Status, Control Beliefs, and Risk Taking*

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Abstract

We show that relative standing 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 standing 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 taking and underlying beliefs highlights the benefits of incorporating personality constructs 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. Relative concerns are inevitably intertwined with individuals' willingness to take risks and have far ranging implications for a host of economic issues, such as asset pricing, economic growth, monetary policy, savings behavior, income inequality, taxation, job performance and satisfaction, and well-being.[1] Understanding the direct impact of relative concerns on risk preferences is therefore essential to predict behavioral responses to relative concerns across domains.

Intuitively, individuals' concern about their status in the wealth distribution should motivate risk taking when there is a chance to improve one's relative standing, even if this improvement is very small.[2] The relative attractiveness of choices that entail different degrees of risk may therefore depend on the initial position of a decision maker and their taste for relative improvements. A series of theoretical papers model such interdependencies 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). The first contribution of our study is to provide empirical evidence on the relativistic foundation of risk preferences by documenting a causal link from relative wealth 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 their relative standing with increased risk taking. To do so, we borrow from personality psychology and focus on locus of control (Rotter, 1966), an individual-specific belief system 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 to perceive life outcomes as within one's control, or alternatively, as predominantly the result of luck or fate.

We argue that an individual's locus of control shapes their response to relative standing

[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); Fliessbach et al. (2007); Card et al. (2012); Cohn et al. (2014); Perez-Truglia (2020); Michaillat and Saez (2021).

[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) has illustrated how relative comparisons can rationalize Friedman and Savage's argument.

for two reasons. First, people who do not believe they have control over life outcomes – i.e., those with an *external* locus of control – tend to generally have a higher interest in relative comparisons.[3] Given that external control beliefs are negatively correlated with a range of important life outcomes, this may in part reflect that well-being of internal individuals, who enjoy better outcomes in other domains of life, is less dependent on favorable relative comparisons.[4] Second, control beliefs may influence the set of available strategies to improve relative standing. The appeal of gambling and other risky strategies with low expected returns for moving up the social ladder depends to a good extent on the availability of alternatives, such as investments in human capital or increased effort on the job. 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 can act as a (perceived) constraint on the set of strategies available to improve relative standing or social status.

To address the question of how risk preferences are linked to relative standing, we implemented our study in the Innovation Sample of the Socio-Economic Panel (SOEP-IS), a representative longitudinal study of the German population. We designed a tailor-made survey module, including a pre-treatment measure of locus of control and an incentivized measurement of individual risk taking. Specifically, 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 estimate individual parameters of risk aversion using a standard utility function specification.

Credibly testing for the impact of relative standing on risk preferences is challenging because of two issues. First, there may be reverse causality. Varying levels of risk-aversion are likely to result in fundamentally different wealth accumulation outcomes to begin with. Second, it is difficult if not impossible to create exogenous variation in relative wealth. Our strategy to address these challenges relies on the fact that most people have to infer their relative standing from their limited information on the distribution of income and wealth, and that these inferences are more easily malleable.[5] Thus, we take respondents' rank in the wealth distribution as given

[3]While this relationship is well-documented in psychological research (e.g., Testa and Major, 1990; Aspinwall and Taylor, 1993; Fiske, 2011), we present direct evidence on the relationship between control beliefs and interest in relative comparisons from the Socio-Economic Panel Innovation Sample (SOEP-IS), see Figure A1.

[4]Growing evidence suggests that, similar to other non-cognitive skills, locus of control is strongly associated with several important life outcomes. For example, more internal beliefs tend to be positively correlated with subjective health, life satisfaction, educational attainment, investment in work-related training, and 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; Caliendo et al., 2020).

[5]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). Relatedly, people tend to underestimate

and manipulate their *perceived* standing in the wealth distribution. To do so, we ask respondents about their net wealth and randomly vary the range of response categories of the question.[6] Half of the respondents see response categories with wide intervals, e.g., the lowest category ranges up to the 80th percentile of the net wealth distribution (treatment condition). The other half of respondents receive response categories with small intervals, with the lowest category ranging up to 20th percentile and the highest category starting at the 60th percentile (control condition). 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 standing in the wealth distribution. Take, for example, two respondents with the same objective wealth level that would place them into the 60th percentile. The respondent in the control condition would end up in the highest category, whereas the respondent in the treatment condition would end up in the lowest category. Therefore, in the treatment condition respondents are induced to feel that their wealth is at the lower end of the distribution and thus further away from the top, whereas this is less pronounced in the control condition. The variation in perceptions is non-persistent in nature, but we can use it to isolate its causal effect on risk taking.

We examine the intended consequences of our intervention along two margins. First, we look at the distribution of responses to the wealth categorization. As intended, the wider wealth intervals in the treatment condition lead the overwhelming majority of respondents to locate themselves at the lower end of the distribution, while in the control condition a majority of respondents sort themselves into the three highest categories. Second, we investigate whether the treatment induced a feeling of being further away from the top. For this purpose, we focus on relative income to minimize possible anchoring and demand effects. More precisely, respondents have to estimate the household income above which one is richer than 90 percent of other households. We find that this estimate is 21 percent higher among treated than non-treated respondents, suggesting that the treatment induced a perception of a larger gap to the top of the distribution. Taken together, our intervention generated a strong "first-stage," shifting perceptions about relative standing in the wealth distribution.

