# Impact of Economic Conditions on Individual Risk Attitude

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The current study uses the German Socio Economic Panel to examine how the financial crisis of 2008-2010 impacted individuals' risk attitude. We find substantial changes in risk attitudes associated with the financial crisis which supports countercyclical risk aversion. We find that managers who continued to work in a leadership position were more risk taking in the beginning and reacted quicker compared both to the general population and to individuals who entered the crisis but did not exit the crisis with managerial positions. Changes in risk tolerance levels differ across socio-demographic groups, including gender and income levels. Finally, we observe variations across generations, which we attribute to generation-specific macro-economic experiences.

**Keywords**: Variable risk attitudes, risk aversion, economic conditions, 2008 financial crisis, countercyclical risk aversion

**JEL classification:** D81, G01, J11, J13, J14

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# 1 Motivation

A commonly accepted tenant of economic analysis is that an individual's risk tolerance has a significant impact on his or her decision making (see, for instance, Friedman and Savage (1948) and Arrow (1971)). This includes decisions on how to allocate funds between savings and consumption, as well as how to invest funds that are saved (see, for instance, Markowitz (1952)). Attitude toward risk influences job choices, educational objectives, and decisions whether or not to buy insurance and, if so, how much (see, for instance, Mossin (1968) (1968), Cohen and Einav (2007), or Dreze (1981)). Models built on expected utility theory yield hypotheses on decision making under risk. The models typically either implicitly or explicitly assume that risk attitude is invariant over time. Recent work in neural economics provides evidence that risk attitudes are to some degree genetically determined (see, for instance, Guo et al. (2010) and Thompson et al. (2007)). As many decisions made in the presence of risk have a long-lasting impact on an individual's resources over his or her lifetime, it is of interest to know whether and, if so, to what degree attitudes toward risk are shaped by macro-economic conditions. This question has implications for public policy, such as social insurance programs, as well as for businesses and household management.

Changing risk attitudes have been discussed in the field of asset pricing in order to assess whether the assumption of countercyclical risk aversion[1] can contribute to explaining the equity premium puzzle. Barberis et al. (2001) develop an asset pricing model where individuals exhibit countercyclical risk aversion, while Campbell and Cochrane (1999) assume that investors become more risk averse when consumption levels approach a previously established habit level. Mehra (2012) points out that empirical evidence on the level of countercyclical risk aversion is sparse due to difficulties disentangling the impact of wealth changes on risk attitude from crisis-induced changes. In a recent study, Cohn et al. (2015) investigate financial professionals in the lab and find evidence of countercyclical risk aversion. Our study, which spans the period before and after the 2008 financial crisis, is the first to find evidence of countercyclical risk aversion in a large, nationally representative dataset. Given the detailed information reported in the SOEP dataset, we are able to check the robustness of our results on a subset of individuals who did not experience changes in wealth during the period of the financial crisis. Further, we observe whether differences in holding a managerial position, income, gender, and generation are associated with different changes in risk attitude over the period of the financial crisis.

[1] Countercyclical risk aversion implies that individuals become more risk averse when economic conditions worsen and vice versa. Note that our empirical data does include risk tolerance levels and not risk aversion. Therefore, the concept of countercyclical risk aversion implies cyclical risk tolerance levels in our dataset.

The 2008 financial crisis was unquestionably a major shock to the global economy. Although Germany was not the center of the crisis, the German economy was severely affected. Figure 1 shows the German stock index (DAX) from 2004 through 2012. The significant drop in stock prices in 2008/2009 is clearly discernible, as is a drop in stock prices following the European sovereign debt crisis starting in 2010. Yet, the debt crisis had a much less significant impact on stock prices than the global financial crisis. Consequently, we focus on the 2008-2009 crisis to study the effect of an economic shock on individuals' risk attitudes. Our work, based as it is on data from a historical event, complements research on risk attitudes conducted in a laboratory setting.

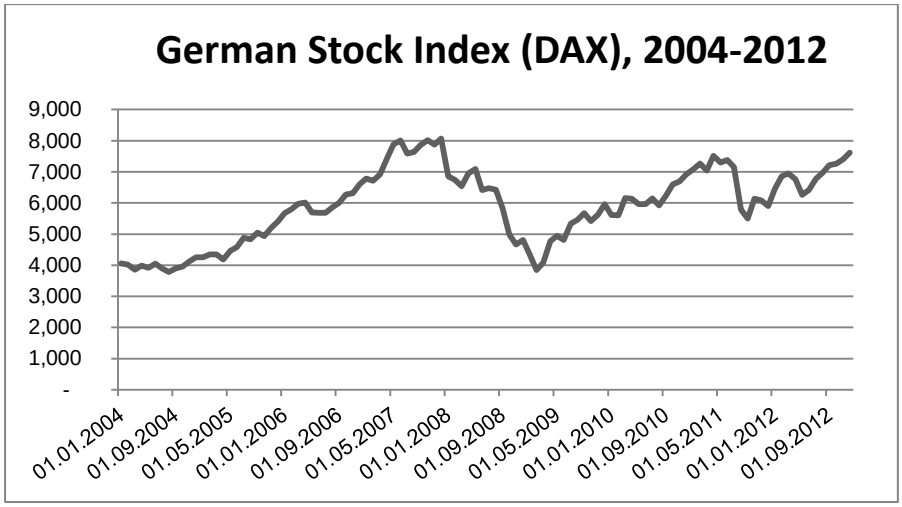

Figure 1: German Stock Index (DAX) during observation period of 2004 to 2012

In order to observe potential changes in risk attitudes, we use the German Socio Economic Panel (SOEP), which is a large, multi-year nationally representative survey of the German population. The SOEP contains a significant amount of demographic and socio-economic data, including a measure of individuals' willingness to take risks. Our results support the idea of countercyclical risk aversion. We find that prior to the onset of the crisis, individuals report greater willingness to take risks than during the crisis. After the peak of the crisis, individuals' willingness to take risks increases again. We further observe socio-demographic differences in risk attitude responsiveness and observe that managers are more willing to take risks at the beginning of the crisis, but decrease their willingness to take risks during the crisis compared to the general population. The more affluent segments of the society showed a stronger reaction to the economic downturn and their risk tolerance levels recovered comparatively more slowly. We find that women took longer than men to recover from the economic shock. We also find that the older generation, which experienced World War II as well as the vicissitudes of the market over

a longer period than other generations, exhibit a more timely responsiveness to the financial crisis.

After the introduction, in Section 2 we review the literature on the formation of risk attitude and factors associated with changes in risk attitude. Section 3 discusses our data and empirical methodology. Our results are reported in Section 4. We conclude the paper in Section 5 with a review of our major findings.

## 2 Variable risk attitudes in the literature

Variable risk attitudes have been discussed in different streams of prior research. In their seminal work, Kahneman and Tversky (1979) introduced the concept of probability weighting and domain specific risk attitudes. They argued that an individual bases his or her decisions in reference to an aspiration level (or reference point) and is risk averse above the reference point and risk seeking below. March (1988) formalizes these ideas and applies it to managerial decision making. He develops a model in which risk attitudes follow a recursive process depending on wealth levels. He uses the same assumption that risk attitude is dependent on whether an individual is above, below or at an aspired level of wealth. This model is further specified by March and Shapira (1992), who distinguish between aspiration levels and survival points and assume that risk attitude depends on how an individual evaluates his or her current situation relative to these levels. In another paper, March and Shapira (1987) argue that prior risk taking may increase the willingness of managers to take future risks when the outcomes were favorable. Empirical research seem to be supportive of the March-Shapira models, see e.g. Miller and Chen (2004). In our paper, we apply the theory of variable risk attitudes to individuals in general and investigate whether the risk attitude of managers' differs from that of the general population.

In the asset pricing literature, variable risk attitudes have been suggested as an explanation for high variations observed in the equity premium. In their seminal paper, Cochrane and Campbell (1999) introduced habit forming utility functions that imply countercyclical risk premiums. In a prospect theory framework, Barberis et al. (2001) find that loss averse preferences imply countercyclical risk aversion. Both of these studies imply that individuals require greater compensation to take risks in time of economic turmoil. Mehra (2012) points out that it is yet to be proven empirically whether individuals' actual risk aversion is countercyclical. This is primarily due to a lack of reliable data as many factors have been shown to impact risk attitudes, including chang-

es in risk perception[2], changes in market expectations,[3] changes in background risk[4] and changes in levels of fear[5], all of which may change in times of economic turmoil.[6]

Guiso et al. (2014) survey customers of an Italian bank before and after the 2008 financial crisis. They find evidence that financial investors increased their risk attitude after the crisis independent of whether they suffered an actual loss. Meanwhile Cohn et al. (2015) provide evidence in favor of countercyclical risk aversion in an experimental setting. Working with financial professionals, they find that subjects who were primed with a financial bust scenario were substantially more fearful and risk averse than those primed with a financial boom scenario. Furthermore, there is evidence of a decreased supply of credit during and immediately after the 2008 global financial crisis (see Ivashina and Scharfstein (2010) and Cornett et al. (2011)), which may also be a result of countercyclical risk aversion on the part of the lenders. Yet, no study to date has provided evidence of countercyclical risk aversion in a large, nationally representative study. We do so in the current study by employing a rich data set which follows the same individuals over several years. The data allow us to control for wealth effects. We find empirical evidence that individuals adjusted their risk tolerance levels as macro-economic conditions changed during the financial crisis of 2008-2010. We contribute to prior studies by shedding light on short-term and longer-term effects of changing economic conditions on risk attitude. Using the German Socio Economic Panel, we are able to control for a variety of factors that may influence risk attitude and are also able to see whether specific subgroups differing by such factors as management status, gender, level of educational attainment, income level, and generation of birth, , reacted differently during the observation period.

Our main finding is that the financial crisis significantly decreased individuals' willingness to take risks; however, willingness to take risks rebounded after the crisis. We observe that these effects were particularly strong for the more affluent. In contrast, the oldest age cohort in our sample, which experienced World War II and the economic vicissitudes since then, showed a lower level of responsiveness to the financial crisis.

