registered for Estonia (3.6%) and Poland (3.5%) and it is among the

lowest in Europe, if we exclude Greece and Latvia that have participation rates lower than 1%. On the other side, indirect equity investment through mutual funds is more common in Europe than in the US, especially in Belgium (21%), Germany (13.1%) and the Netherlands (13.3%). In the US the participation rate is around the 8%, while in Italy we register a participation rate of 5.9%, again, well below the Euro area average of 9.4%. Regarding other managed assets, the striking difference between the US (5.2%) and the Euro area countries, all below 1%, casts doubts about the comparability of such category between the two surveys.

The picture we have given so far, however, it is incomplete without considering equity holdings through retirement accounts. Indeed, here we observe the largest cross country differences, likely reflecting substantial differences in social security infrastructures. The largest participation rates are observed for the US and Germany (56.5% and 51.8%, respectively), followed by Belgium and France (47.6 and 40.4%) and the Netherlands (35.3%). Also for what regards the share of this retirement savings on total financial assets the cross country differences are very strong, with a share as high as 40.3% in France, higher than 30% in Germany, Ireland, Netherlands and United States, and a share between 16.6% and 20.4% in Austria, Belgium and Spain, with Italy at 13.2%. Italy has also the lowest participation rate in our sample, around 17%, and we have already mentioned how the development of occupational pension plans has been very recent. Such saving instrument, indeed, was practically not existent before the 2005 reform, which took effects in 2007. Finally, we register substantial heterogeneity also in other financial assets. Regarding the HFCS, such item is made by money owed to households and other financial assets, such as derivatives, futures, royalties etc. The high rates registered for Germany and Spain are mostly due to the former, that is, money owed to households. It is likely that such assets are loans made by the households to a cooperative (typically composed by other households that are also lenders) in order to build residential real estate. This mechanism is in some countries a common way to acquire home ownership. This may only partly explains those figures, as in Germany, France and the US we also registered high participation rates for other financial assets that, given the lack of further information, we cannot explore deeper. It is reassuring, however, by looking at table 1.7 that this category does not represent more than 6-7% of financial assets in none of the countries.

In terms of composition of the whole portfolio, financial assets represents a much

Table 1.7: Asset shares in household portfolios by country, in percent. Statistics computed using survey weights.

	AT	BE	DE	ES	FR	IE	IT	NL	U.S.	EA
Total financial assets [1]	15.0	24.7	24.0	15.1	19.1	15.1	12.1	24.9	44.6	18.6
Transaction and savings accounts [2]	61.2	38.8	43.1	40.6	36.2	44.1	45.0	39.6	14.7	42.1
Bonds [3]	3.3	3.4	3.1	1.7	1.2	2.1	19.2	7.7	3.1	4.4
Mutual funds	10.6	23.2	8.9	5.6	4.3	4.9	12.3	7.5	13.9	8.6
Listed shares	3.2	6.6	6.3	9.1	9.2	8.3	2.6	2.5	14.6	6.8
Non listed shares	2.1	2.2	2.6	16.5	4.4	0.5	1.8	0.2	5.5	4.5
Managed accounts	0.2	0.9	0.0	1.0	0.0	1.3	4.6	0.2	7.2	0.7
Life insurance/Voluntary pension	16.6	20.4	30.9	18.7	40.3	36.7	13.2	36.5	39.5	28.2
Other financial assets [4]	2.8	4.3	5.1	6.8	4.5	2.1	1.3	5.9	1.6	4.7
Total real assets [5]	85.0	75.3	76.0	84.9	80.9	84.9	87.9	75.1	55.4	81.4
Main residence	58.0	67.0	55.1	58.5	56.2	53.3	70.2	80.1	51.5	60.3
Other real estate	16.9	19.3	24.4	28.5	20.2	35.8	17.4	12.6	12.6	22.3
Private business	20.3	9.8	15.1	9.2	14.3	6.1	7.8	1.6	28.6	11.7
Valuables	1.3	0.9	1.5	1.0	6.0	2.0	1.6	0.8	1.4	2.3
Vehicles	3.5	2.9	3.8	2.8	3.4	2.9	3.1	4.9	5.9	3.5
Debt [6]	6.2	10.5	10.5	11.3	12.0	24.0	4.2	35.2	15.2	11.3
Safe financial assets [7]	61.2	38.8	43.1	40.6	36.2	44.1	45.0	39.6	14.7	42.1
Liquid risky financial assets [8]	17.0	33.2	18.2	16.4	14.6	15.3	34.1	17.6	31.5	19.8
Risky financial assets [9]	38.8	61.2	56.9	59.4	63.8	55.9	55.0	60.4	85.3	57.9
Total risky assets (1) [10]	23.1	22.5	25.2	16.8	23.8	13.6	13.5	16.2	53.9	20.3
Total risky assets (2) [11]	37.4	37.0	43.7	41.0	40.1	44.0	28.8	25.7	60.9	38.4

Country codes: AT Austria, BE Belgium, DE Germany, ES Spain, FR France, IE Ireland, IT Italy, NL Netherlands, U.S. United States, EA Euro area. Euro area includes all 19 eurozone countries except Lithuania.

[1] Total financial assets as a percentage of total assets. Financial assets categories are expressed as a fraction of total financial assets.

[2] Include certificates of deposit.

[3] Include government and corporate bonds.

[4] Include foreign assets, loans to cooperative and other financial assets as options, futures, royalties ecc.

[5] Total real assets as a percentage of total assets. Real assets categories are expressed as a fraction of total financial assets.

[6] Debt as a fraction of total assets. It includes mortgages, unsecured credit lines and credit card debt.

[7] Safe assets as a percentage of total financial assets. transaction and saving accounts.

[8] Risky liquid financial assets as a percentage of total financial assets. Comprise bonds, listed shares, mutual funds and managed accounts.

[9] Risky financial assets as a percentage of total financial assets. Include risky liquid assets plus non listed shares, other financial assets, defined contribution pension plan and life insurance.

[10] Total risky assets (1) are risky financial assets plus private business. Expressed as a percentage of total assets.

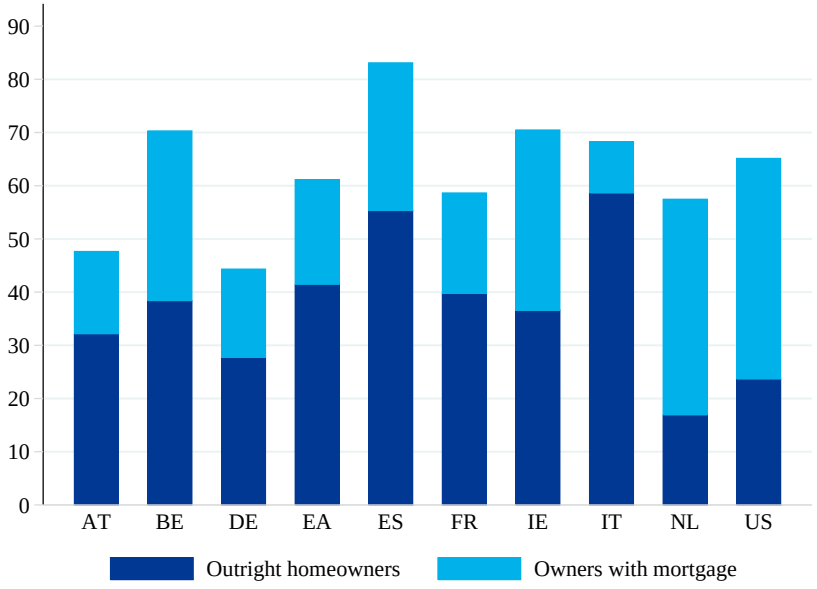
[11] Total risky assets (2) are risky financial assets plus private business and other real estate. Expressed as a percentage of total assets.

higher share of total assets in the United States than in Europe. Only 55% percent of US households wealth is in real assets, while for the whole Euro Area this share is as high as 81.4%. However, the fraction of households owning their main residence in the US are 65.2%, against a Euro area average of 61.2%. Still, large differences are present across the Eurozone, especially in Austria and Germany it is very low, below 50%, while in Spain 83,1% of households own their house. Such heterogeneity may be seen graphically in figure 1.10, which shows the home ownership rates for all the country in the sample. Figure 1.10 splits also indebted from outright homeowners. We notice that in the U.S. and in the Netherlands the vast majority of homeowners has a mortgage. Having a mortgage is common also in Belgium and Spain and, to a lesser extent, in France and Germany. In Italy, as we have previously shown, only a small fraction of homeowners have a mortgage. In an influential paper, Mian et al. (2013) show that there is a strong connection between housing net worth and consumption, and that such connection is stronger for indebted households[5]. Since then, the role of homeownership, household debt and house prices in driving consumption slumps and economic recessions has drawn a lot of attention. Research on the topic focused mainly in the U.S., mainly due to data availability reasons. Although a review of this vast literature is beyond the scope of the present work, such wide differences in household homeownership rates and indebtedness seem to point out that the levered losses story may not be sufficient to explain the magnitude of the Great Recession in many European countries.

Another key aspect of cross country differences in household portfolios is private businesses, both at the extensive and at the intensive margin. As regards participation, the highest rates are registered in Ireland (20.2%), Italy (16%) and Spain(14.3%). Then we find Austria, Belgium, Germany, France ad the Unites States, in which the participation rate ranges from 7% in Austria to 9.6% in the U.S. In the Netherlands, instead, the participation rate is very low, only 2.7%. Concerning, instead, the share of private business in real assets, in the United States it is much higher than in Europe, 28.6% with respect to a Euro area average of 11.7%. Comparing participation rates and the shares, it seems that on average, such businesses have a higher value in the U.S., in Austria,

[5]Mian et al. (2013) is just a part of the extensive narrative of the Great Recession by these authors, that they sum up in Mian and Sufi (2014). They highlight the role of "levered losses" suffered by indebted homeowners following the collapse in house prices as one of the main driver of the strong and prolonged reduction in consumption during the Great Recession.

Figure 1.10: Homeownership rate by country, in percent.



Statistics computed using survey weights.

Germany and France, rather than in Italy, Spain and Ireland, the three countries with the highest participation rates. Obviously, looking only at the share of private business in total real assets may be misleading: indeed, in these latter three countries households accumulate much more real wealth in houses and real wealth than in the others, thus lowering the share. Another argument that imposes attention in evaluating these numbers is related to the different degree of oversampling that takes place in the surveys. A largely documented fact, indeed, is that private business wealth is concentrated at the top of the wealth distribution[6]. Since the ability to cover the top tail of the wealth distribution varies across surveys, as we have already mentioned, we have the concern that such shares are not truly comparable.

Finally, we observe a wide heterogeneity in the fraction of indebted households in different countries. On this aspect, the difference between Europe and the Unites States is very strong: considering Euro area as a whole, the participation rate 42.4% while in

[6]This is a well known fact that we have shown for Italy in the previous section. There is large evidence that it is a common feature of household portfolios also in other countries (see (Eurosystem Household Finance and Consumption Network, 2016b) for evidence on Euro area).

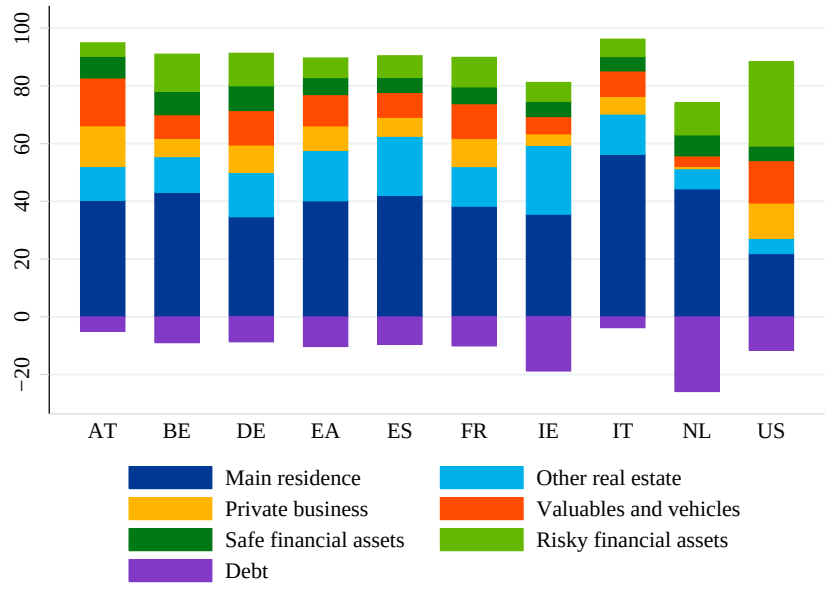
the US 74.5% of households have some kind of debt. Regarding the eight Euro area countries we are considering, we notice that Belgium, Germany, Spain and France are very similar, both in terms of participation (ranging between 45% and 50%) and in terms of the share of debt on total assets, which ranges between 10 and 12%. Further, being indebted is less common in Austria (34.4%) and much more common in Ireland, where 56.8% of the households have some kind of financial liabilities. At the two extremes we find Italy, where only 21.2% recur to debt, and the Netherlands, where instead the participation rate is as high as 63.1%.

Finally, we present the figures for some aggregated categories. We divide financial assets into safe and risky, and then we separately consider financial risky assets, total risky assets including private business and an alternative definition that includes also real estates other than the main residence[7]. From the discussion above regarding savings for retirement and the role that voluntary pension plans play in some countries, it seems clear that in this international comparison would not be useful to focus on risky liquid assets only. Household financial portfolios are typically safer in Europe than in the US, especially if we look at the share invested in risky assets: in the US, such share equals the 85.3% of financial assets, while in Europe the average share is 57.9%. However, it is misleading to consider our definition of risky financial assets as equity. First it includes bonds, even though the share of directly held bonds in portfolios is very low, on average. But, more importantly, it considers the whole value of mutual funds and retirement accounts. Obviously, a large part of these items may be invested in safe assets. Imputing the share invested in equity in these accounts is not straightforward, given that such information is not available in the HFCS and in the SCF. Hence, we prefer to avoid an imputation exercise of this kind, which would have to rely on assumptions that are somewhat arbitrary[8]. Figure 1.11 shows net wealth composition by country, and allows

[7]The results of these tables are different from the results for the SHIW presented in the first section. This is due to the fact that in the HFCS some categories are defined broader, especially for what concerns financial assets: for example, we cannot distinguish short and long term bonds, or corporate and government. Moreover, we cannot distinguish amounts invested in voluntary pension plans from cash value of life insurance policies.

[8]Campbell (2016) exploits alternative sources, and estimates a share of mutual funds and retirement accounts invested in bonds and stocks equal to 0.85 for the US. He further assumes that such share equals one in Europe (in the absence of reliable information) and estimates a share invested in equity of 0.49 in Germany, 0.64 in the Netherlands, 0.34 in Spain, 0.51 in France for mutual funds and 0.213 (Germany), 0.372 (Netherlands), 0.266 (Spain) and 0.278 (France) for retirement accounts. Given the lack of alternative sources, he assumes the share for Italy equal to 0.5.

Figure 1.11: Net wealth composition by country, in percent.



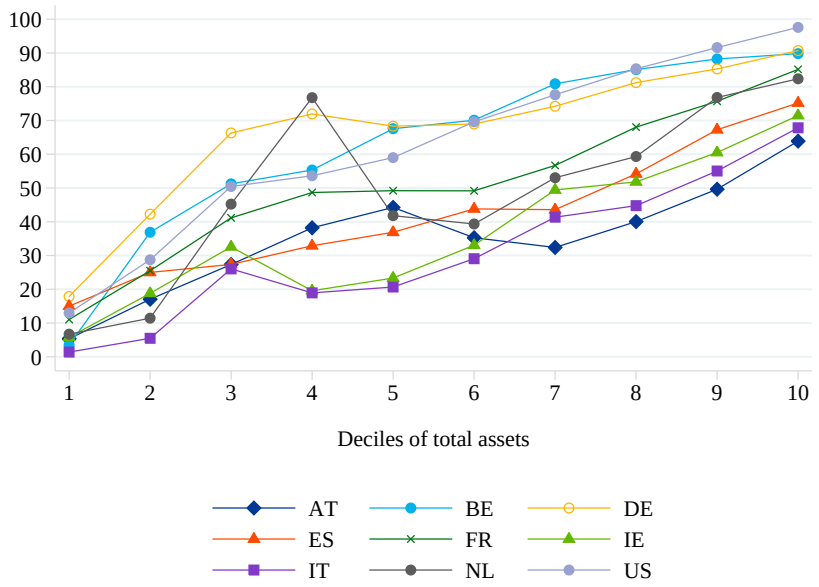
Statistics computed using survey weights.

us to sum up the facts highlighted up to now. In particular, we see that even if in the US debt is much more diffused, on average the amount of debt is much lower. This is due to the fact that while in Europe debt typically takes the form of mortgage to purchase real estate, in the US debt in the form of credit card debt or unsecured credit lines to finance consumption is more widespread. The figure highlights also the striking difference in the weight of financial and real assets in Europe and in the United States, where financial assets represent almost 45% percent of total assets.

The wide heterogeneity in household attitudes towards risky investment is maintained also when we look at the participation rates by total assets deciles, as in figure 1.12. Some features of the chart are worth to be mentioned. First, we see that at the top of the gross wealth distribution, in the US almost every household holds some kind of risky assets, while in European countries as Italy, Austria, Ireland and Spain the participation rate does not exceed 70% even at such levels of wealth. Second, we se that in some countries (i.e. Netherlands, Austria and, to a lesser extent, Germany) the participation rates increases in the first deciles, then decreases and rises again at the top of the distribution. One explanation for this pattern is related to home ownership. In-

deed, since we consider here the distribution of total wealth, it is clear that in the bottom deciles the majority of households do not own their main residence, while homeowners are concentrated in the right part of the distribution. Thus, the peak in the participation rate most likely corresponds to the decile in which we find those households that we may call "rich renters". This households are relatively very rich, considered that they do not own the house i which they live. This explanation seems consistent with the fact that such peculiar pattern is observed at higher deciles in the countries where the home ownership rate (figure 1.10) are the lowest. Indeed, the rich renter category is much less numerous in countries as Spain or Italy. Though this pattern seems common to almost of the countries, its magnitude varies a lot. In particular in the Netherlands it is very strong, with the participation rate in the third decile that is more or less the same of the one in the tenth decile.

