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Abstract

This study questions the popular stereotype that women are more risk averse than men in their investment decisions. The analysis is based on micro-level data from large-scale surveys of private households in five European countries. We enrich the conventional approach to examination of gender differences by explicitly controlling for investors' self-perceived risk aversion. Our results confirm the gender stereotype only partially. We find that women are less likely to hold risky assets. However, female owners of risky assets allocate an equal or even a higher share of their wealth to these assets than men. Our findings suggest that especially in case of women, the declared attitude toward financial risks may be misleading as it does not necessarily reflect the actual willingness to bear risks.

Keywords: gender, risk aversion, financial behavior

JEL Classification: G11, J16

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1 Introduction

It is a common belief that there are systematic differences between men and women with respect to financial decision-making. In fact, most empirical studies provide evidence that men are more willing to take risks than their female counterparts when actual financial behavior is considered.¹ Furthermore, studies that focus on measurement of risk aversion either according to the theoretical framework of [Friend & Blume \(1975\)](#) or using respondents' self-assessment of risk attitudes find that men appear to be more risk tolerant than women.²

The established stereotype regarding the gender differences in financial behavior has two important implications. Firstly, it becomes a common praxis in empirical research to use gender as a proxy for risk aversion when no direct information on individuals' risk attitude is available. Yet, the explanatory power of gender especially in the context of financial decision-making may be overestimated. For example, [Johnson & Powell \(1994\)](#) show that male and female managers display similar risk propensity. Also [Schubert et al. \(1999\)](#) find no influence of gender on financial decisions. Secondly, very often it is suggested that the observed gender differences have their roots in differences in individual risk aversion.³ Nevertheless, a comprehensive test of this hypothesis fails because in most cases researchers do not have direct information on the risk attitudes of individuals.

The hypothesis that observed gender differences in investment decisions are ultimately the result of differences in individual risk attitudes is in the heart of the present study. We examine whether risk aversion has similar effect on financial decisions of males and females when differences in socioeconomic characteristics are accounted for. Two aspects of investment behavior are considered. Firstly, we ask whether men and women with the same degree of risk aversion have the same probability to invest in risky financial assets (bonds and stocks). Secondly, for individuals who own risky assets, we analyze differences in influence of risk aversion on the share of wealth that men and women invest in these assets.

¹e.g. [Bajtelsmit et al. \(1996\)](#), [Dwyer et al. \(2002\)](#), [Hartog et al. \(2002\)](#), [Fellner & Maciejovsky \(2007\)](#) and others.

² e.g. [Jianakoplos & Bernasek \(1998\)](#), [Donkers & van Soest \(1999\)](#), and [Perrin \(2007\)](#).

³[Bajtelsmit & Bernasek \(1996\)](#) provide a summary of the explanations for gender differences than are offered in the existing literature.

Additionally we examine the role of professional background for investment decisions. The aim is to test whether gender differences can be observed in a subpopulation of individuals who are highly qualified professionals working in financial services industry. The existing literature provides conflicting evidence in this respect.

The present study has several advantages over the previous research. Firstly, our analysis involves a large micro-level data set drawn from several national surveys of European private households. Secondly, we are able to conduct an explicit test of the effects of risk aversion because the data we employ contain information on the investors' stated willingness to take financial risks. Another advantage of the data is that it has a cross-country nature. Specifically, we assemble data from five European countries: Austria, Cyprus, Germany, Italy and the Netherlands. Thus we are able to examine whether the patterns in gender behavior previously observed in some countries are an universal phenomenon.⁴

The paper is organized as follows. In the next section, we review the relevant literature. In Section 3, we formulate our hypotheses and describe how the hypotheses are tested. In Section 4, we present the data. In Section 5, we analyze the effects of risk aversion on the decision to hold risky financial assets separately for men and women. In Section 6, we examine the gender differences in influence of risk aversion on share of wealth invested in risky assets. The last section concludes.

2 Existing evidence on gender differences in financial behavior

There is a large body of empirical literature studying differences between males and females in financial decision-making under risk. The literature generally agrees that women exhibit lower levels of risk tolerance than men in financial matters. The finding is highly consistent considering the fact that a wide range of methodologies is employed and investment behavior is studied from different perspectives and in different contexts.

⁴The majority of previous studies test their hypotheses on the US data. There are only few studies outside the US that also employ large-scale survey data, e.g. [Palsson \(1996\)](#) use 1985 survey data on Swedish households, and [Perrin \(2007\)](#) uses 2006 survey data on Swiss households.

The existing literature can be categorized in two main groups. To the first group belong studies that analyze gender differences based on the observed behavior of individuals in the real life or in an experimental framework. One of the early studies in this group that was conducted by [Hinz et al. \(1996\)](#). Analyzing data on investment decisions of 500 participants of a defined contribution plan in the USA, they find that men are significantly more likely to hold risky assets and that their percentage of wealth invested in these assets is higher. [Bajtelsmit et al. \(1996\)](#) investigate what factors influence the percentage of wealth invested in risky assets in a defined contribution plan in 1989 in the USA. They too find that women are relatively more risk averse than men. The results of the study may be however biased by the fact that it is not known whether individuals themselves or their employer made the allocation decision. [Jianakoplos & Bernasek \(1998\)](#) test gender differences in investment behavior on a large data set drawn from the Survey of Consumer Finances (CFS) 1989. The analysis reveals that single women are relatively more risk averse than single men or married couples.

Numerous experimental studies are consonant with studies that build upon data about actual investment practices. [Powell & Ansic \(1997\)](#) find that men have significantly higher preference for risk than women: males prefer “riskier” investment strategies in order to achieve the highest gains, while women select “safer” strategies that allow them avoiding the worst possible losses. [Barsky et al. \(1997\)](#) elicit the individual risk tolerance from survey responses to hypothetical situations and link it to investment behavior. Here again females appear to be less risk tolerant than males. Males invest higher fraction of their financial wealth in stocks, while women prefer safer assets such as Treasury bills and saving accounts. Finally, the same gender difference is confirmed in experimental lotteries by [Hartog et al. \(2002\)](#) who deduce individuals’ Arrow-Pratt measure of risk aversion and [Fellner & Maciejovsky \(2007\)](#) who reveal a systematic correlation between gender and risk attitudes. Specifically, [Fellner & Maciejovsky \(2007\)](#) find that women prefer less volatile investments and exhibit lower market activity, e.g. they submit fewer offers and engage less often in trades.

The second group of literature embraces research that links gender and self-reported risk aversion. In the study by [Jianakoplos & Bernasek \(1998\)](#), analysis of respondents’ self-assessed tolerance towards investment risk provides evidence that women perceive themselves as less inclined to risk taking than men. Also [Donkers & van Soest \(1999\)](#) who use a survey of Dutch households which contains direct information on perceived risk aversion find that being a women significantly increases the degree of risk aversion. One

of the most recent studies by Perrin (2007) provides evidence on perceived risk aversion towards financial risks by Swiss households. In the sample of about 2,300 respondents the distribution of individuals over three groups of risk aversion show significant differences between men and women: a higher fraction of men describes themselves as risk tolerant, while the fraction of women is higher in the group that prefers to avoid risk.

