The Role of Risk Aversion in Predicting Individual Behaviour ¤

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Abstract

We use household survey data to construct a direct measure of absolute risk aversion based on the maximum price a consumer is willing to pay to buy a risky asset. We relate this measure to a set of consumers' decisions that in theory should vary with attitude towards risk. We …nd that elicited risk aversion has considerable predictive power for a number of key household decisions such as choice of occupation, portfolio selection, moving decisions and exposure to chronic diseases in ways consistent with theory. We also use this indicator to address the importance of self-selection when relating indicators of risk to individual saving decisions.

JEL Classi…cation: D1, D8

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1 Introduction

The theory of choice under uncertainty implies that the attitude an individual has towards risk is decisive in a variety of contexts that are critical for understanding individual behavior. According to theory, di¤erences in risk aversion among individuals should show up sharply in their occupational choices, their decisions on how to allocate accumulated assets, how much insurance to buy in the market and how much to self-insure. In some cases - as in simple portfolio theory (Samuelson, 1969, Merton, 1969, and Gollier, 2001) - theory goes so far as to imply that all the di¤erences across individuals in observed portfolio composition should re‡ect di¤erences in risk preferences. Thus, the well-documented massive heterogeneity in portfolio shares across households[1] could all be traced back to such di¤erences. More generally, di¤erences in risk aversion should a¤ect individuals' investment choices with the more risk-averse being ready to forego relatively higher expected returns for returns with lower variability. The immediate implication is that more risk-averse individuals should have less variable earnings but end up, on average, poorer. One key question then is how much of the inequality in income and wealth distribution can be due to di¤erences across individuals in their risk preferences. The answer clearly depends on how much the attitudes towards risk di¤er across consumers and how important risk aversion is in explaining behavior vis-à-vis other income determinants that may themselves di¤er signi…cantly across individuals. In order to be able to provide evidence on these issues one needs to be able to measure risk aversion at the individual level. However, individual willingness to bear risk is not normally observable; this is one reason why researchers have typically assumed that individuals have identical risk preferences and so explained the observed di¤erences in behavior and wealth by assuming some form of market friction or imperfection that a¤ects individuals di¤erentially.[2]

This paper makes two contributions to help sort out the role of di¤erences in risk preferences. First, we employ information on households' willingness to pay for a hypothetical risky security contained in the 1995 Bank of Italy Survey of Household Income and Wealth (SHIW), to recover a measure of the Arrow-Pratt index of absolute risk aversion of the consumer's lifetime utility function and check how much measured risk aversion dif-

[1] Se Guiso, Haliassos and Jappelli (2001).

[2] For instance, inequalities in income and wealth have been related to limited access to …nancial markets either because of …xed costs of investing in assets with high expected yield (Guvenen, 2002) or because of rationing in credit markets arising from information and commitment problems (Cagetti and De Nardi, 2002).

fers across individuals. Second, we relate this measure to various behaviors that according to theory should be greatly a¤ected by risk preferences. In particular, we focus on individuals' occupational and portfolio choices, their demand for insurance, their investment in education, the propensity to move or change jobs and their exposure to chronic diseases. We …nd unequivocal evidence that risk preferences di¤er considerably across individuals and that these di¤erences have substantial explanatory power as regards individual decisions.

Although the vast majority of the survey participants are risk-averse according to our measure, a small proportion (4 percent) are either risk-neutral or risk-loving (we will call this group "risk-prone"); furthermore, even among the risk-averse there is a lot of heterogeneity in the degree of risk aversion, which shows that preferences for risk do di¤er signi…cantly across individuals. Furthermore, these di¤erences are systematically related to individual choices that involve risk. Di¤erences in risk preferences are important for understanding di¤erences in behavior across individuals. For instance, compared to the risk-prone, the risk-averse are 9 percentage points less likely to be self-employed (corresponding to 50 percent of the sample share of the self-employed), have a 10-point lower chance of holding risky securities (corresponding to 70 percent of the sample mean), and have, on average, 110,000 euros less in total net worth, 75% of the sample mean. Correspondingly, individuals with a low degree of risk aversion (at the 10^{th} percentile of the cross-sectional distribution) face earnings that are 60% more variable than those of highly risk-averse individuals (90^{th} percentile).

Our …ndings imply that individuals sort themselves out in such a way that the highly risk-averse face less risky prospects. This self-selection makes it problematic to assess the e¤ect of risk on choice, an issue that arises, for instance, in evaluating the e¤ect of income uncertainty on investment in risky assets or testing for precautionary savings. The problem here is that the risk that agents face is correlated with preferences for risk that are unobservable. This unobserved preference heterogeneity biases - normally towards zero - the measured e¤ect of risk. Since we observe risk preferences directly, we can assess the importance of self-selection for estimates of the e¤ect of risk on behavior, and we do this with reference to precautionary saving.

The rest of the paper is organized as follows. Section 2 describes our measure of risk aversion. Section 3 presents descriptive evidence on risk aversion and individuals' choices in our cross-section of households. In Section 4 we summarize what theory says about the e¤ect of risk aversion on a number of household decisions: occupational choice, portfolio allocation, in-

surance demand, investment in education, moving and job change. Section 5 presents the results of the estimates. In Section 6 we look more closely at the link between attitudes towards risk and the mean and variance of individual income. Section 7 discusses self-selection induced by risk attitudes and illustrates its relevance for precautionary savings estimates. Section 8 concludes.

2 Measuring risk aversion

To measure risk aversion we exploit the 1995 wave of the Survey of Household Income and Wealth (SHIW), which is run every two years by the Bank of Italy. The 1995 SHIW collects data on income, consumption, real and …nancial wealth and its composition, insurance demand, type of occupation, educational attainment, geographic and occupational mobility, and several demographic variables for a representative sample of 8,135 Italian households. Balance-sheet items are end-of-period values. Income and ‡ow variables refer to 1995.[3]

The 1995 survey had a section designed to elicit attitudes towards risk. Each participant was o¤ered a hypothetical negotiable asset and was asked to report the maximum price that he would be willing to pay for it. Speci…cally:

> "We would like to ask you a hypothetical question that you should answer as if the situation were a real one. You are o¤ered the opportunity of acquiring an asset permitting you, with the same probability, either to gain 10 million lire or to lose your entire investment all the capital invested. What is the most that you would be prepared to pay for this asset?"

Ten million lire is roughly equal to 5,000 euros. The expected gain from the investment is equal to 16 percent of average household's annual consumption. Thus, the investment represents a relatively large risk. Putting consumers face-to-face with a relatively large investment is a better strategy to elicit risk attitudes when one relies, as we do, on expected utility maximization to characterize risk aversion. In fact, expected utility maximizers behave risk-neutrally with respect to small risks even if they are averse to larger risks (Arrow, 1970). The interviews are conducted personally at the consumer's home by professional interviewers. To help the respondent understand the question, the interviewers showed an illustrative card and were

[3] The appendix describes the survey contents, sample design, interviewing procedure and response rates in more detail.

ready to provide explanations. The respondent could respond in one of three ways: a) declare the maximum amount he was willing to pay for the asset, which we denote Z_i; b) answer "don't know"; c) not answer.

