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FINANCIAL RISK AVERSION, ECONOMIC CRISES AND PAST RISK PERCEPTION*

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PRELIMINARY VERSION

Abstract

We use a panel dataset from the Dutch Household Survey, covering annually the period 1993-2011, to analyze whether individual risk aversion changes over time with the background economic conditions. Considering six different measures of self-assessed risk aversion, which cover different aspects of risk, our preliminary results show that risk aversion is not stable over time. Its dynamics, however, depends on the type of investor. Those who made no investment in the previous year showed higher risk aversion at the end of the 90s; those who invested, in contrast, showed a steadily constant or decreasing pattern. The gap between the risk aversion of investors and non-investors was the largest between the end of the 90s and the beginning of the 00s, when the stock market experienced exceptionally high volatility.

Keywords: household finance, risk aversion, background risk, past risk perception.

JEL classification codes: D81, G11, D14.

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1. Introduction

In the current economic scenario, with the world facing an unprecedented crisis, people are quickly changing their behavior and lifestyle: they spend less money for holidays, they share cars and use public transportation more frequently, and they eat cheaper, lower-quality food (e.g., Crossley et al., 2011). The crisis is having dramatic impact on everyday life, and in particular it hits those groups of individuals (the young, the elderly, and those with low education levels) that are more likely excluded from the labor market in periods of recession. In this work we aim to study empirically whether the crisis has had an impact also on household finance decisions and, in particular, on risk attitude.

There is growing evidence on the impact of the crisis in household finance. Hudomiet et al. (2011) study the effect of the recent stock market crash on households' expectations about future stock returns. They find that expectations on average returns and return volatility tend to increase right after a market crash, although the answers are also more widely spread among the respondents. Negative correlation between return expectations and past market returns is found also in Bucciol et al. (2012). Having different expectations about future market returns clearly has a large impact on portfolio choice. Malmendier and Nagel (2011) find that cohorts that have experienced low stock market returns in the past are less likely to participate in the stock market and, if they participate, they invest a lower fraction of their wealth in stocks. This suggests that the recent shocks to financial market returns might persistently lower future stock market participation.

It is interesting to link the crisis with a key concept in household finance: risk attitude. Depending on their degree of risk attitude, and everything else being equal, investors may want to hold different amounts of risky assets, and therefore expose themselves to the uncertainty in financial market prices. Guiso et al. (2012) find large increase in risk aversion using a repeated survey of a sample of customers of an Italian bank. The change they observe is not correlated with wealth, consumption habits, or background risk, which makes them argue that the observed change may be driven by psychological factors. Their sample, however, has two problems: first, it is not representative of the whole population, because the respondents are on average richer than the population; second, it includes only the first part of the crisis, and not its subsequent ups and downs.

In this work we run an econometric analysis to study the connection between risk attitude, economic crises and the perception of past risk exposure. Specifically, our goal is to understand if risk aversion changes over time as a result of different background economic conditions, different investment decisions, and different perceptions of risk exposure. In our analysis we will use the

panel survey dataset called *Dutch Household Survey (DHS)*, which provides annually over the period 1993-2011 data on the household as a whole and on individuals residing within the household, regarding aspects of household economics, demography, and health, for a sample representative of the population in the Netherlands. Overall, the sample from 1993 to 2011 allows one to study up to 1,500 households over a maximum of 19 times.

Risk attitude can be inferred from observed portfolio shares (e.g., Riley and Chow, 1992; Bucciol and Miniaci, 2011), or directly measured through experiments (e.g., Andersen et al., 2008; Dohmen et al., 2010a; von Gaudecker et al., 2011) or surveys (e.g., Donkers et al., 2001; Guiso and Paiella, 2008). Although observed portfolios are informative on the risk borne by the households, inference about investors' risk attitude can be drawn only conditional on specific assumptions on household expectations and investment behavior. In particular, it has to be required that portfolio shares are instantaneously adjusted. If investors do not adjust their portfolios – which seems to happen frequently (Calvet et al., 2009) – market price variations will automatically generate variations in portfolio shares. In particular, a drop in the stock market price during the crisis will cause the stock portfolio share to fall, leading to a positive spurious correlation between the crisis and risk aversion.

Experiments elicit risk preferences through paid lottery choices with real money at stake. In contrast, surveys measure risk by means of hypothetical self-assessed questions involving no money. Although simple, these questions prove to deliver information consistent with the one derived from paid lottery choices (Dohmen et al., 2010b). In addition these questions generally result in few non-responses, have small marginal cost and therefore can be collected over a large number of observations. For this reason the study of the attitude toward financial risk using self-assessed questions is now consolidated. Our analysis exploits a set of six questions regarding different aspects of risk aversion, that we analyze with a fixed-effect panel ordered logit model.

There are at least three advantages to use DHS data in our exercise. First, the dataset contains information on portfolio composition and several self-assessed measures of risk attitude, both collected regularly over time. In particular the latter type of information is rarely found in such detail on a survey. Second, this is a long panel dataset, which allows us to use panel regression methods and control for (observable and unobservable) individual heterogeneity. Third, the dataset is a representative sample of the population in a country, the Netherlands, that faced periods of both growth and recession during the years under investigation. The Dutch economy is structurally exposed to external developments due to some structural vulnerabilities, noticeably its considerable export sector, its internationally-oriented financial sector and its vast pension fund system

(Masselink and Van den Noord, 2009). In particular the country was severely hit by the recent financial crisis since its beginning.

Our preliminary results show that the dynamics of risk aversion depends on the type of investor. Those who made no investment in the previous year showed higher risk aversion at the end of the 90s; those who invested, in contrast, showed a steadily constant or decreasing pattern. Having invested in self-assessed low-risk assets, and even more having invested in declared high-risk assets, lowers risk aversion in a way that is also varying with time. The gap between the risk aversion of investors and non-investors was the largest between the end of the 90s and the beginning of the 00s, when the stock market experienced exceptionally high volatility. Once controlled for unobserved time-invariant heterogeneity, wealth, income, occupation and other observable characteristics do not seem to correlate with risk aversion.

The remainder of the paper is organized as follows. Section 2 presents the environment, the historical economic background and the data used in our analysis; Section 3 discusses the econometric method and our main findings; finally, Section 4 concludes.

2. Environment and Data

Our analysis is based on the DNB Household Survey (hereafter DHS), a panel survey managed by CentERdata on behalf of the Dutch National Bank. The survey is meant to study primarily psychological and economic aspects of financial behavior, and includes information on work and pensions, housing and mortgages, income, assets and debts, health, as well as demographic characteristics. The interview is performed on the Internet, at the convenience of the respondent and without the intervention of an interviewer; participants who do not have Internet access are provided with a device and technical support. Data are collected on about 2,000 households representative of the Dutch population, annually since year 1993. Although questionnaires have changed gradually over the years, in particular including further variables on saving, they are comparable across waves.

