Risk Aversion, Wealth and Financial Market* Imperfections

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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 enter a lottery. We relate this measure to consumers' endowment and attributes and to measures of exposure to background risk and liquidity constraints. We find that risk aversion is a decreasing function of endowment - thus rejecting CARA preferences - but that the elasticity to consumption is far below the unitary value predicted by CRRA utility. We also find that households' attributes are of little help in predicting their degree of risk aversion, which is characterized by massive unexplained heterogeneity. However, consumers' environment affects risk aversion. Individuals who are more likely to face income uncertainty or to be liquidity-constrained exhibit a higher degree of absolute risk aversion. This is consistent with recent theories of attitudes towards risk in the presence of uninsurable risks and credit market imperfections. We also find that risk attitudes have considerable predictive power on several household decisions, including occupation and portfolio choice, moving decisions and health status.

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1 Introduction

The relationship between a consumer's attitude towards risk, as indicated for instance by the degree of absolute risk aversion or of absolute risk tolerance, and wealth is central to many fields of economics. As was argued by Arrow as long as 35 years ago "the behavior of these measures as wealth varies is of the greatest importance for prediction of economic reactions in the presence of uncertainty" (p.35).

Most of the inference on the nature of this relation is based on common sense, introspection, casual observation of behavioral differences between the rich and the poor and a priori reasoning and concerns the sign of the relation, whereas no evidence at all, even indirect, is available on its curvature. The consensus view is that absolute risk aversion should decline with wealth.[1] Furthermore, if one agrees that preferences are characterized by constant relative risk aversion - a property of one of the most commonly used utility functions, the isoelastic - then absolute risk aversion is decreasing and convex in wealth, while risk tolerance is increasing and linear. The curvature of absolute risk tolerance has been shown to be relevant in a number of contexts. For instance, Gollier and Zeckhauser (1997) show that it determines whether the portfolio share invested in risky assets increases or decreases over the consumer life cycle, an issue that is receiving increasing attention. Moreover, if risk tolerance is concave, wealth inequality can help elucidate the risk premium puzzle (Gollier, 1999). Furthermore, the curvature of risk tolerance and the nature of risk aversion may explain why the marginal propensity to consume out of current resources, rather than being constant, declines as the level of resources increases (Carroll and Kimball (1996), Gollier (1999)).

The aim of this paper is to provide empirical evidence on the nature of the relationship between risk aversion and wealth. Using data from the Bank of Italy Survey of Household Income and Wealth (SHIW), we employ the information on household willingness to pay for a lottery to recover a measure of the Arrow Pratt index of absolute risk aversion and relate it to indicators of consumers' endowment, as well as to a set of demographic characteristics to control for individual preference heterogeneity.

The usual definition of risk aversion and tolerance developed by Arrow (1970) and Pratt (1964) is based on the assumption that initial wealth is non-random. It is also constructed in a static setting or in settings where

[1] It is on these grounds that quadratic and exponential utility, though often analytically convenient, are regarded as misleading representations of preferences.

full access to the credit market is assumed. Recently it has been shown that attitudes towards risk can be affected by the prospect of being liquidity-constrained and by the presence of additional uninsurable, non-diversifiable risks. Gollier (1999) shows that the possibility that consumers will be subject to a liquidity constraint in the future makes them less willing to bear risk presently, i.e. increases their risk aversion. Pratt and Zeckhauser (1987), Kimball (1993) and Eekhoudt, Gollier and Schlesinger (1996) establish a set of conditions on preferences that define classes of utility functions whose common feature is that the presence of background risk makes the individual behave in a more risk-averse manner. They call these classes of utility functions "proper", "standard" and "risk vulnerable", respectively.[2] The main implication is that even if risks are independent, individuals will react to background risk by reducing their exposure to avoidable risks. One important consequence is that individuals facing high exogenous labor income risk - which is normally uninsurable - will be more risk-averse and thus avoid exposure to portfolio risk by holding less or no risky assets. Similarly, they should tend to buy more insurance against the risks that are insurable (Eekhoudt and Kimball (1992))[3]. Furthermore, insofar as income risk evolves with age, under standardness, background risk may help explain the life cycle of asset holdings. Several papers have cited background risk and risk vulnerability (or standardness) to explain the portfolio puzzles.[4] In all these studies, standardness or risk vulnerability is just assumed, but it is not tested because of lack of evidence on individual risk aversion.

The evidence presented in this paper sheds light also on the empirical relevance of these concepts. In fact, as shown by Eekhoudt, Gollier, and Schlesinger (1996), a sufficient (but not necessary) condition for absolute risk

[2] Pratt and Zeckhauser (1987) define as "proper" the class of utility functions that ensure that introducing an additional independent undesirable risk when another undesirable one is already present makes the consumer less willing to accept the extra risk. Kimball defines as "standard" the class of utility functions that guarantee that an additional independent undesirable risk increases the sensitivity to other loss-aggravating ones. Starting from initial wealth w, a risk $\widetilde{x}$ is undesirable if and only if it satisfies $Eu(w-\widetilde{x}) \leq u(w)$, where $u(w)$ is an increasing and concave utility function. A risk $\widetilde{x}$ is loss-aggravating if and only if it satisfies $Eu'(w+\widetilde{x}) \geq u'(w)$. When absolute risk aversion is decreasing, every undesirable risk is loss-aggravating, but not every loss-aggravating risk is undesirable. See Kimball (1993) and Gollier and Pratt (1996). Finally, Eeckhoudt, Gollier and Schlesinger (1996)'s risk vulnerability implies that adding a zero-mean background risk makes consumers more risk averse.

[3] Guiso, Jappelli and Terlizzese (1996) find that households facing greater earnings risk buy less risky assets; Guiso and Jappelli (1998) show that households buy more liability insurance in response to earnings risk.

[4] See Weil (1992), Gollier and Zeckhauser (1997), Gollier (1999), Coco et al. (1998).

aversion to increase with background risk is that it is a decreasing and convex function of the endowment, an assumption that is satisfied, for instance, by CRRA utility.[5] In addition to this, the availability of information on the subjective probability distribution of future earnings and on household access to the credit market allows us to relate our index of risk aversion directly to indicators of employment-related risk and of liquidity constraints.

Our findings show that absolute risk aversion is a decreasing and convex function of consumers' resources, while risk tolerance is increasing and concave: thus, we reject both CARA and CRRA preferences. Yet, we find that risk aversion decreases with the subjective variance of the earnings of the respondent: rather than reject the influence of background risk, we argue that this finding reflects self-selection of more risk-averse consumers into safer occupations. In fact, when income risk is proxied by the variance of shocks to GDP in the province where consumers live - arguably less subject to self-selection - we find that risk aversion is positively affected by background risk. Furthermore, consistent with recent theories, we find that risk aversion is higher among consumers who are more exposed to liquidity constraints. Our estimates, however, show that these variables can only explain a small amount of the sample variability in attitudes towards risk. Even after controlling for individual characteristics there remains a large amount of unexplained variation reflecting partly genuine differences in tastes. We also find that our measure of attitude towards risk has considerable explanatory power on a number of household decisions including occupation and moving/staying choices, the demand for risky financial assets, insurance and health status.

The paper is organized as follows: Section 2 describes our measure of risk aversion when wealth is non-random and when there is background risk. Section 3 presents descriptive evidence on absolute risk aversion in our cross-section of households. In Section 4 we discuss the empirical specification we use to relate absolute risk aversion to the consumer endowment, his attributes and then to his environment. Section 5 presents the results of the estimates. In Section 6 we check the robustness of the main findings to the endogeneity of consumption and wealth, non-responses and the possible presence of outliers. Section 7 presents evidence regarding the effects of background risk and liquidity constraints on the propensity to bear risk. In Section 8 we characterize empirically the regime of the attitude towards risk to which households belong (i.e. whether they are risk-averse, risk-neutral

[5] Similarly, Hennessy and Lapan (1998) show that a positive and concave relation of risk tolerance with wealth is sufficient for preferences to be standard as in Kimball (1993).

or risk lovers). In addition, we test the Friedman-Savage idea that utility may be concave in household resources at very low and very high levels of wealth and convex in between. Section 9 provides evidence on whether risk attitudes help to predict behavior. Section 10 summarizes and concludes.

2 Measuring risk aversion

To measure absolute risk aversion and tolerance, we exploit the 1995 wave of the Survey of Household Income and Wealth (SHIW), which is run biannually by the Bank of Italy. The 1995 SHIW collected data on income, consumption, financial wealth, real estate wealth, and several demographic variables for a representative sample of 8,135 Italian households. Balance-sheet items are end-of-period values. Income and flow variables refer to 1995.[6]

The 1995 wave has a section designed to elicit attitudes towards risk. Each participant is offered a hypothetical lottery and is asked to report the maximum price that he would be willing to pay to participate. Specifically:

> "We would like to ask you a hypothetical question that we would like you to answer as if the situation was a real one. You are offered the opportunity of acquiring a security permitting you, with the same probability of 1/2, to either gain 10 million lire or to gain nothing. What is the most that you are prepared to pay for this security?"

Ten million lire corresponds to just over Euros 5,000 (or roughly $5,000). The interviews are conducted personally at the consumer's home by professional interviewers. In order to help the respondent understand the question, the interviewers show an illustrative card and are ready to provide explanations. The respondent can answer in one of three ways: a) declare the maximum amount he is willing to pay to participate, which we denote Z_i, known as the compensating certainty equivalent; b) don't know; c) unwilling to answer.

