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Title: **Relative Risk Aversion Is Constant: Evidence from Panel Data**

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Relative Risk Aversion Is Constant: Evidence from Panel Data *

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Abstract

Most classical tests of constant relative risk aversion (CRRA) based on individual portfolio composition use cross sectional data. Such tests must assume that the distributions of wealth and preferences are independent. We use panel data to analyze how individuals' portfolio allocation between risky and riskless assets varies in response to changes in total financial wealth. We find the elasticity of the risky asset share to wealth to be small and statistically insignificant, supporting the CRRA assumption; this finding is robust when the sample is restricted to households experiencing 'large' income variations. Various extensions are discussed.

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1 Introduction

Assuming time-separable, homogeneous preferences characterized by constant relative risk aversion (CRRA) is a standard practice in macroeconomic and asset pricing models. The CRRA utility function has a scale invariance property: if investment opportunity sets are constant, (relative) risk premia do not change over time as aggregate wealth and the size of the economy increase.[1] An additional property is that if investors have the same coefficient of relative risk aversion but different wealth levels, they will allocate to risky assets the same fraction of their respective wealth; moreover, they can be aggregated into a single representative agent with the same utility function. This provides a justification for the use of aggregate, rather than individual consumption in the empirical appraisal of models studying intertemporal choices.

In recent years, the CRRA assumption has been questioned, in particular because the standard approach just described was unable to explain a number of empirical 'puzzles'. However, despite the analytic importance of risk aversion and the abundant debates the 'puzzles' have generated,[2] the empirical evidence regarding the actual shape of agents' preferences is scarce. Most empirical studies simply *assume* constant relative risk aversion.[3] What is known on how risk aversion changes with wealth comes mainly from the analysis of household-level data on asset holdings, and specifically from contributions like Friend and Blume (1975), Cohn et al. (1975), Blake (1996), Morin and Fernandez Suarez (1983) and Guiso and Paiella (2001) that study how portfolio composition changes with individual wealth. A important aspect of this approach is that in a context of recursive utility a la Epstein-Zin (1989, 1991), in which risk aversion and the intertemporal elasticity of substitution are governed by distinct parameters, portfolio composition only depends on risk aversion and not on the intertemporal elasticity of substitution,

[1]Grossman and Shiller (1982) show in a continuous-time model that this result generalizes to a model with uninsurable idiosynchratic risks if consumption and asset prices follow diffusion processes.

[2]See Kocherlakota (1996) for a beautiful summary.

[3]This is the case, for instance, of most studies based on consumption dynamics, which focus on the relationship between the rate of growth of consumption and real interest rates. See Mehra and Prescott (1985) and Hansen and Singleton (1982) for early analysis and Attanasio et al. (2002), Vissing Jorgensen (2002) and Attanasio and Vissing Jorgensen (2003) for recent contributions.

as demonstrated by Svensson (1989).[4] The approach is thus compatible with and complementary to the growing literature aimed at distinguishing between the two concepts (see Attanasio and Weber, 1989, for an early attempt, and Attanasio and Vissing-Jorgensen, 2003, and Gomes and Michaelides, 2005, for recent contributions).

Most works on portfolio composition, however, share a common weakness: they rely on *cross sectional* data on portfolio composition. If, however, preferences are heterogeneous, the cross sectional distribution of the share of risky assets in individuals portfolios depends not only on the shape of individual preferences but also on the joint distribution of wealth and risk aversion in the population under consideration. Disentangling the two effects is impossible in the absence of time variations. In a world in which all agents have CRRA preferences, but less risk averse agents are wealthier on average (say, because they have received high returns on previous risky investments), the cross sectional correlation between wealth and the share of risky assets in the portfolio is positive, a pattern usually associated with decreasing relative risk aversion (DRRA). We actually prove below that *any* given joint distribution of wealth and portfolio composition can be made compatible with an *arbitrary* form for individual preferences by the choice of an adequate joint distribution of wealth and preferences in the population. Since such a distribution is unobservable, cross sectional evidence alone tells exactly nothing on the shape of preferences. This conclusion is reversed if one is willing to make the additional assumption that the distribution of risk aversion is *independent* of wealth. Then the shape of preferences (or, technically, the function giving the share of risky assets for any given wealth level) can be recovered up to a scale normalization. However, the independence assumption is strong, ad hoc, and non testable.

Clearly, further progress on this issue requires richer data sets. The goal of this note is precisely to use panel data to revisit the problem. Panel data allow to estimate a first-difference model, hence to eliminate the effects of preference heterogeneity by concentrating on the impact of *changes* in an investor's wealth on the structure of the portfolio detained by this investor. One can also control for aggregate shocks that might affect asset prices, returns or volatility, and condition on current and past risky asset holdings,

[4]This property may however fail to hold when the investment opportunity set is itself stochastic and non iid, see Bhamra and Uppal (2006) (we thank Tano Santos for this reference).

since entry/exit decisions are likely to involve issues other than the attitude towards risk, such as fixed costs of participation (see Paiella, 2007, and Vissing-Jorgensen, 2003). Finally, the availability of detailed information on socio-demographic characteristics allows us to control for life-cycle changes affecting directly both portfolio shares and wealth levels.[5] In summary, panel data allow to disentangle two phenomena - the variation of risk aversion with wealth at the individual level and the population-wide correlation between wealth and preferences - that are indistinguishable on cross sectional data. With such data, one can directly test for CRRA; and if CRRA is not rejected, one can then estimate the correlation between individual wealth and individual relative risk aversion.

Our first finding is that individuals' relative risk aversion is indeed constant. We find no significant response of portfolio structure to changes in financial wealth. Our coefficient estimates are very small and precisely estimated; our conclusions are robust to various extensions (for instance considering only agents experiencing 'large' wealth variations) and to the introduction of different sets of controls.

A second finding is that the inclusion of business equity in our measure of an investor's risky assets reverses our conclusion: we find evidence of a positive elasticity of risky asset shares to wealth. Further investigation suggests that the main explanation for this result is the illiquidity of business equity holdings. Indeed, when considering agents who simultaneously hold business equity and risky financial assets, we find that increases in wealth are associated with a raise in the share of business equity but also with a significant *decline* in the share of other risky financial assets, suggesting the type of portfolio reallocation implied by theory in the presence of illiquid business equity holdings. Our evidence thus supports the *business equity puzzle* discussed by Moskowitz and Vissing-Jorgensen (2002). Finally, when housing in included in the risky wealth measure, the impact of wealth variations over the share of risky assets becomes significantly negative. However, whether housing, as an asset, should be considered as risky or safe is somewhat unclear.

Finally, our approach allows to independently test for the CRRA assump-

[5] After having completed this paper, we became aware of a recent work by Brunnermeier and Nagel (2005) adopting an approach similar to ours. However, the main focus of the two papers is distinct. Brunnermeier and Nagel use a panel of US households to test for wealth dependent risk aversion. In addition to testing the CRRA hypothesis, we provide a formal proof of non-identification of the form of individual preferences from cross-sectional data and estimate the cross-sectional distribution of risk aversion.

tion *and* to identify the joint distribution of wealth and risk aversion. The knowledge of this distribution is important per se, if only because it plays a key role in the cost-benefit analysis of any policy aimed at reducing risks or improving insurance possibilities at the individual level (see Chiappori, 2006, for a precise discussion). Our first, robust finding is that the distribution of relative risk aversion across households is heterogeneous.[6] Secondly, assuming that agents face identical investment sets, the distribution of the shares of risky assets coincides with that of the risk aversion coefficients up to a multiplicative factor which in turn depends on the financial characteristics of the market portfolio. Using a rough estimation of this factor, we can recover an approximation of the joint distribution of wealth and risk aversion of households with positive risky asset holdings. In particular, we find a significant correlation between wealth and the share of risky assets, suggestive of a negative correlation between risk aversion and wealth. Hence, in our data, cross-sectional regressions of portfolio shares on wealth would lead to the spurious conclusion that relative risk aversion is slightly decreasing. However, the coefficient, although significantly different from zero, is small; the independence assumption can thus be seen as a good approximation.

