# Perceived Relative Wealth and Risk Taking*

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**Abstract**

We show that perceptions of relative rank in the wealth distribution shape individuals' willingness to take risks. Using a representative large-scale survey, we manipulate perceptions of relative standing by randomly varying response categories when asking respondents about their wealth level. Respondents who are induced to perceive their relative position as low display more tolerance towards risk in a subsequent incentivized lottery task. This effect is mainly driven by individuals who more firmly believe that life outcomes are beyond their control. This interaction between risk preferences and underlying beliefs spotlights the benefits of incorporating personality traits into economic analysis.

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# 1 Introduction

Relative consumption and wealth are important components of well-being. A voluminous literature, dating back at least to Veblen (1899) and Duesenberry (1949), has accumulated evidence that people care not only about absolute outcomes but also about their relative position. This relativistic nature of utility potentially has far-reaching implications for asset pricing, savings behavior, economic growth, taxation, income inequality, and well-being.[1] We take a step back to investigate the implications of relative position and social status on the more fundamental notion of preferences. Focusing on choices under uncertainty, we present empirical evidence that people's perceptions of their relative position in the wealth distribution shape their willingness to take risk.

Intuitively, individuals' concern about their status in the wealth distribution should motivate risk taking, as positive outcomes not only lead to absolute gains but also gains in relation to others. The relative attractiveness of choices that entail different degrees of risk may therefore depend on the importance of relative improvements for a decision maker and their initial position. A series of theoretical papers model such interdependences between relative concerns and risk-taking by explicitly incorporating concerns for status and rank into the utility function (Robson, 1996; Becker, Murphy and Werning, 2005; Ray and Robson, 2012; Kuziemko et al., 2014).[2] The first contribution of our study is to provide empirical evidence on the social foundation of risk preferences by documenting a causal link from perceived relative wealth rank to risk taking, as suggested by these theories of social status.

The second contribution we make is to delve deeper into this proposed relationship, and to identify the type of individuals who are particularly likely to respond to a perceived relative disadvantage with increased risk taking. We focus here on individual-specific beliefs about the source of relative standing, i.e., the question to what extent one's own efforts rather than external forces are responsible for one's position in society. To measure this aspect, we borrow from personality psychology and focus on an individual's locus of control (Rotter, 1966), a personality trait that forms early in life and has a large degree of short- and medium-term stability (Cobb-Clark and Schurer, 2013).The concept of locus of control expresses the general disposition of an individual

[1] See for example, Frank (1985); Abel (1990); Gali (1994); Carroll, Overland and Weil (2000); Ljungqvist and Uhlig (2000); Hopkins and Kornienko (2004); Luttmer (2005); Perez-Truglia (2020).

[2] In an early 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) illustrates how relative comparisons can rationalize Friedman and Savage's argument.

to perceive life outcomes as within one's control, or alternatively, as predominantly the result of luck or fate. As many other non-cognitive skills, locus of control is strongly associated with a range of important life outcomes. For example, people who do not believe they have control over life outcomes – i.e., those with an *external* locus of control – tend to report lower subjective health and life satisfaction, have less educational attainment, and worse labor market outcomes (Coleman and DeLeire, 2003; Heckman, Stixrud and Urzua, 2006; Barón and Cobb-Clark, 2010; Heckman and Kautz, 2012; Becker et al., 2012; Cobb-Clark, 2015; Caliendo, Cobb-Clark and Uhlendorff, 2015). We argue that an individual's locus of control also shapes their response to social position as this belief system is related to economic mobility. Clearly, the appeal of riskier occupations, gambling, and other strategies for moving up the social ladder is partially determined by the perceived availability of alternatives, such as investment in education. An external belief system, however, may render these latter options, which rely more on one's own efforts and abilities, less attractive. In the spirit of Borghans et al. (2008), a person's locus of control could thus act as a (perceived) constraint on the set of strategies available to improve relative standing in the wealth distribution.

To address the question of how relative standing influences risk taking, we implemented our study in the Innovation Sample of the Socio-Economic Panel (SOEP-IS), a representative longitudinal study of the German population that contains rich background information of respondents. We designed a tailor-made survey module, including a pre-treatment locus of control measurement and an incentivized measurement of risk. We measure risk taking through an easy-to-understand lottery choice task that is well suited for the elicitation of risk preferences in general population samples and that allows us to parameterize an individual's utility function.

Estimating the impact of relative wealth rank on risk taking is complicated by concerns about reverse causality. Varying levels of risk-aversion are likely to result in fundamentally different wealth accumulation outcomes. Our strategy to address this identification challenge relies on the manipulation of perceived relative wealth.[3] Specifically, we ask respondents about their net wealth and randomly vary the response categories of the question. Half of the respondents see response categories with wide intervals, e.g., the lowest category ranges up to 275,000 euros (treatment condition). The other half of respondents receive response categories with small intervals. That is, the lowest category is less than 2,500 euros and the highest category starts at 112,000 euros (control

[3] Evidence, for example for the US, suggests that individuals have limited knowledge about the wealth distribution and systematically underestimate wealth inequality (Norton and Ariely, 2011). Similarly, people tend to 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, 2021), which has implications on public policy preferences such as redistribution (see also Gimpelson and Treisman, 2018, for correlational evidence).

condition).[4]

The randomization ensures that the objective income and wealth distribution are the same across treatment and control, while it creates, at the same time, exogenous variation in respondents' perceptions about their relative wealth. In the treatment condition, the overwhelming majority of respondents should place themselves into the lowest category, as this category encompasses the bottom 80 percent of the German net wealth distribution. By contrast, the narrow response intervals and the low threshold of the highest category (corresponding to the 60th percentile of the net wealth distribution) should prompt the majority of respondents in the control condition to locate themselves in the middle and top categories. For example, two respondents who have the same objective wealth levels (e.g. in the 60th percentile) can end up in the lowest or highest category depending on their treatment status. Thus, in the treatment condition respondents should perceive their relative rank as low and engage in upward comparisons, while the reverse is true in the control condition. We can use this variation in perceptions to estimate the causal effect of perceived relative wealth on risk preferences.

We examine the intended consequences of our intervention along two margins. First, as expected we observe that the overwhelming majority of treated respondents categorize themselves into the lowest category, while in the control condition a majority of control group respondents sort themselves into the three highest categories. Second, varying the response categories has a strong effect on respondents' perceptions about relative income. When asked about the pre-tax household income that is necessary to be part of the top 10%, treated respondents believed that this income is 21 percent higher than the estimates of respondents in the control group. Taken together, our intervention generated a strong "first-stage" shifting perceptions about relative standing.