[2] See e.g. Sitkin and Weingart (1995) and Weber et al. (2002).
[3] Guiso (2012) investigated individuals' trust in financial institutions during the financial crisis. He finds that trust in banks and financial institutions dropped dramatically. Only 5% of the respondents in his data reported to have full trust in banks and financial markets whereas 30% reported to have full trust just before the crisis. Similar findings were observed in Europe using data from primarily Italy and Austria (see, e.g., Guiso et al. (2014) or Knell and Stix (2009))
[4] See e.g. Guiso and Paiella (2008).
[5] See e.g. Loewenstein (2000), Lerner and Keltner (2001), and Cohn et al (2015). Mood in general have been shown to impact risk preferences as shown by Hirshleifer and Shumway (2003), Wright and Bower (1992) or Bagozzi, Gopinath and Nyer (1999). They find that individuals in a good mood have a greater propensity to make more optimistic decisions.
[6] Chetty and Szeidl (2007) argue that consumption commitments, such as a mortgage and insurance premiums, also impact risk aversion towards moderate size lotteries.

Compared to the general population, we find that managers reduced their willingness to take risks more strongly and their willingness to take risks took longer to recover. Resigned managers, who held a managerial position at the onset of the crisis but did not retain it over the course of the crisis, demonstrate changes in their risk attitude over the course of our study that are more similar to those of the general population, as opposed to those mangers who retained their managerial positions.

The findings of the current study contribute to the growing literature directed at advancing knowledge on the determinants of risk aversion. A more complete understanding of how sudden and sharp decreases in the macro-economic environment impact risk attitudes may help to explain phenomena such as downward spirals and bank runs. Furthermore, the recovery speed of an economy as a whole may be strongly dependent on how individuals react to post-crisis investment opportunities.

# 3 Data and Methodology

Our analysis employs data from the German Socio-Economic Panel (SOEP)[7], which is a representative, longitudinal panel survey of private households and individuals in Germany containing approximately 21,000 individuals in 12,000 households.[8] The survey has been conducted on a yearly basis since 1984. For our analysis, we use data for the years 2004, 2006, 2008, 2009, 2010, 2011, and 2012.[9]

### *Measuring Risk Attitude*

The SOEP asks individuals to self-assess their willingness to take risks on a scale of 0 to 10, with 0 representing no tolerance for risk and 10 representing the greatest willingness to be exposed to risk. Figure 1 shows summary statistics of reported risk attitudes over time for the years 2004, 2006, and 2008 through 2012. Risk attitude was not collected before 2004 nor in the 2005 and 2007 waves of the SOEP. Note that simple t-tests on the means of the unbalanced as well as balanced dataset reject the null hypothesis that the means are identical. A first glance at the data suggests a general decrease in the willingness to take risks in 2008 and 2009, which may be due to the 2008 financial crisis.[10] Our dataset is a balanced dataset and consists of 10,130 individuals older than 18 years (or turning 18 in the year they were included in the dataset). After

[7] See Wagner et al. (2008) for more information on the SOEP.
[8] Naturally, households may consist of more than 1 individual.
[9] Risk preferences were not surveyed before 2004 and in 2005 and 2007.
[10] Germany was not as negatively affected as the U.S. or U.K. during the economic crisis because Germany did not have a real estate bubble that burst. Yet, there were considerable economic consequences due to the global downturn. The German GDP dropped by 5% from 2008 to 2009, see https://www.destatis.de/DE/PresseService/Presse/Pressemitteilungen/2010/01/PD10_012_811.html.

dropping individuals with missing data we are left with a panel dataset of 8,143 individuals and 57,001 observations.

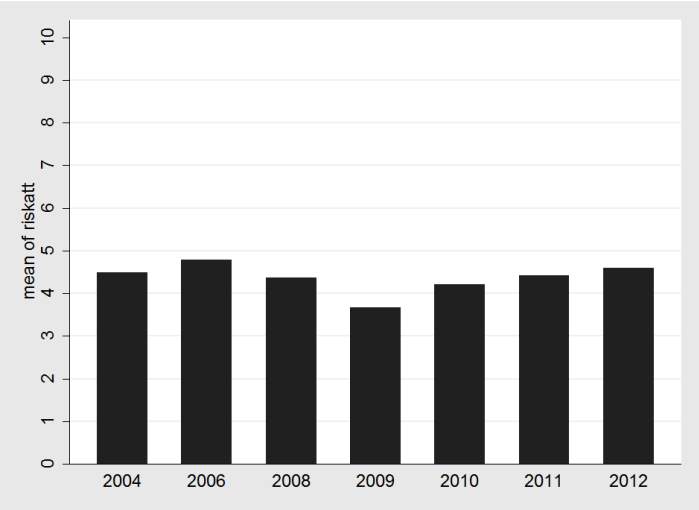


Figure 2: Average risk taking (scale 0: not willing to take risks at all, 10: very willing to take risks)

Generally, there are three ways risk attitude can be deduced and reported in datasets. First, many studies rely on self-reported risk attitude as done in the SOEP (see, for instance, Dorn and Hubermann (2005), Dorn and Hubermann (2010), Dohmen et al. (2011), Malmendier and Nagel (2011)). To determine an individual's risk attitude, they use survey questions where respondents have to self-assess their risk attitude; for example, the SOEP asks the survey participants to rate their willingness to take risks on a scale from 0 to 10. Dohmen et al. (2011) show that the self-reported risk attitudes of the SOEP perform very well. They resample the SOEP population and elicit preferences in an experimental set up as discussed below to compare them to self-reported measures. Also, Kapteyn and Teppa (2011) finds that subjective risk measures can outperform more sophisticated choices between income streams as proposed by Barsky et al. (1997). Accordingly, self-reported measures have been shown to be reliable estimators for risk attitude.

Second, many experiments and some datasets elicit risk attitude via asking hypothetical choices in lotteries (see, for instance, Donkers et al. (2001), and Hartog et al. (2002)). Barsky et al. (1997) and Kimball et al. (2008) provide a detailed explanation of how to elicit preferences from these choices. Holt and Laury (2002) show that choices with respect to larger scale lotteries differ depending on whether choices are cast as purely hypothetical or are rewarded with cash. This approach seems more sophisticated at first glance and less prone to potential reporting

biases. As mentioned above, Dohmen et al. (2011) show that the self-reported score performs similarly well to elicited preferences.

Third, risk attitudes are estimated by a variety of different instrumental variables. Chetty (2006) uses labor supply. In the field of agricultural economics, risk attitudes of farmers are estimated by technology choice and time allocation as done by Bar-Shira et al. (1997) and Antle (1989). For insurance, Cicchetti and Dubin (1994) use the decision to insure certain risks while Cohen and Einav (2007) estimate risk attitude from the deductible choice.

As mentioned above, our dataset contains self-reported risk attitude. Using this measure allows us to track the risk attitude of individuals over multiple years.

***Regression models***

We estimate several different statistical models to investigate changes in risk attitude. First, we run a cross-sectional model in which we regress year dummies and the previously mentioned control variables on risk attitude (model 1).

$$riskattitude_i = \beta_0 + \beta_1 Year2006 + \cdots + \beta_6 Year2012 + \delta \cdot X_{controls} + \varepsilon \quad (1)$$

with *i=1,…, N* and *N = number of individuals*. Our set of control variables is denoted by $X_{controls}$. The cross-sectional model enables us to observe the influence of time-invariant control variables, several of which are statistically significant at the 1% level, e.g. gender, income, level of educational attainment and body height. Including information on leadership position resulted in a multicollinearity issue with the variables age and male.[11] To avoid multicollinearity we only use our manager variable for specific analysis of socio-demographic groups.

Since the control variables will likely only capture part of the individual specific effects, we run an individual fixed effects model to control for unobserved individual specific characteristics (model 2). As in model (1) we include year fixed effects and clustered standard errors and run the following model to test our hypotheses. [12, 13]

[11] The reported variation inflation factors are 60.35 for the variable age and 14.33 for male.
[12] Clustered standard errors account for possible correlations within a cluster and asymptotically equal unclustered standard errors. Since we cannot exclude that clustered standard errors are not necessary, we include them to err on the side of caution.
[13] The Hausman test gives justification for using a fixed effects approach.

$$riskattitude_{i,t} = \beta_0 + \beta_1 Year2006 + \cdots + \beta_6 Year2012 + \delta \cdot X'_{controls} + \varepsilon \quad (2)$$

with *i=1,…, N* and *t=1,…,T* where *N = number of individuals and T = number of years*.

In this model, we do not include variables that do not change randomly over time (e.g. gender and height) and the reduced set of control variables is denoted by $X'_{controls}$. In order to utilize the panel structure of our dataset and because of the greater explanatory power, our discussion relies mostly on model 2. To analyze the association between risk attitude and time invariant controls we utilize model 1 as these measures are not included in model 2.

As a robustness check we run the same models and replace the dummies by GDP growth rates. Results are reported in the Appendix. We find our coefficient estimates to be consistent across all of our models. In addition, we ran several robustness checks to control for wealth effects.

As we are interested in socio-demographic differences, we run several regressions in which we interact selected groups of our dataset with year dummies. The interaction models are specified as follows,

$$riskattitude_i = \beta_0 + \beta_1 Year2006 + \cdots + \beta_6 Year2012 + \gamma \cdot X_{interactions} + \delta \cdot X_{controls} + \varepsilon \quad (3)$$

$$riskattitude_{i,t} = \beta_0 + \beta_1 Year2006 + \cdots + \beta_6 Year2012 + \gamma' \cdot X'_{interactions} + \delta \cdot X'_{controls} + \varepsilon \quad (4)$$

with *i=1,…, N* and *t=1,…,T* where *N = number of individuals and T = number of years*. The sets of control variables are denoted by $X_{controls}$ and $X'_{controls}$ and similar to the specification above, we run a cross-sectional model (model 3) as well as a fixed effects model (model 4).

***Control Variables***

The paper investigates determinants of changes in risk attitude over the period of the financial crisis. We are interested both in the general change in risk aversion of the surveyed population as a whole and changes in risk aversion of different socio-demographic groups in the population. To capture the impact of economic conditions, we include year dummy variables and use the year 2004 as the omitted category. We investigate changes in risk attitude of specific socio-

demographic groups by interacting year effects with generation, region and gender variables, as well as measures of wealth and educational attainment.

In addition to risk attitude, the SOEP includes rich information on demographic characteristics. We further include control variables for those factors that have been found to be associated with risk attitude in previous cross-sectional studies. These include gender, age, marital status, family structure, height, education level attained, type of employment, wealth, income, geographic region, home ownership, and self-rated health.[14] Furthermore, the longitudinal character of the SOEP allows us to track individuals over the whole observation period allowing us to control for other unobserved individual characteristics. We capture wealth by including individuals' income as well as the income they receive from interest and dividend payments.[15] We include individuals' monthly after-tax household income and find – similar to prior studies – that willingness to take risks increases as income increases. In order to investigate changes in risk attitude of more affluent segments of society we later replace the continuous income variable by a dummy variable for high income groups[16].

