Perceived Relative Wealth and Risk Taking*

Dietmar Fehr
University of Heidelberg

Yannick Reichlin
European University Institute

December 24, 2020

Abstract

Risk taking is intimately linked to the distribution of wealth. This paper presents representative evidence that perceptions about relative rank in the distribution shapes individuals' willingness to take risks, and that this effect is moderated by a key personality trait, an individuals' locus of control. Using a large-scale survey in Germany, we manipulate perceptions of relative wealth standing by randomly varying response categories when asking respondents about their wealth level and measure their risk tolerance in a subsequent incentivized lottery task. We find that respondents who are confronted with wide response categories and thus are induced to perceive their relative position as low choose riskier lotteries than respondents facing narrow response categories. We show that this effect is more pronounced among people who more firmly believe that life outcomes are beyond their control (external locus of control). This suggests that heterogeneity in preferences crucially depends on individuals' underlying belief system and highlights the benefits of incorporating personality traits into economic analysis.

Keywords: relative concerns, risk taking, personality, locus of control, survey experiment
JEL classification numbers: C72, D31, D63, D81, D90, I00

*We thank Davide Cantoni, Alexander Cappelen, David Levine, Ed Hopkins, Andrea Ichino, Tatiana Kornienko and Ricardo Perez-Truglia as well as seminar participants at EUI Florence for valuable comments. We are grateful to the Deutsche Forschungsgemeinschaft (DFG) for financial support through individual grant FE 1452/3-1.
E-mail: dietmar.fehr@awi.uni-heidelberg.de and yannick.reichlin@eui.eu

1 Introduction

Decisions under risk are ubiquitous in life, and they inevitably affect one's relative position in society. At the same time, relative consumption and wealth are important components of well-being. While this relativistic nature of well-being received much attention in the literature starting with Veblen (1899) and Duesenberry (1949), we know little about how relative position or social status shapes the more fundamental notion of preferences. This study provides novel empirical evidence on the social foundation of risk preferences. In particular, we hypothesize that people at the lower end of the wealth distribution are willing to take greater risks.

Our study is informed by a large theoretical literature. In an attempt to rationalize why people are both willing to buy lottery tickets and insurance plans, Friedman and Savage (1948) proposed and introduced a theoretical interdependence between wealth rank and risk taking behavior. They model a utility specification with both concave and convex parts, such that large enough gambles might induce people to accept risk in order to move up the wealth distribution. Gregory (1980) clarifies the relative component of Friedman and Savage's argument. A series of later studies refined the linkage between social influences and risk-taking by explicitly incorporating concerns for status and rank in the utility function (Robson, 1996; Becker, Murphy and Werning, 2005; Ray and Robson, 2012; Kuziemko et al., 2014).

If people care about their position in the wealth distribution, as suggested by these theories of social status, then risk taking appears as an immediate option for relative improvements, particularly at the bottom of the wealth distribution. Clearly the appeal of choosing riskier occupations, gambling and similar risky strategies to move upwards is partially determined by the perceived availability of alternatives, such as investments in education. A second focus of our analysis is therefore a key personality trait – an individual's locus of control (Rotter, 1966) – that arguably moderates these perceptions and allows us to distinguish types that are more likely to react to social comparisons. In the spirit of Almlund et al. (2011), an external locus of control – the belief that life outcomes are beyond one's control and rather a result of fate or luck – can act as a constraint on the set of strategies available to improve relative standing in the wealth distribution. That is, an extrinsic belief system may eliminate responses such as increased effort or higher investments into education from the choice set, leaving more risky choices as more viable options.[1]

[1] Recent evidence suggests that human capital investments are associated with an internal locus of control. That is, a stronger belief in having control over life outcomes predicts high school graduation (Coleman and DeLeire, 2003; Cebi, 2007; Barón and Cobb-Clark, 2010).

To test our hypotheses, we design and implement a tailor-made survey module in the Innovation Sample of the Socio-Economic Panel (SOEP-IS), a representative longitudinal study of the German population. The survey module consists of three parts: pre-treatment measures of personality traits, such as optimism and locus of control, the treatment intervention, and our main outcome measure of risk. We measure risk taking through an easy-to-understand incentivized lottery choice task that is well suited for elicitation of risk preferences in general population samples and allows us to parameterize individuals' utility functions.

Examining the causal impact of relative wealth rank on risk taking requires exogenous variation in the wealth distribution, which is, however, not feasible. Instead, we take advantage of individuals' lack of knowledge about the wealth distribution and manipulate their perception of it.[2] This has several advantages. First, perception are easier and less costly to manipulate. Second, the randomization, which we will explain in detail below, ensures that objective income and wealth is, on average, the same across treatment and control. Third, our manipulation implicitly prompts respondents to engage in upward social comparisons.

To vary perceptions of the wealth distribution, we ask respondents about their net wealth and randomly vary the response categories of the question.[3] Half of the respondents see response categories with wide intervals, e.g., the lowest category ranges up to 275,000 euro (treatment condition). Accordingly, the overwhelming majority of respondents (about 80 percent) should place themselves into this category, and thus they should perceive their relative wealth rank as low. The other half of respondents receive response categories with small intervals where, for example, the lowest category was less than 2,500 euro (control condition). This implies, in contrast to the treatment condition, that the majority of respondents should locate themselves in the middle and top categories and thus perceive their wealth rank as higher.

As intended, the treatment resulted in a strong "first-stage." The vast majority of treated respondents categorized themselves into the lowest category, while the majority of control group respondents sorted themselves into the three highest categories. Moreover, the categorization had a strong effect on respondents' perception about relative standing. When asked about the 90th-percentile threshold in the pre-tax household income distribution, treated respondents believe

[2]Evidence for the US, for example, suggests that individuals systematically underestimate wealth inequality (Norton and Ariely, 2011). Similarly, people underestimate their relative income rank nationally (e.g., Cruces, Perez-Truglia and Tetaz, 2013; Karadja, Mollerstrom and Seim, 2017) and globally (Fehr, Mollerstrom and Perez-Truglia, 2019).

[3]Our instrument builds on research in social psychology showing that response behavior can depend on the specific design of response scales (e.g., Schwarz et al., 1985). This technique was also successfully used in related work by Haisley, Mostafa and Loewenstein (2008).

that this threshold is 21 percent higher than the estimates of respondents in the control group.

We present three main findings. First, we find that the "first-stage" translates into a sizable treatment effect. That is, treated respondents who perceive their relative position as low are more likely to take risks than respondents in the control group. The estimated CRRA parameter ρ is about 0.5 lower, implying less risk aversion. This finding resonates with theoretical models incorporating status concerns. For example, Hopkins (2018) models this concern as a competition for societal rewards. Instead of allowing status to explicitly enter the utility function, rewards are allocated according to spending on conspicuous consumption. This makes fair gambles particularly attractive for individuals at the lower end of the initial wealth distribution because taking more risk is their only option to successfully compete in the tournament.

Second, we use pre-treatment measures of personality traits to examine how belief heterogeneity affects the relationship between relative wealth rank and risk taking. As argued above, an extrinsic belief system may constrain a person's choice set. Believing that life circumstances are determined by fate, may result in disregarding any options with future payoffs that partially depend on own actions, such as education investments, leaving only options that involve more risk. In fact, we observe a substantial degree of heterogeneity in the data that is driven by locus of control. Participants displaying an internal locus of control are not affected by our treatment. On the other hand, participants with an external locus of control increase their risk tolerance substantially. The effect is sizable: a one standard deviation increase in external control beliefs shifts the estimated risk parameter ρ by an additional 0.9 towards less risk aversion. Importantly, we can rule out that other relevant factors interact with our treatment. In particular, we find no evidence that other personality traits, such as the Big 5 and optimism, play a role. The same is true for socio-economic characteristics that typically correlate with risk taking and locus of control, such as gender, employment status, education and income.

Third, while our study discusses the impact of relative wealth rank, we provide complementary evidence that (income) inequality is related to risk taking and that this relationship is significantly shaped by beliefs about personal agency. Using data from the Global Preference Survey (Falk et al., 2018), we first show that inequality is negatively associated with a validated risk measure at the national level across 76 countries representing 90 percent of the world population. We then turn to the World Value Survey (Inglehart et al., 2014), which includes proxy measures for locus of control and risk attitudes, to show that this relationship holds more broadly using individual data and that this effect is moderated by individuals' beliefs about how much control

they have over life outcomes. Similar to our experimental results, we observe that people believing in a predetermined life are more strongly affected by inequality and become more risk tolerant.

These findings tie into several literatures. First, they relate to a nascent literature that studies the foundations of preferences in general (e.g., Hoff and Pandey, 2006; Benjamin et al., 2010; Malmendier and Nagel, 2011; Giuliano and Spilimbergo, 2013; Kosse et al., 2020; Butler and Fehr, 2020; Cappelen et al., 2020) and risk preferences in particular. For example, several empirical studies suggest that risk preferences adjust in response to life experiences such as natural disasters (e.g., Eckel, El-Gamal and Wilson, 2009; Cameron and Shah, 2015), macroeconomic shocks (e.g., Malmendier and Nagel, 2011; Giuliano and Spilimbergo, 2014; Cohn et al., 2015), and violence (e.g., Voors et al., 2012; Callen et al., 2014; Jakiela and Ozier, 2019; Brown et al., 2019). We contribute to this literature by providing novel evidence on the social foundation of risk preferences based on experimental variation of subjective wealth comparisons in a representative sample.

The study also relates to a handful of studies showing that social comparison affects decision under uncertainty in the laboratory or in lab-in-the-field experiments (Dijk, 2017; Fafchamps, Kebede and Zizzo, 2015; Gamba, Manzoni and Stanca, 2017; Haisley, Mostafa and Loewenstein, 2008; Kuziemko et al., 2014; Mishra, Hing and Lalumiere, 2015). For example, Kuziemko et al. (2014) demonstrate that randomly assigned ordinal ranks matter for risk taking behavior in a lab setting. Subjects in the lowest rank are more willing to gamble than higher ranked subjects in order to avoid the last place. In contrast, in our setting, respondents are willing to gamble if they *perceive* their rank as low and even though potential gains would not change their position in the *real* wealth distribution. Haisley, Mostafa and Loewenstein (2008) use a similar treatment manipulation as we use to study how subjective relative income affects lottery tickets purchases in a selected sample of low-income people. Our study moves beyond this literature by (1) addressing a large representative sample, (2) using a risk elicitation method that allows for parameterization of a standard utility function, and (3) studying the role of personality in shaping responses to social influences.

The latter is tied to efforts of incorporating personality traits into economic analysis more systematically (Borghans et al., 2008; Almlund et al., 2011; Heckman, Jagelka and Kautz, 2019). While one current debate in this field is the question of whether risk preferences are complements or substitutes in explaining economic behavior (Becker et al., 2012; Jagelka, 2020), we focus on how their relationship is influenced by environmental factors. In a related fashion, Pinger, Schäfer and Schumacher (2018) illustrate that subjects displaying higher internal control tendencies pro-

cess information about their own experimental investment outcomes differently from externally controlled, eventually leading to less consistent decisions. Caliendo, Cobb-Clark and Uhlendorff (2015) include locus of control into a job search framework, arguing that people with an external locus of control believe less in a relationship between their own search effort and the arrival rate of job offers. Our findings illustrate that psychological primitives can play an important role in explaining heterogeneity in risk preferences.