Although scarce, there is some evidence that questions the prevailing notion. Schubert et al. (1999) emphasize that neither survey based studies nor other experimental studies allow examination of behavior in the same contextual frames as defined by Hershey & Schoemaker (1980)). By means of an experimental study they find no significant gender differences in risk propensity in financial decisions. Outside the laboratory Booth & Nolen (2008) identify no difference if women decide in a group of women but differ if they are in a group of mixed sex. Caliendo & Kritikos (2008) who investigate gender differences in the context of start-ups reveal another interesting pattern. The authors find that women start own business less frequently than men. Yet, male and female start-ups invest an equal share of own capital in their businesses.

Along with evidence on gender differences in the general population, there is also some research that focuses on investment decision-making in professional setting. So Johnson & Powell (1994) explore differences in the decisions taken by individuals with managerial education. They find that males and females in this subpopulation display similar risk propensity. On contrast, Olsen & Cox (2001) who investigate the gender differences for professionally trained investors, find that women weigh risk attributes, such as possibility of loss and uncertainty, more heavily than men. Female investors also tend to emphasize risk reduction more than their male colleagues. Consonant with these findings, Dwyer et al. (2002) and Niessen & Ruenzi (2007) show for managers of the US mutual funds that gender differences are significant even when educational background and work experience are comparable.

Concluding, the majority of empirical studies show that women are more conservative than men when investment decisions are considered. As to the explanation of what determines the differences between the two gender groups, the literature does not give a decisive answer. The prevailing view is that differences in risk taking are related to the specifics of genders' nature due to evolutionary and social factors. Yet, it might be that differences in financial behavior richly observed in real world could not be solely attributed to the 'intrinsic' differences in risk attitudes. There might be other factors re-

sponsible for women being more conservative investors. For example, it is well known that women earn less than men over their working lives and thus accumulate less savings. They have also a higher background risk associated with uncertainty of labor income due to necessity of staying at home to raise children and keeping the household.

3 Research hypotheses and test methodology

As shown in the previous section no consensus in the literature is achieved regarding the explanation of what determines the differences between the two gender groups. In this section we set up two conjectures about the role of risk aversion and test them in the following sections of the paper.

Hypothesis 1: Men and women with the same degree of risk aversion would invest in risky financial assets with equal probability.

To test this hypothesis we compare the financial behavior of two groups. Specifically, we separately estimate the probability that men and women with specified risk aversion invest in risky assets. If we find no significant differences in the probability between males and females, and at the same time there will be differences in probability across individuals with different risk aversion then we can conclude that risk aversion is in fact the dominant determinant of differences in financial behavior while gender is endogenous with respect to risk aversion. Alternatively, if we find that men and women with equal degree of risk aversion expose different likelihood of investing in risky assets then we can conclude that risk aversion can not fully explain the gender differences in investment behavior.

We model the decision to hold risky financial assets in the following way. Denote U_r the individual's utility of holding risky assets, and U_s the utility of not holding risky assets. Both utilities are not observable, but are assumed to be functions of the individual's socioeconomic and demographic characteristics:

$$U_s = \mathbf{x}'\beta_s + \mathbf{e}_s, \quad \text{and} \quad U_r = \mathbf{x}'\beta_r + \mathbf{e}_r,$$

where \mathbf{x} is a vector of observed characteristics of an individual and \mathbf{e} captures unobserved factors.

The investor decides to hold risky financial assets if the $U_r > U_s$. Then, if we denote by $Y_i = 1$ the choice to own risky assets, the probability of this choice conditional on the investor's observed characteristics is:

$$\begin{aligned} \text{Probability}[Y_i = 1|\mathbf{x}] &= \text{Probability}[U_r > U_s|\mathbf{x}] \\ &= \text{Probability}[\mathbf{x}'(\beta_r - \beta_s) + (\mathbf{e}_r - \mathbf{e}_s) > 0|\mathbf{x}] \\ &= \text{Probability}[\mathbf{x}'\beta + \mathbf{e} > 0|\mathbf{x}] \end{aligned} \quad (1)$$

We estimate equation (1) performing a logit regression. The econometric representation of this equation takes the form of:

$$\text{Probability}(Y_i = 1|\mathbf{x}_i) = 1 - F(-\beta'\mathbf{x}_i) = \frac{\exp(\beta'\mathbf{x}_i)}{1 + \exp(\beta'\mathbf{x}_i)},$$

where Y_i is an indicator variable equal to 1 if investor i owns risky assets and 0 otherwise; and $F(\bullet)$ is the cumulative distribution function of logistic distribution; \mathbf{x}_i is a vector of explanatory variables.⁵ Definitions of the variables are reported in Table 6.

Hypothesis 2: Men and women with the same degree of risk aversion would invest equal share of their financial portfolios in risky assets.

To test this hypothesis we estimate and compare the shares of wealth that males and females with the same risk aversion invest in risky assets. Following [Friend & Blume \(1975\)](#) we link the relative share of financial wealth invested in risky assets to investors' risk aversion as following:

$$\alpha_i = \frac{E(r_m - r_f)}{\sigma^2} \frac{1}{C_i}, \quad (2)$$

where α_i is the fraction of financial portfolio that individual i invests in risky financial assets; r_m is the interest rate on the market portfolio; r_f is the return on the risk free asset; σ^2 is the variation in returns on the market portfolio; and C_i is the Arrow-Pratt measure

⁵We do not address the issue of potential endogeneity of the explanatory variables. It is assumed that a person that has identified herself as a household's head is also the main decision-maker in the household. We recognize that parameter estimates may be clouded by our inability to determine the true decision-maker in multi-person households.

of investor's relative risk aversion. Equation (2) forms the theoretical basis for the test of the Hypothesis 2. However, instead of Arrow-Pratt measure of risk aversion we use a direct measure – the investors' self-reported risk aversion.

An econometric estimation of the equation requires selection of an appropriate regression model. The specifics of the data on investment is that the large portion of individuals invest zero amounts in risky assets. Thus a conventional linear model estimated by ordinary least squares is not suitable here. Instead we use a Tobit model following Jianakoplos/Bernasek 1998.⁶

The predicted share of risky assets is computed as a conditional mean of the dependent variable in the positive part of the distribution:

$$E[\alpha_i | X_i, \alpha_i > 0] \frac{\partial \text{Prob}[\alpha_i > 0]}{\partial X_i}$$

Hypothesis 3: There are no significant differences in investment behavior between males and females who are professional investors.

The expectation is based on the assumption that persons with professional experience in investing possess comparable knowledge and make their investment decisions relying on this knowledge. Thus, decisions of professional investors should be in line with models of rational behavior. On contrast, gender differences in investment behavior that emerge among non-professionals can be attributed to some irrationality of their decisions.

We test the hypothesis by, first, comparing the predicted probabilities of investing in risky assets by men and women who are "professional" investors; second, we compare the predicted shares of risky assets between the two gender groups for this category of investors. In both cases, we expect to find no significant differences.

⁶Another regression model that may be employed for the analysis is the two-stage Heckman estimation suggested by Guiso/Haliassos/Jappelli 2002. We decide against this approach, because we can not confirm the presence of any selection bias.

4 Empirical Implementation

4.1 Description of the data

We employ a cross-sectional data set that includes data on private households in five European countries: Austria, Cyprus, Germany, Italy and the Netherlands. The data contain detailed information on demographic and socioeconomic characteristics of households and their members. There is also information on whether a household owns risky financial assets and how much money is invested in these assets.⁷ Most importantly, the data contain information on self-assessed risk aversion of respondents.