We present three main findings. First, we find that our intervention translates into a sizable treatment effect. That is, treated respondents who are induced to perceive their relative wealth as low are more likely to take risks than respondents in the control group. The estimated constant relative risk aversion (CRRA) parameter $\rho$ is about 0.5 lower, implying less risk aversion. This finding resonates with theoretical models that incorporate status concerns. For example, Hopkins (2018) models this concern as a competition for societal rewards. 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

[4] 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).

option for rising in the wealth hierarchy. Note that while the potential gains in our context are not sufficient to generate large jumps along the wealth distribution, the results can be rationalized if we consider relative wealth as informative of more short-term relative consumption budgets.[5]

Second, we demonstrate that belief heterogeneity affects the relationship between relative wealth rank and risk taking. Respondents who believe they have control over their life, i.e., those displaying an internal locus of control, are not affected by our treatment. On the other hand, as predicted respondents who believe that life outcomes are a matter of luck and fate (external locus of control), increase their risk tolerance substantially. The effect is sizable, with a one standard deviation increase in external control beliefs shifting the estimated risk parameter $\rho$ by an additional 0.9 towards less risk aversion. The observed heterogeneity is in line with the idea that an extrinsic belief system constrains 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. Importantly, we can rule out that other relevant factors interact with our treatment. We find no evidence that other personality traits, such as the Big 5, self-control, 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 perceivd relative wealth rank, we provide complementary evidence that inequality is related to risk taking and that this relationship is significantly moderated by beliefs about personal agency as well. Using data from the Global Preference Survey (Falk et al., 2018) and focusing on income inequality, we first show that income inequality is negatively associated with a validated risk measure at the national level across 76 countries that collectively represent 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. Consistent with our experimental results, we observe that people who believe in predetermined outcomes are more strongly affected by income inequality and become more risk tolerant.

[5] In fact, Fudenberg and Levine (2006) use the separation of short-term consumption budgets from background wealth as part of a solution to the paradox outlined by Rabin (2000), according to which risk taking in laboratory contexts is only rationalizable with absurdly large levels of risk aversion.

**Contribution to the literature.** The presented findings tie into several strands of the literatures. First, they relate to a nascent literature that studies the foundations of risk preferences. Most of these studies focus on the lasting effects of aperiodic personal experiences such as natural disasters (e.g., Eckel, El-Gamal and Wilson, 2009; Cameron and Shah, 2015; Hanaoka, Shigeoka and Watanabe, 2018), macroeconomic crises (e.g., Malmendier and Nagel, 2011; Giuliano and Spilimbergo, 2014; Cohn et al., 2015) or violence (e.g., Voors et al., 2012; Callen et al., 2014; Jakiela and Ozier, 2019; Brown et al., 2019). A few other studies investigate short-term fluctuations in attitudes towards risk that are triggered by reoccurring economic and psychological phenomena such as emotions (Meier, 2021) or day-to-day income fluctuations (Akesaka et al., 2021).[6] Our study places in between these two lines of research. We complement the literature on violence, crisis and disaster by explicitly focusing on the impact of a more common and natural experience, namely the relative standing of individuals in the economic hierarchy of society. Relative standing as such is stable at least in the short-term and its impact on choices is thus more permanent than, for example, the impact of emotional states.

Second, our paper contributes to a burgeoning literature on perceptions that documents often large discrepancies between factual reality and individual views on economic issues, inequality, and on various societal topics, such as discrimination, immigration, and social norms more generally (e.g., Jensen, 2010; Norton and Ariely, 2011; Cruces, Perez-Truglia and Tetaz, 2013; Karadja, Mollerstrom and Seim, 2017; Alesina, Miano and Stantcheva, 2018; Grigorieff, Roth and Ubfal, 2020; Bursztyn, González and Yanagizawa-Drott, 2020; Haaland and Roth, 2021; Hvidberg, Kreiner and Stantcheva, 2021). Most of this literature shows that misperceptions are related to or affect policy preferences and behavior. Our evidence on the social foundation of risk preferences further highlights the integral role that perceptions play in determining economic decision-making. While it is rare to observe large jumps in the factual wealth hierarchy in the short-run, our evidence shows that changes in perceptions are sufficient to invoke varying levels of risk-aversion. This has also implications for policy makers, as any public discourse shaping the perceived standing of people could fundamentally affect how they react to uncertainty.

The study also relates to a growing literature on aspirations (see La Ferrara 2019, and Genicot and Ray 2020, for reviews). Aspirations are relative in nature, as comparisons to others significantly inform individual desires and goals. In this sense aspirations may encourage risk-taking (Ray and Robson, 2012; Genicot and Ray, 2020). A handful of studies show that social comparison

[6] See Chuang and Schechter (2015) for a recent review of the literature on variation in (risk) preferences over time.

affects decision under uncertainty in the laboratory and 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, Haisley, Mostafa and Loewenstein (2008) show that low-income individuals are more inclined to buy lottery tickets if they are primed to think that their relative income is low, while Kuziemko et al. (2014) demonstrate that randomly assigned ordinal ranks matter for risk taking behavior in a lab setting. Our study moves beyond this literature by addressing a large representative sample and highlighting that similar dynamics can be generated from a *perceived* relative disadvantage in background household wealth. Moreover, our findings emphasize the role of personality in shaping responses to social influences.

The latter issue is tied to recent efforts to incorporate personality traits into economic analysis with greater rigor (Borghans et al., 2008; Almlund et al., 2011; Heckman, Jagelka and Kautz, 2019). While a current debate in this field is the question of whether preferences and personality traits are complements or substitutes in explaining economic behavior (Becker et al., 2012; Jagelka, 2020), we focus on how personality moderates social factors that shape risk preferences. In a related fashion, Pinger, Schäfer and Schumacher (2018) illustrate that subjects displaying higher internal control tendencies process information about their own experimental investment outcomes differently from their counterparts with higher external control tendencies, 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 enables researchers to

include tailor-made survey modules including incentivized decision tasks and experiments (for more detailed information, see Richter and Schupp, 2015). 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 and measures

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 and measures.** The first part of the survey purposefully elicits our personality trait of interest, locus of control (LoC), which we will use to analyze heterogeneous responses to our treatment. LoC expresses 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"* and *"which opportunities I have in life is determined by social conditions"*, using a Likert-scale ranging from 1 (disagree completely) to 7 (agree completely).[7] In addition, 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 specific events, such as a financial gains, career success or illness, relative to an average person (on a 7-point scale). This measure serves as a control, as risk taking is typically associated with a more optimistic outlook.