2 Research Design

2.1 Setting

We run our study using the German Socio-Economic Panel (SOEP), a nationally representative longitudinal study that collects basic socio-demographic and socio-economic information, measures of attitudes, preferences and psychological traits as well as perceptions about various personal and social issues, ranging from individual well-being to immigration (see Goebel et al., 2018, for more details). The SOEP includes an innovation sample (SOEP-IS) that relies on the same infrastructure and methods and covers the same topics in a more compact format (for more detailed information, see Richter and Schupp, 2015). In addition, the SOEP-IS offers researchers the possibility to include tailor-made survey modules including incentivized decision tasks and experiments. Participating households are surveyed on a yearly basis and all household members above age 16 are interviewed in computer-assisted face-to-face interviews.

2.2 Design of the survey module

We implemented a tailor-made survey module in the SOEP-IS that consists of three parts: questions on personality traits, the treatment manipulation, and a lottery task to measure risk preferences (see the Appendix for the full details of the survey module).

Personality traits. The first part elicits key personality traits that relate to risk preferences, such as optimism and locus of control (LoC). We measure optimism with two questions: a general question about optimism regarding the future (on a 4-point scale) taken from the SOEP and a question about the likelihood of experiencing an event relative to an average person (on a 7-point scale). LoC characterizes the extent to which someone believes that life events are under their control (Rotter, 1966). We implemented the same ten items that are routinely used in the SOEP (Nolte et al., 1997).

For each item, respondents had to determine to which degree they agree with statements such as *"the course of my life is depending on me"* or *"which opportunities I have in life is determined by social conditions"*, using a Likert-scale ranging from 1 (disagree completely) to 7 (agree completely).[4]

Treatment variation. The second part contains our treatment manipulation, which is embedded in a question about respondent's wealth. Specifically, we ask respondents to indicate their net wealth using five predefined wealth categories. The idea is to induce an unequal perception of the distribution of wealth and relative wealth rank. To manipulate respondents' perception of the spread of wealth, we randomly vary the available response categories. That is, we assign half of the respondents to categories with relatively wide intervals, i.e., *less than €275,000; €275,001 to €468,000; €468,001 to €722,000; €722,001 to €989,000; more than €989,000* (treatment condition), while the other half of respondents is assigned to much smaller intervals, i.e., *less than €2,500; €2,501 to €11,000; €11,001 to €27,000; €27,001 to €112,000; more than €112,000* (control condition), see also Table A1 in the Appendix.[5] Accordingly, in the treatment condition the overwhelming majority of respondents (about 80 percent) should place themselves into the lowest category. Thus they find themselves at the lower end of the relative wealth ranking. In contrast, in the control condition the responses should be distributed more uniformly over categories, which likely creates a more equal perception of the wealth distribution. Note that the random assignment ensures that the objective distribution of wealth is equal in both groups. This allows us to keep absolute wealth levels constant, while analyzing exclusively relative concerns.

The manipulation is subtle and builds on research showing that response behavior and judgments can depend on the design of response scales. Response scales inevitable carry information about the population distribution, which may be readily used by respondents to inform their decisions (e.g., Schwarz et al., 1985; Rockwood, Sangster and Dillman, 1997; Menon, Raghubir and Schwarz, 1997). In particular, they may use this information for social comparisons. While such comparisons are likely the case in both conditions, they are predominantly upward facing for respondents in the treatment condition as most of them are located in the lowest category. In contrast to the control condition, respondents were not only primed to consider their relative

[4]For an overview over the wording of each item and the construction of the LoC scale, see Appendix Table A2 and the table notes.

[5]We constructed the intervals based on the 2014 German data of the Household Finance and Consumption Survey (HFCS). The upper bounds of the intervals correspond to the 20th, 30th, 40th, and 60th percentile of the distribution in the control condition and to the 80th, 90th, 95th, and 97th percentile in the treatment condition (see Deutsche Bundesbank, 2016, for more information).

position in society, but in addition to perceive the society as unequal as the categories suggest the existence of (potentially many) other households with considerably higher endowments.

Risk-elicitation task. Directly after the wealth categorization, respondents participate in a risk-preference elicitation task. We use a choice set that requires respondents to make a single choice from a set of six gambles (Binswanger, 1980; Eckel and Grossman, 2002). Each gamble consist of an equal chance of receiving a low payoff and a high payoff. While the first gamble guarantees respondents a payoff of €50, the remaining gambles gradually decrease the low payoff and increase the high payoff (see Table 1). The lotteries are increasing in expected value, but also in the implicit level of risk (standard deviation). This task is easy to understand and therefore well suited for eliciting risk preferences in a sample of the general population (Charness, Gneezy and Imas, 2013). We incentivized the task by randomly selecting one in ten respondents and paying them the outcome of their chosen gamble.

2.3 Data

We collected data from a representative sample of 1,115 individuals using the 2017 wave of the SOEP-IS. The longitudinal character of SOEP-IS gives us access to a rich set of controls and missing information is typically rare. However, our study requires that respondents participated in the risk-preference elicitation task. Because respondents could refuse to do so, we include only respondents with non-missing observations resulting in a sample of 914 observations. In Section 3.4, we provide evidence that there is no differential selection into the risk elicitation task, and that our results are robust to re-weighting the study sample to match the socio-economic characteristics of the full sample.

Personality measures. Before the treatment manipulation, we elicit two important personality traits that are related to risk preferences: optimism and locus of control. Following Kling, Liebman and Katz (2007), we combine the two questions on optimism into an index by standardizing the two variables and taking a equally-weighted average. For locus of control (LoC), we combine seven of the ten items into a single proxy for locus of control beliefs in accordance with prior studies (Specht, Egloff and Schmukle, 2013; Cobb-Clark and Schurer, 2013), and standardize this measure to have a mean of zero and a standard deviation of one. Higher values correspond to a more external LoC. While the use of a single measure for LoC makes the interpretation more straightforward, other

measures differentiate explicitly between scores for external and internal LoC. As discussed in more detail below, our results on LoC do not depend on the choice of how to construct the measure for individual locus of control.

Risk measure. Our main variable of interest is the choice of respondents in the risk preference elicitation task. As discussed above, the task involves a single choice, is easy to implement, and, importantly, is easy to understand (see e.g., Dave et al., 2010).[6] At the same time, the setup of the task is rich enough to obtain detailed utility information. Following the standard practice in the literature, we assume that respondents are expected utility maximizers exhibiting constant relative risk aversion (CRRA) (e.g., Binswanger, 1980; Andersen et al., 2008; Carvalho, Prina and Sydnor, 2016; Carvalho, Meier and Wang, 2016).[7] Under this assumption, we can represent the utility of a monetary amount x as $u(x) = \frac{x^{1-\rho}}{1-\rho}$, where ρ is the coefficient of relative risk aversion, with higher values corresponding to greater risk aversion. It is common in the literature to assume that individuals do not integrate their background wealth into the payoffs offered in the laboratory (Andersen et al., 2008). With this assumption, calculating indifference between a gamble with its preceding and successive gamble gives us an interval of potential CRRA parameters for each choice, which we display in Table 1. They range from extreme risk aversion ($\rho > 7.51$) to risk neutral (loving) ($\rho \leq 0$). We use the CRRA parameter intervals to inform a maximum likelihood estimation of the treatment effect on the underlying latent parameter.

Covariates and Balance. We control for a set of observables that have been shown to relate to risk aversion (see Dohmen et al., 2011). These observables include age, gender, education, parents education, net income, marital status, the number of household members, employment status (self-employed, employed, unemployed, retired), citizenship, homeownership, satisfaction with health, and region (East/West Germany). Homeownership is the most important component of wealth in Germany below the top-1% of the wealth distribution and we use this variable as a proxy for wealth because the SOEP-IS includes no wealth module. Education is measured by the highest degree or diploma taking into account general schooling, vocational and university education. Accordingly, higher categories represent a higher level of education. We use this scheme instead of

[6] About 89 percent of respondents rated the comprehensibility of the risk-elicitation task as good or very good, and for only 2 percent of respondents it was insufficient or unintelligible.

[7] Chiappori and Paiella (2011) present empirical evidence that portfolio choices across the distribution of household wealth are well described by constant relative risk aversion (see also Brunnermeier and Nagel (2008); Sahm (2012)).

years of schooling as it better describes educational attainment in Germany (see Card, 1999).[8] In addition, we include the educational background of both parents by using eligibility for attending university (completed Abitur) as a proxy for high educational attainment.

In Appendix Table A3, we present p-values of a set of linear regressions assessing the balance of the observables presented above across treatment and control group. The results of these regressions (including an F-test for joint significance of all covariates) indicate that the treatment and control group are very similar along these observables. Nevertheless, we will show all empirical results with and without covariates. In Appendix Table A4, we present the same exercise for our personality traits (Optimism and Locus of Control). Again, the table indicates that these traits are well balanced across treatment and control group.

3 Main Experimental Results

3.1 First Stage

We start our analysis with a closer look at the answers to the wealth categorization. Table A1 in the Appendix shows the wealth categories in both conditions along with the share of responses in each category. As intended, the treatment manipulation was successful in sorting respondents into the different wealth categories. In the control condition, the distribution of responses in the five wealth categories is almost uniform, and a majority of respondents aligned themselves in one of the three top categories starting from €11,000. In strong contrast, we see that about 80 percent of respondents in the treatment condition placed themselves into the lowest category. Accordingly, the wider wealth intervals of the treatment condition induced a large majority of respondents to feel that their wealth is at the lower end of the distribution. This implies that social comparisons are predominantly upward, as respondents may compare their situation with respondents in higher categories.

To see whether the treatment successfully induced a feeling of a low relative standing and a larger gap with respect to the top, we test whether the variation of the wealth categories had an effect on respondents' perceptions about the relative income distribution. That is, we show how the categorization into wider wealth categories affects subsequent perceptions about the top-10% threshold in the pre-tax income distribution for households. Table 2 presents these "first-stage"

[8] Germany tracks students after four to six years of schooling into different types of high schools. Consequently, the same number of years of schooling not necessarily implies the same level of educational attainment.

results and indicates a strong effect: treated respondents believe that the 90th percentile of the household income distribution is higher compared to what untreated respondents think.[9] This result is robust to excluding outliers, i.e., the bottom and top-5% of the answers. Therefore, varying the wealth intervals of our wealth categorization generated a very strong "first stage," significantly shifting views about the relative income distribution.

3.2 Average Treatment Effect

We now turn to the analysis of the effect of the perceived relative wealth distribution on risk-taking behavior. To investigate this effect, we assume that individuals have CRRA preferences, and model the unobserved risk preference parameter as a latent variable that is linear in its covariates:

$$CRRA_i^* = \tau \times Treatment_i + \mathbf{X_i'}\boldsymbol{\beta} + \epsilon_i, \tag{1}$$

where *Treatment* is an indicator for being induced to think that own wealth is at the lower end of the wealth distribution and **X** includes a constant term and our standard set of covariates as outlined in Section 2.3 (see also Table A3).

The observed lottery choices allow us to construct boundaries for intervals of the utility function parameters (see Table 1). We can use them to inform a maximum likelihood estimation of the coefficients of model 1. For example, for individual i choosing lottery 1 the likelihood is $Pr(7.51 \leq CRRA_i^* < \infty)$, i.e., the probability that their curvature parameter ρ falls within the interval defined by the lottery choice. Assuming normally distributed errors with some variance σ_ϵ^2 leaves us in the standard set-up of interval regressions.