Clearly, $Z_i = 5$ million lire, $Z_i < 5$ and $Z_i > 5$ million lire imply risk neutrality, risk aversion and risk loving, respectively. This characterizes attitudes towards risk qualitatively. But we can do more; a measure of the Arrow-Pratt index of absolute risk aversion can be obtained for each

[6] See the appendix for a detailed description of the survey contents, its sample design, interviewing procedure and response rates.

consumer. Let w_i denote household $i's$ endowment, which for a moment is assumed to be non-random. Let $u_i(\cdot)$ be its utility function and $\widetilde{P}$ be the random prize of the lottery, taking values 10 million and 0 with equal probability. The maximum entry price is thus given by:

$$u_i(w_i) = \frac{1}{2}u_i(w_i + 10 - Z_i) + \frac{1}{2}u_i(w_i - Z_i) = Eu_i(w_i + \widetilde{P} - Z_i) \tag{1}$$

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

$$Eu_i(w_i + \widetilde{P} - Z_i) \approx u_i(w_i) + u_i'(w_i)E(\widetilde{P} - Z_i) + 0.5u_i''(w_i)E(\widetilde{P} - Z_i)^2 \tag{2}$$

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

$$R_i(w_i) \approx -u_i''(w_i)/u_i'(w_i) = 4(5 - Z_i)/\left[10^2 + 2Z_i^2 - 20Z_i\right] \tag{3}$$

Equation (3) uniquely defines the Arrow-Pratt measure of absolute risk aversion in terms of the parameters of the lottery in the survey. Absolute risk tolerance is defined by $T_i(w_i) = 1/R_i(w_i)$. Obviously, for risk-neutral individuals (i.e. those reporting $Z_i = 5$), $R_i(w_i) = 0$ and for the risk-prone (those with $Z_i > 5$), $R_i(w_i) < 0$. According to (3) absolute risk aversion may vary with consumer endowment and with all the attributes that are correlated with his preferences. 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 unspecified. Second, it is not restricted to risk-averse individuals but extends to the risk-neutral and the risk lovers. Third, our definition provides a point estimate, rather than a range, of the degree of risk aversion for each individual in the sample. These features mark a difference between our study and 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. More, their sample consists of individuals aged 50 or above, which makes it hard not only to study the age profile of risk aversion but also to test its relationships with liquidity constraints and background risk since both are likely to matter most for the young.[7] These relationships are instead the focus of this paper.

2.1 Risk aversion with background risk

The measure of risk aversion in (3) is for non-random initial wealth, but it is easily generalized to the case of background risk using the results of Kihlstrom, Romer and Williams (1981) and Kimball (1993). For this purpose we have to restrict the analysis to risk-averse individuals (i.e. those reporting $Z_i < 5$).

Let $\widetilde{y}_i$ denote a zero-mean background risk for individual i, whose variance is σ^2 . Denoting with E_x $(x = y, P)$ the expectation with respect to the random variable $\widetilde{x}$, our indifference condition for undertaking the lottery and paying Z_i becomes

$$E_y u_i(w_i + \widetilde{y}_i) = E_P E_y u_i(w_i + \widetilde{y}_i + \widetilde{P} - Z_i) \tag{4}$$

where we have implicitly assumed that the background risk and the lottery are independent, which is assured by construction. If preferences are risk-vulnerable as in Gollier and Pratt (1996), we can use the equivalence:

$$E_y u_i(w_i + \widetilde{y}_i) = v_i(w_i) \tag{5}$$

where $v_i(w_i)$ is a concave transformation of u_i, which implies that $v_i(w_i)$ is more risk-averse than $u_i(w_i)$. In other words, if consumers h and j are both risk-averse and their preferences are risk-vulnerable, then, assuming $w_j = w_{h,}$ h is more risk-averse than j if $\widetilde{y}_h$ is riskier than $\widetilde{y}_j$, i.e. if he faces more background risk.[8]

[7] However, the Barsky et al. measure of risk aversion has other advantages. Since the risk tolerance question is asked in both wave I and II of the survey they use and a subset of the respondents is common to both waves, they can account for measurement errors in their measure of relative risk aversion. Furthermore they collect information on intertemporal substitution and can thus study its relation with risk aversion. But they have no direct information on liquidity constraints or on background risk.

[8] Preferences are said to be risk-vulnerable if the presence (or the addition) of an exogenous zero-mean background risk increases the aversion to any other independent risk. An alternative, but slightly more restrictive, preference property leading to analogous behavior is "standardness", developed by Kimball (1993). Standardness corresponds to vulnerability with respect to the set of risks that are marginal-utility increasing.

We can thus account for background risk by expressing our measure of risk aversion in terms of the utility function $v_i(w_i)$ to get

$$R_i(w_i) \approx -v_i''(w_i)/v_i'(w_i) = 4(5 - Z_i)/\left[10^2 + 2Z_i^2 - 20Z_i\right] \qquad (6)$$

Risk aversion will now vary not only with the consumer's endowment and attributes but also with any source of uncertainty characterizing his environment. If measures of the latter are available, one can directly test for standardness of preferences.

Interestingly, the shape of the relation between R and w can have implications for the sign of the effect of background risk on absolute risk aversion. Eekhoudt, Gollier, and Schlesinger (1996) show that a sufficient (but not necessary) condition for absolute risk aversion to increase with background risk is that it is a decreasing and convex function of the endowment, an assumption that is satisfied, for instance, by CRRA utility. Gollier and Pratt (1996) argue that the convexity of absolute risk aversion should be regarded as a natural assumption, ".. since it means that the wealthier an agent is, the smaller is the reduction in risk premium of a small risk for a given increase in wealth". Though plausible, this assertion is not backed by any empirical evidence. Our results lend support to this conjecture in that they imply that absolute risk aversion is a convex function of the endowment.

3 Descriptive evidence

The lottery question was submitted to the whole sample of 8,135 household heads, but only 3,439 answered and were willing to participate. Out of the 4,696 who did not, 3,110 overtly refused to answer or to participate with positive price and 1,586 reported a "do not know". 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 to provide an answer.[9]

Table I reports descriptive statistics for the whole sample of 8,135 households, for the sample of 3,439 lottery respondents and, for the latter, for

[9] On the basis of these considerations and of the actual amounts reported (relative to the values reported for household wealth) it is likely that some respondents misunderstood the question and gave erroneous answers. In Section 4, we argue that measurement error due to misunderstanding of the lottery question is unlikely to affect the consistency of our analysis.

several sub-samples. Out of 3,439 individuals willing to participate in the lottery the great majority (78 percent) are risk averse, in that they report a maximum price lower than the expected value of the lottery; 576 individuals (17 percent of the sample) are risk neutral, while only a tiny minority (189 individuals, 5 percent) are risk lover. The table reports characteristics also for these three sub-samples. Those who responded to the lottery question are on average 6 years younger than the total sample and have higher shares of male-headed households (79.8 compared to 74.4 percent), of married people (78.9 and 72.5 percent respectively), of self-employed (17.9 and 14.2 percent) and of public sector employees (27.5 and 23.3 percent respectively). They are also somewhat wealthier and slightly better educated (1.3 more years of schooling). These differences seem to suggest that there are some systematic effects explaining the willingness to respond. At the same time, however, the small difference in education between the total sample and the sample of respondents seems to suggest that - in so far as education is also a proxy for better understanding - non-responses can ascribed only partly to differences in the ability to understand the question.[10]

The three sub-samples of risk-lovers, risk-neutral and risk-averse consumers exhibit several interesting differences. For most characteristics the pattern has a clear ordering with the highest (or lowest) value for the risk-lovers and the lowest (or highest) for the risk-averse, with risk-neutral in the middle. Risk lovers are older and more educated; they are more likely to be male, to be married and to live in the North. Strong differences also emerge comparing the type of occupation: among the risk averse the share of self-employed is 16.6 percent, among the risk-prone it is much higher at around 26.5 percent with the risk-neutral in between (21.2 percent).This ordering is reversed for public sector employees. The risk-lovers are public employees in 24 percent of the cases and the risk-averse in 28 percent, while the risk-neutral are in between. These differences are likely to reflect self-selection, with more risk averse individuals choosing safer jobs. Finally, notice that the risk-lovers are significantly wealthier than the risk-averse, who in turn are poorer than the risk-neutral. In Section 9 we will return to the relation between risk attitude and the level of wealth.

Figure 1 focuses on the larger group of risk-averse consumers and shows the cross-sectional distribution of the degree of relative risk aversion, obtained by multiplying our measure of absolute risk aversion by household

[10] A probit regression suggests that the probability of responding to the lottery question is higher among younger, more educated, healthy, male-headed households. Single persons are less likely to respond. In addition, the response probability is higher among public employees and depends positively on the number of earners.

consumption. The distribution is right-skewed and the median of relative risk aversion is 5.8, somewhat higher than the commonly used value of 3, but with considerable heterogeneity ranging from 0.005 to 36.4. Furthermore, 90 percent of the cross-sectional distribution is comprised between 2.4 and 13.5, with 1,417 households (53 percent) falling in the range 2.5-6.5. As we will see, most of this variability cannot be explained by any observable characteristics.

Table I also reports also the characteristics of the modestly risk-averse consumers (at or below the sample median) and of the high risk-averse (above median). To classify households we rely on the value of the entry price, i.e. on absolute risk aversion. Highly risk-averse consumers are on average older, somewhat less well educated, less likely to be married and more likely to live in the South. They are also less wealthy than the modestly risk-averse, both in terms of net worth and consumption (the median net worth of the two groups is 127.4 and 183.2 million lire respectively). Finally, the share of the self-employed is 14.2 percent for the highly risk-averse and 18.4 percent for the modestly risk averse, but that of public sector employees is 27.3 and 28.5 percent. Thus, being risk-averse as opposed to risk-lover or risk-neutral seems to explain sorting into riskier occupations, but within the risk-averse group, differences in the degree of risk aversion appear to be less relevant in this regard.

4 Empirical Specification

Most of the literature assumes that agents are risk averse and is interested in assessing how risk aversion varies with the consumer's attributes and in particular with his endowment. Accordingly, the next four sections focus on risk-averse individuals. In Section 9 we look at the determinants of the regime of risk attitudes.

To estimate the relation between our index of absolute risk aversion and consumption or wealth we use the following specification (we omit the household index i for brevity) :

$$R(c) = \frac{ae^{\gamma H+\eta}}{c^{\beta}} = \frac{\kappa}{c^{\beta}} \tag{7}$$

where c is consumption, H is a vector of consumer characteristics affecting individual preferences, η is a random shock to preferences, a is a constant and γ and β are two unknown parameters. Equation (7) is a generalization of absolute risk aversion under CRRA preferences; the latter obtain when $\beta = 1$ in which case $\kappa = ae^{\gamma H + \eta}$ measures relative risk aversion. Notice that $R(\;)$ is always positive and is decreasing in c for all positive values of β. Furthermore, if $\beta > 0$, it is always convex in c. Though simple, this formulation is flexible enough to allow us to analyze the curvature of absolute risk tolerance, which is defined as:

$$T(c) = \kappa^{-1} c^{\beta}. \tag{8}$$

Thus, if $\beta > 0$, risk tolerance is an increasing function of c; however, it will be concave, linear or convex in c depending on whether β is less than, equal to or greater than 1. Since β measures the speed at which $R()$ declines with wealth, $T()$ is a concave (respectively convex) function of c if absolute risk aversion falls as consumption increases at a speed lower (respectively greater) than that characterizing CRRA preferences. Since most theoretical ambiguities rest on the curvature of T , not R, our approach is not restrictive.