In accordance with prior studies (Specht, Egloff and Schmukle, 2013; Cobb-Clark and Schurer, 2013), we use the unweighted average of seven of the ten items of our LoC measure as a single index for LoC beliefs. Each item is coded such that higher values correspond to a more external LoC. For the regression analysis, we standardize our index, subtracting its sample mean and dividing by the sample standard deviation. 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 in Section 3.4, our LoC results do not depend on choice regarding how to construct the measure for individual locus of control.

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

**Treatment variation.** The second part contains our treatment manipulation, which is embedded in a question about respondents' 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 1). We constructed the intervals based on the most recent data on the German wealth distribution based on the 2014 wave of the Household Finance and Consumption Survey (HFCS).[8] As the lowest interval in the treatment condition covers 80 percent of the German net wealth distribution, the overwhelming majority of respondents should 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 perception of more equal wealth distribution. Note that the random assignment ensures that the real distribution of wealth is equal in both groups. This allows us to keep absolute wealth levels constant, while exclusively analyzing 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; Bertrand and Mullainathan, 2001). In particular, they may use this information for social comparisons. While such comparisons are likely in both conditions, they are predominantly upward facing for respondents in the treatment condition, as most of them should locate themselves in the lowest category.

**Risk-elicitation task and measure.** 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

[8] 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. The median net wealth in the same year was 60,400 euros, while the average was 214,500 (see HFCS, Deutsche Bundesbank, 2016, for more information).

gamble has an equal chance of yielding a low or 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 A1). The lotteries gradually increase 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 (Dave et al., 2010; Charness, Gneezy and Imas, 2013).[9] We incentivized the task by randomly selecting one in ten respondents and paying them the outcome of their chosen gamble.

Although the task involves only a single choice, it is rich enough to obtain detailed utility information. Following standard practice in the literature, we assume that respondents are expected utility maximizers who exhibit constant relative risk aversion (CRRA) (e.g., Binswanger, 1980; Andersen et al., 2008; Carvalho, Prina and Sydnor, 2016; Carvalho, Meier and Wang, 2016).[10] Under this assumption, we can represent the utility of a monetary amount $x$ as $u(x) = \frac{x^{1-\rho}}{1-\rho}$, where $\rho$ is the coefficient of relative risk aversion, with higher values corresponding to greater risk aversion. Note that with $\rho = 1$ we have the log utility function $u(x) = log(x)$. 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 A1. They range from extreme risk aversion ($\rho > 7.51$) to risk neutral (loving) ($\rho \leq 0$). We use the CRRA parameter intervals to perform a maximum likelihood estimation of the treatment effect on the underlying latent parameter.

### 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. Importantly, missing observations are randomly distributed across conditions (17 percent in the control and 20 percent in the treatment condition, t-test, p=0.20). In Section 3.4, we provide further evidence that there is

[9] A comprehension check after the risk elicitation task revealed that about 89 percent of respondents rated the comprehensibility of the risk-elicitation task as good or very good, and only 2 percent of respondents as insufficient or unintelligible.

[10] 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).

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.

**Covariates.** We consider 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, equivalized net income, marital status, the number of household members, employment status (self-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 (Schröder et al., 2020) and we use this variable as a proxy for wealth because the SOEP-IS includes no detailed wealth module. Education is measured by the highest degree or diploma taking into account general schooling, vocational training, and university education. Accordingly, higher categories represent a higher level of education. We use this scheme instead of years of schooling as it better describes educational attainment in Germany (see Card, 1999).[11] In addition, we include the educational background of both parents by using eligibility for attending university (a completed *Abitur*) as a proxy for their educational attainment.

**Balance.** In Table A3, we present p-values from a set of linear regressions assessing the balance of the observables presented above across the treatment and control groups. The results of these regressions (including an F-test for joint significance of all variables) 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 Table A4, we present the same exercise for LoC and other personality traits. Again, the table indicates that these traits are well balanced across the treatment and control groups.

# 3 Main Experimental Results

## 3.1 First Stage

We start our analysis with a closer look at the answers to the wealth categorization. Table 1 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

[11] Germany separates students after four to six years of schooling into different school tracks. Consequently, the same number of years of schooling does not necessarily mean the same level of educational attainment.

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 if respondents compare their relative situation, social comparisons are predominantly directed up the wealth hierarchy.

To see whether the treatment successfully induced a feeling of a low relative standing and a larger gap to the top, we test whether the variation in 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 estimates about the top-10% income threshold in the pre-tax income distribution of households. Table 2 presents these "first-stage" results and indicates a strong effect: treated respondents believe that the 90th percentile in the household income distribution is 21 percent higher compared to what untreated respondents think. This result is robust to the exclusion of outliers, i.e., the bottom and top 5 percent of the answers.

In summary, exposing respondents to differing wealth intervals in our wealth categorization question 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 how perceived relative rank in the wealth distribution impacts 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 one's own wealth is at the lower end of the wealth distribution and $\mathbf{X}$ includes a constant term and our standard set of socio-demographic variables, 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 A1). We can use them to inform a maximum likelihood estimation of the coefficients of model (1). For example, the choice of lottery 3 is consistent with a latent CRRA parameter on the interval $[0.821, 1.74]$. The likelihood contribution of an individual $i$ choosing

lottery 3 is consequently the probability that their curvature parameter $\rho$ falls within this interval, i.e., $Pr(0.821 \leq CRRA_i^* < 1.74)$. Assuming normally distributed errors with some variance $\sigma_\epsilon^2$ 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, to look at the correlates of risk preferences with socio-demographic variables (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., Barsky et al., 1997; Dohmen et al., 2011; 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 the marriage indicator (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 with an experimentally elicited risk measure and is predictive of risk taking in several domains (Dohmen et al., 2011). Our control group data 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 standard deviation increase in the qualitative risk measure is related to a 0.57 lower curvature parameter $\rho$.

**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 $\rho$ 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 indicator, whereas specification (2) also adjusts for our set of covariates. Unsurprisingly given the random assignment, the estimated effect is in both cases almost identical. In line with the theoretical reasoning above, the treatment effect is negative, indicating a decrease in risk aversion. The estimates point to a reduction in the measured CRRA parameter of roughly 0.52. Compared to the control group mean of 2.86, this amounts to a change of 18 percent.

To put this result into perspective, consider for example Carvalho, Prina and Sydnor (2016), who 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. At the same time, we have to keep in mind that the average CRRA parameter in both the treatment and control groups is well above 2 and thus consistent with risk aversion. While the relative wealth treatment shifts the level considerably, it does so by reducing the aversion to risk and not by leading to risk neutrality or even risk loving behavior.