We control for geographical region by adding dummy variables for all 16 federal states of Germany. Similar to prior studies (see, e.g. Dohmen et al. (2011)) we find most of these dummy variables to be statistically significant.
To control for family structure, we include individuals' marital status and the number of children. Individuals' marital status is incorporated by differentiating between married, widowed and divorced individuals as well as individuals who are single. The omitted category in our analysis is single. With respect to family size, we include the number of children the household receives child allowances for.[17] In addition, we include a dummy variable to capture individuals who provide care for elderly or disabled family members.

To account for individuals' level of educational attainment, we control for individuals who received an Abitur. An Abitur is the highest certificate awarded to high school graduates. Students who are awarded an abitur are allowed to enroll at a university in Germany. An abitur is compa-

[14] See Barsky et al. (1997), Donkers et al. (2001) and Hartog et al. (2002), Kimball et al. (2008) and Dohmen et al. (2011).
[15] We use 2012 numbers in our analysis and account for inflation by referring to
[16] According to the 'Statistische Bundesamt', a governmental institution that researches on demographics in Germany, households can be referred to as being rich or as being a high income household if they have a monthly after tax income of 6,000 Euros or higher.
[17] The German Government pays child allowances to a primary caregiver who is financially responsible for each child they are providing care for. Monthly allowances are 184 Euros for the first two children and up to 215 Euros for further children. We prefer using this measure over the actual number of children living in the household as it better reflects the financial responsibility for the children.

rable to A-levels in the U.K. and the baccalauréat in France. Other school leaving certificates awarded to graduates, such as a medium school degree (Realschulabschluss) or low school degree (Hauptschulabschluss), do not qualify one for university enrollment.[18]

We differentiate between blue-collar employees, white-collar employees, civil servants and self-employed individuals to incorporate individuals' occupational status in our analysis. We also control for trainees[19] and retirees, as well as for individuals without any gainful employment. Here we distinguish between those currently seeking employment, which we refer to as unemployed individuals, and those who are not, e.g. housewives. The latter category we refer to as individuals with "no job". The omitted category in our analysis is blue-collar workers.

The self-reported health state is measured by an integer variable taking values between 1 (very good health status) and 5 (poor health status). Dohmen et al. (2011) show the significance of the self-reported health state for risk attitude. Therefore, we also include it our study even though the literature has repeatedly discussed biases in self-reported health. Table 1 reports summary statistics for all of the independent variables.

[18] The main difference between the lowest and the medium school degree in Germany is related to the fact that most white collar positions require a medium school degree, whereas certain blue collar workers only need to have the lowest school degree.

[19] In corporation with the state governments, German companies have extensive trainee programs where school graduates enroll in a two to three year trainee program. Several weeks of instruction in a public specialized school are followed by several weeks of training on the job.

| Variable | Definition | Mean | Std. Dev. | Min | Max |
|---|---|---|---|---|---|
| Dependent variable | | | | | |
| riskattitude | Scale from 0 to 10 (0): no risk tolerance and (10): high willingness to take risk s | 4.35 | 2.25 | 0 | 10 |
| Control variables | | | | | |
| health* | Scale from 1 to 5 with (1): very good health status and (5): poor health status | 2.69 | 0.91 | 1 | 5 |
| height | body height in cm | 171.17 | 12.06 | 80 | 207 |
| single* | (1): single | 0.18 | 0.37 | 0 | 1 |
| married* | (1): married | 0.68 | 0.46 | 0 | 1 |
| widowed* | (1): widowed | 0.06 | 0.25 | 0 | 1 |
| divorced* | (1): divorced | 0.08 | 0.27 | 0 | 1 |
| supportpersoncare* | (1): if individual supports person in care | 0.06 | 0.24 | 0 | 1 |
| number_children | Number of children that qualify for child allowance | 0.62 | 0.97 | 0 | 10 |
| age | age of individual | 52.27 | 15.86 | 17 | 102 |
| male* | (1): male | 0.47 | 0.50 | 0 | 1 |
| gdp_change | % change in GDP | 1.16 | 3.01 | -5.6 | 4.1 |
| ln_real_aftertaxincome | natural logarithm of individual's real monthly household after tax income | 7.87 | 0.58 | 0 | 12.20 |
| ln_real_interestdividendincome | Income received income from interest and dividends | 5.16 | 2.52 | 0 | 14.46 |
| propertyownership* | (1): individual owns house or flat | 0.57 | 0.49 | 0 | 1 |
| civilservant* | (1): civil servant | 0.05 | 0.22 | 0 | 1 |
| nojob* | (1): individual has no job | 0.06 | 0.25 | 0 | 1 |
| trainee* | (1): individual is trainee | 0.03 | 0.16 | 0 | 1 |
| whitecollar* | (1): individual is white collar worker | 0.31 | 0.47 | 0 | 1 |
| bluecollar* | (1): individual is blue collar worker | 0.15 | 0.37 | 0 | 1 |
| unemployed* | (1): individual is registered as unemployed | 0.05 | 0.22 | 0 | 1 |
| retired* | (1): individual is retired | 0.28 | 0.45 | 0 | 1 |
| selfemployed* | (1): individual is self-employed | 0.07 | 0.26 | 0 | 1 |
| manager* | (1): individual has leadership position | 0.13 | 0.34 | 0 | 1 |
| resigned manager | (1): individual lost leadership position during crisis | 0.05 | 0.22 | 0 | 1 |
| highlevelschool* | (1): individual has high level school leaving certificate | 0.28 | 0.44 | 0 | 1 |
| high income* | (1): monthly after tax household income exceeds EUR 6,000 | 0.06 | 0.24 | 0 | 1 |
| generation war* | (1): individual is born before 1945 | 0.28 | 0.44 | 0 | 1 |
| generation baby boomers* | (1): individual is born 1946-1964 | 0.39 | 0.48 | 0 | 1 |
| generation x* | (1): individual is born 1965-1980 | 0.26 | 0.44 | 0 | 1 |
| generation y* | (1): individual is born 1981-1990 | 0.07 | 0.25 | 0 | 1 |

Table 1: Summary statistics of variables in full sample and different subsamples, 2004, 2006, 2008, 2009, 2010, 2011, and 2012. (* denotes dummy variables)

# 4 Results

### *General Impact of Financial Crisis*

In the current section we report our empirical findings. We find that macro-economic conditions matter and that a difficult macro-economic environment changes short and medium term risk attitude. Individuals became more risk averse with the onset of the financial crisis; however, their willingness to take risks recovers within a couple of years.

As mentioned above, we include year dummies in our analysis, using 2004 as our reference year, to control for the macro-economic environment. Our main results are reported in Table 2. Table 3 and Table 4 report the results of our robustness checks.

In the years of strong economic growth from 2004 to 2006 we see an increase in the willingness to take risks in Tables 2 and 3. The effects are statistically significant at the 1% level with risk taking roughly increasing by .2-.3 points on our scale from 0 to 10. This can be attributed to the overall optimistic attitude in the economy. We see a decline in the willingness to take risks after the beginning of the financial crisis in 2008. The effect of the financial crisis is persistent through all of our models. We see a change in the absolute levels of risk taking in model (2) of roughly -.2 in 2008 and almost 1 in 2009 compared to 2004. The effects are significant at the 1% level. Over the course of the financial crisis, these effects diminish and individuals' willingness to take risks increases again. Absolute levels of risk taking, however, are still lower relative to 2004 as we see that coefficient estimates for the years 2010 and 2011 are roughly -.4 and -.2, respectively. The coefficient estimates are significant at the 1% level. Models 1 and 2 show coefficient estimates with the same negative sign for the years 2006-2010, but signs start to differ starting in 2011. One possible reason for these discrepancies in the estimators is unobserved wealth effects after the crisis. In order to control for this, we run a robustness analysis in which we only include individuals who reported not having any assets in the form of investments or savings accounts. Without going into too much detail here to avoid repetitiveness, we find significant and robust estimators, particularly in 2006 where the willingness to take risks increases and in 2009 where it declines, as predicted by the theory of countercyclical risk aversion.

| VARIABLES | (1)<br>OLS with Clustered Standard Errors<br>dependent variable: riskatt | (2)<br>Fixed Effects with<br>Clustered Standard Errors<br>dependent variable: riskatt |
|---|---|---|
| year2006 | 0.3337*** [0.0259] | 0.2299*** [0.0322] |
| year2008 | -0.0177 [0.0271] | -0.2134*** [0.0477] |
| year2009 | -0.6967*** [0.0303] | -0.9355*** [0.0580] |
| year2010 | -0.1399*** [0.0286] | -0.4173*** [0.0662] |
| year2011 | 0.0574** [0.0284] | -0.2678*** [0.0757] |
| year2012 | 0.2556*** [0.0284] | -0.1110 [0.0863] |
| Health | -0.1997*** [0.0170] | -0.0863*** [0.0131] |
| Bodyheight | 0.0135*** [0.0026] | |
| Married | -0.1274** [0.0593] | -0.1591** [0.0647] |
| Widowed | -0.1382 [0.0907] | -0.1618 [0.1181] |
| Divorced | 0.2267*** [0.0790] | -0.0074 [0.0929] |
| Supportpersoncare | 0.1102** [0.0543] | 0.0994** [0.0388] |
| number_children | -0.0447** [0.0188] | 0.0078 [0.0193] |
| Age | -0.0181** [0.0079] | |
| Age2 | 0.0001 [0.0001] | 0.0003*** [0.0001] |
| Male | 0.7959*** [0.1220] | |
| male_age | -0.0041* [0.0021] | |
| male_gdpchange | 0.0089** [0.0044] | 0.0088** [0.0044] |
| ln_real_aftertaxincome | 0.3268*** [0.0346] | -0.0067 [0.0321] |
| ln_real_interestdividendincome | -0.0179*** [0.0064] | -0.0055 [0.0053] |
| Propertyownership | 0.0005 [0.0360] | 0.0313 [0.0427] |
| Civilservant | -0.0766 [0.0862] | 0.0177 [0.0993] |
| Nojob | -0.0692 [0.0702] | 0.0207 [0.0606] |
| Trainee | 0.3047*** [0.0853] | 0.1131* [0.0686] |
| Whitecollar | 0.0873* [0.0485] | 0.0159 [0.0451] |
| Unemployed | 0.2368*** [0.0673] | 0.0438 [0.0554] |
| Retired | 0.0691 [0.0669] | -0.0002 [0.0612] |
| Selfemployed | 0.8306*** [0.0755] | 0.1880** [0.0765] |
| Highlevelschool | 0.1097*** [0.0417] | |
| Federal States controls | YES | YES |
| Constant | 0.6803 [0.5282] | 4.4289*** [0.4255] |
| Observations | 57,001 | 57,001 |
| Adjusted R-squared | 0.116 | 0.4992 |
| Number of individuals | 8,143 | 8,143 |

Robust standard errors in brackets, *** p<0.01, ** p<0.05, * p<0.1

Table 2: Regression results. Reference categories: regular level of school, blue collar workers, year 2004.