The rest of the paper is organized as follows. Section 2 provides a formal proof of non identification from cross sectional data. Section 3 sets out our empirical strategy. Section 4 describes the data. Section 5 presents and discusses the empirical results.

2 Identifying preferences From Cross Sectional Data: a Formal Analysis

A negative result We begin by showing that without a priori restrictions on the joint distribution of wealth and preferences, the form of individual preferences simply cannot be recovered from cross sectional data. In fact, any form of individual preferences is compatible with any observed, joint distribution of wealth and risky asset shares provided that one can freely choose the joint distribution of wealth and preferences. To substantiate this claim, we shall take an arbitrary, continuous family of individual preferences, and

[6] This result is in line with a number of other studies, for instance Barski et al. (1997), Guiso and Paiella (2001), Halek and Eisenhauer (2001), Cohen and Einav (2005) and Chiappori and Salanié (2006).

we shall show how to construct a joint distribution of wealth and preferences that would generate any given joint distribution of wealth and risky assets shares in the population.

Consider an economy with a continuum of individuals endowed with some wealth w and whose preferences, denoted $\mathcal{P}_\lambda$, can be indexed by a single parameter λ (whose support is normalized to be $(0,1)$). We first impose a monotonicity assumption on the family of preferences:

Assumption M (Monotonicity): *Risk aversion is monotonic in λ, in the sense that whenever $\lambda' > \lambda$, the preferences indexed by λ' are less risk averse than those indexed by λ in the Arrow-Pratt sense.*

The demand side of this economy is thus fully defined by the family $(\mathcal{P}_\lambda, \lambda \in (0,1))$ and the joint distribution of wealth and preferences, i.e. of (λ, w).

The economy has one riskless and one risky asset; the expected return on the risky asset is strictly larger than that on the riskless asset. The optimal portfolio of an individual with wealth w and preferences $\mathcal{P}_\lambda$ includes a proportion of risky asset, which we denote by $\alpha(\lambda, w)$. By standard results, α is increasing in λ. We make the following assumption:

Assumption CFS (Continuity and Full Support): *The function $\alpha(\lambda, w)$ is continuous; moreover, for any w,*

$$\begin{aligned} \lim_{\lambda \to 0} \alpha(\lambda, w) &= 0; \\ \lim_{\lambda \to 1} \alpha(\lambda, w) &= +\infty. \end{aligned}$$

In words, Assumption CFS requires that the family $(\mathcal{P}_\lambda, \lambda \in (0,1))$ is continuous and large enough to include a wide range of risk aversion levels (preferences must tend to risk neutrality when λ tends to one, and to infinite risk aversion when λ tends to zero). For instance, the family of CRRA (resp. CARA) functions with a coefficient of relative (resp. absolute) risk aversion equal to $-\log \lambda$ satisfies both assumptions.

Monotonicity and full support imply that the function α is invertible in λ; we can define its inverse β by

$$\alpha[\beta(a, w), w] \equiv a.$$

Any given joint distribution of wealth and preferences generates a joint distribution of wealth and shares of risky asset in the population under consideration. The latter distribution is empirically observable; i.e., for each individual, one can observe both her wealth and the share of it she invests in the risky asset. Let $f(w)$ denote the marginal distribution of w in the population, and $F(a,w)$ the cumulative distribution of a conditional on w:

$$F(a,\bar{w}) = \Pr[\alpha \leq a \mid w = \bar{w}].$$

Our first claim is the following:

Proposition 1 *Take an arbitrary family of preferences $(\mathcal{P}_\lambda, \lambda \in (0,1))$ satisfying Assumptions M and CFS. For any given, joint distribution of wealth and risky asset shares, defined by F and f, we can construct a joint distribution of wealth and preferences, defined by a density $\phi(\lambda, w)$, that generates it.*

Note that the one-dimensionality of the preference distribution should be seen as a constraint imposed on the construction; obviously, increasing the space of possible distributions (for instance by allowing multi dimensional heterogeneity) can only facilitate our task.

We now proceed to show the Proposition. Note, first, that the marginal of ϕ with respect to wealth must coincide with f. Moreover,

$$\begin{aligned} \Pr[\alpha \leq a \mid w = \bar{w}] &= \Pr[\lambda \leq \beta(a,\bar{w}) \mid w = \bar{w}] \\ &= \frac{\int_0^{\beta(a,\bar{w})} \phi(\lambda,\bar{w})\, d\lambda}{\int_0^1 \phi(\lambda,\bar{w})\, d\lambda}. \end{aligned} \tag{1}$$

Defining Φ by

$$\Phi(\lambda, w) \equiv \int_0^\lambda \phi(l,w)\, dl,$$

Φ must satisfy

$$\Phi(1,w) = f(w),$$

and (1) becomes

$$\Phi[\beta(a,w), w] = f(w) F(a,w).$$

The solution is thus

$$\Phi(\lambda, w) = f(w) F[\alpha(\lambda, w), w],$$

or equivalently

$$\begin{aligned}\phi(\lambda, w) &= \frac{\partial \Phi(\lambda, w)}{\partial \lambda} \\ &= f(w) \frac{\partial F[\alpha(\lambda, w), w]}{\partial \alpha} \frac{\partial \alpha(\lambda, w)}{\partial \lambda}.\end{aligned}$$

Since the joint distribution of preferences and wealth is unobservable, we conclude that it is impossible to recover the form of individual preferences from cross-sectional data. The variation of risk aversion with wealth at the individual level cannot be disentangled from the population-wide correlation between risk aversion and wealth. It follows that an empirical analysis based on cross sectional data must rely on assumptions regarding either the shape of preferences or the correlation between wealth and risk aversion. In the next subsections we briefly review these two approaches.

The case of known preferences Fist, let us assume that the form of preferences (as summarized by the function the function $\alpha(\lambda, w)$) is known. Then the previous argument shows that the joint distribution of preferences and wealth is exactly identified. For instance, if agents have VNM preferences characterized by CRRA utilities, then

$$\alpha(\lambda, w) = A(\lambda),$$

so that

$$\beta(a, w) = B(a),$$

where $B = A^{-1}$. It follows that Φ is characterized by:

$$\Phi(\lambda, w) = f(w) F(A(\lambda), w).$$

Note, however, that since this procedure works for any type of preferences, the assumption made regarding the shape of preferences is not testable from such data.

Identification under independence Alternatively, one may make assumptions on the joint distribution of wealth and preferences. Consider, for instance, the following:

Assumption I (Independence): *The distribution of risk aversion and wealth are independent:*

$$\phi(\lambda, w) = \psi(\lambda) f(w), \quad \forall(\lambda, w).$$

Under Assumption I, (1) becomes:

$$F(a, \bar{w}) = \Pr[\lambda \leq \beta(a, \bar{w}) \mid w = \bar{w}] = \Pr[\lambda \leq \beta(a, \bar{w})].$$

Clearly, the distribution of λ is arbitrary: if its CDF is Λ, the family of preferences under consideration can equivalently be indexed by λ or by $\lambda' = \Lambda(\lambda)$, and λ' is uniformly distributed over $[0, 1]$, We can thus normalize the indexation by assuming, without loss of generality, that λ is uniformly distributed over $[0, 1]$. It follows that

$$F(a, \bar{w}) = \beta(a, \bar{w}),$$

which shows that β, hence α, can be non parametrically identified from the quantiles of the conditional distribution of shares. Hence:

Proposition 2 *Under assumptions M, CFS and I, the function α, which gives the share of risky assets as a function of wealth and the parameter λ, is exactly identified up to a normalization of the parametrization.*

In words: while the shape of individual preferences was arbitrary without the independence assumption, it is identified with it.