### 3.3 Moderating the Effect: 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 outlined above, however, we hypothesized 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 respondents' locus of control. As outlined in Section 2.2, we create a single index 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, which confirms previous findings from the SOEP (e.g., Nolte et al., 1997; Weinhardt and Schupp, 2014). Overall, there is a large degree of variation in underlying control beliefs; the index ranges from 1 to 6.6 (see Figure A1).

In Table A5 (columns 3–4) and Figure A2, we present correlates of LoC based on control group data. 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.[12]

Figure 2 reflects this correlation between LoC and risk aversion. The figure shows the effect

[12] 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).

of the relative wealth treatment on the predicted CRRA parameters separated by 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, consistent with the correlations reported above. While the treatment has no sizable impact on risk aversion for respondents with internal beliefs ($p = 0.649$), it substantially reduces 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:

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

Note that regression specification (2) includes a standardized and continuous measure of control beliefs, $LoC_i$. The main coefficient of interest, $\gamma$, can therefore be interpreted as 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 to a difference in the corresponding treatment effect that is almost twice the size of the average treatment effect (Table 3, column 1). Put differently, for an individual with a 0.5 standard deviations higher LOC score than average, the treatment shifts the CRRA parameter downwards by almost 1. In terms of model calibration, this is equal to a difference between $\rho = 2$ and log-utility. Adjusting for basic socio-demographic characteristics has virtually no effect on the coefficient estimate of the interaction term (column 4). Together, this provides 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 is unlikely to bias 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 observables (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. Moreover, 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 (Table A6). Therefore, it is unlikely that the main effects are driven by differential selection with respect to pre-treatment risk attitudes.

Second, in 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 the treatment and control conditions (panel c.).

Third, 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. 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 facets of personality, such as the Big 5, optimism or self-control. For instance, Judge et al. (2002) consider the LoC as part of a higher-level construct that is intermeshed with other traits such as neuroticism. Similarly, evidence suggests that optimism is related to LoC (see Table A5) and risk aversion (Dohmen, Quercia and Willrodt, 2018).

We explore these concerns along two margins. First, we re-estimate regression (2) and additionally adjust for the Big 5 (obtained from a previous wave), our optimism proxy, and a

self-control score (Table A9, columns 3-5).[13] While this reduces the magnitude of the statistical association between LoC and our risk measure, it does not affect the coefficient estimate of interest: the interaction between LoC and the treatment. This is also true if we condition on all other personality traits at the same time (Table A9, column 6). Second, in Table A10 we additionally show that none of the alternative traits are stand-ins for LoC by fitting models that interact our treatment with each component of the Big 5, optimism, and self-control separately. In contrast to LoC, none of the interactions between these other personality traits are statistically distinguishable from zero, which is reassuring evidence that the treatment effect we observe is moderated by LoC and not other personality traits.

**Other Socio-Economic Characteristics.** To explore whether the heterogeneous effects of LoC just pick up heterogeneity in some 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 of risk. This is also true for gender: women are more risk averse than men.[14] 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 (Table A11).

**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. Qualitatively our conclusions do not change. Individuals with external control beliefs remain those who predominantly react to our treatment manipulation.

[13] The optimism proxy we use here is based on the following question that we administered before the LoC questions: *"If you think about the future: Are you... (1) optimistic; (2) rather optimistic than pessimistic; (3) rather pessimistic than optimistic; (4) pessimistic?"*. The conclusions do not change if we instead use a measure for optimism relative to one's peer group. Note that Dohmen, Quercia and Willrodt (2018) use a different optimism measure based on self-reported degrees of optimism and pessimism. The self-control score is based on a 13-item module following Tangney, Baumeister and Boone (2004) that was administered by an independent study on the same sample (Cobb-Clark et al., 2019). We recode each item such that higher values are indicative of a stronger sense of self-control. Subsequently, we standardized their sum, using the sample mean and standard deviation.

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

**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 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 Income Inequality and Risk-Taking

Our analysis has focused on how perceived relative wealth position shapes risk aversion. We now examine whether our findings are more broadly applicable. 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. These findings are based on our analysis of 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 (GPS).** The GPS contains a validated risk measure, elicited in nationally representative samples of 76 countries spanning some 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 the population is, on average, more risk tolerant. We next turn to an individual level analysis that allows us to consider the moderating effect of LoC.

**World Value Survey (WVS).** The WVS collects socio-demographic information, political attitudes, and value judgments from nationally representative samples in repeated cross-sections. Two recent waves contain two questions that are particularly relevant for our purposes. First, the waves

include a measure of risk attitudes developed by Schwartz (1992), which asks respondents to compare themselves to a hypothetical person who finds it important to "experience 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 include 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.[15] Table 4 shows 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 observable socio-demographic variables, survey year fixed effects, and dummies for cultural country clusters.

In summary, these results illustrate that our experimental evidence has broader significance, as it also aggregates up to the societal level. The WVS results indicate that countries with greater income inequality are characterized by more risk taking in the population and that there is substantial heterogeneity in these preferences along personality traits. Our experimental evidence uncovers a potential mechanism behind this relationship. In fact, our evidence suggests that this relationship is shaped by one's frame of reference, i.e., a perceived low standing in the wealth distribution causes a much greater willingness to take risks.

## 5 Discussion and Concluding Remarks

We presented evidence from a representative survey experiment that perceived relative wealth 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

[15] 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.

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 entire wealth distribution, as long as one's *perceived* standing is low.

The nature of risk might vary along 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 an expected value below the price of a ticket – while the latter promises positive returns. Our treatment manipulates perceptions of wealth rank for a large share of respondents. Given that the quality of risk likely varies along the distribution, the welfare implications are not clear cut. As long as the higher propensity to take risk is reflected in efficient ways of gambling, such as occupational choices or entrepreneurial activities, we can presume positive welfare effects.