Although equation (7) is assumed, a utility function that gives rise to a measure of absolute risk aversion as in (7) is

$$u(c) = \int e^{-\frac{ae^{\gamma H + \eta} c^{1-\beta}}{1-\beta}} = \int e^{-\frac{\kappa c^{1-\beta}}{1-\beta}} \tag{9}$$

which converges to the CRRA utility $u(c) = \frac{c^{1-\kappa}}{1-\kappa}$ as β tends to 1.[11]

Taking logs on both sides of (7), our empirical specification becomes:

$$\log(R) = \log a + \gamma H - \beta \log c + \eta \tag{10}$$

The relation between absolute risk aversion and consumption as well as the curvature of absolute tolerance is thus parameterized by the value of β.

[11] The degree of absolute prudence of this utility function is $P(c) = \frac{\kappa}{c^{\beta}} + \frac{\beta}{c}$; thus, estimation of (10) allows us to recover an expression for absolute prudence as well.

To test whether background risk affects risk aversion we augment (10) by a proxy, s, of such risk and estimate[12]

$$\log(R) = \log a + \gamma H - \beta \log c + \delta s + \eta \tag{11}$$

5 Results

Table II shows the results of the estimation of equation (10) using different measures of consumer resources. The analysis is conducted on the sample of 2,674 risk-averse consumers. Possible misinterpretations of the survey question, as well as difficulties in figuring out the maximum price to be paid suggest that the left-hand-side variable, R, is likely to suffer measurement error. This will be reflected in the residual η but, in so far as it is uncor-

[12] **As pointed out earlier**, when background risk, $\widetilde{y}$, is present our measure of risk aversion must be interpreted as measuring the risk aversion of the indirect utility function $v(c) = Eu(c + \widetilde{y})$. **The problem is to draw the implications for the relation between the risk aversion of $u()$ and the endowment from the relation between the risk aversion of $v()$ and the endowment.** The indirect utility utility function inherits several properties of $u()$. In particular, if $u()$ is DARA then also $v()$ is DARA. Furthermore, as shown by Kihlstrom, Romer and Williams (1981), comparative risk aversion is preserved by the indirect utility if $u()$ is non-increasing risk averse. However, except for the case where $u()$ is CARA, there is no closed form expression for the function $v()$. In the former case, the function $v()$ is CARA as well and its risk aversion is independent of background risk. Thus, under the null that $u()$ is CARA we should find that $\beta = 0$ and $\delta = 0$ in equation (11). However, if the utility function has the general form given by equation (9) no inference can be made. **Yet, if $u()$ is CRRA, taking a second order Taylor expansion of the indirect utility around $\widetilde{y} = 0$ yields the following index of the absolute risk aversion of this approximated utility**:

$$A(c, s) = \kappa c^{-1}[1 + \frac{2(1+\kappa)s^2}{1 + \kappa(1+\kappa)s^2}]$$

where κ is a constant and s is the coeffcient of variation of the consumer's endowment. Notice that $\kappa c^{-1}$is the absolute risk aversion of $u()$ and that $A(c, s) > \kappa c^{-1}$ if $s > 0$, i.e. if there is background risk. Furthermore, since the term in square brackets is increasing in s, $A()$ too is increasing is s. This formulation implies that under the null that $u()$ is CRRA we should find that $\beta = 1$ and $\delta > 0$ when estimating equation (11).

related with the explanatory variables in equation (10), it will not lead to bias but only to a loss of efficiency.[13]

In the first column of the Table we regress $log(R_i)$ only on (log) consumption and do not include any household characteristics that can proxy for differences in tastes. As a measure of consumption we use total expenditure on durable and non-durable goods. Since preliminary estimates show that OLS residuals are far from being normal, we report boostrapped standard errors computed with 100 replications. The estimate of β is 0.035 and is highly statistically significant leading to the rejection of preferences with constant absolute risk aversion (CARA). The estimated value of β implies that absolute risk aversion declines with wealth but at a rate that is far slower than that implied by constant relative risk aversion (CRRA) preferences. In fact, the hypothesis that $\beta = 1$ can be strongly rejected (F =26,644.88). It follows that absolute risk tolerance is a concave function of consumer resources. In the second column of the table we include a set of strictly exogenous individual characteristics, such as gender, age, region of birth and number of siblings. If tastes are impressed in our chromosomes or evolve over life in a systematic way or are affected by the culture of the place of birth or by the possibility of relying on the support of a brother or sister, then these variables should have predictive power. The analysis shows that only the region of birth and the number of siblings in fact do. Yet, a test of the hypothesis that the coefficients on gender, age and number of siblings are jointly equal to zero cannot be rejected at the 5% significance level (F = 2.29, p-value = 0.0763). Instead, the joint significance of the 19 regional dummies[14] included in the regression, capturing the region of birth, cannot be rejected (see the bottom of Table II). Furthermore, the coefficients on these dummies (not shown) reveal a pattern: compared to those born in the central and southern regions, consumers born in the North are somewhat less risk-averse. One possible interpretation is that the dummies are capturing regional differences in culture, which are transmitted by upbringing. Inquiring further into the role of other demographic variables such as family

[13] Notice that if R is measured with error an estimate of relative risk aversion would also be measured with error. However, in this case the error term would depend on wealth as well, which would result in biased parameter estimates in an equation for relative risk aversion. This is a reason for neglecting relative risk aversion in our analysis.

[14] The Italian territory is divided into 20 regions and 95 provinces. The latter correspond broadly to US counties. We will use the provincial partitioning in Section 8 where we look at the effect of background risk and liquidity constraints on risk aversion. For 41 observations, the place of birth of the household head is missing. Excluding these, the regression in column (1) estimated on the remaining 2,633 observations yields a coefficient on log(consumption) equal to -0.0348 (standard error: 0.0098).

size or education by including them in the regression is problematic since these variables are to some extent endogenous. Thus, the interpretation of their coefficients would be unclear; accordingly we elect to focus only on a set of controls that are not subject to the respondent's choice.

The last two columns of the table show a set of results based on total and financial wealth, instead of consumption.[15] The basic findings are confirmed: absolute risk aversion is a decreasing and convex function of wealth (total or financial) but CRRA preferences are strongly rejected. The elasticity of absolute risk aversion to total wealth and to financial wealth is lower than to consumption, but not greatly so, suggesting similar degrees of aversion to consumption, wealth and financial risk. In all cases most of the variance of observed risk aversion is left unexplained, as the low R^2s show, suggesting that most of the taste heterogeneity across consumers cannot be accounted for by the set of variables that we can observe. The estimated relation between absolute risk aversion and consumer resources is consistent with Arrow's (1965) hypothesis that absolute risk aversion should decrease as wealth increases while relative risk aversion should increase: but the latter is consistent with the former only if the wealth elasticity of absolute risk aversion is less than one, as our findings indicate.

6 Robustness

6.1 Endogenous consumption and wealth

The results we have reported thus far do not take into account that consumption and wealth are endogenous variables which are themselves affected by consumer preferences. Thus, the estimated coefficients are potentially affected by endogeneity bias. The direction of the bias, however, is not clear a priori. If more risk-averse individuals choose safer but less rewarding prospects, they may end up being poorer and consume less than the less risk-averse. This would tend to overstate the negative relation between risk aversion and wealth. However, if the more risk averse are also more prudent, ceteris paribus, they will compress current consumption, save more and end up accumulating more assets.[16] In this case, our estimates of the relationship

[15] The samples used for these regressions is somewhat smaller than that used in the first two columns because of some zero and negative wealth observations.

[16] Risk aversion and prudence usually go together. If the utility function is exponential, absolute risk aversion and prudence are measured by the same parameter; if it is CRRA,

between risk aversion and wealth will be biased towards zero, which could partly explain why, in our estimates, risk aversion declines only slightly as wealth increases. On the other hand, the relation between risk aversion and consumption would be biased downward, implying that the true elasticity of absolute risk aversion to consumption is even less than what we obtain.

To address this issue we re-estimate equation (10) with instrumental variables. Finding appropriate instruments for consumption and wealth is no easy task. We rely on three sets of instruments. First, we rely on characteristics of the father of the household head, namely his education and year of birth, on the ground that wealth is likely to be correlated with that of one's family, proxied by the father's education and cohort. Second, we use measures of windfall gains, such as a dummy for the house being acquired as a result of a bequest or gift, the value of transfers received and an estimate of the capital gain on the house since the time of acquisition. Third, we use consumer characteristics that are likely to be correlated with wealth and consumption and are at least partly exogenous, such as education attainment and education interacted with age. Overall, the instruments explain about 30 percent of the variance of (log) consumption, almost 24 percent of the variance of (log) total wealth and about 16 percent of that of (log) financial wealth.

Table III shows the results when consumption, total wealth and financial wealth are used. We report the specification including age, gender, number of siblings and region of birth. Since for some consumers the information on their parents' characteristics or on some other instruments were missing the sample size is smaller by about 200 observations with respect to the OLS estimates.[17] In all cases the instrumental variables estimates result in a larger estimate (in absolute value) of the parameter β. For instance, when consumption is used as a measure of consumer's endowment the estimated β is 0.0756, more than twice as the OLS estimate. But the difference with respect to the OLS estimates does not change the previous conclusions: absolute risk aversion is a decreasing function of wealth and both CARA and CRRA preferences are rejected. Figure 2 reports the risk aversion-consumption relation when the OLS and IV estimators are used.