Our final dataset is made of about 1,800 households with head in the age range 20-80 interviewed annually in up to 19 waves, between 1993 and 2011. During this period the Netherlands witnessed phases of both economic growth and recession. The Dutch economy is historically characterized by large international trade and a developed stock exchange market. These two features make this economy heavily exposed to foreign events and the condition of the financial

markets. The country experienced prolonged growth in the 90s, while it faced a period of recession between 2000 and 2003 following international events such as the Internet bubble in the stock markets, terrorism attacks, the war in Iraq, and the SARS outbreak. After a moderate recovery, it underwent the global financial crisis since fall 2008. In that period stock prices went down, and in particular banks suffered from heavy losses. The government had to provide loans to one of the main national banks, ING, while it had to nationalize the Dutch branch of Fortis bank. The economy started recovering in year 2010, fueled by the export sector.

Figure 1 plots the trend in annual variations of the real GDP (source: OECD) and the Amsterdam Stock Exchange (AEX) stock market index (source: Yahoo Finance) in the Netherlands between 1993 and 2011. In addition it plots the standard deviation of the AEX daily returns within each year. The figure clearly highlights two periods of major stock price fall (in the early 2000s and in 2008) following a period of prolonged growth (in the late 1990s) and momentary recoveries (such as in 2009).

FIGURE 1 ABOUT HERE

Our dataset includes a set of six self-assessed qualitative questions covering different aspects of risk attitude, or using a different framing. The questions ask respondents to declare how much they agree with a given sentence, on a discrete scale from 1 ("totally disagree") to 7 ("totally agree"). The questions are listed in Table 1, in the same order as in the questionnaire. Notice that, in the question statements, the meaning of risk is not explicitly defined, apart from the second question (which refers to shares) and the fifth one (which refers to financial risk). However, since the questions are presented in order and within a section on assets and liabilities, we may expect that respondents have in mind financial risk. In addition, three questions (the first, second and fourth ones) are framed in such a way that they seek for agreement with risk aversion sentences, while the remaining questions (the third, fifth and sixth ones) seek for agreement with risk tolerance sentences.

In the data, pairwise correlation between the responses in each group of questions is not so high (on average 0.40 within the group of "risk aversion" measures, and 0.42 within the group of "risk tolerance" measures) and is low when comparing the two groups (-0.18 on average); this suggests that the variables convey different information, which is useful to analyze separately. For sake of comparability, we convert the variables measuring "risk tolerance" to take higher values when the respondent disagrees with the statement. Specifically, in the following analysis we transform the

variables on the third, fifth and sixth questions to take a value of 7 instead of a declared 1, 6 instead of a declared 2, 5 instead of a declared 3, and vice versa.

TABLE 1 ABOUT HERE

Figure 2 shows the average of these risk aversion variables (normalized by 1), separately by each year of the sample. The variables show a roughly similar trend, in particular with a marked reduction in the years 2000 and 2006, following the periods of market boom discussed above. For comparability purpose the figure depicts, together with the average of these six variables, the average value of two variables related to observed portfolio composition: a dummy variable equal to 1 if the households does not hold stock assets in any form (either directly or indirectly), and the share of risk-free deposits (mainly checking accounts) plus bonds (mainly corporate and government bonds) in the total financial portfolio (which also includes stock assets). These two variables, which are often employed as objective indicators of risk attitude among households, also show a trend similar to the self assessed variables in the sample.

FIGURE 2 ABOUT HERE

Figure 3 shows the transitions in risk aversion classes of the same individual from one year to another, for each of the six variables in the dataset. For sake of simplicity, we consider any answer between 1 and 3 as an indication of “low risk aversion”, and any answer between 5 and 7 as an indication of “high risk aversion”. Transitions are rather frequent in the data, although most households keep being highly risk averse between two waves.

FIGURE 3 ABOUT HERE

The DHS dataset includes not only the necessary financial data to evaluate the riskiness of the household’s portfolio at the time of the interview, but also one variable informing of self-perception of the risk exposure in past investment decisions. The question reads as follows:

[Past risk exposure] "*What would you say was the risk factor that you have taken with investments over the past few years? If you haven't made any investments, choose 'not applicable'.*"

Possible answers:

1. I have taken no risk at all
2. I have taken small risks every now and then
3. I have taken some risks
4. I have sometimes taken great risks
5. I have often taken great risks
6. not applicable
7. don't know

Notice that, if the respondent made no investment in the past, she is asked to answer "not applicable". In contrast, if she thinks she had made investments of any type, she has to judge the degree of riskiness of her past investments. The wording of the statement can be interpreted with ambiguity, for instance because different respondents may have different opinions on the number of years to consider as "past few years", or they may answer "not applicable" if they had kept the same investments for a number of years, without making further purchases. This notwithstanding, it is interesting to use this information as a proxy for the individual perception of risk bearing.

In the analysis we consider a dummy variable equal to one if the respondent reports any value between 1 (no risk) and 5 (great risk). This variable is meant to understand whether the respondent had made any investment. In addition, we include a dummy variable equal to one if the respondent reports a value between 3 (some risk) and 5 (great risk) to the above question, as an indication of past risk exposure. We expect this variable to have a negative correlation with the six risk aversion variables. In principle the correlation might also have the opposite sign, though. Let us suppose that an individual declares large past risk exposure. This would mean that either the individual is intrinsically risk tolerant, or she believes the risk exposure of her past investment was too high. We should observe low risk aversion in the former case, and high risk aversion in the latter. Table 2 lists summary statistics on these and other key variables in the sample.

TABLE 2 ABOUT HERE

Figure 4 reports the average of each risk aversion measure, conditional on past risk perception. According to the figure, risk aversion is always lower when the respondent reports high past risk exposure. The figure then suggests that the correlation between risk aversion and past risk exposure is mainly negative. This evidence is confirmed statistically by a two-group test of proportion. In what follows we shed more light on the relation between risk aversion and past risk exposure, controlling for the time effect.

FIGURE 4 ABOUT HERE

3. Analysis

3.1. Econometric model

Our goal is to understand if risk aversion changes over time with different background economic conditions, in a different way for past non-investors, past investors who declared low risk exposure in their investments, and past investors who declared high risk exposure. We therefore perform a regression analysis, where the dependent variables are each of those listed in Table 1. The specification includes time dummy variables (in pairs of two consecutive years), alone and interacted with the dummy variables on past investment and past risky investment. The specification also includes control variables on socio-demographic characteristics (employment status, age, marital status, living in a large city), financial status (financial wealth, household income, home ownership) as well as happiness.

To limit biases due to the possible endogeneity in the regression equation, we exploit the panel dimension of the data and run a fixed-effect ordered logit model in the variant proposed by Baetschmann et al. (2011) and labeled as Blow-Up and Cluster (BUC) estimator. In the following we briefly describe the estimator.