Our findings relate to a rekindled debate about the central premise of immutable preferences that is implicit in most standard economic models. Some evidence suggests that risk preferences adapt to social influences, experience, and institutions (see Bowles, 1998; Fehr and Hoff, 2011, for a general discussion on endogenous preferences). Using insights from personality psychology, Schildberg-Hörisch (2018) proposes a framework that describes preferences as a distribution with a (potentially time-variant) mean and some variance; this framework manages to reconcile the conflicting empirical evidence on risk preference stability. In this sense the change in perceived relative wealth position may be interpreted as setting off a variation in the measured preferences around the baseline mean. While this approach illustrates the benefits of incorporating concepts from personality psychology into economic analysis, our context facilitates another explanation that incorporates personality but need not invoke unstable tastes. That is, we may model utility as a weighted average of both standard preferences for absolute consumption and a relative component where locus of control moderates the weight on the relative component.[16]

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 outlined in the introduction, the concept of locus of control can be easily and fruitfully incorporated into economic analysis

[16] This is in spirit of Kuziemko et al. (2014), who propose a similar framework using a utility function that is additively separable into absolute wealth and relative rank to illustrate that individuals might be "last-place averse."

as a constraint on the available choice set of individuals. We show that respondents believing in fate and luck react strongly to our treatment and that, accordingly, a pure focus on average treatment effects likely underestimates the relevance of relative comparisons significantly. This finding illustrates not only the potential importance of psychological primitives in explaining preference heterogeneity, but also has more practical implications. Indeed, our finding favors an interpretation in which risk taking could be seen as a strategy to facilitate intragenerational upward mobility. In such a framework, individuals who believe that life outcomes mainly depend on their own decisions, arguably have alternative strategies than risk taking for generating positive returns. These beliefs may be significantly shaped by initial conditions or priors inherited from parents. For example, Gärtner, Mollerstrom and Seim (2018) document that Swedish parents teach their children to believe in effort as a determinant of mobility to a degree that exceeds their own beliefs. 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 the transmission of traits across generations.

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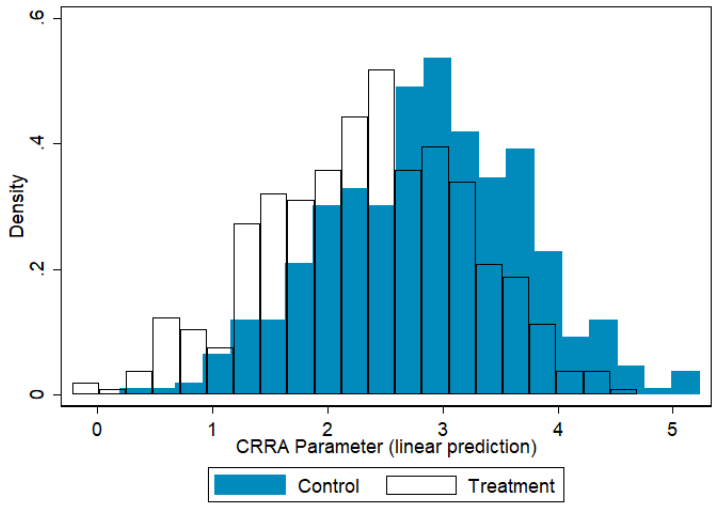
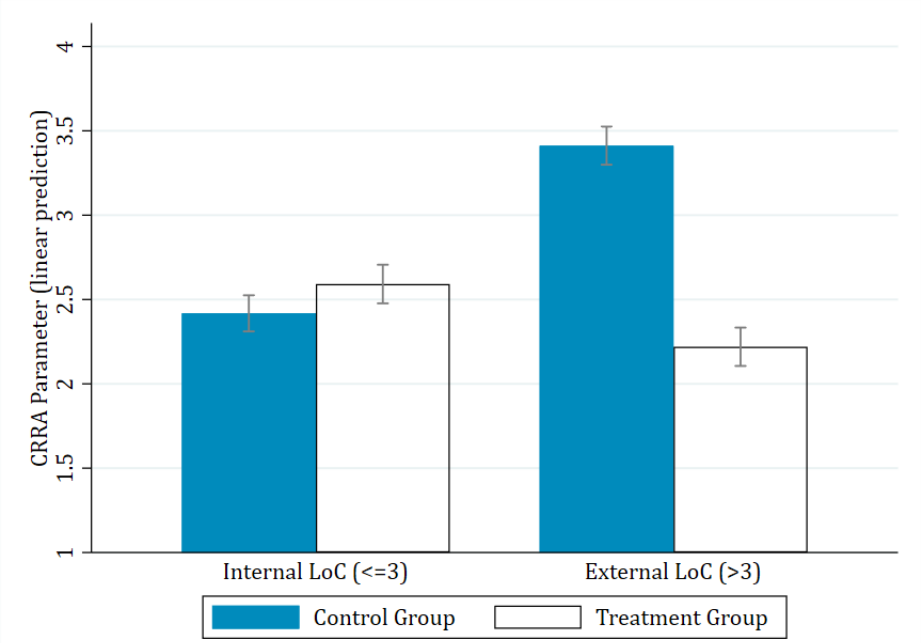
# Figures

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, equivalized net income, marital status, the number of household members, employment status (self-employed, unemployed, retired), citizenship, homeownership, satisfaction with health, and region.

Figure 2: Treatment Effect - Locus of Control Median Split




Notes: Predicted CRRA parameters from interval regression regressing CRRA on the treatment variable and a set of standard covariates: age, gender, education, parents' education, equivalized net income, marital status, the number of household members, employment status (self-employed, unemployed, retired), citizenship, homeownership, satisfaction with health, and region. The sample in treatment and control is splitted by the median of locus of control (3).

# Tables

Table 1: 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 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 |

Notes: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.
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: "In your estimation, what gross annual income is required to be in the top 10 percent of German households?" 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, equivalized 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 |

Notes: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.
Interval regressions with standard errors in parentheses. The dependent variable is the CRRA parameter $\rho$ (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, equivalized 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 |

Notes: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.
OLS regressions. Standard errors, clustered at the country level, in parentheses. Data from the *World Value Survey*. The dependent variable is Schwartz's 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) is 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, education, employment status, 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 states, Latin Europe, post-Soviet countries, Eastern Europe, Nordic/Germanic countries, Latin American, South/East Asia, and Sub-Saharan Africa. The reference category is Anglo-Saxon countries. *Survey Year FE* is an indicator for wave 5 (base is wave 6).

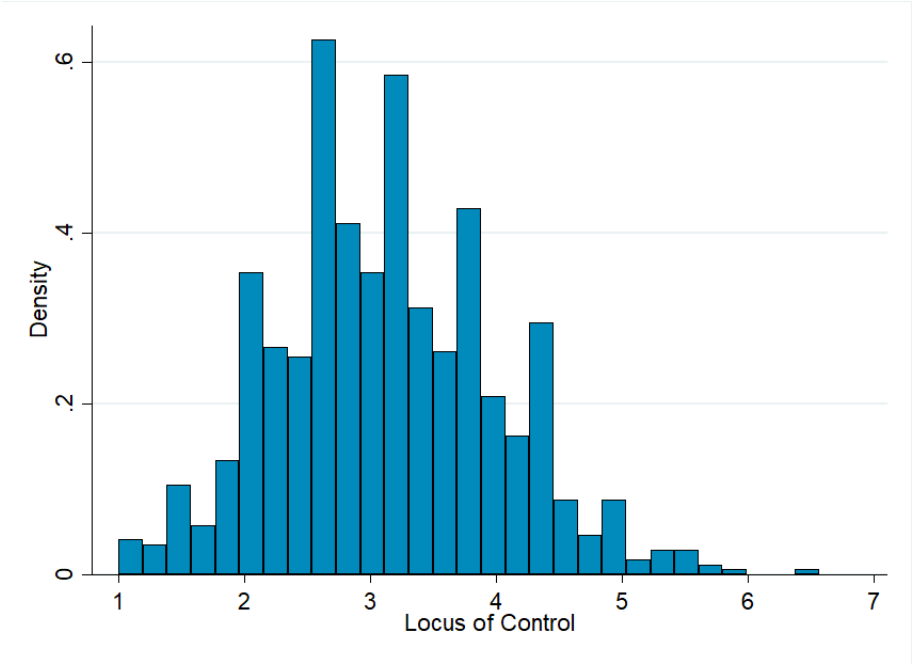
# Appendix – For Online Publication Only