Notice that the way the hypothetical asset is designed implies that with probability 1/2 the respondent gets 10 million lire and with probability 1/2 he loses Z_i: So the expected value of the lottery is $1=2(10 \text{ ¡ } Z_i)$: Clearly, $Z_i < 10$ million lire, $Z_i = 10$, and $Z_i > 10$ million lire imply risk aversion, risk neutrality and risk loving, respectively. This characterizes attitudes towards risk qualitatively. Within the expected utility framework a measure of the Arrow-Pratt index of absolute risk aversion can also be obtained for each consumer. Let w_i denote household i^0s endowment. Let $u_i(¢)$ be its (lifetime) utility function and $\tilde{R}_i$ be the random return on the security for individual i, taking values 10 million and $\text{¡ } Z_i$ with equal probability. The maximum purchase price is thus given by:

$$u_i(w_i) = \frac{1}{2}u_i(w_i + 10) + \frac{1}{2}u_i(w_i \text{ ¡ } Z_i) = Eu_i(w_i + \tilde{R}_i); \qquad (1)$$

where E is the expectations operator. Taking a second-order Taylor expansion of the right-hand side of (1) around w_i gives:

$$Eu_i(w_i + \tilde{R}_i) \text{ h } u_i(w_i) + u_i^0(w_i)E(\tilde{R}_i) + 0{:}5u_i^{00}(w_i)E(\tilde{R}_i)^2{:} \qquad (2)$$

Substituting (2) into (1) and simplifying we obtain:

$$R_i(w_i) \text{ h } \text{¡}\, u_i^{00}(w_i)=u_i^0(w_i) = 4(5 \text{ ¡ } Z_i=2)=\left[10^2 + Z_i^2\right]{:} \qquad (3)$$

Equation (3) uniquely de…nes the Arrow-Pratt measure of absolute risk aversion in terms of the parameters of the hypothetical asset of the survey. Obviously, for risk-neutral individuals (i.e. those reporting $Z_i = 10$), $R_i(w_i) = 0$ and for the risk-prone (those with $Z_i > 10$), $R_i(w_i) < 0$. Notice that since the loss Z_i or the gain from the investment need not be fully borne by or bene…t current consumption but may be spread over lifetime consumption, our measure of risk aversion is better interpreted as the risk aversion of the consumer's lifetime utility.[4]

A few comments on this measure and on how it compares with those used in other studies are in order. First, our measure requires no assumption on the form of the individual utility function, which is left unspeci…ed. Second, it is not restricted to risk-averse individuals but extends to the risk-neutral and the risk lovers. Third, our de…nition provides a point estimate,

[4] In a related paper (see Guiso and Paiella, 2001) we study the shape and determinants of the risk aversion function.

rather than a range, of the degree of risk aversion for each individual in the sample. These features distinguish our study from that of Barsky, Juster, Kimball and Shapiro (1997) who only obtain a range measure of (relative) risk aversion and a point estimate under the assumption that preferences are strictly risk-averse and utility is of the CRRA type. However, their elicitation strategy allows them to recover a measure of the risk aversion of period utility instead of lifetime utility as we do. In this regard, our and their study should be viewed as complementary.[5]

3 Descriptive evidence

The question on the risky asset was submitted to the whole sample of 8,135 heads of household, but only 3,458 answered and were willing to purchase the asset. Of the 4,677 who did not, 1,586 answered "do not know" and 3,091 refused to answer or to pay a positive price (25 o¤ered more than 20 million). This is likely to be due to the complexity of the question, which might have led some participants to skip it altogether because of the relatively long time required to understand its meaning and provide an answer. No-responses also re‡ect the fact that the question was asked abruptly by the interviewers, not prepared for by "warm up" questions. However, this strategy has its advantages: …rst, the framing and timing of the introductory questions could a¤ect the response to the main question, thus distorting the measure of the true preference parameter. Second, the abrupt approach avoids noise respondents (i.e. those with a poor understanding of the question), as would probably happen with "warm up" questions. Thus, while the high non-response rate signals that the question is complex and there may be cognitive problems, it does not mean that those who chose to respond gave erroneous answers. This is not to say that our gauge of risk aversion is free of measurement error. However, if this is of the classical type, it will bias our results towards …nding small e¤ects of risk aversion on behavior. Thus, our estimates should be regarded as lower bounds of the true e¤ects of risk preferences on consumer decisions.[6]

[5] Tiseno (2002) shows that knowledge of the maximum subjective price function for a risk is su¢cient to identify the risk aversion of a consumer lifetime utility. He also shows that under certain conditions the risk aversion of lifetime utility and that of period utility are proportional.

[6] The reported prices are likely to be a¤ected by a well known problem in experimental economics: individuals asked to price hypothetical lotteries (or risky assets) tend to report lower buying than selling prices (see Kagel and Roth, 1995, pp. 68-86). If the "true" willingness to pay/accept for a lottery is in between the reported bid and ask prices,

Table I reports descriptive statistics for the sample of 3,458 respondents to the risky-asset question and for the sub-samples of risk-averse individuals and of the risk-prone.[7] The risk-averse make up the great majority of respondents: 96 percent, in fact, set a maximum price lower than the potential gain. The risk-prone consists of 144 individuals, of whom 125 are risk-neutral and 19 are risk-loving. The mean reported price is 2.2 million lire (1.8 million for the risk averse and 11.2 million for the risk prone, Panel A), about 36% of the expected gain from the lottery. There is, however, considerable heterogeneity. The value of the standard deviation is 2.7 million, larger than the average reported price, while the 90^{th} percentile is 5 million lire, 100 times larger than the 10^{th} percentile. This di¤erence in willingness to pay translates into large di¤erences in risk aversion: the 90^{th} percentile of the cross-sectional distribution of the degree of absolute risk aversion is 2.5 times as great as the 10^{th} percentile. We also report a measure of the degree of relative risk aversion obtained multiplying absolute risk aversion by household consumption expenditure. Relative risk aversion is 5.4 on average (5.8 among the risk-averse) and ranges between 1.8 (10^{th} percentile) and 9.8 (90^{th} percentile), showing that there is considerable diversity in aversion to proportional risks too.

Panel B reports summary statistics of the characteristics of the respondents. The two sub-samples of risk-prone and of risk-averse consumers exhibit several interesting di¤erences. The risk-averse are younger and less well educated; they are less likely to be male, to be married, to be borne in the North of Italy and more likely to have children.

Panel C shows summary statistics for the variables that in principle should be a¤ected by individual preferences for risk. Strong di¤erences emerge in type of occupation: among the risk-averse the share of self-employed is 17.4 percent; among the risk-prone it is much higher at 29.2 percent. This ordering is reversed for public sector employees. The risk-prone are public employees in 27 percent of cases, the risk-averse in 28 per-

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the reported willingness to pay (sell) will lead to upward (downward) biased estimates of individual risk aversion. Since our survey elicits the willingness to pay it is likely that our individual risk aversion measures are biased upward. But experiments are silent on whether the extent of the bias (or the di¤erence between bid and ask prices) is correlated with some observable individual characteristics. If the bias is proportional to the reported price and constant across individuals, our results will be una¤ected.

[7] Those who answered have somewhat di¤erent characteristics than non-respondents. They are on average 6 years younger than the total sample, slightly better educated (1.3 more years of schooling) and have higher shares of male-headed households (79.8 compared to 74.4 percent), of married people (78.9 and 72.5 percent) and are signi…cantly more likely to have children (41.9 and 31.6 percent, respectively).

cent. As we argue, these di¤erences are likely to re‡ect self-selection, with more risk-averse individuals choosing safer jobs. Further, the risk averse are less likely to have changed jobs more than twice and to be chronically ill. On average, the risk-averse are signi…cantly less wealthy than the risk-prone (275 million lire - 142,000 euros - of mean net worth compared with 330 million - 277,000 euros) and expect to earn lower but less variable salaries. Finally, they have a lower share of risky asset holders (13.5 percent compared to 36.1) but also of households holding life, health or theft insurance.