Consider a model for the unobserved latent variable $y_{i,t}^{*}$, for individual $i = 1,...,N$ and time $t = 1,...,T$:

$$y_{i,t}^{*} = x_{i,t}^{*\prime}\beta + \alpha_i + \varepsilon_{i,t}.$$

We observe the variable $y_{i,t}$, with possible realizations $k = 1,...,K$ and thresholds strictly increasing $\left(\tau_{i,k} < \tau_{i,k+1}\right)$ with $\tau_{i,1} = -\infty$ and $\tau_{i,K+1} = \infty$:

$$y_{i,t} = k \quad \text{if } y_{i,t}^{*} \in \left(\tau_{i,k}, \tau_{i,k+1}\right].$$

Assuming a logistic distribution for $\varepsilon_{i,t}$,

$$\Pr\left(y_{i,t} = k \middle| x_{i,t}, \alpha_i\right) = \Lambda\left(\tau_{i,k+1} - x_{i,t}'\beta - \alpha_i\right) - \Lambda\left(\tau_{i,k} - x_{i,t}'\beta - \alpha_i\right).$$

There are two problems with this model. First, $\tau_{i,k}$ cannot be distinguished from α_i. Second, there is an incidental parameter problem, in that too many individual effects have to be estimated. A solution is given by the conditional logit model, which collapses $y_{i,t}$ into a binary variable at a given cutoff point k:

$$d_{i,t}^{k} = \begin{cases} 1 & y_{i,k} \geq k \\ 0 & y_{i,k} < k. \end{cases}$$

A consistent estimate for β, β^{k}, is found from the maximization of a conditional log-likelihood function (with $j_{i,t} \in \{0,1\}$ being the realization of $d_{i,t}^{k}$):

$$\beta^{k} = \arg\max_{\beta}\left\{\ln L^{k}(\beta)\right\} = \arg\max_{\beta}\left\{\sum_{i=1}^{N} \ln \Pr\left(d_i^{k} = j_i \middle| \sum_{t=1}^{T} d_{i,t}^{k} = \sum_{t=1}^{T} j_{i,t}\right)\right\}.$$

Conditioning on $\sum_{t=1}^{T} d_{i,t}^{k}$ causes all the time-invariant elements (in particular α_i and $\tau_{i,k}$) to cancel. In addition there are two further problems with this model: first, the choice of the cutoff point is arbitrary; second, there is loss of information because individuals with $d_{i,t}^{k}$ constant over t do not contribute to the likelihood[3]. A remedy is to pick a different cutoff point for each individual (Ferrer-i-Carbonell and Frijters, 2004). However, an individual-specific cutoff point brings endogeneity into the problem. An alternative is to estimate β on all the possible $K-1$ cutoff points, and combine the resulting estimates (Das and Van Soest, 1999) through a minimum distance approach. Ferrer-i-Carbonell and Frijters (2004), however, found that the weighting matrix in the distance measure might be estimated imprecisely in small samples.

Another approach is to estimate β jointly from the maximization of the sum of all the conditional log-likelihood functions. This is the BUC estimator:

[3] Indeed in this case $\Pr\left(d_i^{k} = 1 \middle| \sum_{t=1}^{T} d_{i,t}^{k} = T\right) = \Pr\left(d_i^{k} = 0 \middle| \sum_{t=1}^{T} d_{i,t}^{k} = 0\right) = 1.$

$$\beta^{BUC} = \arg\max_{\beta} \left\{ \sum_{k=2}^{K} \ln L^{k}(\beta) \right\}.$$

The name of the estimator is due to a two-step algorithm. First, "blow-up": replace every observation by $K-1$ copies of itself, dichotomizing each at a different cutoff point. Second, "cluster": use cluster-robust variance allowing for correlation within the observations of the same individual. The BUC estimator does not have the problems mentioned above, and is found to have better small-sample properties than the estimator proposed by Das and Van Soest (1999).

3.2. Results

Table 3 reports the estimated parameters for the six fixed-effect ordered logit regressions on the self assessed risk attitude indicators described above. Our preliminary results show that once controlled for the unobserved time invariant heterogeneity, the observable characteristics of the respondent do not play a major role. In particular, financial wealth, income, homeownership and occupation do not affect the self assessed risk aversion. The shape of the age effect varies across indicators: the average marginal effect is positive and significantly different from zero for the risk attitude indicator related to "No investment", "Borrowing" and "Chance to gain", negligible for the "Safe investment" and "Financial risk" questions and negative for the "Guaranteed returns" variable.

Time effects for those households that did not make any investment in the last few years are heterogeneous across alternative measures. According to the results for the first question ("*I think it is more important to have safe investments and guaranteed returns, than to take a risk to have a chance to get the highest possible returns*") risk aversion increased from 1993 to 2001 and flattened afterward on a level slightly lower than the peak in 2001. For the other measures, we obtain a significant rise in the risk aversion in the first years, followed by a decline which brings the values at or below the original 1993 level. It is worth noticing that the (common) increase in risk aversion until 2001 coincides with a period in which the volatility in the Dutch stock market increased and reached its maximum (see Figure 1). The non-investing households might have been scared by the increase in the volatility and raised their level of risk aversion. According to all but one of the measures the risk attitude went back to the original values after the 2000-2003 recession.

Households that made some investment in the past are more likely to be willing to bear some financial risk, all the more so for those who declare to have borne some risk in the last few years. In fact, for all the six measures the parameters for the interactions between year and investor dummies

are negative and statistically significant, and the same holds for the interactions between year and past risky investment dummies. Moreover, the size of these estimated parameters is such that the time profile of the risk aversion is remarkably different from the one for the non-investor households. The patterns of the time effects for the three different types of households are plotted in Figure 5. For the households participating the financial markets there is no particular increase in the risk aversion in the years 1993-2001, the estimated profile is almost flat for the "Safe investment" and the "Financial risk" variables, and declining for all but the first "Guaranteed returns" indicator.

From the figure it is possible to see that the difference between investors and non-investors was at the maximum in the first half of the period considered and shrunk over time. That is, ceteris paribus, over time the risk attitude of the non-investors became more and more similar to that of the investors. Moreover, the pattern of the two types of investors (those investing in risky assets and those avoiding risky investments) are almost parallel, affected in the same way by the ups and downs of the markets.

TABLE 3 ABOUT HERE

FIGURE 5 ABOUT HERE

In Table 4 and Figure 6 we show the results for the same models, but estimated on the sub sample of households holding stocks in their portfolios in the previous year. We focus on this subsample as we want to exploit the conventional objective definition of risky portfolio (holding stocks or not) together with the self-assessed riskiness of the portfolio. Here all the households have at least part of their portfolio invested in shares, but only 30% of them declare to have taken at least some risk in the past few years. We wonder to what extent this different perception of the riskiness of their portfolios affects the self assessed risk attitude. Our estimates show that also among stock holders, those declaring to bear some risk have significantly lower risk aversion.

TABLE 4 ABOUT HERE

FIGURE 6 ABOUT HERE

4. Conclusions

The goal of this paper was to understand if individual risk aversion changes over time with the background economic conditions, following investment decisions and the self-perception of their risk exposure. The analysis was performed using a fixed-effect ordered logit model on a panel sample of about 1,800 Dutch households interviewed every year in up to 19 waves between 1993 and 2011.

Using a set of six measures of self-assessed risk aversion (covering different aspects of risk), we find that risk aversion is not stable over time. Its dynamics, however, depends on the type of investor. Those who made no investment in the previous year showed higher risk aversion in the second-half of the 90s. Having invested in declared low-risk assets, and even more having invested in declared high-risk assets, steadily lowers risk aversion in a way that is however constant or slightly decreasing over time. The distance between investors and non-investors was the largest between the end of the 90s and the beginning of the 00s, when the stock market experienced exceptionally high volatility. However, the different measures of risk aversion are little correlated and predict different patterns. Once controlled for unobserved time-invariant heterogeneity, wealth, income, occupation and other observable characteristics do not seem to correlate with risk aversion.