The data set is assembled from several sources. The data on Germany and Netherlands are drawn from the countries' national surveys: the German Socioeconomic Panel (SOEP) and the DNB Household Survey. The data on other three countries are drawn from the [Luxembourg Wealth Study \(LWS\)](#) database.⁸ Although the surveys are comparable in many aspects, they differ in the content of some variables, especially financial variables, and measurement of risk aversion. In order to do the data comparable across countries, we make several adjustments.

Firstly, following [Sierminska et al. \(2006\)](#), we convert the income and wealth amounts to common currency using the comparative price levels estimated by Eurostat.⁹ Additionally, the money amounts referring to years prior to 2004 are deflated using harmonized indices of consumer prices.¹⁰ Secondly, income is adjusted to account for household size.¹¹

An important adjustment is made to the variable reflecting respondents' risk aversion. Each of the original surveys collects information on perceived risk aversion, that is the respondents are asked to assess their own attitude towards financial risks. Yet, the formulation of the questions as well as the scala on which the individuals have to assess their willingness to take risks differ from survey to survey. We construct a new variable that standardizes values of the original measures to a common scala from 1 (low risk aver-

⁷The information on invested amount is not available for Germany.

⁸ More details on the data sets are provided in Table 1 in the appendix.

⁹Comparative price levels of final consumption by private households including indirect taxes (EU-27=100) at <http://epp.eurostat.ec.europa.eu>

¹⁰ Harmonized Indices of Consumer Prices (HICPs) (2004=100) at <http://epp.eurostat.ec.europa.eu>

¹¹Adjusted income is equal to unadjusted income divided by the square root of the household size ([Sierminska et al. \(2006\)](#)).

sion) to 4 (high risk aversion). The correspondence matrix of the original measures with the standardized variable is presented in Table 3.

We drop several observations from the original data where information on the gender of respondents was missing. The resulting data set has a size of 25,510 observations.¹² Table 4 provides summary statistics of the variables in the data set.

4.2 Ownership of risky assets

We distinguish between risk free and risky financial assets. Assets with certain returns like bank deposits in current and saving accounts, certificates of deposits and postal savings certificates make up the group of risk free financial assets. The second group – risky financial assets – comprises financial assets that are characterized by uncertain returns like bonds and stocks held directly or through investment funds. A person who owns any of the specified risky financial assets is defined as “owner of risky assets”. This definition of risky assets is rather arbitrary, since the actual riskiness of each individual portfolio can vary substantially. So, a portfolio of government bonds would be by far more safe than a portfolio of corporate bonds or shares. The riskiness of investment through mutual funds can vary too depending on the mix of asset classes. For this reason, we additionally consider a more clear-cut class of risky assets: company shares that are directly held by investors. In the following, persons who directly invest in shares are called “direct shareholders”.¹³

Figure 1 presents the number of male and female owners of risky assets as a fraction of total households with male and female household heads respectively. In multi-person households, the differentiation into male and female owners is done according to the gender of a household head. Apparently, there are significant differences between the two gender groups with respect to ownership of risky assets in all five countries. The fraction of households with a female household head owning these assets is considerably lower than the fraction of households with a male household head. The highest difference of 16% is observed in Germany; the lowest difference of 8% is found in the Netherlands.

¹²Although we made the original data from the underlying surveys comparable in all main aspects, the country sub-samples may still differ in certain ways. It is important to keep this in mind that the number of observations varies significantly across the countries.

¹³We are not able to identify direct shareholders for Germany, because in the national survey it was not distinguished between directly held stock and stock held through mixed investment funds.

[Insert Figure 1 here]

Since we can not prove whether a household head is also the decision-maker in mixed households, we additionally compare the number of owners in the sub-sample of single-person households. Remarkably, the difference between males and females decreases when only single persons are considered.

[Insert Figure 2 here]

As to the sub-group of direct shareholders, the ownership rates in all five counties are considerably smaller than in the case when ownership of all risky assets is considered. The differences between the two gender groups are well pronounced: the fraction of direct shareholders among men is on average by 10% higher than among women.

[Insert Figure 3 here]

Yet, even among direct shareholders the discrepancies between males and females seem to weaken when the comparison is made among single persons. In this case, the average difference between the fractions of male and female shareholders is approximately the same in all countries – about 5%. Overall, the observed gender differences in ownership rates in the five European countries are in agreement with the notion that women are more risk averse than men.

In the next step, we compare the two gender groups by the share of financial wealth invested in total risky assets and in directly held stocks. The share is computed as a percentage of total amount of financial assets conditional on the ownership of risky assets. Since we do not have information on how much is invested in individual assets in Germany, the following descriptive analysis is conducted for the remaining four countries.

Among all households that own some risky assets, women seem to invest on average almost the same fraction of their financial wealth in risky financial assets as men. Although there is considerable variation in the figures across countries, within each country the differences between men and women are very small: from 1% in Cyprus to 4% in the Netherlands. These figures are quite surprising. They contradict the established stereotype.

[Insert Figure 5 here]

A comparison of single-person household does not change the picture very much. Except for the Netherlands, the differences are negligibly small. Only for Dutch single persons the difference is noticeable: the average share invested by men is by 8% higher than those of women. Yet, this difference becomes less pronounced when the median values are compared.

[Insert Figure 6 here]

The behavior of the sub-group of direct shareholders is similar to the owners of risky assets. Except for the Netherlands, the differences in the average fraction invested by men and women in directly held stock are very small. We do not analyze the behavior of single direct shareholders because the number of observations in this group is very small and does not allow to draw any valid inference.

[Insert Figure 7 here]

In concluding, the analyzed data does not confirm the existence of gender differences with respect to portion of risky assets in financial portfolios. We can not be sure whether this finding reflects the actual situation or emerges because of some sample bias in the data. Due to high non-response rates on the question regarding portfolio allocations, the distribution of the respective variables in the sample may deviate from the distribution in the underlying population. At the same time, there exist no other empirical evidences based on data comparable with ours. The previous literature supporting the established stereotype by figures from large scale data sets is limited to few surveys conducted in the US that go back in 90's.¹⁴ Neither can we compare our finding with results of numerous experimental studies due to their small samples and the specifics of the individual experiments. At the same time, a more recent evidence from survey data outside the US confirms the prevailing notion only partially. So Perrin (2007) finds significant gender differences in fraction of wealth invested in risky assets when individual stocks are considered. There are however no gender differences when allocations to investment funds are considered. The survey was conducted in Switzerland.

¹⁴One study based on Swedish survey data of 1985 are in agreement with the US evidence.

4.3 Perceived risk aversion

Individuals in our sample can be categorized in four groups according to perceived risk aversion. The group with average risk aversion is the largest accounting for 40 percent of the sample. The second largest group with 34 percent includes individuals with high risk aversion. The groups with low and below average risk aversion make up 5 and 21 percent of the sample respectively. We then calculate a bivariate distribution of individuals by risk aversion and gender (figure 8).

[Insert Figure 8 here]

The figures do not allow to draw a definite conclusion regarding which group - men or women - is more risk averse. Apparently men prevail among individuals with low or below average risk aversion, while women prevail in the category of high risk aversion. Nevertheless, the proportions in the group with average risk aversion are almost equal. The coefficient of correlation between gender and risk aversion equals 0.14. The value is too small to give any evidence of a strong relationship between the two factors. Thus, based on simple descriptive statistics we can not confirm that gender determines individual's risk aversion. This simple correlation coefficient alone speaks against using 'sex' as a proxy for 'risk aversion', and consequently take the results of studies that used it with great caution.