We present two main findings. First, we find that our intervention translates into a sizable

their relative income rank nationally and globally (e.g., Cruces, Perez-Truglia and Tetaz, 2013; Karadja, Mollerstrom and Seim, 2017; 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).

[6]Our instrument builds on research in social psychology showing that response scales carry information about the population distribution (e.g., Schwarz et al., 1985). This technique was also successfully used in related work by Haisley, Mostafa and Loewenstein (2008).

treatment effect. That is, treated respondents who are induced to perceive their relative standing as low are more likely to take risks than respondents in the control group. As is standard in the literature, we estimate individual-level utility function parameters assuming constant relative risk aversion (CRRA). The estimated CRRA parameter ρ is about 0.5 lower among treated respondents, corresponding to shift of 18 percent relative to the control group mean and 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 option for rising in the wealth hierarchy.

Second, we demonstrate that heterogeneity in control beliefs moderates the relationship between relative wealth standing 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. In contrast, respondents who believe that life outcomes are a matter of luck and fate (external locus of control) substantially increase their risk taking, as predicted. The effect is sizable, with a one standard deviation increase in external control beliefs shifting the estimated risk parameter ρ by an additional 0.9 towards less risk aversion. The observed heterogeneity is consistent with the idea that an extrinsic belief system constrains a person's choice set: believing that life circumstances are determined by fate can result in disregarding any options with future payoffs that partially depend on own actions, such as education investments, leaving only options with less productive risks.

We can address a host of alternative explanations for our results. Most importantly, we find no evidence that locus of control merely picks up other facets of personal characteristics. Personality traits, such as the Big 5, self-control, and optimism as well as emotions and socio-demographic characteristics, such as gender, employment status, education, and income, do not moderate the observed relationship. Moreover, we can rule out differential participation in the risk elicitation task across conditions. The same is true for selection into the lottery task: respondents' baseline risk preferences are almost identical across conditions. Finally, we provide evidence that our findings extend beyond our context. Relative position in the wealth (and income) distribution is naturally linked to inequality because the distribution of wealth (and income) has implications for how much richer others are. This notion of relative deprivation is, at the aggregate level, related to the Gini coefficient (Yitzhaki, 1979; Hey and Lambert, 1980). Using data from the World Value Survey, we show that greater income inequality is related to lower risk aversion and, again, that

this relationship is moderated by external control beliefs.

2 Related Literature

Given the central role risk preferences play in economic analyses, it is not surprising that their origin has been the target of empirical investigation before. A nascent literature focuses 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) on risk preferences. A few other studies investigate short-term fluctuations in attitudes towards risk that are triggered by reoccurring economic and psychological phenomena such as day-to-day income fluctuations (Akesaka et al., 2021) and emotions (Meier, 2021).[7] 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 less transient than, for example, the impact of emotional states.

A handful of studies show that social comparison 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; Schwerter, 2020).[8] The experiments in this literature let participants take risky decisions involving their laboratory earnings and randomly vary whether the earnings of other participating peers are observed or not. While this stimulates social comparisons, it tightly links the nature of the social comparison to the elicitation method of risk preferences. By embedding our treatment into a simple question about background household wealth, we can strictly separate the risk task from the manipulation of perceived relative standing. This not only mitigates concerns about experimenter demand effects, but also endogenously creates social comparisons with respect to individuals' standing in the economic hierarchy of society and does

[7] See Chuang and Schechter (2015) and Schildberg-Hörisch (2018) for a recent review of the literature on variation in (risk) preferences over time.

[8] 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).

not need to rely on randomly assigned income ranks.[9] In this way, our experimental design is related to Haisley, Mostafa and Loewenstein (2008), who show that low-income individuals are more inclined to buy lottery tickets if they are primed to think that their relative income is low. Our study moves beyond this literature by using a large representative sample and highlighting that similar dynamics can be generated from a *perceived* relative disadvantage in background household wealth. Moreover, we unveil a mechanism behind this relationship and show that enduring and individual-specific beliefs play a key role in shaping responses to relative concerns.

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 in a job search framework, showing 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. Similarly, workers with an external locus of control invest less in work-related training (Caliendo et al., 2020). Our findings illustrate that psychological primitives can play an important role in explaining heterogeneity in risk preferences.

3 Research Design

3.1 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

[9] Kuziemko et al. (2014) demonstrate that, even if randomly assigned, such income ranks matter for risk taking behavior in a lab setting.

propose their own modules with the option to run 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 by professional interviewers. This has unique advantages over other frequently used survey modes (e.g., phone and online surveys), as it minimizes non-response and misunderstandings, and prevent information look-up and communication within households.

3.2 Design of the survey module and measures

Our survey module in the SOEP-IS consists of three parts: questions on locus of control, the treatment manipulation, and a lottery task to measure risk preferences (see the Appendix for the full details of the survey module).