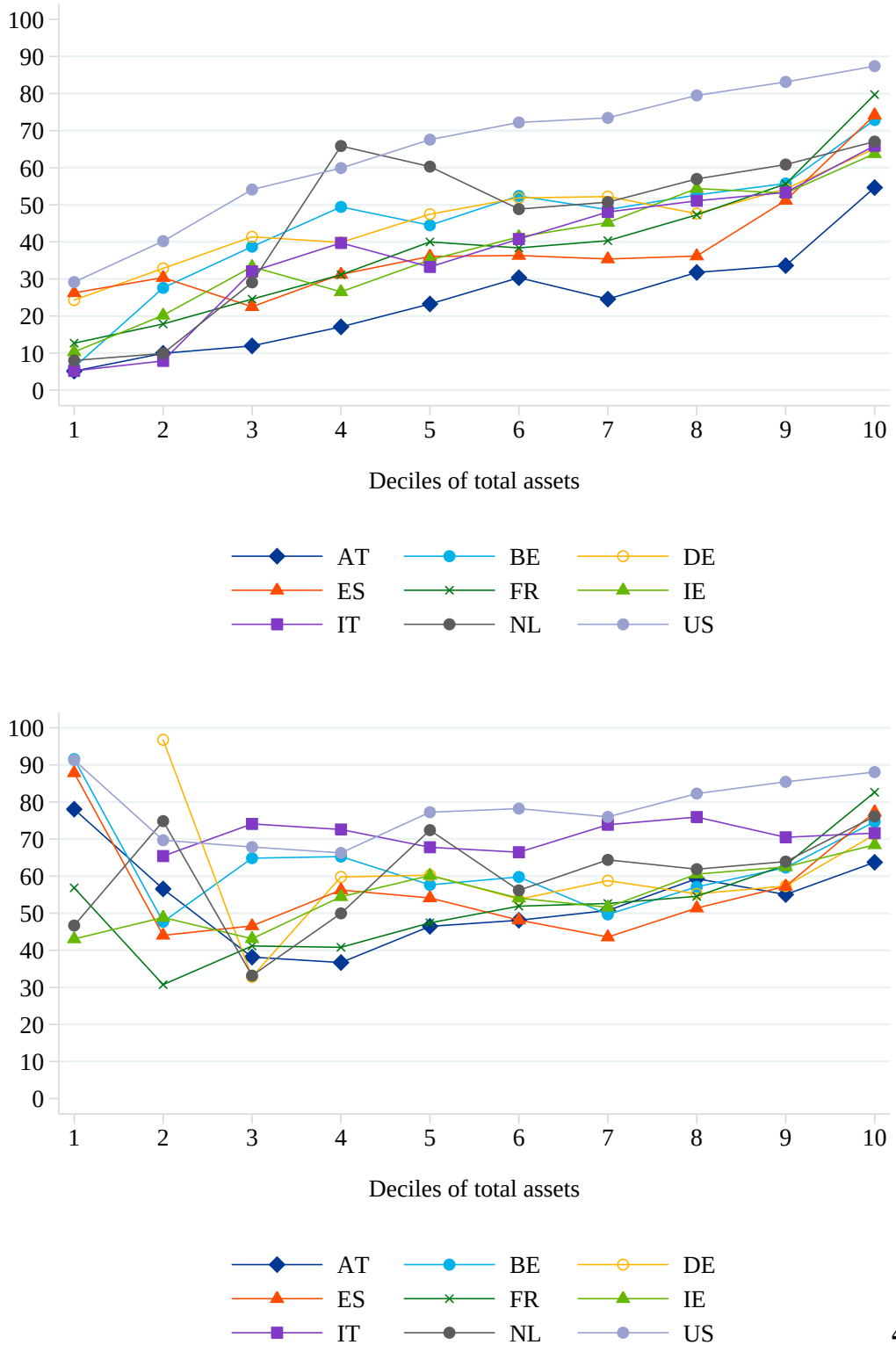
Figure 1.12: Participation rates in risky asset by country and deciles of total assets.



Statistics computed using survey weights..

Figure 1.13 shows the share of risky assets in household financial portfolio by deciles of total assets. The top panel shows the unconditional share, while in the bottom panel we consider only households that own risky assets. For the reasons mentioned above, such shares do not provide a true measure of the riskiness of the portfolio, given

Figure 1.13: Unconditional share (top) and conditional share (bottom) invested in risky asset by country and deciles of total assets.



Statistics computed using survey weights.

that we considered as risky assets also all kinds of bonds, and mutual funds and retirement accounts as a whole. Hence, they provide an upper bound. Figure 1.13, however, shows at least two important evidences. First, coherently with what observed in the literature[9], portfolios of the rich are much riskier on average than portfolios of the rest of the population. Second, once we consider only households that own risky assets, a large part of the heterogeneity disappears, and the relationship between the share and wealth becomes flat. This is a strong argument in favor of using a constant relative risk aversion function to describe household preferences, rather then ones in which relative risk aversion is declining. As we will make clearer in the next chapter, a strong implication of CRRA utility functions is that the share invested in the risky asset does not depend on wealth. At the same time, however, if risk aversion does not decline with wealth, we need to resort to alternative factors able to explain why the correlation between wealth and participation is so high. This will be precisely the objective of the next chapter, in which we present the theory of household portfolios, and we analyse the extent to which various explanation that have been put forward in the literature match the evidences of our descriptive analysis.

[9] See Carroll (2002), Bach et al. (2015), Campbell (2016), among many others.

2

The theory of household portfolio choice

The lack of participation to the financial markets poses significant challenges to the standard theory of portfolio choice. To begin with, we introduce a very simple framework to describe household portfolio choice. In particular, we will show that in the simplest version, given a positive equity premium, a standard portfolio choice model are not able to explain why so few households participate in the stock market. The literature has referred to this as the "stock market participation puzzle", or "stockholding puzzle" (Haliassos and Bertaut, 1995), and has developed a number of different explanations able to account, at least in part, for such puzzle. Let us a consider a single period portfolio choice model. Households are endowed with an amount of wealth W that allocate into two assets: one is risky, and pays a random gross return $\tilde{r}$ while the other one is risk free, with a (certain) return r_f. Households maximize their expected utility from wealth, and have a standard utility function $U(W)$, that is, the utility function is monotonically increasing in W, so that $U^{'}(W) > 0$ and moreover the investor is risk averse, thus $U^{''}(W) < 0$. The investor then has to choose the fraction α^* to invest in the risky asset that maximizes her expected wealth. Conversely, the fraction invested in the risk free asset is given by $1 - \alpha^*$. Note that short sales are not allowed.

Formally, we can describe the problem above in the following way:

$$\max_{\alpha} \quad EU[W(r_f + \alpha(\tilde{r} - r_f))]. \tag{2.1}$$

Deriving equation (2.1) we obtain the following first order condition:

$$EU'[W(r_f + \alpha(\tilde{r} - r_f))]W(\tilde{r} - r_f) = 0. \tag{2.2}$$

From (2.2) is clear why non participation in the risky asset is a puzzle: substituting $\alpha = 0$ we obtain

$$EU'[W(r_f)]W(\tilde{r} - r_f) = U'[W(r_f)]E(\tilde{r} - r_f)W = 0. \tag{2.3}$$

Thus, with an expected positive equity premium equation (2.3) is always positive, since $U'(Wr_f) > 0$, and hence with $\alpha = 0$ optimality is violated. Such a conclusion is a strong implication of the basic asset allocation model: every investor should invest a positive fraction of her wealth in the risky asset, independently from her degree of risk aversion.

The rest of the chapter is organized as follows: section one introduces participation costs, and show how they affect participation. Section two combine participation costs and trust, and we present the results of a portfolio choice model in which both factors are considered. Finally, section three is devoted to analyze further elements that the literature has related to portfolio choice, specifically risk aversion and background risk, financial literacy and expectations.

2.1 Introducing participation costs

A first extension of the framework that, at least in part, can explain the puzzle is the introduction of a fixed participation cost. In particular, such feature explains one of the well documented features of the data, the correlation between stock market participation and wealth that we have documented in the previous chapter. This section closely follows Vissing-Jørgensen (2004). In her seminal contribution, she introduced two types of participation costs: a one-time entry and a per-period participation cost. Such costs have a monetary component, that we can think of as the commission fee that has to be paid to the financial intermediaries, and a non monetary cost, assimilable to the time and efforts that the investor must spend in researching the information necessary to make the investment. It is clear that both of these components can be heterogenous, and more-

over, correlated each other: in a market with frictions, lower educated investors may have to devote more efforts to acquire information about the investment opportunities available, and, at the same time, they are more likely to end up making less attractive investments.

We abstain from inter temporal considerations and we limit ourselves to consider only the presence of a per period participation cost. We assume that in order to invest in the risky asset and to benefit from the positive equity premium, households must pay a fixed cost f, and thus their decision weights the benefits from participation against this cost. First of all, let us see how the presence of a fixed (per-period) participation cost changes the problem in equation (2.1). Similarly, households choose α to maximize the expected utility from their wealth, that, however, in the case of positive α becomes $W - f$. Thus, we can define α^* as the optimal share invested in the risky asset that solves the following optimization problem:

$$\max_{\alpha} \quad EU[(W - f)(r_f + \alpha(\tilde{r} - r_f))]. \tag{2.4}$$

Deriving with respect to α we obtain the same first order condition as in (2.2), only with W replaced by $W - f$. Clearly, the conclusion is the same, the α^* that solves the optimization problem must be strictly positive. However, given α^*, the investor participates in the stock market if her expected utility from the investment is higher than the (certain) utility coming from investing only in the risk-free asset, thus avoiding to pay the fixed cost. Formally, we can summarize it in the following condition:

$$EU[(W - f)(r_f + \alpha^*(\tilde{r} - r_f))] \geq U(Wr_f). \tag{2.5}$$

We can replace the left hand side of (2.5) with its certain equivalent to obtain

$$EU[(W - f)(r_f + \alpha^*(\tilde{r} - r_f))] = U[(W - f)(r_f + \alpha^*(r^{ce} - r_f)) \geq U(Wr_f), \tag{2.6}$$

from which we can express the participation condition as

$$(W - f)(\alpha^*(r^{ce} - r_f)) \geq fr_f. \tag{2.7}$$

We can then interpret the two sides of equation (2.7) as the benefits and the costs from

participation, respectively. The left hand side represents the net benefit from investing $\alpha^*(W - f)$ in the risky asset, proportional to the risk-adjusted equity premium, while the left hand side represents the cost avoidable by not investing in the risky asset, times the return r_f that can be achieved investing the amount f in the risk-free assets. From equation (2.7) it is clear that the value of the fixed cost defines a wealth threshold below which the expected utility maximizing investor is better off staying out from the stock market and investing all of her wealth in the safe asset. Rearranging equation (2.7) we can express such wealth threshold as

$$\underline{W} = f\left(1 + \frac{r_f}{\alpha^*(r^{ce} - r_f)}\right). \tag{2.8}$$

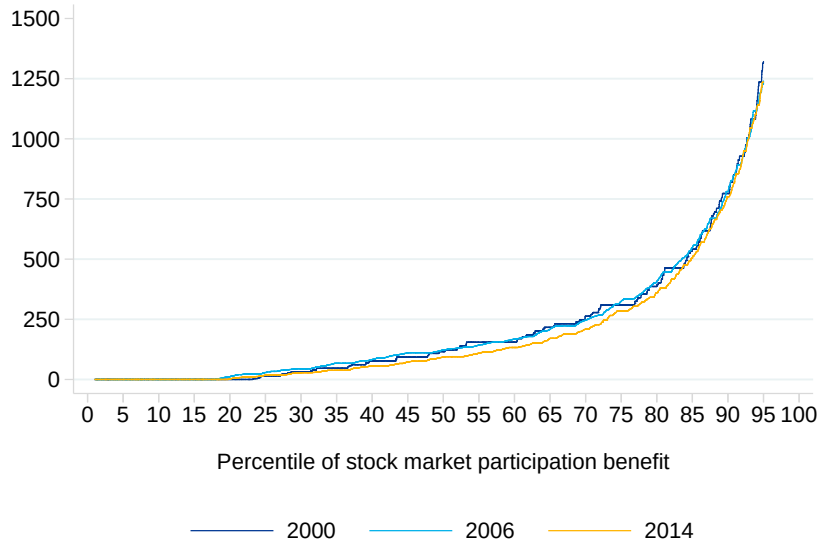
As can be seen from equation (2.8), the framework above implies that the relationship between the wealth threshold that triggers participation and the fixed cost is linear; the slope depends on the ratio between the return on the risk free asset and the risk-adjusted excess return obtainable investing a fraction α^* in the risky asset, where α^* is the optimal share invested in case of participation. Given a fixed cost f, the lower α^* or the risk adjusted equity premium, the higher the threshold.

We can now replicate the exercise made by Vissing-Jørgensen (2004) in order to obtain an estimate of these costs from the data. The intuition is quite simple: since we assume that cost is fixed for everyone and we observe a participation rate of $x\%$ in the risky asset, given the risk-adjusted equity premium and the optimal share invested conditional on participation, we can compute the value of the benefit as a function of wealth, and then estimate the level of the cost necessary in order to explain a participation rate of $x\%$. We need three assumption in order to make this computation. First of all, we assume that each nonparticipant would invest an optimal share α^* equal to the average share invested by participants. We consider as risky the amounts invested directly in stocks, in mutual funds or in managed accounts. Then, we compute the share invested in the risky asset as the fraction of liquid financial wealth (i.e. financial wealth excluding the cash value of life insurance policies and voluntary pension plans, as defined in table 1.2) held into these three financial instruments. From the one side, this approach clearly overstates both the participation rates and the risky share in the portfolio, as a significant part of mutual funds and managed accounts holdings may not be invested in stocks. At the same time, however, it entails also understating the total amount of

stocks in household portfolios, by ignoring holdings through pension funds. However, there are various reasons that lead us to prefer this approach. First of all, the quality of the data on pension funds and their composition is lower than the rest of the portfolio data in the survey, and many values are imputed (see the appendix); in particular data on pension funds are very scarce in the waves before 2006. Second, even assuming that our imputation is reliable, it would be difficult to estimate which share of the fund is invested in stocks. Third, as we have seen in chapter 1, investing in mutual funds entails a monetary benefit rather than a cost, thanks to the tax advantage, though it may involve some non-monetary costs. Fourth, and last, following the 2005 reform, the majority of investments in these instruments are related to specific agreements between employer and employee, and many households in the survey show very little knowledge of the exact characteristics of the investment. This last point is supported also by evidences from the SHIW. In 2008, respondents have been asked four questions relative to the characteristics of occupational pension plans. The questions asked about the tax advantage, the possibility to withdraw part of the capital, the riskiness of the investment and the way in which the pension is calculated. It is striking that only 3% of the households answered correctly to all the four questions, while more than the 40% answered wrongly to all the questions. A final consideration that leads us to exclude those amounts is the fact that the transfer of the severance pay to a private fund generates differences in wealth across households that may not be true. Indeed, severance pay is very difficult to be estimated and it is not measured in the survey. So, such value is not present in the dataset for people who retained it within the firm, while we have it for those who transferred it to the new regime. Imagine two households with identical wealth and the same accumulated severance pay. One transferred it to a private fund, while the other chose to retain it within the firm. Including the value of the pension plans the former would appear richer and the latter poorer, even though such difference does not exist, in practice. For these reasons, we prefer to exclude such amounts from the following analysis.

The second assumption regards the equity premium: following, again, Vissing-Jørgensen (2004) we set the risk-adjusted equity premium at 0.04, which is a quite conservative value, considered that the historical excess return in the United States is estimated between 6% and 7%. A third assumption is to compute the benefits as $(W)(\alpha^*(r^{ce} - r_f))$ rather than $(W - f)(\alpha^*(r^{ce} - r_f))$. Also this third assumption overstates the benefits from participation. Figure 2.1 shows the distribution of the stock

Figure 2.1: Stock market participation benefits for nonparticipants.



Euros (2014 = 1).

market participation benefit computed as described above using data of three different SHIW waves. Given that in each wave we have assumed that the risk-adjusted equity premium and the optimal share invested if participation occurs are the same across the sample, the value of the benefit is linear in financial wealth. For a matter of readability, percentiles above the 95^{th} are not included in figure 2.1. Table 2.1 shows the level of fixed costs needed to explain the decision of 50, 75, 90 and 100% of non participants households in each wave. From table 2.1 it is evident that even a low participation cost is able to account for the decision to not participate of a large share of the sample. For example, a cost of only 92.9 euros explains the decision of half of the non participants in 2014. Clearly, this is related to wealth: from equation 2.7, indeed, we notice that the benefits from participation are directly proportional to wealth. Thus, the low levels of costs able to explain the decision of a significant part of non participants households reflect the low median financial wealth, as can be seen in table 2.1. Hence, the presence of a fixed participation cost can plausibly explain the relationship between wealth and stock market participation well documented in the data, at least at relatively low values of wealth.

Table 2.1: Fixed costs needed to explain the decision of $x\%$ of nonparticipants.

Year	1998	2000	2002	2004	2006	2008	2010	2012	2014
Fraction									
50% [1]	95.3	115.9	122.8	129.0	122.5	86.9	92.0	79.6	92.9
75% [1]	317.6	309.1	294.7	335.4	324.2	253.6	312.9	262.6	284.9
90% [1]	817.9	772.7	663.2	773.9	780.9	608.4	699.5	795.7	759.8
100% [1]	44,864.5	111,891.3	55,263.5	59,333.2	54,687.2	35,668.8	54,915.2	82,648.3	47,541.6
Matching participation rate [2]	952.9	865.5	736.8	902.9	1,026.4	909.3	1,029.7	1,452.1	1,234.6
Share fixed to 0.45 [3]	774.1	693.1	682.6	758.9	958.0	1035.1	1082.1	1333.2	1170.0
Summary statistics									
Participation rate	13.5	16.8	16.4	12.8	11.3	9.9	9.1	7.1	8.3
Average share [4]	55.4	56.2	48.6	53.5	48.2	39.5	42.8	49.0	47.5
Liquid financial wealth									
Mean	29,827.1	36,214.2	29,018.6	26,197.5	29,314.14	26,615.6	29,478.3	28,708.9	28,392.6
Median	7,167.8	6,876.0	8,216.9	8,432.6	7,992.6	6,713.4	7,306.2	5,598.3	6,000.0

[1] Values in euros, 2014 = 1.
[2] Fixed costs that generate a participation rate equal to the one observed in the data.
[3] Fixed costs that generate a participation rate equal to the one observed in the data, with the share invested fixed to 0.45.
[4] Average share conditional on participation, in percent.

However, there are two features of the data that participation costs cannot explain. First of all, there is a large fraction of households that do not own risky assets even at high level of wealth. As an example, in the table we report also the hypothetic fixed cost necessary to explain the decision to not invest in the risky asset of every non participating investor in the sample. As can be seen, we would be forced to assume implausibly high values for the fixed cost.

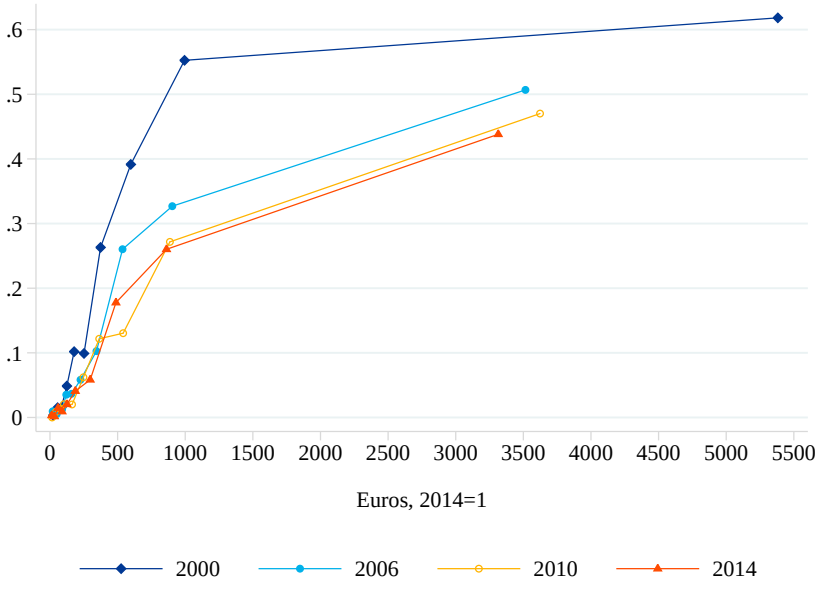
Second, participation costs cannot account for the considerable drop in participation that we report in table 2.1. In the table we compute also the value of fixed costs that generates a participation rate equal to the one observed in the data. The computation is very simple: we assume that participation is related to wealth only and since a given value of the cost determines a wealth threshold that triggers participation, we select the level of the cost that exactly individuates the percentile along the wealth distribution that corresponds to the rate of non participation observed. To be more clear, let us consider for example participation in 2006. The participation rate is 11.2% and the average share equals 48.2%. Following the computation described before we find a cost equal to 1,026.4 euros. In order to allow an easier interpretation of the evolution of these costs over time, we also repeat the same computation but fixing α^* equal to 0.45. Indeed, costs in a specific year are determined by the participation rate, the corresponding percentile of the distribution of financial wealth and the share invested. Hence, setting a fixed α^* we limit the sources of variability only to changes in financial wealth and in the

participation rates. It is clear, looking at table 2.1 that to be able to explain the drop in participation fixed costs should have increased throughout the years. But it is very unlikely that this happened, if anything, instead, the access to stock and financial products such as mutual funds should have became easier, thanks to the technological progress and the progressive development of financial markets in Italy occurred especially in the first half of the 2000s.