5 Results of regression analysis

5.1 Decision to invest in risky financial assets

In this section we discuss the results of estimation of equation (1).¹⁵ The dependent variable in the regression equation is an indicator variable that equals 1 if a household owns risky assets and 0 otherwise. The equation is first estimated on a sub-sample of males, then on a sub-sample of females.¹⁶ The results of the estimation are found in Table 7.

¹⁵The regression model is estimated with maximum likelihood method

¹⁶The results of a Chow-Test confirm that coefficients in both equations are significantly different, which means that effects of the same variables have different effect on males and females.

All three coefficients of the dummy-variables indicating specific groups of risk aversion are highly significant. Thus, risk aversion explains a significant part of variation in the probability of owning risky financial assets. The interpretation of the results is as follows. *Ceteris paribus*, the probability that a man would invest in risky assets would increase by 34 percent if he had low risk aversion. Having a below average risk aversion would increase the probability by almost 22 percent, while being in the group of average risk aversion will increase the probability by 13 percent only. Apparently, the probability of investing in risky assets decreases as risk aversion rises.

Turning to the equation with females, the effects of risk-aversion variables differ from the respective effects in the males' equation. Everything else being equal, the probability that a woman holds risky assets increase by 20 percent if she has a low risk aversion. The effects of "below average" and "average" risk aversion are 0.21 and 0.12 respectively and are quite close to those obtained for men.

Based on the parameter estimates, we compute the predicted probabilities of owning risky assets for each of four risk aversion groups separately for men and women.¹⁷ The probabilities are presented in the Figure 9.

[Insert Figure 9 here]

As expected, men and women with the same risk aversion have different probability to invest in risky financial assets. In the group of low risk aversion, men outweigh women by 12 percent. Thus, a woman that perceives herself as risk tolerant will nevertheless act more risk averse than a man with the same perceived risk aversion. However, in the groups of "below average" and "average" risk aversion the probability to hold risky assets turns out to be equal for men and women. Furthermore, for individuals with high risk aversion, it seems that women are more likely to hold stocks and bonds than men.

One note of caution is in place here. When estimating equation we do not control for wealth because a considerable fraction of surveyed households does not provide the relevant information. In case of Germany we do not have this information because the relevant question was not asked in the 2004 wave of SOEP. Inclusion of wealth in this situation would lead to a considerable loss of observations. At the same time, the fact that we

¹⁷The predicted probabilities are computed for both sub-sample at the same values of explanatory variables; continuous variables are held at their mean values from the joint distribution of males and females, and categorical variables are held at 0.

omit wealth from the equation can bias our results to the extent that risk aversion depends on wealth and that participation decision is also influenced by wealth. As a robustness check, we estimate the model where the value of financial wealth is accounted for on the data without Germany. The estimated marginal effects of the risk aversion dummies do not differ significantly from those obtained in the estimation without wealth. Using the estimated coefficients we calculate the predicted probabilities of owning risky assets holding the income and wealth at the level of sample average (i.e. when men and women are considered together). Figure 10 documents the predicted probabilities. Apparently, the probabilities have increased for all groups of risk aversion. The differences between men and women become less pronounced than in the estimation without wealth. At the same time, there remains a significant difference in the group with low risk aversion. Thus, the results obtained previously are quite robust.

In concluding, the analysis of the influence of risk aversion on the probability to hold risky financial assets refutes the Hypothesis 1. We can say that perceived risk aversion does not fully explain the differences between men and women in this respect. Obviously the relationship between gender and the perceived risk aversion is more complex and the two factors can not be used as substitutes when decision to invest is analyzed.

5.2 Share of financial wealth invested in risky assets

Table 8 documents the estimated coefficients for equation (2) separately for men and women.¹⁸ In both equations the estimated coefficients on risk aversion dummies are highly significant. The coefficients should be interpreted in relation to the base category – high risk aversion. A positive coefficient indicates that a person with specified risk aversion will increase the share of risky assets as compared to an individual with highest risk aversion. For men, the share invested by an individual with low risk aversion is by 0.28 units higher than the share invested by a person with high risk aversion; respectively, the share invested by individuals with below average (average risk aversion) are by 0.22 (0.16) units higher. For women, the share invested by an individual with low risk aversion is by 0.21 unit higher than the share invested by a person with high risk aversion. The magnitude of the coefficients on below average risk aversion is even higher – 0.28 – which indicates that the share invested does not increase linearly with risk aversion.

¹⁸The coefficients are found to be significantly different between male and female equation.

Apparently, the change from high to below average risk aversion has stronger effect for women than for their male counterparts. The magnitude of the estimated coefficient for the average risk aversion for women is only marginally lower than for males.

Based on the results of the estimated Tobit model, we predicted the share of risky assets for three different profiles of financial wealth and income. The first profile reflects the financial situation of an average male investor with financial wealth of 32302 Euro and income of 17780 Euro. These values correspond to the sample averages computed for the sub-sample of males. The second profile represents an average female investor with income of 14365 Euro and financial wealth of 17642 Euro. The values are calculated from the sample distributions in the sub-sample of females. The third profile captures the situation of an average investor regardless of gender. The income and wealth of this investor correspond to the sample averages obtained for the total sample (see Table 4). We distinguish among these to profiles in order to see how would the representatives of both genders behave if their financial situation equaled to the one of the opposite sex or to the hypothetical representative investor.

Table 9 documents the predicted shares for the three profiles. Apparently, the differences between men and women are substantial. Especially among individuals with the below average risk aversion. Women in this category of risk aversion seem to invest a lot more aggressively than men. On possible explanation is that women underestimate their degree of risk aversion: their actual behavior is more risk-tolerant as their perceived attitude towards risk.

[Insert Table 9 here]

5.3 Behavior of investors with professional background

In this section we investigate the role of professional background for the investment decisions of males and females. We define *professional investors* as individuals who are highly qualified professionals working in financial services industry. According to this definition, professional investors constitute about 1 percent of our sample: there are 142 male and 80 female “professionals”. A look at the descriptive statistics in the table 5 shows that this sub-sample of individuals differs from the total population in several aspects: “professionals” are clearly wealthier, younger and have more frequently a university degree;

they all are working, none is retired; finally, they have a higher ownership rate of risky assets and allocate a larger portion of their portfolios into these assets. Noteworthy, the fraction of males are higher than in the total sample.

In the following, we present the results of the test of gender differences in the sub-sample of professional investors.¹⁹ Due to the small number of observations, we do not estimate the regression for men and women separately. Instead, we put them together and include a dummy variable *Sex* in the regression model.

Table 10 documents the coefficient estimates after the estimation of a logit model. The model describes the influence of the explanatory variables on the probability that a person invests in risky assets. Surprisingly, risk aversion does not have any significant effect. It seems, that neither gender nor risk attitude of professional investors are relevant for the decision whether to hold risky assets or not. With exception for income and availability of savings, which have a weak positive effect on the probability of investing in risky assets, none of other coefficients are significant. Thus we can not confirm our hypothesis that gender affects the probability of owning risky assets by professional investors.

6 Summary and conclusions

In this paper we question the popular stereotype that women are more risk averse in financial matters than men. While studying the behavior of the two gender groups, we augment the ordinary analysis of observed behavior by subjective information on risk attitudes. Specifically, we link the actual investment decisions of individuals with their perceived risk aversion.