Locus of Control and measures. The first part of the survey purposefully elicits our personality construct 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).[10] 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 aversion is typically associated with a less 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

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

external and internal LoC. As discussed in more detail in Section 4.4, our heterogeneity results do not depend on the choice of the construction of the measure for individual locus of control.

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 variation in perceived relative standing in the wealth distribution. To manipulate these perceptions, 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 at the time of the survey.[11] As the lowest interval in the treatment condition covers 80 percent of the German net wealth distribution, the overwhelming majority of respondents should locate themselves at the lower end of the wealth distribution. In contrast, the responses in the control condition should be more concentrated in the middle and top categories. Note that the random assignment to the two conditions ensures that the real distribution of income and wealth is equal in both groups. This allows us to keep absolute wealth levels constant, while creating exogenous variation in perceived relative standing in the wealth distribution. This variation is naturally not persistent, but allows us to isolate the causal effect on risk taking.

We intentionally use a subtle manipulation and abstain from providing more explicit information about wealth ranks to minimize the risk of inducing experimenter demand effects (Haaland, Roth and Wohlfart, 2021). The manipulation 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 and psychological and survey research suggests that respondents use their own location on the scale to determine their location in the distribution (e.g., Schwarz et al., 1985; Rockwood, Sangster and Dillman, 1997; Menon, Raghubir and Schwarz, 1997; Bertrand and Mullainathan, 2001).

[11] The upper bounds of the intervals are taken from the 2014 wave of the Household Finance and Consumption Survey (HFCS) and 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 2014 was 60,400 euros, while the average was 214,500 (see HFCS, Deutsche Bundesbank, 2016, for more information).

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 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).[12] 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; Brunnermeier and Nagel, 2008; Chiappori and Paiella, 2011; Sahm, 2012; Carvalho, Meier and Wang, 2016).[13] Under this assumption, we can represent the utility of a monetary amount x as $u(x) = x^{1-\rho} \times (1-\rho)^{-1}$, where ρ 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 such incentivized choice tasks (Andersen et al., 2008). With this assumption, we can calculate lower and upper bounds for the CRRA parameter ρ for each lottery as explained and displayed in Table A1. The parameters range from extreme risk aversion ($\rho > 7.51$) to risk neutral (loving) ($\rho \leq 0$). We then use an interval regression to estimate the treatment effect on the underlying latent preference parameter.

3.3 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 socio-demographics, and missing information is typically rare. However, our study requires that respondents participated

[12] 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.

[13] Using panel data, 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).

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 not more likely to appear in either of the two treatment conditions (17 percent in the control and 20 percent in the treatment condition, t-test, p=0.20). In Section 4.4, we provide further evidence that there is no differential selection into the risk elicitation task, and that our results are robust to re-weighting the study sample to match the socio-economic characteristics of the full sample.

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, equivalized net income, marital status, household size, employment status, citizenship, satisfaction with health and life, and region (East/West Germany). We consider education, which is measured by the highest degree or diploma taking into account general schooling, vocational training, and university education.[14] 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. Finally, we consider homeownership as a proxy for wealth because the SOEP-IS includes no detailed wealth module. Homeownership is the most important component of wealth in Germany below the top 1% of the wealth distribution (Schröder et al., 2020).

Balance. In Table A3, we present p-values from a set of linear regressions assessing the balance of the observables presented above by treatment status. 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 group.

[14] We use this scheme instead of years of schooling as it better describes educational attainment in Germany (see Card, 1999). 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.

4 Main Results

4.1 First Stage

We start our analysis with a closer look at the "first-stage" of our intervention and examine whether it induced a feeling of low relative standing. As a first step, we show in Table 1 the responses to the wealth categorization in both conditions. The treatment manipulation was successful in sorting respondents into the different wealth categories, as intended. In the control condition, the distribution of responses in the five wealth categories is well dispersed 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 locate themselves at the lower end of the wealth distribution.

The second step is to see whether the treatment successfully induced a feeling of a low relative standing and a larger gap to the top. To minimize concerns about anchoring and demand effects, we focus here on respondents' perceptions about the relative income distribution and introduce a time lag to the intervention by embedding the question in a subsequent and unrelated survey module.[15] We ask respondents to estimate the household income above which one is richer than 90 percent of other households. If the treatment successfully induced a perception of lower relative standing, we should expect a similar qualitative effect on this relative income estimate, given the positive correlation between wealth and income. That is, inferring the 90th income percentile based on own income should result in higher estimates in the treatment condition, indicating a larger perceived gap to the top. Table 2 confirms this hypothesis and indicates a strong effect: treated respondents estimate 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, we take this as evidence that exposing respondents to wider wealth intervals in the treatment condition generated a very strong "first stage," significantly shifting their views about whether their standing in the wealth distribution is low or not.

[15] Both measures should alleviate concerns that the "first-stage" merely reflect numerical anchoring effects (or demand effects) because anchoring is a short-lived phenomenon and the treatment targeted relative wealth standing for which the exact quantitative mapping from wealth to income figures is non-trivial.