To conclude this analysis, we replicate a more ambitious exercise proposed by Vissing-Jørgensen (2004) in which we allow the fixed cost to be heterogenous across households. Equation (2.7) defines the condition that should induce households to participate in the stock market. With the assumptions we made above, that is, that α^* is the same (0.45) and that the adjusted equity premium equals 0.04, we have been able to calculate the distribution of the benefit and the corresponding cost needed to explain household's observed decision. However, an homogenous participation cost implies that the wealth threshold derived in equation (2.8) splits the population into non participants and participants. Instead, allowing for the fixed cost to vary across households could explain different choices by households with similar characteristics, that is, with similar levels of financial wealth.

A simple approach to estimate the cross-section distribution of the participation cost is the following: we start observing that the benefit is linear in wealth, so individuals with the same level of wealth would potentially have the same gains from the investment. If we observe that in a given wealth range the participation rate is $x\%$, we can therefore conclude that condition (2.7) holds for $x\%$ of the households, and the fixed cost they face is lower than the benefit, while the opposite is true for the remaining $1 - x\%$. By dividing the sample into 10 deciles of liquid financial wealth we can estimate 10 points on the cumulative distribution function of the fixed cost. Clearly, such CDF never reaches one, as we do not observe complete participation at any level of wealth. Figure 2.2 shows the result of this computation in four years of the SHIW. For the interpretation of figure 2.2 there are two elements that we have to address. First, we see that this CDF shifted down across the years. That means that within each decile, a larger fraction of households must have costs higher than the benefit, since they do not participate. For what regards the benefit, we see that it varies throughout the years, since wealth changed. In particular, the cost needed to explain non participation at the highest decile was higher than 5000 euros in 2000, but it declined substantially over the

Figure 2.2: Cumulative density function of the participation cost.



years. In the other deciles, however, financial wealth declined less, and the changes in the level of costs that explains non participation are less pronounced. Figure 2.2 overall confirms our previous findings that even a low fixed costs may explain non participation of poor households. At the same time, it shows that more than the 50% of households in the top decile of financial wealth should face a cost higher than 3000 euros in 2014 in order to justify their non participation. Such value is clearly not plausible, thus other factors are needed in order to explain the stock holding puzzle.

2.2 Portfolio choice and trust

In the previous section we showed how participation costs can affect household portfolio choice and how they can help in addressing the stock holding puzzle. However, from the explanation above, it is also clear that costs only cannot fully explain the puzzle: in particular, fixed costs are not able to account for the lack of risky investment observed at high level of wealth and for the decline of participation over time. Moreover, participation costs must differ very much across countries in order to explain the wide cross country differences we observe. In order to explain these features of the data, Guiso

et al. (2008) introduce subjective trust in the asset choice framework. To see how trust enters the picture, let us go back, for the moment to the simple framework described by equation (2.1). As before, only two assets are available to households: a safe one, which pays a return r_f with certainty, and a risky one that pays a random return $\tilde{r}$. We further assume that the random return is normally distributed, $\tilde{r} \sim N(\bar{r}, \sigma^2)$. Following Guiso et al. (2008), trust is modeled as a subjective probability p of being cheated in the stock market. If cheating occurs, then the value of the investment in the risky asset will be equal to zero. Taking this into account we can express investor's next period wealth as:

$$\begin{array}{lll} W_t(r_f + \alpha(\tilde{r} - r_f)) & \text{with probability} & (1-p), \\ W_t(1-\alpha)r_f & \text{with probability} & p. \end{array} \tag{2.9}$$

In the following we will omit the time subscript for simplicity. Thus, investor seeks to maximize:

$$\max_{\alpha} \quad (1-p)EU[W(r_f + \alpha(\tilde{r} - r_f))] + pU[(1-\alpha)Wr_f]. \tag{2.10}$$

Equation (2.10) shows that when there is a non zero probability of being cheated, expected utility is given by a weighted average of the expected utility achieved if cheating does not occur, with probability $1-p$, and the utility obtained in case of cheating. The first order condition in (2.2) now becomes:

$$(1-p)EU'\left[W(r_f + \alpha(\tilde{r} - r_f))\right](\tilde{r} - r_f)W + pU'\left[(1-\alpha)r_f W\right](-r_f)W = 0. \tag{2.11}$$

We can interpret equation (2.11) in the following way: the first term represents the marginal utility of investing an extra dollar in the risky asset when cheating does not occur, while the second term is the marginal utility of investing in the risky asset when cheating takes place. Now, if the investor does not invest in stocks (choosing $\alpha = 0$), the quantity above becomes just

$$(1-p)U'\left[Wr_f\right](\bar{r} - r_f) - pU'\left[Wr_f\right](r_f) = 0, \tag{2.12}$$

that can be rearranged into

$$U'\left[Wr_f\right](\bar{r} - r_f - p\bar{r}) = 0. \tag{2.13}$$

Then if the quantity above is negative, it is not optimal to invest in the risky asset, and α will be zero. Given that $U'(r_f) > 0$ by definition, the LHS of (2.13) is greater than zero, and so the investor will participate in the stock market, if and only if

$$p \leq 1 - \frac{r_f}{\bar{r}}. \tag{2.14}$$

Hence, there exists a lack of trust threshold $\bar{p}$ such that an investor will never enter the stock market. Moreover, it does not depend on the level of wealth, and so it is particularly suited to explain why even wealthy households do not participate. This threshold may be estimated: Guiso et al. (2008) assume the expected risky return equal to 1.12 and the risk free rate equal to 1.05, obtaining that households with a subjective probability of being cheated higher than 6.25% will not enter the stock market. Let us now assume that p is lower than $\bar{p}$. In this case it is optimal to invest a positive share α in the risky asset, that we can obtain solving the first order condition:

$$(1-p)EU'\left[\alpha\tilde{r} + (1-\alpha)r_f\right](\bar{r} - r_f) = pU'\left[(1-\alpha)r_f\right](r_f). \tag{2.15}$$

Solving this, we will find the optimal value α^*. How changing p will modify this α^*? Obviously, if p increases the left hand side of (2.15) decreases, while the right hand side increases. Thus, α has to adjust accordingly. Then we observe that the right hand side is also increasing with α, for

$$\frac{d}{d\alpha}\left(pU'\left[(1-\alpha)r_f\right](r_f)\right) = -pU''\left[(1-\alpha)r_f\right](r_f^2) > 0,$$

due to the concavity of $U(\cdot)$ ($U''(\cdot) < 0$). This means that increasing α will increase the right hand side of (2.15). In the same way, by the concavity of the utility function, we have

$$\begin{aligned}\frac{d}{d\alpha}\big((1-p)EU'\big(\alpha\tilde{r}+(1-\alpha)r_f\big)(\bar{r}-r_f)\big) = \\ = (1-p)EU''\big(\alpha\tilde{r} + (1-\alpha)r_f\big)(\bar{r}-r_f)^2 < 0.\end{aligned}$$

Hence, increasing α will decrease the left hand side of (2.15). Clearly, this implies that if the investor's lack of trust p increases, his optimal share α^* decreases or, higher level trust gives higher values of the optimal share. As an example, let us assume the

investor has an exponential utility function, $U(W) = -e^{-\theta W}$, where θ is the coefficient of (constant) absolute risk aversion. Making use of the fact that the risky asset return are normally distributed with mean $\bar{r}$ and variance σ^2 equation (2.15) becomes:

$$(1-p)\left(-e^{-\theta(\alpha\bar{r}W+(1-\alpha)r_fW-\frac{\theta}{2}\sigma^2(\alpha W)^2)}\right)(-\theta W\bar{r}+\theta Wr_f+\theta^2\alpha\sigma^2W^2)+p\left(-e^{-\theta(1-\alpha)r_fW}\right)(\theta Wr_f), \tag{2.16}$$

where we used the fact that if $X \sim N(\mu, \sigma^2)$ then

$$E(e^X) = e^{\mu+\frac{\sigma^2}{2}}. \tag{2.17}$$

Equation (2.16) may be reduced to

$$\alpha^* = \frac{\bar{r} - r_f}{\theta\sigma^2 W} - \frac{pr_f}{(1-p)A\theta\sigma^2 W}, \tag{2.18}$$

where $A = e^{-\theta\left(\alpha\bar{r}W-\frac{\theta}{2}\sigma^2(\alpha W)^2\right)}$.

We are now interested in combining the results of these two sections, and see how trust does affect the participation decision in the presence of a fixed cost. Similarly to (2.4) the investor chooses α^* that solves the following maximization problem:

$$\max_{\alpha} \quad (1-p)EU\left[(W-f)(r_f+\alpha(\tilde{r}-r_f))\right] + pU\left[(1-\alpha)(W-f)r_f\right]; \tag{2.19}$$

and participate in the stock market if

$$(1-p)EU\left[(W-f)(r_f+\alpha^*(\tilde{r}-r_f))\right] + pU\left[(1-\alpha^*)(W)r_f\right] \geq U[Wr_f]. \tag{2.20}$$

Obviously, there is still a level of mistrust such that if $p > \bar{p}$ the investor will not enter into the market. We can show that this threshold is lower than in the case without participation cost. To prove it, let us start with considering the participation condition implied by (2.14) in the absence of participation costs, that is, if $p = \bar{p}$ the investor is indifferent between participating and non participating:

$$(1-\bar{p})EU\left[(W)(r_f+\alpha(\tilde{r}-r_f))\right] + \bar{p}U\left[(1-\alpha)(W-f)r_f\right] = U\left[Wr_f\right]. \tag{2.21}$$

Inserting a participation cost f lowers the LHS of (2.21) while the RHS remains the

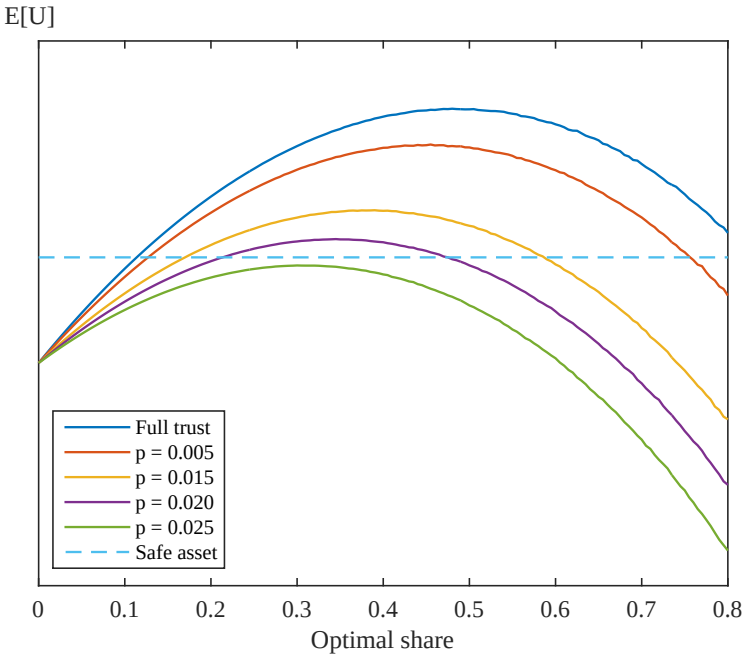
same. Since $\frac{U[W]}{dW} > 0$, that is, U is increasing in wealth, it follows that

$$\begin{aligned}
&(1-\bar{p})EU\left[(W-f)(r_f+\alpha(\tilde{r}-r_f))\right]+\bar{p}U\left[(1-\alpha)(W-f)r_f\right]= \\
&=EU\left[(W-f)(r_f+\alpha(\tilde{r}-r_f))\right]- \\
&\bar{p}\left(EU\left[(W-f)(r_f+\alpha(\tilde{r}-r_f))\right]-U\left[(1-\alpha)(W-f)r_f\right]\right)<U[Wr_f].
\end{aligned} \tag{2.22}$$

Since $EU\left[(W-f)(r_f+\alpha(\tilde{r}-r_f))\right]-U\left[(1-\alpha)(W-f)r_f\right]>0$, it follows that for $f>0$ $\bar{p}$ must decrease in order for the above expression to hold with equality.

Similarly, Guiso et al. (2008) show that also the wealth threshold defined in equation (2.8) is lower when the investor perceives the risk of being cheated in the stock market.

Figure 2.3: Simulation of optimal asset allocation with different levels of trust and risk aversion.



Simulation assumes a CRRA utility function. Parameters: $W=25,000$, $\gamma=3$, $f=200$, $r_f=1.05$. Random returns are assumed normally distributed, $\tilde{r}\sim N(\bar{r},\sigma^2)$; $\bar{r}=1.12$, $\sigma^2=0.05$.

Figure 2.3 shows the results of a simulation corresponding to equation (2.20). We assumed a CRRA utility function, in the form $U(\cdot)=\frac{\cdot^{1-\gamma}}{1-\gamma}$. A strong implication of the CRRA utility function is that the optimal share invested in risky asset is not related to wealth, since relative risk aversion is constant. With a Monte Carlo approach, we

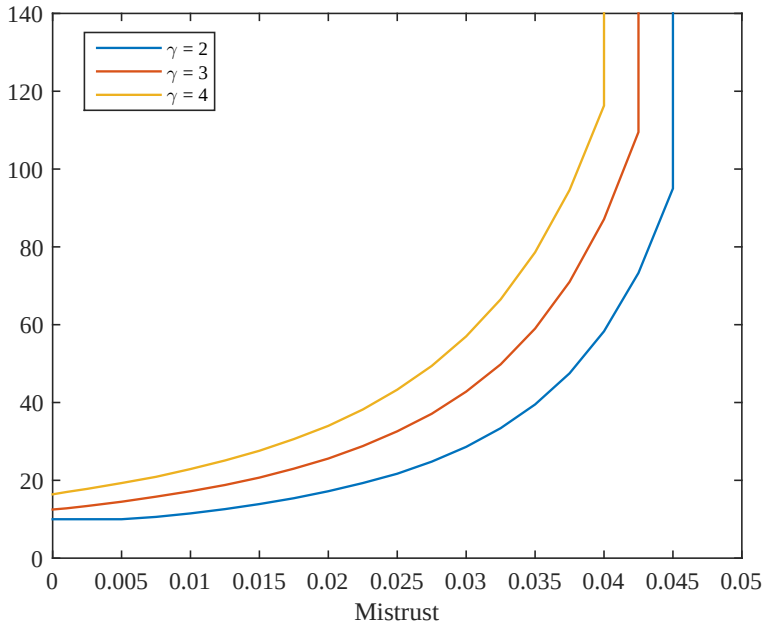
simulate 1 million of realizations of the random return on the risky asset, and we then compute the expected utility for different levels of α. The figure shows expected utility corresponding to different values of mistrust as a function of α. The dashed line instead represents the utility from investing in the risk free asset only (i.e $\alpha = 0$). As specified in equation (2.20), households compare the expected utility from choosing the optimal α with the utility from investing in the risk free asset only. As we can see, with this particular set of parameter, an investor with financial wealth equal to 25,000, that faces a fixed cost equal to 200, with constant relative risk aversion equal to 3 would not participate in the stock market if she perceives a probability of 2.5% of being cheated. The assumption of a fixed cost of 200 euros seems reasonable, as such value is able to explain non participation of around two thirds of non participants, depending on the year. However, as we have highlighted in the previous section, assuming that fixed costs are homogenous across the population, does not take into account the individual component of such costs, which is related to the (non monetary) cost of acquiring information and take decisions. But estimating the value of these costs is in any case very difficult, and making arbitrary assumptions cannot be avoided. Thus, we assume that these 200 euros represent a fixed monetary cost common to all investors, and, more unrealistically, that each investor decides on the basis of a common information set. Hence, the decision is driven only by the investor's level of trust and risk aversion.

Figure 2.5a shows the wealth threshold that triggers investment in risky assets as a function of the (mis) trust parameter p, for three different levels of risk aversion. First of all, we notice how the presence of a fixed cost (again, we set it equal to 200 euros) reduces the level of mistrust below which individuals do not invest. Above, we have shown how a lack of trust of $\bar{p} = 0.0625$ was sufficient to explain non participation, in the absence of fixed costs. From figure 2.5a we see first of all how inserting a participation cost significantly lowers such threshold $\bar{p}$[1]. From figure 2.5a we see how the wealth threshold increases with trust. Let us focus on the baseline case with $\gamma = 3$. The wealth threshold when trust is zero and the fixed cost is 200 euros, is equivalent to 12,400 euros. Such threshold grows very fast as p increases. Moreover, if the fixed cost

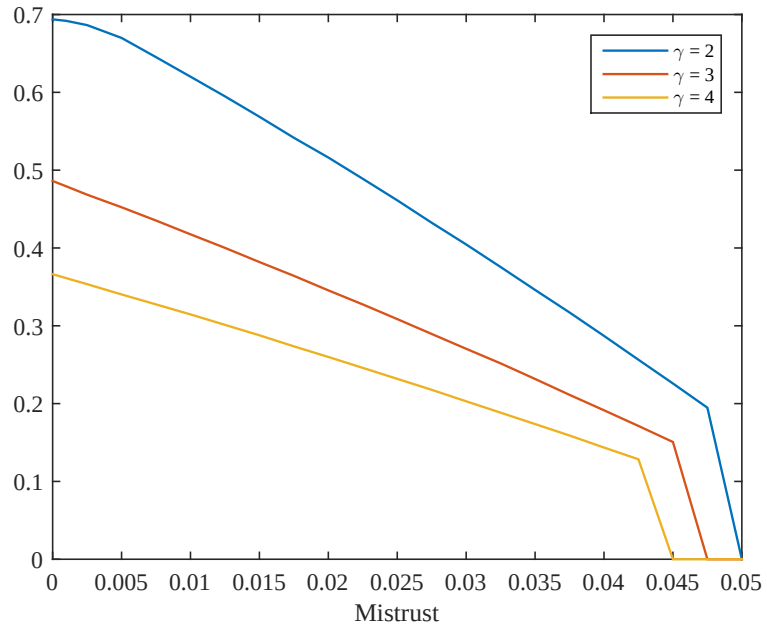
[1]Note, however, that the result that investors with $p < 0.0625$ will not participate holds independently from individual characteristics, such as risk aversion, wealth and properties of the specific utility functional form chosen; thus, it is a much stronger result than the one shown in figure 2.5a. There we see that the exact level of $\bar{p}$ depends on individual risk aversion. It does not depend on wealth, given our specification of a CRRA utility function.

Figure 2.4: Trust, the wealth threshold and the optimal share.

(a) Wealth threshold and the level of trust, for different levels of γ, the coefficient of relative risk aversion.



(b) Optimal share invested in stocks and the level of trust, for different levels of γ, the coefficient of relative risk aversion.



Simulation assumes a CRRA utility function. Parameters: $W = 25,000$, $\gamma = 3$, $f = 200$, $r_f = 1.05$. Random returns are assumed normally distributed, $\tilde{r} \sim N(\bar{r}, \sigma^2)$; $\bar{r} = 1.12$, $\sigma^2 = 0.05$.

equals 200 euros, an investor with a relative risk aversion of 3 would not invest in the stock market if her perceived probability of being cheated exceeds 4%.

Moreover, we see that a higher (lower) level of risk aversion implies a higher (lower) wealth threshold at each level of trust. The effect of varying the level of the fixed cost is very similar, intuitively. But what about the optimal share invested, conditional on participation?

Figure 2.5b is derived from the same simulation used to produce figure 2.5a and shows the relationship between the optimal share invested conditional on participation and trust. In line with the theoretical predictions above, we see that the higher the level of p, the lower the optimal share α^*. Similarly to what we have seen regarding the wealth threshold, the effect of an increase in the level of risk aversion further reduces the optimal share. Intuitively, varying the amount of fixed costs does not impact the optimal share: if the investor has a CRRA utility function and her wealth is higher than the wealth threshold for investing, given a certain value of trust p, then the optimal share invested will not depend on the value of the fixed costs or on wealth. Of course, the magnitude of fixed costs impacts the participation decision through its effect on the wealth threshold, but not the optimal share invested conditional on participation.