The results of a bivariate analysis of the relationship between perceived risk aversion and gender do not provide a definite answer on the question whether women are less risk tolerant than men. The data on observed behavior shows that among owners of risky asset males significantly outbalance females in all five European countries. Nevertheless, the observed average portfolio share of risky assets does not differ between male and female investors. These results disagree with previous empirical studies in this respect. The pattern that we find – disparities in participation, but equality in allocation – corresponds

¹⁹The analysis of the behavior of professional investors is limited to the examination of participation decisions only. A test of allocation decision can not be conducted as the number of observations is too small and does not allow to draw any valid conclusions.

to the findings of [Caliendo & Kritikos \(2008\)](#), who documented similar behavior among male and female start-ups.

The results of a regression analysis do not fully confirm the gender stereotype too. While controlling for the degree of perceived risk aversion, we find that males and females with high to average risk aversion have equal probability to invest in risky financial assets. Yet, in the group of investors with low risk aversion the differences in probability between males and females are still evident. Thus, although differences in risk aversion seem to explain a large portion of the observed variation in participation decision, they do not fully explain why women invest in risky assets less frequently than men.

Furthermore, for those who hold risky assets, our regression model predicts that women allocate an equal or even a higher portion of their wealth to these assets than males. This result holds even when we control for stated risk aversion. It seems that women underestimate their willingness to take risk, since their actual behavior appear to be more risk-tolerant than what is expected from the stated risk aversion.

Regarding the professional investors we can not reveal any differences between the two gender groups. Men and women with expertise in financial matters are equally likely to invest in risky financial assets.

All in all, our findings clearly show that relationship between stated risk aversion and actual behavior is not straightforward. Especially in case of women, the declared attitude toward financial risks may be misleading as it does not necessarily reflect the actual willingness to bear risks.

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7 Appendix

Table 1: Sources of microeconomic data employed in the study

	Austria	Cyprus ^a	Germany	Italy	Netherlands
Survey	LWS	LWS	SOEP	LWS	DNB Household Survey
Year of survey	2004	2002	2004	2004	2004
N observations	2556	895	13005	8012	1097
Female household heads, in %	35.8	39.2	38.9	39.0	22.9

^a the underlying national survey over-samples wealthy households

Table 2: Measures of risk aversion in the original surveys

Country	Data source	Original definition of the variable	Variable's name in the original data set
Austria	LWS	Whether person prefers secure investment instruments and avoids risk, measure on a scale from 1(completely applicable) to 4 (completely inapplicable)	RISK2
Cyprus	LWS	Level of financial risk one is willing to take, measured on a scale from 1 (not willing to take any financial risks) to 4 (take substantial financial risks)	RISK1
Germany	SOEP	Willingness to take financial risk, measured on a scale from 0 (risk averse) to 10 (fully prepared to take risks)	up12002
Italy	LWS	Preference for risk taking in relation to expected return, measured on a scale from 1 (low return without any risk) to 4 (very high return regardless of risk)	RISK1
Netherlands	DNB Household Survey	Willingness to take risk of losing money, when there is also a chance of gaining money, measured on a scale from 1 (not willing) to 7 (willing)	spaar6

Table 3: Correspondence matrix of the original risk aversion measures with the standardized measure

Standardized measure of risk aversion	Austria "I prefer safe investments and avoid risk in investments"	Cyprus "I am willing to take..."	Germany "Willingness to take risk in financial matters"	Italy "I prefer ..."	Netherlands "I am prepared to take the risk to lose if there is a chance of gain"
1 = low risk aversion	- completely disagree	substantial financial risks	from 9 to 10 (willing to take risks)	very high return regardless of risk	7 (totally agree)
2 = below average risk aversion	- partially disagree	above average financial risks	from 6 to 8	high return with reasonable security if invested capital	from 5 to 6
3 = average risk aversion	- almost agree	average financial risks	from 3 to 5	reasonable return with very good security of invested capital	from 3 to 4
4 = high risk aversion	- completely agree	no financial risks	from 0 (not willing to take risks) to 2	low return, without any risk	1 (totally disagree) to 2

Table 4: Descriptive statistics of the variables in the sample

Variable	N _{obs}	Mean	Median	St.Dev.	Min	Max
Sex	25510	0.62	1.00	0.49	0	1
Owners of risky assets	25510	0.27	0.00	0.45	0	1
Share of wealth invested in risky assets	3334	0.54	0.55	0.30	0	1
Total financial assets, in Euro	12505	26884.95	8812.85	91912.77	0	6415640
Owners of real property	25510	0.40	0.00	0.49	0	1
Income, in Euro	25510	19598.32	17592.23	18069.13	0	1316274
Single	25510	0.35	0.00	0.48	0	1
N _{children}	25510	0.42	0.00	0.83	0	9
N _{persons}	20506	2.71	2.00	1.25	1	13
Age	24274	53.14	52.00	16.04	17	97
Has a university degree	25510	0.20	0.00	0.40	0	1
Employed	25510	0.50	0.00	0.50	0	1
Self-Employed	25510	0.08	0.00	0.27	0	1
Retired	25510	0.33	0.00	0.47	0	1
Professional	25510	0.01	0.00	0.09	0	1
Risk Aversion "low"	18911	0.05	0.00	0.21	0	1
Risk Aversion "below average"	18911	0.21	0.00	0.41	0	1
Risk Aversion "average"	18911	0.40	0.00	0.49	0	1
Risk Aversion "high"	18911	0.34	0.00	0.48	0	1

^a income is adjusted to the household size.

Table 5: Descriptive statistics of the sub-sample of professional investors

Variable	N_{obs}	Mean	Median	St.Dev.	Min	Max
Sex	222	0.64	1.00	0.48	0	1
Owners of risky assets	222	0.62	1.00	0.49	0	1
Share of wealth invested in risky assets	38	0.57	0.51	0.32	0	1
Total financial assets, in Euro	66	53583.68	13856.93	150667.81	0	1166480
Owners of real property	222	0.40	0.00	0.49	0	1
Income, in Euro	222	26640.73	22929.37	13444.25	0	107401
$N_{persons}$	222	2.68	2.50	1.29	1	6
$N_{children}$	222	0.65	0.00	0.92	0	3
Age	222	41.60	40.00	9.86	21	65
Employed	222	1.00	1.00	0.00	1	1
Self-Employed	222	0.08	0.00	0.27	0	1
Retired	222	0.00	0.00	0.00	0	0
Has a university degree	222	0.38	0.00	0.49	0	1
Professional	222	1.00	1.00	0.00	1	1
Risk Aversion "low"	208	0.15	0.00	0.36	0	1
Risk Aversion "below average"	208	0.38	0.00	0.49	0	1
Risk Aversion "average"	208	0.31	0.00	0.46	0	1
Risk Aversion "high"	208	0.15	0.00	0.36	0	1

^a income is adjusted to the household size.