4 Predicting behavior with risk aversion: theory

Attitudes towards risk should a¤ect consumers' willingness to take risk in a variety of situations. In this section we review theoretical arguments for the e¤ects of risk preferences on individuals' behavior and then test whether our measure of risk preferences has predictive power with respect to consumer choices in ways consistent with theory.

4.1 Occupational choice and entrepreneurship

If di¤erent jobs di¤er not only in expected return but also in the riskiness of those returns, individuals should sort themselves into occupations on the basis of their risk aversion. One of the few theories of entrepreneurship, put forward by Kihlstrom and La¤ont (1979), is indeed based on heterogeneity in risk aversion among individuals. Since running a business is equivalent to the choice of a risky prospect, the less risk-averse will become entrepreneurs while the relatively risk-averse will prefer to be employees and work for a …xed wage. Thus, heterogeneity in risk aversion may explain who becomes an entrepreneur in a society. Understanding the role of preferences in the decision to set up a …rm vis-à-vis other possible explanations (e.g. ability to combine factors of production as in Lucas (1978) or access to the loan market as in Evans and Jovanovic (1989)) is of critical relevance for policy since if tastes for risk are innate and cannot be acquired they can potentially be a formidable obstacle to the growth of business.

4.2 Portfolio choice

Standard portfolio theory predicts that the amount of wealth an individual is willing to invest in risky assets depends on his degree of risk aversion. Given the return and riskiness of the risky assets, the more risk-averse should hold safer portfolios. Furthermore, under the conditions for the validity of the

two-fund separation theorem, since all investors face the same distribution of asset returns, di¤erences in portfolio composition across individuals should only re‡ect di¤erences in their degree of risk aversion. Although the conditions for the two-fund separation theorem are rather severe (see Gollier, 2001) we expect di¤erences in risk aversion across individuals to help predict di¤erences in portfolio holdings. Besides helping understand why risky asset holders di¤er in the share of wealth invested in risky assets, di¤erences in risk aversion may also help explain why some do not invest at all in risky assets (e.g. stocks). If there are …xed costs of acquiring risky assets, those who in the absence of these costs would optimally invest little in the risky assets - because they are strongly risk-averse - will …nd it unpro…table to incur the …xed cost and enjoy the excess return. Thus, di¤erences in risk aversion should also help predict who will become a stockholder and who will not.

4.3 Insurance demand

The classical model of the demand for casualty insurance elaborated by Mossin (1968) implies that risk-averse individuals should fully insure if insurance is o¤ered at fair terms. If insurance is unfair, the amount purchased will depend on one's degree of risk aversion: the more risk-averse will demand more insurance coverage. Nevertheless, even some risk averse may choose not to insure if departure from fairness is signi…cant. Thus, differences in risk aversion should predict not only the amount of insurance demand among insurance holders but also the decision to buy an insurance policy among risk-averse consumers. [Extend to life insurance.]

4.4 Investment in education

Like all forms of investment, that in education entails risk: in fact, compared to accepting a current job o¤er at a known wage, the decision to obtain more education exposes the investor to a risk of failure - because the program may turn out more di¢cult that anticipated or because the individual later discovers he lacks the necessary ability. He may thus lose the sum invested (including the direct fees, the living costs and the forgone salary in the alternative job). In addition, since the investment in education only bears fruit after a relatively long time span, the investor also bears the uncertainty over the market value of the degree at time of completion. Thus, the less risk-averse individuals should be more likely to obtain higher education. Brunello (2002) shows formally that the number of years of education a

person optimally chooses depends negatively on absolute risk aversion.[8]

4.5 Migration, job change and health

The decision to migrate or to change jobs and the consumer's health status (in-so-far as it depends on how cautious a consumer is), all depend on one's attitude towards risk. Compared with staying in the area of birth, migrating to another area or country entails undertaking a risky prospect as it implies leaving a sure and known prospect for an unknown, though typically more promising future. Similarly, leaving a known job and taking a new one implies incurring new risks. Thus, one expects more risk-averse individuals to be less likely to move and to change jobs than the risk-prone. Also, since risk-averse consumers should behave more prudently, they should have better health status.

5 Results

5.1 Occupational choice

Table II reports the results of estimating probit regressions for occupational choice. We focus on the household head's decision to be self-employed (…rst two columns), to be a bona …de entrepreneur (third and fourth columns) and to be a public sector employee (last two columns). All regressions include as controls a second order polynomial in the age of the household head, dummies for gender, education, and a full set of region of residence dummies to account for local factors that may a¤ect job choice, such as di¤erences in the degree of development of local …nancial markets (Guiso, Sapienza and Zingales, 2003). In addition we include dummies for the occupation of the household head's father to capture any intergenerational links in occupational choice. The …rst column shows the regression for the whole sample, which includes as explanatory variables a dummy for risk-averse consumers. The benchmark is the group of risk-prone. The left-hand-side variable is set equal to one if the household head is a bona …de entrepreneur, both in manufacturing and retailing, or a professional (doctors, lawyers, etc.). Risk-averse consumers are less likely than the risk-prone to be self-employed, and the coe¢cient is statistically signi…cant at less than the 0.5 percent level. The di¤erences are economically very substantial: being risk-averse rather

[8] Compensation for risk may thus be an additional reason why education carries a higher return (Hartog and Vijverberg, 2001).

than risk-prone lowers the probability of being self-employed by 9 percentage points, or 50 percent of the sample share of self-employed. This evidence suggests that self-selection into occupations triggered by differences in individuals' preferences is indeed an important feature of reality, an issue to which we return in Section 5 when we examine the correlation between the degree of absolute risk aversion and a subjective measure of the variance of earnings. The second column restricts the sample to risk-averse households and uses as explanatory variable our measure of absolute risk aversion. Since the risk-prone group includes relatively few observations we feel more confident exploiting the variability in the degree of risk aversion rather then differences in the regime of attitudes towards risk. Obviously, within the class of risk-averse individuals those who are more strongly risk-averse should be less likely to choose risky jobs. This is confirmed by the estimates, which imply a negative coefficient for the degree of risk aversion: increasing absolute risk aversion by one standard deviation lowers the probability of being self-employed by 1.4 percentage points (8 percent of the unconditional probability).

In the third and fourth column we focus on pure business entrepreneurs, where the amount of risk-taking is probably greater than for other categories of self-employed. Results are similar to those reported in the first two columns for the self-employed: being risk-averse as compared to being risk-prone makes it less likely to be an entrepreneur (reducing the chances by almost 5 percentage points, or 33% of the sample mean); among the risk-averse, those who are more risk-averse are less likely to be entrepreneurs. These results are remarkable because the control group now includes not only all the employees but also the remaining self-employed; this - together with the low number of entrepreneurs in the sample (15% of the observations) - explains why we lose some precision in the estimated coefficients.

The fifth and sixth columns look at the probability of being a public sector employee for the whole sample and for the sample of risk-averse individuals. Consistent with the general perception that public jobs are more secure,[9] our estimates show that risk-averse individuals are more likely than the risk-prone to work in the public sector, though the coefficient is significant only at the 24 percent level. Compared with the risk-prone, the risk-averse have a 5-point higher chance of being in the public sector (corresponding to 18 percent of the unconditional probability). Furthermore,

[9] In Italy for instance, public sector employees cannot be laid off except in a few extreme circumstances of misconduct. In addition, public sector jobs provide less variable on-the-job wages (see Guiso, Jappelli and Pistaferri, 1998).

among the risk-averse, the probability of choosing the safer occupation is an increasing function of the degree of risk aversion: increasing the latter by one standard deviation raises the probability of being a public sector employee by over 2 percentage points (about 8 percent of the sample mean), suggesting again that risk preferences have a strong impact on job choice.