4.2 Average Treatment Effect

We now turn to the analysis of how perceived relative standing in the wealth distribution impacts respondents' willingnes to take risk. 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 **X** includes a constant term and our standard set of socio-demographic variables, as outlined in Section 3.3 (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 CRRA parameter ρ falls within this interval, i.e., $Pr(0.821 \leq CRRA_i^* < 1.74)$. Assuming normally distributed errors with some variance σ_ϵ^2 leaves us in the standard set-up of interval regressions.

Risk parameters. In a first step, we estimate the parameters of a model similar to (1), using control group observations only, 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 aversion (measured on a scale from 0 to 10 – very willing to not 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 life domains (Dohmen et al., 2011). Our control group data affirm these relationships as well. We see a strong correlation between our incentivized measure of risk aversion (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 higher CRRA parameter ρ (see Table A5, column 3).

Regression Analysis. To provide statistical evidence on the effect of perceived relative wealth standing on risk preferences, we repeat the estimation of (1) for the full study sample. Figure 1 illustrates the predicted results and indicates a sizable shift towards a lower CRRA parameter ρ in the treatment condition, indicating less risk aversion. 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, we can compare our estimates to other studies. For example, Carvalho, Prina and Sydnor (2016) 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 predicted CRRA parameter in both the treatment and control groups is well above 2 and is thus consistent with risk aversion. While the 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. It is also important to note that the potential monetary gains in our context are not sufficient to generate large jumps along the wealth distribution. However, we can rationalize the results if we consider relative wealth as informative of more short-term relative consumption budgets.[16]

4.3 Moderating the Effect: Locus of Control

The analysis so far has focused on average treatment effects, indicating less risk aversion if respondents perceive to be at the lower end of the wealth distribution. As outlined above, however, we

[16] 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 implausible levels of risk aversion.

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. Figure A2 depicts the distribution of LoC and indicate a large degree of variation. The median LoC 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). In Table A5 (columns 3–4) and Figure A3, we present correlates of LoC based on control group data. Consistent with existing 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, risk aversion is associated with more external control beliefs for both our qualitative measure and incentivized measure of risk.[17] As indicated earlier, LoC is related to the extent of relative comparisons. In Figure A1, we use data from a different SOEP-IS sample and show that individuals with more external control beliefs are more inclined to say that relative comparisons are important to them, whereas no such relationship exists for individuals with more internal control beliefs.

Figure 2 shows the effect of the 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, reflecting the correlation 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 34.7% (90%-CI: [15.5%, 53.9%]) shift away from risk aversion.

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

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

Note that regression specification (2) includes a standardized and continuous measure of control beliefs, LoC_i. The main coefficient of interest, γ, can therefore be interpreted as the additional effect

[17] 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 aversion is associated with higher external control beliefs. However, the correlation is small (correlation coefficient of 0.15).

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 treatment effect – i.e., towards a lower estimated 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, the treatment shifts the CRRA parameter downwards by almost 1. In terms of model calibration, this is equal to a difference between a relative risk aversion parameter $\rho = 2$ 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 individual-specific beliefs in shaping responses to relative concerns.

4.4 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 other personality traits unlikely moderate the effect on risk taking.

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 in the SOEP-IS and was asked before our survey module to show that the sample is also balanced with respect to this baseline measure of risk aversion. 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 A7). Therefore, it is unlikely that the main effects are driven by differential selection with respect to pre-treatment risk aversion.

Second, in Table A6 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 aversion is 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).[18] 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 by other personality traits.

Emotions. There is some evidence that risk preferences and LoC are tightly linked to emotions (e.g., Loewenstein et al., 2001; Cohn et al., 2015; Meier, 2021). To investigate the potential role of

[18] 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.

emotions in moderating the treatment effect, we follow the same approach as in our analysis on personality traits above. The SOEP-IS routinely asks how often respondents experienced anger, fear, happiness, and sadness in the four weeks prior to the interview. In Table A11, we re-estimate regression (2) and control for anger, fear, and a combined measure of happiness and sadness.[19] Again, we basically see that our main result is robust to controlling for emotions. Next, we interact each of these emotions with our treatment and report the results in Table A12. We find no indication for heterogeneity in our results that are related to emotions. Overall, emotions appear to play no role in our context.

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, for example, true for gender: women are more risk averse than men.[20] 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 A13).

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 aversion. Nonetheless, we present results from such regressions in Table A14. Qualitatively our conclusions do not change. Individuals with external control beliefs remain those who predominantly react to our treatment manipulation.

Alternative LoC Scores. As is common in the literature, we use a single index for LoC in our analysis. However, a concern is that this index is based on unweighted averages (Cobb-Clark and Schurer, 2013). An alternative is to perform a principal component analysis to extract a separate score for internal and external control beliefs (see e.g., Pinger, Schäfer and Schumacher, 2018). In

[19] Following the literature, we combine happiness and sadness in an index by taking the average of their difference and adjusting the index to be in the same range as the other emotions (see Meier, 2021).