## Robustness of results

### *Wealth Effects*

Variations in individual risk attitude during financial cycles are often attributed to wealth effects. Wealth changes can affect the curvature of the utility function in the relevant domain as in habit persistent models (Campbell and Cochrane (1999)) or prospect theory models (Barberis, Huang and Santos (2001)). Using data collected outside of a controlled setting it is often challenging to address endogeneity and disentangle wealth effects as discussed by Cohn et al. (2015). We address this issue with several robustness tests. First, we run a robustness analysis where we consider changes in income and changes in risk attitude instead of absolute values. Second, we rerun our analysis on several subsamples of individuals restricted to those who are very unlikely to have suffered losses and significant wealth changes during the financial crisis. Accordingly, we ran our regressions on a subset of individuals who report not to own a savings account or have zero income from interest and dividends or both. Our coefficient estimates are consistent and statistically significant in all of these robustness tests.[20] In addition, it has been argued – particularly in the context of the financial crisis – that individual' risk attitude changes regardless of wealth effects. Guiso et al. (2014), for instance, find an increase in risk aversion among Italian bank clients following the 2008 financial crisis. The increase in risk aversion was observed even among investors who did not suffer a financial loss and are unlikely to have suffered a reduction in their lifetime income.

[20] Note that we omit the corresponding tables in the interest of readability of the paper. They are upon request from the authors directly.

| VARIABLES | (1)<br>OLS with Clustered Standard Errors<br>dependent variable: riskatt | (2)<br>Fixed Effects with<br>Clustered Standard Errors<br>dependent variable: riskatt |
|---|---|---|
| year2006 | 0.2813*** [0.1068] | 0.3888*** [0.1400] |
| year2008 | 0.0907 [0.1067] | 0.2259 [0.1985] |
| year2009 | -0.7002*** [0.1124] | -0.6140*** [0.2341] |
| year2010 | -0.0093 [0.1109] | 0.1584 [0.2719] |
| year2011 | 0.1441 [0.1088] | 0.2817 [0.3099] |
| year2012 | 0.4653*** [0.1031] | 0.6107* [0.3497] |
| Health | -0.2740*** [0.0417] | -0.1373*** [0.0450] |
| Bodyheight | 0.0226*** [0.0061] | |
| married | -0.1807 [0.1479] | 0.2725 [0.2939] |
| widowed | 0.0006 [0.2283] | 0.2852 [0.5228] |
| Divorced | 0.2628 [0.1680] | 0.4029 [0.3473] |
| Supportpersoncare | 0.1436 [0.1455] | 0.3406** [0.1546] |
| number_children | 0.0409 [0.0434] | -0.0549 [0.0609] |
| Age | -0.0385** [0.0186] | |
| age2 | 0.0002 [0.0002] | -0.0005 [0.0004] |
| Male | 0.8002*** [0.2816] | |
| male_age | -0.0066 [0.0051] | |
| male_gdpchange | 0.0130 [0.0153] | 0.0105 [0.0158] |
| ln_real_aftertaxincome | 0.2634*** [0.0803] | 0.0974 [0.0933] |
| propertyownership | -0.1327 [0.0951] | 0.0586 [0.1708] |
| civilservant | 0.2847 [0.2903] | -0.0350 [0.5281] |
| nojob | -0.1850 [0.1566] | -0.0289 [0.1685] |
| trainee | -0.1126 [0.1935] | -0.1643 [0.1959] |
| whitecollar | 0.0683 [0.1173] | -0.0435 [0.1408] |
| unemployed | -0.0551 [0.1249] | -0.1366 [0.1180] |
| retired | -0.1538 [0.1489] | 0.0601 [0.1907] |
| selfemployed | 0.8622*** [0.1716] | 0.2917 [0.2509] |
| highlevelschool | 0.1937 [0.1256] | |
| Federal States controls | YES | YES |
| Constant | 0.2417 [1.2224] | 6.2210*** [1.3445] |
| Observations | 16,086 | 16,086 |
| Adjusted R-squared | 0.135 | 0.4995 |
| Number of individuals | 2,298 | 2,298 |

Robust standard errors in brackets, *** p<0.01, ** p<0.05, * p<0.1

Table 3: Robustness analysis regression results. Reference categories: regular level of school, blue collar workers, year 2004.

**GDP vs. year dummies**

We replace year dummies with changes in GDP as a robustness check to see if estimates on specific years may be caused by unobserved events other than financial turmoil. Table 4 reports the estimation results. A downside of this approach compared to employing year dummies is that we assume a linear relationship between relative changes in GDP and willingness to take risks, which may not be true in times of extreme financial conditions as observed in our dataset. Yet, this approach enables us to provide further evidence of countercyclical risk aversion. Table 4 reports all coefficient estimates. We observe a positive and highly significant coefficient estimate for the GDP growth variable of 0.07. This indicates that as GDP grows, individuals are on average more willing to take risks. A GDP increase of 1% implies an increase of 0.07 points on the willingness-to-take-risks-scale. The coefficient estimate is significant at the 1% level. Signs and significance of the control variables are robust for all variables other than being widowed and being in a trainee program in the fixed effects model. In these two cases, the coefficient estimates increase and they become significant when GDP changes are incorporated in the models rather than year dummies.

| VARIABLES | (1)<br>OLS with Clustered Standard Errors<br>dependent variable: riskatt | (2)<br>Fixed Effects with<br>Clustered Standard Errors<br>dependent variable: riskatt |
|---|---|---|
| gdp_change | 0.0725*** [0.0030] | 0.0730*** [0.0030] |
| Health | -0.2009*** [0.0170] | -0.0898*** [0.0132] |
| Bodyheight | 0.0134*** [0.0026] | |
| Married | -0.1239** [0.0592] | -0.2621*** [0.0641] |
| Widowed | -0.1376 [0.0905] | -0.2460** [0.1183] |
| Divorced | 0.2302*** [0.0789] | -0.1252 [0.0931] |
| Supportpersoncare | 0.1198** [0.0543] | 0.1114*** [0.0394] |
| number_children | -0.0445** [0.0188] | 0.0205 [0.0196] |
| Age | -0.0195** [0.0079] | |
| Age2 | 0.0001 [0.0001] | -0.0002*** [0.0000] |
| Male | 0.8021*** [0.1220] | |
| male_age | -0.0042** [0.0021] | |
| male_gdpchange | 0.0089** [0.0044] | 0.0088** [0.0044] |
| ln_real_aftertaxincome | 0.3327*** [0.0346] | -0.0041 [0.0324] |
| ln_real_interestdividendincome | -0.0196*** [0.0063] | -0.0111** [0.0054] |
| Propertyownership | -0.0009 [0.0360] | 0.0019 [0.0431] |
| Civilservant | -0.0700 [0.0863] | 0.0195 [0.0998] |
| Nojob | -0.0544 [0.0702] | 0.0626 [0.0610] |
| Trainee | 0.3194*** [0.0851] | 0.2178*** [0.0684] |
| Whitecollar | 0.0903* [0.0485] | 0.0171 [0.0456] |
| Unemployed | 0.2465*** [0.0673] | 0.0691 [0.0564] |
| Retired | 0.0735 [0.0666] | 0.0193 [0.0618] |
| Selfemployed | 0.8387*** [0.0755] | 0.2004*** [0.0774] |
| Highlevelschool | 0.1065** [0.0416] | |
| Federal States controls | YES | YES |
| Constant | 0.5905 [0.5279] | 5.5121*** [0.3245] |
| Observations | 57,001 | 57,001 |
| Adjusted R-squared | 0.107 | 0.394 |
| Number of individuals | 8,143 | 8,143 |

Robust standard errors in brackets, *** p<0.01, ** p<0.05, * p<0.1

Table 4: Robustness analysis regression results. Reference categories: regular level of school, blue collar workers, year 2004.

# 5 Differences among Socio-Demographic Groups

Prior literature provides evidence that individuals' experiences can affect their willingness to take risks. We investigate whether the 2008 financial crisis affected the willingness to take risks differently across different groups. Below, we consider changes over the crisis in the willingness to assume risk of individuals in corporate leadership positions relative to the general population. Furthermore, we are particularly interested in managers who remained in a leadership position throughout the crisis compared to those who did not retain their leadership position. We also examine whether there was a differential impact of the financial crisis on the willingness to take risks between males and females and between high income and lower income individuals. In addition, we analyze generation-specific effects.

***Manager***

One group we consider are those individuals who held a corporate leadership position at the onset of the financial crisis. The SOEP reports if an individual is part of the upper, middle, or lower level management of an enterprise. As the survey does not include an objective definition of these levels, individuals need to self-assess. We created a single dummy variable indicating whether an individual held a leadership position at any level to avoid potential biases. Information on leadership position is reported only in the 2007, 2009, and 2011 waves of the SOEP. We base our analysis on whether an individual held a leadership position in 2007 since we are interested in how individuals with managerial experience before the downturn reacted during and after the crisis. In an additional analysis, we also investigate how managers who were still in a leadership position after the crisis differ from managers who while still in the workforce but were no longer in a leadership position after the crisis, whether voluntarily or involuntarily. We refer to the latter group as resigned managers.