It is worth noticing that in all regressions the occupation of the father of the household head is highly signi…cant statistically and shows a strong positive correlation with the son current occupation. Sons of entrepreneurs or the self-employed are more likely to become themselves entrepreneurs or self-employed and less likely to be public employees, and similarly for the sons of public employees. The e¤ects are also very important economically: having a self-employed father raises the chances of the son being self-employed by 11 percentage points, 61% of the unconditional mean; if he is a bona …de entrepreneur, the chances that the son also becomes an entrepreneur are higher by 9 percentage points and those of becoming a public employee, if the father is one, rise by 11 points. These remarkable e¤ects are obtained after we control for individual preferences towards risk; thus, they do not re‡ect intergenerational correlation in individuals ability to deal with risk but other factors that a¤ect occupation choice, such as access to information, or the inheritance of one's father's business or professional practice.....

5.2 Asset allocation

Table III shows the e¤ect of the risk attitude indicators and of the degree of risk aversion on the ownership and portfolio share of risky …nancial assets, i.e. private bonds, stocks and mutual funds. Second-order polynomials in total net worth and in the level of non-asset income are added to the right-hand-side controls which include a second order polynomial in age, dummies for gender, education, for the region of birth and for that of residence. The risk-averse indicator has a negative e¤ect on the risky asset ownership decision, and its coe¢cient is highly signi…cant. When estimated on the whole sample of households, the probability of holding risky …nancial assets (…rst column) is less than half as great among risk-averse consumers as among the risk-prone. Compared to the latter, risk-averse investors have a 10-point lower chance of holding risky securities, corresponding to 70 percent of the sample mean (equal to 14.4 percent). Among risk-averse consumers (second column), the probability of holding risky assets is a decreasing function of our measure of absolute risk aversion, and the coe¢cient is precisely estimated. A one-standard-deviation increase in absolute risk aversion lowers the probability of holding risky assets by 1.1 percentage points (11 percent

of the unconditional probability). The third and fourth columns report Tobit estimates of the portfolio share of risky assets (ratio of risky to total …nancial assets). This set of results con…rms the probit estimates: the share invested in risky assets declines as the degree of risk aversion increases and is lower among the risk-averse than among the risk-prone. Consistent with the predictions of the classical theory of portfolio choice, di¤erences in risk attitudes prove to be powerful determinants of portfolio composition.

5.3 Insurance demand

We report the estimates of the e¤ect of risk attitudes on the demand for insurance in Table IV, separately for life, health and casualty insurance, respectively. Standard insurance theory predicts that, provided that insurance premiums depart from fair pricing, di¤erences in risk aversion should predict both the decision to buy insurance and the amounts bought, with more risk-averse individuals being more likely to take out insurance and to hold more of it when they do. We test these predictions by focusing on the sub-sample of risk-averse individuals and estimate a probit model for whether the household has insurance and a Tobit model for the amount of insurance purchased (i.e. the value of insurance premiums) scaled with consumption. Second-order polynomials in wealth and income are included among the right-hand-side variables to account for di¤erences in household endowments and in human capital. In all cases we …nd that more-risk averse consumers are less likely to hold insurance and that they buy less of it, and the e¤ect is statistically signi…cant. This …nding contradicts the predictions of the simple models of insurance demand but is not necessarily in contrast with extended models. One possible explanation is that insurance companies are able to price-discriminate on the basis of customers' risk aversion. This would lead to higher premiums (which we do not observe and therefore cannot control for) for more risk-averse consumers, who would then reduce insurance demand. This explanation - which we consider unlikely - relies on risk aversion being observable. Another, more convincing, explanation is that individuals can act to self-insure against the consequences of adverse events. This leads them to replace market insurance with self-insurance. If market insurance is sold at highly unfair prices, while self-insurance is relatively e¢cient - in the sense that one extra euro of current spending results in a large reduction in the loss - an increase in risk aversion can reduce market insurance and increase self-insurance. To see this, consider the static insurance model and assume that the loss L is a decreasing and convex function of the investment s in self-insurance (i.e. $L' < 0; L'' > 0$). Convexity implies

that marginal returns to self-insurance are decreasing. Let a be the market insurance coverage, ¦ the market insurance premium, w initial wealth and p the probability that the adverse state occurs. The consumer chooses a and s so as to maximize expected utility :

$$pu(w - (1 - a)L(s) - s - a\phi) + (1 - p)u(w - s - a\phi) \tag{4}$$

To illustrate, assume utility is exponential with absolute risk aversion parameter μ and let $\lambda > 1$ be the mark-up on the fair insurance premium. From the …rst-order conditions the following two equations relating a and s can be obtained:

$$a = 1 - (1/\mu L(s)) \log(\lambda(1 - p)/(1 - \lambda p)) \tag{5}$$

[from the f.o.c. on a , call this the aa locus]

$$a = 1 + (1/\lambda p L'(s)) \tag{6}$$

[from combining the f.o.c. on s and a, call this the ss locus]

Both functions are downward sloping with slopes:

$$da/ds_{jaa} = (L'/\mu L^2) \log(\lambda(1 - p)/(1 - \lambda p)) \tag{7}$$

and:

$$da/ds_{jss} = -(L''/p\lambda L'^2) \tag{8}$$

respectively. The relative slope of the two loci depends on the e¢ciency of self-insurance (how fast the loss declines with s, i.e. on L') and on the e¢ciency of market insurance, i.e. on λ. If self-insurance is relatively e¢cient (L' is large in absolute terms) and market insurance is relatively ine¢cient (λ is large) the aa locus will be steeper than the ss locus. Notice now that an increase in the degree of absolute risk aversion shifts the aa locus upwards but leaves the ss locus unchanged. Thus, starting from an internal solution, if the aa locus is steeper than the ss locus the increase in risk aversion leads to a decline in market insurance and an increase in self-insurance. Since we do not observe the amount of self-insurance in the data, this is picked up by our measure of risk aversion which re‡ects substitutability between self-insurance and market insurance.

5.4 Investment in education

We report the effects of risk attitudes on the investment in education in Table V. Our left-hand-side variable is the number of years of education an individual has obtained. The set of controls includes a second-order polynomial in age (or year of birth) to account for differences in the return to schooling across different cohorts, a dummy for gender and a full set of regional dummies to proxy for differences across areas in the return to education. In addition we insert four dummies for the educational attainment of the father of the household head to account for intergenerational persistence in education, finding strong supportive evidence. As shown in the first column, compared to the risk-prone, risk-averse individuals invest less in education and the effect is statistically significant: being risk-averse lowers education by almost one year, on average. Among the risk-averse those who are more averse invest less in education and again the effect is strongly significant (second column).