# Perceived Relative Wealth and Risk Taking

Dietmar Fehr and Yannick Reichlin

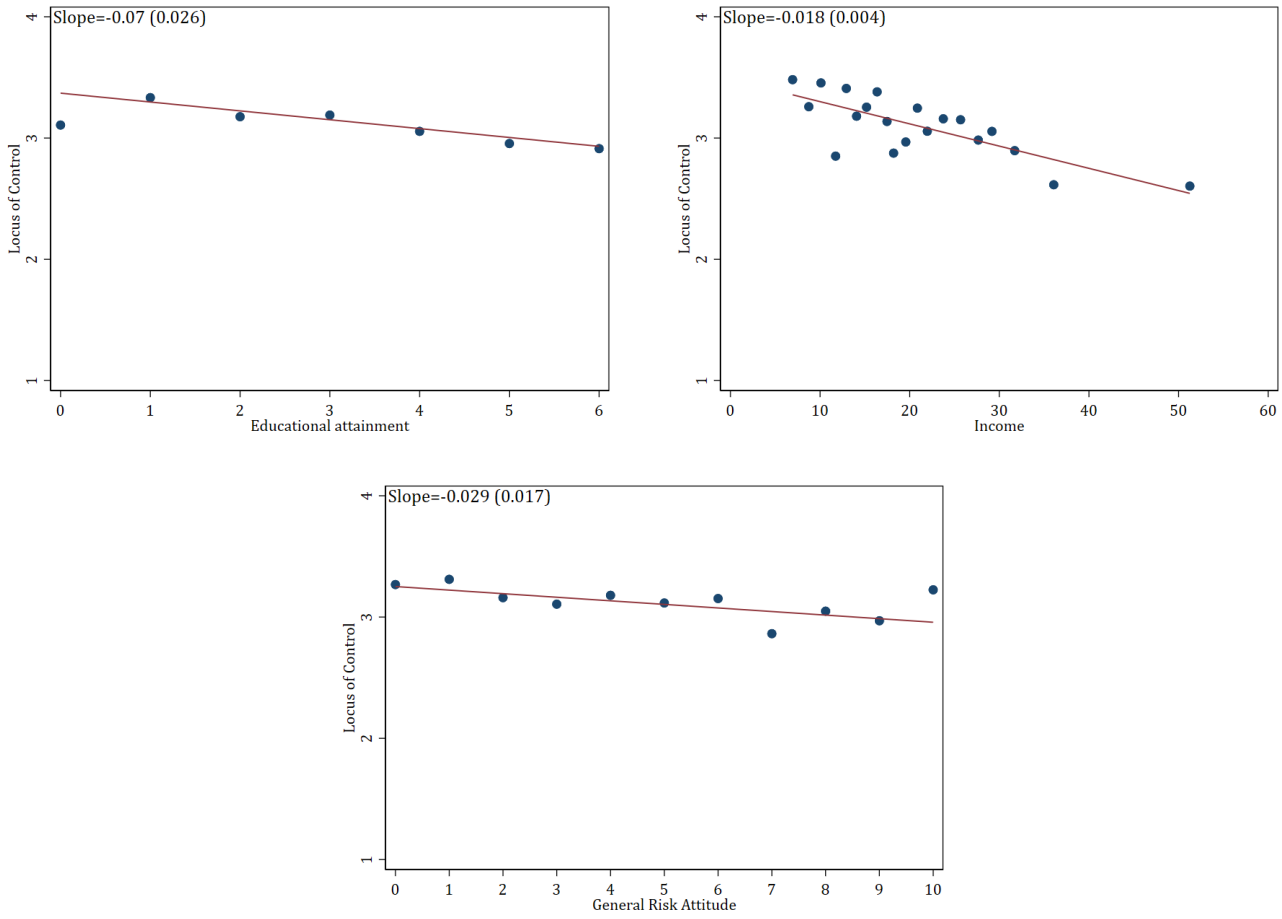
## A.1 Additional Figures

Figure A1: Histogram of Locus of Control




Notes: Distribution of Locus of Control based on the unweighted average of seven Locus of Control items (for more details on the constructed index, see Table A2). Higher values imply more external control beliefs.

Figure A2: Correlates of Locus of Control




Notes: Binscatter plots. *Locus of Control* is the unweighted average of seven Locus of Control items (for more details on the constructed index, see Table A2). Higher values imply more external control beliefs. *Educational attainment* 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). *Income* is the equivalized net household income in hundreds. *General Risk Attitude* is a qualitative risk measure on a scale from 0 (not at all willing to take risks) to 10 (very willing to take risks).

## A.2 Additional Tables

Table A1: 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 | $(-\infty, 0]$ |

Notes: 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 $\rho$ the coefficient of interest.

Table A2: Locus of Control Questions

| **Locus of Control Module Items** | | | | | |
|---|---|---|---|---|---|
| | **N** | **Mean** | **S.D.** | **Min** | **Max** |
| *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 |

Notes: Descriptive statistics for each item in the Locus of Control (LoC) module. 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 **?**. 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: 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 |
| Homeowner=1 | 0.49 | 0.48 | 0.736 |
| General Risk (Baseline) | 4.98 | 4.89 | 0.583 |
| $Prob > F$ | | | 0.43 |

Notes: $^{*}$ $p < 0.1$, $^{**}$ $p < 0.05$, $^{***}$ $p < 0.01$.
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. 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 lived in East Germany before 1990. *Citizenship* indicates non-German citizenship status and *Homeowner* identifies respondents who own their house or apartment. *Female, Married, Self-employed, Unemployed, and Retired* are indicator variables. *Satisfaction with health* is measured on 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).