In addition to their intrinsic interest, findings of this research are important for professionals, to offer financial products better suited to the investor's needs, and for policy makers, to help stabilizing the economy. Sharp fluctuations in risk attitude lead to changes in portfolio decisions (massive purchase or selling of assets), cause variations in asset prices, put the financial system under pressure, and ultimately affect the macroeconomy (Korniotis and Kumar, 2011). Being able to understand, anticipate and possibly contrast unmotivated modifications of risk attitude is an important challenge to guarantee long-run economic development.

References

Andersen, S., G.W. Harrison, M.I. Lau, and E.E. Rutstrom (2008), "Eliciting Risk and Time Preferences," *Econometrica*, 76(3), 583–618.

Baetshcmann, G., K.E. Staub, and R. Winkelmann (2011), "Consistent Estimation of the Fixed Effects Ordered Logit Model," *IZA Discussion Paper*, 5443.

Bucciol, A., and R. Miniaci (2011), "Household Portfolios and Implicit Risk Preference," *The Review of Economics and Statistics*, 93(4), 1235-1250.

Bucciol, A., R. Miniaci, and S. Pastorello (2012), "Return Expectations and Risk Aversion Heterogeneity in Household Portfolios," *Journal of Risk and Insurance*, forthcoming.

Calvet, L.E., J.Y. Campbell, and P. Sodini (2009), "Fight or Flight? Portfolio Rebalancing by Individual Investors," *Quarterly Journal of Economics*, 124, 301–348.

Crossley, T.F., H. Low, and C. O'Dea (2011), "Household Consumption Through Recent Recessions," *IFS Working Paper W11/18.*

Das, M., and A. Van Soest (1999), "A Panel Data Model for Subjective Information on Household Income Growth," *Journal of Economic Behavior and Organization*, 40(4), 409-426.

Dohmen, T., A. Falk, D. Huffman, and U. Sunde (2010a), "Are Risk Aversion and Impatience Related to Cognitive Ability?," *American Economic Review*, 100(3), 1238-60.

Dohmen, T., A. Falk, D. Huffman, U. Sunde, J. Schupp, and G.G. Wagner (2010b), "Individual Risk Attitudes: New Evidence from a Large, Representative, Experimentally-Validated Survey," *Journal of the European Economic Association*, 9(3), 522-550.

Donkers, B., B. Melenberg, and A. Van Soest (2001), "Estimating Risk Attitudes Using Lotteries: A Large Sample Approach," *Journal of Risk and Uncertainty*, 22(2), 165-195.

Ferrer-i-Carbonell, A., and P. Frijters (2004), "How Important is Methodology for the Estimates of the Determinants of Happiness?," *Economic Journal*, 114(497), 641-659.

Guiso, L., and M. Paiella (2008), "Risk Aversion, Wealth, and Background Risk," *Journal of the European Economic Association*, 6(6), 1109-1150.

Guiso, L., P. Sapienza, and L. Zingales (2012), "Time Varying Risk Aversion," mimeo.

Hudomiet, P., G. Kézdi, and R.J. Willis (2011), "Stock Market Crash and Expectations of American Households," Journal of Applied Econometrics, 26(3), 393-415.

Korniotis, G.M., and A. Kumar (2011), "Do Behavioral Biases Adversely Affect the Macroeconomy?," *Review of Financial Studies*, 24(5), 1513-1559.

Malmendier, U., and S. Nagel (2011), "Depression Babies: Do Macroeconomic Experiences Affect Risk-Taking?," *Quarterly Journal of Economics*, 126(1), 373-416.

Masselink, M., and P. Van den Noord (2009), "The Global Financial Crisis and Its Effects on the Netherlands," *ECFIN Country Focus*, 6(10).

Riley, W.B., and K.V. Chow (1992), "Asset Allocation and Individual Risk Aversion," *Financial Analysts Journal*, 48(6), 32-37.

Von Gaudecker, H., A. Van Soest, and E. Wengstrom (2011), "Heterogeneity in Risky Choice Behavior in a Broad Population," *American Economic Review*, 101, 664-694.

Table 1. Self-assessed questions on risk attitude

No.	Label in our analysis	Question
1	Guaranteed returns	*"I think it is more important to have safe investments and guaranteed returns, than to take a risk to have a chance to get the highest possible returns."*
2	No investment	*"I would never consider investments in shares because I find this too risky."*
3	Borrowing	*"If I think an investment will be profitable, I am prepared to borrow money to make this investment."*
4	Safe investment	*"I want to be certain that my investments are safe."*
5	Financial risk	*"I get more and more convinced that I should take greater financial risks to improve my financial position."*
6	Chance to gain	*"I am prepared to take the risk to lose money, when there is also a chance to gain money."*

Note. Answers are provided on a discrete scale between 1 ("totally disagree") and 7 ("totally agree"). In the analysis we transform the answers to questions 3, 5 and 6 in such a way that higher values indicate more risk aversion..

Table 2. Summary statistics (17,789 observations)

Variable	Mean	Std. dev.	Minimum	Maximum
Age	51.670	13.830	20	80
Female	0.395	0.489	0	1
College education	0.100	0.300	0	1
Lives with a partner	0.758	0.428	0	1
Lives in a large city	0.398	0.490	0	1
Employee	0.536	0.499	0	1
Self-employed	0.026	0.159	0	1
Homeowner	0.467	0.499	0	1
Financial assets (thousand euros)	37.169	90.913	0.001	3,702.125
Income (thousand euros)	25.407	24.150	-3.136	1,577.808
Happy	0.830	0.376	0	1
Past investment	0.435	0.496	0	1
Past risk exposure	0.172	0.378	0	1
	Risk measures			
Guaranteed returns	5.096	1.730	1	7
No investment	4.428	2.032	1	7
Borrowing	5.421	1.404	1	7
Safe investment	5.676	1.601	1	7
Financial risk	5.190	1.652	1	7
Chance to gain	5.356	1.548	1	7