There are however two problems with the independence assumption. One is that it is not testable: *any* observed distribution F can be rationalized from well chosen preferences (i.e. functions α or β). Secondly, there exists strong theoretical reasons to doubt it should hold. If some agents are less risk averse than others, they will be more willing to hold risky portfolios or engage into risky, entrepreneurial activities. If, as it can be expected, risk is associated with higher expected returns, these agents should on average end up being wealthier, although their distribution of wealth should be more dispersed than among more risk averse investors. One can thus expect a negative correlation between wealth and risk aversion. Clearly, however, the theoretical argument just sketched says nothing on the magnitude of the correlation, which remains an empirical issue.

3 Empirical strategy

The main consequence of the previous argument is that in the absence of specific (and untestable) assumptions on the joint distribution of preferences and wealth, panel data are needed to assess the form of individual preferences. Clearly, with time variations our non identification result does not hold. More precisely, CRRA exhibits a property that is easy to test empirically; namely, controlling for the financial characteristics of the market portfolio, the share of an individual wealth invested in risky assets should not vary with the person's wealth. Further, it follows from the previous arguments that if the CRRA assumption is not rejected, then a cross sectional analysis may provide an estimation of the joint distribution of wealth and risk aversion.

In practice, consider the approximation used by Friend and Blume (1975). According to this model, and assuming no taxes and that all assets are liquid and can be traded at no cost in any quantity, the optimal investment in risky assets of investor h can be approximated by the following formula:

$$\alpha_h = \frac{1}{\gamma_h} \frac{E\left(r_m - r_f\right)}{\sigma_m^2}, \tag{2}$$

or equivalently

$$\log \alpha_h = \log \frac{E\left(r_m - r_f\right)}{\sigma_m^2} - \log \gamma_h. \tag{3}$$

Here, α_h is the share of wealth invested in risky assets; γ_h is Pratt's measure of relative risk aversion, which is defined as $W_{h,t}\left[-U''\left(W_{h,t}\right)/U'\left(W_{h,t}\right)\right]$, and can be interpreted as the wealth elasticity of the marginal utility of wealth; r_m and σ_m^2 denote the return and the variance of the return on the portfolio of risky assets, and r_f is the riskless interest rate. Given estimates of α_h and the market price for risk, (2) can be used to estimate the coefficient of relative risk aversion for investor h.

An important aspect of (3) is that the financial characteristics of the risky asset enter the log share additively. Empirically, the impact of aggregate shocks affecting the return and/or the variance of the risky portfolio can therefore be captured through yearly dummy variables.

The main insight of the test is that if γ_h remains constant as $W_{h,t}$ varies, so does α_h. This is the basis for our econometric specification, which relies on the following discrete-time counterpart of (3):

$$\log(\alpha_{h,t}) = \beta_0 + \beta_1 \log(W_{h,t}) + \beta_2 X_{h,t} + u_h + v_{h,t}, \tag{4}$$

where $\alpha_{h,t}$ is investor's h risky wealth share at time t; $W_{h,t}$ is the sum of her risky and riskless wealth; $X_{h,t}$ is a vector of control variables; u_h captures any time-invariant unobserved heterogeneity in preferences, including risk aversion; and $v_{h,t}$ is a random disturbance uncorrelated with $W_{h,t}$, $X_{h,t}$ and u_h. This framework is flexible enough to allow for the differences in the risky asset shares to reflect differences in preferences and in socioeconomic characteristics.

In practice, the vector $X_{h,t}$ consists of two types of controls. First, it contains individuals' specific (time-varying) characteristics that may affect the risky asset share as they proxy for changes in risk aversion, related for example to life-cycle or changes in household composition. If they are correlated with changes in wealth, omitting such factors will result in biased estimates of β_1. Second, it includes a full set of time dummies that capture aggregate shocks to wealth and asset prices.

The coefficient β_1 should be interpreted as the average elasticity of the risky asset share to wealth over time. If households exhibit constant relative risk aversion, this elasticity should be zero. Note, however, that, in the line of the previous section, β_1 cannot be estimated on cross sectional data. If preferences for risk are heterogeneous and the heterogeneity is a function of wealth (so that the distribution of u_h is non degenerate and correlated with $W_{h,t}$), then a regression of the type (4) performed on cross sectional data yields a biased estimate of β_1 because the cross-sectional error term $u_h + v_{h,t}$ is correlated with the regressor $W_{h,t}$.

Therefore, we take first difference of equation (4) and focus on:

$$\Delta \log(\alpha_{h,t}) = \beta_1 \Delta \log(W_{h,t}) + \beta_2 \Delta X_{h,t} + \Delta v_{h,t}. \tag{5}$$

Taking first differences removes any observed and unobserved time-invariant heterogeneity in preferences and individual characteristics. Then the estimate of the β_1 coefficient is unbiased, which allows to consistently test the CRRA assumption.

4 Data

For the estimation we use data from the Survey of Household Income and Wealth (SHIW), a large-scale household survey run every two years by the Bank of Italy on a sample of about 8,000 Italian households.[7] The SHIW is available for several years and embraces at least two full business cycles. We

[7] This survey has been widely used in studies on saving behavior by Italian households. See, among others, the essays in the volume edited by Ando et al. (1994).

rely on the last 8 waves, which cover the period 1989-2004. Over that period, the questionnaire contents, survey methodology and variable definition are broadly homogeneous. The survey has a rotating panel component such that about half of the observations refer to households that have been interviewed in more than one year. The SHIW collects detailed information on Italian households' wealth, as well as portfolio allocation across a wide range of financial instruments, in addition to the standard set of socio-demographic and economic characteristic. The Appendix contains a more detailed description of the dataset and of the variables that we use in our study.

We define as risky assets the end-of-year holdings of stocks and shares, corporate bonds and mutual funds at their market (self-reported) value. In some instances we include also the value of business equity, which corresponds to the market value of the business, firm or practice (including equipment, stocks, goodwill, excluding land and buildings) of any household member. We then compute total wealth by adding bank and post deposits and government security holdings to our measure of risky assets. Throughout most of the analysis, we exclude home equity, whose impact is however discussed in section 5.3. To ensure comparability over time, we express all variables in euros and deflate them using the consumer price index based in 2004.[8]

Table I reports some descriptive statistics of the data. For our study we use only those households who participate in the survey for at least two adjacent years and who hold risky financial assets both at t and at $t-1$, which leaves us with an unbalanced panel of 3,785 observations on 1,332 households. It is evident from the comparison of the first two columns of the table that only a small fraction of households invest in risky assets and that the share has increased sharply over the 1990s, which is consistent with evidence presented in Guiso et al. (2002). Furthermore, among holders, over the same period, risky financial asset holdings have increased substantially both in absolute value and as a share of total financial assets. Since the end of the 1990s, the average share has fluctuated around 60 percent. Including business equity in the definition of risky assets leads to a larger data set as many business equity holders do not invest in other risky financial assets. For this sample, risky asset holdings are larger and have accounted for around 70 percent of total wealth in recent years. The last set of columns focuses on the

[8] Since there is no information about asset purchases and sales, we cannot distinguish between portfolio changes due to price changes and due to active investment/disinvestment. The distinction might matter if one believed that household do not respond promptly to capital gains and losses due to, for example, transaction costs or limited attention.

few households holding both risky financial assets and business equity. These households are much wealthier and business equity absorbs over 50 percent of their wealth and the share has been relatively constant over time. Their risky financial assets holdings (not reported in the Table I) have increased over time and in recent years have accounted for almost 30 percent of wealth.