To further verify the robustness of our results, we have estimated our basic instrumental variable specification on a restricted reference sample of

absolute prudence is equal to absolute risk aversion + $1/c$; if preferences are described by equation (11) absolute prudence is equal to absolute risk aversion + β/c.

[17] Differences in results between the OLS and the IV estimates are not due to differences in sample. Using OLS on the smaller sample yealds estimates of the parameters similar to those in Table III.

1,767 households. This was obtained from the sample of 2,449 risk-averse consumers for which the information on the set of instruments is available by excluding households with total wealth below 20 million lire (511 observations), corresponding to twice our hypothetical lottery prize (in fact, it could be argued that responses are affected by the size of the lottery that individuals face); those who reported zero financial assets (123 observations),[18] in an attempt to take into account mis-reporting and underreporting of assets; and those who are either too young or too old (below age 21 or above age 75, 48 observations) on the ground that difficulties in grasping the lottery question should probably be concentrated at the two tails of the age distribution. The results based on consumption as scale variable, shown in the last column of Table III, confirm those obtained on the whole sample, shown in the first column.[19]

6.2 Sample selection

One additional concern with our results, given the relatively small number who answered the lottery question, is that non-response may be systematically related to attitudes towards risk. To address this problem we have re-estimated our model using Heckman (1976) two-step estimator correcting the second stage estimates of risk aversion for selection bias. In the first-stage probit equation, we have included, in addition to all the exogenous second-stage regressors (i.e. gender, age, number of siblings and region of birth), a set of explanatory variables that are likely to affect willingness to participate in the survey, such as education, education interacted with age, age squared, marital status, household size, number of earners and employment sector. The results, not shown for brevity, confirm the estimates of Tables II. The Mills ratio has a small coefficient and is only statistically significant in one case, when total wealth is used as the scale variable, implying

[18] In the survey, financial assets include also currency, in addition to bank and postal deposits and bonds and stocks.

[19] Another possibility is that the *quality* of our indicator of risk aversion depends on the size of the lottery relative to the resources of the consumer; in particular, it may be that for some consumers the lottery is too large making them unwilling to accept. Notice that the framing of the question is such that the consumer chooses the maximum loss he is willing to incur, which he can choose as small as he wishes. To address this issue further we have estimated our basic equation splitting the sample below and above median wealth. Results are very similar to those for the whole group. The OLS estimate of β is 0.0291 for households with below median wealth and 0.0376 for those with above median wealth. Both coefficients are statistically significant but we cannot reject the hypothesis that they are equal.

that self selection is unlikely to be a problem.

6.3 Quantile regressions

Finally, we check our results for departure of the distribution of residuals from symmetry by estimating least absolute deviation regressions using Amemyia (1982) two-stage estimator to account for endogeneity bias. Given the considerable heterogeneity in the measure of risk aversion, quantile regressions may also help give a sense of the determinants of risk aversion for the median consumer. And unlike the conditional mean, quantiles are invariant to monotonic transformations such as taking logs, as in equation (10), our empirical specification. Table IV shows the estimates for the specification with only exogenous demographic characteristics when consumption, total wealth and financial wealth are alternatively used to measure endowment. The main results of the OLS and IV estimates reported in Tables II and III are confirmed: for the median consumer absolute risk aversion declines with endowment and the sensitivity is somewhat larger for consumption than for wealth. Furthermore, the estimates of the β, though significantly different from zero (contrary to CARA preferences) are far below 1 in absolute value (rejecting CRRA utility).

7 Risk aversion, background risk and liquidity constraints

In a world of incomplete markets the attitude towards risk, measured by willingness to accept a fair lottery, may vary between consumers not only because of differences in taste parameters but also because they face different environments. In Section 2 we have discussed how risk aversion can be affected by background risk. Willingness to accept the survey lottery may also be affected by the possibility of liquidity constraints (Gollier, 2000). In fact, liquidity constraints act to reduce the horizon, thus limiting the opportunities to time diversify any risk currently taken, accentuating risk aversion. In this Section we test for these effects, starting with background risk.

7.1 Risk aversion and background risk

To test whether attitudes towards risk are affected by the presence of uninsurable, independent risks we need a measure of background risk. We use two proxies. The first is obtained from a special section of the 1995 SHIW in which half the households were asked a set of questions designed to elicit the perceived probability of being employed over the twelve months following the interview and the variation in earnings if employed. We use this information to construct measures of the first two moments of the distribution of future earnings following the methodology developed in Guiso, Jappelli and Pistaferri (1998). The second proxy relies on per capita GDP at the provincial level for the period 1952-1992, which we use to compute a measure of the variability of GDP in the province of residence.

As to the first measure, it is based on four questions on labor income expectations that are asked to half of the overall sample in a special section of the 1995 SHIW questionnaire. The selection of the sub-sample is random, based on whether the year of birth of the household head is even or odd. The employed and job seekers are asked to report, on a scale from 0 to 100, their chances of keeping their job or finding one in the next twelve months. Each individual assigning a positive probability to being employed is then asked to report the minimum and the maximum income he expects to earn if employed and the probability of earning less than the midpoint of the distribution of future earnings conditional on working. These data can be combined to obtain an estimate of expected earnings and their variance, which we use as a gauge of background risk. Since these questions were addressed to only half the sample and of those interviewed only 4,218 individuals (in 2,605 households) replied, when combined with the information on the lottery, we end up with a reference sample of 1,264 observations, of which 999 are risk-averse; excluding observations with missing values for the explanatory variables we end up with a reference sample of 896 consumers. The survey elicits information on the probability distribution of individual earnings, rather than household income. Since the lottery question is put to the household head, to match background risk with the risk-aversion measure we rely on heads' expectations. This raises two issues. First, for the variance of the earnings of the household head to be able to identify background risk, income risk must be exogenous. However, as we show later, the attitude towards risk affects job choice, with more risk-averse individuals choosing safer occupations. This tends to produce a negative correlation between earnings risk and risk aversion, counteracting the background-risk effect. Second, the household head's willingness to bear risk may well depend on the exposure to risk of other family members. If the head's job choice is not affected (or is only slightly affected) by the earnings risk faced by other members of the household - for instance because occupational choice takes place before meeting the spouse - then the earnings riskiness of the other members can help identify the effect of background risk. Thus, we will provide also estimates that take the variance of the earnings of the spouse and of the an additional earner in the household as explanatory variables.

Table V reports the estimation results. The first column adds to our basic specification the variance of the earnings of the household head. If the household head does not work, we set his or her earnings variance equal to zero. The estimated coefficient of the variance is statistically significant but is negative, which suggests that the self-selection effect dominates any background-risk effect. To try to identify the latter, in the second column, in addition to the household head's earnings variance, we add that of the spouse and of an additional earner. If the spouse does not work, we set her or his earnings variance equal to zero. Similarly, if there is no additional earner we replace his earnings variance with a zero. Interestingly, while the own-earnings variance still carries a negative and significant coefficient, the variance of the earnings of the additional earner and of the spouse have a positive impact on the degree of risk aversion, consistent with the background risk explanation. Their precision, however, is too low to permit conclusions. Furthermore, if occupational choices within the household are a collective decision, the riskiness of the occupation of one member may affect the job choice of another and our estimates would be biased downward.[20]

To address this problem we use the second indicator of background risk, obtained from time series data on provincial GDP. For each province we regress the (log) GDP on a time trend and compute the residuals. We then calculate the variance of the residuals and attach this estimate to all households living in the same province. This is an estimate of aggregate risk and should be largely exogenous unless risk-averse consumers move to provinces with low variance GDP (we return to this issue shortly). The third column reports the estimates using this measure as a proxy for background risk and consumption as scale variable. The degree of risk aversion is increasing in the variance of per capita GDP in the province of residence even after controlling for region of birth, and the effect is statistically significant. This

[20] If, as suggested in footnote 12, the square of the coefficient of variation of future income is used to measure background risk, results (a part from scale) would be unaffected. The parameter of the (square of) coefficient of variation of the survey respondent is -0.2582 (standard error: 0.128) and those of the spouse and other earner 0.1477 and 0.0413, respectively (standard errors: 0.215 and 0.110, respectively)

is consistent with background risk models: increasing our measure of background risk by one standard deviation increases absolute risk aversion by about 1 percent. If risk-averse individuals tend to move from high-variance to low-variance provinces this would tend to generate a negative correlation between risk aversion and background risk; thus the above is, if anything, a lower bound of the true effect of background risk. The estimates are robust to a cluster correction for province effects as well as to the use of wealth instead of consumption to measure household resources.[21] Furthermore, as shown in the fourth column they are robust to the presence of outliers: using LAD estimates, the coefficient of background risk is somewhat lower but more precisely estimated.

7.2 Risk aversion and liquidity constraints

To test whether absolute risk aversion varies with the probability of facing liquidity constraints, we rely on information contained in the SHIW on the availability of loans to households. All surveys since 1989 ask two questions aimed at measuring households' access to the credit market. The first indicates whether a consumer is a "discouraged borrower", the second whether he is a "turned-down applicant"'. We classify consumers as liquidity-constrained if they respond positively to at least one of the following questions: "During the year did you or a member of the household think of applying for a loan or a mortgage to a bank or other financial intermediary, but then changed your mind on the expectation that the application would be turned down?", "During the year did you or a member of the household apply for a loan or a mortgage to a bank or other financial intermediary and have your application turned down?". In each year about 2 percent of the sample households were discouraged from borrowing (i.e. answered "yes" to the first question), while 1 percent were turned down ("yes" to the second question). To obtain an estimate of the probability of being liquidity-constrained, we compute the share of households in a province that are discouraged borrowers or rejected applicants by pooling the survey years 1989, 1991, 1993 and 1995. This procedure can be justified on the grounds of systematic differences in access to credit between local credit markets. Such differences can result from differences in the degree of judicial enforce-

[21] When the cluster correction is used the point estimate (which is obviously unchanged) of the coefficient of the variance of the shocks to provincial GDP retains its significance. When wealth is used instead of consumption, the point estimate is somewhat greater (1.29) and estimated with greater precision.

ment, which, as is shown by Generale and Gobbi (1996), varies considerably across Italian provinces. Alternatively, as is argued by Guiso, Sapienza and Zingales (2000), they may reflect differences in the degree of social capital and trust across provinces. The credit rationing indicators based on the provincial averages exhibit considerable variation, ranging from 0.3 to 8.8 percent, with a median of 2.1 percent.