[20] 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.

Table A15 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.

Additional Evidence. In Section A.3, we move beyond the German context using data from the World Value Survey (WVS) and present evidence that in countries with greater income inequality, the population is less risk averse and that this relationship is stronger for people with more external control beliefs. This suggests that our findings on the relationship between relative standing, control beliefs, and risk preferences also apply to the distribution of income, which itself may affect the degree to which people seek relative comparisons.

5 Conclusion

We presented evidence that perceived relative wealth standing causally influences risk taking. This lends empirical credibility to a long-standing hypothesis that social components, such as concerns for status or relative position, are important determinants of risk preferences. While various 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. This may have implications on a large range of economic behavior, such as saving, investment, and consumption decision, as well as migration, entrepreneurial activities, and technology adoption.

The nature of risk taking may vary along the distribution, however. As Becker, Murphy and Werning (2005) point out, unproductive risk taking is more frequent among less well-endowed individuals, while risk taking in the form of entrepreneurship is typically only feasible at higher wealth levels. The former often corresponds to risk-seeking behavior, for example, gambling and other risky activities with low average returns, while the latter can be seen as more productive risk. 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 entrepreneurial activities, educational investments, and occupational choices, we can presume

positive welfare effects.

The second contribution of this paper is the identification of personality types in the population that are particularly prone to respond to relative concerns and thus adjust their risk behavior. We document that external respondents (i.e. those who believe in luck and fate) show a stronger reaction to our treatment. This way our findings relate to a rekindled debate about non-standard preferences and preference stability. As discussed, a series of theoretical models studying the link from status or relative standing to risk taking rely explicitly on non-standard preferences. In this spirit, we may rationalize our findings by modelling utility as a weighted average of both standard preferences for absolute consumption and a relative component and let locus of control moderate the weight on the relative component. This would be in line with the documented tendency that external people care more about social comparisons than others. Alternatively, some evidence suggests that risk preferences adapt to social influences, experience, and institutions (see Bowles, 1998; Fehr and Hoff, 2011, for general discussions on endogenous preferences). Schildberg-Hörisch (2018) proposes a framework that describes preferences as a distribution with a (potentially time-variant) mean and some variance that can reconcile most of the evidence on changes in risk preferences. In this sense, the change in perceived relative wealth standing may be interpreted as setting off a variation in the measured preferences around the baseline mean. Although we are not able to discriminate between the two interpretations, our findings highlight that control beliefs are important components in the relativistic foundation of risk preferences and that their origin and implications consequently merit further study.

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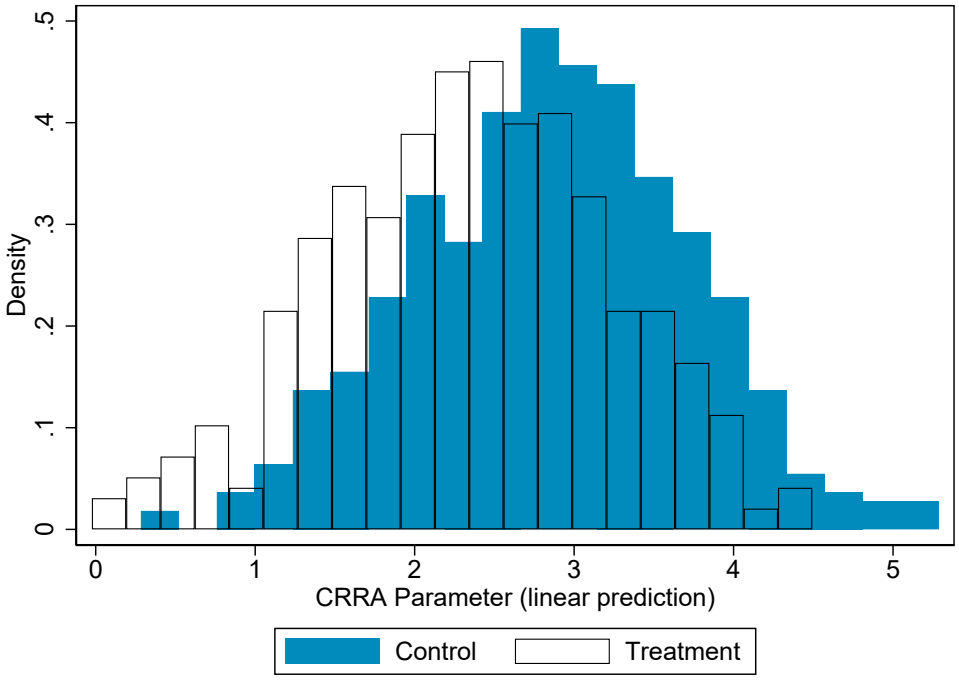
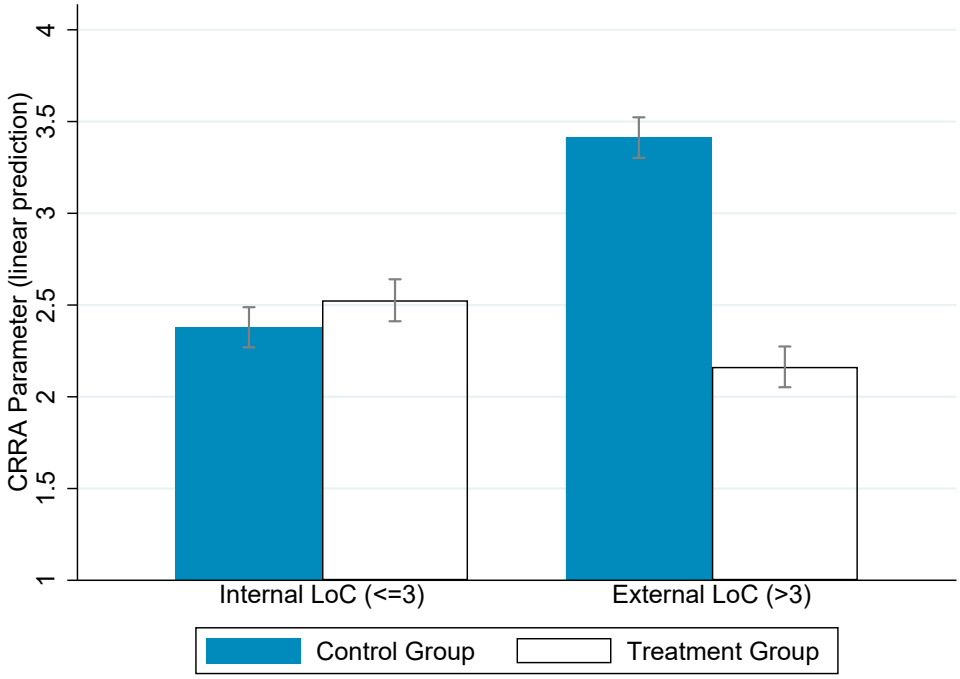
Figures