5 Results

5.1 Cross sectional analysis versus first-difference regression

Table II reports the results of the estimation of the regression in levels reported in equation (4), with risky assets consisting of just risky financial instruments. Column (1) reports our baseline specification, where we control only for aggregate shocks with year dummies. Standard errors are heteroskedasticity robust. If unbiased, the coefficient on $\log W_{h,t}$ would measure the average elasticity of risky asset shares to wealth. Our estimate is positive and statistically significant, implying a positive association between the level of wealth and the share invested in risky assets. This result is robust to the inclusion of a polynomial in the household's head age and of family size, reported in column (2), which are intended to capture life-cycle changes in wealth and asset allocation.

However, as mentioned, if risk aversion is heterogeneous and negatively correlated with wealth, failing to control for the heterogeneity results in a positive bias in the estimation. Taking first differences allows us to overcome this problem.

Table III reports the results of the estimation of the model in first-difference in equation (5). In the regression in the first column, the only controls that we include are year dummies. The point estimate of the coefficient of $\Delta \log W_{h,t}$ is small (half that in the cross sectional regression), and not significantly different from zero. In the specification reported in the second column of the table we include age and changes in family size. The coefficient of $\Delta \log W_{h,t}$ is unaffected. In columns (3) and (4), we verify the robustness of our results by estimating the model on restricted samples of observations. In column (3) we exclude the young, who might be subject to liquidity constraints, and the elderly, whose portfolio behavior seems to be quite different from that of the rest, especially of the working population (see

Hurd, 2001). We exclude also those with less than 5,000 euros of wealth (2 percent of the sample) and those whose risky asset share is below 3.5 percent (1 percent of the sample), because changes in portfolio composition for these households may be largely affected by transaction costs. The estimated elasticity decreases slightly, and remains statistically insignificant.

A natural concern, in this type of analysis, is that the absence of correlation may, as suggested by Vissing-Jorgensen (2002), reflect inertia in portfolio allocation, resulting from the absence of significant variation in the exogenous variable, coupled with fixed transaction costs and/or measurement errors. Assume most households in the sample experience little or no permanent income changes, so that most observed income variation results from minor and temporary shocks. In the presence of transaction costs, the asset portfolio will not be adjusted, and the coefficient of $\Delta \log W_{h,t}$ in our regression is biased toward zero. One way of (partially) avoiding this problem is to concentrate specifically on households experiencing significant changes in income. In column (4) we exclude household whose wealth changes by less than 25 percent. Again, our results are unchanged, suggesting that people who experience large income shocks do adjust their portfolio consistently with the predictions of economic theory. In column (5) we verify whether slow adjustments might bias our estimates by including in the regression the lagged change in wealth, $\Delta \log W_{h,t-1}$. The wealth effects on portfolio allocation remain statistically negligible. Finally, our results are robust to the introduction of additional controls, such as interactions between the wealth quartile dummies and the change in wealth.[9]

We conclude that on the sample of household holding a positive fraction of their wealth under the form of risky financial assets, the hypothesis of constant relative risk aversion is not rejected by the data.

5.2 Net equity in private business

There are reasons to expect that business equity holdings may differ from the other risky assets in the portfolio. Private business equity is in general less liquid and less divisible. Furthermore, there is evidence that those who hold business equity tend to invest substantial amounts in a single privately held firm and their portfolios are little diversified (see Moskowitz and Vissing-Jorgensen, 2002).

[9] The regressions are available upon request.

Tables IV and V repeat the analysis in levels and first-differences using a measure of risky wealth that includes the holdings of net equity in private business. The estimation of the model in levels, reported in Table IV, points towards a positive and statistically significant relationship between wealth and portfolio allocation. The estimated coefficient is over three times that from the regressions that do not include business equity, and the conclusion is valid for both the whole sample and the restricted one that excludes the young, the elderly and those with negligible wealth or with very small shares of risky assets. Interestingly enough, the positive, statistically significant association remains when taking first differences, with an estimated elasticity of 0.077 for the whole sample and 0.109 for the restricted one (Table V, columns 1 and 2).

It thus appears that when business equity is included, increases in net wealth are associated with an augmentation of the share of risky assets in the portfolio. This positive and large wealth effect can be read either as evidence of decreasing relative risk aversion or as an illustration of the business equity puzzle pointed out by Moskowitz and Vissing-Jorgensen (2002). A natural explanation of the puzzle relies on agents' inability to adjust their investment, due to the indivisibility of their business equity holding, its lack of tradeability, or to the desire to keep a significant fraction of the corresponding property rights.

In order to check the validity of this explanation, we consider a subsample of agents holding *both* business equity and 'standard' risky financial assets. The positive association remains, both in cross section and in first difference, although the point estimates are smaller (see column 3). More interestingly, if we consider independently the share of business equity (column 4) and that of risky financial assets (column 5), we see that the positive correlation results in fact from the aggregation of two opposite effects. While the share of business equity increases with wealth, the proportion of other risky assets decreases significantly. Part of the latter effect may be attributed to 'mechanical' causes: a raise in total wealth increases the denominator of the ratio of risky financial assets to total wealth, hence tend to reduce the ratio even if the numerator is not changed. However, the actual magnitude of the change, as captured by the regression coefficient, is about twice as large as this mechanical effect would imply.[10] Our results thus support the second

[10]For agents holding both business and non business risky assets, the average share of risky financial assets to total wealth, is about 30%. Therefore a 1% increase in total

story: agents who experience sudden variations in the value of their business equity are indeed constrained by the illiquidity of their holdings, and tend to compensate it (when possible) by readjusting in the opposite direction their holdings of other risky assets.

Overall, the evidence in Table V seems to suggest that the wealth allocation behavior of most business equity holders cannot be completely understood within the framework provided by our model: there is indeed a business equity effect, which seems mostly related to the illiquid nature of these assets.

5.3 Housing and human capital

The inclusion of housing in the analysis raises various difficulties. In fact, from a conceptual perspective, housing is more than a standard asset: it is also a durable commodity providing consumption services. Furthermore, it is to some extent illiquid and indivisible. Finally, even if housing is viewed as an asset, the level of risk that should be associated with it is unclear. Real estate risk is neither absent nor perfectly correlated among individuals; as a consequence, the very definition of risky assets is delicate when housing equity is taken into account.

Nevertheless, since housing is a very important component of privately-held wealth and many households hold portfolios consisting of a house worth several times their net worth, in Table VI we report two sets of results on data that include housing and other real estate among wealth. In this instance, total wealth is measured as the sum of all financial assets and real estate net of any debt for the purchase or restructuring of real estate. We carry out our analysis on both the whole set of risky asset holders and on a restricted sample, which excludes the young and the elderly and those with less than 30,000 euros of wealth (bottom 5 percent of the wealth distribution). The first two columns of Table VI report the regressions in levels, the other two are based on first differences. The estimated elasticities turn out to be negative, large and significant, which confirms our concerns that investments in housing and in real estate cannot be considered as non risky assets.

Another extension that we have considered concerns human capital. Including human capital in the analysis is not straightforward, for (at least)

wealth should inflate the ratio by .3 percentage point, while the (precisely estimated) effect reported in Table V is close to .6.

two reasons. First, while the average return on human capital investment has been often estimated, much less is known on the corresponding risk, and especially about its correlation with financial risks. Secondly, the approach we use relies on the assumption that assets under consideration are freely tradable, which hardly applies to human capital. This problem is standard in the literature; existing approaches generally assume that human wealth is riskless and freely tradable. Under these simplifying assumptions, equation (2) applies to total wealth and the regression equations must be modified to include a set of variables that allow for changes in the composition of human and non-human wealth, along the lines of Brunnermeier and Nagel (2005). This does not change our results.