2.3 Expectations, preferences and portfolio choice

In the two previous sections we have highlighted how combining trust and portfolio choice we can provide a theoretical explanation of the stock holding puzzle. There are however two other elements that we have considered as given, but that can be determinants of household risk taking: the degree of risk aversion and subjective expectations of the portfolio returns. For what regards risk preferences, the literature pointed out several factors that may affect household risk tolerance. An extensive review on the role of risk aversion in household portfolio choice, the issue of measuring it and understanding its determinants can be found in Guiso and Sodini (2013). As we have already mentioned, a crucial issue is understanding the relationship between risk aversion and wealth. Models with constant relative risk aversion, as the classical consumption and portfolio choice model in continuous time developed by Merton (1969), predict that the share invested in the risky assets is determined only by the expected risk premium, the variance of the return, and the degree of relative risk aversion. Specifically, the share

invested by household i would be given by:

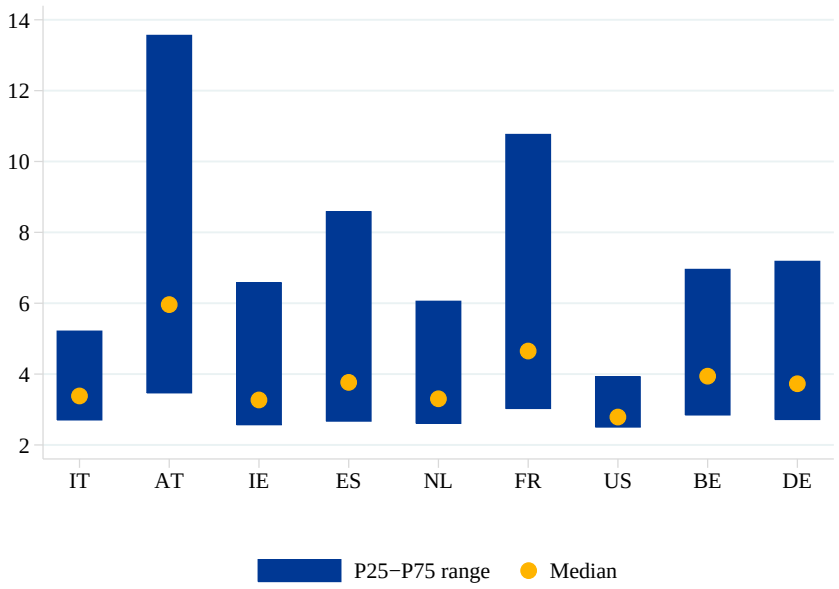
$$\alpha_i^* = \frac{E(\tilde{r} - r_f)}{\sigma^2 \gamma_i}, \tag{2.23}$$

where, as before, $\tilde{r}$ and σ^2 are the normally distributed, which we assume to be the same for all households. Hence, the differences in the shares invested merely reflect differences in risk aversion. Hence, a first simple approach to measure risk aversion would be to simply infer it from the (observed) share invested in risky assets. In particular, the Arrow-Pratt measure of relative risk aversion γ_i may be estimated as

$$\gamma_i = \frac{E(\tilde{r} - r_f)}{\sigma^2 \alpha_i^*} \tag{2.24}$$

We present the results of such computation in figure 2.6, setting the equity premium

Figure 2.6: P25-P75 range and median level of risk aversion inferred with the revealed preference approach, by country.



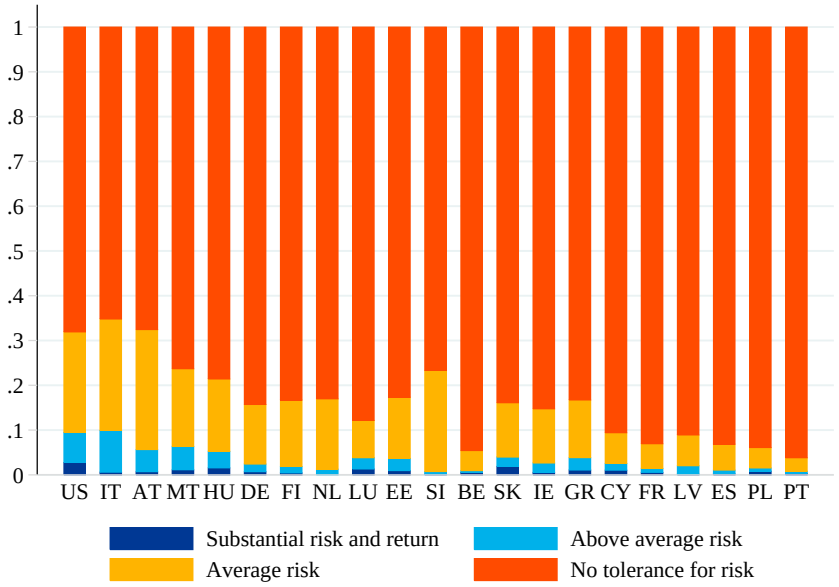
Assumptions: $\bar{r}$=1.12, $r_f = 1.05$, $\sigma^2 = 0.05$. Countries are sorted by the participation rate in risky assets. Computed using survey weights.

to 0.07 and the variance of the risky return to 0.05. Perhaps surprisingly, we estimate that the vast majority of households have reasonable levels of risk aversion, below ten.

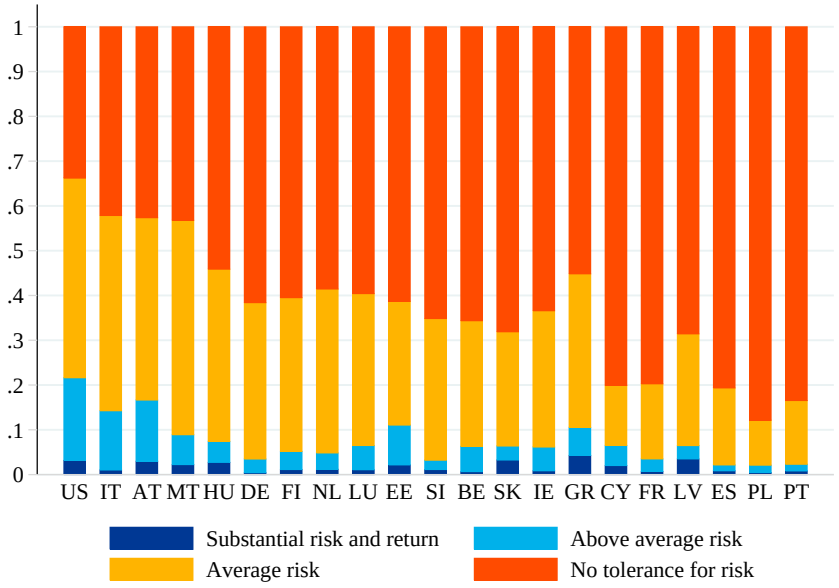
Moreover, the results are remarkably stable across countries. Two exceptions are Austria and France, in which the 75th percentiles corresponds to 13.56 and 10.77, respectively. Such approach, however, presents important limitations. First of all, it can be applied only to households that hold some kind of risky assets, thus, it cannot help in explaining non participation. Second, in each country there are some households who have a very small share invested in risky assets, for which we estimate implausibly large values of risk aversion. Guiso and Sodini (2013) point out two main reasons to explain this. First of all, the measure obtained from equation (2.24) does not consider the relationship between risk aversion and other characteristic of the household, such as wealth, background risk, past experience. Moreover, assuming that each household has the same expectations about the mean and riskiness of the return, we are attributing to differences in risk aversion all the differences in expectations that may be present in the data.

An alternative way to elicit risk aversion in survey contexts would be through qualitative questions. In both the HFCS and the SCF, subjective risk aversion is elicited by asking: *"Which of the following statements comes closest to the amount of financial risk that you are willing to take when you make your financial investment? (1) Take substantial financial risks expecting to earn substantial returns; (2) Take above average financial risks expecting to earn above average returns; (3) Take average financial risks expecting to earn average returns; (4) Not willing to take any financial risks"*. The composition of the answers in different countries is presented in figure 2.7, which reports the percentage of answers in each country by risky asset ownership status. As can be seen, risky asset participants in each country have a lower average self reported value of risk aversion, compared to non participants. We see however that even among who owns risky assets, a significant fraction reports to not want to bear any financial risk at all. We may be concerned that even in this category, many households do not have risky investment in practice, since we considered as risky the entire amount invested in mutual funds and retirement accounts. We checked indeed that such pattern is still there even if we consider stock owners only. Regarding the cross country differences, we notice that in the United States the fraction of households that answered one or two is significantly higher than in every European country. Surprisingly, Italy is the country with the lowest average self reported risk aversion and it is also the country with the lowest share of four answers among non participants. Such share ranges from slightly less than 70% in Italy, to more than 90% in Belgium, Cyprus, France, Latvia, Spain, Poland and Portugal. In

Figure 2.7: Composition of self-reported risk aversion by participation status in risky assets.



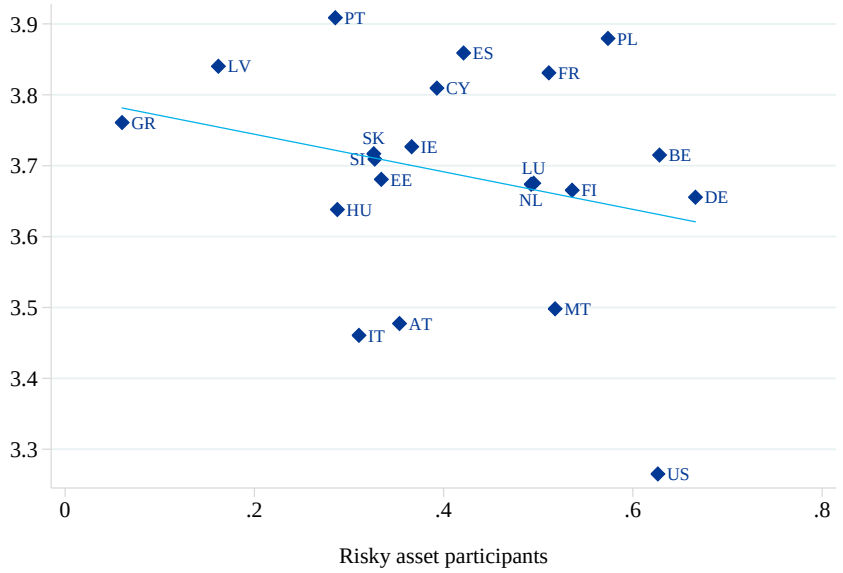
(a) Non participants



(b) Participants

Countries sorted by the average of the (1-4) variable. Computed using survey weights.

Figure 2.9: Correlation between average self reported risk aversion (y-axis) and risky asset participation rate.



Computed using survey weights.

figure 2.9 we show the relationship between average self reported risk aversion and the participation rate in risky assets, by country. We see that overall there is a slightly negative correlation between the two measures, but there are also significant outliers. This measure of risk aversion has the advantage that it comes from a question easy to ask in surveys which lead to a very few non responses. However, it has the drawback that differences in the answers may be due not only to differences in individual risk aversion, but also differences in the perception of risks. Indeed, this may also explain why we observe large differences in the country averages. Some respondents may appear more risk averse than they actually are if they place higher probabilities on adverse events.

In the literature the determinants of risk averse behaviour have been widely investigated. A complete discussion of such literature is beyond the scope of this chapter. In the following we will briefly present the main evidences, mainly following the review made in Guiso and Sodini (2013). As we have already mentioned, a key focus has been posed on identifying the relationship between financial wealth and risk aversion. The most common specification that has been tested in the literature assumes that γ, the

Arrow-Pratt measure of risk aversion, is given by

$$\gamma_i = \frac{\lambda_i}{W_i^{\eta}}. \tag{2.25}$$

Note that $\eta = -1$ implies constant absolute risk aversion and $\eta = 0$ implies constant relative risk aversion. Values of η in the (-1,0) interval corresponds to declining absolute risk aversion and increasing relative risk aversion, while values above zero imply that both absolute and relative risk aversion are decreasing. Combining (2.25) with (3.19) and taking logs, suggests the following regression

$$\ln \gamma_i = \xi_i + \eta \ln W_i + \epsilon_i, \tag{2.26}$$

where $\xi_i = \dfrac{\bar{r} - r_f}{\lambda_i \sigma^2}$ is an individual fixed effect that capture unobservable factors that affect risk aversion. In a cross sectional context, that is, treating ξ as common to all households, η is usually found positive, supporting the conclusion that average investor has DRRA preferences.

There are other factors, apart from wealth, that have been pointed out in the literature as affecting risk aversion. The presence of background risks, for example, can increase aversion to risk if these risk cannot be insured due to market incompleteness. In particular, the literature focused on the role of human capital, housing wealth and private business wealth. Concerning the first, in a life cycle model agents who have to rely on an uncertain stream of income that they cannot insure, have a higher degree of risk aversion. Gollier (2002) shows that in the presence of an independent background risk, the agent utility function becomes more convex, if the utility function belongs to the class that he calls "risk vulnerable" utility functions, among which the CRRA utility function is included.

About the role of housing, we have already mentioned that many studies predict that housing should reduce household demand for risky assets, since it increases household exposure to risk and illiquidity. Cocco (2005) proposes a life cycle model in which households optimize their expected utility from consumption and can invest in housing, risk-free and risky financial assets. In his framework, investing heavily in housing reduces financial wealth, thus lowering the potential benefit from stock market investing, and may lead to non participation. He finds also that house price risk crowds out stock

holding, especially for what concerns households with low financial wealth. Sinai and Souleles (2005) provide an alternative explanation of the role of housing in influencing households risk attitudes. They develop a model to analyze the tradeoff between renting and owning the residence. Since every one needs to live somewhere, every one is exposed to fluctuations in rent prices. Thus, buying a house might serve as a hedge against this risk, as it ensures a certain flow of housing services in exchange of a known upfront payment. Homeowners, even if hedged against rent risk, are exposed to house price risk. However, if they do not move, such risk does not affect household behaviour since the eventual loss from a decline in the property value is never realized. Hence, the overall effect of housing on risk taking is not clear, a priori. If house price risk prevails, then housing reduces household investment in risky assets; conversely, if rent risk is greater or the household does not consider to move, then homeowners may have a higher propensity to invest in risky assets than non homeowners. A recent study that investigates both these aspects is Chetty et al. (2017). They find that an increase in property value, holding wealth fixed (thus, with a corresponding increase in mortgage debt), increases household risk aversion and reduces their propensity to participate i the stock market. On the other side, an increase in home equity, defined as property value minus mortgage debt, holding property value fixed, increases stockholding. Specifically on this issue, Chetty et al. (2017) report an elasticity of the risky share with respect to mortgage debt of -0.2. On the other side, an increase in home equity, holding property value fixed, has the opposite effect on household risk taking behaviour, and they find an elasticity of the share with respect to home equity approximatively equal to 0.3. These results are in line with previous literature in two ways: first, housing wealth exacerbates household risk aversion due to its illiquidity. Second, they point out that mortgage debt, and the commitment to make regular mortgage payments, exacerbates this illiquidity. Chetty et al. (2017) argue that in the 2000s, the increase in mortgage debt and the increase in the illiquidity of the housing market in the U.S., may have been concurrent factors in exacerbating household risk aversion and reducing the demand for stocks.

Figure 2.10 shows the correlation between the home ownership rate and the average self reported risk aversion. As can be seen, the relationship is positive, and it would be even more so if we excluded Italy, United States, Austria and Malta, that represents four significant outliers since they have far lower average risk aversion.

Another determinant of risk aversion that has been investigated is past macroeco-

Figure 2.10: The correlation between average self reported risk aversion and home ownership rate.

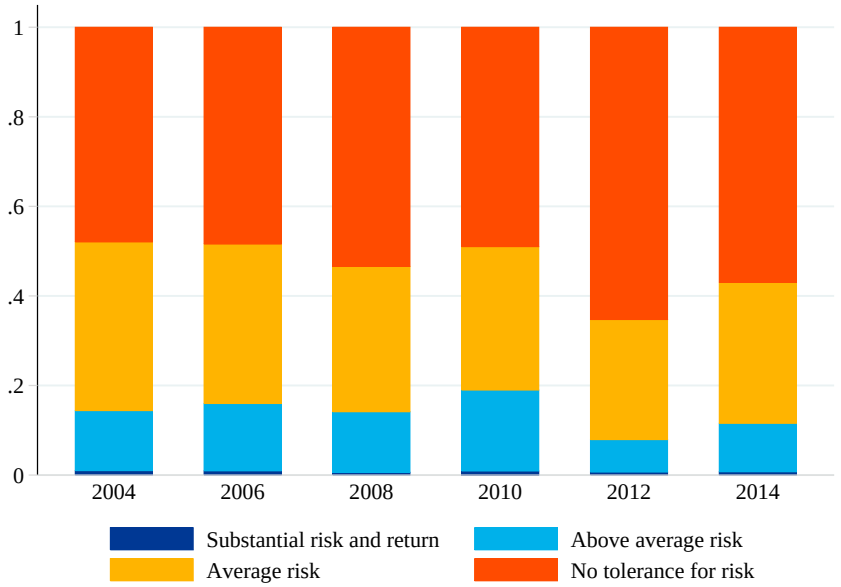
Computed using survey weights.

nomic experience. In particular Malmendier and Nagel (2011) show that the stock market performance experienced over the lifetime is strongly correlated with stock ownership. Using SCF data, they show that individuals who grew up in periods of high stock market volatility and experienced strong downturns are less likely to invest in stock. Similar evidence for Europe comes from Ampudia and Ehrmann (2017b), who employed data from the first wave of the HFCS. In both these analysis, a crucial aspect is how individuals weight past experiences. Both papers point to the fact that households seem to attach a higher weight to more recent experiences. Moreover, Ampudia and Ehrmann (2017b) find evidences that the memory of stock market crashes is more persistent than the one of booms.

The above analysis naturally leads to a crucial question: does risk aversion fluctuate over time, responding to developments in the external environment, or is it a relatively stable characteristic of investor? Guiso et al. (2013) analyze the change in both a quantitative and qualitative measure of risk aversion using data from the Unicredit Customer Survey between 2007 and 2009. They find substantial shifts in both measures, following the financial crisis. They also show that trust and risk aversion are strongly related: indi-

viduals whose trust has increased or remained stable exhibits a very contained increase in risk aversion, compared to those whose trust worsened between the two surveys [2].

Figure 2.11: Risk aversion over time in Italy.



Computed using survey weights.

Figure 2.11 shows the composition of answers to the qualitative risk aversion question in the SHIW throughout the years. We present the chart for all household together, since splitting by risky asset ownership may give a biased measure, given that the changes in risk aversion and the participation decision are correlated. From the chart we notice that the increase in risk aversion has been especially strong between 2010 and 2012, following the sovereign debt crisis. It has been, instead, much less pronounced between 2006 and 2008. This is coherent with the macro economic dynamics of the last decade. Indeed, the two crisis affected households very differently: the sovereign debt crisis, indeed, has been followed by a strong rise in unemployment and a decline in house prices. These two elements did not characterize, instead, the financial crisis of 2007-2008. Hence, we can conjecture that the drivers of the changes in risk aversion

[2] In Guiso et al. (2013) the predictive power of a change in trust on the change in risk aversion is strong both for a qualitative measure of risk aversion and a quantitative measure, inferred through the revealed preference approach.

have been different. In 2006-2008, it is likely that trust in the financial markets and a change in the perception of financial risks led households to self report higher level of risk aversion. In the period 2010-2012, instead, factors as higher income risk, declining house prices and worse expectations about the economic situation are likely the drivers of the increase in risk aversion.