Risk parameters. In a first step, we estimate the parameters of a model similar to 1, using control group observations only. We then predict their CRRA parameters using the obtained coefficients and look at the correlates of risk preferences with socio-demographic covariates (see Table A5). In line with most of the literature, we find that females are more risk averse and that better educated respondents are less risk averse (e.g., Chapman et al., 2018). We also find that married and unemployed respondents are more risk averse, while higher income, having better educated fathers and higher health satisfaction is associated with less risk aversion. However, these latter correlations do not survive the inclusion of all covariates at the same time, except for married

[9] Looking at the raw data, reveals that respondents had a biased perception of the threshold. The median threshold was €300,000 in the treatment group and €200,000 in the control group.

respondents (see Table A5, column 2).

Taking advantage of the rich data of the SOEP-IS, we can relate our incentivized measure of risk preferences to a qualitative measure of general risk attitudes (measured on a scale from 0 to 10 – not willing to very willing to take risks). Prior research indicates that this qualitative measure correlates strongly a with experimentally elicited risk measures and is predictive of risk taking in several domains (Dohmen et al., 2011). Our finding affirm this relationship as well. We see a strong correlation between our incentivized measure of risk preferences (that differs from the validation instrument in the previous literature) and the qualitative risk measure. That is, a one-point increase in the qualitative risk measure is related to a 0.24 lower curvature parameter ρ.

Regression Analysis. To provide statistical evidence on the effect of relative wealth perceptions on risk preferences, we repeat the estimation for the full study sample. Figure 1 illustrates the predicted results and indicates a sizable shift towards a lower CRRA parameter ρ in the treatment condition, indicating more risk tolerance. Table 3 presents the estimated coefficients underlying the predictions of Figure 1. Specification (1) of Table 3 includes only a constant and a treatment dummy, whereas specification (2) additionally controls for the standard set of covariates. The estimated treatment effect is in both cases almost identical and negative, indicating that the treatment decreased risk aversion.

To put the results into perspective, consider that the treatment effect amounts to a 18 percent change relative to the control group mean in both specifications. Carvalho, Prina and Sydnor (2016), for example, estimate that a random assignment to savings accounts for rural Nepalese households leads to a 17 percent increase in risky choices in a similar lottery task. Other studies estimate gender differences in CRRA parameters of 30 percent (e.g., Garbarino, Slonim and Sydnor, 2011). Given these numbers, the average treatment effect presented above appears sizable.

3.3 Heterogeneous effects: Locus of Control

The analysis so far has focused on average treatment effects indicating more risk tolerance if respondents perceive to be at the lower end of the wealth distribution. As reasoned above, however, we hypothesize that the responses to our treatment differ with respect to respondents' beliefs about their control over life, i.e., with respect to their locus of control (LoC).

Locus of Control. Immediately before the treatment manipulation, we implemented a ten-item module to elicit the locus of control of respondents. As outlined in Section 2.3, we create a single measure for LoC on a scale from 1 to 7, where higher values imply more external beliefs. The median score in our sample is 3 (average 3.13), indicating that the majority of respondents have internal control beliefs.[10] In Appendix Table A5, columns 3–4 and Figure A1, we present correlates of LoC. Consistent with empirical evidence, we document an education and income gradient, i.e., more education and higher income are associated with lower external control beliefs. A similar pattern is true for risk aversion. That is, more risk tolerance is associated with lower external control beliefs for both our qualitative measure and incentivized measure of risk.[11]

Figure 2 reflects this correlation between LoC and risk aversion. The figure shows the effect of the inequality treatment on the predicted CRRA parameters separately for a median split along the LoC score. Looking at the control group only, it is apparent that respondents with an external LoC exhibit higher risk aversion than respondents with an internal LoC. While the treatment had no sizable impact on risk aversion for respondents with internal beliefs ($p = 0.649$), it substantially reduced measured risk aversion for those with above median beliefs (more external beliefs, $p = 0.000$). The treatment effect in this case corresponds to a shift towards increased risk tolerance of 34.7% (90%-CI: [15.5%, 53.9%]).

Regression Analysis. In Table 3, we present regression results on these heterogeneous effects using the following specification for the latent CRRA parameter:

$$CRRA_i^* = \tau * Treatment_i + \delta * LoC_i + \gamma * Treatment_i \times LoC_i + \mathbf{X_i'}\boldsymbol{\beta} + \epsilon_i, \tag{2}$$

The main coefficient of interest in this section thus is γ, which captures the additional effect of our treatment for an individual with a one standard deviation higher *LoC* score.

As illustrated in column (3) of Table 3, there is a significant and sizable interaction effect between the treatment and LoC. Respondents with a higher LoC score, indicating more external beliefs, display a stronger effect towards higher risk tolerance (i.e., a lower CRRA parameter). The magnitude of the effect is sizable: a one standard deviation shift towards more external beliefs, leads

[10] This is in line with previous findings from the SOEP (e.g., Nolte et al., 1997; Weinhardt and Schupp, 2014)

[11] This is in line with previous research. For example, Salamanca et al. (2016) demonstrate a positive relationship between internal control beliefs and the likelihood of households to hold equity using data from a Dutch National Bank survey. Using data from the SOEP, Becker et al. (2012) illustrate that more risk tolerance is associated with lower external control beliefs. However, the correlation is small (correlation coefficient of 0.15).

to a difference in the corresponding treatment effect that is twice the size of the average treatment effect (column 1). Adding covariates to control for basic socio-demographic characteristics has virtually no effect on the coefficient estimate of the interaction term (column 4). Together, this provides causal evidence for the moderating role of personality traits in shaping responses to social influences.

3.4 Robustness

We next address concerns about internal validity and provide evidence that our findings are robust to various alternative specifications and explanations. Specifically, we show that non-compliance with the risk elicitation measure unlikely biases our estimates and that the operationalization of both our outcome measure and the LoC score are neither crucial for estimation nor for inference.

Non-Compliance. Recall that participation in the risk-preference elicitation task was voluntary. Consequently a potentially worrisome threat to internal validity is differential selection into the risk-preference elicitation task. We address this issue in several ways. First, we note that the sample is balanced on a set of important covariates, see Table A3. Importantly, we can fall back on the qualitative measure of risk that is a regular component of the SOEP and was asked before our survey module to show that the sample is also balanced with respect to this baseline measure of risk attitudes. Therefore, it is unlikely that the main effects are driven by differential selection with respect to pre-treatment risk attitudes. Second, including the baseline risk measure in the regression specification 1 has virtually no effect on the coefficient estimates, even though it correlates significantly with the elicited risk preferences (Appendix Table A6).

Third, in the Appendix (Table A7), we provide further evidence that non-participation in the risk-elicitation task is orthogonal to the randomly assigned treatment status. In particular, we show that non-participation in the risk-elicitation task does not differ across conditions (panel a.), and that baseline risk attitudes are the same across respondents and non-respondents (panel b.) as well as treatment and control conditions (panel c.).

Finally, we show that our results are robust to re-weighting the study sample to match the socio-economic characteristics of the full sample. That is, we use a probit regression to predict the sampling probability of each respondent with a set of observable characteristics, and use the inverse of this probability to construct individual weights (see Table in the Appendix for the results). Appendix Table A8 reveals that this re-weighting exercise yields very similar results as our

unweighted estimates. Taken together, there is little reason to worry that the decision to participate in the lottery task biases our estimates.

Other Personality Traits. A widespread concern is that LoC merely captures the effects of other personality traits, such as the Big 5. We explore this concern along two margins. First, we re-estimate regression 2 and include the Big 5 from a previous wave as additional controls (Appendix Table A9, column 3). This reduces the magnitude of the statistical association between LoC and our risk measure, but does not affect the coefficient estimate of the interaction term. In Appendix Table A10 of the Appendix, we additionally show that the Big 5 traits are not a stand-in for LoC by fitting models that interact our treatment with each component of the Big 5 separately. None of the interaction effects is statistically distinguishable from zero.

Second, another personality trait that may play a role in this context is optimism. According to Dohmen, Quercia and Willrodt (2018), optimism is a significant predictor of risk attitudes, as it arguably determines whether individuals focus on positive or negative aspects of risk-taking. Controlling for optimism in Appendix Table A9 leaves the estimates and our conclusions unaffected (Column 4).[12] This is also true if we control for Big 5 and optimism simultaneously. As a final exercise, we directly interact our optimism measures with the treatment (instead of LoC) and report the results in Appendix Table A10. Again, there is no indication that optimism is a substitute for LoC.

Other socio-economic characteristics. To explore whether the heterogeneous effects of LoC just pick up heterogeneity in socio-economic characteristics, we rerun our specification 2 with socio-economic characteristics that are associated with LoC, such as unemployment status, income, and education. Differentiating respondents along these categories also reveals substantial differences in their tolerance towards risk. This is also true for gender: women are more risk averse than men.[13] However, we find no evidence that any of these socio-economic characteristics interact with the treatment, suggesting that LoC affects heterogeneity independent of these characteristics (Appendix Table A11).

[12]The optimism proxy used in Table A9 is based on the following question: *"If you think about the future: Are you... (1) optimistic; (2) rather optimistic than pessimistic; (3) rather pessimistic than optimistic; (4) pessimistic?"*. We administered this question before the LoC questions. Note that (Dohmen, Quercia and Willrodt, 2018) use a different optimism measure eliciting self-reported degrees of optimism and pessimism.

[13]The sample gender difference in the implicit CRRA parameter is roughly 33%, the unemployed/employed contrast is at 29%, both magnitudes lie well above the difference observed for the LoC.

Alternative Outcome Measures. Instead of constructing a mapping between lottery choices and CRRA utility parameters, one could alternatively use the lottery choices directly as a categorical outcome and estimate linear regressions by OLS. While this is less demanding in terms of distributional assumptions, it renders the quantitative interpretation of the estimates more difficult as it is a rather ad-hoc measure of risk attitudes. Nonetheless, we present results from such regressions in Table A12 of the Appendix. Qualitatively our conclusions do not change. It is still predominantly people with external control beliefs reacting to our treatment manipulation.

Alternative LoC Scores. As is common in the literature, we use a single index for LoC in our analysis. However, a concern is that this index is based on unweighted averages (Cobb-Clark and Schurer, 2013). An alternative is to perform a principal component analysis to extract a separate score for internal and external control beliefs (see e.g., Pinger, Schäfer and Schumacher, 2018). In Appendix Table A13 we interact each of the two scores with our treatment indicator. The findings corroborate our previous conclusions and show that the choice of how to represent individual LoC beliefs does not affect our conclusions in a meaningful way.

4 Inequality and Risk-Taking

We have focused our analysis on the impacts of the relative position in the wealth distribution and now we examine whether our findings apply more broadly. The impact of relative position is naturally linked to inequality, as the distribution of income or wealth has implications for how much richer or poorer others are (e.g., Yitzhaki, 1979). This section provides evidence that the patterns in our data also apply if we take our relativistic approach to the societal level: income inequality is related to risk taking, and personal control beliefs moderate this relationship. To do so, we use data from two large-scale international surveys: the Global Preference Survey (Falk et al., 2016, 2018) and the World Value Survey (Inglehart et al., 2014).