We find that managers are on average more willing to take risks. Our results are reported in Table 5 and in Figure 3. The coefficient estimate of our manager variable is positive (0.59) and significant at the 1% level. With respect to macro-economic changes, we observe that managers' willingness to take more risk did not increase as much as that of the general population during the exuberant economic conditions prevailing in 2006 even though they still exhibit a higher willingness to take risks than the general population. With the beginning of the financial crisis we observe a comparatively strong responsiveness in managers' risk attitude. We find that managers decreased their willingness to take risks more than the control group. At the peak impact of the financial crisis, 2009, the decrease was particularly strong with managers' risk tolerance

dropping by -0.15 points more than non-managers. The coefficient estimate is significant at the 5% level. In addition, we observe that the decreased willingness to take risks of managers persists through 2010 and managers seem to be reluctant to quickly recover their willingness to risk. The respective coefficient estimate in 2010 is -0.26, which is significant at the 1% level. As the overall effect of 2010 is -0.13, which is also significant at the 1% level, we find that managers are in 2010 still -0.26 below their initial risk tolerance level, whereas the control group recovered to a risk tolerance level that is only -0.13 below its initial value in 2004.

| | (1) |
|---|---|
| **VARIABLES** | **Base Model With Controls with Clustered Standard Errors dependent variable: riskatt** |
| year2006 | 0.3432*** [0.0282] |
| year2008 | -0.0302 [0.0292] |
| year2009 | -0.7414*** [0.0290] |
| year2010 | -0.1343*** [0.0297] |
| year2011 | 0.0227 [0.0294] |
| year2012 | 0.2180*** [0.0296] |
| manager | 0.5911*** [0.0703] |
| manager_year2006 | -0.1304* [0.0680] |
| manager_year2008 | -0.0929 [0.0733] |
| manager_year2009 | -0.1523** [0.0722] |
| manager_year2010 | -0.2586*** [0.0718] |
| manager_year2011 | -0.0150 [0.0707] |
| manager_year2012 | -0.1724** [0.0702] |
| Socio-demographic controls | YES |
| Federal States controls | YES |
| Constant | -2.3915*** [0.4198] |
| Observations | 57,001 |
| Adjusted R-squared | 0.1040 |
| Number of individuals | 8,143 |

Robust standard errors in brackets, *** p<0.01, ** p<0.05, * p<0.1

Table 5: Risk attitude responsiveness of individuals who hold a leadership position in their corporation. Reference categories: Individuals without leadership position and year 2004. Socio-demographic control variables include information on health, height, family status, income, occupation, and education. Estimates for these controls are reported in the Appendix.

We further consider the group of high risk takers, which we define as the set of individuals who report their willingness to take risks to be between 7 and 10 on our 0-to-10 scale. In 2004, we find 34% of managers to be in the high risk taker group, whereas only 19% of our control group

self-asses themselves to be a 7 or higher. During the financial crisis, the numbers dropped to 17% for managers and 9% for the control group. In 2010, the portion of high risk takers in the control group increased to 17%, which is almost as much as in 2004, whereas the portion within the group of managers remained comparatively low at 26%.

To shed more light on managerial success during stewardship in terms of financial turmoil, we further distinguish managers who were still in a managerial position after the 2008 crisis and resigned managers as mentioned above. Managers who kept their position were significantly more willing to take risks than those who resigned from a managerial career overall. This is consistent with the idea that companies take on more risk in times of financial turmoil as discussed by Stuelz (1996). Companies hold a default put option implying that they cannot lose more than the value of their shares and might invest in riskier and less worthwhile projects in times of financial turmoil.

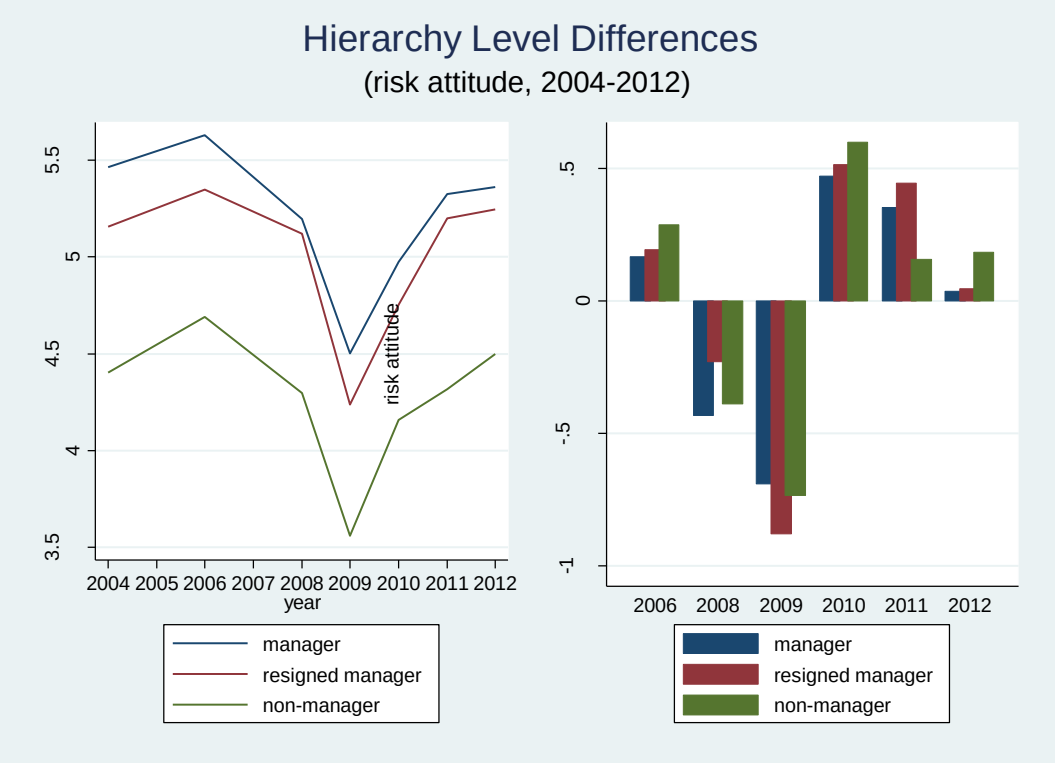


Figure 3: (Changes in) willingness to take risks during the observation period for different hierarchy levels. Regression results are reported in the Appendix.

The rationale behind this is that in case of a default the company can pass part of the loss to their lenders while they fully participate in the revenue of any successful projects. Accordingly, managers who are more willing to take risks can be thought to be more likely to remain in their

leadership positions during and after the crisis. In addition, we see that resigned managers reacted later in terms of adjusting their preferences. We see that risk attitude went up more in 2006 and 2008 for resigned managers than for managers who are still in a managerial position after the crisis. Overall, the reaction pattern of the resigned managers is not significantly different than that of the general population, while that of managers who kept their position is different.

***Gender***

There is significant economic evidence that males on average have different risk attitudes than women. Croson and Gneezy (2009) and Outreville (2014) provide extensive overviews of the literature. Both conclude that men are more risk tolerant than women.

When it comes to changes in risk attitudes, much less is known about gender differences. To our knowledge, it has not been studied yet which gender, if either, is more likely to experience changes in risk attitude over time. In order to make predictions about changes in the risk attitudes of men and women, we borrow findings from the framing literature, where framings have been found to affect males and females differently in many experiments. We believe that the 2008 financial crisis provides a natural framing experiment in the sense that economic perspectives were different before, during and after the crisis. In the field of retirement research, Brown et al. (2013) find that women are more sensitive to framing when claiming their social security benefits. Furthermore, Agnew et al. (2008) find that women react differently than men to different annuity frames. Women are more sensitive to annuity framing, while men are more sensitive to investment framing. Kahn et al. (1971) argue that women are more sensitive to social cues. He believes that small differences in experiments might have a bigger impact on women than on men, which is a possible explanation for findings on gender differences. Croson and Gneezy (2009) suggest that there is more variability in findings on female behavior across different experiments on ultimatum games and voluntary contribution mechanism experiments, which is also in line with Kahn's hypothesis. Furthermore, Gilligan and Attanucci (1988) argue that decisions of men are less context-specific. These findings lead us to expect that women are more likely than men to change their risk attitude.

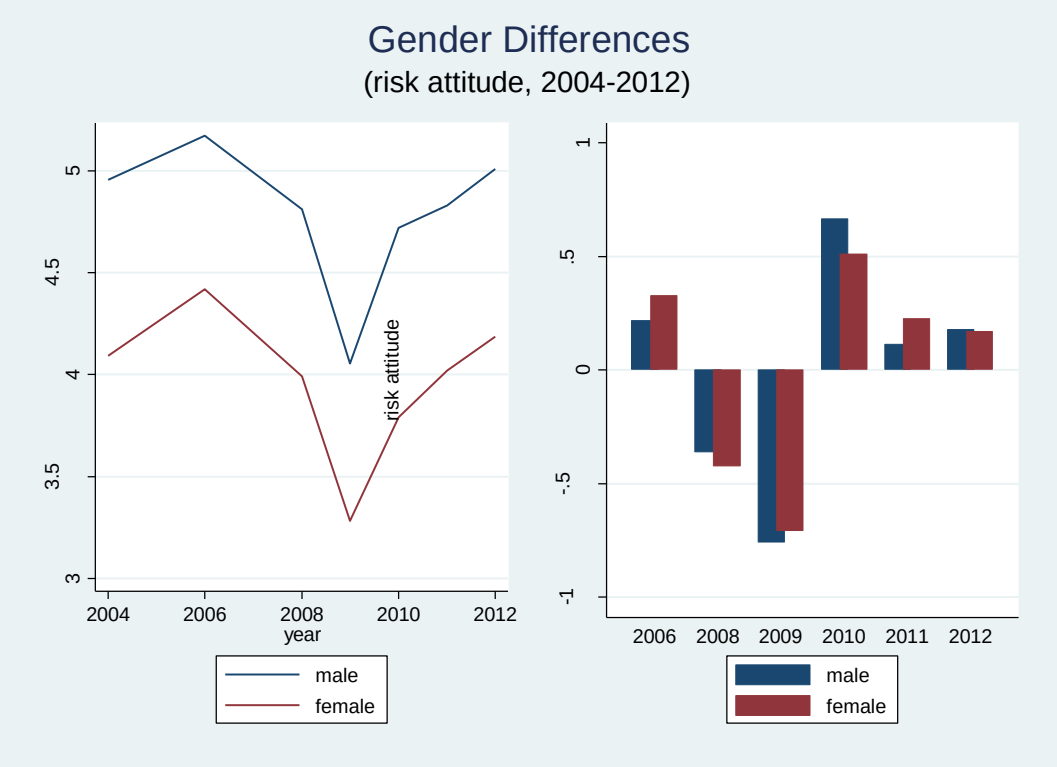


Figure 4: (Changes) in willingness to take risks during observation period for different genders.

We measure gender effects by including gender in our cross-sectional estimations and add interactions of gender with age and year dummies to control for the differing effects of ageing and economic conditions on gender. Figure 4 provides a first preview of gender-specific patterns and Table 6 summarizes our regression results.