5.4 The distribution of risk aversion

An interesting property of (3) is that the financial characteristics of the portfolio enter additively into the formula. If agents face the same market portfolio, the log normalized excess return term $\log \frac{E\left(r_m - r_f\right)}{\sigma_m^2}$ is identical for all households in any given year. It follows that for the set of households who hold a positive fraction of their wealth in risky assets, the distribution of $\log \gamma_h$, the log of relative risk aversion, can be deduced from that of the log share of risky assets through a shift in the mean. Equivalently, the distribution of shares identifies that of risk aversion up to a scale factor, equal to the ratio $\frac{E\left(r_m - r_f\right)}{\sigma_m^2}$. Moreover, one can test the stability of that distribution over time.

Participation to financial markets in Italy has been far from constant over the period considered. The proportion of households in the sample who invest a positive fraction of their wealth in risky financial assets has increased steadily from about 5 percent at the end of the 1980s, to over 20 percent at the end of last decade. Since 2000, it has been fairly constant around 25 percent.[11] This upward trend in participation has been recorded for several other countries (see Guiso et al., 2002). A country-specific factor that has contributed to this evolution is given by the large-scale privatizations that started in 1993-94 and that have risen the stock market capitalization from around 10 percent of GDP in 1993 to over 70 percent in 2000. Privatizations

[11] The participation rates are somewhat lower in our data which are drawn from a panel, whose representativeness tend to diminish over time.

were heavily advertised, which has lowered the information costs of stock market investment and encouraged participation.

The rapid increase in the number of households holding risky financial assets in the 1990s is likely to have been associated to significant changes in the composition of the population of asset holders. However, the three waves since 2000 seem pretty stationary. The distribution of log shares over the period is given in Figure 1. We do indeed see a stabilization of the shape after 2000; a Kolmogorov-Smirnof test does not reject the equality of the distributions in 2000, 2002 and 2004. The distribution is neither normal nor log normal (the distribution of the log is skewed). The corresponding distribution of risk aversion is given by Figure 2.

This distribution has been rescaled, since it is estimated only up to a multiplicative factor. As a rough calibration, we have taken the expected excess return and volatility to be at their realization on the period, i.e. $E\left(r_m - r_f\right) \approx .04$ and $\sigma_m \approx .2$, so that the ratio $\frac{E\left(r_m - r_f\right)}{\sigma_m^2}$ is calibrated at 1.

This evidence should be considered with some caution. Dealing with agents who invest only a small fraction of their financial wealth in risky assets is a difficult exercise, because transaction costs may play a major role in their case. Some results are indeed sensitive to the inclusion of these individuals. For instance, the mean risk aversion in the population is at 4.2, but only at 2.5 is we disregard agents with a share of risky assets smaller than 6%. Moreover, the opposite truncation may also take place. Almost no agent has a ratio of risky assets larger than one, which may be reflect the presence of borrowing constraint. The quantiles of the distribution are probably more robust. The median is estimated at 1.7, irrespective of whether the holders of small shares are included or not, and 25% of the population has a coefficient of relative risk aversion larger than 3.

6 Conclusion

Our paper is aimed at recovering information on preferences under uncertainty from portfolio composition. We first argue that cross sectional data cannot provide information on the shape of individual preferences unless the distribution of preferences is assumed to be independent of wealth. From a theoretical perspective, the independence assumption is ad hoc, non testable, and unlikely to hold because the less risk averse investors are likely to receive higher returns on average, hence accumulate more wealth. However, theory has little to say on the expected magnitude of the correlation: this remains an empirical issue.

Our second claim is that the use of panel data allows precisely to disentangle the two issues at stake - i.e., the shape of individual preferences and the correlation between preferences and wealth. A simple regression in first differences allows to test for constant relative risk aversion: this property is not rejected. Then, cross sectional regressions allow to estimate the joint distribution of wealth and preferences. Based on these, we reach two main conclusions. First, the distribution of risk aversion is widely heterogeneous. Our calibration suggests that the median of the distribution of relative risk aversion could be slightly smaller than 2; however, a fourth of the population is found to exhibit a coefficient of relative risk aversion larger than 3. It should however be noted that the ratio under consideration is that of risky assets within the agents' *financial* wealth. The inclusion of other sources of wealth (housing, human capital) generates specific problems. Nevertheless, such a change may significantly reduce the ratio of risky assets, hence increase our risk aversion estimates. Secondly, the correlation between risk aversion and wealth is significantly negative but quantitatively small (our estimates imply a correlation between wealth and share of risky assets equal to 0.05). Hence the estimates obtained in previous, cross sectional works, which implicitly relied on an independence assumption regarding the joint distribution of wealth and risk aversion, probably provided good approximations of the true distribution.

Data Appendix

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. The survey is biannual with the exception of the 1998 wave which was run three years after the previous one. Each wave surveys a representative sample of the Italian resident population and covers about 8,000 households. 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 then 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.

Construction and definition of the variables

All wealth variables refer to the household as a whole and are self reported, end of year, market values. Risky financial wealth is defined as the sum of corporate bonds, investment funds, Italian shares of listed and unlisted companies and partnerships, managed savings, foreign securities and loans to cooperatives. Total financial wealth is given by risky financial assets plus bank and post office deposits, certificates of deposits, Italian government bills and bonds. The value of business equity is reported if: a) any member of the household reports to be a member of profession, a sole proprietor, a free lance, a contingent worker employed on none account, or if they are employed in a business owned in whole or in part by members of the household (all figures then refer to the household's ownership share), or if they are active shareholders or partners in a firm; and if: b) they report that the firm possesses machinery, equipment or other capital goods or other assets (e.g. licences and patents) with a market value. In these instances they are asked to report the market value of the firm (including equipment, stocks, goodwill, excluding land and buildings) or the market value of their share for partners and active shareholders. Finally, the value of real estate is given by the self reported market value of the principal residence, of other dwellings, buildings, agricultural and non-agricultural land. Information on total end of year outstanding debt are also available.

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Table I: Descriptive statistics

	SHIW panel	Holders of risky financial assets				Holders of risky financial assets and/or business equity				Holders of risky financial assets and business equity		
Year	# obs.	# obs.	Risky assets (a)	Total wealth (b)	(a)/(b)	# obs.	Risky assets (c)	Total wealth (d)	(c)/(d)	# obs.	Business equity (e)	(e)/(d)
1989	2,187	93	17	61	0.30	351	90	120	0.70	18	122	0.50
			(24)	(74)	(0.22)		(342)	(357)	(0.31)		(201)	(0.30)
1991	4,607	205	32	71	0.34	659	108	136	0.69	39	220	0.65
			(71)	(99)	(0.24)		(171)	(186)	(0.31)		(267)	(0.27)
1993	4,536	299	55	102	0.45	746	142	173	0.66	58	411	0.58
			(136)	(153)	(0.27)		(455)	(465)	(0.31)		(954)	(0.28)
1995	4,018	368	51	102	0.45	766	94	129	0.64	60	120	0.45
			(116)	(149)	(0.29)		(168)	(196)	(0.31)		(149)	(0.29)
1998	4,662	637	64	96	0.60	1,032	122	152	0.66	106	283	0.50
			(128)	(150)	(0.27)		(418)	(432)	(0.28)		(1,007)	(0.31)
2000	4,887	823	56	85	0.63	1,190	112	139	0.69	140	257	0.51
			(117)	(150)	(0.27)		(367)	(379)	(0.27)		(724)	(0.31)
2002	4,687	798	47	75	0.62	1,164	110	135	0.69	141	264	0.55
			(95)	(153)	(0.26)		(267)	(285)	(0.27)		(503)	(0.32)
2004	3,604	562	50	77	0.63	833	122	146	0.71	98	307	0.57
			(115)	(146)	(0.26)		(382)	(407)	(0.26)		(845)	(0.28)
Total	33,188	3,785	52	85	0.57	6,741	114	142	0.68	660	265	0.53
			(113)	(147)	(0.28)		(340)	(356)	(0.29)		(722)	(0.30)

Note: The number of observations refers to the number of households in the survey who are interviewed also in the previous and/or in the following survey. Amounts are in thousands of 2004 euros. Averages and standard deviations (in parenthesis) of individual values, per year. Total wealth in (b) consists of risky and riskless financial assets; total wealth in (d) consists of risky and riskless financial assets plus business equity.