Another element that has been emphasized in the literature as an explanation of the limited stock market participation is financial literacy. Lusardi and Mitchell (2014) provides a survey of the vast literature devoted to the topic. They define financial literacy as "peoples' ability to process economic information and make informed decisions about financial planning, wealth accumulation, pensions, and debt". Financial literacy has been linked to stock market participation (van Rooij et al., 2011), to portfolio diversification (Guiso and Jappelli, 2009), retirement savings (Lusardi and Mitchell, 2011). In order to explain the participation puzzle, financial literacy has been linked to participation costs. As we have described above, participation costs have a monetary component and a non monetary component, linked to the time spent acquiring information. Clearly, this second component is likely to be individual specific: individuals with a better knowledge of the financial markets and with better cognitive abilities should, in principle, need to put less efforts in the process of acquiring information. Jappelli and Padula (2015) argue that financial literacy is itself an endogenous variable and that households decide how much to invest in financial literacy simultaneously with their other decisions related to consumption and portfolio allocation. Jappelli and Padula (2015) develop a model in which financial literacy affects positively the returns from the risky asset and negatively the cost. The predictions of their model are consistent with the data: financial literacy and stock ownership are correlated, as well as the accumulation of financial literacy and wealth over the life cycle. Moreover, their model implies that the higher the level of social security, the lower the incentive for households to invest in financial literacy. Using data from the Survey on Health, Ageing and Retirement in Europe, they show how this prediction is matched in the data.

Finally, it is clear that subjective expectations on the return and the variance of the stock market play a key role in determining investors' choices. A factor that, at a first observation, seems indicating a role for household expectations is that the relationship between the participation rate and the performance of the stock market. As we presented before, Guiso and Jappelli (2002) have shown how the '90s witnessed a strong

increase in the fraction of households investing in the stock market. As shown above, the participation rate peaked in 2000, at the end of a period of stock market boom in Italy. Participation declined significantly between 2002 and and 2006, though household wealth increased during this period and the stock market witnessed another boom, as shown in figure 1.1 and 6b. After the second big crash of the 2000s, when the FTSE MIB lost more than the 50% between mid-2007 and the end of 2008, participation declined to very low levels, similar to the ones observed at the beginning of the '90s. So, at first glance, it seems that households expectations and behaviour responded strongly to the poor performance of the Italian stock market, and in particular to the shock at the beginning of the century. Clearly, such a speculation must be taken with caution, since the international equity market through mutual funds became easier to access. However many other works have analyzed how a strong home bias remains present. Measuring expectations in a survey context poses some challenges. Manski (2004) argues in favour of the measurement through probabilistic questions, that is, asking respondents to report the probability of earning a positive return investing in the stock market within a certain horizon (typically one year). This kind of answers may then be used to infer, given an assumption on the distribution of expected returns, the moments of the subjective distribution. Such methodology is followed, for example, by Hudomiet et al. (2011). Unfortunately, the data available in the SHIW do not allow us to perform a similar exercise. Such questions have been asked only after the financial crisis, in the 2008, 2010 and 2012 waves. Moreover many households do not answer the questions, or provide inconsistent answers[3]. Particularly striking is also the fact that a large fraction of those who answer the questions attach a probability equal to zero to achieve a positive return in the stock market[4]. In our interpretation, this is due in part to a poor understanding of the probabilistic question and in part to a deep lack of trust in the stock market.

[3] An example of inconsistent answer is if the respondent attaches a higher probability to achieve a return of at least 10% than the probability attached to a positive return.

[4] Specifically, 22.9% in 2008, 24.5% in 2010 and 33.2% in 2012.

3

Empirical analysis

This chapter is devoted to our empirical analysis. In particular, we study the determinants of risky asset ownership and the likelihood of changes in the participation status. For what regards the first aspect, we follow the estimation framework proposed by Miniaci and Weber (2002). In particular, the discrete choice variable indicating participation, may be studied in a static or dynamic framework. We limit ourselves to the former. Static models of portfolio choice in a panel data context present the challenge of modeling the unobservable individual disturbances. In the first specification, we assume that such disturbance is negligible, and, thus, we can apply a standard cross section logit model in which we pool together all the observations. Then, we present the results of two other specifications: one in which the unobservable idiosyncratic term is treated as random and one in which, instead, it is treated as a fixed effect. In section one we theoretically describe these framework, while section two is devoted to the presentation of the results. In section three, instead, we employ a bivariate probit analysis, following Bilias et al. (2010), to account jointly for the participation status in two consecutive periods.

3.1 Econometric models of portfolio choice

In the description of the econometric framework we closely follow Greene (2003). In first place, we want to study if and when households own risky assets. From the econometric point view, this implies using a binary choice model, in which we are interested in estimating the effect (β) of a change in the explanatory variables (x) on the probability

of investing in risky assets; formally, we have:

$$\begin{aligned} \Pr(Y = 1|x) &= F(x, \beta) \\ \Pr(Y = 0|x) &= 1 - F(x, \beta). \end{aligned} \tag{3.1}$$

The problem is to find a suitable form for $F(\cdot)$. One possibility is to retain the linear regression framework, so that

$$F(x, \beta) = x'\beta, \tag{3.2}$$

and since $E(y|x) = F(x, \beta)$ we can construct the regression model as

$$y = E(y|x) + (y - E(y|x)) = x'\beta + \epsilon. \tag{3.3}$$

Because $x'\beta + \epsilon$ must be equal to zero or one, ϵ equals $x'\beta$ or $1 - x'\beta$, and it can be easily shown that the variance of the error term is

$$\text{Var}(\epsilon|x) = x'\beta + (1 - x'\beta). \tag{3.4}$$

Thus, the error is heteroskedastic in a way that depends on β. Such complication could be solved using, for example, a feasible generalized least square estimator to correct for the heteroskedasticity of the error term. One more serious shortcoming of the linear probability model is that we cannot be sure that the predictions of such model will look like probabilities, a priori. In order to produce predictions consistent with (3.1), we need that the function $F(\cdot)$ satisfies the following conditions:

$$\begin{aligned} \lim_{x'\beta \to +\infty} \Pr(Y = 1|x) &= \lim_{x'\beta \to +\infty} F(x'\beta) = 1 \\ \lim_{x'\beta \to -\infty} \Pr(Y = 0|x) &= \lim_{x'\beta \to -\infty} F(x'\beta) = 0. \end{aligned} \tag{3.5}$$

In principle, any proper, continuous probability distribution defined over the real line would respect those conditions. Two distributions that respect the properties above and have been widely used in applications are the normal distribution, giving rise to the probit model,

$$\Pr(Y = 1|x) = \int_{-\infty}^{x'\beta} \phi(t)dt = \Phi(x'\beta), \tag{3.6}$$

and the logistic distribution

$$\Pr(Y = 1|x) = \frac{e^{x'\beta}}{1 + e^{x'\beta}} = \Lambda(x'\beta). \tag{3.7}$$

Finally, the probability model is defined as a regression

$$E(y|x) = 0(1 - F(x'\beta) + 1(F(x'\beta)) = F(x'\beta). \tag{3.8}$$

It is important to remark the fact that the non linearity of the model implies that the parameters estimated do not represent the marginal effects of x on y as in the linear regression framework. In general, we have that

$$\frac{\partial E(y|x)}{\partial x} = \left(\frac{\partial F(x'\beta)}{\partial (x'\beta)}\right)\beta = f(x'\beta)\beta. \tag{3.9}$$

In the probit case, this is equivalent to

$$\frac{\partial E(y|x)}{\partial x} = \phi(x'\beta)\beta, \tag{3.10}$$

while in the logit case we have

$$\frac{\partial \Lambda(x'\beta)}{\partial (x'\beta)} = \frac{e^{x'\beta}}{(1 + e^{x'\beta})^2} = \Lambda(x'\beta)(1 - \Lambda(x'\beta)), \tag{3.11}$$

thus

$$\frac{\partial E(y|x)}{\partial x} = \Lambda(x'\beta)(1 - \Lambda(x'\beta))\beta. \tag{3.12}$$

It is clear that these marginal effects vary with x. In order to interpret the model, it will be useful to compute such effects at relevant levels of x (e.g. at the mean). As we will see later, another alternative is to compute the marginal effect for each observation in the sample, and then take the average of these marginal effects. Estimation of non linear binary choice models is usually based on the method of maximum likelihood. Each observation i is treated as a random draw from a Bernoulli distribution. Assuming that observations are independent, the joint probability, or likelihood function is defined as

$$\Pr\left(Y_1 = y_1, Y_2 = y_2, \ldots, Y_n = y_n|X\right) = \prod_{y_i=0}(1 - F(x_i'\beta)) \prod_{y_i=1} F(x_i'\beta), \tag{3.13}$$

which may conveniently be written as

$$L(\beta|data) = \prod_{i=1}^{n} (F(x_i'\beta))^{y_i}(1 - F(x_i'\beta))^{1-y_i}. \tag{3.14}$$

Taking logs, we obtain the log likelihood function

$$\ln L = \sum_{i=1}^{n} y_i \ln F(x_i'\beta) + (1 - y_i) \ln(1 - F(x_i'\beta)), \tag{3.15}$$

and in the case of symmetric distributions, as the normal or the logistic, since $1 - F(x_i\beta) = F(-x_i\beta)$, defining $q_i = 2y_i - 1$, this can be further simplified into

$$\ln L = \sum_{i=1}^{n} \ln F(q_i x_i'\beta). \tag{3.16}$$

A useful formulation of discrete choice models is the latent regression formulation. In this context the outcome of the binary is seen as the reflection of an underlying regression. Assuming that y_i^* is desired share of risky assets in the portfolio for household i, we want to study the probability Pr($y_i = 1$), where

$$\begin{aligned} y_i^* &= x_i'\beta + \epsilon \\ y_i &= \begin{cases} 1 & \text{if } y_i^* > 0 \\ 0, & \text{if } y_i^* \leq 0 \end{cases} \end{aligned} \tag{3.17}$$

if short sales are not permitted. In this formulation, $x_i'\beta$ is called the index function. Such models assume that the distribution of ϵ is known, and corresponds to a standard normal distribution with mean 1 in the probit case and a standardized logistic distribution with variance $\pi^2/3$. Assuming that the variance is known is an innocent assumption, as we can scale both y^* and β by an unrestricted parameter without effects on the outcome variable y. In other words, this means that there is no information about the variance of the error term in the data, and it cannot be estimated.

Since we want to perform our analysis using panel data, we have to extend the model of the previous section to account for the time dimension. If ownership is independent over time, then the joint probability of $(y_{i1}, ..., yiT)$ is given by Pr$(y_{i1}, ..., yiT) =$

$\prod_{t=1}^{T} \Pr(y_{it})$. Hence, such assumption implies:

$$\Pr\left(y_{it}=1|y_{it-1}=1\right)=\Pr\left(y_{it}=1\right). \tag{3.18}$$

In this case, the model can be consistently estimated using standard cross sections binary response models where the number of observations in NT instead of N. However, Miniaci and Weber (2002) point out two main reasons because of which equation (3.18) may fail to hold. The first one is heterogeneity: households are characterized by some unobservable characteristics that affect their risk aversion and their information set and, thus, their attitude towards risky assets investment. The second one is true state dependence, that is, current ownership is directly affected by past ownership, as it would be the case if, for example, investors learned by their experience holding assets. True state dependence is consistent with some theoretical models that predict that transaction costs or cumulated experience through asset ownership affect household decisions. Generally, we can specify a linear model in which the desired risky share depends linearly on a set of strictly exogenous variables x_{it} and on the ownership status at $t-1$, y_{it-1}:

$$y_{it}^{*}=\beta x_{it}^{\prime}+\gamma y_{it-1}+\epsilon_{it}, \tag{3.19}$$

where x_{it} is a $1\times K$ vector of strictly exogenous independent variables. If there is no true state dependance, then $\gamma=0$. We thus have a static discrete choice model, that we can write as

$$\begin{aligned} y_{it}^{*} &= x_{it}^{\prime}\beta+\epsilon_{it} \\ y_{it} &= \begin{cases} 1 & \text{if } \epsilon_{it}>-x_{it}^{\prime}\beta \\ 0, & \text{if } \epsilon_{it}\leq -x_{it}^{\prime}\beta \end{cases} \\ \epsilon_{it} &= \alpha_i+u_{it}, \end{aligned} \tag{3.20}$$

where the error term ϵ_{it} is decomposed into a time invariant component α_i related to unobservable characteristics of the household, such as risk aversion, and a time varying effect u_{it}, such as expectation errors or individual income innovations. Assuming that $F(\cdot)$ is the cumulative distribution function of the random variable ϵ_{it}, we have:

$$E\left(y_{it}|x_{it}\right)=\Pr\left(y_{it}=1|x_{it}\right)=F\left(\beta x_{it}^{\prime}\right). \tag{3.21}$$

If we assume that unobservable individual heterogeneity is negligible, then equation (3.18) holds, and we can consistently estimate β from a single cross-sections. If instead the individual time invariant effect is not negligible, we can treat α_i as a random or fixed variable. In the first case, we assume that α_i is unrelated to x_{it}, so that the conditional distribution $f(u_i|x_{it})$ is not dependent on x_{it}. If we relax this restriction, allowing u_i and x_{it} to be correlated, then we have a fixed effect model. Specifically, the random effect model requires:

$$\begin{aligned} E(\alpha_i|x_i) &= E(u_{it}|x_i) = 0 \\ Var(\epsilon_{it}|\alpha_i, x_i) &= \sigma_u^2 + \sigma_\alpha^2 = 1 + \sigma_\alpha^2 \\ Corr(\epsilon_{it}, \epsilon_{is}|x_i) &= \rho = \frac{\sigma_\alpha^2}{1+\sigma_\alpha^2}, \end{aligned} \tag{3.22}$$

where $x_i = (x_{i1}, ..., x_{iT})$. In the cross section case, the probability associated with an observation is

$$\Pr(y_i|x_i) = \int_{L_i}^{U_i} f(\epsilon_i) d\epsilon_i, \tag{3.23}$$

where

$$(L_i, U_i) = \begin{cases} (-\infty, -x_i'\beta) & \text{if } y_i = 0 \\ (-x_i'\beta, \infty) & \text{if } y_i = 1 \end{cases} \tag{3.24}$$

This simplifies to $\Phi[(2y_i - 1)x_i'\beta]$ for the normal distribution and $\Lambda[(2y_i - 1)x_i'\beta]$ for the logit model, as we have shown in equation (3.16). In the general case with an unrestricted covariance matrix, the contribution of households i to the likelihood function would be the joint probability for all observations T_i:

$$L_i = \Pr(y_{i1}, \ldots, y_{iT_i}|x_i) = \int_{L_{iT_i}}^{U_{iT_i}} \cdots \int_{L_{i1}}^{U_{i1}} f(\epsilon_{i1}, \epsilon_{i2}, \ldots, \epsilon_{iT_i}) d\epsilon_{i1} d\epsilon_{i2} \ldots d\epsilon_{iT_i}. \tag{3.25}$$

The integration of the joint density as it is in the previous equation is impractical in most cases. However, Greene (2003) shows how the joint density of u_{it} can be obtained by integrating α_i out of the joint density of $(\epsilon_{i1}, \epsilon_{i2}, \ldots, \epsilon_{iT_i}, \alpha_i)$, which is given by

$$f(\epsilon_{i1}, \epsilon_{i2}, \ldots, \epsilon_{iT_i}, \alpha_i) = f(\epsilon_{i1}, \epsilon_{i2}, \ldots, \epsilon_{iT_i}|\alpha_i) f(\alpha_i). \tag{3.26}$$

So

$$f(\epsilon_{i1}, \epsilon_{i2}, \ldots, \epsilon_{iT_i}) = \int_{-\infty}^{\infty} f(\epsilon_{i1}, \epsilon_{i2}, \ldots, \epsilon_{iT_i}|\alpha_i) f(\alpha_i) d\alpha_i; \tag{3.27}$$

this formulation has the advantage that the ϵ_i's are independent conditioned on α_i, and thus the previous expression becomes

$$f(\epsilon_{i1}, \epsilon_{i2}, \ldots, \epsilon_{iT_i}) = \int_{-\infty}^{\infty} \prod_{t=1}^{T_i} f(\epsilon_{it}|\alpha_i) f(\alpha_i) d\alpha_i. \tag{3.28}$$

Inserting this result in equation (3.25) we obtain

$$L_i = \Pr(y_{i1}, \ldots, y_{iT_i}|x_i) = \int_{L_{iT_i}}^{U_{iT_i}} \ldots \int_{L_{i1}}^{U_{i1}} \int_{-\infty}^{\infty} \prod_{t=1}^{T_i} f(\epsilon_{it}|\alpha_i) f(\alpha_i) d\alpha_i d\epsilon_{i1} d\epsilon_{i2} \ldots d\epsilon_{iT_i}, \tag{3.29}$$

and since the ranges of integration are independent, we can change the order of integration

$$L_i = \Pr(y_{i1}, \ldots, y_{iT_i}|x_i) = \int_{-\infty}^{\infty} \left[\int_{L_{iT_i}}^{U_{iT_i}} \ldots \int_{L_{i1}}^{U_{i1}} \prod_{t=1}^{T_i} f(\epsilon_{it}|\alpha_i) d\epsilon_{i1} d\epsilon_{i2} \ldots d\epsilon_{iT_i} \right] f(\alpha_i) d\alpha_i. \tag{3.30}$$

Finally, since the ϵ's are independent conditioned on the common α_i, the term in square brackets equals the product of the individual probabilities:

$$L_i = \Pr(y_{i1}, \ldots, y_{iT_i}|x_i) = \int_{-\infty}^{\infty} \left[\prod_{t=1}^{T_i} \left(\int_{L_{it}}^{U_{it}} f(\epsilon_{it}|\alpha_i) d\epsilon_{it} \right) \right] f(\alpha_i) d\alpha_i. \tag{3.31}$$

The individual densities in the product are now, conditioned on α_i, the familiar probabilities for the individual observations, computed at $x'_{it}\beta$ as in equation (3.23). Collecting all terms, we obtain a general random effects binary choice model:

$$L_i = \Pr(y_{i1}, \ldots, y_{iT_i}|x_i) = \int_{-\infty}^{\infty} \left[\prod_{t=1}^{T_i} \Pr\left(Y_{it} = y_{it}|x'_{it}\beta + \alpha_i\right) \right] f(\alpha_i) d\alpha_i. \tag{3.32}$$

Note that such result holds for any symmetric probability function $f(\cdot)$, it can thus be applied to both probit and logit models. The conditional independence assumption for the ϵ's with respect to α allows to simplify the T-dimensional integral in equation (3.25)

into the one dimensional integral above. Still, however, the computation of the outer integral is not trivial. Assuming that α_i is normally distributed, as $\alpha_i \sim N(0, \sigma_\alpha^2)$, the Butler and Moffitt's method can be applied, which relies on the Gauss-Hermit quadrature to approximate the integral [1]. This is the method applied by the Stata routines xtprobit and xtlogit, when the options random effect is specified.