Global Preference Survey. The Global Preference Survey (GPS) contains a validated risk measure, elicited in nationally representative samples of 76 countries spanning about 90% of the world's population. The risk measure is a weighted average of a qualitative self-assessment of risk tolerance akin to the qualitative measure in the SOEP (see section 3.4) and a quantitative measure of a sequence of lottery choices. We focus here on the aggregated level and compare national-level summary statistics of the risk measure with a national-level measure of inequality, the Gini index, taken

from the World Bank's World Development Indicators (WDI). The two measures are significantly correlated (p=0.005) with a Pearson correlation coefficient of 0.33, suggesting that in more unequal countries that population is, on average, more risk tolerant. We next turn to an individual level analysis that allow us to consider the moderating effect of LoC.

World Value Survey. The World Value Survey (WVS) collects socio-demographic information, political attitudes, and value judgments for nationally representative samples in repeated cross-sections. Two recent waves contain two questions that are particularly relevant for our purposes. First, they contain a measure of risk attitudes developed by Schwartz (1992), which asks respondents to compare themselves to a hypothetical person that finds it important to "adventure and [take] risks." Answers range on a scale from (1) – *very much like me* to (6) – *not at all like me*. The measure captures sensation-seeking as developed by personality psychologists and is conceptually related to economists' notion of risk-aversion (Almlund et al., 2011). Second, they contain a proxy for locus of control. Respondents are asked about their view of whether they can decide their own destiny or whether it is impossible to escape a predetermined fate on a scale from (1) – *everything is determined by fate* to (10) – *people shape their fate themselves*. To ease interpretation we standardize answers to both questions by their sample mean and standard deviation and recode the LoC question such that higher values imply more external beliefs.

We merge the WVS again with information on national-level inequality from the WDI, allowing us to estimate linear regressions of measured risk attitudes on a proxy for inequality, locus of control beliefs and their interaction.[14] Table 4 presents the results, all standard errors are clustered at the country level. We observe that individual risk aversion is negatively correlated with national-level inequality. This complements the aggregate-level correlation we have seen in the GPS that is based on a validated risk measure. Moreover, we see that this relationship is considerably more pronounced for individuals with external control beliefs and robust to including a battery of socio-demographic covariates, survey year fixed effects, and dummies for cultural country clusters. This finding suggests that our experimental evidence has broader appeal.

[14]The risk measure is only elicited in waves 5 (2005 – 2009) and 6 (2010 – 2014), which leaves us with a sample of 145,206 individual observations, coming from 71 countries and spanning 12 years.

5 Discussion and Concluding Remarks

We presented evidence from a representative survey experiment that relative wealth standing causally influences risk taking. This lends empirical credibility to a long-standing hypothesis that social components, such as concerns for status or relative position, are important determinants of risk preferences. While distinct modeling approaches of the economic context and preferences predict that risk taking is most prominent either at the lower end (Kuziemko et al., 2014; Hopkins, 2018) or in the middle of the distribution (Friedman and Savage, 1948; Ray and Robson, 2012), our study highlights that the phenomenon could be wide-spread across the whole distribution, as long as one's *perceived* standing is low.

The nature of risk might vary across the distribution, however. As Becker, Murphy and Werning (2005) point out, gambling is more frequent among less well endowed individuals, while risk taking in the form of entrepreneurship is typically only achievable with higher wealth levels. The former often corresponds to risk-loving – e.g., consider a typical state lottery with expected value below the price of a ticket – while the latter promises positive returns. Our treatment manipulated perceptions of wealth rank for a large share of the population. Given this variation in quality of risk, the welfare implications of changing perceptions about the wealth distribution are not clear cut.

The second contribution of this paper is the identification of personality types in the population that are particularly prone to adjust their risk behavior. As eluded to in the introduction, the concept of locus of control can be easily and fruitfully incorporated as a constraint on the available choice set of individuals. The fact that particularly those with external control beliefs display a substantial response to the treatment favors an interpretation in which risk taking could be a strategy for upward mobility. In such a framework, individuals who believe that life outcomes mainly depend on their own doing, arguably have alternative strategies at hand that entail positive returns. An interesting avenue for further research would be to draw out the theoretical implications of this heterogeneity on long-term distributional outcomes in a setting that allows for transmission of traits across generations. For example, Gärtner, Mollerstrom and Seim (2018) find that Swedish parents teach their children to believe in effort as a determinant of mobility to a degree that exceeds their own beliefs.

Our findings should also caution researchers who are interested in measuring more standard types of preference parameters. If their elicitation framework induces social comparisons and their

utility contribution is not jointly estimated, the risk preference parameters might be significantly biased. This resonates with the idea of standardizing measurement for incentives and context with respect to personality constructs that was formulated by Almlund et al. (2011).

The empirical results presented above stem from a representative sample of the German population and our complementary cross-country evidence suggests that the proposed relationship holds more broadly. Nonetheless our understanding of the social foundation of risk preferences would benefit from future research that varies both the cultural context and the nature of risk entailed in the studied decisions.

References

Almlund, Mathilde, Angela Lee Duckworth, James Heckman, and Tim Kautz. 2011. "Personality psychology and economics." In *Handbook of the Economics of Education*. Vol. 4, 1–181. Elsevier.

Andersen, Steffen, Glenn W Harrison, Morten I Lau, and E Elisabet Rutström. 2008. "Eliciting risk and time preferences." *Econometrica*, 76(3): 583–618.

Barón, Juan D, and Deborah A Cobb-Clark. 2010. "Are young people's educational outcomes linked to their sense of control?" *IZA Discussion Paper*.

Becker, Anke, Thomas Deckers, Thomas Dohmen, Armin Falk, and Fabian Kosse. 2012. "The relationship between economic preferences and psychological personality measures." *Annual Review of Economics*, 4(1): 453–478.

Becker, Gary S, Kevin M Murphy, and Ivan Werning. 2005. "The equilibrium distribution of income and the market for status." *Journal of Political Economy*, 113(2): 282–310.

Benjamin, Daniel J, James J Choi, A Joshua Strickland, et al. 2010. "Social identity and preferences." *American Economic Review*, 100(4): 1913–1928.

Binswanger, Hans P. 1980. "Attitudes toward risk: Experimental measurement in rural India." *American Journal of Agricultural Economics*, 62(3): 395–407.

Borghans, Lex, Angela Lee Duckworth, James J Heckman, and Bas Ter Weel. 2008. "The economics and psychology of personality traits." *Journal of Human Resources*, 43(4): 972–1059.

Brown, Ryan, Verónica Montalva, Duncan Thomas, and Andrea Velásquez. 2019. "Impact of violent crime on risk aversion: Evidence from the Mexican drug war." *Review of Economics and Statistics*, 101(5): 892–904.

Brunnermeier, Markus K, and Stefan Nagel. 2008. "Do wealth fluctuations generate time-varying risk aversion? Micro-evidence on individuals." *American Economic Review*, 98(3): 713–36.

Butler, Jeffrey V, and Dietmar Fehr. 2020. "The Causal Effect of Cultural Identity on Cooperation." *mimeo*.

Caliendo, Marco, Deborah A Cobb-Clark, and Arne Uhlendorff. 2015. "Locus of control and job search strategies." *Review of Economics and Statistics*, 97(1): 88–103.

Callen, Michael, Mohammad Isaqzadeh, James D Long, and Charles Sprenger. 2014. "Violence and risk preference: Experimental evidence from Afghanistan." *American Economic Review*, 104(1): 123–48.

Cameron, Lisa, and Manisha Shah. 2015. "Risk-taking behavior in the wake of natural disasters." *Journal of Human Resources*, 50(2): 484–515.

Cappelen, Alexander W, John A List, Anya Samek, and Bertil Tungodden. 2020. "The effect of early education on social preferences." *Journal of Political Economy*, forthcoming.

Card, David. 1999. "The causal effect of education on earnings." In *Handbook of labor economics*. Vol. 3, 1801–1863. Elsevier.

Carvalho, Leandro S, Silvia Prina, and Justin Sydnor. 2016. "The effect of saving on risk attitudes and intertemporal choices." *Journal of Development Economics*, 120: 41–52.

Carvalho, Leandro S, Stephan Meier, and Stephanie W Wang. 2016. "Poverty and economic decision-making: Evidence from changes in financial resources at payday." *American Economic Review*, 106(2): 260–84.

Cebi, Merve. 2007. "Locus of control and human capital investment revisited." *Journal of Human Resources*, 42(4): 919–932.

Chapman, Jonathan, Erik Snowberg, Stephanie Wang, and Colin Camerer. 2018. "Loss attitudes in the US population: Evidence from dynamically optimized sequential experimentation (DOSE)." NBER Working Paper w25072.

Charness, Gary, Uri Gneezy, and Alex Imas. 2013. "Experimental methods: Eliciting risk preferences." *Journal of Economic Behavior & Organization*, 87: 43–51.

Chiappori, Pierre-André, and Monica Paiella. 2011. "Relative risk aversion is constant: Evidence from panel data." *Journal of the European Economic Association*, 9(6): 1021–1052.

Cobb-Clark, Deborah A, and Stefanie Schurer. 2013. "Two economists' musings on the stability of locus of control." *The Economic Journal*, 123(570): F358–F400.

Cohn, Alain, Jan Engelmann, Ernst Fehr, and Michel André Maréchal. 2015. "Evidence for countercyclical risk aversion: An experiment with financial professionals." *American Economic Review*, 105(2): 860–85.

Coleman, Margo, and Thomas DeLeire. 2003. "An economic model of locus of control and the human capital investment decision." *Journal of Human Resources*, 38(3): 701–721.

Cruces, Guillermo, Ricardo Perez-Truglia, and Martin Tetaz. 2013. "Biased perceptions of income distribution and preferences for redistribution: Evidence from a survey experiment." *Journal of Public Economics*, 98: 100–112.

Dave, Chetan, Catherine C Eckel, Cathleen A Johnson, and Christian Rojas. 2010. "Eliciting risk preferences: When is simple better?" *Journal of Risk and Uncertainty*, 41(3): 219–243.

Deutsche Bundesbank. 2016. "Vermögen und Finanzen privater Haushalte in Deutschland: Ergebnisse der Vermögensbefragung 2014." *Monatsbericht März*, 61.

Dijk, Oege. 2017. "For whom does social comparison induce risk-taking?" *Theory and Decision*, 82(4): 519–541.

Dohmen, Thomas, Armin Falk, David Huffman, Uwe Sunde, Jürgen Schupp, and Gert G Wagner. 2011. "Individual risk attitudes: Measurement, determinants, and behavioral consequences." *Journal of the European Economic Association*, 9(3): 522–550.

Dohmen, Thomas J, Simone Quercia, and Jana Willrodt. 2018. "Willingness to take risk: The role of risk conception and optimism." *IZA Discussion Paper No. 11642*.

Duesenberry, James S. 1949. *Income, Saving and the Theory of Consumer Behavior.* Cambridge, MA:Harvard University Press.

Eckel, Catherine C, and Philip J Grossman. 2002. "Sex differences and statistical stereotyping in attitudes toward financial risk." *Evolution and Human Behavior*, 23(4): 281–295.

Eckel, Catherine C, Mahmoud A El-Gamal, and Rick K Wilson. 2009. "Risk loving after the storm: A Bayesian-Network study of Hurricane Katrina evacuees." *Journal of Economic Behavior & Organization*, 69(2): 110–124.

Fafchamps, Marcel, Bereket Kebede, and Daniel John Zizzo. 2015. "Keep up with the winners: Experimental evidence on risk taking, asset integration, and peer effects." *European Economic Review*, 79: 59–79.

Falk, Armin, Anke Becker, Thomas Dohmen, Benjamin Enke, David Huffman, and Uwe Sunde. 2018. "Global evidence on economic preferences." *The Quarterly Journal of Economics*, 133(4): 1645–1692.