Table II: OLS regressions of wealth shares in risky financial assets

	(1) All	(2) All	(3) Restricted sample	(4) Large changes	(5) Lagged changes
log ($W_{h,t}$)	0.035***	0.036***	0.010	0.043***	0.040***
	(0.013)	(0.013)	(0.015)	(0.015)	(0.015)
Year 1991	0.115	0.112	0.077	0.176	0.194
	(0.109)	(0.109)	(0.123)	(0.118)	(0.158)
Year 1993	0.415***	0.411***	0.278**	0.411***	0.460***
	(0.101)	(0.102)	(0.115)	(0.112)	(0.150)
Year 1995	0.361***	0.359***	0.316***	0.368***	0.419***
	(0.104)	(0.105)	(0.111)	(0.117)	(0.151)
Year 1998	0.800***	0.796***	0.671***	0.839***	0.830***
	(0.094)	(0.094)	(0.101)	(0.102)	(0.142)
Year 2000	0.896***	0.891***	0.779***	0.960***	0.917***
	(0.092)	(0.093)	(0.099)	(0.100)	(0.141)
Year 2002	0.894***	0.887***	0.737***	0.959***	0.908***
	(0.091)	(0.092)	(0.100)	(0.099)	(0.141)
Year 2004	0.895***	0.888***	0.753***	0.981***	0.849***
	(0.093)	(0.093)	(0.102)	(0.101)	(0.142)
Age	-	0.022***	0.010	0.021**	0.013
		(0.008)	(0.019)	(0.009)	(0.008)
$Age^2/100$	-	-0.021***	-0.010	-0.021**	-0.013*
		(0.007)	(0.021)	(0.009)	(0.008)
Family size	-	-0.021*	-0.030**	-0.010	-0.034**
		(0.012)	(0.014)	(0.014)	(0.014)
Constant	-1.877***	-2.346***	-1.614***	-2.487***	-2.111***
	(0.160)	(0.248)	(0.436)	(0.296)	(0.281)
Observations	3,785	3,785	2,216	2,712	2,347
R-squared	0.12	0.12	0.12	0.14	0.11

Note: The left-hand-side variable is the (log) share of wealth invested in risky financial assets. Column (3) is based on a sample that excludes those households whose head is aged less than 25 or over 60, whose wealth is less than 5,000 euros and whose risky asset share is less than 3.5 percent. Column (4) is based on a sample that excludes those whose wealth changes by less than 25 percent. 'Family size' denotes the number of persons (adults and children) in the household. Robust standard errors in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%.

Table III: OLS regressions of changes in the wealth shares in risky financial assets

	(1) All	(2) All	(3) Restricted sample	(4) Large changes	(5) Lagged changes
Δlog ($W_{h,t}$)	0.017	0.017	0.012	0.019	0.040
	(0.023)	(0.022)	(0.025)	(0.024)	(0.028)
Δlog ($W_{h,t-1}$)	-	-	-	-	0.011
					(0.025)
Year 1993	0.339***	0.339***	0.297*	0.322**	-
	(0.123)	(0.123)	(0.152)	(0.129)	
Year 1995	0.074	0.074	0.121	0.084	-0.413**
	(0.114)	(0.114)	(0.143)	(0.127)	(0.182)
Year 1998	0.488***	0.492***	0.391***	0.401***	-0.017
	(0.120)	(0.120)	(0.144)	(0.132)	(0.179)
Year 2000	0.081	0.082	0.140	0.018	-0.332*
	(0.104)	(0.104)	(0.126)	(0.106)	(0.173)
Year 2002	0.020	0.025	0.037	-0.044	-0.400**
	(0.103)	(0.103)	(0.126)	(0.105)	(0.168)
Year 2004	0.034	0.047	0.084	0.001	-0.452***
	(0.102)	(0.103)	(0.127)	(0.104)	(0.168)
Age	-	0.029***	0.043	0.036**	-0.005
		(0.011)	(0.030)	(0.014)	(0.013)
$Age^2/100$	-	-0.029***	-0.044	-0.035***	0.000
		(0.010)	(0.033)	(0.013)	(0.012)
Family size up	-	-0.015	0.082	-0.048	-0.133
		(0.093)	(0.088)	(0.120)	(0.117)
Family size down	-	0.092*	0.012	0.084	0.061
		(0.054)	(0.089)	(0.074)	(0.067)
Constant	-0.016	-0.702**	-1.058	-0.864**	0.676*
	(0.098)	(0.307)	(0.686)	(0.391)	(0.401)
Observations	2,424	2,424	1,392	1,620	1,063
R-squared	0.03	0.04	0.02	0.04	0.05

Note: The left-hand-side variable is the change in the (log) share of wealth invested in risky financial assets. Column (3) is based on a sample that excludes those households whose head is aged less than 25 or over 60, whose wealth is less than 5,000 euros and whose risky asset share is less than 3.5 percent. Column (4) is based on a sample that excludes those whose wealth changes by less than 25 percent. ‘Family size up’ and ‘Family size down’ are dummies that take on value 1 if the number of persons (adults and children) in the household increases or decreases between t-1 and t. Robust standard errors in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%.

Table IV: OLS regressions of wealth shares in business equity and /or risky financial assets

	(1)	(2)	(3)	(4)	(5)
	All	Restricted sample	Business equity holders with some risky financial assets		
	LHS: tot. risky wealth share	LHS: tot. risky wealth share	LHS: tot. risky wealth share	LHS: business equity share	LHS: fin. risky wealth share
log ($W_{h,t}$)	0.114***	0.130***	0.065***	0.165***	-0.309***
	(0.007)	(0.007)	(0.008)	(0.021)	(0.046)
Year 1991	-0.034	-0.006	0.160*	0.151	0.028
	(0.050)	(0.050)	(0.082)	(0.143)	(0.355)
Year 1993	-0.065	-0.057	0.099	-0.090	0.497
	(0.048)	(0.050)	(0.088)	(0.149)	(0.320)
Year 1995	-0.138***	-0.087*	0.026	-0.223	0.631**
	(0.052)	(0.051)	(0.094)	(0.157)	(0.308)
Year 1998	-0.018	-0.037	0.196**	-0.071	0.621**
	(0.046)	(0.046)	(0.079)	(0.137)	(0.299)
Year 2000	0.076*	0.054	0.215***	-0.078	0.786***
	(0.045)	(0.045)	(0.077)	(0.134)	(0.284)
Year 2002	0.094**	0.046	0.204***	-0.011	0.596**
	(0.045)	(0.045)	(0.077)	(0.131)	(0.285)
Year 2004	0.147***	0.101**	0.210***	0.020	0.691**
	(0.046)	(0.046)	(0.078)	(0.135)	(0.286)
Age	-0.001	-0.015	-0.004	-0.029	-0.013
	(0.005)	(0.011)	(0.008)	(0.019)	(0.032)
$Age^2/100$	-0.005	0.013	0.002	0.017	0.034
	(0.005)	(0.012)	(0.008)	(0.019)	(0.031)
Family size	0.030***	0.018**	0.002	0.034	-0.106**
	(0.008)	(0.009)	(0.012)	(0.030)	(0.053)
Constant	-1.768***	-1.583***	-1.027***	-1.771***	1.382
	(0.148)	(0.236)	(0.218)	(0.505)	(0.955)
Observations	6,741	4,455	555	555	555
R-squared	0.06	0.07	0.13	0.13	0.16