Alternatively, the fixed effect model is specified as:

$$\begin{aligned} y_{it}^* &= \alpha_i d_i + \beta x_{it}' + \epsilon_{it}, \\ y_{it} &= \begin{cases} 1 & \text{if } \epsilon_{it} > -\alpha_i d_i - x_{it}'\beta \\ 0, & \text{if } \epsilon_{it} \leq -\alpha_i d_i - x_{it}'\beta \end{cases} \end{aligned} \tag{3.33}$$

With respect to the random effects framework, treating α_i as a fixed effect allows us to relax the assumption of zero correlation between α_i and x_i. In the fixed effect models, the distribution of α_i is unrestricted. The terminology should not, however, be misleading: indeed, in a fixed effect framework, α_i can be a constant term as well as a random variable, and the term "fixed" does not refer to any intrinsic characteristic of the effect itself. In this setting, we may be interested in estimating both the K elements of β and the n individual constant terms. Clearly, the number of these parameters may be huge in a typical applications, posing practical difficulties to the estimation. Following again Greene (2003), the log likelihood function of the fixed effects model is:

$$\ln L = \sum_{1=1}^{n} \sum_{t=1}^{T_i} \ln \Pr\left(y_{it} | \alpha_i + x_{it}'\beta\right), \tag{3.34}$$

where the probability of the observed outcome is given by a cumulative density function, $\Phi(\cdot)$ in the probit case or $\Lambda(\cdot)$ in the logit. Such estimator suffers from the so called incidental parameters problem. Indeed, the estimation of the individual unobserved fixed effects, α_i, relies on T_i observations. Thus, such estimator is consistent when T_i tends to infinity, however, in most of the applications T_i is fixed, and usually also quite small. As a consequence, the estimators of the constant terms are not consistent. Moreover, the estimator of β is a function of the estimators of α, so that the MLE

[1] An in depth description of the Butler and Moffit's algorithm may be found in Greene (2003), pp.550-554.

estimation of β is not consistent either [2]. In the linear case the incidental parameters problem is circumvented transforming the data into deviations from group means. In that context, even if $f(y_{it}|x_i)$ is a function of α_i, $f(y_{it}|x_i, \bar{y}_i)$ does not depend on α_i, and it is used in the estimation of β, then, $\bar{y}_i$ is a sufficient statistic for α_i. In the present, non linear setting, a sufficient statistic is available for the logit model, but not for the probit. The idea is thus to condition upon the sufficient statistic to obtain a conditional likelihood function, which does not depend on α and may be consistently estimated. Given the logistic assumption, we have

$$\Pr(y_{it} = 1|x_{it}) = \frac{e^{\alpha_i + x'_{it}\beta}}{1 + e^{\alpha_i + x'_{it}\beta}}, \tag{3.35}$$

and the unconditional likelihood for the nT independent observations is (from a generalization to T periods of equation (3.14))

$$L = \prod_i \prod_t F_{it}^{y_{it}} (1 - F_{it})^{1-y_{it}}. \tag{3.36}$$

Chamberlain (1980) observes that a sufficient statistic is given by $S_i = \sum_{t=1}^{T_i} y_{it}$, that is, the number of times that $y_{it} = 1$. The statistic is sufficient, since the conditional likelihood function defined as

$$L^c = \prod_{i=1}^{n} \Pr\left(Y_{i1} = y_{i1}, Y_{i2} = y_{i2}, \ldots, Y_{iT_i} = y_{iT_i} \Big| \sum_{t=1}^{T_i} y_{it} \right) \tag{3.37}$$

is free of the incidental parameter α_i. To practically illustrate this point, let us consider an example in which $T_i = 2$. The unconditional likelihood, from equation (3.36), is given by

$$\prod_i \Pr\left(Y_{i1} = y_{i1}\right) \Pr\left(Y_{i2} = y_{i2}\right). \tag{3.38}$$

For each n pair of observations, $S_i = y_{i1} + yi2$ may be equal to zero, one or two. The cases $S_i = 0$ or $S_i = 2$ are not informative on β. Indeed, for either of these cases, the ith term in the conditional likelihood L^c defined in equation (3.37) is just one, so they contribute nothing to L^c. When we take logs, these terms (and the corresponding obser-

[2] Miniaci and Weber (2002) note that in the linear case, the two ML estimators for α_i and β are independent of each other, thus it is possible to obtain consistent estimates of β independently of α.

vations) will drop out. The only informative case is when $S_i = 1$, that is, when some transition from non ownership to ownership or viceversa has been observed. Assume now that $y_{i1} = 0$ and $y_{i2} = 1$. Then,

$$\Pr\left(y_{i1}=0, y_{i2}=1 | S_i = 1, \alpha_i, x_i\right) = \frac{\Pr\left(y_{i1}=0, y_{i2}=1\right)\Pr\left(S_i = 1 | y_{i1}=0, y_{i2}=1\right)}{\Pr\left(S_i = 1\right)} = \\ = \frac{\Pr\left(y_{i1}=0, y_{i2}=1\right)}{\Pr\left(y_{i1}=0, y_{i2}=1\right)\Pr\left(y_{i1}=1, y_{i2}=0\right)}, \tag{3.39}$$

from the Bayes' theorem. Therefore, for this pair of observations, the conditional probability is

$$\frac{\dfrac{1}{1+e^{\alpha_i + x'_{i1}\beta}}\dfrac{e^{\alpha_i + x'_{i2}\beta}}{1+e^{\alpha_i + x'_{i2}\beta}}}{\dfrac{1}{1+e^{\alpha_i + x'_{i1}\beta}}\dfrac{e^{\alpha_i + x'_{i2}\beta}}{1+e^{\alpha_i + x'_{i2}\beta}} + \dfrac{e^{\alpha_i + x'_{i1}\beta}}{1+e^{\alpha_i + x'_{i1}\beta}}\dfrac{1}{1+e^{\alpha_i + x'_{i2}\beta}}} = \frac{e^{x'_{i2}\beta}}{e^{x'_{i1}\beta} + e^{x'_{i2}\beta}}, \tag{3.40}$$

which shows how by conditioning on the sum of the two observations we can remove the heterogeneity. Therefore, we can construct the conditional likelihood function as the product of these terms for the pair of observations for which the two observations are (0,1). Analogously, we can include pairs of observations for which the two observations are (1,0). In a general framework, with an arbitrary T_i, the conditional likelihood consists in the product of the terms such as the one defined in equation (3.40) for those observation sets for which the sum is not zero or T_i. Then the maximization of the log likelihood function is straightforward. Such estimation may be performed through Stata by using the command xtlogit with the fixed effect options, or using the command clogit, which implement the conditional logit model. Such estimator, indeed, is also called conditional logit estimator.

From the discussion above it is clear that the conditional logit estimator has the advantage of being more flexible than the random effect model, as it does not require any assumption on the distribution or the variance structure of the unobserved α_i; at the same time however, to implement the estimation some variability in the dependent variable is needed. Moreover, with conditional logit, the effect of time-invariant characteristics, such as gender, cannot be estimated. In the context of risky asset participation, the problem is compounded because the time dimension is usually small, and thus one

cannot rely on conditional logit to estimate the effects of variable that are almost constant, especially over a short horizon, such as education, region of residence and family size. Guiso and Jappelli (2002) note also that the estimation of the effect of variables that vary in a predictable way, such as age, is difficult to be estimated with precision, since the estimation relies only on non linear terms.

3.2 Estimation results

We turn now to the application of these methodologies on our sample. First of all, we consider only the time period going from 2004 to 2014, since the measure on risk aversion is not available for the waves of 1998, 2000 and 2002. From 2004 to 2014, we have an unbalanced panel of 48,015 observations, of which 30,818 are panel observations. Though in principle we could use all observations in the pooled logit estimation, we reduce our sample to consider only panel households, so to have more comparable results (at least between the pooled logit and the random effect estimation).

Table 3.1: Panel dimension in the SHIW.

	2000	2002	2004	2006	2008	2010	2012	2014
1998	3,873	2,591	1,855	1,476	1,284	1,088	915	634
2000		3,605	2,522	1,951	1,682	1,418	1,171	804
2002			3,604	2,623	2,207	1,834	1,511	1,025
2004				3,957	3,202	2,620	2,142	1,420
2006					4,345	3,476	2,790	1,834
2008						4,621	3,596	2,315
2010							4,611	2,894
2012								4,459

Table 3.1 shows the size of the panel component across years. Remarkably, there are 1,420 households that have been observed in each of the six waves between 2004 and 2014. To perform our econometric analysis we drop those observation for which there has been a change in the household head. In this way our sample reduces to 29,645 observations. Table 3.2 shows the results of the estimation of the probability of owning risky liquid assets using the pooled logit model. Before comparing such estimates with the ones from other models, we are concerned about the role of wealth in the regression.

As it is clear from the discussion in chapter 1, wealth is strongly correlated with risky assets participation and with many of our explanatory variables. For this reason, we are interested in estimating the effects of the other independent variables controlling also for wealth, so to isolate their effect at a given level of wealth. However, wealth might correlate with the error term if investing in the risky assets favors the accumulation of wealth, this may happen, for example, if participants benefit of a higher rate on return on wealth than non participants. For this reason, table 3.2 presents three different specifications: one in which wealth is not included, one in which we include quartiles of total net wealth and a third one in which we include quartiles of net wealth excluding the amount invested in risky assets.

From the table, we first of all notice that in the three specifications there are some common factors that strongly predict participation, in line with the implications of theoretical models. Risk aversion has a strong negative effect on the probability to invest, as well as family size. The more conservative investment strategy of families with more members appears in line with theories of precautionary saving, as these households are likely to need a greater safe buffer stock in order to cope with unexpected shocks. Education, income and wealth are strongly correlated with participation, while the coefficients of age and age squared imply the hump shaped participation profile in age that we have highlighted in chapter one. We notice also that households with a female head tends to participate less to the stock market. Finally, participation is higher in the North, especially in the North East, and lower in the Center, the South and in the Islands. Interestingly, such geographic differences remain strong even after controlling for wealth. Considering the time effects, we see that the coefficients are negative and significant in each year with respect to 2004, except 2006. We see that 2008, 2012 and 2014 are the years in which the probability of participating was lower. This show once again the strong relationship between wealth and investment in risky assets, as from figure 1.1 we see that these are also the years in which the drop in net wealth has been most severe. Between the three regressions we notice also some interesting differences, especially for what regards the effect of housing on participation. Indeed, the first column predicts a negative effect on participation for those who owns their house with a mortgage, renters and those who live in their house for free or through a usufruct agreement with respect to outright home owners. However, once we control for wealth, the coefficients of non home owners categories change their sign, and become positive. Intuitively, non home

Table 3.2: Pooled logistic regressions for risky liquid assets.

Risky liquid assets ownership[1]	β	SE	β	SE	β	SE
No tolerance for risk	-0.501***	[0.0418]	-0.469***	[0.0424]	-0.485***	[0.0420]
Age	0.0657***	[0.0127]	0.0500***	[0.0130]	0.0579***	[0.0128]
Age squared	-0.000513***	[0.000107]	-0.000412***	[0.000110]	-0.000466***	[0.000108]
Female	-0.216**	[0.0706]	-0.169*	[0.0723]	-0.188**	[0.0715]
Family size	-0.262***	[0.0268]	-0.231***	[0.0267]	-0.247***	[0.0266]
Housing status						
Owner with mortgage	-0.339***	[0.0778]	-0.145	[0.0785]	-0.222**	[0.0781]
Renter	-0.518***	[0.0922]	0.803***	[0.116]	0.19	[0.114]
Usufruct/free	-0.257*	[0.103]	0.844***	[0.121]	0.354**	[0.116]
Education						
Secondary	0.717***	[0.0763]	0.622***	[0.0782]	0.666***	[0.0770]
Tertiary	1.203***	[0.0976]	0.965***	[0.0995]	1.058***	[0.0986]
Working status						
Self employed	0.136	[0.0758]	-0.149	[0.0767]	-0.0333	[0.0763]
Retired	0.225**	[0.0762]	0.185*	[0.0774]	0.195*	[0.0766]
Other not working	0.269*	[0.131]	0.118	[0.134]	0.187	[0.131]
Municipality size						
20,000-40,000	0.0669	[0.0718]	0.0835	[0.0729]	0.0655	[0.0720]
40,000-500,000	-0.00349	[0.0623]	-0.00841	[0.0634]	-0.0137	[0.0627]
>500000	-0.179	[0.105]	-0.254*	[0.107]	-0.233*	[0.106]
Income quartile						
II	1.055***	[0.112]	0.731***	[0.113]	0.919***	[0.113]
III	1.889***	[0.114]	1.281***	[0.115]	1.607***	[0.117]
IV	2.823***	[0.120]	1.899***	[0.121]	2.346***	[0.124]
Year						
2006	-0.145**	[0.0536]	-0.140*	[0.0555]	-0.135*	[0.0544]
2008	-0.323***	[0.0556]	-0.336***	[0.0574]	-0.328***	[0.0564]
2010	-0.286***	[0.0587]	-0.263***	[0.0605]	-0.271***	[0.0595]
2012	-0.318***	[0.0616]	-0.337***	[0.0630]	-0.318***	[0.0621]
2014	-0.408***	[0.0670]	-0.397***	[0.0688]	-0.395***	[0.0677]
Area of residence						
North East	0.345***	[0.0664]	0.332***	[0.0676]	0.336***	[0.0668]
Center	-0.196**	[0.0690]	-0.304***	[0.0697]	-0.265***	[0.0693]
South	-1.469***	[0.0977]	-1.497***	[0.0971]	-1.491***	[0.0969]
Islands	-1.063***	[0.114]	-1.021***	[0.115]	-1.042***	[0.114]
Total net wealth [2]						
II			1.731***	[0.133]		
III			2.170***	[0.146]		
IV			3.050***	[0.150]		
Net wealth excl. risky assets [3]						
II					0.746***	[0.116]
III					0.948***	[0.128]
IV					1.508***	[0.133]
Constant	-4.565***	[0.386]	-5.802***	[0.406]	-5.073***	[0.391]
Observations	29,645		29,645		29,645	
Pseudo R-squared	0.244		0.278		0.255	

* p<0.05, ** p<0.01, *** p<0.001.

In all regressions standard errors are clustered at the household level.

[1] Risky financial assets include risky liquid assets plus non listed shares, other financial assets and defined contribution pension plan and other financial assets.

[2] Quartiles of total net wealth.

[3] Quartiles of net wealth excluding risky assets.

owners are on average much poorer than homeowners, so when we do not control for wealth, the negative effect on the probability to invest in risky assets is mainly driven by this difference in wealth. Owning the house with a mortgage, instead, still has a negative effect on participation.

Hence, controlling for wealth allows to a cleaner estimation of the effects of variables such as housing or working status that are much correlated with wealth. Surprisingly, the standard errors are generally greater in the second and third specifications than in the first. Regarding the predictive power of the regression, inserting the quartiles of net wealth on the right hand side improves the R^2 from 0.24 to 0.275 in the second column, and 0.251 in the third. In the following we choose to follow our third specification: indeed, considering a measure of wealth that includes risky assets in its definition raises strong endogeneity concerns, hence, excluding the value of those assets seems to be a safer choice.

In table 3.3 we compare the results of the pooled logistic regression with a random and a fixed effect model. Columns 1 and 2 present the pooled logit model, and correspond to columns 5 and 6 of table 3.2. Columns 3 and 4 correspond to the random effects model described above, where, conditional on a normally distributed individual effect, the time varying disturbances are independently distributed according to a logistic cumulative function. The results obtained with the random effect model largely confirm the evidences from the pooled logit model. To truly compare the coefficients across the two models, we should focus on ratios rather than on absolute values. For example, in both specifications being in the top quartile of wealth has an effect approximatively double than being in the second quartile. Proportionally to the coefficient of risk aversion, we find much larger effects of gender, family size and education in the random effects framework than in the pooled logit estimates. The pattern of coefficients for income and real and non risky financial wealth quartiles is very similar, as well as for the year effects. At the bottom of the table, we report also the estimated values of σ_α, the estimated variance of the individual effect, and for $\rho = \dfrac{\sigma_\alpha^2}{1+\sigma_\alpha^2}$. A likelihood ratio test strongly reject the null hypothesis of $\rho = 0$. If ρ is equal to zero, then individual variance component is negligible, and the random effect model is equivalent to the pooled estimator. Thus, the likelihood ratio test formally tests the difference between the two models. Finally, in columns 5 and 6 we report conditional logit estimate. The

Table 3.3: Logistic regressions for risky liquid assets ownership.

	Pooled		Random effect		Fixed effect	
Risky liquid assets ownership[1]	β	SE	β	SE	β	SE
No tolerance for risk	-0.485***	[0.0420]	-0.464***	[0.0539]	-0.217***	[0.0600]
Age	0.0579***	[0.0128]	0.119***	[0.0185]	0.0780*	[0.0350]
Age squared	-0.000466***	[0.000108]	-0.000956***	[0.000154]	-0.000969**	[0.000298]
Female	-0.188**	[0.0715]	-0.421***	[0.101]		
Family size	-0.247***	[0.0266]	-0.307***	[0.0359]	-0.0289	[0.0668]
Housing status						
Owner with mortgage	-0.222**	[0.0781]	-0.134	[0.101]	0.151	[0.130]
Renter	0.19	[0.114]	0.122	[0.144]	0.571*	[0.240]
Usufruct/free	0.354**	[0.116]	0.289*	[0.143]	-0.0807	[0.187]
Education						
Secondary	0.666***	[0.0770]	1.058***	[0.105]		
Tertiary	1.058***	[0.0986]	1.904***	[0.145]		
Working status						
Self employed	-0.0333	[0.0763]	0.071	[0.104]	0.0595	[0.163]
Retired	0.195*	[0.0766]	0.336***	[0.102]	0.396**	[0.142]
Other not working	0.187	[0.131]	0.467**	[0.180]	0.886***	[0.240]
Municipality size						
20,000-40,000	0.0655	[0.0720]	0.0644	[0.105]		
40,000-500,000	-0.0137	[0.0627]	-0.044	[0.0899]		
>500000	-0.233*	[0.106]	-0.444**	[0.159]		
Income quartile						
II	0.919***	[0.113]	1.093***	[0.134]	0.490**	[0.165]
III	1.607***	[0.117]	1.952***	[0.141]	0.865***	[0.180]
IV	2.346***	[0.124]	2.932***	[0.152]	1.370***	[0.195]
Year						
2006	-0.135*	[0.0544]	-0.275***	[0.0795]	-0.202*	[0.0834]
2008	-0.328***	[0.0564]	-0.523***	[0.0812]	-0.286**	[0.0941]
2010	-0.271***	[0.0595]	-0.435***	[0.0824]	-0.123	[0.106]
2012	-0.318***	[0.0621]	-0.553***	[0.0855]	-0.134	[0.123]
2014	-0.395***	[0.0677]	-0.671***	[0.0936]	-0.159	[0.143]
Area of residence						
North East	0.336***	[0.0668]	0.448***	[0.101]		
Center	-0.265***	[0.0693]	-0.437***	[0.104]		
South	-1.491***	[0.0969]	-2.308***	[0.137]		
Islands	-1.042***	[0.114]	-1.709***	[0.155]		
Net wealth excl. risky assets [2]						
II	0.746***	[0.116]	0.909***	[0.138]	0.397*	[0.175]
III	0.948***	[0.128]	1.207***	[0.156]	0.433*	[0.195]
IV	1.508***	[0.133]	1.865***	[0.163]	0.653**	[0.208]
Constant	-5.073***	[0.391]	-8.296***	[0.583]		
ρ			0.57	0.0124		
σ_α			2.087	0.0528		
LR $H_0 : \rho = 0$ (p-value)			0.0			
Observations	29,645		29,645		7,569	
Pseudo R-squared	0.255				0.034	

* p<0.05, ** p<0.01, *** p<0.001.

In the pooled regression standard errors are clustered at the household level.

[1] Risky financial assets include risky liquid assets plus non listed shares, other financial assets and defined contribution pension plan and other financial assets.

[2] Quartiles of net wealth excluding risky assets.

sample size is reduced to the 7,569 observations of households for which there are transitions. With respect to the random effect model, here we allow α_i to depend on the explanatory variables. As it is clear from the discussion above, the parameters of all time invariant variables cannot be identified. We still find the same pattern of coefficients on risk aversion, income and wealth, even though the coefficients for quartiles II and III of wealth are less significant than in the other models. In line with the finding of Miniaci and Weber (2002), the coefficient on age is not precisely estimated, as well as the time effects. The coefficient of age squared, instead, is very similar to the one of the random effect model. Moreover, we decided to include variables such as family size and housing status but the effects of those variables is not clearly identified. This may be due to the fact that there is not enough variability in these variables. Coherently with the other models, being self employed does not have an effect different from being an employee. In the conditional logit, however, we find a stronger positive effect of being neither working nor retired, which we have difficulty in explaining. The explanatory power of this model is apparently very low, with a pseudo R^2 equal to 0.034, compared to the one of 0.251 in the pooled model.

With respect to this analysis, a crucial point is to understand the effects that the severance pay reform could have on household portfolio allocation. Indeed, our choice of focusing on liquid risky assets only could cause a bias in our results. As we have highlighted in the previous chapter, after the 2007 reform many households have seen their severance pay transferred to a private pension plan. Our concern is that households have adjusted their portfolio to respond to the increased riskiness of their saving for retirement. Hence, this could explain the low participation rates observed in risky liquid assets. Our thesis is that such a crowding out effect is not present, or at least is not so strong, for a number of reasons. First of all, as highlighted in chapter one, the decline in participation is observed since 2002 onwards, so it starts before the reform. Second, in chapter two we showed that there was a diffused ignorance about the characteristics of investment in these employee-sponsored pension plan. Third, the mechanism of "silenzio-assenso", combined with the "previdential illiteracy", may have caused that many households entered the new severance pay regime without even being aware. A first reassuring evidence is that the boom in the number of participants is observed in 2010 and not in 2008, suggesting that when the reform took effectiveness many households were not aware of the change. As a further check, we repeat the same estimations

Table 3.4: Logistic regressions for risky assets ownership.