Our results are consistent with the pervasive finding that males are on average more willing to take risks than females. Our coefficient estimate is 0.83 and significant at the 1% level. As individuals age, risk aversion increases and this effect is even stronger for men than for women. The coefficient estimate for age is -0.0179 and significant at the 5% level. This indicates that each additional decade decreases risk attitude by almost -0.2. For women, the respective decrease is -0.24. With respect to changes in risk taking, we find differences particularly in terms of recovery, i.e. women take longer to recover from the crisis. We also observe gender specific differences prior and during the beginning of the financial crisis (see, e.g., Figure 3) but these are not statistically significant.

| VARIABLES | (1)<br>OLS with Clustered Standard Errors<br>dependent variable: riskatt | (2)<br>Fixed Effects with<br>Clustered Standard Errors<br>dependent variable: riskatt |
|---|---|---|
| year2006 | 0.3876*** [0.0359] | 0.2860*** [0.0408] |
| year2008 | -0.0047 [0.0372] | -0.1887*** [0.0537] |
| year2009 | -0.6970*** [0.0371] | -0.9216*** [0.0615] |
| year2010 | -0.1766*** [0.0390] | -0.4371*** [0.0708] |
| year2011 | 0.0707* [0.0386] | -0.2349*** [0.0796] |
| year2012 | 0.2505*** [0.0390] | -0.0951 [0.0895] |
| male | 0.8300*** [0.1197] | |
| male_year2006 | -0.1049** [0.0513] | -0.1090** [0.0510] |
| male_year2008 | -0.0185 [0.0534] | -0.0426 [0.0523] |
| male_year2009 | -0.0597 [0.0532] | -0.0879* [0.0513] |
| male_year2010 | 0.1033* [0.0546] | 0.0683 [0.0524] |
| male_year2011 | -0.0066 [0.0541] | -0.0469 [0.0510] |
| male_year2012 | 0.0038 [0.0546] | -0.0388 [0.0508] |
| age | -0.0179** [0.0079] | |
| age2 | 0.0001 [0.0001] | 0.0003*** [0.0001] |
| male_age | -0.0044** [0.0022] | |
| Socio-demographic controls | YES | YES |
| Federal States controls | YES | YES |
| Constant | 0.4340 [0.5301] | 4.2989*** [0.4072] |
| Observations | 57,001 | 57,001 |
| Adjusted R-squared | 0.115 | 0.394 |
| Number of individuals | 8,143 | 8,143 |

Robust standard errors in brackets, *** p<0.01, ** p<0.05, * p<0.1

Table 6: Gender specific risk attitude responsiveness. Reference category: year 2004. Socio-demographic control variables include information on health, height, family status, income, occupation, and education. Estimates for these controls are reported in the Appendix.

With respect to recovery, our reported coefficient estimate of the interaction between male and year 2010 (the first year of recovery) is positive (0.10) and significant at the 10% level. We conclude from this that males adjust their risk tolerance faster and more immediately than females after the financial crisis. In fact, females recover as well but not as promptly as males do. These findings are consistent with our robustness check, where we replaced year fixed effects with a control variable for GDP changes. Our robustness results indicate that men alter their willingness to take risks in alignment with GDP changes. As GDP grows, men increase their willingness to take risks. The coefficient estimate is 0.0089 and is significant at the 5% level. Our results are consistent across all models.

***Generations***

To investigate generation specific effects we create categorical variables for the following generations: War Generation, Baby Boom Generation, Generation X, and Generation Y. We use the following classification:

- War Generation (year of birth before or in 1945)
- Baby Boomer Generation (year of birth between 1946 and 1964)
- Generation X (year of birth between 1965 and 1980)
- Generation Y (year of birth between 1981 and 1990).

The oldest individuals in our dataset were born in 1910, and the youngest in 1987. We use the baby boomers generation as our omitted category. We find that the war generation is significantly less willing to take risks than the Baby Boomer generation. The reported coefficient estimate is -0.3612, which is statistically significant at the 1% level. Later generations are even less risk averse than the Baby Boomers. The coefficient estimate for the Generation X variable is 0.1941 and for the Generation Y variable it is 0.5996. Both estimates are significant at the 1% level. Overall, our results indicate that generations vary in self-reported risk tolerance during the study period.

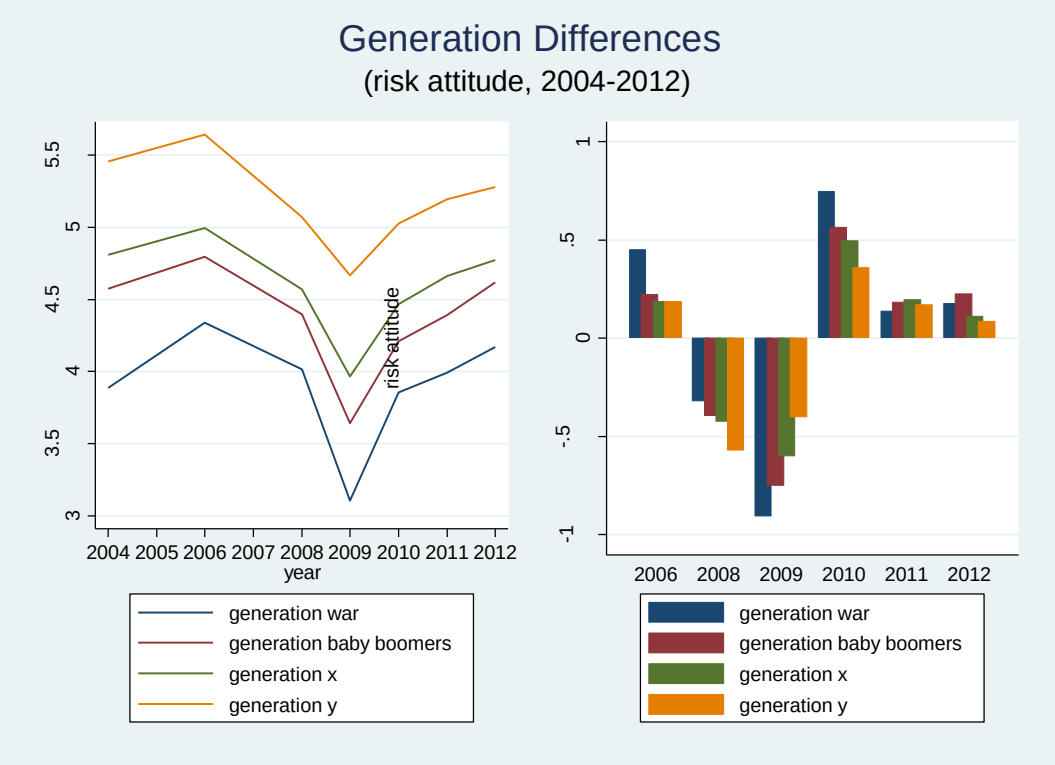


Figure 5: (Changes in) willingness to take risks during observation period for different generations.

We next consider the extent to which the financial crisis affected risk tolerance of the different generations. As shown in Figure 5, while changes in risk tolerance followed a similar pattern over time with all four generations, there are differences in the ways in which the financial crisis appears to have affected the age cohorts.

Results reported by Table 7 indicate that the war generation in particular differed. They exhibit a stronger increase in the willingness to take risks in 2006. Compared to 2004 data, individuals born before 1945 adjusted their risk attitude to a lesser degree than the other generations. Yet, they took a steeper drop from before as they had beforehand increased their willingness to take risks more. The coefficient estimate of the interaction term with year 2009 is positive (0.2003) and significant at the 1% level. Furthermore, we observe that the speed of its recovery in risk tolerance was greater than that of other generations.

Most German individuals born before 1945 directly or indirectly experienced the circumstances and aftermath of World War II. There is recent evidence that even infants who experience destruction and losses are harmed by the consequences of war (Bode, 2015). We contribute the lower risk tolerance of this generation to its having experienced the traumatic events of World War II and its aftermath as well as greater economic fluctuations over time than other generations. Overall, individuals born before 1945 experienced relatively long periods with strong economic conditions. They experienced the booming 1950's and 1960's and the less profitable but still growing decades of the 1970's and 1980's. Even after reunification, the German economy was comparatively robust. However, over the lifetime of the war generation, Germany was interrupted by cyclical downturns in 1967, 1975, 1982, 1993 and 2003. With respect to the changing patterns in risk tolerance of the war generation, we find that adjustments in risk tolerance levels are more immediate relative to other generations. This can also be seen in Figure 5.

The time span of our observation period, however, does not allow us to fully disentangle age and cohort effects. More observation years would be necessary to determine if the changes in risk attitude are due to individuals' age and their stages in life, e.g. retirement, of if they are attributable to belonging to a specific cohort which experienced a particular stream of economic circumstances over the lifetime of its members. The first is certainly true (see previously described age effects) but we also argue in favor of the latter. Average ages of generation war, generation baby boomers and generation X, for instance, differ by approximately 20 years[21], respective differences in risk tolerance, however, are less balanced. The absolute difference in risk attitude be-

[21] Average ages as of 2004 are: generation war 72 years; generation baby boomers 51 years; generation X 35 years; generation Y 24 years.

tween the baby boomers generation and the war generation is 0.36, whereas the absolute difference between the baby boomer generation and generation X is 0.19.

| VARIABLES | (1) OLS with Clustered Standard Errors dependent variable: riskatt | (2) Fixed Effects with Clustered Standard Errors dependent variable: riskatt |
|---|---|---|
| year2006 | 0.2543*** [0.0396] | 0.2283*** [0.0395] |
| year2008 | -0.1284*** [0.0415] | -0.1687*** [0.0413] |
| year2009 | -0.8656*** [0.0411] | -0.9141*** [0.0410] |
| year2010 | -0.3042*** [0.0418] | -0.3506*** [0.0419] |
| year2011 | -0.1019** [0.0415] | -0.1634*** [0.0413] |
| year2012 | 0.1204*** [0.0415] | 0.0593 [0.0414] |
| generation_war | -0.3612*** [0.0768] | |
| generation_x | 0.1941*** [0.0626] | |
| generation_y | 0.5996*** [0.1225] | |
| generation_war_year2006 | 0.2542*** [0.0645] | 0.2348*** [0.0644] |
| generation_war_year2008 | 0.3591*** [0.0661] | 0.3171*** [0.0658] |
| generation_war_year2009 | 0.2003*** [0.0652] | 0.1596** [0.0650] |
| generation_war_year2010 | 0.3942*** [0.0670] | 0.3458*** [0.0669] |
| generation_war_year2011 | 0.3506*** [0.0661] | 0.3009*** [0.0659] |
| generation_war_year2012 | 0.3073*** [0.0648] | 0.2535*** [0.0647] |
| generation_x_year2006 | -0.0501 [0.0627] | -0.0301 [0.0625] |
| generation_x_year2008 | -0.0981 [0.0654] | -0.0509 [0.0654] |
| generation_x_year2009 | 0.0369 [0.0648] | 0.0995 [0.0644] |
| generation_x_year2010 | -0.0319 [0.0654] | 0.0366 [0.0655] |
| generation_x_year2011 | -0.0450 [0.0647] | 0.0442 [0.0645] |
| generation_x_year2012 | -0.1603** [0.0655] | -0.0651 [0.0656] |
| generation_y_year2006 | 0.0026 [0.1148] | -0.0018 [0.1151] |
| generation_y_year2008 | -0.1619 [0.1183] | -0.1557 [0.1185] |
| generation_y_year2009 | 0.1810 [0.1162] | 0.1990* [0.1149] |
| generation_y_year2010 | 0.0036 [0.1241] | 0.0106 [0.1227] |
| generation_y_year2011 | -0.0454 [0.1164] | 0.0009 [0.1151] |
| generation_y_year2012 | -0.1758 [0.1259] | -0.1298 [0.1223] |
| Socio-demographic controls | YES | YES |
| Federal States controls | YES | YES |
| Constant | | |
| Observations | 57,001 | 57,001 |
| Adjusted R-squared | 0.115 | 0.4715 |
| Number of Individuals | 8,143 | 8,143 |

Robust standard errors in brackets, *** p<0.01, ** p<0.05, * p<0.1

Table 7: Generation specific risk attitude responsiveness. Reference categories: generation baby boomers and year 2004. Socio-demographic control variables include information on gender, health, height, family status, income, occupation, and education. Estimates for these controls are reported in the Appendix.