Table 3. Risk aversion and time

Dep.var.	(1) Guaranteed returns	(2) No investment	(3) Borrowing	(4) Safe investment	(5) Financial risk	(6) Chance to gain
Age	0.086*	0.140***	0.175***	0.131***	0.013	0.119**
	(0.048)	(0.050)	(0.049)	(0.047)	(0.047)	(0.046)
Age^2	-0.002***	-0.001	-0.000	-0.001***	0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Lives	0.206	-0.217	-0.467***	-0.201	-0.094	-0.023
with a partner	(0.135)	(0.146)	(0.152)	(0.161)	(0.140)	(0.148)
Lives	0.316*	0.057	-0.017	0.038	0.348*	0.094
in a large city	(0.191)	(0.188)	(0.192)	(0.175)	(0.187)	(0.191)
Employee	-0.007	-0.183	-0.210	-0.003	0.025	-0.178
	(0.168)	(0.160)	(0.153)	(0.158)	(0.145)	(0.155)
Self-employed	0.263	-0.216	0.359	0.283	-0.014	-0.131
	(0.327)	(0.349)	(0.327)	(0.337)	(0.294)	(0.278)
Homeowner	0.128	0.021	0.076	-0.064	0.023	0.084
	(0.078)	(0.074)	(0.085)	(0.078)	(0.073)	(0.073)
Log(fin. assets)	0.035	-0.011	0.029	0.026	0.003	-0.001
	(0.022)	(0.023)	(0.023)	(0.024)	(0.021)	(0.021)
Log(income)	0.025	-0.006	-0.054	-0.027	-0.064	-0.003
	(0.046)	(0.047)	(0.049)	(0.054)	(0.045)	(0.047)
Happy	0.100	0.075	0.010	0.109	-0.015	0.016
	(0.091)	(0.087)	(0.093)	(0.089)	(0.085)	(0.086)
Years	0.375**	0.149	0.163	0.058	0.126	-0.082
1996-1997	(0.146)	(0.139)	(0.141)	(0.138)	(0.140)	(0.141)
Years	1.435***	0.683***	0.879***	0.913***	0.687***	0.417**
1998-1999	(0.206)	(0.192)	(0.214)	(0.203)	(0.198)	(0.200)
Years	1.426***	0.548*	0.401	0.601**	0.519*	0.155
2000-2001	(0.286)	(0.281)	(0.303)	(0.290)	(0.278)	(0.283)
Years	1.271***	0.521	0.350	0.669**	0.383	-0.028
2002-2003	(0.337)	(0.329)	(0.345)	(0.323)	(0.323)	(0.326)
Years	0.831**	-0.120	-0.328	0.109	-0.066	-0.803**
2004-2005	(0.384)	(0.375)	(0.401)	(0.373)	(0.376)	(0.391)
Years	1.034**	-0.416	-0.444	0.001	-0.197	-0.913**
2006-2007	(0.448)	(0.439)	(0.470)	(0.439)	(0.440)	(0.453)
Years	0.611	-0.454	-0.598	-0.351	0.062	-1.022*
2008-2009	(0.520)	(0.511)	(0.556)	(0.510)	(0.519)	(0.531)
Years	0.858	-1.040*	-0.812	-0.536	0.210	-1.285**
2010-2011	(0.595)	(0.583)	(0.629)	(0.583)	(0.595)	(0.601)

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Invested × Years	-0.266*	-0.532***	-0.384***	-0.710***	-0.339***	0.027
1993-1995	(0.144)	(0.128)	(0.134)	(0.142)	(0.131)	(0.128)
Invested × Years	-0.620***	-1.181***	-0.828***	-0.900***	-0.977***	-0.582***
1996-1997	(0.143)	(0.142)	(0.144)	(0.144)	(0.149)	(0.145)
Invested × Years	-1.359***	-1.879***	-1.624***	-1.549***	-1.732***	-1.601***
1998-1999	(0.176)	(0.165)	(0.180)	(0.169)	(0.171)	(0.178)
Invested × Years	-1.396***	-1.867***	-1.022***	-1.362***	-1.259***	-1.611***
2000-2001	(0.194)	(0.191)	(0.211)	(0.198)	(0.179)	(0.191)
Invested × Years	-0.951***	-1.301***	-0.964***	-0.953***	-0.631***	-1.006***
2002-2003	(0.160)	(0.152)	(0.167)	(0.151)	(0.154)	(0.160)
Invested × Years	-0.457***	-1.199***	-0.802***	-0.700***	-0.707***	-0.858***
2004-2005	(0.131)	(0.142)	(0.145)	(0.131)	(0.141)	(0.149)
Invested × Years	-0.465***	-1.327***	-1.131***	-0.703***	-0.949***	-1.127***
2006-2007	(0.133)	(0.143)	(0.158)	(0.131)	(0.138)	(0.152)
Invested × Years	-0.076	-1.003***	-0.842***	-0.418***	-0.554***	-1.121***
2008-2009	(0.173)	(0.162)	(0.184)	(0.157)	(0.169)	(0.169)
Invested × Years	-0.010	-0.570***	-0.618***	-0.247	-0.734***	-0.675***
2010-2011	(0.178)	(0.191)	(0.189)	(0.190)	(0.173)	(0.168)
Past risk × Years	-1.080***	-0.776***	-0.307	-0.477**	-0.674***	-1.126***
1993-1995	(0.214)	(0.217)	(0.202)	(0.212)	(0.200)	(0.203)
Past risk × Years	-1.055***	-0.803***	-0.208	-0.424**	-0.628***	-1.248***
1996-1997	(0.194)	(0.192)	(0.184)	(0.176)	(0.189)	(0.187)
Past risk × Years	-1.387***	-1.225***	-0.364*	-0.858***	-0.350*	-1.104***
1998-1999	(0.218)	(0.235)	(0.200)	(0.209)	(0.213)	(0.224)
Past risk × Years	-1.077***	-1.485***	-0.583***	-0.944***	-0.274	-1.288***
2000-2001	(0.231)	(0.222)	(0.219)	(0.212)	(0.196)	(0.201)
Past risk × Years	-1.009***	-1.393***	-0.528***	-1.219***	-0.481***	-1.177***
2002-2003	(0.166)	(0.162)	(0.170)	(0.171)	(0.157)	(0.163)
Past risk × Years	-0.688***	-0.794***	-0.186	-0.463***	-0.347**	-0.525***
2004-2005	(0.153)	(0.152)	(0.147)	(0.149)	(0.151)	(0.147)
Past risk × Years	-0.908***	-0.627***	-0.206	-0.393***	-0.545***	-0.939***
2006-2007	(0.140)	(0.158)	(0.178)	(0.145)	(0.152)	(0.161)
Past risk × Years	-0.611***	-0.595***	-0.125	-0.713***	-0.491***	-0.598***
2008-2009	(0.183)	(0.164)	(0.195)	(0.176)	(0.177)	(0.178)
Past risk × Years	-0.463**	-0.864***	-0.160	-0.427*	-0.775***	-0.970***
2010-2011	(0.206)	(0.201)	(0.230)	(0.230)	(0.181)	(0.183)
Observations	39,637	45,980	35,415	33,079	37,793	33,468
Households	1,830	1,795	1,642	1,805	1,755	1,720
Pseudo-R^2	0.066	0.105	0.066	0.067	0.057	0.089
Log-likelihood	-14,313.642	-15,734.913	-12,634.454	-11,772.866	-13,983.119	-11,671.599

*Note. Method: Blow-Up and Cluster estimator of the fixed-effect ordered logit model. Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1*