Figure 1: Distribution of Predicted CRRA Parameters by Treatment



Notes: Predicted CRRA parameters from interval regression regressing the CRRA parameter ρ on a treatment indicator 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. Lower values of ρ indicate higher tolerance for risk.

Figure 2: Treatment Effect - Locus of Control (Median Split)



Notes: Predicted CRRA parameters from interval regression regressing the CRRA parameter ρ on a treatment indicator 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 split by the median of locus of control (3). Lower values of ρ indicate higher tolerance for risk.

Tables

Table 1: Wealth Categories by Treatment

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 observed responses in each category.

Table 2: First-Stage Effects of Treatment

	Perceived Top-10% Household Income			
	(1)	(2)	(3)	(4)
Treated	0.213**	0.200**	0.169**	0.172**
	(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, life satisfaction, and region (East/West Germany).

Table 3: Main Treatment Effects

	CRRA Parameter			
	(1)	(2)	(3)	(4)
Treated	-0.518*	-0.546*	-0.525*	-0.538*
	(0.283)	(0.279)	(0.282)	(0.278)
Treated x LoC			-0.917***	-0.924***
			(0.284)	(0.279)
LoC			0.589***	0.404*
			(0.209)	(0.214)
Constant	2.863***	3.459***	2.884***	3.650***
	(0.200)	(1.071)	(0.199)	(1.086)
Covariates	No	Yes	No	Yes
Observations	914	914	914	914
Log-Likelihood	-2077.43	-2058.05	-2071.99	-2052.39

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

Appendix – For Online Publication Only

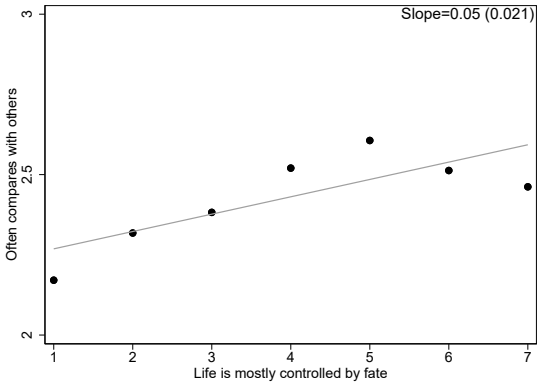
Status, Control Beliefs, and Risk Taking