Falk, Armin, Anke Becker, Thomas J Dohmen, David Huffman, and Uwe Sunde. 2016. "The preference survey module: A validated instrument for measuring risk, time, and social preferences."

Fehr, Dietmar, Johanna Mollerstrom, and Ricardo Perez-Truglia. 2019. "Your Place in the World: The Demand for National and Global Redistribution." NBER Working Paper w26555.

Friedman, Milton, and Leonard J Savage. 1948. "The utility analysis of choices involving risk." *Journal of political Economy*, 56(4): 279–304.

Gamba, Astrid, Elena Manzoni, and Luca Stanca. 2017. "Social comparison and risk taking behavior." *Theory and Decision*, 82(2): 221–248.

Garbarino, Ellen, Robert Slonim, and Justin Sydnor. 2011. "Digit ratios (2D: 4D) as predictors of risky decision making for both sexes." *Journal of Risk and Uncertainty*, 42(1): 1–26.

Gärtner, M, J Mollerstrom, and D Seim. 2018. "Income Mobility, Luck vs Effort Beliefs, and the Demand for Redistribution: Perceptions and Reality." mimeo.

Giuliano, Paola, and Antonio Spilimbergo. 2013. "Growing up in a Recession." *Review of Economic Studies*, 81(2): 787–817.

Giuliano, Paola, and Antonio Spilimbergo. 2014. "Growing up in a Recession." *Review of Economic Studies*, 81(2): 787–817.

Goebel, Jan, Markus M Grabka, Stefan Liebig, Martin Kroh, David Richter, Carsten Schröder, and Jürgen Schupp. 2018. "The German Socio-Economic Panel (SOEP)." *Jahrbücher für Nationalökonomie und Statistik*.

Gregory, Nathaniel. 1980. "Relative wealth and risk taking: A short note on the Friedman-Savage utility function." *Journal of Political Economy*, 88(6): 1226–1230.

Haisley, Emily, Romel Mostafa, and George Loewenstein. 2008. "Subjective relative income and lottery ticket purchases." *Journal of Behavioral Decision Making*, 21(3): 283–295.

Heckman, James J, Tomáš Jagelka, and Timothy D Kautz. 2019. "Some contributions of economics to the study of personality." National Bureau of Economic Research.

Hoff, Karla, and Priyanka Pandey. 2006. "Discrimination, social identity, and durable inequalities." *American Economic Review*, 96(2): 206–211.

Hopkins, Ed. 2018. "Inequality and risk-taking behaviour." *Games and Economic Behavior*, 107: 316–328.

Inglehart, Ronald, Christian Haerpfer, Alejandro Moreno, Christian Welzel, Kseniya Kizilova, Jaime Diez-Medrano, Marta Lagos, Pippa Norris, Eduard Ponarin, Bi Puranen, et al. 2014. "World values survey: All rounds-country-pooled datafile version." *Madrid: JD Systems Institute*.

Jagelka, Tomáš. 2020. "Are Economists' Preferences Psychologists' Personality Traits? A Structural Approach." IZA Discussion Paper.

Jakiela, Pamela, and Owen Ozier. 2019. "The impact of violence on individual risk preferences: evidence from a natural experiment." *Review of Economics and Statistics*, 101(3): 547–559.

Karadja, Mounir, Johanna Mollerstrom, and David Seim. 2017. "Richer (and holier) than thou? The effect of relative income improvements on demand for redistribution." *Review of Economics and Statistics*, 99(2): 201–212.

Kling, Jeffrey R, Jeffrey B Liebman, and Lawrence F Katz. 2007. "Experimental analysis of neighborhood effects." *Econometrica*, 75(1): 83–119.

Kosse, Fabian, Thomas Deckers, Pia Pinger, Hannah Schildberg-Hörisch, and Armin Falk. 2020. "The formation of prosociality: causal evidence on the role of social environment." *Journal of Political Economy*, forthcoming.

Kuziemko, Ilyana, Ryan W Buell, Taly Reich, and Michael I Norton. 2014. ""Last-place aversion": Evidence and redistributive implications." *The Quarterly Journal of Economics*, 129(1): 105–149.

Malmendier, Ulrike, and Stefan Nagel. 2011. "Depression babies: do macroeconomic experiences affect risk taking?" *Quarterly Journal of Economics*, 126(1): 373–416.

Menon, Geeta, Priya Raghubir, and Norbert Schwarz. 1997. "How much will I spend? Factors affecting consumers' estimates of future expense." *Journal of Consumer Psychology*, 6(2): 141–164.

Mishra, Sandeep, Leanne S Son Hing, and Martin L Lalumiere. 2015. "Inequality and risk-taking." *Evolutionary Psychology*, 13(3): 1 – 11.

Nolte, Helmut, Christoph Weischer, Uwe Wilkesmann, Jakob Maetzel, and Hans Georg Tegethoff. 1997. "Kontrolleinstellungen zum Leben und zur Zukunft–Auswertung eines neuen, sozialpsychologischen Itemblocks im sozio-oekonomischen Panel." *Diskussionspapier der Fakultät für Sozialwissenschaft der Ruhr-Universität Bochum*.

Norton, Michael I, and Dan Ariely. 2011. "Building a better America—One wealth quintile at a time." *Perspectives on Psychological Science*, 6(1): 9–12.

Pinger, Pia, Sebastian Schäfer, and Heiner Schumacher. 2018. "Locus of control and consistent investment choices." *Journal of Behavioral and Experimental Economics*, 75: 66–75.

Ray, Debraj, and Arthur Robson. 2012. "Status, Intertemporal Choice, and Risk-Taking." *Econometrica*, 80(4): 1505–1531.

Richter, David, and Jürgen Schupp. 2015. "The SOEP Innovation Sample (SOEP IS)." *Schmollers Jahrbuch*, 135(3): 389–399.

Richter, David, Maria Metzing, Michael Weinhardt, and Jürgen Schupp. 2013. "SOEP scales manual." SOEP Survey Papers.

Robson, Arthur J. 1996. "The evolution of attitudes to risk: Lottery tickets and relative wealth." *Games and Economic Behavior*, 14(2): 190–207.

Rockwood, Todd H, Roberta L Sangster, and Don A Dillman. 1997. "The effect of response categories on questionnaire answers: context and mode effects." *Sociological Methods & Research*, 26(1): 118–140.

Rotter, Julian B. 1966. "Generalized expectancies for internal versus external control of reinforcement." *Psychological Monographs: General and Applied*, 80(1): 1.

Sahm, Claudia R. 2012. "How much does risk tolerance change?" *Quarterly Journal of Finance*, 2(04): 1250020.

Salamanca, Nicolas, Andries de Grip, Didier Fouarge, and Raymond Montizaan. 2016. "Locus of Control and Investment in equity." IZA Discussion Paper.

Schwartz, Shalom H. 1992. "Universals in the content and structure of values: Theoretical advances and empirical tests in 20 countries." *Advances in Experimental Social Psychology*, 25(1): 1–65.

Schwarz, Norbert, Hans-J Hippler, Brigitte Deutsch, and Fritz Strack. 1985. "Response scales: Effects of category range on reported behavior and comparative judgments." *Public Opinion Quarterly*, 49(3): 388–395.

Specht, Jule, Boris Egloff, and Stefan C Schmukle. 2013. "Everything under control? The effects of age, gender, and education on trajectories of perceived control in a nationally representative German sample." *Developmental Psychology*, 49(2): 353.

Veblen, Thorstein. 1899. *The theory of the leisure class.* New York:MacMillan.

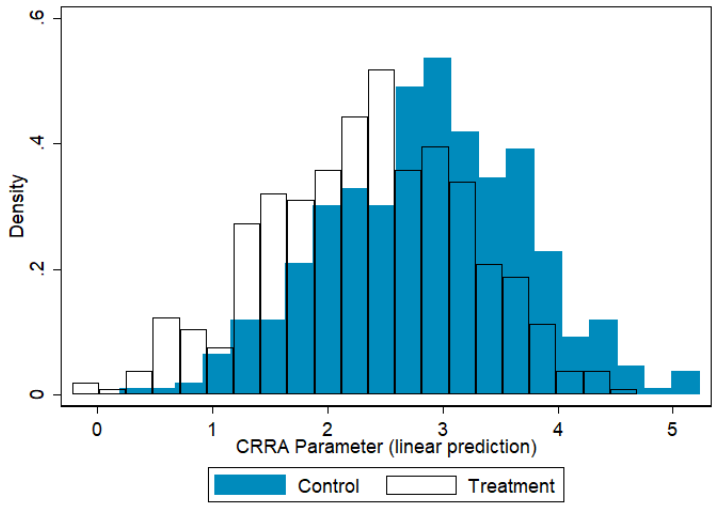
Voors, Maarten J, Eleonora EM Nillesen, Philip Verwimp, Erwin H Bulte, Robert Lensink, and Daan P Van Soest. 2012. "Violent conflict and behavior: a field experiment in Burundi." *American Economic Review*, 102(2): 941–64.

Weinhardt, Michael, and Jürgen Schupp. 2014. "Multi-Itemskalen im Soep Jugendfragebogen." SOEP Survey Papers.

Yitzhaki, Shlomo. 1979. "Relative Deprivation and the Gini Coefficient." *The Quarterly Journal of Economics*, 93(2): 321–324.

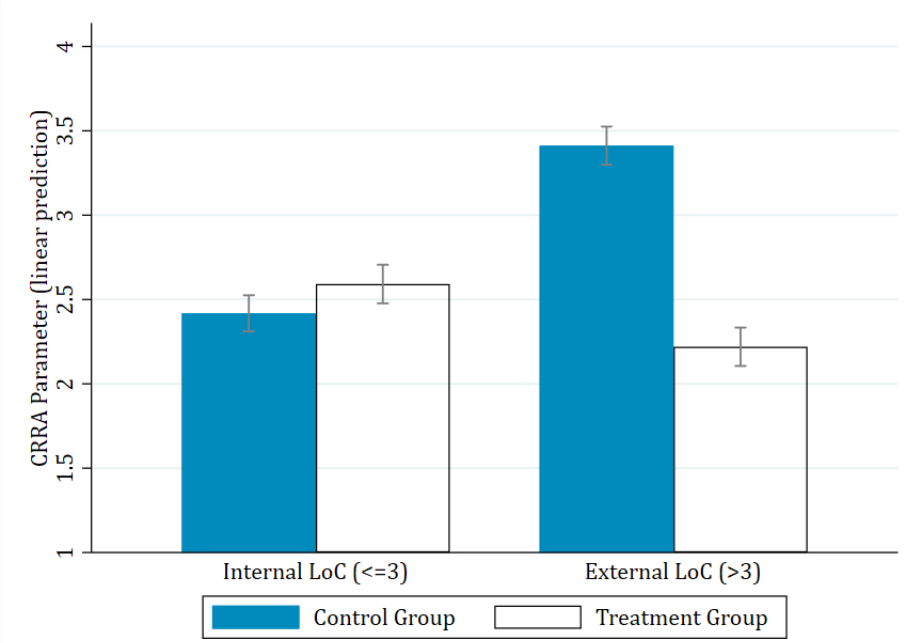
Figures & Tables

Figure 1: Distribution of predicted CRRA parameters by treatment status



Notes: Predicted CRRA parameters from interval regression regressing CRRA on the treatment variable and a set of standard covariates (age, gender, education, parents education, net income, marital status, the number of household members, employment status (self-employed, employed, unemployed, retired), citizenship, homeownership, satisfaction with health, and region).