Table A4: Personality Traits – Balance

| | **Mean Treatment** | **Mean Control** | **P-Value** |
|---|---|---|---|
| Openness | -0.00 | 0.01 | 0.829 |
| Conscientiousness | -0.02 | -0.01 | 0.892 |
| Extraversion | 0.01 | 0.03 | 0.736 |
| Agreeableness | -0.02 | -0.00 | 0.820 |
| Neuroticism | 0.00 | 0.01 | 0.888 |
| Optimism | -0.01 | 0.05 | 0.343 |
| Relative Optimism | 0.01 | -0.01 | 0.776 |
| Locus of Control | 3.10 | 3.17 | 0.280 |
| Self Control | -0.04 | -0.06 | 0.773 |
| $Prob > F$ | | | 0.970 |

Notes: $^{*}$ $p < 0.1$, $^{**}$ $p < 0.05$, $^{***}$ $p < 0.01$.
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 recoded the variable, such that higher values reflect more 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 Big 5 consist of *Openness*, *Conscientiousness*, *Extraversion*, *Agreeableness*, *and Neuroticism*, which are standardized to a mean of zero and standard deviation of 1. *Self-Control* is a standardized (mean zero, standard deviation 1) sum of 13 self-control indicators, in the spirit of Tangney, Baumeister and Boone (2004).

Table A5: Correlates of Risk Aversion and Locus of Control

| | CRRA Parameter | | Locus of Control | |
|---|---|---|---|---|
| | (1) | (2) | (3) | (4) |
| Female | 1.185*** | 0.925** | 0.080 | 0.049 |
| | (0.415) | (0.425) | (0.078) | (0.076) |
| Age | 0.005 | -0.002 | 0.002 | 0.001 |
| | (0.011) | (0.019) | (0.002) | (0.003) |
| Education | -0.399*** | -0.330** | -0.073*** | -0.064** |
| | (0.140) | (0.164) | (0.026) | (0.030) |
| Mother has Abitur | -0.944 | 0.582 | -0.046 | 0.118 |
| | (0.765) | (0.897) | (0.145) | (0.160) |
| Father has Abitur | -1.040* | -0.754 | -0.150 | -0.014 |
| | (0.596) | (0.670) | (0.111) | (0.118) |
| Income (net/month) | -0.033* | -0.000 | -0.018*** | -0.010** |
| | (0.020) | (0.024) | (0.004) | (0.004) |
| Married | 0.914** | 1.054** | 0.008 | 0.139 |
| | (0.416) | (0.509) | (0.078) | (0.091) |
| No. of HH Members | 0.261 | 0.207 | 0.013 | -0.010 |
| | (0.184) | (0.236) | (0.034) | (0.042) |
| Self-employed | -0.733 | 0.206 | -0.075 | 0.135 |
| | (0.969) | (1.006) | (0.178) | (0.177) |
| Unemployed | 1.624* | 1.252 | 0.628*** | 0.236 |
| | (0.876) | (0.968) | (0.163) | (0.173) |
| Retired | 0.408 | 0.308 | 0.009 | -0.091 |
| | (0.459) | (0.694) | (0.086) | (0.122) |
| East Germany | 0.736 | 0.831 | 0.111 | 0.004 |
| | (0.535) | (0.546) | (0.099) | (0.096) |
| Citizenship (Non-German) | -0.682 | -0.792 | 0.176 | 0.195 |
| | (1.058) | (1.053) | (0.195) | (0.186) |
| Satisfaction with Health | -0.157* | -0.104 | -0.069*** | -0.035* |
| | (0.095) | (0.105) | (0.018) | (0.019) |
| Homeowner | -0.112 | -0.241 | -0.122 | -0.028 |
| | (0.418) | (0.464) | (0.078) | (0.083) |
| General Risk (Baseline) | -0.566*** | -0.553** | -0.070* | -0.049 |
| | (0.219) | (0.218) | (0.039) | (0.038) |
| Optimism | 0.155 | 0.289 | -0.203*** | -0.189*** |
| | (0.212) | (0.222) | (0.039) | (0.039) |
| Observations | | 446 | | 443 |

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

Dependent variables are the CRRA parameter $\rho$ (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 live in East Germany. *Citizenship* indicates non-German citizenship status and *Homeowner* identifies respondents who own their house or apartment. *Female, Married, Self-employed, Unemployed, and Retired* are indicator variables. *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). *Optimism* is measured on a scale from 1 (optimistic) to 4 (pessimistic) and recoded such that higher values reflect more optimism.

Table A6: ATE – Adjusting for General Attitudes towards Risk

| | CRRA Parameter | | |
|---|---|---|---|
| | (1) | (2) | (3) |
| Treated | -0.544* | -0.533* | -0.553* |
| | (0.279) | (0.289) | (0.285) |
| General Risk (Baseline) | | -0.347** | -0.290** |
| | | (0.145) | (0.145) |
| Covariates | Yes | No | Yes |
| Observations | 914 | 893 | 893 |
| Log-Likelihood | -2058.14 | -2026.44 | -2007.77 |

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

Interval regressions with standard errors in parentheses where the dependent variable is the CRRA parameter $\rho$ (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, equivalized 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 aversion 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 aversion of non-participators in treatment and control

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

Notes: $^{*}$ $p < 0.1$, $^{**}$ $p < 0.05$, $^{***}$ $p < 0.01$.
OLS regressions with standard errors in parentheses. Panel a) reports the difference in the likelihood of non-participation in treatment versus control (column Treatment), 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 versus control (column Treatment), 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) | (6) |
| Treated | -0.546* | -0.559* | -0.539* | -0.547* | -0.569* | -0.513* |
| | (0.299) | (0.295) | (0.292) | (0.296) | (0.297) | (0.297) |
| Treated x LoC | -0.931*** | -0.936*** | -0.856*** | -0.927*** | -0.963*** | -0.865*** |
| | (0.323) | (0.321) | (0.319) | (0.320) | (0.325) | (0.322) |
| LoC | 0.600** | 0.409 | 0.306 | 0.405 | 0.480* | 0.345 |
| | (0.250) | (0.252) | (0.255) | (0.254) | (0.260) | (0.261) |
| Observations | 879 | 879 | 872 | 878 | 849 | 843 |
| Log-Likelihood | -2384.34 | -2364.46 | -2340.34 | -2362.75 | -2274.15 | -2254.23 |
| Covariates | No | Yes | Yes | Yes | Yes | Yes |
| Big 5 | No | No | Yes | No | No | Yes |
| Optimism | No | No | No | Yes | No | Yes |
| Self-Control | No | No | No | No | Yes | Yes |

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

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, equivalized 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 baseline risk attitudes.