Dietmar Fehr and Yannick Reichlin

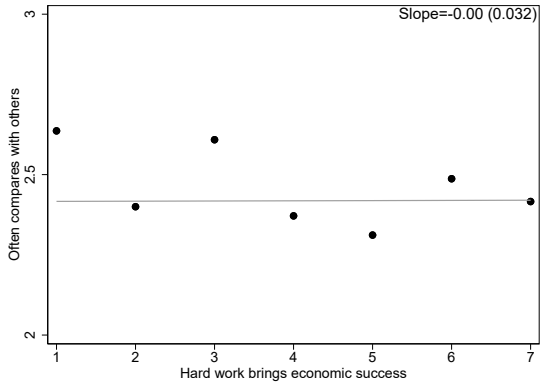
A.1 Additional Figures

Figure A1: Locus of Control and Importance of Relative Comparisons

(a) External LoC

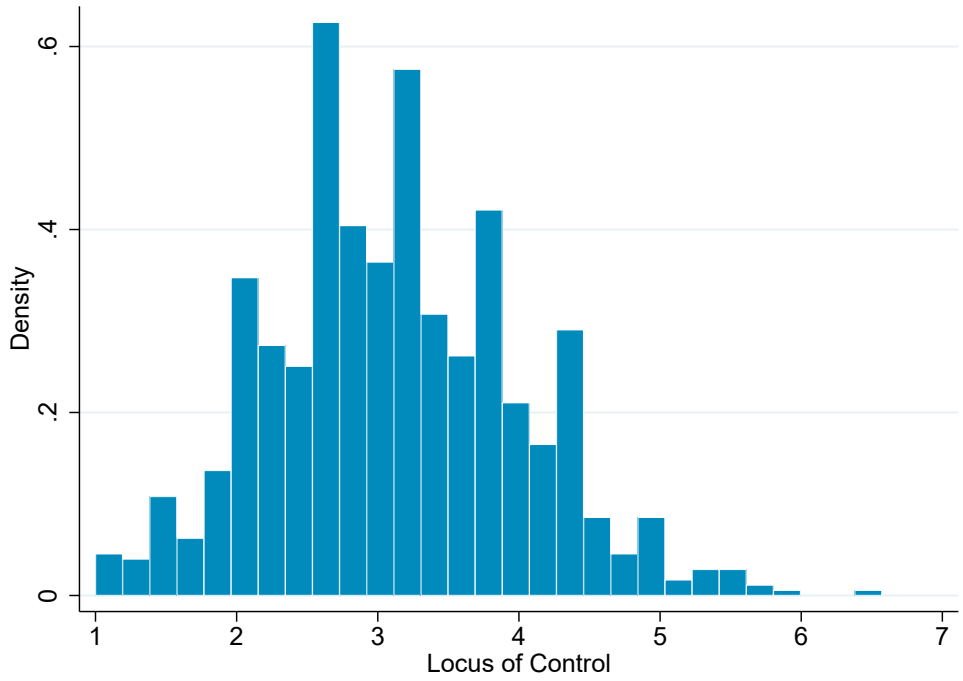


(b) Internal LoC



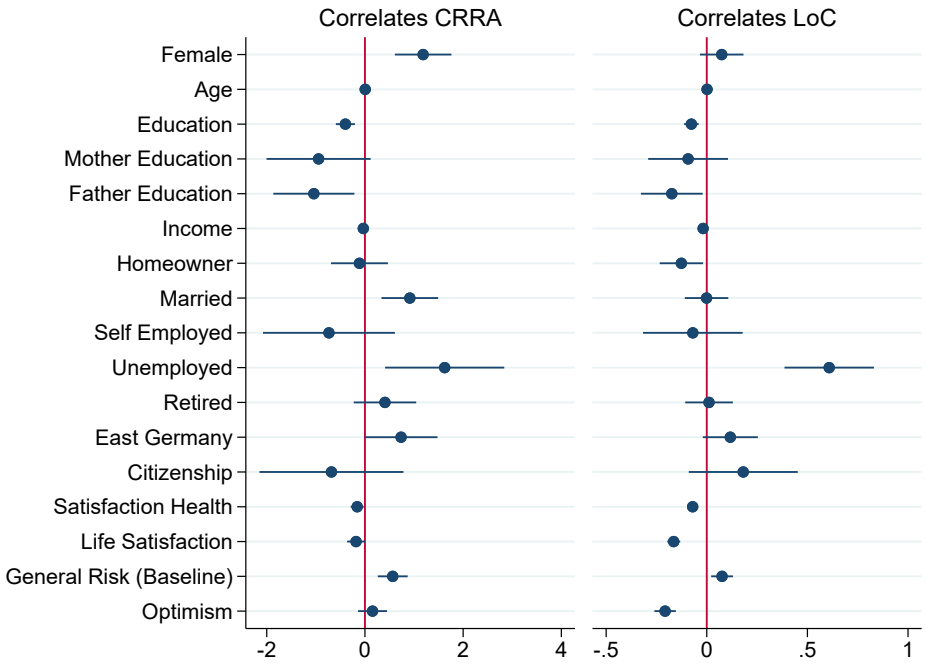
Notes: Binned scatterplot of LoC and importance of relative comparisons using data from a different representative SOEP-IS sample ($N = 1,388$). Panel (a) displays the relationship with external LoC proxied by the belief that *life is mostly controlled by fate* measured on a scale from 1 (disagree) to 7 (agree) and panel (b) displays the relationship with internal LoC proxied by the belief that *working hard enough likely results in a good life* measured on a scale from 1 (fully disagree) to 7 (completely agree). Importance of relative comparisons is measured by the agreement to the statement *I am the type of person who often compares him-/herself with others* measured on a scale from 1 (do not agree at all) to 5 (completely agree). 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, life satisfaction, and region (East/West Germany).