5.5 Moving, job changes and health status

Table VI shows the results for the decisions to migrate and change jobs and for health status. The first two columns estimate a model for the probability that an individual has moved from his region of birth to another region. In the sample, 18.5 percent of household heads were born in a region different from the one where they currently live. Since the regressions include a full set of dummies for region of birth, local factors affecting the decision to move, such as labor market conditions, wage prospects in the area, etc., are accounted for. We also control for age, gender and education. Compared to the risk-prone, the risk-averse are less likely to have moved, but the effect is not statistically significant (first column). The second column reports the estimates for the restricted group of risk-averse individuals. The degree of risk aversion has a negative and highly significant effect on the probability of having moved; increasing the degree of risk aversion by one standard deviation lowers the probability by almost 2 percentage points, or 10 percent of the sample mean.[10] The third and fourth columns show the results for the propensity to change jobs. The left-hand-side variable is a dummy

[10] As pointed out by Daveri and Faini (1999), migration may be triggered by households' need to diversify their sources of income, spreading income earners geographically. The implication is that members of households (heads) that are more risk-averse will tend to work in different geographical locations rather than bunch in the same place. We cannot test this prediction since in our data a household groups only the individulas who live in the same house.

equal to 1 if the household head has changed jobs at least twice, and zero otherwise. About 33 percent of the consumers in our sample have changed jobs more than twice. Being risk-averse compared to being risk-prone lowers the probability of being a job changer, but the coe¢cient is not precisely estimated. Within the group of risk-averse individuals, however, a higher degree of risk aversion has a negative and statistically signi…cant e¤ect on the probability of changing jobs; a one-standard deviation increase in risk aversion lowers the probability of taking the risks connected to changing job by 1.4 percentage points. The last two columns report probit regressions for the probability of being a¤ected by a chronic disease. When the total sample is used the estimates indicate that the risk-averse are signi…cantly less likely than the risk-prone to incur a chronic disease, with an e¤ect equal to 18 percentage points, about 88 percent of the sample share of households with a chronic disease. When the sample is restricted to the risk-averse, the degree of risk aversion has moderate predictive power on health status; one standard deviation increase lowers the probability of a chronic disease by 1 percentage point (5 percent of the sample mean).

Overall, the evidence in Tables III to VII implies that attitudes towards risk have considerable explanatory power for several important consumer decisions. In some cases, namely for occupational and portfolio choice, our evidence strongly suggests that leaving out measures of risk aversion in empirical analysis of household behavior is likely to be a substantial problem.

6 Risk, return and risk aversion

The results in the previous section show that risk-averse individuals tend to undertake safer actions when they choose their occupation, invest in education and allocate their savings, decide to move or change jobs. Choosing safer actions means, in equilibrium, choosing prospects with a lower but more predictable payo¤. As a consequence, the more risk-averse individuals should end up earning lower incomes, on average, than the more risk-prone. At the same time, they should face less variable prospects and more predictable incomes. To check these implications we exploit information available in the 1995 SHIW on the subjective probability distribution of future earnings[11] to

[11] Four questions on income expectations were put to half of the overall sample after excluding the retired and people not in the labor force (a total of 4,799 individuals). The employed, the unemployed and the job seekers are asked to state, on a scale from 0 to 100, their chances of having a job in the 12 months following the interview. Each individual assigning a positive probability to being employed is then asked to report the minimum and the maximum he or she expects to earn if employed, and the probability of earning

construct a measure of expected earnings and their variance and correlate it with consumers' risk aversion. Since the subjective probability questions were put to only half of the sample, these regressions are based on a much smaller sample. For this we do not report regressions using the indicator for being risk-averse, since very few belong to the control group of the risk-prone, and focus instead on the sample of risk-averse consumers as such. Table VII reports the results of the estimates. The …rst two columns show the regression using expected earnings as a left-hand-side. We control for age to account for experience and productivity e¤ects on wages and for gender and family size, as well as for di¤erences in economic development (and thus wage levels) across areas by inserting a full set of regional dummies; in the …rst column we control for di¤erences in education. Being more risk-averse translates into lower expected labor income, and the e¤ect is statistically signi…cant and economically important: having a risk aversion coe¢cient equal to the 90th percentile implies a level of expected earnings that is 6.4 million lire lower than for the 10th percentile (25% of mean expected earnings). The second column shows estimates when education is excluded from the set of explanatory variables; in fact, since the attitude towards risk affects the investment in education, the dummies for education may be partly capturing the e¤ect of risk aversion. When education is omitted the e¤ect of risk aversion increases substantially implying that the more risk-averse should receive earnings that are 8 million lire lower than the less risk-averse. These results are consistent with the idea that the more risk-averse will, on average, end up poorer. But they should also have less variable earnings.

The third column shows the regression for the variance of income. After controlling for age, gender, education and household location, more risk-averse consumers face lower earnings variance, and the e¤ect is highly signi…cant. Economically, those with a degree of risk aversion in the 90th percentile of the cross-sectional distribution face an income risk, as measured by the standard deviation of expected earnings, that is 63% lower than that of those at the 10th percentile. The last column further re…nes these results by adding to the regression the expected value of future income and estimating the risk/return options faced by individuals. Since expected income represents the premium the market o¤ers for bearing more risk, once one controls for expected earnings, risk aversion should no longer a¤ect the variance of earnings. And this is indeed the case. Once expected earnings is

less than the midpoint of the support of the distribution. The exact wording of these questions is reported in the appendix. The answers are then used to compute expected earnings and their variance (see Guiso et al., 2002, for details on the computation).

added to the regression, the coe¢cient of the degree of risk aversion becomes six times smaller and is no longer statistically signi…cant.

7 Preferences about risk: the consequences of self-selection

The evidence shown in the previous sections shows that risk attitudes have important e¤ects on observable behavior and that risk-averse individuals sort themselves into activities that entail lower exposure to risk. This self-selection is relevant in many situations where one is interested in studying the e¤ect of risk on choice. For instance, hours worked will in general depend on wage riskiness (see Block and Heineke (1973) and Killingsworth (1983)) and higher wage variability may reduce leisure. Similarly, precautionary savings decisions will be a¤ected by the income risk faced by prudent consumers (Leland (19xx), Drezè and Modigliani (1972)); labor income risk may also a¤ect portfolio choice and insurance demand, inducing investors to pick up safer portfolios or demand more insurance in order to reduce overall exposure to risk (Kimball (1993), Guiso, Jappelli and Terlizzese (1996), Guiso and Jappelli (1998)). In order to assess the relevance of risk for consumers' decisions one needs variation in risk. This is often unobserved and has thus been proxied with observable variables. Typically, since Friedman (1959)'s study of the consumption function, labor income risk has been measured with occupational dummies (e.g. Skinner 19xx). More recently, starting with the work of Guiso, Jappelli and Terlizzese (1993), survey measures of the subjective probability distribution of future income have been used to obtain indicators of the expected value and riskiness of an individual's labor income. These measures have then been used to test for precautionary savings and for the e¤ects of background risk on insurance demand and portfolio choice. The problem with these studies is self-selection: labor income risk is endogenous, because more risk-averse individuals sort themselves into safer occupations. If risk aversion is unobservable, estimates of the e¤ect of labor income risk on choice will be inconsistent because the measure of risk is correlated with the error term which contains the (unobserved) preference parameter.

In this section we o¤er evidence on the importance of self-selection in estimating precautionary savings by proxying risk with a dummy for self-employment.[12] We estimate a saving function based on a life-cycle model

[12] Fuchs and Fuchs (2003) address the relevance of self-selection for estimates of precautionary saving by comparing the saving behaviour of East and West German households

extended to allow for precautionary savings due to earnings uncertainty. If preferences are exponential (and ignoring occupational choice) there exists a closed form solution for the saving rate where the precautionary motive is additive with respect to life cycle savings (Caballero, 1991). We approximate this function as:

$$s_i = a_0 w_i + a_1 y_i + a_2 z_i + a_{3i} \varphi_i + u_i \qquad (9)$$

where s_i is household i saving, y_i its labor income, w_i is the household's net-worth and z_i is a vector of demographic variables. The precautionary saving component is captured by the fourth term on the right-hand-side where household labor income risk, φ_i; is proxied by a dummy variable for self-employment. The coefficient a_{3i} reflects the strength of the precautionary motive, as measured by the degree of absolute prudence, which if preferences are of the CARA variety is equal to the degree of absolute risk aversion; this is why a_{3i} is household-specific. Self-selection emerges because strongly risk-averse individuals choose safer jobs and will be less exposed to income risk. If risk aversion is unobservable it will show up in the residual and will bias the precautionary motive estimate downwards. Since we observe individuals' risk aversion we can assess the importance of the self-selection bias in estimates of precautionary savings.