The estimation results reported in Table VI refer to the basic specification including the exogenous demographic characteristics and using consumption to measure individual endowment. If total or financial wealth is used similar results obtain. The instrumental variable estimates reported in column 1 show that our measure of the probability of being credit constrained has a positive and statistically significant effect on absolute risk aversion: increasing the probability of liquidity constraints from the median to the 95th percentile increases risk aversion by 3.5 percent. Correcting the residuals for provincial cluster leaves the result unchanged. The second column shows that conclusions are unaffected if the conditional median rather than the conditional mean is estimated. However, the latter estimates show that the effect of liquidity constraints on the degree of absolute risk aversion is smaller for the median consumer than for the average consumer. Still using the LAD estimator, in the third column we replace the provincial measure of the probability of liquidity constraints with a dummy equal to 1 for households that are either discouraged or turned-down in 1995. This indicator is likely to be a less precise proxy for the probability of liquidity constraint since some households that are good candidates for being turned down or being discouraged applicants did not actually apply or think of applying in 1995; consequently, they will be classified as non-liquidity-constrained, leading to less precise estimates. The estimated liquidity constraint coefficient is positive and significant, and the point estimate implies that if the median consumer is liquidity constrained his degree of risk aversion is about 1 percent greater than otherwise. Similar results (not reported) obtain if the indicator of discouraged borrowers and that of rejected applicants are entered separately, though in this case the dummy for rejection carries a coefficient that is twice as high as for discouraged borrowers.

One final concern with these results is that the indicator of liquidity constraints may be proxying for background risk. If intermediaries are more conservative in their lending policy in provinces where income is more volatile, then the individual probability of being turned down is higher in areas with high background risk. To check this possibility, in the last column we add to the set of explanatory variables our measure of the variance of provincial GDP. Results are robust to this modification: compared to column 2, the coefficient on liquidity constraints is slightly reduced, consistent with the idea that income uncertainty and liquidity constraints may be positively correlated, but retains its statistical significance. Furthermore, the variance of provincial GDP also carries a positive and statistically significant coefficient, which is only slightly smaller than that reported in Table V, column 4. In sum, this evidence suggests that both liquidity constraints and background risk forge consumers attitudes towards risk.

8 Wealth, risk loving and risk aversion

Thus far we have limited the analysis to the determinants of the degree of risk aversion among individuals who are risk-averse. As Table I shows, while the vast majority of the sample are risk-averse, 17 percent of the respondents are willing to pay the expected value of the lottery - i.e. are risk-neutral - and 5 percent are ready to pay more than the expected value: that is, they are risk lovers. In this section we look at the determinants of the regime of attitude towards risk. To this purpose, we construct a discrete variable that is equal to 3 for the risk-averse, 2 for the risk-neutral, and to 1 for the risk lover. We then estimate an ordered probit model relating this variable to a set of observable exogenous individual characteristics and to measures of consumer endowment. Results are shown in Table VII. The regressions in the first and second column include as explanatory variables only strictly exogenous characteristics, plus a linear and quadratic term of the consumer endowment. The risk attitude regime is independent of age (or, equivalently, year of birth) and of the number of siblings but is affected by gender, with men less likely to be risk-averse than women, which is consistent with some of the findings of Schubert, Brown, Gysler and Brachinger (1999). Furthermore, region of birth is systematically related to being risk-averse, risk-neutral or risk lover: those born in the southern regions are more likely to be risk-averse than those born in the North. However, since a large fraction of those born in an area continue to live there the region of birth may be not only picking up feature of preferences that can be traced back to upbringing but also the impact of the culture and tastes of the present area of residence. To assess the relative importance of these two effects we add a set of dummies for region of residence. The estimates - not reported for brevity - of the coefficients on both sets of dummies are statistically significant with a p-value below 0.03 for the dummies for the region of birth and near zero for the dummies for the region of residence.[22] This suggests that even controlling for the area of residence having been born in the South makes individuals more likely to be risk-averse. At the same time, the simple fact of living in the South increases the likelihood of risk aversion, independently of place of birth. Thus, individual preferences appear to be shaped by the culture and tastes both of the place of birth and of the area of residence.

The regressions in the table also include a second order polynomial in a measure of household endowment: in the first column we include the level of consumption; in the second, total wealth. The analysis suggests that the probability of being risk-averse is high but decreasing at low values of wealth and again high and increasing for high values, whereas it is low for values of wealth in between. These results are consistent with the model of Friedman and Savage (1948), which implies that the utility function may be concave (implying risk aversion) at very low and at very high levels of wealth and convex (or perhaps linear) at intermediate levels (implying risk loving or neutrality). This hypothesis reconciles the theoretical prediction that individuals should not enter fair lotteries, much less unfair ones, with the evidence that individuals (particularly low-income individuals) gamble and even purchase unfair lotteries. In addition, it is consistent also with the evidence that many consumers buy both lottery tickets and insurance.[23]

9 Predicting behavior with risk aversion

Attitudes towards risk should affect consumers' willingness to bear risk in a variety of situations. In this section we document that our measure of risk preferences does have predictive power with respect to consumer choices. If different jobs differ 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. Similarly, the willingness to hold riskier portfolios should be lower among risk-averse consumers than among the risk-neutral or risk-prone and among the former should be lower for those who dislike risk more strongly. Similar arguments can be made for the demand for insurance, the decision to migrate and the consumer health condition in so far as it depends on how cautious a consumer is. Table VIII checks these predictions.

[22] The hypothesis of equal coefficients cannot be rejected (p-value around 0.2).

[23] See Friedman and Savage (1948) for a thorough analysis.

9.1 Choice of occupation

Panel A of Table VIII reports the results of estimating probit regressions for occupation choices. We focus on the decision to be self-employed (first two columns) and to become a public sector employee (last two columns). All regressions include as controls the worker's age, number of siblings, household size and number of earners, dummies for gender, marital status, education, region of birth, and homeownership. The first column shows the regression for the whole sample including as explanatory variables a dummy for risk-averse consumers and a dummy for risk-neutral individuals. The benchmark is a dummy for risk-lovers. Risk-averse consumers are less likely than risk-lovers to be self-employed, and the coefficient is statistically significant at less than the 0.2 percent level. The coefficient on the dummy for risk-neutral consumers is almost half as great as that for the risk-averse indicator, but it is statistically significant only at the 9 percent level. These differences are economically relevant: being risk-averse rather than risk-lover lowers the probability of being self-employed by 8 percentage points, or 44 percent of the sample share of self-employed, suggesting that self-selection is indeed an important feature and thus supporting our interpretation in Section 7 of the negative correlation between the degree of absolute risk aversion and 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. 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 2.4 percentage points (14 percent of the unconditional probability).

The third and fourth columns estimate the probability of being a public sector employee on the whole sample and the sample of risk-averse individuals. Consistent with the general perception that public jobs are more secure,[24] our estimates show that risk-averse individuals are more likely than the risk-lovers to work in the public sector. Compared with risk-prone, the risk-averse have a 7-point higher chance of being in the public sector (corresponding to 25 percent of the unconditional probability). Furthermore, 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

[24] In Italy for instance, public sector employees cannot be laid off except in a few extreme circumstances of misconduct.

employee by 6.6 percentage points (about 24 percent of the sample mean), suggesting again that risk preferences have a strong impact on job choice.

9.2 Asset allocation

The second panel of Table VIII shows the effect of the risk attitude indicators and of the degree of risk aversion on the ownership and portfolio share of risky financial assets, i.e.e private bonds, stocks and mutual funds. When estimated on the whole sample of 3,439 observations, the probability of holding risky financial assets (first column) is less than half as great among risk-averse consumers as among the risk-neutral and lower still compared with risk lovers. Compared to the latter, risk-averse investors have a 6.7-point lower chance of holding risky securities, corresponding to 40 percent of the sample mean (equal to 16.9 percent). Among risk-averse consumers (second column), the probability of holding risky assets is a decreasing function of our measure of absolute risk aversion, even though the coefficient is not precisely estimated. A one standard deviation increase in absolute risk aversion lowers the probability of holding risky assets by 2.4 percentage points (14.2 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 financial assets). A second order polynomial in total financial assets is added to the right hand side controls. This set of estimates confirms the probit estimates: the share invested in risky assets is significantly lower among the risk-averse than among the risk-neutral or risk lovers and among the risk-averse it declines as the degree of risk aversion increases, consistent with the predictions of the classical theory of portfolio choice.

9.3 Insurance demand

The third panel of Table VIII reports the estimates of the effect of risk attitudes on the demand for life, health and casualty insurance, respectively. Standard insurance theory predicts that, provided that insurance premiums depart from fair pricing, more risk-averse individuals should buy more insurance. We test this prediction by focusing on the sub-sample of risk-averse individuals and estimate 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 earnings are included among the right hand side variables. In all cases we find that more-risk averse consumers buy less insurance, though the effect is significant for health and for theft and casualty insurance but not for life insurance. This finding contradicts 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 for more risk-averse consumers, who would then reduce insurance demand. This explanation relies on risk aversion being observable. Another, perhaps more convincing, explanation is that individuals can undertake activities to self-insure against the consequences of adverse events. This leads them to replace market insurance with self-insurance. It can be shown that if market insurance is sold at highly unfair prices, while self-insurance is relatively efficient - 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.[25]

9.4 Moving decisions and health status

Compared with staying in the region of birth, moving to another region entails undertaking a risky prospect. Thus, one expects that risk-averse (or

[25] 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 $L' < 0, L'' > 0$). Let a be the insurance coverage, Π 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 :

$pu(w - (1-a)L(s) - s - a\Pi) + (1-p)u(w - s - a\Pi)$

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

$a = 1 - (1/\theta L(s)) \log(\mu(1-p)/(1-\mu p))$ [from the foc on a, call this the aa locus]

$a = 1 + (1/\mu p L'(s))$ [from combining the foc on s and a, call this the ss locus]