Note: The left-hand-side variable of the regressions of columns (1) through (3) is the (log) share of wealth invested in business equity and/or risky financial assets. The left-hand-side variable of the regressions of columns (4) and (5) is the (log) share of wealth invested in business equity and the (log) share of wealth invested in risky financial assets, respectively. Column (2) is based on a sample that excludes those households whose head is aged less than 25 or over 60, whose wealth is less than 5,000 euros and whose risky asset share is less than 3.5 percent. Columns (3) through (5) are based on a sample that excludes those without risky financial assets, those whose business equity holdings amount to less than 5000 euros and whose business equity share is less than 5 percent. 'Family size' denotes the number of persons (adults and children) in the household. Robust standard errors in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%.

Table V: OLS regressions of changes in the wealth shares in business equity and/or risky financial assets

	(1) All LHS: tot. risky wealth share	(2) Restricted sample LHS: tot. risky wealth share	(3) Business equity holders with some risky financial assets LHS: tot. risky wealth share	(4) LHS: business equity share	(5) LHS: fin. risky wealth share
$\Delta\log(W_{h,t})$	0.077***	0.109***	0.064***	0.226***	-0.543***
	(0.015)	(0.013)	(0.016)	(0.045)	(0.088)
Year 1993	0.044	0.008	-0.209**	-0.432**	0.777
	(0.056)	(0.056)	(0.088)	(0.219)	(0.541)
Year 1995	0.013	-0.012	-0.253***	-0.282	0.167
	(0.054)	(0.054)	(0.092)	(0.208)	(0.455)
Year 1998	0.131**	0.043	-0.064	-0.285	0.165
	(0.063)	(0.060)	(0.104)	(0.246)	(0.491)
Year 2000	0.064	0.071	-0.155**	-0.262	0.218
	(0.052)	(0.051)	(0.075)	(0.201)	(0.438)
Year 2002	0.021	0.004	-0.177**	-0.046	-0.178
	(0.051)	(0.049)	(0.077)	(0.189)	(0.430)
Year 2004	0.074	0.061	-0.167**	-0.083	0.083
	(0.051)	(0.050)	(0.076)	(0.188)	(0.422)
Age	0.017**	0.015	0.004	0.004	-0.033
	(0.007)	(0.016)	(0.012)	(0.031)	(0.053)
$Age^2/100$	-0.018**	-0.015	-0.005	0.000	0.012
	(0.007)	(0.018)	(0.011)	(0.031)	(0.050)
Family size up	-0.043	0.036	-0.114	0.078	-0.189
	(0.057)	(0.053)	(0.169)	(0.317)	(0.542)
Family size down	0.018	-0.036	0.003	0.086	0.045
	(0.040)	(0.049)	(0.050)	(0.136)	(0.234)
Constant	-0.408**	-0.374	0.098	-0.105	1.368
	(0.186)	(0.345)	(0.320)	(0.792)	(1.426)
Observations	4,354	2,853	332	332	332
R-squared	0.02	0.03	0.08	0.12	0.18

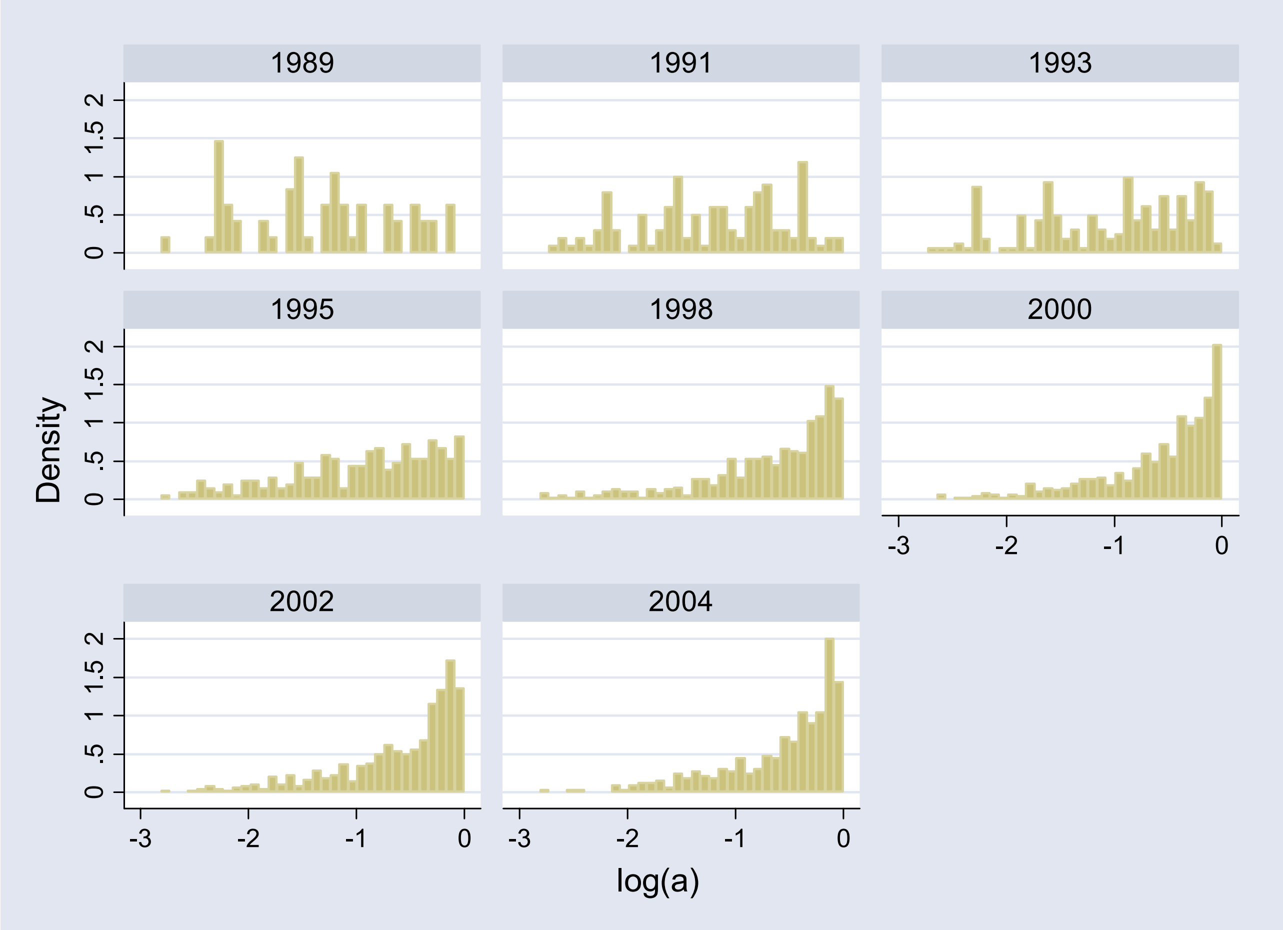
Note: The left-hand-side variable of the regressions of columns (1) through (3) is the change in the (log) share of wealth invested in risky financial assets. The left-hand-side variable of the regressions of columns (4) and (5) is the change in the (log) share of wealth invested in business equity and the change in the (log) share of wealth invested in risky financial assets, respectively. Column (2) is based on a sample that excludes those households whose head is aged less than 25 or over 60, whose wealth is less than 5,000 euros and whose risky asset share is less than 3.5 percent. Columns (3) through (5) are based on a sample that excludes those without risky financial assets, those whose business equity holdings amount to less than 5000 euros and whose business equity share is less than 5 percent. 'Family size up' and 'Family size down' are dummies that take on value 1 if the number of persons (adults and children) in the household increases or decreases between t-1 and t. Robust standard errors in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%.