Table 4. Risk aversion and time: stock holders in the previous year

Dep.var.	(1) Guaranteed returns	(2) No investment	(3) Borrowing	(4) Safe investment	(5) Financial risk	(6) Chance to gain
Age	-0.078	0.119	0.187	0.010	-0.062	0.094
	(0.115)	(0.130)	(0.129)	(0.115)	(0.117)	(0.119)
Age^2	-0.000	0.000	-0.000	-0.001	0.001**	0.001
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Lives	0.207	0.345	-0.534*	-0.190	-0.049	0.285
with a partner	(0.352)	(0.364)	(0.320)	(0.376)	(0.286)	(0.326)
Lives	-1.006**	-0.402	-0.791*	-0.508	-0.286	-0.812
in a large city	(0.430)	(0.501)	(0.412)	(0.489)	(0.426)	(0.503)
Employee	0.352	-0.317	-0.663	-0.093	-0.315	-0.157
	(0.564)	(0.442)	(0.459)	(0.458)	(0.406)	(0.443)
Self-employed	0.535	0.247	-0.027	0.664	0.882	0.567
	(0.890)	(0.788)	(0.613)	(0.583)	(0.666)	(0.800)
Homeowner	0.411**	0.071	-0.040	-0.072	0.339	0.166
	(0.185)	(0.214)	(0.212)	(0.200)	(0.227)	(0.182)
Log(fin. assets)	-0.077	0.014	-0.046	0.162**	-0.061	-0.019
	(0.073)	(0.072)	(0.075)	(0.079)	(0.073)	(0.067)
Log(income)	-0.071	0.076	0.112	-0.086	0.031	0.257**
	(0.141)	(0.125)	(0.163)	(0.129)	(0.112)	(0.129)
Happy	0.190	0.057	0.097	0.365*	0.170	0.059
	(0.196)	(0.213)	(0.246)	(0.199)	(0.184)	(0.218)
Years	0.232	-0.392	-0.232	0.113	-0.256	-0.407
1996-1997	(0.338)	(0.319)	(0.382)	(0.340)	(0.343)	(0.337)
Years	1.555***	0.483	0.463	0.970**	0.446	0.232
1998-1999	(0.464)	(0.467)	(0.523)	(0.463)	(0.492)	(0.471)
Years	1.526**	-0.025	0.207	1.369**	0.463	0.111
2000-2001	(0.718)	(0.712)	(0.694)	(0.693)	(0.689)	(0.705)
Years	2.025***	0.228	0.034	1.276*	0.536	0.039
2002-2003	(0.759)	(0.770)	(0.797)	(0.748)	(0.803)	(0.779)
Years	2.073**	-0.703	-0.231	1.220	0.278	-0.895
2004-2005	(0.911)	(0.918)	(0.977)	(0.932)	(0.956)	(0.961)
Years	2.037*	-0.965	-1.127	1.092	-0.757	-1.501
2006-2007	(1.099)	(1.077)	(1.123)	(1.066)	(1.106)	(1.071)
Years	2.217*	-1.227	-1.049	1.058	-0.490	-2.042
2008-2009	(1.209)	(1.242)	(1.251)	(1.223)	(1.281)	(1.245)
Years	2.596*	-1.642	-0.886	0.747	-0.594	-1.780
2010-2011	(1.409)	(1.422)	(1.451)	(1.393)	(1.451)	(1.412)
Past risk × Years	-0.944**	-0.843**	0.378	-1.093***	-0.556	-0.328
1993-1995	(0.381)	(0.424)	(0.439)	(0.402)	(0.380)	(0.416)
Past risk × Years	-0.649*	-0.958***	-0.179	-0.511	-0.976***	-1.055***
1996-1997	(0.363)	(0.357)	(0.369)	(0.350)	(0.328)	(0.328)
Past risk × Years	-1.883***	-2.257***	-1.594***	-1.584***	-1.391***	-1.972***
1998-1999	(0.358)	(0.379)	(0.331)	(0.346)	(0.341)	(0.364)
Past risk × Years	-1.344***	-2.235***	-0.760*	-2.183***	-1.305***	-2.238***
2000-2001	(0.505)	(0.479)	(0.424)	(0.474)	(0.371)	(0.449)
Past risk × Years	-1.676***	-1.975***	-0.558*	-1.725***	-1.007***	-1.922***
2002-2003	(0.293)	(0.310)	(0.309)	(0.267)	(0.280)	(0.283)
Past risk × Years	-1.430***	-1.411***	-0.901***	-1.158***	-1.483***	-1.124***
2004-2005	(0.343)	(0.296)	(0.302)	(0.303)	(0.303)	(0.312)
Past risk × Years	-1.190***	-1.376***	-0.207	-0.868***	-0.796***	-1.354***
2006-2007	(0.247)	(0.264)	(0.282)	(0.215)	(0.245)	(0.261)
Past risk × Years	-0.715**	-0.763**	-0.106	-0.960***	-0.515*	-0.684**
2008-2009	(0.324)	(0.308)	(0.346)	(0.292)	(0.299)	(0.315)
Past risk × Years	-0.688**	-1.204***	-0.436	-0.285	-0.928***	-1.300***
2010-2011	(0.322)	(0.320)	(0.373)	(0.358)	(0.290)	(0.297)
Observations	6,055	7,640	6,357	5,065	7,040	6,588
Households	426	437	384	424	436	430
Pseudo-R^2	0.075	0.109	0.061	0.068	0.068	0.097
Log-likelihood	-2,117.572	-2,529.039	-2,316.560	-1,757.107	-2,557.767	-2,228.458

*Note. Method: Blow-Up and Cluster estimator of the fixed-effect ordered logit model. Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1*