To illustrate, Table VIII shows the results of the estimates where all variables are scaled by household earnings. The first column reports the estimates when the self-selection problem is ignored. The self-employment dummy - our proxy for labor income risk - is statistically significant but carries a negative coefficient. This is contrary to the precautionary savings hypothesis but is consistent with a strong self-selection bias if risk aversion has a strong effect on individual occupational choice, as shown in Section 5. To check whether the result is indeed driven by self-selection we interact our measure of risk aversion (scaled by labor income) with the self-employment dummy and use this variable as a measure of risk in the regression. The result, shown in the second column of Table VIII, reveals a positive and statistically significant effect of this risk-aversion-weighted measure of risk consistent with the predictions of precautionary savings models. Computed at the sample mean of risk aversion, being self-employed raises the saving rate by 5.2 percentage points, or about 28% of the median saving rate in

after unification. They argue that under Communisms, allocation to jobs in East German was essentially exogenous and not driven by individual preferences, contrary to West Germany. They compare the effect of being self-employed (their proxy for earnings risk) on the propensity to save in the two countries after unification and argue that the stronger effect found for East Germany households is an estimate of the effect of self-selection.

the sample, suggesting that precautionary saving exists and is relevant, once self-selection is properly addressed.

8 Conclusions

Theory of choice under uncertainty implies that preferences for risk should strongly a¤ect individuals' choices in a variety of contexts. Thus, di¤erences in risk attitudes across individuals should be very important in explaining observed di¤erences in behavior. In some instances, theory suggests that di¤erences in attitudes towards risk could be the only factor a¤ecting differences in behavior. We have used a survey-based measure of individuals' willingness to pay for a hypothetical risky asset to construct a measure of the Arrow-Pratt index of absolute risk aversion at the individual level. We have then related this measure to a number of choices under uncertainty. Our results show that this measure has a very strong predictive power on some key consumer decisions including occupational choice, portfolio allocation, investment in education, job change and moving decisions, in ways that are consistent with what theory predicts. In some cases the e¤ects are extremely substantial. For instance, being risk-averse as opposed to being risk-neutral or risk-loving, raises the probability of being self-employed by as much as 50% of the sample mean and the chances of holding risky assets by 70% of the sample mean. Our evidence shows strongly that individuals di¤er markedly in their attitudes towards risk and that these di¤erences lead them to sort themselves out in such a way that the more risk-averse choose lower returns in exchange for lower risk exposure when they invest their assets, choose their occupation, decide to invest in education, migrate or change jobs or to take precautions against illness. How important, then, are di¤erences in risk aversion in explaining income inequality? One way to answer is to look at how much of the explained variability in expected earnings is explained by di¤erences in risk aversion compared to other factors. A regression of expected earnings on a second-order polynomial in age, a set of dummies for place of birth and a dummy for gender explains 6.4% of the sample variability in expected earnings. Adding risk aversion explains an additional 2.2% of the sample variability, about a third of what is explained by age, gender and area of birth! Furthermore, if dummies for father's occupation are included - as proxies for intergenerational transmission of inequality - they can explain an additional 1.2 percent of the variability. Overall, di¤erences in attitudes on risk are at least as important in explaining di¤erences in average income across individuals as are such variables as

age, gender, place of birth and family of origin, which are deemed to have a substantial explanatory power on income levels.

A APPENDIX

A.1 The SHIW

The Bank of Italy Survey of Household Income and Wealth (SHIW) collects detailed data on demographics, households' consumption, income and balance sheet items. The survey was …rst run in the mid-60s but has been available on tape only since 1984. Over time, it has gone through a number of changes in sample size and design, sampling methodology and questionnaire. However, sampling methodology, sample size and the broad contents of the information collected have been unchanged since 1989. Each wave surveys a representative sample of the Italian resident population and covers about 8,000 households, - although at times speci…c parts of the questionnaire are asked to only a random sub-sample. Sampling occurs in two stages, …rst at municipality level and then at household level. Municipalities are divided into 51 strata de…ned by 17 regions and 3 classes of population size (more than 40,000, 20,000 to 40,000, less than 20,000). Households are randomly selected from registry o¢ce records. They are de…ned as groups of individuals related by blood, marriage or adoption and sharing the same dwelling. The head of the household is conventionally identi…ed with the husband, if present. If instead the person who would usually be considered the head of the household works abroad or was absent at the time of the interview, the head of the household is taken to be the person responsible for managing the household's resources. The net response rate (ratio of responses to households contacted net of ineligible units) was 57 percent in the 1995 wave. Brandolini and Cannari (1994) present a detailed discussion of sample design, attrition, and other measurement issues and compare the SHIW variables with the corresponding aggregate quantities.

A.2 Expected earnings and their variance

The variance and the expected value of individual earnings are computed as in Guiso et al. (2002) and are based on the following questions that were asked in the SHIW.

(i) "Do you expect to voluntarily retire or stop working in the next 12 months?"

If the answer is "Yes" the interviewer goes on to the next survey section. If the answer is "No" each respondent is asked questions (ii) through (v) below:

(ii) "What are the chances that in the next 12 months you will keep your job or …nd one (or start a new activity)? In other words, if you were

to assign a score between 0 and 100 to the chance of keeping your job or of …nding one (or of starting a new activity), what score would you assign? ("0" if you are certain not to work, "100" if you are certain to work).

(iii) Suppose you will keep your job or that in the next 12 months you will …nd one. What is the minimum annual income, net of taxes and contributions, that you expect to earn from this job?

(iv) Again suppose you will keep your job or that in the next 12 months you will …nd one. What is the maximum annual income, net of taxes and contributions, that you expect to earn from this job?

(v) What are the chances that you will earn less than X (where X is computed by the interviewer as [(iii)+(iv)]/2)? In other words, if you were to assign a score between 0 and 100 to the chance of earning less than X, what score would you assign? ("0" if you are certain to earn more than X, "100" if you are certain to earn less than X).

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Table I: Descriptive statistics

All the variables refer to the household head, unless stated otherwise. Z denotes the amount households are willing to invest in the risky security and is in million lira. 'Children' denotes the share of household with components aged less than 18. The variables referred to the 'father' denote the share of households whose head has a father with 5 years of schooling or less, who is/was self-employed or a public employee. 'Self-employed' includes the entrepreneurs. 'Mover' denotes the share of households whose head has moved from his/her region of birth. 'Job changer' denotes the share of households whose head has changed jobs more than twice. 'Chronic disease' refers to the share of households whose head is chronically ill. Net worth and income are in million lira. The mean of the 'saving rate' is computed excluding the top and bottom one percent of its distribution. 'Risky assets' include private bonds, stocks and mutual funds. 'Other insurance' includes casualty and theft insurance. The mean and standard deviation of expected earnings refer to the subjective distribution of the household head (see Guiso *et al*., 1998, for details).