***Income***

Testing the relationship between income and risk appetite, we find that willingness to take risks increases with income. We are aware of potential endogeneity issues and we cannot fully disentangle the causal relationship between willingness to take risks and income. To address the issue of wealth effects we conducted several robustness tests as mentioned earlier.

Further, we investigate the risk attitude responsiveness of different income groups, with particular focus on the more affluent. We include a dummy variable for those individuals whose monthly after tax household income exceeds 6,000 Euros.

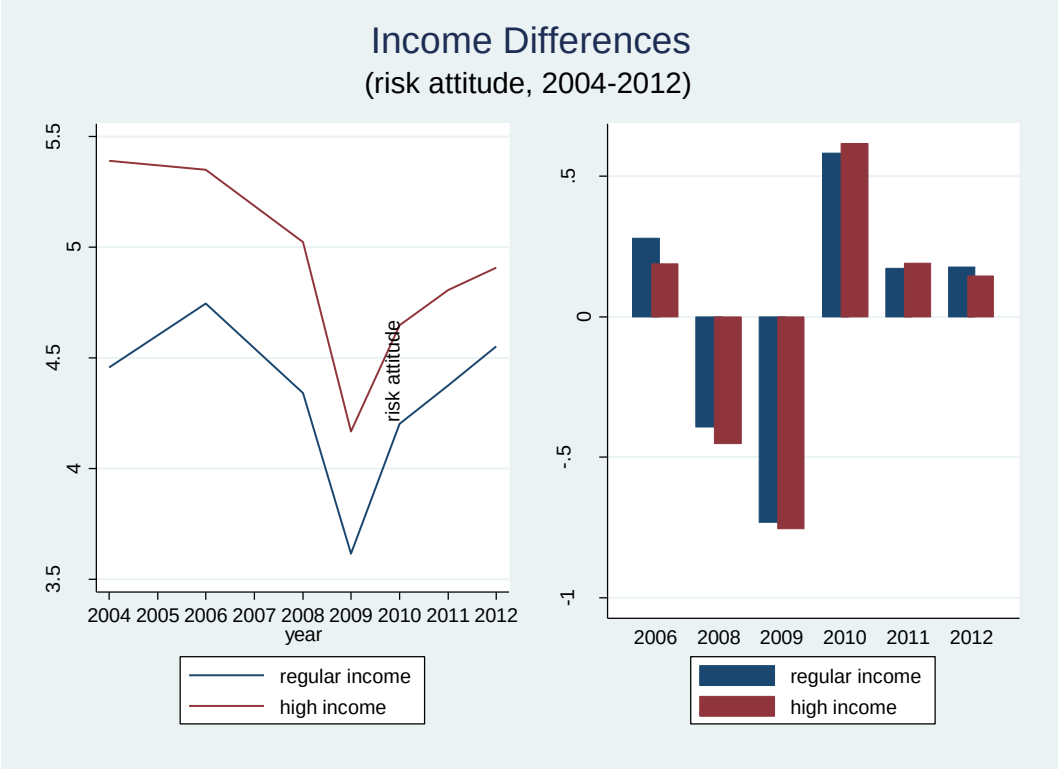


Figure 6: (Changes in) willingness to take risks by individuals at different income levels during the observation period.

Our findings reported by Figure 6 and Table 8 indicate that income is positively associated with overall risk tolerance. Our coefficient estimates are highly significant and we observe that wealthier individuals, albeit having higher overall risk tolerance, decreased their risk tolerance more drastically following the financial crisis. The coefficient estimate of our 2009 interaction term is negative (-0.3456) and significant at the 1% level, indicating that affluent individuals decreased their risk tolerance even more than the control group. Likewise, we observe that the speed of recovery is much slower for the higher income group. We attribute this to inertia in port-

folio rebalancing, as well as to the likelihood that high income individuals suffered substantial losses due to the financial crisis. This in turn, may have shaped individuals' experience and expectations. Differences in changing patterns are also displayed in Figure 6. The figure shows that, on average, higher income individuals decreased their risk tolerance level more following the financial crisis than others.

| | (1) | (2) |
|---|---|---|
| **VARIABLES** | **OLS with Clustered Standard Errors dependent variable: riskatt** | **Fixed Effects with Clustered Standard Errors dependent variable: riskatt** |
| year2006 | 0.3374*** [0.0267] | 0.2440*** [0.0328] |
| year2008 | -0.0255 [0.0279] | -0.1982*** [0.0480] |
| year2009 | -0.7269*** [0.0278] | -0.9510*** [0.0567] |
| year2010 | -0.1171*** [0.0289] | -0.3900*** [0.0662] |
| year2011 | 0.0777*** [0.0288] | -0.2430*** [0.0757] |
| year2012 | 0.2718*** [0.0294] | -0.0917 [0.0865] |
| high_income | 0.6820*** [0.1119] | 0.4239*** [0.0918] |
| high_income_year2006 | -0.3254** [0.1277] | -0.2411** [0.1127] |
| high_income_year2008 | -0.2882** [0.1320] | -0.3006*** [0.1111] |
| high_income_year2009 | -0.4105*** [0.1356] | -0.3456*** [0.1177] |
| high_income_year2010 | -0.5239*** [0.1298] | -0.4077*** [0.1090] |
| high_income_year2011 | -0.5277*** [0.1290] | -0.4162*** [0.1074] |
| high_income_year2012 | -0.6372*** [0.1302] | -0.5357*** [0.1050] |
| Socio-demographic controls | YES | YES |
| Federal States controls | YES | YES |
| Constant | -0.4129 [0.4928] | 4.9765*** [0.3083] |
| Observations | 57,001 | 57,001 |
| Adjusted R-squared | 0.115 | 0.4715 |
| Number of Individuals | 8,143 | 8,143 |

Robust standard errors in brackets, *** p<0.01, ** p<0.05, * p<0.1

Table 8: Income specific risk attitude responsiveness. Reference categories: low and medium income groups and year 2004. Socio-demographic control variables include information on gender, age health, height, family status, occupation, and education. Estimates for these controls are reported in the Appendix.

## 5 Conclusion

Understanding how individuals make decisions in the presence of risk is a significant area of research in both psychology and economics. Risk attitudes influence many decisions.. From a societal welfare perspective, the design of well-functioning safety nets should reflect risk attitude. Although risk attitude has been studied widely there is scant research on its association with economic conditions.

In our paper, we analyse the association between economic conditions – in particular the economic crisis of 2008 – and individuals' risk attitude as reported in a nationally representative panel of the German population. Significantly, we find evidence for countercyclical risk aversion. The financial crisis significantly decreased individuals' willingness to take risks.

We investigate how risk attitude shifted for different groups within the population over the course of the financial crisis. We are first and foremost interested in how the financial crisis affected the willingness to take risks of individuals in positions of corporate leadership. Corporate leadership is thought to be of utmost importance in times of economic turmoil to ensure the survival of the corporation. Further, the decisions of corporate leaders impact the recovery of the economy itself. We find that managers in our sample were more willing to take risks in general, particularly those managers who survived the crisis in a managerial position. Managers increased their willingness to take risks less than non-managers prior to the crisis and decreased their willingness to a greater degree during and directly after the crisis. We also find differences in risk attitude over the crisis between those managers who survived the crisis in a leadership position and those that did not. We observe gender differences in risk attitude, in particular that the willingness to take risks of women took longer to recover than men. We further observe a stronger reaction to the crisis among the affluent segments of the German population. In contrast to this, the older generation, which experienced World War II and the up and downs but still stable economy of the last decades, showed an timely responsiveness to the financial crisis relative to younger generations.

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# Appendix

## *A.1 Manager Interaction Model*

### *A.1.1 Estimates for Additional Controls*

| VARIABLES | (1) OLS with Clustered Standard Errors - dependent variable: riskatt | (2) Fixed Effects with Clustered Standard Errors dependent variable: riskatt |
|---|---|---|
| year2006 | 0.3432*** [0.0282] | 0.3014*** [0.0282] |
| year2008 | -0.0302 [0.0292] | -0.0960*** [0.0291] |
| year2009 | -0.7414*** [0.0290] | -0.8143*** [0.0288] |
| year2010 | -0.1343*** [0.0297] | -0.2124*** [0.0297] |
| year2011 | 0.0227 [0.0294] | -0.0646** [0.0294] |
| year2012 | 0.2180*** [0.0296] | 0.1257*** [0.0295] |
| manager | 0.5911*** [0.0703] | |
| manager_year2006 | -0.1304* [0.0680] | -0.1080 [0.0677] |
| manager_year2008 | -0.0929 [0.0733] | -0.0551 [0.0730] |
| manager_year2009 | -0.1523** [0.0722] | -0.1146 [0.0722] |
| manager_year2010 | -0.2586*** [0.0718] | -0.2172*** [0.0718] |
| manager_year2011 | -0.0150 [0.0707] | 0.0162 [0.0705] |
| manager_year2012 | -0.1724** [0.0702] | -0.1324* [0.0700] |
| health | -0.2156*** [0.0170] | -0.0879*** [0.0132] |
| bodyheight | 0.0329*** [0.0019] | |
| married | -0.3142*** [0.0514] | -0.1725*** [0.0651] |
| widowed | -0.4811*** [0.0844] | -0.1650 [0.1191] |
| divorced | -0.0161 [0.0728] | -0.0129 [0.0935] |
| supportpersoncare | 0.0596 [0.0553] | 0.0958** [0.0389 |
| number_children | 0.0000 [0.0181] | 0.0071 [0.0196] |
| ln_real_aftertaxincome | 0.2646*** [0.0347] | -0.0147 [0.0326] |
| ln_real_interestdividendincome | -0.0212*** [0.0065] | -0.0051 [0.0054] |
| propertyownership | -0.0458 [0.0359] | 0.0269 [0.0432] |
| civilservant | -0.2762*** [0.0883] | -0.0075 [0.1012] |
| nojob | -0.3357*** [0.0701] | 0.0130 [0.0614] |
| trainee | 0.4051*** [0.0835] | 0.1535** [0.0690] |
| whitecollar | -0.0956* [0.0489] | -0.0030 [0.0457] |
| unemployed | 0.1983*** [0.0684] | 0.0436 [0.0560] |
| retired | -0.1664*** [0.0546] | 0.0085 [0.0612] |
| selfemployed | 0.6510*** [0.0776] | 0.1717** [0.0774] |
| highlevelschool | 0.1108*** [0.0420] | |
| Constant | -2.3915*** [0.4198] | 4.9412*** [0.2615] |
| Observations | 57,001 | 57,001 |
| Adjusted R-squared | 0.104 | 0.2004 |
| Number of Individuals | 8,143 | 8,143 |