Figure 1: Fraction of persons owning risky financial assets (all households)

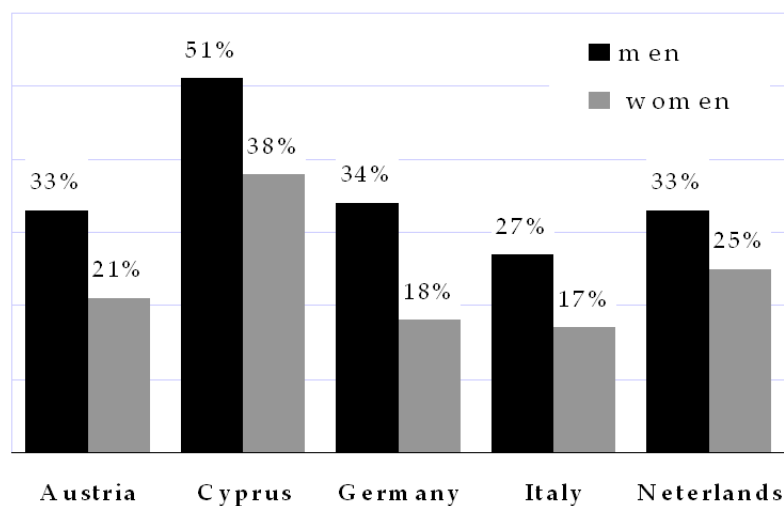


Figure 2: Fraction of persons owning risky financial assets (sub-sample of single-person households)

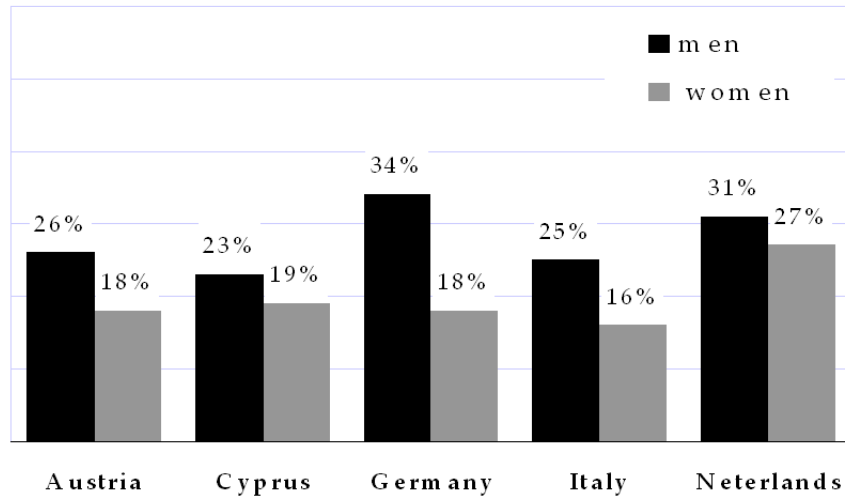


Figure 3: Fraction of persons owning directly held stocks (all households)

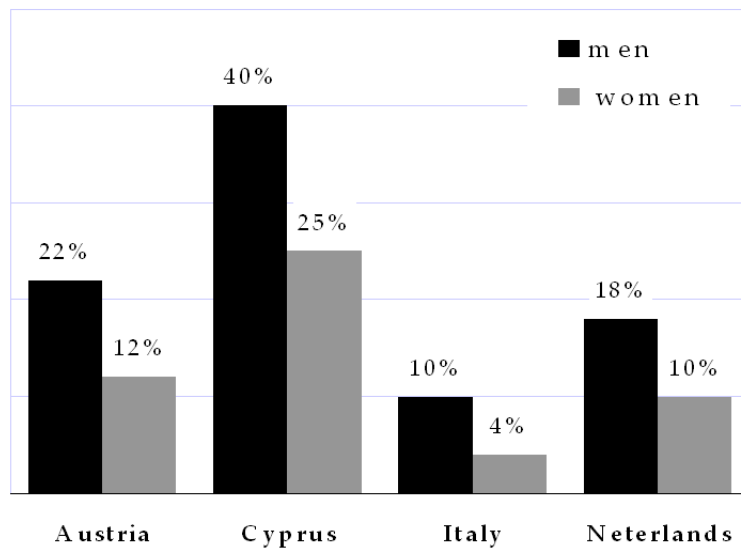


Figure 4: Fraction of persons owning directly held stocks (sub-sample of single-person households)

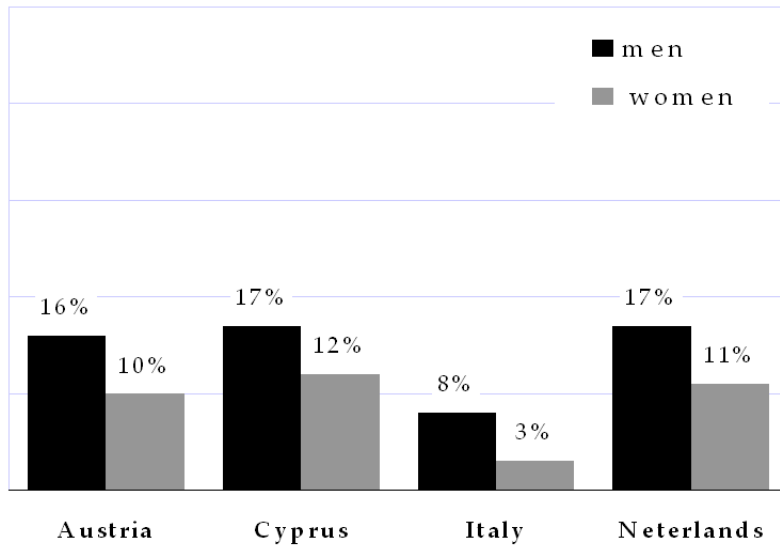


Figure 5: Average fraction of financial portfolio invested in risky assets (all households)

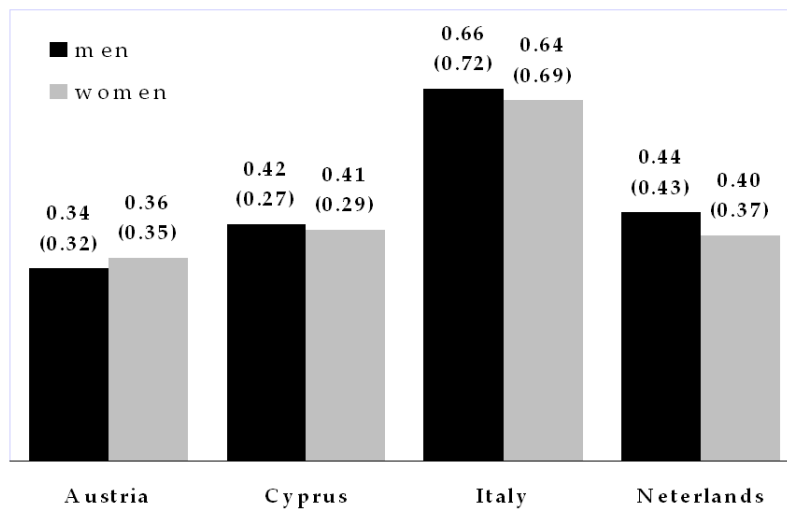


Figure 6: Average fraction of financial portfolio invested in risky assets (sub-sample of single-person households)

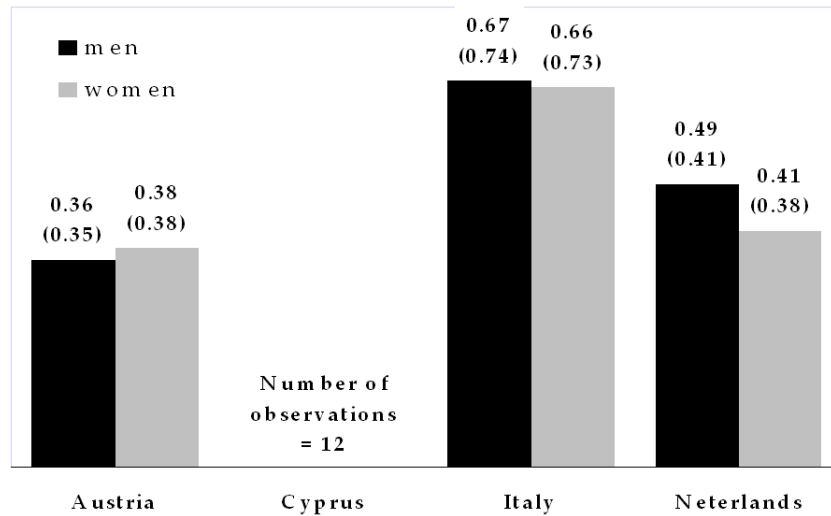


Figure 7: Average fraction of financial portfolio invested in directly held stocks (all households)