Both functions are downward sloping with slopes $da/ds_{|aa} = (L'/\theta L^2) \log(\mu(1-p)/(1-\mu p))$ and $da/ds_{|ss} = -(L''/p\mu L'^2)$, respectively. The relative slope of the two loci depend on the efficiency of self insurance (how fast the loss declines with s, i.e. on L') and on the efficiency of market insurance, i.e. on μ. If self insurance is relatively efficient (L' is large in absolute terms) and market insurance is relatively inefficient (μ 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. By international standards departures from fair insurance are stronger in Italy and this may perhaps explain the difference between our results and those of Barsky et al. (1997) who find a positive effect of a measure of risk aversion on the demand for insurance in the US.

more risk-averse) individuals are less likely to be movers than the risk-neutral or lovers (or the less risk averse). Also, since risk-averse consumers should avoid risky behavior and act more prudently, they should have better health status. In panel D of Table VIII we test these two implications, starting with the first. The first column estimates 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 the 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. Compared to the risk lovers, the probability of being a mover is lower among the risk-neutral and even lower among the risk-averse, and the latter effect is statistically significant at the 0.7 percent level (the former is significant at the 13 percent level). Being risk-averse rather than risk lover reduces the probability of being a mover by 8 percentage points, more than 40 percent of the value of the unconditional mean. The second column reports the estimates for the restricted group of risk-averse individuals. The degree of risk aversion has a negative effect on the probability of being a mover, but its coefficient is not statistically significant. The last two columns report probit regressions for the probability of being affected by a chronic disease. When the total sample is used the estimates indicate that both the risk-averse and the risk-neutral are significantly less likely than the risk lovers to incur a chronic disease, with an effect equal to 10 percentage points, about 37 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 no predictive power on health status.

Overall, the evidence in Table VIII implies that attitudes towards risk have considerable explanatory power for several important consumer decisions. Thus, our evidence suggests that leaving out measures of risk aversion in empirical analysis of households behavior is likely to be a substantial problem.

10 Conclusions

In this paper we construct a direct measure of absolute risk aversion using the 1995 Bank of Italy Survey of Household Income and Wealth. The measure is based on a simple yet powerful question on the maximum price a consumer is willing to pay to enter a lottery. Its main advantage is that it does not rely on any assumption as to the form of individual utility. As a consequence, it applies not only to the risk-averse, but also to risk-neutral and risk-prone individuals, providing a point estimate of the degree of risk aversion for each individual in the sample. This estimate has then been used to gather direct evidence on the nature of the relationship between individual risk predisposition on the one hand and individual endowment, demographic characteristics and measures of uninsurable risk exposure on the other.

So far there is very limited evidence on the sign of the relationship between risk attitude and wealth and no evidence at all on the curvature of this relationship. Our findings suggest that among risk averse consumers the degree of absolute risk aversion is decreasing in individual endowment - thus rejecting CARA preferences but the elasticity to consumption is far below the unitary value predicted by CRRA utility. Consequently, absolute risk tolerance is a concave function of consumer endowment. These findings are consistent with the empirical evidence that young households take on relatively less portfolio risk than more mature households. In fact, according to Gollier and Zeckhauser (1997), the concavity of absolute risk tolerance is a necessary and sufficient condition for such behavior to be optimal.

Individual risk aversion appears also to be characterized by a substantial amount of unexplained heterogeneity. In fact, consumers attributes and demographic characteristics are of little help in predicting the degree of risk aversion. The only exception is the region of birth, which is likely to capture regional differences in risk predisposition and culture that are transmitted with upbringing within the family.

In a world of incomplete markets, individual attitudes towards risk may vary across households not only because of differences in tastes, but also because of differences in the environment. We address this issue by analyzing the impact that various measures of liquidity constraint and earnings uncertainty have on the degree of risk aversion. We find unequivocal evidence that credit market imperfections and employment-related risk shape consumers attitudes to accept risk.

Finally, we verify the predictive power of our measure of risk attitude with respect to consumer choices, such as occupation, portfolio composition, insurance, health-related conduct and moving decisions. Apart from market insurance, which might be replaced by self-protecting actions, for virtually every type of behavior we investigate, our risk attitude measure makes qualitatively correct predictions: as expected, potentially risky conduct is negatively correlated with risk aversion and effects are economically important. Overall, these results suggest that attitudes towards risk have considerable explanatory power for a number of important consumer decisions. Given the amount of heterogeneity that characterizes risk aversion and its unobservable nature, our evidence suggests that excluding measures of risk aversion from the empirical analysis of household behavior is likely to constitute a serious problem. As a consequence, an effort should be made to elicit indicators of attitudes towards risk of the sort used in this paper.

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 first 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 of the survey covers about 8,000 households, though at times specific parts of the questionnaire are asked to only a random sub-sample. Each wave surveys a representative sample of the Italian resident population. Sampling occurs in two stages, first at municipality level and then at household level. Municipalities are divided into 51 strata defined 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 office records. They are defined as groups of individuals related by blood, marriage or adoption and sharing the same dwelling. The head of the household is conventionally identified 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 Definitions of the variables'

In the empirical analysis all demographic variables - age, education, gender, number of brothers and sisters, marital status, region of birth, occupation type and sector - refer to the household head.

Bond, stock and mutual fund ownership and amounts: Households are asked first to report ownership of the specific financial instrument and then to report in which bracket (out of 14) the amount held falls. Asset amounts are then imputed assuming that the household holds the mid-point of the interval. It is clear from this procedure that while ownership data only suffer from non-reporting, the information on the amounts is affected by imputation errors. For details on how financial assets values are computed in the SHIW see Guiso and Jappelli (1999).

Consumption, net worth and financial wealth: Consumption is the sum of the expenditure on food, entertainment, education, clothing, medical expenses, housing repairs and additions, and imputed rents. It also includes expenditures on durable goods (vehicles, furniture and appliances, art objects). Net worth is the total of financial and real assets net of household debt. Financial wealth is given by the sum of cash balances, checking accounts, savings accounts, postal deposits, government paper, corporate bonds, mutual funds and investment in fund units and stocks. Real assets include investment real estate, business wealth, primary residence and the stock of durables.

Discouraged borrowers and rejected loan applicants: The following questions have been asked in each wave of the survey since 1989: "During the year did you or a member of the household think of applying for a loan or a mortgage to a bank or other financial intermediary, but then changed your mind on the expectation that the application would be turned down?" Those answering yes to this question are classified as "discouraged borrowers". Those answering yes to the following questions are classified as "rejected" consumers: "During the year did you or a member of the household apply for a loan or a mortgage to a bank or other financial intermediary and have it turned down?" To compute the probability of liquidity constraints we determine the share of consumers in a province that were turned down or discouraged borrowers using all waves since 1989. We than attach this fraction to each household living in the same province.

Education of the household head's father : This variable is originally coded as: no education (0); completed elementary school (5 years); completed junior high school (8 years); completed high school (13 years); completed university (18 years); graduate education (more than 20 years). For each of the five categories, we define a dummy variable indicator.

Education of the household head : This variable is originally coded as: no education (0); completed elementary school (5 years); completed junior high school (8 years); completed high school (13 years); completed university (18 years); graduate education (more than 20 years). We define three indicators: the first is equal to 1 when education is up through junior high school (zero otherwise); the second is equal to 1 when it is through high school (zero otherwise) and the third is equal to 1 for university or more (zero otherwise).

Indicators of background risk : We use two indicators, the variance of expected earnings at the individual level and the variance of shocks to per capita GDP in the province of residence. The first is computed directly from survey questions asking: a) the probability of keeping one's job (if employed) or of finding one (if unemployed) in the twelve months following the interview; b) the minimum and maximum earnings expected conditional on being employed. After making some assumptions on the shape of the on the job probability distribution of earnings and on the value of the unemployment compensation to each individual in the sample, Guiso, Jappelli and Pistaferri (1998) use this information to recover measures of expected earnings and their variance. The second indicator is obtained from time series data on per capita GPD at the province level from 1952 to 1992. For each province we regress the logarithm of per capita GDP on a linear trend and compute the variance of the residuals from this regression. We than impute this variance to all households leaving in the same province.

Indicators of health : The two indicators consist in dummy variables based on the answers to the questions on chronic diseases and permanent disabilities.

Risk aversion : the Arrow-Pratt measure of absolute risk aversion and the risk attitude indicators are obtained from a direct question to a survey lottery. Each survey participant is offered a hypothetical lottery and is asked to report the maximum price that he would be willing to pay in order to participate. The wording of the lottery question and the methodology implemented to compute risk aversion are described in the text.

Year of birth of the household head's father: this variable is used to define ten-year intervals, starting from 1900. An additional interval is defined for those born in or after 1950. We then construct six indicators: the first is equal to one if the household head's father was born between 1900 and 1909, the second is one if he is born between 1910 and 1919, and so on.

Windfall gains measures : six measures are used. The first is a dummy for home ownership as a result of gift or bequest. The second is the sum of the settlements received related to life (excluding annuities), health and theft and casualty insurance. The third measure is the sum of severance payments, unemployment benefits and redundancy allowance. The fourth is the sum of any additional financial aid from central or local governments, other public institutions or charities. The fifth consists of gifts/monetary contributions received from friends or family living outside the household dwelling. The last instrument is a measure of windfall gains (or losses) on housing constructed using time series data on house prices at the province level over the years 1965-1994. For homeowners, we compute the house price change since the year when the house was acquired or since 1965 if it was acquired earlier. Otherwise, we attach to non-homeowners the house price change since the year when they started working or since 1965. This can be justified on the ground that they start saving to buy a home as soon as they start working.

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Table I

Descriptive statistics for the total sample, for the sample of respondents and various sub samples

The figures for consumption, total wealth and financial wealth are the sample median expressed in million lire. The variable "North" includes Piemonte, Valle d'Aosta, Lombardia, Trentino Alto Adige, Veneto, Friuli Venzia Giulia, Liguria and Emilia Romagna; "Center" includes Toscana, Umbria, Marche, Lazio, Abruzzo and Molise and "South" includes all the remaining regions. Low risk averse are those who are willing to bet at least 1 million lire, which is the median of the bet distribution.