Robust standard errors in brackets *** p<0.01, ** p<0.05, * p<0.1

### *A.1.2 Estimates for Additional Controls: Resigned vs Retained Managers*

| VARIABLES | (1)<br>OLS with Clustered Standard Errors –<br>dependent variable: riskatt |
|---|---|
| year2006 | 0.3441*** [0.0284] |
| year2008 | -0.0255 [0.0294] |
| year2009 | -0.7412*** [0.0291] |
| year2010 | -0.1288*** [0.0298] |
| year2011 | 0.0248 [0.0296] |
| year2012 | 0.2214*** [0.0297] |
| manager | 0.6834*** [0.0849] |
| manager_year2006 | -0.1552* [0.0845] |
| manager_year2008 | -0.2041** [0.0896] |
| manager_year2009 | -0.1698* [0.0875] |
| manager_year2010 | -0.3175*** [0.0878] |
| manager_year2011 | -0.0979 [0.0847] |
| manager_year2012 | -0.2760*** [0.0833] |
| resigned_manager | 0.4742*** [0.1108] |
| resigned_manager_year2006 | -0.1048 [0.1062] |
| resigned_manager_year2008 | 0.0507 [0.1169] |
| resigned_manager_year2009 | -0.1050 [0.1197] |
| resigned_manager_year2010 | -0.1898* [0.1145] |
| resigned_manager_year2011 | 0.1416 [0.1164] |
| resigned_manager_year2012 | -0.0075 [0.1161] |
| health | -0.2183*** [0.0171] |
| height | 0.0328*** [0.0019] |
| married | -0.3206*** [0.0517] |
| widowed | -0.4914*** [0.0846] |
| divorced | -0.0416 [0.0729] |
| supportpersoncare | 0.0779 [0.0555] |
| number_children | 0.0010 [0.0183] |
| ln_real_aftertaxincome | 0.2612*** [0.0350] |
| ln_real_interestdividendincome | -0.0209*** [0.0065] |
| propertyownership | -0.0543 [0.0361] |
| civilservant | -0.2887*** [0.0896] |
| nojob | -0.3383*** [0.0703] |
| trainee | 0.3974*** [0.0840] |
| whitecollar | -0.1035** [0.0491] |
| unemployed | 0.1958*** [0.0687] |
| selfemployed | 0.6499*** [0.0786] |
| highlevelschool | 0.1114*** [0.0422] |
| Federal States controls | YES |
| constant | -2.3446*** [0.4220] |
| Observations | 57,001 |
| Adjusted R-squared | 0.1053 |
| Number of Individuals | 8,143 |

Robust standard errors in brackets *** p<0.01, ** p<0.05, * p<0.1

## *A.2 Gender Interaction Model: Estimates for Additional Controls*

| VARIABLES | (1)<br>OLS with Clustered Standard Errors<br>dependent variable: riskatt | (2)<br>Fixed Effects with<br>Clustered Standard Errors<br>dependent variable: riskatt |
|---|---|---|
| health | -0.2000*** [0.0170] | -0.0866*** [0.0131] |
| bodyheight | 0.0135*** [0.0026] | |
| married | -0.1269** [0.0593] | -0.1591** [0.0647] |
| widowed | -0.1384 [0.0907] | -0.1611 [0.1180] |
| divorced | 0.2271*** [0.0790] | -0.0068 [0.0929] |
| supportpersoncare | 0.1099** [0.0543] | 0.0991** [0.0388] |
| number_children | -0.0446** [0.0188] | 0.0079 [0.0193] |
| ln_real_aftertaxincome | 0.3268*** [0.0346] | -0.0065 [0.0321] |
| ln_real_interestdividendincome | -0.0179*** [0.0064] | -0.0055 [0.0053] |
| propertyownership | 0.0006 [0.0360] | 0.0320 [0.0427] |
| civilservant | -0.0761 [0.0863] | 0.0168 [0.0993] |
| nojob | -0.0704 [0.0702] | 0.0186 [0.0606] |
| trainee | 0.3054*** [0.0853] | 0.1135* [0.0686] |
| whitecollar | 0.0877* [0.0485] | 0.0156 [0.0451] |
| unemployed | 0.2377*** [0.0673] | 0.0445 [0.0555] |
| retired | 0.0699 [0.0670] | 0.0005 [0.0612] |
| selfemployed | 0.8309*** [0.0755] | 0.1874** [0.0766] |
| highlevelschool | 0.1098*** [0.0417] | |
| Federal States controls | YES | YES |
| Observations | 57,001 | 57,001 |
| Adjusted R-squared | 0.115 | 0.394 |
| Number of Individuals | 8,143 | 8,143 |

Robust standard errors in brackets, *** p<0.01, ** p<0.05, * p<0.1

## *A.3 Generation Interaction Model: Estimates for Additional Controls*

| VARIABLES | (1)<br>OLS with Clustered Standard Errors<br>dependent variable: riskatt | (2)<br>Fixed Effects with<br>Clustered Standard Errors<br>dependent variable: riskatt |
|---|---|---|
| health | -0.2040*** [0.0169] | -0.0863*** [0.0131] |
| bodyheight | 0.0151*** [0.0026] | |
| married | -0.1492*** [0.0577] | -0.1620** [0.0645] |
| widowed | -0.1934** [0.0884] | -0.1761 [0.1182] |
| divorced | 0.2147*** [0.0777] | -0.0101 [0.0931] |
| supportpersoncare | 0.1088** [0.0543] | 0.1020*** [0.0388] |
| number_children | -0.0238 [0.0191] | -0.0017 [0.0201] |
| male | 0.5640*** [0.0481] | |
| ln_real_aftertaxincome | 0.3241*** [0.0348] | -0.0079 [0.0323] |
| ln_real_interestdividendincome | -0.0186*** [0.0064] | -0.0053 [0.0053] |
| propertyownership | -0.0086 [0.0360] | 0.0389 [0.0431] |
| civilservant | -0.0996 [0.0862] | 0.0214 [0.0992] |
| nojob | -0.1076 [0.0701] | 0.0276 [0.0607] |
| trainee | 0.1649* [0.0888] | 0.1189* [0.0708] |
| whitecollar | 0.0775 [0.0484] | 0.0154 [0.0452] |
| unemployed | 0.1964*** [0.0674] | 0.0419 [0.0554] |
| retired | -0.0945 [0.0708] | -0.0233 [0.0614] |
| selfemployed | 0.8063*** [0.0756] | 0.1917** [0.0765] |
| highlevelschool | 0.1108*** [0.0417] | |
| Federal States controls | YES | YES |
| Constant | -0.4129 [0.4928] | 4.9765*** [0.3083] |
| Observations | 57,001 | 57,001 |
| Adjusted R-squared | 0.115 | 0.4715 |
| Number of Individuals | 8,143 | 8,143 |

Robust standard errors in brackets, *** p<0.01, ** p<0.05, * p<0.1

## *A.4 Income Interaction Model: Estimates for Additional Controls*

| VARIABLES | (1)<br>OLS with Clustered Standard Errors<br>dependent variable: riskatt | (2)<br>Fixed Effects with<br>Clustered Standard Errors<br>dependent variable: riskatt |
|---|---|---|
| health | -0.2076*** [0.0169] | -0.0860*** [0.0131] |
| bodyheight | 0.0141*** [0.0026] | |
| married | -0.0516 [0.0589] | -0.1621** [0.0646] |
| widowed | -0.1579* [0.0912] | -0.1727 [0.1179] |
| divorced | 0.2070*** [0.0793] | -0.0116 [0.0930] |
| supportpersoncare | 0.1150** [0.0545] | 0.0987** [0.0387] |
| number_children | -0.0245 [0.0187] | 0.0017 [0.0191] |
| age | -0.0175** [0.0079] | |
| age2 | 0.0000 [0.0001] | 0.0003*** [0.0001] |
| male | 0.8071*** [0.1222] | |
| male_age | -0.0041* [0.0021] | |
| ln_real_interestdividendincome | -0.0016 [0.0062] | -0.0055 [0.0053] |
| propertyownership | 0.0629* [0.0354] | 0.0255 [0.0421] |
| civilservant | -0.0040 [0.0862] | 0.0081 [0.0994] |
| nojob | -0.1037 [0.0703] | 0.0220 [0.0605] |
| trainee | 0.3050*** [0.0853] | 0.1124 [0.0685] |
| whitecollar | 0.1259*** [0.0485] | 0.0131 [0.0451] |
| unemployed | 0.1367** [0.0667] | 0.0466 [0.0553] |
| retired | 0.0403 [0.0672] | 0.0038 [0.0612] |
| selfemployed | 0.8434*** [0.0763] | 0.1821** [0.0765] |
| highlevelschool | 0.1496*** [0.0415] | |
| Federal States controls | YES | YES |
| constant | 2.7388*** [0.4807] | 4.2182*** [0.3137] |
| Observations | 57,001 | 57,001 |
| adjusted R-squared | 0.112 | 0.4821 |
| Number of Individuals | 8,143 | 8,143 |

Robust standard errors in brackets, *** p<0.01, ** p<0.05, * p<0.1