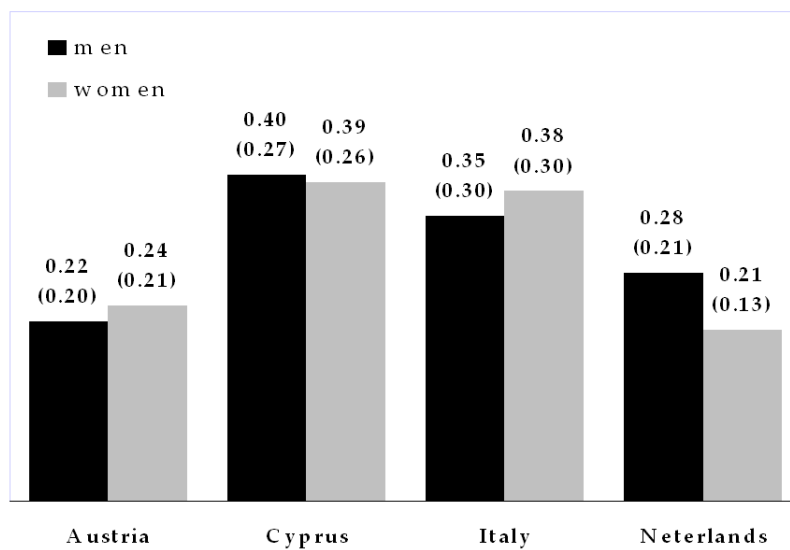


Figure 8: Distribution of individuals over the groups of risk aversion, by gender

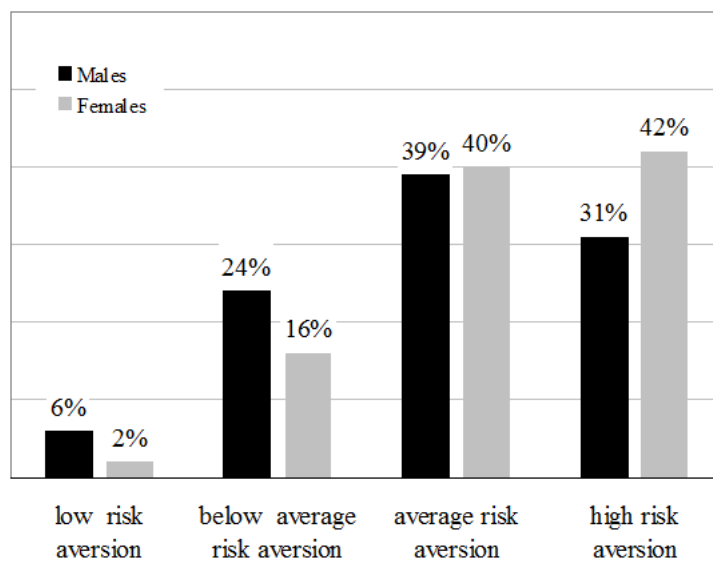


Table 6: Definition of variables used in regression analysis

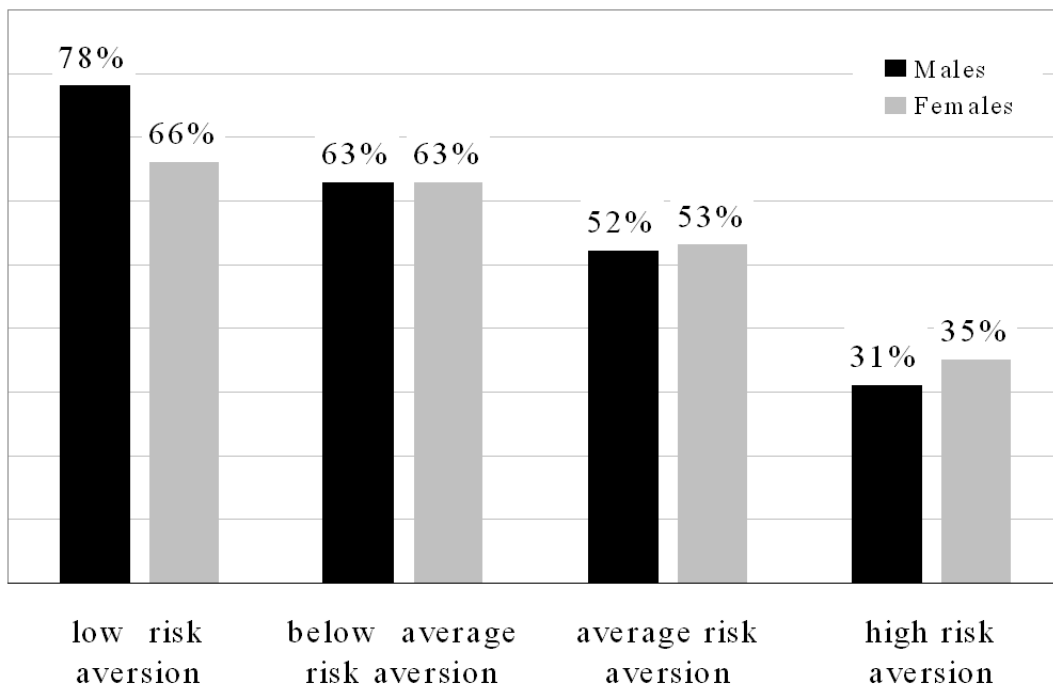
Variable name	Definition
<i>RiskyAssets</i>	Dummy variable equal to 1 if a household owns risky financial assets, 0 otherwise.
<i>Share</i>	Fraction of a household's financial portfolio allocated to risky assets.
<i>RiskAversion</i> "low" through <i>RiskAversion</i> "high"	Set of dummy variables each equal to 1 if a household head has the respective degree of risk aversion and 0 otherwise. <i>RiskAversion</i> "high" is the base category and is excluded from the regression equation.
<i>Savings</i>	Dummy variables equal to 1 if a household has a positive amount of money on checking or saving accounts.
<i>ln(Wealth)</i>	Natural logarithm of a household's total financial wealth.
<i>RealProperty</i>	Dummy variable equal to 1 if a household owns a house or flat that is its primary residence and 0 otherwise.
<i>ln(Income)</i>	Natural logarithm of a household's net annual income.
<i>Employed</i>	Dummy variable equal to 1 if a household head has a full- or part-time job and 0 otherwise.
<i>SelfEmployed</i>	Dummy variable equal to 1 if a household head is self-employed. <i>Retired</i> is a dummy variable equal to 1 if a household head is retired.
<i>University</i>	Dummy variable equal to 1 if a household head has a university degree and 0 otherwise.
<i>Professional</i>	Dummy variable equal to 1 if a household head is a highly qualified professional working in financial services industry.
$N_{children}$	Number of children under 18 in a household.
$N_{persons}$	Number of adult members of a household.
<i>Capitalization</i>	Ratio of market capitalization to GDP for country where a household comes from.