Variable	Risk averse	Risk lovers and neutral	Total sample of respondents			
			Mean	SD	10^{th} pct.	90^{th} pct
A. Risk aversion						
Value of Z	1.82	11.19	2.21	2.71	0.05	5.0
Absolute risk aversion	0.158	-0.005	0.1507	0.05	0.08	0.20
Relative risk aversion	5.62	-0.248	5.38	3.58	1.83	9.83
B. Characteristics						
Age	48.50	49.34	48.54	13.61	31	68
Male (%)	79.24	93.75	79.84	40	0	1
Married (%)	78.58	87.50	78.95	41	0	1
No. of components	3.20	3.00	3.19	1.31	1	5
Children (%)	42.12	36.11	41.87	49	0	1
Area of birth (%): North	37.69	52.78	38.32	49	0	1
Center	21.61	19.44	21.52	41	0	1
South	39.20	25.69	38.64	49	0	1
Father (%): with 5^{th} grade	76.67	66.67	76.26	42.56	0	1
self-employed	31.20	32.64	31.26	46.36	0	1
public employee	14.73	16.67	14.81	35.52	0	1
C. Choices						
Self-employed (%)	17.38	29.17	17.87	38.32	0	1
Entrepreneur (%)	14.70	19.44	14.89	35.61	0	1
Public employee (%)	27.55	27.08	27.53	44.67	0	1
Mover (%)	18.5	18.8	18.5	39	0	1
Job changer (%)	32.38	38.89	32.65	46.90	0	1
Years of education	9.25	10.81	9.31	4.28	5	16
Chronic disease (%)	19.76	36.11	20.45	40	0	1
Household net worth	275.22	537.28	286.13	431.65	3.91	641.01
Household income	47.45	72.02	48.48	36.23	17.49	84.60
Mean saving rate (%)	13.52	19.77	13.77	33.39	-23.20	48.52
Holders of (%): risky assets	13.46	36.11	14.40	35.12	0	1
life insurance	21.97	37.50	22.61	41.84	0	1
health insurance	8.96	13.19	9.14	28.82	0	0
other insurance	31.11	45.83	31.72	46.55	0	1
Expected earnings: mean	25.38	31.41	25.59	18.88	8.82	42.50
standard deviation	1.02	1.39	1.03	2.51	0	2.04
No. of observations	3,314	144	3,458	3,458	3,458	3,458

Table II: Risk aversion and occupation choice

"Risk-averse" is a dummy variable equal to 1 if the consumer is risk-averse, i.e. if the maximum price he/she is willing to pay for the lottery is lower than its fair value of 10 million lire. "Absolute risk aversion" is the measure of absolute risk aversion discussed in the text and is defined only for the risk averse. The left-hand-side variable is a dummy equal to 1 if the household head is a self-employed (first two columns), an entrepreneur (third and fourth column) or a public employee (last two columns). The occupation dummies under the heading 'father' refer to the occupation of the father of the household head. Dummies for the region of birth are also included. Standard errors are reported in brackets.

	Self-employed (probit regressions)		Entrepreneur (probit regression)		Public sector employee (probit regression)	
Variable	Whole sample	Sample of risk-averse	Whole sample	Sample of risk-averse	Whole sample	Sample or risk-averse
Risk averse	-0.3413	-	-0.2156	-	0.1454	-
	(0.1220)		(0.1346)		(0.1234)	
Absolute risk aversion	-	-1.3636	-	-0.9061	-	1.5332
		(0.6112)		(0.6519)		(0.5752)
Age	0.0753	0.0745	0.1034	0.0983	0.0576	0.0613
	(0.1666)	(0.0172)	(0.0186)	(0.0189)	(0.0123)	(0.0126)
Age squared	-0.0991	-0.0984	-0.1283	-0.1226	-0.0508	-0.0551
	(0.0174)	(0.0180)	(0.0196)	(0.0199)	(0.0119)	(0.0122)
Gender dummy	0.5730	0.5693	0.5234	0.5312	0.0610	0.0666
	(0.0808)	(0.0819)	(0.0854)	(0.0866)	(0.0624)	(0.0631)
High school diploma	-0.1172	-0.1297	-0.3204	-0.3155	0.5880	0.6276
	(0.0639)	(0.0664)	(0.0680)	(0.0704)	(0.0564)	(0.0581)
University degree	-0.0084	-0.0505	-1.0259	-1.1863	1.2048	1.2104
	(0.0913)	(0.0957)	(0.1463)	(0.1696)	(0.0804)	(0.0831)
Father: Self-employed	0.4609	0.4607	-	-	-0.0427	-0.0366
	(0.0580)	(0.0598)			(0.0551)	(0.0564)
Entrepreneur	-	-	0.4436	0.4520	-	-
			(0.0614)	(0.0631)		
Public employee	-0.1307	-0.1322	-0.1843	-0.1543	0.3255	0.3191
	(0.0859)	(0.0889)	(0.0970)	(0.0995)	(0.0687)	(0.0704)
No. of observations	3,401	3,260	3,401	3,260	3,401	3,260

Table III: The effect of risk preferences on portfolio choice

Risky assets include stocks, private bonds and mutual funds. The left-hand-side variable for the regressions in the first two columns is a dummy equal to 1 if the household head owns risky assets. The left-hand-side variable in the tobit (last two columns) is the share of financial asset held in risky assets. Dummies for the region of birth and for the region of residence are also included. Standard errors are reported in brackets.

	Ownership of risky assets (probit regressions)		Portfolio share of risky assets (tobit regressions)	
Variable	Whole sample	Sample or risk-averse	Whole sample	Sample or risk-averse
Risk averse	-0.4357	-	-0.1712	-
	(0.1220)		(0.0734)	
Absolute risk aversion	-	-2.3797	-	-1.2103
		(0.6770)		(0.4249)
Wealth	-	-	0.0003	0.0003
			(0.0001)	(0.0001)
Wealth squared	-	-	-7.07e-08	-8.42e-08
			(2.48e-08)	(3.49e-08)
Income	-	-	0.0058	0.0066
			(0.0009)	(0.0011)
Income squared	-	-	-6.13e-06	-9.28e-06
			(1.64e-06)	(3.03e-06)
Age	0.0531	0.0541	0.0057	0.0055
	(0.0152)	(0.0159)	(0.0094)	(0.0101)
Age squared	-0.0463	-0.0471	-0.0057	-0.0051
	(0.0147)	(0.0155)	(0.0091)	(0.0098)
Gender dummy	0.2328	0.2328	0.0746	0.0707
	(0.0777)	(0.0793)	(0.0493)	(0.0511)
High school diploma	0.5897	0.5860	0.2088	0.2156
	(0.0680)	(0.0712)	(0.0435)	(0.0464)
University degree	0.9400	0.9457	0.2488	0.2389
	(0.0904)	(0.0945)	(0.0604)	(0.0648)
No. of observations	3,401	3,260	3,030	2,897

Table IV: Risk aversion and the demand for insurance

The left-hand-side variable is a dummy equal to 1 if the household head owns a life insurance (first column), health insurance (second column) or theft or casualty insurance (third column). The left-hand-side variables for the tobit are the ratios of the insurance premiums to household consumption. 'Siblings' is a dummy equal to 1 if the household head has any brother or sister. Dummies for the region of birth and for the region of residence are also included. Standard errors are reported in brackets.