Table VI: Regressions with housing wealth

	(1)	(3)	(2)	(4)
	Regressions in levels		Regressions in 1st differences	
	All	Restricted sample	All	Restricted sample
log ($W_{h,t}$)	-0.022***	-0.036***	-	-
	(0.006)	(0.004)		
Δlog ($W_{h,t}$)	-	-	-0.082***	-0.078***
			(0.010)	(0.010)
Year 1991	0.022**	0.040***	-	-
	(0.011)	(0.012)		
Year 1993	0.028***	0.042***	-0.003	-0.020*
	(0.011)	(0.012)	(0.010)	(0.012)
Year 1995	0.039***	0.060***	0.004	-0.013
	(0.011)	(0.013)	(0.010)	(0.012)
Year 1998	0.054***	0.065***	-0.019	-0.032**
	(0.011)	(0.012)	(0.012)	(0.014)
Year 2000	0.070***	0.092***	-0.008	-0.016
	(0.011)	(0.013)	(0.011)	(0.013)
Year 2002	0.055***	0.086***	-0.039***	-0.047***
	(0.010)	(0.012)	(0.011)	(0.013)
Year 2004	0.086***	0.102***	0.017*	-0.013
	(0.010)	(0.012)	(0.010)	(0.012)
Age	-0.004***	-0.007**	0.001	-0.005
	(0.001)	(0.003)	(0.002)	(0.005)
$Age^2/100$	0.001	0.005	-0.001	0.006
	(0.001)	(0.004)	(0.001)	(0.005)
Family size	0.013***	0.012***	-	-
	(0.002)	(0.002)		
Family size up	-	-	0.033*	0.025
			(0.018)	(0.018)
Family size down	-	-	0.008	0.001
			(0.008)	(0.010)
Constant	0.247***	0.485***	-0.013	0.141
	(0.070)	(0.091)	(0.048)	(0.108)
Observations	23,905	11,610	16,463	7,825
R-squared	0.02	0.03	0.03	0.03

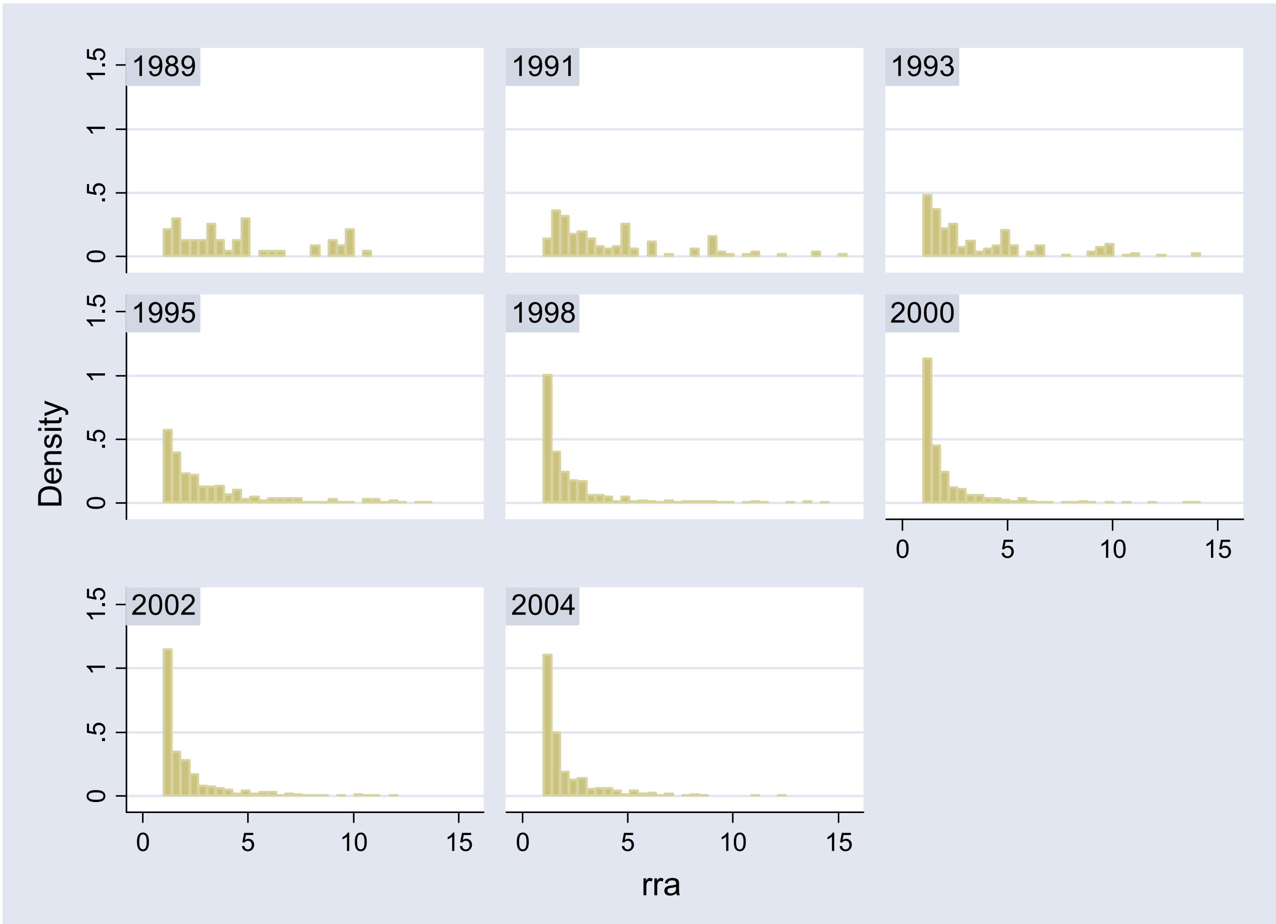
Note: In columns (1) and (3), the left-hand-side variable is the (log) share of wealth invested in risky financial assets plus real estate. In columns (2) and (4), the left-hand-side variable is the change in the (log) share of wealth invested in risky financial assets plus real estate. Columns (2) and (4) are based on a sample that excludes those households whose head is aged less than 25 or over 60, whose wealth is less than 30,000 euros and whose risky asset share is less than 3.5 percent. 'Family size' denotes the number of persons (adults and children) in the household. 'Family size up' and 'Family size down' are dummies that take on value 1 if the number of persons (adults and children) in the household increases or decreases between *t*-1 and *t*. Robust standard errors in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%.

Figure 1: (Log) Risky asset share distribution



Note: Households whose risky asset share is less than 6 percent (3.5 percent of the sample) and those holding business equity have been excluded from the sample. The histograms are based on 64, 135, 208, 276, 465, 614, 611 and 412 observations, respectively.

Figure 2: Relative risk aversion distribution



Note: The relative risk aversion estimates are based on the assumption that the equity premium is 0.04 and the standard deviation of stock returns are around 0.2. Households whose risky asset share is less than 6 percent (3.5 percent of the sample) and those holding business equity have been excluded from the sample. The histograms are based on 64, 135, 208, 276, 465, 614, 611 and 412 observations, respectively.