Table 7: Marginal effects after the estimation of equation (1)

	Males	Females
Risk Aversion "low"	0.344*** (0.023)	0.199*** (0.053)
Risk Aversion "below average"	0.216*** (0.012)	0.209*** (0.020)
Risk Aversion "average"	0.132*** (0.008)	0.115*** (0.014)
Savings	0.185*** (0.012)	0.169*** (0.022)
Real Property	-0.006 (0.009)	-0.030 (0.017)
ln(Income)	0.101*** (0.019)	0.083*** (0.023)
Employed	0.067*** (0.020)	0.049* (0.020)
Self-Employed	0.064*** (0.019)	0.021 (0.035)
Retired	0.099*** (0.025)	0.020 (0.028)
University	0.111*** (0.012)	0.093*** (0.017)
Professional	0.437*** (0.062)	0.250** (0.087)
Single	-0.013 (0.015)	-0.048* (0.020)
$N_{persons}$	0.030*** (0.007)	0.040*** (0.009)
$N_{children}$	-0.034*** (0.008)	-0.026* (0.012)
Age	0.008** (0.002)	0.008** (0.003)
Age ²	-0.000 (0.000)	-0.000 (0.000)
Capitalization	-0.122*** (0.024)	0.062 (0.054)
Pseudo- R^2	0.10	0.07
N_{obs}	10598	4584

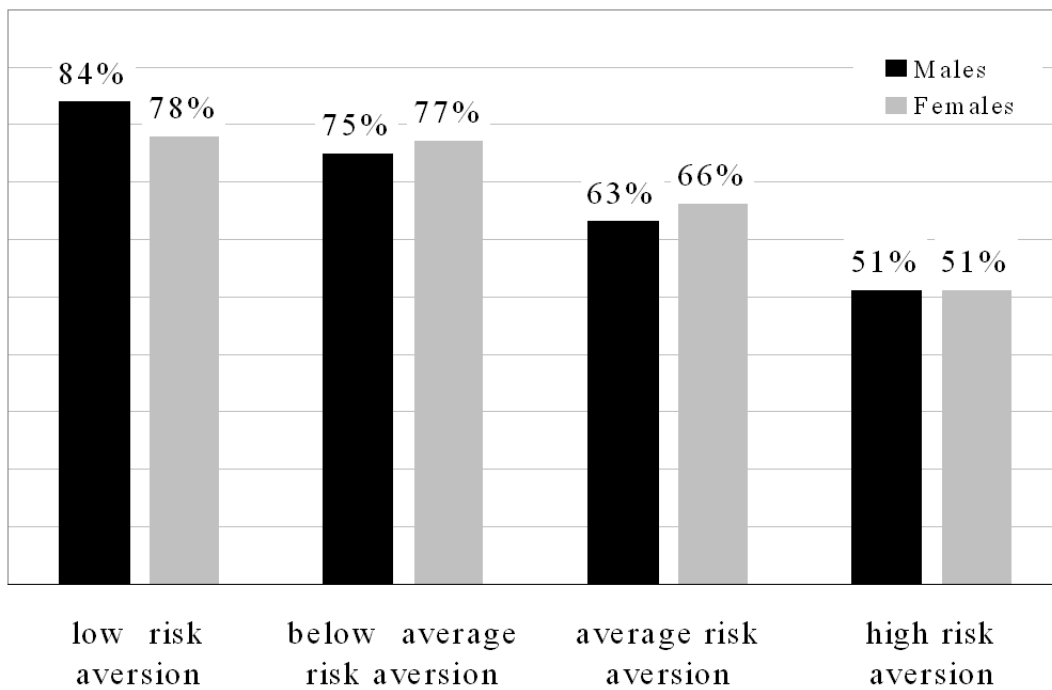
*, ** and *** correspond to 10%, 5% and 1% significance levels respectively

Figure 9: Estimated probability of investing in risky financial assets by investors' risk aversion and gender



The probabilities are predicted at sample averages of continuous variables and base categories of binary and count variables. The average values are: Income = 19,598 Euro, and Age = 53. These values are calculated from the distributions in the sample where men and women are considered together.

Figure 10: Estimated probability of investing in risky financial assets by investors' risk aversion and gender when financial wealth is accounted for



The probabilities are predicted at sample averages of continuous variables and base categories of binary and count variables. The average values are: Income = 19,598 Euro, total financial assets = 26,885 Euro and Age = 53. These values are calculated from the distributions in the sample where men and women are considered together.

Table 8: Marginal effects after the estimation of a Tobit model

	Males	Females
Risk Aversion "low"	0.284*** (0.052)	0.211* (0.106)
Risk Aversion "below average"	0.220*** (0.026)	0.275*** (0.046)
Risk Aversion "average"	0.157*** (0.020)	0.144*** (0.033)
ln(Wealth)	0.184*** (0.007)	0.228*** (0.013)
Real Property	-0.083*** (0.027)	-0.18 (0.044)
ln(Income)	0.003 (0.010)	-0.021 (0.015)
$N_{persons}$	0.062*** (0.012)	0.052* (0.021)
$N_{children}$	-0.081*** (0.015)	0.001 (0.026)
Employed	0.106* (0.048)	0.218*** (0.041)
Self-Employed	0.118*** (0.028)	0.069 (0.055)
Retired	0.162** (0.050)	0.157** (0.048)
University	-0.066*** (0.020)	-0.068* (0.034)
Age	0.007 (0.005)	0.017** (0.006)
Age ²	-0.000 (0.000)	-0.000 (0.000)
Single	-0.018 (0.026)	-0.096* (0.041)
Professional	0.322*** (0.091)	0.108 (0.195)
Capitalization	0.006 (0.041)	0.255** (0.081)
Pseudo-R ²	0.17	0.18
$N_{obs.}$	4862	2396
$N_{censored\ obs.}$	2461	1474
σ	0.48	0.54

*, ** and *** correspond to 10%, 5% and 1% significance levels respectively

Table 9: Predicted share of risky assets

Hypothetical profile of an investor:	Average		Male		Female	
Actual gender of an investor:	Male	Female	Male	Female	Male	Female
low risk aversion	0.32	0.33	0.34	0.34	0.23	0.20
below average risk aversion	0.22	0.35	0.24	0.36	0.13	0.23
average risk aversion	0.14	0.21	0.16	0.22	0.4	0.9
high risk aversion	-0.07	0.2	-0.06	0.3	-0.17	-0.11

Table 10: Parameter estimates after logit regression on the sub-sample of professional investors

	Parameter estimates
Sex	0.951 (0.582)
Risk Aversion "low"	0.581 (1.139)
Risk Aversion "below average"	0.737 (0.826)
Risk Aversion "average"	0.431 (0.783)
Savings	1.285* (0.686)
Real Property	-0.345 (0.654)
ln(Income)	0.821* (0.461)
$N_{persons}$	0.169 (0.572)
$N_{children}$	-0.294 (0.570)
Age	0.028 (0.036)
University	-0.068 (0.600)
Self-Employed	1.401 (1.150)
Capitalization	11.467 (15.352)
Constant	-14.596 (7.797)
Log-Likelihood	-55.62
Pseudo-R ²	0.202
$N_{obs.}$	162

*, ** and *** correspond to 10%, 5% and 1% significance levels respectively.