	Pooled		Random effect		Fixed effect	
Risky assets ownership[1]	β	SE	β	SE	β	SE
No tolerance for risk	-0.281***	[0.0370]	-0.234***	[0.0454]	-0.0437	[0.0510]
Age	0.0526***	[0.0107]	0.117***	[0.0147]	0.201***	[0.0299]
Age squared	-0.000512***	[0.0000926]	-0.00108***	[0.000126]	-0.00194***	[0.000258]
Female	-0.192**	[0.0599]	-0.353***	[0.0810]		
Family size	-0.162***	[0.0220]	-0.159***	[0.0283]	0.0719	[0.0543]
Housing status						
Owner with mortgage	-0.0466	[0.0649]	0.0723	[0.0833]	0.227*	[0.110]
Renter	0.194*	[0.0928]	0.117	[0.115]	0.428*	[0.192]
Usufruct/free	0.428***	[0.0927]	0.402***	[0.115]	0.136	[0.154]
Education						
Secondary	0.590***	[0.0651]	0.849***	[0.0854]		
Tertiary	0.856***	[0.0860]	1.399***	[0.121]		
Working status						
Self employed	-0.358***	[0.0653]	-0.443***	[0.0873]	-0.290*	[0.143]
Retired	-0.303***	[0.0660]	-0.410***	[0.0860]	-0.194	[0.124]
Other not working	-0.304**	[0.109]	-0.362**	[0.139]	-0.0434	[0.181]
Municipality size						
20,000-40,000	0.0262	[0.0615]	0.0349	[0.0862]		
40,000-500,000	-0.0426	[0.0523]	-0.0958	[0.0735]		
>500000	-0.228*	[0.0910]	-0.377**	[0.129]		
Income quartile						
II	0.730***	[0.0792]	0.801***	[0.0950]	0.325**	[0.117]
III	1.307***	[0.0834]	1.526***	[0.101]	0.693***	[0.130]
IV	1.950***	[0.0906]	2.335***	[0.112]	1.102***	[0.146]
Year						
2006	-0.145**	[0.0495]	-0.247***	[0.0704]	-0.241**	[0.0743]
2008	-0.279***	[0.0520]	-0.417***	[0.0714]	-0.337***	[0.0841]
2010	0.146**	[0.0536]	0.203**	[0.0711]	0.283**	[0.0947]
2012	0.0502	[0.0556]	0.052	[0.0736]	0.207	[0.111]
2014	-0.014	[0.0601]	-0.00936	[0.0797]	0.206	[0.130]
Area of residence						
North East	0.617***	[0.0590]	0.849***	[0.0861]		
Center	-0.00038	[0.0608]	-0.0318	[0.0873]		
South	-1.065***	[0.0732]	-1.558***	[0.102]		
Islands	-0.796***	[0.0882]	-1.231***	[0.119]		
Net wealth excl. risky assets [2]						
II	0.562***	[0.0863]	0.551***	[0.104]	0.082	[0.130]
III	0.753***	[0.0995]	0.801***	[0.120]	0.153	[0.150]
IV	1.274***	[0.105]	1.465***	[0.127]	0.522**	[0.161]
Constant	-3.816***	[0.321]	-6.328***	[0.451]		
ρ			0.502	0.0119		
σ_α			1.821	0.0433		
LR $H_0 : \rho = 0$ (p-value)			0.0			
Observations	29,645		29,645		10,219	
Pseudo R-squared	0.238				0.041	

* p<0.05, ** p<0.01, *** p<0.001.

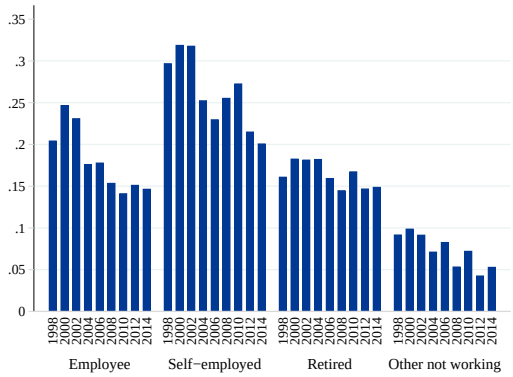
In the pooled regression standard errors are clustered at the household level.

[1] Risky financial assets comprise long term government bonds, other bonds, listed shares, mutual funds, managed accounts and voultary/occupational pension plans.

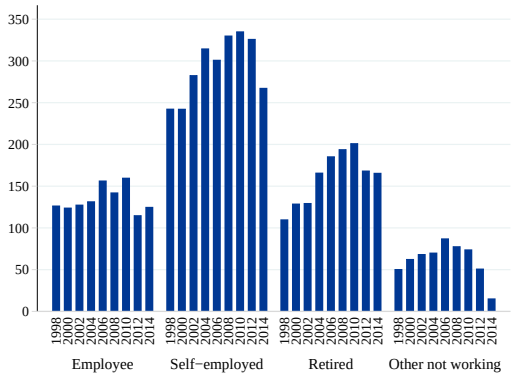
[2] Quartiles of net wealth excluding risky assets.

Figure 3.1: Participation rates and median net wealth by working status and year.

(a) Participation rate in liquid risky assets.



(b) Median net wealth, thousands of euros.



Wealth deflated by the consumer price index (2014 = 1, source: Istat), statistics computed using survey weights.

of table 3.3 for ownership of risky assets including pensions in table 3.4. The regression results show the same patterns of coefficients for risk aversion, age, sex, family size, income, wealth, area of residence and municipality size, largely confirming our previous analysis. Also the relationship between the three models is very similar. One notably difference is that the coefficient on risk aversion is no longer significant in the conditional logit specification. The most interesting evidences, however, regard the parameter for housing and working status of the reference person. Indeed, the effect of the reform on employee with respect to other work categories is very evident, and the coefficients for self-employed, retired and other not working are all negative and strongly significant. We notice also that the coefficient for being home owners with a mortgage on the main residence change sign with respect to table 3.3, even if it is not significant here. This is probably correlated to the fact that households with a mortgage are likely to be employee with a regular income source. These results reinforce our argument that the investment in complementary pensions following the reform has to be considered with care and, at least in part, it is not the result of a specific portfolio choice of the households. Figure 3.1 shows the participation rate in risky liquid assets (3.2a) and median net wealth (3.2b) by the working status of the reference person across the years. From the figure we see that the pattern of participation after 2008 is not particularly different for employee, as we would expect if the crowding out effect of the severance pay reform

was there. Moreover, we see that across the four categories, all experienced a sharp drop in median net wealth between 2006 and 2014. The drop is especially striking for what concerns households whose head is nor working neither retired; from table 1.1 we see that the fraction of these households increased from 4.9% of the sample in 2006 to 9.5% in 2009. If such crowding out effects of investment in pension funds was present, we should expect to see a sharper decrease of the participation rate for employee with respect to the other categories. From the evidences presented so far, this does not seem to be the case. We have to remind, however, that the reform took effectiveness in 2007, thus its effects may be confounded with effects of the 2007-2008 financial crisis.

3.3 Accounting for stock market entry and exit

In this last section we want to study the determinants of the decisions to entry or exit the stock market. We will carry out such analysis over two different time frame: the period 2006-2010 and the period 2010-2014. We choose to focus on four years time windows instead of narrower two years windows so to capture more transitions in the participation status. In order to understand the factors that drive entries, exits and inertia in participation, we employ a bivariate probit following Bilias et al. (2010), in which we simultaneously consider the participation decision in two consecutive periods. In general, accounting for the participation decision dynamically is particularly challenging, as it usually requires long panel data series. If there is true state dependance, that is $\gamma \neq 0$ in equation (3.19), or the u_{it} are serially correlated, then past ownership influences actual ownership. Miniaci and Weber (2002) note how in the estimation of such a model two central issues arise. First, the assumptions made concerning the initial conditions are crucial to obtain consistent estimates. Such problem may be circumvented by assuming that the initial conditions are exogenous or that the process is in equilibrium at time 0. Clearly, this may be problematic if the underlying process is evolving. The second problem that arises in estimating these dynamic models is related to distinguish between true and spurious state dependence. In particular, time dependence may be due to the fact that actual experience of ownership has modified individual behaviour, or to the presence of unobserved components, or due to both. Since the unobserved individual effects persist over time, there is a serial correlation in the residuals, which does not allow to distinguish true state dependence from spurious state dependence. Miniaci

and Weber (2002) show how the estimator suggested by Honoré and Kyriazidou (2000) generalizes the conditional logit model to the case in which there is true state dependence. In this case $S_i = \sum_{t=1}^{T}$ is no longer a sufficient statistic for the fixed unobserved effect α_i, and a consistent estimation requires at least four observations. Instead, using a bivariate probit model has a few advantages: it is a relatively simple model which allow to test for the correlation in the decision to participate in two different moments. Thus, the bivariate probit seems to be a convenient compromise to study jointly the ownership decision in two consecutive periods.

Again, we base our theoretical description on Greene (2003). We specify the general bivariate probit model as

$$\begin{aligned}
&y_1^* = x_1'\beta_1 + \epsilon_1, \qquad y_1 = 1 \quad \text{if } y_1^* > 0, 0 \text{ otherwise,} \\
&y_2^* = x_2'\beta_2 + \epsilon_2, \qquad y_2 = 1 \quad \text{if } y_2^* > 0, 0 \text{ otherwise,} \\
&E[\epsilon_1|x_1, x_2] = E[\epsilon_2|x_1, x_2] = 0, \\
&\text{Var}[\epsilon_1|x_1, x_2] = \text{Var}[\epsilon_2|x_1, x_2] = 1, \\
&\text{Cov}[\epsilon_1, \epsilon_2|x_1, x_2] = \rho.
\end{aligned} \tag{3.41}$$

The key assumption is that the errors of the two equations are jointly normally distributed. We allow the disturbances, and, thus, the two outcome variables, to have a correlation ρ. If ρ is equal to zero, then y_{i1} and y_{i2} are independent, and they could be studied individually using a univariate probit model. Given the joint normality assumption, the bivariate normal cumulative density function is given by

$$\Pr\left(X_1 < x_1, X_2 < x_2\right) = \Phi_2\left(x_1, x_2, \rho\right) = \int_{-\infty}^{x_2}\int_{-\infty}^{x_1} \phi_2\left(z_1, z_1, \rho\right) dz_1 dz_2, \tag{3.42}$$

where the subscript 2 on Φ_2 and ϕ_2 denotes the bivariate distribution. The density function is

$$\phi_2(x_1, x_2, \rho) = \frac{e^{-(1/2)\left(x_1^2 + x_2^2 - 2\rho x_1 x_2\right)(1-\rho^2)}}{2\pi(1-\rho^2)^{1/2}}. \tag{3.43}$$

In order to construct the log likelihood function, we define $q_{i1} = 2y_{i1} - 1$ and $q_{i2} = 2y_{i2} - 1$, so that $q_{ij} = 1$ if $y_{ij} = 1$ and $q_{ij} = -1$ if $y_{ij} = 0$, for $j = 1, 2$. Now we denote

$$z_{ij} = x_{ij}'\beta_j \quad \text{and} \quad w_{ij} = q_{ij} z_{ij}, \quad j + 1, 2, \tag{3.44}$$

and

$$\rho_{i^*} = q_{i1} q_{i2} \rho. \tag{3.45}$$

Such notational arrangements are necessary in order to account for all the sign changes needed to compute probabilities for the four combinations of zero and one of y_{i1} and y_{i2}. Such probabilities enter the likelihood function, and are defined by

$$\Pr\left(Y_1 = y_{i1}, Y_2 = y_{i2} | x_1, x_2\right) = \Phi_2\left(w_{i1}, w_{i2}, \rho_{i^*}\right). \tag{3.46}$$

Thus, the log likelihood function is written as

$$\ln L = \sum_{i=1}^{n} \ln \Phi_2\left(w_{i1}, w_{i2}, \rho_{i^*}\right). \tag{3.47}$$

To obtain the maximum likelihood estimate, we need to set the three partial derivatives $\partial \ln L / \partial \beta_j$, $\partial \ln L / \partial \rho$ equal to zero, while the variance matrix is estimated from the second derivatives, as shown in Greene (2003).

We now present the results of the estimation. Table 3.1 shows the panel dimension and composition in the various waves. We see that our two samples include 3,476 and 2,894 households observed in the periods 2006-2010 and 2010-2014, respectively. Table 3.5 shows the transitions between participation and non participation of risky liquid assets between each year. In particular, we notice that there is a considerable degree of inertia across the years, especially considering 2-years transitions. In our sample, 79% and 82% of the sample did not switch between ownership and non ownership in 2006-2010 and in 2010-2014 (and viceversa).

Table 3.6 and 3.7 show the average marginal effects obtained from the bivariate probit estimation of risky liquid asset ownership 2006-2010, and in 2010-2014, respectively. Such effects represent the derivatives of $\Pr\left(y_1 = 1, y_2 = 1 | x_1, x_2\right)$, computed at each single observation and then averaged across the sample. Bilias et al. (2010) note that such methodology provides more realistic and economically relevant interpretation with respect to, for example, marginal effects computed at means or at other relevant values of the dependent variables [3]. The results presented in table 3.6 and 3.7 overall

[3] Differently from Bilias et al. (2010), we can avoid to compute the marginal effects manually for each observation, and then average them across the sample, thanks to the command margins introduced in Stata 13.

Table 3.5: Transition probabilities for risky liquid assets ownership across the years.

	2000		2002		2004		2006		2008		2010		2012		2014	
1998	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1
0	0.59	0.13	0.59	0.12	0.55	0.13	0.55	0.12	0.56	0.11	0.53	0.13	0.52	0.21	0.54	0.14
1	0.09	0.19	0.10	0.20	0.11	0.21	0.14	0.19	0.16	0.18	0.15	0.19	0.16	0.25	0.15	0.17
2000	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1
0			0.59	0.08	0.55	0.10	0.55	0.09	0.55	0.09	0.52	0.11	0.51	0.12	0.51	0.12
1			0.11	0.22	0.12	0.23	0.15	0.21	0.17	0.20	0.15	0.22	0.17	0.20	0.18	0.19
2002	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1
0					0.61	0.10	0.60	0.10	0.60	0.08	0.56	0.12	0.56	0.12	0.56	0.12
1					0.09	0.20	0.12	0.19	0.13	0.18	0.13	0.19	0.13	0.20	0.14	0.18
2004	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1
0							0.63	0.08	0.61	0.09	0.57	0.13	0.56	0.13	0.58	0.13
1							0.11	0.17	0.13	0.17	0.12	0.18	0.13	0.17	0.13	0.16
2006	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1
0									0.67	0.07	0.61	0.13	0.59	0.13	0.61	0.13
1									0.08	0.17	0.09	0.18	0.10	0.18	0.10	0.16
2008	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1
0											0.64	0.12	0.62	0.13	0.63	0.12
1											0.06	0.18	0.08	0.17	0.09	0.16
2010	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1
0													0.61	0.09	0.62	0.09
1													0.10	0.21	0.10	0.20
2012	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1
0															0.64	0.08
1															0.09	0.19

Table 3.6: Bivariate participation probit, 2006-2010.

Participation in risky liquid assets [1]				
	Own in 2006		Own in 2010	
	Marginal effect	SE	Marginal effect	SE
No tolerance for risk	-0.0171***	[0.00499]	-0.0263***	[0.00462]
Age	0.00224	[0.00148]	0.00292*	[0.00131]
Age squared	-0.0000182	[0.0000119]	-0.0000253*	[0.0000114]
Female	-0.00346	[0.00704]	-0.00843	[0.00654]
Family size	-0.0120***	[0.00278]	-0.0119***	[0.00243]
Housing status				
Owner with mortgage	0.0117	[0.0129]	0.0103	[0.00792]
Renter	0.0272	[0.0182]	0.0379***	[0.00772]
Usufruct/free	0.0469*	[0.0208]	0.0270**	[0.00938]
Education				
Secondary	0.0478***	[0.00910]	0.0272***	[0.00675]
Tertiary	0.0888***	[0.0165]	0.0427***	[0.00900]
Working status				
Self employed	0.000593	[0.0116]	-0.00314	[0.00755]
Retired	0.0206	[0.0121]	0.0107	[0.00724]
Other not working	0.0341	[0.0283]	0.0366***	[0.0105]
Municipality size				
20,000-40,000	0.00631	[0.0110]	0.000769	[0.00621]
40,000-500,000	-0.000124	[0.00939]	-0.00184	[0.00555]
>500000	0.00274	[0.0168]	-0.0091	[0.0103]
Income quartile				
II	0.0361***	[0.00730]	0.0382***	[0.00850]
III	0.0840***	[0.00887]	0.0546***	[0.00879]
IV	0.163***	[0.0130]	0.0927***	[0.00961]
Net wealth excl. risky assets [2]				
II	0.0437***	[0.00949]	0.0338***	[0.00923]
III	0.0640***	[0.0115]	0.0555***	[0.0104]
IV	0.130***	[0.0141]	0.0820***	[0.0108]
Area of residence				
North East	0.0761***	[0.0132]	0.0214***	[0.00563]
Center	-0.0144	[0.0116]	-0.0164*	[0.00682]
South	-0.0900***	[0.00970]	-0.0630***	[0.00819]
Islands	-0.0660***	[0.0115]	-0.0541***	[0.00924]
ρ	0.601 (SE .0284)			
Wald $H_0 : \rho = 0$ (p-value)	0.0			
Observations	3266			

Robust standard errors, * p<0.05, ** p<0.01, *** p<0.001.

[1] Risky financial assets include risky liquid assets plus non listed shares, other financial assets and defined contribution pension plan and other financial assets.

[2] Quartiles of net wealth excluding risky assets.

Table 3.7: Bivariate participation probit, 2010-2014.

Participation in risky liquid assets [1]				
	Own in 2010		Own in 2014	
	Marginal effect	SE	Marginal effect	SE
No tolerance for risk	-0.0345***	[0.00507]	-0.0246***	[0.00468]
Age	0.0012	[0.00158]	0.00223	[0.00137]
Age squared	-0.00000893	[0.0000126]	-0.0000193	[0.0000117]
Female	-0.00368	[0.00738]	-0.00935	[0.00672]
Family size	-0.0118***	[0.00274]	-0.0101***	[0.00252]
Housing status				
Owner with mortgage	-0.0199	[0.0116]	-0.00461	[0.00721]
Renter	-0.000653	[0.0191]	0.0031	[0.0116]
Usufruct/free	0.0500*	[0.0239]	0.0337***	[0.00838]
Education				
Secondary	0.0409***	[0.01000]	0.0187*	[0.00732]
Tertiary	0.0606***	[0.0157]	0.0293**	[0.00941]
Working status				
Self employed	0.00862	[0.0119]	0.00601	[0.00727]
Retired	0.0172	[0.0126]	0.0150*	[0.00755]
Other not working	0.0289	[0.0249]	0.0201	[0.0114]
Municipality size				
20,000-40,000	0.00819	[0.0117]	0.00281	[0.00668]
40,000-500,000	0.00991	[0.00997]	0.00266	[0.00562]
>500000	-0.0207	[0.0160]	-0.00256	[0.0105]
Income quartile				
II	0.0258***	[0.00717]	0.0172	[0.00925]
III	0.0657***	[0.00880]	0.0549***	[0.00948]
IV	0.155***	[0.0137]	0.0815***	[0.0105]
Net wealth excl. risky assets [2]				
II	0.0470***	[0.0108]	0.0394***	[0.0112]
III	0.0595***	[0.0128]	0.0432**	[0.0133]
IV	0.105***	[0.0147]	0.0695***	[0.0135]
Area of residence				
North East	0.0359*	[0.0150]	0.0229***	[0.00640]
Center	-0.0179	[0.0137]	0.00401	[0.00684]
South	-0.109***	[0.0114]	-0.0566***	[0.00846]
Islands	-0.0737***	[0.0139]	-0.0341***	[0.00907]
ρ	0.6002 (SE .0323)			
Wald $H_0 : \rho = 0$ (p-value)	0.0			
Observations	2696			

Robust standard errors, * p<0.05, ** p<0.01, *** p<0.001.