Figure 2: Median LoC Split - Treatment Effects



Notes: Predicted CRRA parameters from interval regression regressing CRRA on the treatment variable and a set of standard covariates (age, gender, education, parents education, net income, marital status, the number of household members, employment status (self-employed, employed, unemployed, retired), citizenship, homeownership, satisfaction with health, and region).

Table 1: Overview of Gambles

	Payoffs	**EV**	**S.D.**	**CRRA-Interval**
Lottery 1	(50, 50)	50	0	$[7.51, \infty)$
Lottery 2	(45, 95)	70	25	$[1.74, 7.51]$
Lottery 3	(40, 120)	80	40	$[0.812, 1.74]$
Lottery 4	(30, 150)	90	60	$[0.315, 0.812]$
Lottery 5	(10, 190)	100	90	$[0, 0.315]$
Lottery 6	(0, 200)	100	100	$(-\infty, 0]$

Note: Each respondent could choose one lottery from above. A randomly drawn 10% of all respondents received a pay-off according to their chosen lottery. Within each lottery both pay-offs were equally likely – all amounts in €. The CRRA coefficient interval derives from an assumed utility function of the form $u(x) = \frac{x^{1-\rho}}{1-\rho}$, where x is the respective payoff and ρ the coefficient of interest.

Table 2: First Stage Effects of Treatment

	Perceived Top-10% Household Income			
	(1)	(2)	(3)	(4)
Treated	0.213**	0.199**	0.169**	0.170**
	(0.087)	(0.087)	(0.069)	(0.069)
Covariates	No	Yes	No	Yes
Observations	865	865	777	777
R^2	0.01	0.06	0.01	0.05

Note: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.
OLS regression with standard errors in parentheses. The dependent variable is the natural logarithm of a respondent's subjective 90th-percentile threshold in the pre-tax household income distribution in Germany. respondents answered the following question: "What do you think, from what annual pre-tax household income one belongs to the richest 10 percent of households in Germany?" Columns (3) and (4) exclude outliers, i.e., thresholds below €60,000 (lowest 5% of answers) or above €2,875,000 (highest 5%). Covariates include: age, gender, education, parents education, net income, marital status, household size, employment status (self-employed, unemployed, retired), citizenship, homeownership, satisfaction with health, and region (East/West Germany).

Table 3: Main Treatment Effects

	CRRA Parameter			
	(1)	(2)	(3)	(4)
Treated	-0.518*	-0.517*	-0.484*	-0.481*
	(0.283)	(0.279)	(0.284)	(0.280)
Treated x Locus of Control			-0.914***	-0.940***
			(0.293)	(0.287)
Locus of Control			0.590***	0.397*
			(0.215)	(0.215)
Constant	2.863***	3.623***	2.902***	3.650***
	(0.200)	(0.971)	(0.199)	(0.982)
Covariates	No	Yes	No	Yes
Observations	914	914	899	899
Log-Likelihood	-2077.43	-2057.52	-2040.20	-2021.25

Note: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.
Interval regressions with standard errors in parentheses. Dependent variables is the CRRA parameter ρ (with lower values indicating higher tolerance for risk). *Locus of Control* is the z-score of a single index for locus of control, constructed as detailed in Table A2. Higher values correspond to more external beliefs. Covariates include: age, gender, education, parents education, net income, marital status, household size, employment status (self-employed, unemployed, retired), citizenship, homeownership, satisfaction with health, and region (East/West Germany).

Table 4: Cross-Country Regressions: Inequality and Locus of Control

	Risk Aversion			
	(1)	(2)	(3)	(4)
Inequality: Gini	-1.185**	-0.756*	-0.087	0.093
	(0.456)	(0.431)	(0.366)	(0.343)
Inequality x LoC	-0.482**	-0.322**	-0.302***	-0.260**
	(0.200)	(0.160)	(0.111)	(0.123)
LoC	0.253***	0.161***	0.166***	0.145***
	(0.075)	(0.060)	(0.043)	(0.047)
Constant	0.447**	-0.264	-0.289*	-0.313**
	(0.171)	(0.233)	(0.148)	(0.153)
Individual Covariates	No	Yes	Yes	Yes
Region FE	No	No	Yes	Yes
Survey Year FE	No	No	No	Yes
Observations	145,206	130,068	130,068	130,068
Countries	71	70	70	70
R^2	0.02	0.09	0.12	0.12

Note: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

OLS regressions standard errors, clustered at the country level, in parentheses. Data from the *World Value Survey* The dependent variable is Schwartz' risk sensation seeking measure. Higher values imply higher risk aversion. Inequality measured by the national-level GINI coefficient, after tax and transfers. Higher values imply higher inequality (Scale: 0 to 1). Locus of Control (LoC) proxied by the standardized answers to the question: "Some people feel they have completely free choice and control over their lives, while other people feel that what they do has no real effect on what happens to them. (Scale from 1 – "none at all" – to 10 – "a great deal.") *Individual covariates* include marital status, number children, subjective health status, satisfaction with financial situation of household, gender, age, age squared, education, unemployment dummy, and relative income position on the national level, measured on a scale from 1 (poorest 10%) to 10 (richest 10%). *Region FE* include the Arab World /Maghreb, Latin Europe, Post Soviet countries, Eastern Europe, Nordic / Germanic, Latin American, South / East Asia, and Sub-Saharan Africa. The reference category are Anglo-Saxon countries. *Survey Wave FE* is an indicator for wave 5 (base is wave 6).

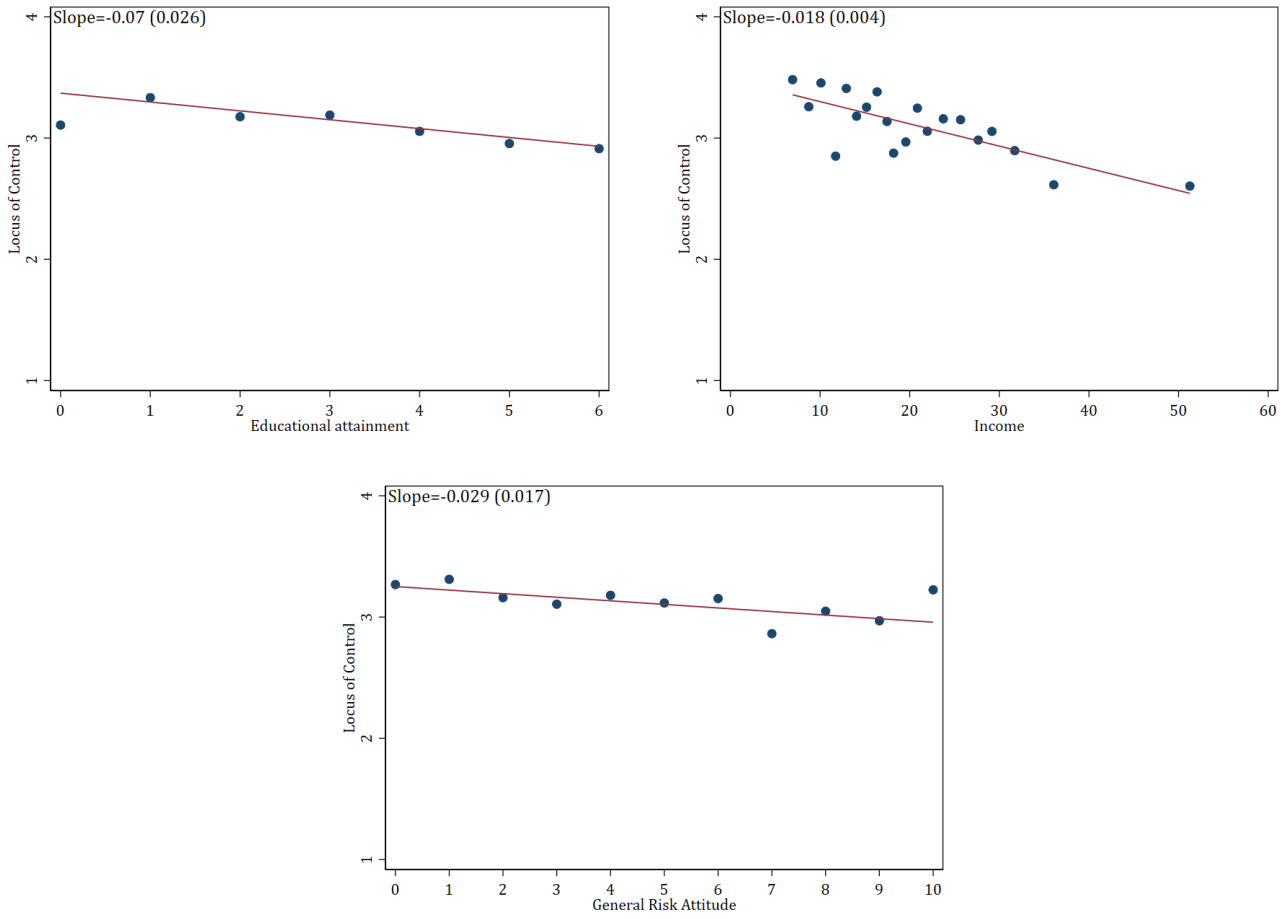
Appendix – For Online Publication Only

Relative Wealth, Personality, and Risk Taking

Dietmar Fehr and Yannick Reichlin

A.1 Additional Figures

Figure A1: Correlates of Locus of Control



A.2 Additional Tables

Table A1: Wealth Categories by Treatment Group

Control Group			**Treatment Group**		
Wealth Category in €	*N*	*%-Share*	*Wealth Category in €*	*N*	*%-Share*
<2,500	119	27.05	<275,000	335	79.01
2,501 – 11,000	88	20.00	275,001 – 468,000	54	12.74
11,001 – 27,000	51	11.59	468,001 – 722,000	22	5.19
27,001 – 112,000	74	16.82	722,001 – 989,000	7	1.65
>112,001	108	24.55	>989,001	6	1.42

Notes: Wealth categories used in the two conditions and number of observations in each category separated by condition.

Table A2: Locus of Control Questions

	N	Mean	S.D.	Min	Max
Locus of Control Module Items					
IT 1: The course of my life is depending on me.	914	2.356	1.308	1	7
IT 2: In comparison to others, I have not achieved what I deserve.	903	3.102	1.708	1	7
IT 3: What you achieve in life, is first of all a question of fate or luck.	914	2.693	1.610	1	7
IT 4: I often experience that others are deciding about my life.	912	2.693	1.585	1	7
IT 5: You have to work hard to be successful.	914	5.910	1.118	1	7
IT 6: When I face difficulties in life, I often doubt my abilities.	914	3.170	1.615	1	7
IT 7: Which opportunities I have in life is determined by social conditions.	911	4.454	1.526	1	7
IT 8: More important than all effort, are the abilities you have.	912	4.830	1.356	1	7
IT 9: I have little control over the things happening in my life.	914	2.655	1.434	1	7
IT 10: Social or political involvement can influence social conditions.	909	3.958	1.657	1	7
Locus of Control Index					
LoC = (-(IT1-8)+IT2+IT3+IT4+IT6+IT7+IT9)/7	899	3.133	0.872	1	6.571
External Scale (IT3, IT4, IT6, IT7, IT9)	910	3.093	0.998	1	6.608
Internal Scale (IT1, IT5, IT8)	912	5.483	0.840	2.932	7

Each item required respondents to answer on a scale from 1 (disagree completely) to 7 (Agree completely). We follow Specht, Egloff and Schmukle (2013) and the SOEP scales manual Richter et al. (2013) in the choice of items for the combined LoC index. Note that item 1 is recoded in the construction, such that higher values correspond to more external beliefs. Note also that the given procedure implies attaching equal weights to every item as in Cobb-Clark and Schurer (2013). As in Pinger, Schäfer and Schumacher (2018), we additionally construct two separate indices for the items corresponding to internal and external control beliefs respectively. The items are weighted according to a principal component analysis. For the regression analyses we use standardized versions of all indices with a mean of zero and standard deviation of one. The non-standardized figures here are for illustrative purposes.