Variable	Sample of respondents						Total sample
	Risk neutral	Risk averse			Risk lovers	Total	
		Low	High	Total			
Age	47.26	47.43	50.47	48.74	49,66	48.29	54.23
Male %	82.64	79.19	77.24	78.35	91.01	79.76	74.35
Years of education	10.06	9.78	8.11	9.07	10.37	9.30	8.03
Married %	80.90	78.59	77.85	78.27	82.01	78.92	72.50
No. of earners	1.83	1.87	1.81	1.85	1.83	1.84	1.80
No. of components	3.20	3.20	3.20	3.20	2.95	3.19	2.94
No. of siblings	2.24	2.44	2.60	2.51	2.06	2.44	2.50
Area of Birth: North	40.77	41.71	31.45	37.30	55.98	38.90	37.43
Center	23.20	19.79	24.82	21.95	14.13	21.74	24.75
South	36.03	38.51	43.73	40.75	29.89	39.37	37.82
Self-employed %	21.18	18.38	14.16	16.57	26.46	17.88	14.23
Public employee %	26.74	28.50	27.28	27.97	23.81	27.54	23.26
Value of Z	5.00	1.65	0.18	1.02	8.92	2.12	-
Abs. Risk aversion	0	0.178	0.200	0.187	-0.170	0.136	-
Rel. risk aversion	0	6.86	6.34	6.64	-7.75	4.73	-
Consumption	35.45	33.60	30.28	31.20	38.80	32.40	28.80
Financial wealth	18.79	15.78	6.58	11.27	46.73	13.39	10.39
Total wealth	213.15	183.21	127.41	158.98	72.87	173.15	155.85
N. of observations	576	1,523	1,151	2,674	189	3,439	8,135

Table II

Risk aversion, consumption and wealth: OLS estimates

The left-hand-side variable is the log of absolute risk aversion; *c* is expenditure on durable and non-durable goods; *w* is total household net worth and is equal to the sum of real wealth (housing, land and durable goods) and financial wealth net of debt; *wf* is household financial wealth. Regressions in column (2) to (4) include 19 dummies for the region of birth of the household head. Male is a dummy equal to 1 if the head is a male; age and number of siblings refer to the household head. Bootstrapped standard errors (based on 100 replications) are reported in parentheses.

Variable	(1)	(2)	(3)	(4)
Log(*c*)	-0.0349	-0.0314		
	(0.0110)	(0.0093)		
Log(*w*)			-0.0053	
			(0.0023)	
Log(*wf*)				-0.0143
				(0.0045)
Male		0.0032	-0.0018	0.0060
		(0.0093)	(0.0095)	(0.0115)
Age		0.0002	0.0004	0.0003
		(0.0003)	(0.0003)	(0.0003)
No. of siblings		0.0033	0.0032	0.0035
		(0.0015)	(0.0016)	(0.0017)
Constant	-8.2363	-8.3818	-8.6521	-8.5727
	(0.1114)	(0.1003)	(0.0398)	(0.0559)
Region of birth	N0	YES	YES	YES
No. of observations	2,674	2,633	2,515	2,316
Adjusted R^2	0.0061	0.0282	0.0243	0.0270
F test for region of birth = 0	-	7.99	6.99	3.62
(*p*-value)		(0.0000)	(0.0000)	(0.0000)
F test for $\beta = -1$	26,644.88	21,058.11	247,178.02	84,195.00
(*p*-value)	(0.0000)	(0.0000)	(0.0000)	(0.0000)

Table III

Risk aversion, consumption and wealth: IV estimates

The left-hand side variable is the log of absolute risk aversion; *c* is expenditure on durable and non-durable goods; *w* is total household net worth and is equal to the sum of real wealth (housing, land and durable goods) and financial wealth net of debt; *wf* is household financial wealth. All regressions include 19 dummies for the region of birth of the household head. Male is a dummy equal to 1 if the head is a male; number of siblings refers to the household head. The set of instruments includes dummies for the education of the household head, education dummies interacted with age, dummies for the education of the father of the household head and his year of birth; measures of windfall gains (a dummy for the house being acquired as a result of a bequest or gift, insurance settlements and other transfers, capital gains on the house since the time of acquis ition). The estimates in column (4) are conducted on a restricted sample obtained excluding households with total wealth below 20 million (593 observations), those who reported zero financial assets (133 observations), those with head aged less than 21 or above 75 (62 observations). Bootstrapped standard errors (based on 100 replications) are reported in parentheses.

Variable	(1)	(2)	(3)	(4)
log(*c*)	-0.0756			-0.0758
	(0.0196)			(0.0285)
log(*w*)		-0.0162		
		(0.0050)		
log(*wf*)			-0.0237	
			(0.0109)	
Male	0.0102	0.0023	0.0054	0.0108
	(0.0101)	(0.0121)	(0.0140)	(0.0140)
Age	0.0005	0.0009	0.0007	0.0003
	(0.0003)	(0.0003)	(0.0003)	(0.0003)
No. of siblings	0.0019	0.0014	0.0022	0.0030
	(0.0015)	(0.0018)	(0.0022)	(0.0023)
Constant	-7.880	-8.494	-8.4453	-7.8698
	(0.2086)	(0.0575)	(0.0966)	(0.3013)
Region of birth	YES	YES	YES	YES
No. of observations	2,449	2,347	2,170	1,767
Adjusted R^2	0.0173	0.0116	0.0146	0.0273
F test for region of birth = 0	2.84	3.77	2.74	2.05
(*p*-value)	(0.0001)	(0.0000)	(0.0001)	(0.0048)
F test for $\beta = -1$	1,573.32	20,447.59	5,814.95	957.62
(*p*-value)	(0.0000)	(0.0000)	(0.0000)	(0.0000)

Table IV

Risk aversion, consumption and wealth: 2SLAD estimates

The left-hand-side variable is the log of absolute risk aversion; *c* is expenditure on durable and non-durable goods; *w* is total household net worth and is equal to the sum of real wealth (housing, land and durable goods) and financial wealth net of debt; *wf* is household financial wealth. All regressions include 18 dummies for the region of birth of the household head. Male is a dummy equal to 1 if the head is a male; number of siblings refers to the household head. Columns (1) to (3) report 2-stages LAD estimates. The set of instruments includes dummies for the education of the household head, education dummies interacted with age, dummies for the education of the father of the household head and his year of birth; measures of windfall gains (a dummy for the house being acquired as a result of a bequest or gift, insurance settlements and other transfers, capital gains on the house since the time of acquisition). Bootstrapped standard errors (based on 100 replications) are reported in parentheses.

Variable	(1)	(2)	(3)
Log(*c*)	-0.0189		
	(0.0080)		
Log(*w*)		-0.0054	
		(0.0022)	
Log(*wf*)			-0.0093
			(0.0034)
Male	0.0031	0.0030	0.0044
	(0.0017)	(0.0013)	(0.0018)
Age	0.0002	0.0003	0 .0003
	(0.0001)	(0.0001)	(0.0001)
No. of siblings	-0.0003	-0.0005	-0.0006
	(0.0002)	(0.0003)	(0.0003)
Constant	-8.3687	-8.5020	-8.474
	(0.0789)	(0.0245)	(0.0307)
Region of birth	YES	YES	YES
No. of observations	2,449	2,449	2,449
Pseudo R^2	0.0136	0.0194	0.0199

Table V

Risk aversion and background risk

The left-hand-side variable is the log of absolute risk aversion; *c* is expenditure on durable and non-durable goods. All regressions include 19 dummies for the region of birth of the household head. Male is a dummy equal to 1 if the head is a male; number of siblings refers to the household head. In the first and second columns for the variable "earnings variance of the household head", we use either the variance of the household head's earnings and replace it with a zero if the household head is not working and the variance of his earnings is missing. A dummy for non-working household head is also included. In the second column, we also include the variance of the earnings of the wife and of an additional earner. If there is no wife or additional earner or if they do not work (and are not seeking work), the missing variances of their earnings are replaced with a zero. Dummies for non-working head, wife and additional earner are also included in the regression. In the last two columns the measure of background risk is the variance of the shocks to log(GDP) in the province estimated from annual data of provincial GDP over the period 1952-1992. The set of instruments includes dummies for the education of the household head, education dummies interacted with age, dummies for the education of the father of the household head and his year of birth; measures of windfall gains (a dummy for the house being acquired as a result of a bequest or gift, insurance settlements and other transfers, capital gains on the house since the time of acquisition). Bootstrapped standard errors (based on 100 replications) are reported in parentheses.

Variable	IV	IV	IV	2SLAD
Log(*c*)	-0.1030	-0.1044	-0.0765	-0.0202
	(0.0375)	(0.0416)	(0.0220)	(0.0059)
Earnings variance of household head	-0.0005	-0.0006	-	-
	(0.0002)	(0.0003)		
Earnings variance of spouse	-	0.0003	-	-
		(0.0004)		
Earnings variance of other earner	-	2.73e-06	-	-
		(0.0003)		
Variance of shocks to per capita GDP	-	-	1.0016	0.3296
			(0.4567)	(0.1136)
Male	0.0227	0.0287	0.0097	0.0029
	(0.0191)	(0.0195)	(0.0112)	(0.0017)
Age	0.0017	0.0024	0.0004	0.0002
	(0.0007)	(0.0008)	(0.0003)	(0.0001)
No. of siblings	0.0003	0.0004	0.0018	-0.0003
	(0.0026)	(0.0029)	(0.0015)	(0.0002)
Constant	-7.6627	-7.6771	-7.8733	-8.3571
	(0.3903)	(0.4313)	(0.2328)	(0.0624)
Region of birth	YES	YES	YES	YES
No. of observations	896	860	2,428	2,428
Adjusted R^2	0.0520	0.0600	0.0177	0.0150
(or Pseudo R^2 for the 2SLAD)				
F test for region of birth = 0	4.22	5.18	1.92	7.58
(*p*-value)	(0.0000)	(0.0000)	(0.0096)	(0.0000)
F test for $\beta = -1$	620.53	584.96	1,825.95	17,450
(*p*-value)	(0.0000)	(0.0000)	(0.0000)	(0.0000)

Table VI

Risk aversion and liquidity constraints

The left-hand-side variable is the log of absolute risk aversion; *c* is expenditure on durable and non-durable goods. All regressions include 19 dummies for the region of birth of the household head. Male is a dummy equal to 1 if the head is a male; number of siblings refers to the household head. In the first, second and fourth columns the probability of liquidity constraint is the provincial share of households that are discouraged borrowers or turned down applicants in the survey years 1989, 1991, 1993 and 1995; in the third column it is a dummy variable equal to 1 if the household was a discouraged borrower or a rejected loan applicant in 1995. In the last column the variance of shocks to per capita GDP is the variance of the shocks to log(GDP) in the province estimated from annual data of provincial GDP over the period 1952-1992. The set of instruments in the second column includes dummies for the education of the household head, education dummies interacted with age, dummies for the education of the father of the household head and his year of birth; measures of windfall gains (a dummy for the house being acquired as a result of a bequest or gift, insurance settlements and other transfers, capital gains on the house since the time of acquisition). Bootstrapped standard errors (based on 100 replications) are reported in parentheses.