	Ownership of insurance (probit regressions)			Insurance premiums as a share of consumption (tobit regressions)		
Variable	Life insurance	Health insurance	Theft or casualty insurance	Life insurance	Health insurance	Theft or casualty insurance
Absolute risk aversion	-1.2690	-2.3851	-2.4926	-0.0642	-0.0850	-0.0594
	(0.5877)	(0.7377)	(0.5608)	(0.0396)	(0.0271)	(0.0160)
Wealth	-	-		0.00004	0.00001	0.00002
				(7.22e-06)	(4.62e-06)	(2.97e-06)
Wealth squared	-	-	-	-4.99e-09	-9.82e-10	3.29e-09
				(1.60e-09)	(9.13e-10)	(6.83e-10)
Income	-	-	-	0.0003	-0.0001	0.0001
				(0.0001)	(0.0001)	(0.00004)
Income squared	-	-	-	-3.32e-07	9.32e-08	-1.86e-07
				(3.57e-07)	(2.57e-07)	(1.29e-07)
Age	0.1354	0.0657	0.0479	0.0077	0.0021	0.0003
	(0.0171)	(0.0205)	(0.0124)	(0.0012)	(0.0008)	(0.0004)
Age squared	-0.1590	-0.0794	-0.0483	-0.0096	-0.0027	-0.0005
	(0.0181)	(0.0212)	(0.0121)	(0.0013)	(0.0008)	(0.0004)
Gender dummy	0.2523	0.2606	0.2285	0.0073	0.0062	0.0033
	(0.0704)	(0.0922)	(0.0633)	(0.0047)	(0.0033)	(0.0019)
High school diploma	0.2538	0.2867	0.2451	0.0088	0.0077	0.0031
	(0.0606)	(0.0767)	(0.0596)	(0.0042)	(0.0029)	(0.0018)
University degree	0.3210	0.2630	0.4310	0.0010	0.0064	0.0018
	(0.0862)	(0.1124)	(0.0858)	(0.0063)	(0.0045)	(0.0026)
Siblings	-0.0335	0.0155	-0.0197	-0.0018	0.0007	0.00003
	(0.0140)	(0.0188)	(0.0139)	(0.0010)	(0.0007)	(0.0004)
No. of observations	3,260	3,260	3,264	3,264	3,264	3,249

Table V: Risk aversion and the investment in education

Note: The left-hand-side variable is the number of years of schooling reported by the household head. The education dummies under the heading 'father' refer to the education attainment of the father of the household head. Dummies for the region of birth are also included. Standard errors are reported in brackets.

	Years of schooling	
Variable	Whole sample	Sample of risk-averse
Risk averse	-0.7832	-
	(0.3052)	
Absolute risk aversion	-	-6.4719
		(1.3849)
Age	0.0366	0.0204
	(0.0290)	(0.0295)
Age squared	-0.0986	-0.0839
	(0.0281)	(0.0286)
Gender dummy	0.6801	0.6297
	(0.1514)	(0.1516)
Father: Elementary school	2.6616	2.5778
	(0.1465)	(0.1484)
Junior high school	4.9023	4.8881
	(0.2139)	(0.2184)
High school diploma	6.6670	6.6150
	(0.2550)	(0.2590)
University degree	8.3116	8.3230
	(0.3757)	(0.3889)
No. of observations	3,339	3,203

Table VI: Risk aversion, moving decision, job changes and health status (chronic disease)

The left-hand-side variable is a dummy equal to 1 if the household head lives in a region different from the one where he was born (first two columns), if he/she has changed job at least twice over his/her working life (third and fourth column) or if he/she is affected by a chronic disease (last two columns). Dummies for the region of birth are also included. Standard errors are reported in brackets.

	Moving to another region (probit regressions)		Propensity to change job (probit regression)		Health (probit regression)	
Variable	Whole sample	Sample of risk-averse	Whole sample	Sample of risk-averse	Whole sample	Sample or risk-averse
Risk averse	-0.1046	-	-0.1222	-	-0.5788	-
	(0.1346)		(0.1132)		(0.1194)	
Absolute risk aversion	-	-1.7130	-	-0.8853	-	0.9137
		(0.5920)		(0.5298)		(0.6209)
Age	0.0167	0.0113	0.0277	0.0278	0.0410	0.0459
	(0.0130)	(0.0132)	(0.0117)	(0.0121)	(0.0136)	(0.0141)
Age squared	-0.0138	-0.0080	-0.0393	-0.0400	-0.0067	-0.0113
	(0.0126)	(0.0128)	(0.0115)	(0.0120)	(0.0126)	(0.0131)
Gender dummy	-0.1606	-0.1483	0.4094	0.4029	-0.1481	-0.1540
	(0.0655)	(0.0664)	(0.0615)	(0.0622)	(0.0642)	(0.0650)
High school diploma	-0.0312	-0.0373	-0.2590	-0.2728	-0.0956	-0.0908
	(0.0633)	(0.0651)	(0.0547)	(0.0566)	(0.0648)	(0.0677)
University degree	0.2247	0.1972	-0.4484	-0.4649	-0.0136	-0.0059
	(0.0863)	(0.0893)	(0.0840)	(0.0871)	(0.0907)	(0.0945)
No. of observations	3,401	3,260	3,405	3,264	3,401	3,260

Table VII: Return, risk and risk aversion

The left-hand-side variable is household expected earnings (million of lira; first two columns) and the standard deviation of the subjective distribution of the household expected earnings (last two columns), as from Guiso *et al*. (2002). Dummies for the region of birth and for the region of residence are also included. Standard errors are reported in brackets.

Variable	Expected earnings		Earnings uncertainty	
Absolute risk aversion	-53.60	-66.79	-7.1974	-1.3347
	(12.43)	(13.31)	(1.8431)	(1.2561)
Earning mean	-	-	-	0.1094
				(0.0032)
Age	1.42	1.78	0.0038	-0.1521
	(0.48)	(0.53)	(0.0717)	(0.0486)
Age squared	-1.47	-1.93	-0.0061	0.1550
	(0.56)	(0.62)	(0.0837)	(0.0567)
Gender dummy	8.56	8.07	0.6583	-0.2778
	(1.51)	(1.67)	(0.2233)	(0.1532)
High school diploma	7.54	-	0.3146	-0.5102
	(1.19)		(0.1766)	(0.1216)
University degree	20.46	-	0.9811	-1.2573
	(1.66)		(0.2465)	(0.1786)
Household size	1.10	0.37	-	-
	(0.47)	(0.50)		
No. of observations	1,027	1,027	1,027	1,027

Table VIII: Risk aversion, precautionary savings and self-selection

The left-hand-side variable is household saving rate. We exclude the top and bottom one percent of the distribution. The sample is restricted to the risk averse. Dummies for the region of birth and for the region of residence are also included. Standard errors are reported in brackets.

	(1)	(2)
Variable		
Wealth	-0.0117	-0.0130
	(0.0009)	(0.0009)
Self-employed head	-0.0399	-
	(0.0159)	
Self-employed * absolute risk aversion	-	0.0090
		(0.0015)
Absolute risk aversion	-	
Age	0.0095	0.0092
	(0.0029)	(0.0029)
Age squared	-0.0051	-0.0044
	(0.0028)	(0.0028)
Gender dummy	0.0445	0.0355
	(0.0147)	(0.0146)
High-school diploma	0.1186	0.1204
	(0.0136)	(0.0135)
University degree	0.2001	0.1933
	(0.0197)	(0.0199)
Household size	0.0223	0.0195
	(0.0056)	(0.0056)
Dummy for children	-0.0622	-0.0575
	(0.0152)	(0.0152)
No. of observations	3,197	3,197