Figure 1. Macroeconomic trend in the Netherlands

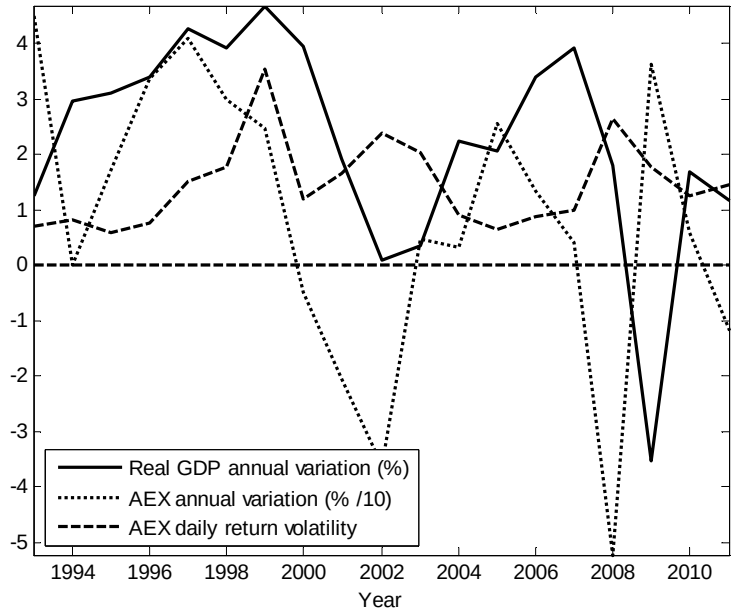


Figure 2. Dynamics of risk aversion

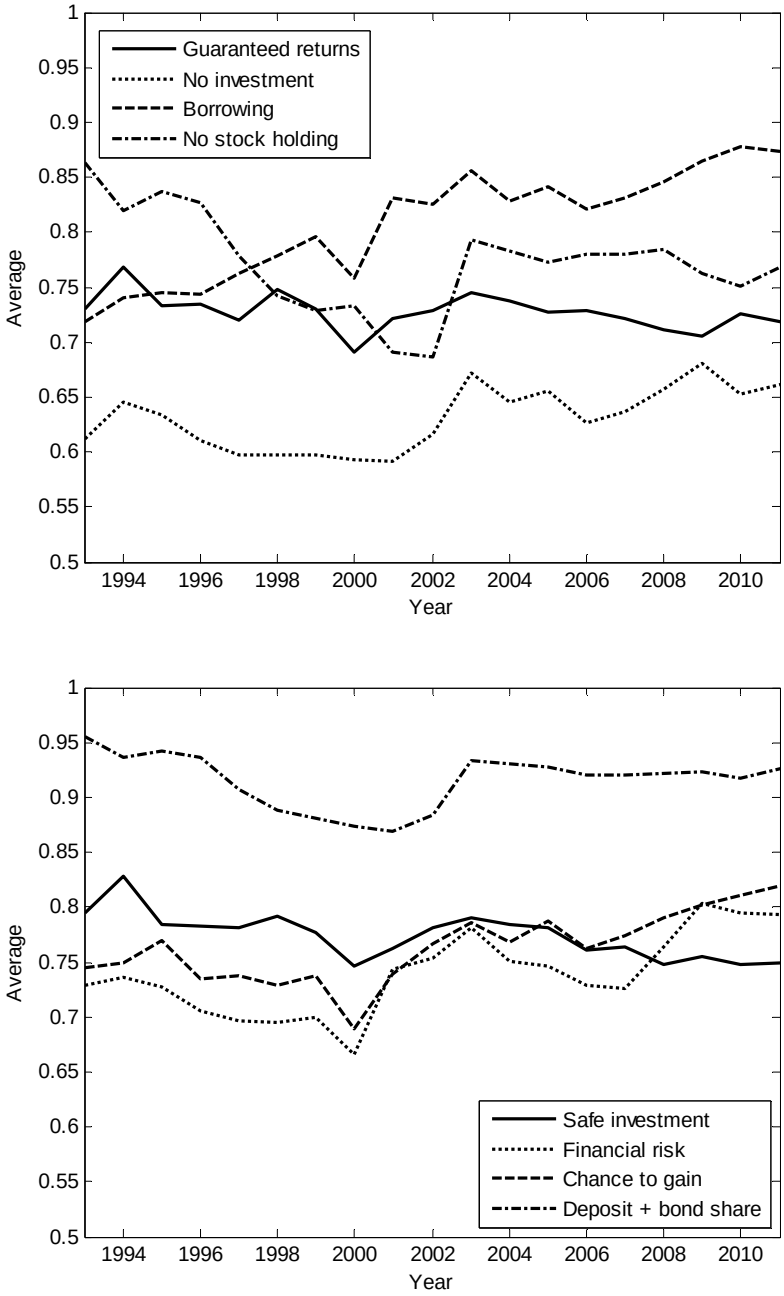


Figure 3. Annual transitions in risk aversion

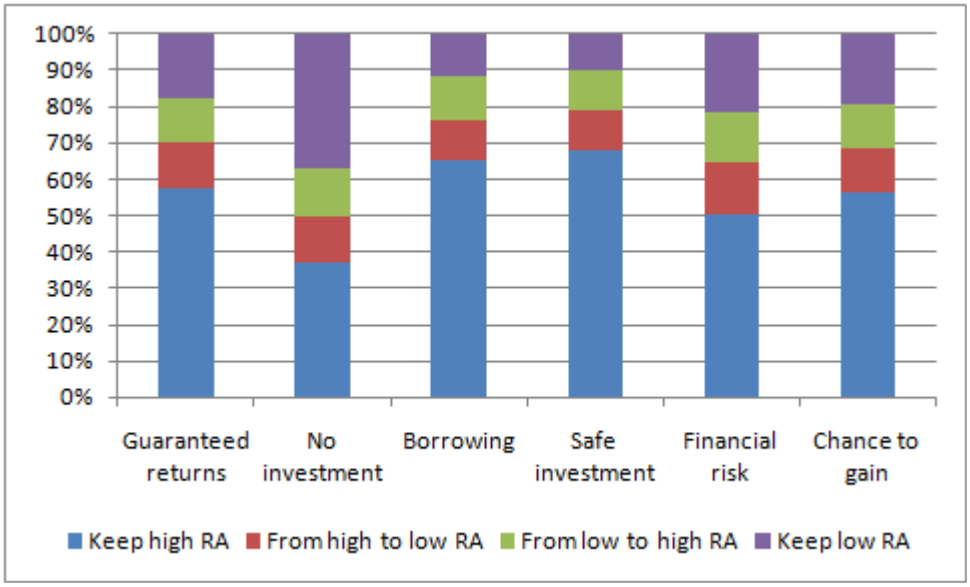


Figure 4. Risk aversion conditional on past risk exposure

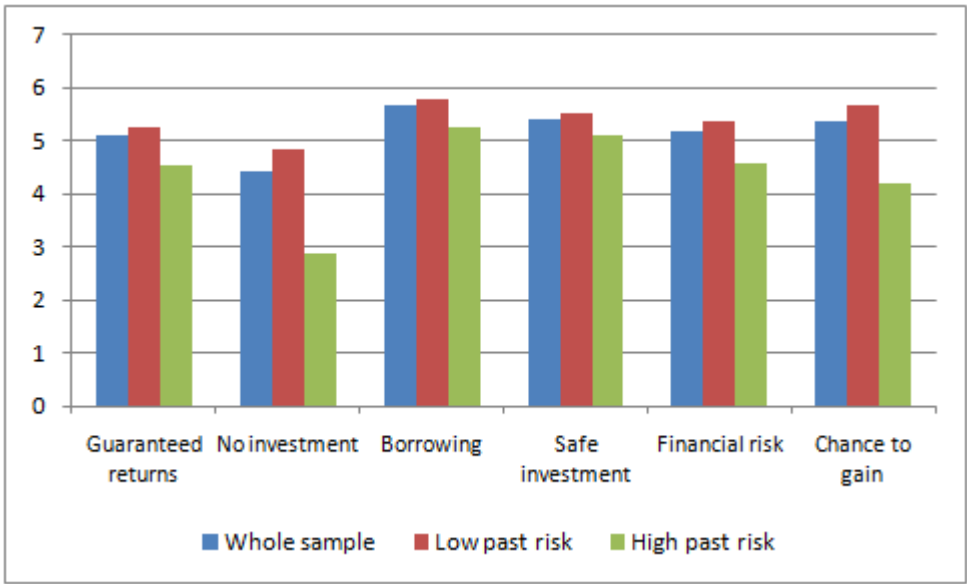
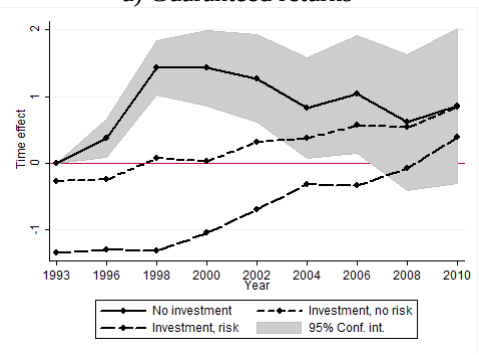
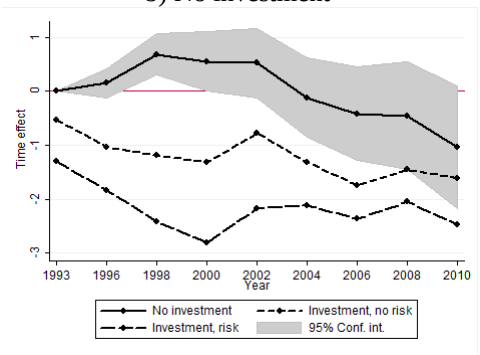