	IV	2SLAD	2SLAD	2SLAD
Log(*c*)	-0.0752	-0.0191	-0.0197	-0.0197
	(0.0209)	(0.0064)	(0.0073)	(0.0052)
Probability of liquidity constraints	0.4801	0.1236	0.0092	0.1054
	(0.2195)	(0.0490)	(0.0043)	(0.0427)
Variance of shocks to per capita GDP	-	-	-	0.2973
				(0.1012)
Male	0.0101	0.0037	0.0033	0.0032
	(0.0102)	(0.0016)	(0.0016)	(0.0016)
Age	0.0005	0.0002	0.0002	0.0002
	(0.0003)	(0.0001)	(0.0001)	(0.0001)
Number of siblings	0.0019	-0.0004	-0.0003	-0.0004
	(0.0016)	(0.0003)	(0.0002)	(0.0003)
Constant	-7.8948	-8.368	-8.3606	-8.3629
	(0.2243)	(0.0688)	(0.0775)	(0.0536)
Region of birth	YES	YES	YES	YES
N. of observations	2,449	2,449	2,449	2,428
Adjusted R^2	0.0217	0.0143	0.0142	0.0155
(Pseudo R^2 for the 2SLAD estimator)				
F test for region of birth = 0	3.16	8.06	7.22	6.85
(p-value)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
F test for $\beta = -1$	1,605.23	23,387.70	17,723.67	17,680
(p-value)	(0.0000)	(0.0000)	(0.0000)	(0.0000)

Table VII

Regimes of attitudes towards risk

The left-hand-side variable is an indicator that is equal to 3 if the consumer is risk-averse, to 2 if he/she is risk-neutral and to 1 if he/she is risk-lover. *c* is expenditure on durable and non-durable goods; *w* is household net worth. All regressions include 19 dummies for the region of birth of the household head. Male is a dummy equal to 1 if the head is a male; age and number of siblings refer to the household head. Standard errors are reported in parentheses.

Variable	(1)	(2)
c	-9.05e-06	
	(2.77e-06)	
c^2	3.34e-11	
	(2.05e-11)	
w	-	-4.52e-07
		(9.92e-08)
w^2	-	7.27e-14
		(3.05e-14)
Male	-0.2603	-0.2717
	(0.0640)	(0.0636)
Age	0.0003	0.0022
	(0.0018)	(0.0018)
No. of siblings	0.0144	0.0133
	(0.0125)	(0.0125)
Region of birth	YES	YES
No. of observations	3,386	3,386
Pseudo R^2	0.0324	0.0342
F test for region of birth = 0	77.24	79.09
(*p*-value)	(0.0000)	(0.0000)
F test for exogenous	17.88	21.96
Characteristics = 0	(0.0005)	(0.0001)
(*p*-value)		

Table VIII

Predicting behavior with risk aversion

In panel A the left-hand-side variable is a dummy equal to 1 if the household head is a self-employed (first two columns) or a public employee (last two columns). In panel B, in the first two columns, it is a dummy equal to 1 if the household holds risky financial assets; in the last two columns it is the portfolio share of risky financial assets. Risky assets include private bonds, stocks and mutual funds. The share of risky assets is relative to total financial assets. In panel C the left-hand-side variable is the value of insurance premiums as a share of current consumption. We consider life (first column), health (second column) and theft and casualty insurance (third column). In panel D, in the first two columns, it is a dummy variable equal to 1 if the consumer lives in a region different from the one where he was born. In the last two columns it is a dummy equal to 1 if the household head is affected by a chronic disease. "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 5 million lire. "Risk-neutral" is similarly defined. "Absolute risk aversion" is the measure of absolute risk aversion discussed in Section 1. All regressions include as explanatory variables age, number of siblings, household size and number of earners, dummies for gender, marital status, education, region of birth and home ownership. The regressions in the last two columns of panel B also include a second order polynomial in financial assets, whereas those in panel C include second order polynomials in wealth and earnings. *t*-statistics are reported in parenthesis.

A: choice of occupation

	Self-employed (probit regression)		Public sector employee (probit regression)	
Variable	Whole sample	Sample of risk-averse	Whole sample	Sample or risk-averse
Risk averse	-0.3481	-	0.2407	-
	(0.1103)		(0.1133)	
Risk neutral	-0.2028	-	0.1284	-
	(0.1217)		(0.1245)	
Absolute risk aversion	-	-2.0056	-	22616
		(1.2469)		(1.2018)
No. of observations	3,382	2,631	3,382	2,631

B: demand for risky assets

	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	-0.4590	-	-0.2079	-
	(0.1103)		(0.0701)	
Risk neutral	-0.2225	-	-0.0717	-
	(0.1226)		(0.0774)	
Absolute risk aversion	-	-1.1494	-	-0.6894
		(1.3200)		(0.8909)
No. of observations	3,382	2,631	3,018	2,316

Table VIII : continue

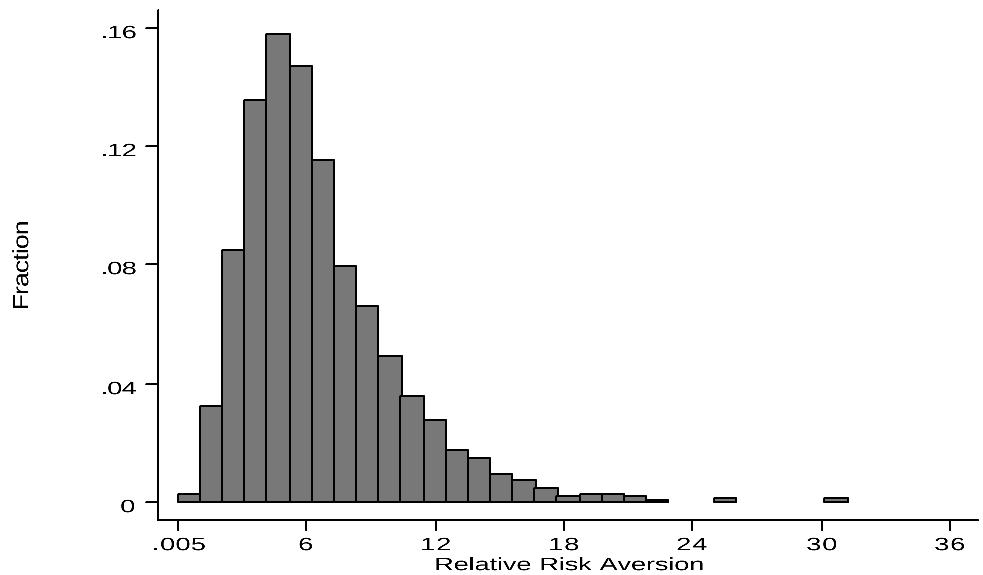
C: demand for insurance

	Insurance premiums as a share of consumption (Tobit regressions; sample or risk-averse)		
Variable	Life insurance	Health insurance	Theft and casualty insurance
Absolute risk aversion	-0.0249 (0.0854)	-0.0969 (0.0465)	-0.0792 (0.0340)
No. of observations	2,633	2,633	2,622

D: moving decision and health status (chronic disease)

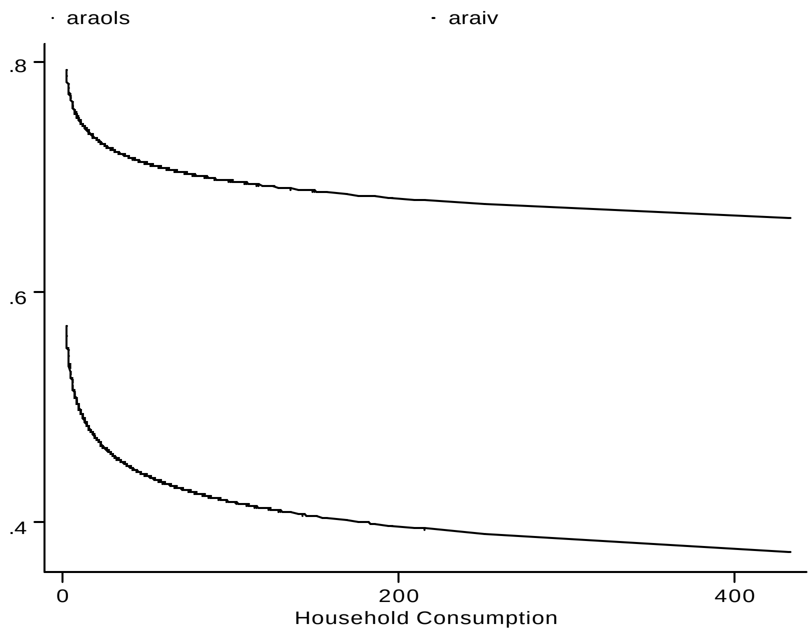
	Moving to another region (probit regressions)		Health (probit regression)	
Variable	Whole sample	Sample of risk-averse	Whole sample	Sample or risk-averse
Risk averse	-0.3062 (0.1136)	-	-0.3700 (0.1103)	-
Risk neutral	-0.1872 (0.1256)	-	-0.3950 (0.1241)	-
Absolute risk aversion	-	-0.6642 (1.2505)	-	1.3229 (1.3389)
No. of observations	3,382	2,631	3,382	2,631

Figure 1
Cross sectional distribution of relative risk aversion



Cross-sectional distribution of relative risk aversion

Figure 2
Risk aversion and consumer endowment



Risk aversion and consumer endowment