Table A3: Covariate Balance

	Mean Treatment (S.D.)	**Mean Control (S.D.)**	**P-Value**
Female=1	0.54	0.53	0.906
Age	48.27	46.63	0.170
Lower secondary=1	0.15	0.14	0.915
Upper secondary=1	0.63	0.64	0.743
College=1	0.23	0.22	0.772
Mother has Abitur=1	0.08	0.11	0.126
Father has Abitur=1	0.14	0.17	0.319
Income (net/month)	2075.35	2203.91	0.076
Married=1	0.53	0.54	0.633
No. of HH Members	2.35	2.44	0.218
Self employed=1	0.05	0.04	0.557
Unemployed=1	0.13	0.10	0.142
Retired=1	0.29	0.26	0.199
East Germany=1	0.19	0.17	0.303
Citizenship=1 (Non-German)	0.04	0.06	0.265
Satisfaction with Health	6.79	6.62	0.273
Home owner=1	0.49	0.48	0.736
General Risk Attitude	4.98	4.89	0.583
$Prob > F$			0.43

Note: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Note: Each row presents the means of *covariate* in the two groups along with the p-values from separate OLS regressions of the form $Treated = \beta_0 + \beta_1 * Covariate + \epsilon_i$. $Prob > F$ is the p-value from an F-test for joint significance of all covariates. Education is measured in 7 categories according to the International Standard Classification of Education (ISCED), where *Lower secondary* corresponds to the first two categories, *Upper secondary* to categories 3,4, and 5, and *College* to the highest category (6). *Mother (Father) has Abitur* indicates a parent with qualification for university admission (Abitur is the final exam at the end of high school). *Income* is the equivalence scale determined by the square root scale (i.e., we divide the monthly household net income by the square root of the number of household members). *East Germany* is an indicator for respondents who have lived in East Germany before 1990. *Citizenship* indicates non-German citizenship status. *Satisfaction with health* is measured one a scale from 0 (completely dissatisfied) to 10 (completely satisfied). *General Risk* is a qualitative risk measure on a scale from 0 (not at all willing to take risks) to 10 (very willing to take risks). *Home owner* identifies respondents who own their house or apartment. *Female, Married, Self employed, Unemployed, and Retired* are indicator variables.

Table A4: Personality Traits – Balance

	Mean Treatment	**Mean Control**	**P-Value**
Optimism	0.05	-0.01	0.343
Relative Optimism	-0.01	0.01	0.776
Locus of Control	3.17	3.10	0.278
Openness	0.01	-0.00	0.829
Conscientiousness	-0.01	-0.02	0.892
Extraversion	0.03	0.01	0.736
Agreeableness	-0.00	-0.02	0.820
Neuroticism	0.00	0.02	0.764
$Prob > F$			0.820

Note: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.
Each row presents the means of *covariate* in the two groups along with the p-values from separate OLS regressions of the form $Treated = \beta_0 + \beta_1 * Covariate + \epsilon_i$. $Prob > F$ is the p-value from an F-test for joint significance of all covariates. *Optimism* indicates how respondents think about their future (*"If you think about the future: Are you... (1) optimistic; (2) rather optimistic than pessimistic; (3) rather pessimistic than optimistic; (4) pessimistic?"*). We re-coded the variable, such that higher values imply increased optimism. *Relative optimism* is the unweighted average of four questions for which respondents had to indicate on a scale from 1 ("Very much less likely") to 7 ("Very much more likely") how they judged the likelihood to: (1) be financially successful; (2) become seriously ill; (3) be successful in their job; (4) be happy in general, relative to peers of the same age and sex. *Locus of Control* is an equally weighted index of the LoC questions with higher values corresponding to more external beliefs. The Big5 consist of *Openness, Conscientiousness, Extraversion, Agreeableness, and Neuroticism*, which are standardized to mean zero and standard deviation of 1.

Table A5: Correlates of CRRA and LoC

	CRRA Parameter		Locus of Control	
	(1)	(2)	(3)	(4)
Female	1.185***	0.900**	0.080	0.019
	(0.415)	(0.429)	(0.078)	(0.078)
Age	0.005	-0.008	0.002	0.002
	(0.011)	(0.019)	(0.002)	(0.003)
Education	-0.399***	-0.363**	-0.073***	-0.054*
	(0.140)	(0.163)	(0.026)	(0.030)
Mother has Abitur	-0.944	0.370	-0.046	0.160
	(0.765)	(0.894)	(0.145)	(0.163)
Father has Abitur	-1.040*	-0.743	-0.150	-0.018
	(0.596)	(0.671)	(0.111)	(0.121)
Income (net/month) x 100	-0.033*	0.003	-0.018***	-0.011**
	(0.020)	(0.024)	(0.004)	(0.004)
Married	0.914**	1.099**	0.008	0.098
	(0.416)	(0.508)	(0.078)	(0.093)
No. of HH Members	0.261	0.161	0.013	0.014
	(0.184)	(0.234)	(0.034)	(0.043)
Self employed	-0.733	0.332	-0.075	0.129
	(0.969)	(1.013)	(0.178)	(0.182)
Unemployed	1.389**	1.160	0.400***	0.229*
	(0.616)	(0.713)	(0.114)	(0.128)
Retired	0.408	0.469	0.009	-0.074
	(0.459)	(0.712)	(0.086)	(0.128)
East Germany	0.736	0.836	0.111	0.028
	(0.535)	(0.545)	(0.099)	(0.098)
Citizenship (Non-German)	-0.682	-0.707	0.176	0.134
	(1.058)	(1.053)	(0.195)	(0.190)
Satisfaction with Health	-0.157*	-0.088	-0.069***	-0.048**
	(0.095)	(0.104)	(0.018)	(0.019)
Home owner	-0.112	-0.223	-0.122	-0.022
	(0.418)	(0.464)	(0.078)	(0.084)
General Risk Attitude	-0.239***	-0.212**	-0.029*	-0.029*
	(0.093)	(0.092)	(0.017)	(0.016)
Observations		447		444

Notes: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Dependent variables are the CRRA parameter ρ (with higher values indicating less tolerance for risk) in columns 1-2, and Locus of Control (with higher values indicating higher control beliefs – external LoC) in columns 3-4. Data from control group only, interval regressions with standard errors in parentheses in columns 1-2 and OLS regressions in columns 3-4. Odd-numbered columns display coefficients from separate regressions for each covariate, while even-numbered columns report a multivariate regression including all covariates at once. Education is measured in 7 categories according to the International Standard Classification of Education (ISCED), with higher categories representing a higher level of education. *Mother (Father) has Abitur* indicates a parent with qualification for university admission (Abitur is the final exam at the end of high school). *Income* is the equivalence scale determined by the square root scale (i.e., we divide the monthly household net income by the square root of the number of household members). *East Germany* is an indicator for respondents who have lived in East Germany before 1990. *Citizenship* indicates non-German citizenship status. *Satisfaction with health* is measured one a scale from 0 (completely dissatisfied) to 10 (completely satisfied). *General Risk* is a qualitative risk measure on a scale from 0 (not at all willing to take risks) to 10 (very willing to take risks). *Home owner* identifies respondents who own their house or apartment. *Female, Married, Self employed, Unemployed, and Retired* are indicator variables.

Table A6: ATE – Controlling for General Attitudes towards Risk

	CRRA Parameter		
	(1)	(2)	(3)
Treated	-0.523*	-0.533*	-0.534*
	(0.279)	(0.289)	(0.285)
General Risk (Baseline)		-0.347**	-0.275*
		(0.145)	(0.145)
Covariates	Yes	No	Yes
Observations	914	893	893
Log-Likelihood	-2057.27	-2026.44	-2006.72

Note: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Interval regressions with standard errors in parentheses where the dependent variable is the CRRA parameter ρ (with lower values indicating higher tolerance for risk). *General Risk (Baseline)* coded as z-score of answers to the general risk question in the SOEP, with higher values indicating less risk-aversion. Covariates include: age, gender, education, parents education, net income, marital status, household size, employment status (self-employed, unemployed, retired), citizenship, homeownership, satisfaction with health, and region (East/West Germany).

Table A7: Non-participation in the survey module

Panel a.)
Non-participation in treatment and control

	Treatment	Control Mean	N
Non-participation	0.030	0.165	1,115
	(0.023)	(0.016)	

Panel b.)
Baseline difference in risk between participation and non-participation

	Non-participation	Participation	N
General Risk (Baseline)	0.062	-0.011	1,092
	(0.078)	(0.033)	

Panel c.)
Baseline difference in risk of non-participators in treatment and control

	Treatment	Control	N
General Risk (Baseline)	0.006	0.048	199
	(0.140)	(0.103)	

Note: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.
OLS regressions with standard errors in parentheses. Panel a) reports the difference in the likelihood of non-participation in treatment versus control, from regressing an indicator for non-participation on a treatment indicator. Panel b) reports the baseline difference in general risk attitudes between participating and non-participating respondents, from regressing baseline general risk on an indicator of non-participation. Panel c) displays the baseline difference in in general risk attitudes of non-participating respondents in treatment and control group, from regressing baseline risk on a treatment indicator using non-participating respondents only. *General Risk (Baseline)* coded as z-score of answers to the general risk question in the SOEP-IS, with higher values indicating less risk-aversion.

Table A8: Results for Inverse Probability Re-Weighting

	CRRA Parameter				
	(1)	(2)	(3)	(4)	(5)
Treated	-0.550*	-0.561*	-0.523*	-0.548*	-0.512*
	(0.293)	(0.288)	(0.286)	(0.289)	(0.287)
Treated x LoC	-0.900***	-0.909***	-0.874***	-0.899***	-0.867***
	(0.309)	(0.309)	(0.307)	(0.308)	(0.306)
LoC	0.591**	0.410*	0.297	0.405*	0.301
	(0.233)	(0.237)	(0.243)	(0.239)	(0.243)
Covariates	No	Yes	Yes	Yes	Yes
Big5	No	No	Yes	No	Yes
Optimism	No	No	No	Yes	Yes
Observations	899	899	892	898	891
Log-Likelihood	-2409.25	-2389.98	-2366.85	-2388.27	-2365.05

Note: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Interval regressions with standard errors in parentheses. Observations weighted by the inverse of the probability that they are part of our study sample. The propensity scores stem from a probit regression of an indicator for respondents in the study sample on the following covariates: age, net income, education, household size, satisfaction with health, and indicators for gender, marital status, employment status (self-employed, retired, unemployed), region (East/West Germany), citizenship, homeownership, qualification for university (Abitur) of mother and father, and LoC beliefs.