Figure 5. Time profiles of risk aversion

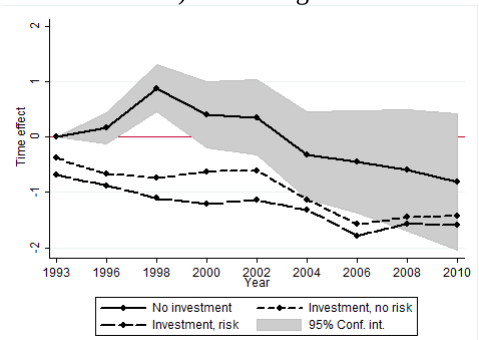
a) Guaranteed returns



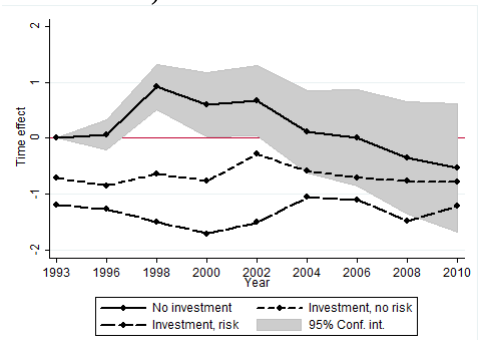
b) No investment



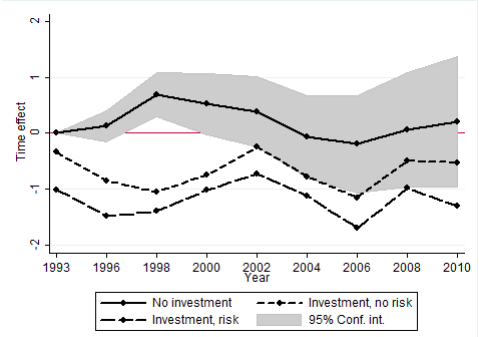
c) Borrowing



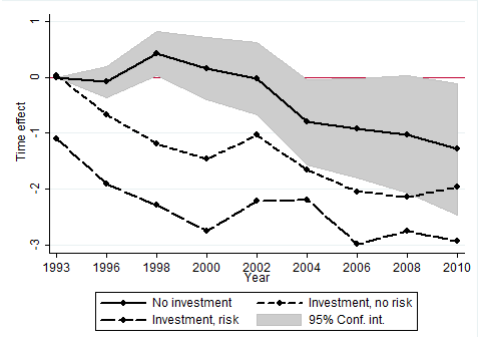
d) Safe investment



e) Financial risk



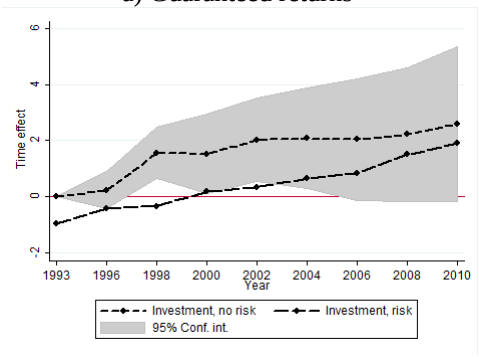
f) Chance to gain



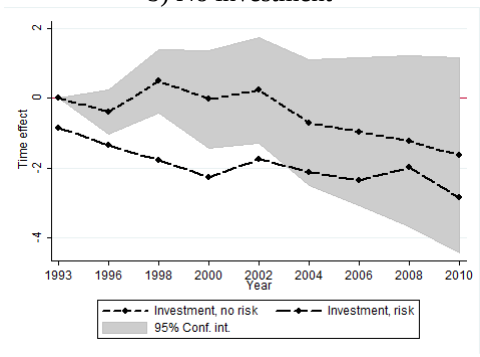
Note: profiles are based on the regression output of Table 3.

Figure 6. Time profiles of risk aversion: stock holders in the previous year

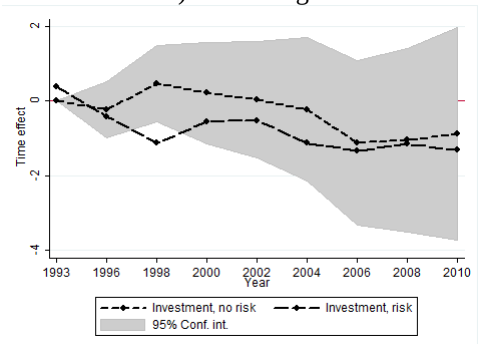
a) Guaranteed returns



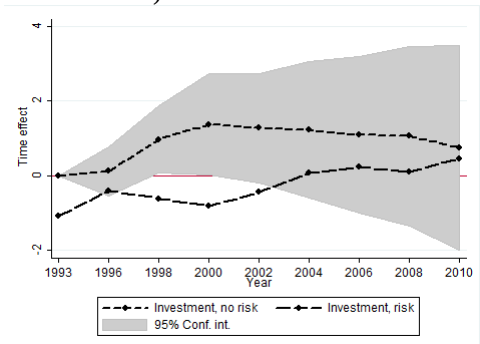
b) No investment



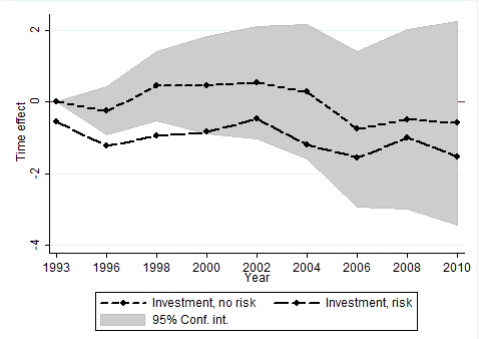
c) Borrowing



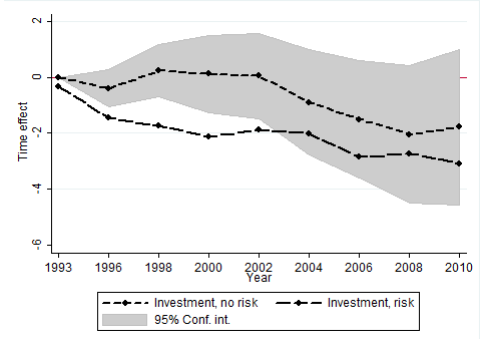
d) Safe investment



e) Financial risk



f) Chance to gain



Note: profiles are based on the regression output of Table 4.