[1] Risky financial assets include risky liquid assets plus non listed shares, other financial assets and defined contribution pension plan and other financial assets.

[2] Quartiles of net wealth excluding risky assets.

support the results of the static participation analysis of the previous section. In particular, the probability of owning risky assets in both period increases with wealth, income and education, and is higher for households living in the North with respect to the South and the Islands. Curiously, there are no differences between Center and North West. On the other side, risk aversion and family size maintain their negative effects on risky liquid assets ownership. The results suggest evidences of inertia in participation status: ρ is estimated to be around 0.6, and it is slightly higher for what regards the period 2010-2014. We test the significance of this correlation with a Wald test, and in both periods the null hypothesis of $\rho = 0$ is strongly rejected. There are also interesting differences, however, across the specification: for example, renting the main residence or being neither working nor retired in 2010, increase the probability of participating in 2010, but these factors does not have a significant effect on ownership probability in 2006. From our bivariate probit analysis also emerges that there are no differences in participation behaviour on the basis of the size of the municipality in which the household lives.

As noted by Greene (2003), however, such marginal effects are unconditional, that is, they do not correspond to a regression coefficient or a slope of a conditional expectations. Formally, these average marginal effects may be defined as follows: from equation (3.46), given our definitions of qij and zij, we have that

$$\Pr\left(y_1, y_2 | x_1, x_2\right) = \Phi_2\left(w_1, w_2, \rho_{i^*}\right) = \Phi_2\left(x_1'\beta_1, x_2'\beta_2, \rho\right). \tag{3.48}$$

Hence, the marginal effects of x_1 may be computed as

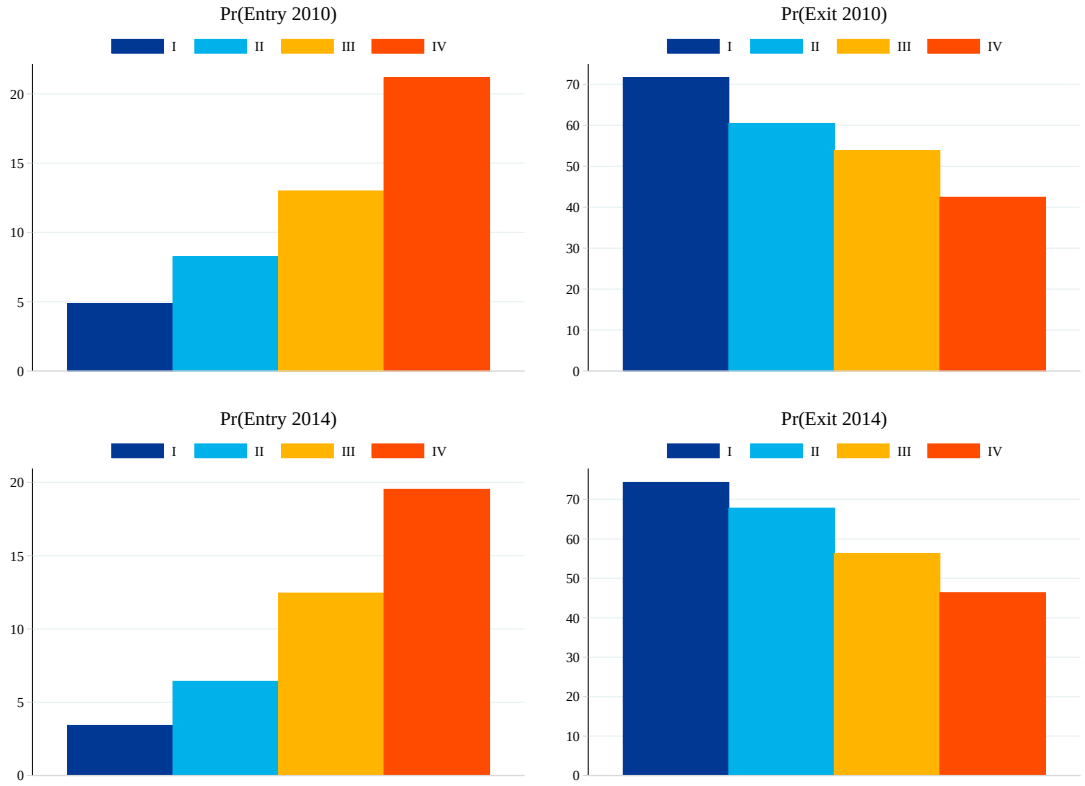
$$\frac{\partial \Phi_2\left(x_1'\beta_1, x_2'\beta_2, \rho\right)}{\partial x_1} = \phi(x_1'\beta_1)\Phi\left(\frac{x_2'\beta_2 - \rho x_1'\beta_1}{\sqrt{1-\rho^2}}\right). \tag{3.49}$$

Note that in (3.48) and (3.49) the household subscript i is omitted for simplicity, and that ϕ and Φ denote the univariate normal density and cumulative density function, respectively. In our case, we are interested in the probabilities of entry or exit, that is

$$\begin{aligned} &\Pr\left(y_{t+4} = 1 | y_t = 0, x_{t+4}, x_t\right) \quad \text{in the case of entry,} \\ &\Pr\left(y_{t+4} = 0 | y_t = 1, x_{t+4}, x_t\right) \quad \text{in the case of exit,} \end{aligned} \tag{3.50}$$

where $t = 2006, 2010$. Applying the Bayes' theorem, such conditional probabilities can

Figure 3.3: Conditional probabilities of entry and exit, by net wealth quartiles.



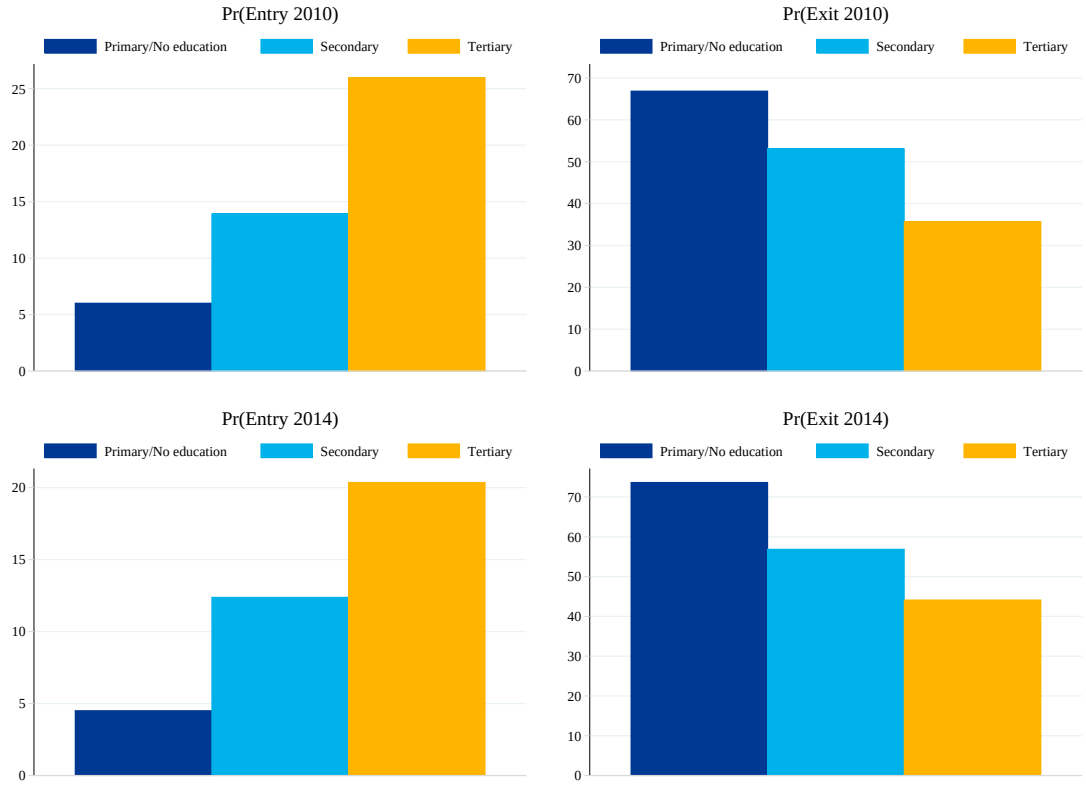
Top panel refers to the period 2006-2010, bottom panel to 2010-2014.

be computed as

$$\Pr\left(y_{t+4}=1|y_t=0,x_{t+4},x_t\right)=\frac{\Pr\left(y_{t+4}=1,y_t=0|x_{t+4},x_t\right)}{\Pr\left(y_t=0|x_{t+4},x_t\right)}. \tag{3.51}$$

Hence we can compute the conditional probabilities of investing and not investing, given the participation status in the previous period. Figure 3.3 shows the probabilities of risk liquid asset ownership and non ownership in 2010 (2014), conditional on participation status in 2006 (2010). The pattern across wealth quartiles is very similar in both the periods observed. For what concerns those who were not participating in the first period, we see that inertia is very common. The probability of entering the market increases with net wealth, but even for those in the top quartile is slightly above 20% in 2010 and it is lower in 2014. For households at the bottom of the wealth distribution, such probability is as low as 5% in 2010 and around 3% in 2014. The charts on the right side,

Figure 3.5: Conditional probabilities of entry and exit, by education level of the reference person.

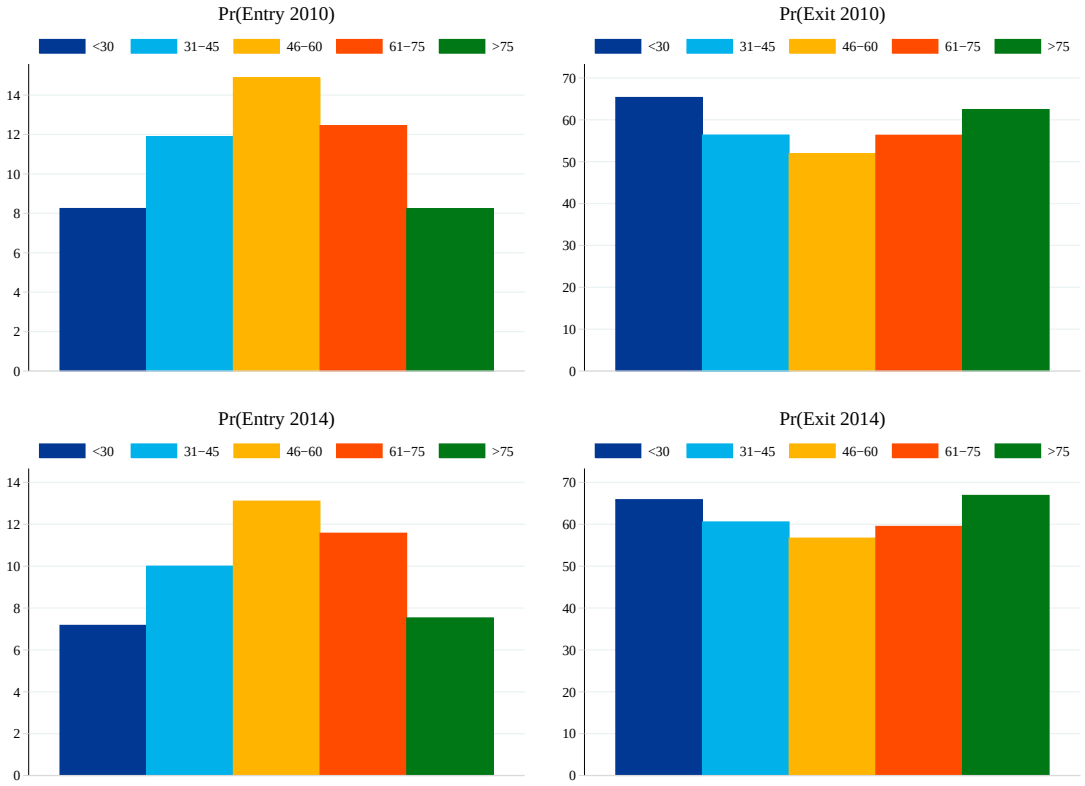


Top panel refers to the period 2006-2010, bottom panel to 2010-2014.

instead, show probabilities of exit, that is, the probability of not participating conditional on participating in the previous period. There we observe very high probabilities of exiting the market, both in 2010 and 2014. With the exception of households in the top net wealth quartile, these probabilities exceed 50%. That means that households are more likely to exit the stock market than staying in. At every level of wealth, we observe that the probabilities of entries (exits) are lower (higher) in 2014. Such results are strongly at odds with the results of Bilias et al. (2010), who document substantial inertia among both participants and non participants, for example, they report a probability of exit between 1999 and 2003 (notice that the time span includes the burst of the dot come bubble) around 25% for the 75th percentile of net wealth.

Similarly, figure 3.5 shows the same conditional probabilities by the level of the educational attainment of the reference person. Overall, we again observe very low probabilities of entry and high probabilities of exit. For households whose head has a

Figure 3.7: Conditional probabilities of entry and exit, by age of the reference person.



Top panel refers to the period 2006-2010, bottom panel to 2010-2014.

low level of education we observe probabilities of entry around 6% between 2006 and 2010, and lower than 5% in the period 2010-2014, and probabilities of exiting close to 70 and 75%, respectively. We see also a sharp decline (rise) in the probability of entry (exit) between 2010-2014 with respect to the previous four years, at each level of educational attainment.

Finally, we show these probabilities by age of the reference person in figure 3.7. In line with the other figures, the likelihood of entry is lower between 2010 and 2014, and, conversely, the likelihood of exit is higher. Once again, we observe the hump-shaped relationship between risky asset participation and age: the probabilities of entry are hump-shaped in age, and the highest are estimated for the 46-60 age group (in both periods). Conversely, exit probabilities are u-shaped, with youngest and oldest households that are more likely to dismiss their investments in risky assets. Such probabilities, however, exceed 50% in each age group. One interesting fact to point out regards the change

occurred in entry probabilities between the two periods. As can be seen from figure 3.7, the drop in these probabilities between the first and the second period has been much more pronounced for young households (especially those whose head is aged between 31 and 45) than for older ones (specifically, those aged 61-75).

The magnitude of these results is surprising. However, is is coherent with the data and potentially with the factors that we discussed in the previous chapter. First of all, we documented that 2012 and 2014 saw the largest drop in real household wealth, and this already can in part explain households' particularly negative attitude towards risky investment between 2010 and 2014. We may also argue that the 2007-2008 financial crisis impacted the level of trust in the financial system, which subsequently worsened due to the prolonged economic depression, and the even harder shocks that hit the economy during and after the sovereign debt crisis of 2011-2012. These effects seem very large and widespread across households, at every level of wealth, education and age.

3. EMPIRICAL ANALYSIS

4

Concluding remarks

In this thesis we have analyzed Italian household financial investments and risk taking behaviour over the last 15 years. We focused in particular on two features of the data: the low participation rate in risky assets and the sharp decline of this participation rate observed since the 2001 shock market crash. Our empirical analysis shows that poorer, less educated and more risk averse households are less likely to invest in risky assets. Furthermore, these households have a higher probability to have exited the stock market during and after the Great Recession. However, our findings point out that the drop in participation has been pronounced also for wealthier and better educated households. In order to explain these evidences, we theoretically discussed several factors that have been considered in the literature, and we analyzed the extent to which these factors can explain the observed trend. First of all, we claim that a drop in wealth, given the fixed participation cost, has reduced the benefits achievable from investing in risky assets. But fixed costs should be implausibly high in order to explain the low participation observed even at high levels of wealth. Hence, we need to resort to other explanations. We conjectured that a decline in the level of trust significantly reduced household propensity to invest in risky assets. Following Guiso et al. (2008) we have shown formally the effects of lower trust on risk taking. Given the fixed participation costs, a lower level of trust increases the wealth threshold that triggers non participation and reduces the optimal share invested upon participation. We also simulated a portfolio choice model in which an expected utility maximizing investor with CRRA utility function allocates her wealth into a risky and a risk-free asset. The investor faces fixed participation costs and has limited trust, which is modeled as a subjective probability of being cheated in the stock market.

4. CONCLUDING REMARKS

The simulation results show that the negative effect of mistrust on investment in risky assets is amplified in the presence of participation costs. We also showed that higher levels of risk aversion or lower expectations on the risk-adjusted equity premium would have similar effects on participation and on the share invested. Risk aversion could have increased because background risk rose due to the crisis. Or expected returns could have been revised downwards. Unfortunately, the available individual-level data on expected returns do not cover the pre-crisis period, so we could not provide evidence on their role. Further research effort should be devoted to disentangle these factors and to evaluate their effects separately. This is a challenging task, for a number of reasons. First, there is a lack of data on trust and expectations. Second, effectively estimating background risk is difficult. Indeed, as we highlighted in our discussion, many different factors can be a source of background risk and increase household risk aversion. Future research projects should focus especially on the role of unemployment, housing and macroeconomic experiences in affecting household attitude towards risky investment.

In a broader perspective, understanding how households invest their savings has several important implications also for public policy. In particular, it may shed light on the dynamics of wealth accumulation and inequality. Indeed, if those households who invest in the stock market achieve a higher rate of return, as a result inequality may widen. This is the point made by Piketty (2014): to use his terminology, if the rate of return on capital exceeds economic growth, then inequality will inevitably rise, given that only a fraction of households benefits from this excess return. Using detailed administrative data on Swedish households, Bach et al. (2015) show that wealthier households achieve a higher return mainly due to the their higher exposure to systemic risk, given that they hold, on average, more equity and private businesses. Further evidences of the potential distributional consequences of asset prices inflation come from Adam and Tzamourani (2016). Using HFCS data, they show that only a few households would benefit from equity and bond price increases, while, instead, the median household would strongly benefit from an increase in house prices. Thus, further developments of the present work would link household portfolios to the dynamics of wealth accumulation and inequality in Italy.

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Appendix

The imputation of missing data

The Survey of Household Income and Wealth (SHIW) provides detailed information on a sample of about 8,000 Italian households demographic characteristics and financial situation. The Survey is conducted by the Bank of Italy through a specialized company (actually Eurisko), with a biannual frequency, with the exception of a three years gap between 1995 and 1998.

The questionnaire is organized in 5 section: section A regards household composition and demographic characteristics, section B contains questions about the labour status of household components, section C and D provide information of financial and real estate wealth, respectively, and finally section F regards complementary pension plans and insurance policies. Other attachments are presents, in which more detailed questions on specific topics (such as income, real estate ownership) are asked.

The number of financial assets included in the questionnaire progressively increased throughout the years. In the SHIW, individuals are asked first of all to provide an estimate of the amount invested in a given asset, then if they do not provide this information, they are asked to select one bracket out of fourteen and subsequently they are asked to indicate whether the amount is closer to the top, the middle of the bottom point of the bracket. In the recent waves, after 2006, values are imputed from bracketing directly by the Bank of Italy, and the data are published without missing observation. For the waves before 2006 instead, we have to impute the missing values. Following Guiso and Jappelli (2002), we impute the middle value of the class. This methodology applies well in this situation, given the high number of classes that are present in the data (14 brackets x 3 subclasses). The estimation of the capital accumulated in pension funds and the cash value of life insurance is more problematic. For such items, the quality of the data

is much lower, and many values are missing. Moreover, before 2004 for pension funds (and 2008 for life insurance policies) the question on the capital was not included in the survey. We impute such amounts on the basis of the number of years of contribution and the value of the contribution made during the year. However, we have doubts on the reliability of such imputation, especially for those households who transferred the severance pay to a private regime following the 2005 reform.

As we have already mentioned in the text, instead, both the HFCS and the SCF resort to multiple imputation techniques in order to deal with missing answers. Thus, we do not need to impute any value. We take into account the multiple imputation when computing statistics following the methodology described in Rubin (2004).