Table A9: Heterogeneous Effects - LoC & Other Personality Traits

	CRRA Parameter				
	(1)	(2)	(3)	(4)	(5)
Treated	-0.484*	-0.488*	-0.451	-0.473*	-0.439
	(0.284)	(0.280)	(0.279)	(0.280)	(0.278)
Treated x LoC	-0.914***	-0.940***	-0.903***	-0.929***	-0.895***
	(0.293)	(0.287)	(0.287)	(0.287)	(0.287)
LoC	0.590***	0.397*	0.290	0.391*	0.292
	(0.215)	(0.215)	(0.222)	(0.218)	(0.223)
Covariates	No	Yes	Yes	Yes	Yes
Big5	No	No	Yes	No	Yes
Optimism	No	No	No	Yes	Yes
Observations	899	899	892	898	891
Log-Likelihood	-2040.20	-2021.02	-2002.28	-2019.30	-2000.47

Note: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.
Interval regressions with standard errors in parentheses. Dependent variables is the CRRA parameter ρ (with lower values indicating higher tolerance for risk). *LoC* is the z-score of a single index for locus of control, constructed as detailed in Table A2. Higher values correspond to more external beliefs. Covariates include: age, gender, education, parents education, net income, marital status, household size, employment status (self-employed, unemployed, retired), citizenship, homeownership, satisfaction with health, and region (East/West Germany).

Table A10: Heterogeneous Effects - Other Personality Traits

	Dependent: CRRA Parameter							
	(1) Neuroticism	(2) Agreeableness	(3) Extraversion	(4) Openness	(5) Conscientiousness	(6) Optimism	(7) Rel. Optimism	(8) Optimism Index
Treated	-0.510*	-0.523*	-0.503*	-0.527*	-0.485*	-0.492*	-0.298	-0.279
	(0.281)	(0.283)	(0.283)	(0.283)	(0.282)	(0.282)	(0.302)	(0.302)
Interaction Effect	0.005	-0.095	0.051	0.275	0.110	-0.366	0.326	-0.017
	(0.278)	(0.281)	(0.287)	(0.287)	(0.281)	(0.288)	(0.303)	(0.301)
Level Effect	0.469**	0.273	-0.015	-0.217	0.077	0.152	-0.166	0.027
	(0.199)	(0.197)	(0.210)	(0.292)	(0.282)	(0.203)	(0.209)	(0.209)
N	914	914	913	910	912	913	779	778

Note: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Interval regressions with standard errors in parentheses. Dependent variables is the CRRA parameter ρ (with lower values indicating higher tolerance for risk). "Interaction effect" is the interaction between Treated and the corresponding personality trait indicated on top of a column, while "level effect" corresponds to the association between personality trait and dependent variable. All personality traits are standardized to have a mean of zero and standard deviation of one. Columns 1-5 show the *Big5* traits and columns 6-8 indicate *Optimism* measures. *Optimism* indicates how respondents think about their future (*"If you think about the future: Are you... (1) optimistic; (2) rather optimistic than pessimistic; (3) rather pessimistic than optimistic; (4) pessimistic?"*). We re-coded the variable, such that higher values imply increased optimism. *Relative optimism* is the unweighted average of four questions for which respondents had to indicate on a scale from 1 ("Very much less likely") to 7 ("Very much more likely") how they judged the likelihood to: (1) be financially successful; (2) become seriously ill; (3) be successful in their job; (4) be happy in general, relative to peers of the same age and sex. *Optimism Index* combines both standardized optimism indicators into a single standardized index, attaching equal weights to both.

Table A11: Heterogeneous Effects – Socio-economic characteristics

	CRRA Parameter			
	(1)	(2)	(3)	(4)
Treated	-0.297	-0.392	-3.670	-1.036
	(0.411)	(0.300)	(4.518)	(0.787)
Female	1.257***			
	(0.407)			
Treated x Female	-0.542			
	(0.580)			
Unemployed		1.717**		
		(0.826)		
Treated x Unemployment		-1.389		
		(1.263)		
ln(Income)			-0.899**	
			(0.409)	
Treated x ln(income)			0.427	
			(0.597)	
Education				-0.434***
				(0.138)
Treated x Education				0.146
				(0.198)
Observations	864	864	864	864
Log-Likelihood	-1958.90	-1962.91	-1962.14	-1958.14

Note: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Interval regressions with standard errors in parentheses. Dependent variables is the CRRA parameter ρ (with lower values indicating higher tolerance for risk). Female and unemployment are indicators for gender and employment status. Income is the equivalence scale determined by the square root scale (i.e., we divide the monthly household net income by the square root of the number of household members). Education is measured in 7 categories according to the International Standard Classification of Education (ISCED), with higher categories representing a higher level of education.

Table A12: Results with Lottery Choice as Outcome

	Lottery Choice (Categorical)				
	(1)	(2)	(3)	(4)	(5)
Treated	0.128	0.135	0.126	0.131	0.123
	(0.106)	(0.105)	(0.106)	(0.106)	(0.106)
Treated x LoC	0.242**	0.251**	0.236**	0.248**	0.233**
	(0.111)	(0.110)	(0.111)	(0.110)	(0.111)
LoC	-0.199**	-0.131	-0.109	-0.128	-0.108
	(0.082)	(0.084)	(0.087)	(0.084)	(0.087)
Covariates	No	Yes	Yes	Yes	Yes
Big 5	No	No	Yes	No	Yes
Optimism	No	No	No	Yes	Yes
Observations	899	899	892	898	891
R^2	0.01	0.05	0.06	0.05	0.06

Note: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.
Dependent variable: categorical lottery choice. Higher values imply a lottery with higher implicit risk. Estimated using OLS, robust standard errors in parentheses. *LoC* is the z-score of a single index for locus of control, constructed as detailed in Table A2. Higher values correspond to more external beliefs. Covariates include: age, gender, education, parents education, net income, marital status, household size, employment status (self-employed, unemployed, retired), citizenship, homeownership, satisfaction with health, and region (East/West Germany).

Table A13: Heterogeneous Effects – Separate Internal and External LoC Scale

	CRRA Parameter				
	(1)	(2)	(3)	(4)	(5)
Treated	-0.508*	-0.517*	-0.468*	-0.502*	-0.456*
	(0.281)	(0.278)	(0.276)	(0.278)	(0.276)
Treated x External Scale	-0.831***	-0.847***	-0.823***	-0.834***	-0.813***
	(0.292)	(0.287)	(0.287)	(0.287)	(0.287)
External Scale	0.530**	0.327	0.186	0.315	0.183
	(0.212)	(0.212)	(0.222)	(0.213)	(0.223)
Treated x Internal Scale	0.103	0.089	0.121	0.082	0.112
	(0.285)	(0.282)	(0.281)	(0.282)	(0.280)
Internal Scale	0.179	0.105	0.071	0.113	0.075
	(0.201)	(0.203)	(0.204)	(0.203)	(0.204)
Covariates	No	Yes	Yes	Yes	Yes
Big5	No	No	Yes	No	Yes
Optimism	No	No	No	Yes	Yes
Observations	908	908	901	907	900
Log-Likelihood	-2060.59	-2042.24	-2023.49	-2040.60	-2021.81

Note: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Interval regressions with standard errors in parentheses. Dependent variables is the CRRA parameter ρ (with lower values indicating higher tolerance for risk). External and internal scale constructed as in Table A2. Both are standardized z-scores. Covariates include: age, gender, education, parents education, net income, marital status, household size, employment status (self-employed, unemployed, retired), citizenship, homeownership, satisfaction with health, and region (East/West Germany).

A.3 Survey Module

Our survey module consists of three parts: questions on personality traits, the treatment manipulation, and a lottery task to measure risk preferences. In what follows, we list the English wording of each question (translated from German).

Optimism. We measure optimism with two questions: a general question about optimism regarding the future taken from the SOEP, and a question about the likelihood of experiencing an event relative to an average person:

1. *When you think about the future: are you... [Scale: (i) ...optimistic, (ii) ...rather optimistic than pessimistic, (iii) ...rather pessimistic than optimistic, (iv) ...pessimistic?]*
2. *Compared to other people of the same age and gender as you: how likely is it that throughout your life you will...*
   - *...be financially successful?*
   - *...not suffer from a serious illness?*
   - *...be successful in your job?*
   - *...be satisfied overall?*

   For each component subjects could answer on a scale from 1 to 7, where 1 implies very much less likely, 4 implies as likely as the average person, and 7 implies very much more likely.

Locus of Control. We implemented the same ten items that are routinely used in the SOEP (Nolte et al., 1997). respondents answered on a Likert-scale ranging from 1 (disagree completely) to 7 (agree completely):

The following statements capture different attitudes towards life and the future. To which degree do you personally agree with the statements?

(i) *The course of my life is depending on me.*

(ii) *In comparison to others, I have not achieved what I deserve.*

(iii) *What you achieve in life, is first of all a question of fate or luck.*

(iv) *I often experience that others are deciding about my life.*

(v) *You have to work hard to be successful.*

(vi) *When I face difficulties in life, I often doubt my abilities.*

(vii) *Which opportunities I have in life is determined by social conditions.*

(viii) *More important than all effort, are the abilities you have.*

(ix) *I have little control over the things happening in my life.*

(x) *Social or political involvement can influence social conditions.*

Treatment Manipulation. Our treatment manipulation is embedded in a question about respondent's wealth. Specifically, we ask respondents to indicate their net wealth using five predefined wealth categories. To manipulate respondents' perception of the spread of wealth, we randomly vary the available categories. That is, we assign half of the respondents to categories with relatively wide intervals (treatment group), while the other half of respondents is assigned to much smaller intervals (control group):

Now I would like to talk with you about wealth. One can divide households in Germany into five categories of wealth. Wealth in this context refers to net wealth. That is, it is equivalent to the total household wealth including for instance cash, savings accounts, stocks or real estate, and subtracts debts, such as credit loans, mortgages, or credit card debt. Please indicate to which category your household belongs:

(i) *Up to 2,500€ (**Treatment Group**: Up to 275,000€)*

(ii) *2,501 to 11,000€ (275,001 to 468,000€)*

(iii) *11,001 to 27,000€ (468,001 to 722,000€)*

(iv) *27,001 to 112,000€ (722,001 to 989,000€)*

(v) *More than 112,001€ (More than 989,001€)*

Risk Elicitation. In the risk elicitation part respondents faced two questions. The first question asked them to indicate whether they would like to participate in a lottery game, whereas the second contained the actual lottery choice:

Now let us turn to a special task with which we try to understand how people make financial decisions. We will present you with six lotteries. We ask you to choose one of the six lotteries. At the end of

*this block of questions every 10th respondent will be randomly chosen to actually receive the winnings from their chosen lottery. The actual payment will be made at the end of the complete questionnaire. [Answers: (1) start the lottery game, (2) I do not want to participate because...*open].*

I will now show you six different lotteries on the screen. Each lottery consists of two pay-offs, each of which can be drawn with equal probability. The lotteries differ in the sense that for each lottery you have an equal chance of winning different amounts of money. At the end of this module we will determine whether your choice will actually be paid out to you. Which lottery do you choose?

(i) *Lottery 1: 50% 50€ / 50% 50€*

(ii) *Lottery 2: 50% 45€ / 50% 95€*

(iii) *Lottery 3: 50% 40€ / 50% 120€*

(iv) *Lottery 4: 50% 30€ / 50% 150€*

(v) *Lottery 5: 50% 10€ / 50% 190€*

(vi) *Lottery 6: 50% 0€ / 50% 200€*

Top-10% income threshold. *From which annual pre-tax household income do you think you belong to the richest 10 percent of households in Germany?*