Table A9: Heterogeneous Effects - Locus of Control & Other Personality Traits

| | CRRA Parameter | | | | | |
|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) |
| Treated | -0.484* | -0.509* | -0.483* | -0.495* | -0.514* | -0.455 |
| | (0.284) | (0.280) | (0.279) | (0.280) | (0.283) | (0.282) |
| Treated x LoC | -0.914*** | -0.934*** | -0.882*** | -0.923*** | -0.953*** | -0.887*** |
| | (0.293) | (0.288) | (0.288) | (0.287) | (0.291) | (0.293) |
| LoC | 0.590*** | 0.403* | 0.334 | 0.398* | 0.469** | 0.369 |
| | (0.215) | (0.216) | (0.221) | (0.218) | (0.226) | (0.231) |
| Observations | 899 | 899 | 892 | 898 | 868 | 862 |
| Log-Likelihood | -2040.20 | -2021.91 | -2003.67 | -2020.25 | -1951.36 | -1935.92 |
| Covariates | No | Yes | Yes | Yes | Yes | Yes |
| Big 5 | No | No | Yes | No | No | Yes |
| Optimism | No | No | No | Yes | No | Yes |
| Self-Control | No | No | No | No | Yes | Yes |

Notes: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.
Interval regressions with standard errors in parentheses. Dependent variables is the CRRA parameter $\rho$ (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, equivalized 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) Self-Control |
| Treated | -0.521* | -0.523* | -0.503* | -0.527* | -0.485* | -0.492* | -0.495* |
| | (0.281) | (0.283) | (0.283) | (0.283) | (0.282) | (0.282) | (0.287) |
| Interaction Effect | -0.184 | -0.095 | 0.051 | 0.275 | 0.110 | -0.366 | -0.218 |
| | (0.284) | (0.281) | (0.287) | (0.287) | (0.281) | (0.288) | (0.289) |
| Level Effect | 0.503** | 0.273 | -0.015 | -0.217 | 0.077 | 0.152 | 0.205 |
| | (0.199) | (0.197) | (0.210) | (0.292) | (0.282) | (0.203) | (0.201) |
| *N* | 914 | 914 | 913 | 910 | 912 | 913 | 879 |

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

Interval regressions with standard errors in parentheses. Dependent variables is the CRRA parameter $\rho$ (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 *Big 5* traits and columns 6-7 indicate *Optimism* and *Self-Control* 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 recoded the variable, such that higher values reflect more optimism. *Self-Control* is the standardized sum of 13 self-control items, following Tangney, Baumeister and Boone (2004). Higher values imply more indicated self-control.

Table A11: Heterogeneous Effects – Socio-economic characteristics

| | CRRA Parameter | | | |
|---|---|---|---|---|
| | (1) | (2) | (3) | (4) |
| Treated | -0.297 | -0.456 | -3.731 | -0.989 |
| | (0.411) | (0.290) | (4.370) | (0.755) |
| Female | 1.166*** | | | |
| | (0.397) | | | |
| Treated × Female | -0.416 | | | |
| | (0.563) | | | |
| Unemployed | | 1.588* | | |
| | | (0.836) | | |
| Treated × Unemployed | | -0.834 | | |
| | | (1.270) | | |
| ln(income) | | | -0.741* | |
| | | | (0.402) | |
| Treated × ln(income) | | | 0.430 | |
| | | | (0.577) | |
| Education | | | | -0.391*** |
| | | | | (0.134) |
| Treated × Education | | | | 0.127 |
| | | | | (0.191) |
| Observations | 914 | 914 | 914 | 914 |
| Log-Likelihood | -2071.37 | -2075.30 | -2075.44 | -2071.30 |

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

Interval regressions with standard errors in parentheses. Dependent variables is the CRRA parameter $\rho$ (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

| | CRRA Parameter | | | | | |
|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) |
| Treated | 0.128 | 0.141 | 0.138 | 0.138 | 0.146 | 0.132 |
| | (0.106) | (0.106) | (0.106) | (0.106) | (0.108) | (0.108) |
| Treated x LoC | 0.242** | 0.254** | 0.235** | 0.251** | 0.264** | 0.240** |
| | (0.111) | (0.110) | (0.111) | (0.110) | (0.112) | (0.113) |
| LoC | -0.199** | -0.131 | -0.122 | -0.129 | -0.163* | -0.139 |
| | (0.082) | (0.084) | (0.087) | (0.084) | (0.088) | (0.090) |
| Observations | 899 | 899 | 892 | 898 | 868 | 862 |
| Covariates | No | Yes | Yes | Yes | Yes | Yes |
| Big 5 | No | No | Yes | No | No | Yes |
| Optimism | No | No | No | Yes | No | Yes |
| Self-Control | No | No | No | No | Yes | Yes |

Notes: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.
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, equivalized 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 Locus of Control Scale

| | CRRA Parameter | | | | | |
|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) |
| Treated | -0.048 | -0.112 | 0.070 | -0.118 | -0.601 | -0.420 |
| | (0.762) | (0.755) | (0.757) | (0.756) | (0.767) | (0.768) |
| Treated x External Scale | 0.215** | 0.225** | 0.206* | 0.222** | 0.235** | 0.208* |
| | (0.108) | (0.107) | (0.107) | (0.107) | (0.109) | (0.109) |
| External Scale | -0.182** | -0.105 | -0.089 | -0.102 | -0.140 | -0.112 |
| | (0.080) | (0.081) | (0.085) | (0.081) | (0.086) | (0.089) |
| Treated x Internal Scale | -0.086 | -0.078 | -0.102 | -0.076 | 0.005 | -0.015 |
| | (0.123) | (0.123) | (0.123) | (0.123) | (0.125) | (0.125) |
| Internal Scale | -0.028 | 0.004 | 0.044 | 0.002 | -0.024 | 0.004 |
| | (0.090) | (0.090) | (0.092) | (0.090) | (0.093) | (0.094) |
| Observations | 908 | 908 | 901 | 907 | 875 | 869 |
| Log-Likelihood | -1706.37 | -1685.45 | -1667.81 | -1683.51 | -1619.92 | -1605.78 |
| Covariates | No | Yes | Yes | Yes | Yes | Yes |
| Big 5 | No | No | Yes | No | No | Yes |
| Optimism | No | No | No | Yes | No | Yes |
| Self-Control | No | No | No | No | Yes | Yes |

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

Interval regressions with standard errors in parentheses. Dependent variables is the CRRA parameter $\rho$ (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, equivalized 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 regarding the distribution 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 total household wealth including cash, savings accounts, stocks and real estate, minus debts, such as 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.** *In your estimation, what gross annual income is required to be in the top 10 percent of German households?*