Figure A2: Distribution of Locus of Control



Notes: Histogram 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 A3: Correlates of Risk and Locus of Control



Notes: Coefficient plots from separate OLS regressions of the form $Y_i = \beta_0 + \beta_1 * Covariate + \epsilon_i$, where Y_i is either the CRRA parameter ρ (with higher values indicating less tolerance for risk) or Locus of Control (with higher values indicating more external control beliefs; see Table A2 for more details on the construction of the index). *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). *Life Satisfaction* 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 (very willing to take risks) to 10 (not at all willing to take risks), standardized using the sample mean and standard deviation. *Optimism* is measured on a scale from 1 (optimistic) to 4 (pessimistic) and recoded such that higher values reflect more optimism.

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: Lotteries used in the risk elicition task. Each lottery pays a low or high payoffs (in €) with equal probability. Respondents choose one of the lotteries and for every tenth respondent the chosen lottery was realized and paid out. Assuming CRRA utility of the form $u(x) = \frac{x^{1-\rho}}{1-\rho}$, where x is the respective payoff and ρ the coefficient of interest, we can calculate lower and upper bounds for relative risk aversion for each lottery. For example, comparing the expected utility of Lottery 2 and lottery 3 gives the lower bound of ρ for lottery 2 and the upper bound of ρ for lottery 3.

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	5.644	1.308	1	7
IT 2: In comparison to others, I have not achieved what I deserve.	914	3.111	1.700	1	7
IT 3: What you achieve in life, is first of all a question of fate or luck.	914	3.491	1.610	1	7
IT 4: I often experience that others are deciding about my life.	914	2.696	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.	914	4.452	1.524	1	7
IT 8: More important than all effort, are the abilities you have.	914	4.828	1.354	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.	914	3.958	1.652	1	7
Locus of Control Index					
LoC = (-(IT1-8)+IT2+IT3+IT4+IT6+IT7+IT9)/7	914	3.133	0.872	1	6.571
External Scale (IT3, IT4, IT6, IT7, IT9)	914	3.104	0.998	1	6.592
Internal Scale (IT1, IT5)	914	2.223	0.935	1	5.500

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) and combine *IT 1, IT 2, IT 3, IT 4, IT 6, IT 7, IT 9* in an equally weighted *LoC* index as in Cobb-Clark and Schurer (2013). As a robustness check, we consider two separate indices for the items corresponding to internal and external control beliefs, respectively Caliendo, Cobb-Clark and Uhlendorff (2015); Pinger, Schäfer and Schumacher (2018); Caliendo et al. (2020). 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	Mean Control	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
Home owner=1	0.49	0.48	0.736
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	0.06	0.05	0.327
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
Life Satisfaction	7.61	7.62	0.922
General Risk (Baseline)	5.02	5.11	0.583
$Prob > F$			0.88

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

Each row presents the means of *covariate* in the treatment and control group 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) and *Homeowner* identifies respondents who own their house or apartment. *Female, Married, Self-employed, Unemployed, and Retired* are indicator variables. *East Germany* is an indicator for respondents who lived in East Germany before 1990. *Citizenship* indicates non-German citizenship status. *Satisfaction with health* is measured on a scale from 0 (completely dissatisfied) to 10 (completely satisfied). *Life Satisfaction* 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 (very willing to take risks) to 10 (not at all 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	0.359
Self Control	-0.04	-0.06	0.773
$Prob > F$			0.28

Notes: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.
Each row presents the means of *covariate* in the treatment and control group 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. The Big 5 consist of *Openness, Conscientiousness, Extraversion, Agreeableness, and Neuroticism*, which are standardized to a mean of zero and standard deviation of 1. *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 (LoC)* is an equally weighted index of the LoC questions with higher values corresponding to more external beliefs. *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 Lottery Choice, Risk Aversion, and Locus of Control

	Lottery Choice		CRRA Parameter		Locus of Control	
	(1)	(2)	(3)	(4)	(5)	(6)
Female	-0.450***	-0.336**	1.185***	0.902**	0.076	0.045
	(0.149)	(0.153)	(0.415)	(0.424)	(0.078)	(0.074)
Age	0.001	0.006	0.005	-0.008	0.002	0.002
	(0.004)	(0.006)	(0.011)	(0.018)	(0.002)	(0.003)
Education	0.169***	0.129**	-0.399***	-0.347**	-0.074***	-0.065**
	(0.050)	(0.059)	(0.140)	(0.163)	(0.026)	(0.029)
Mother has Abitur	0.226	-0.226	-0.944	0.451	-0.080	0.081
	(0.275)	(0.322)	(0.765)	(0.890)	(0.143)	(0.155)
Father has Abitur	0.363*	0.314	-1.040*	-0.728	-0.168	-0.028
	(0.213)	(0.241)	(0.596)	(0.669)	(0.111)	(0.116)
Income (net/month)	0.013*	-0.001	-0.033*	0.001	-0.018***	-0.009**
	(0.007)	(0.009)	(0.020)	(0.024)	(0.004)	(0.004)
Home owner	0.111	0.108	-0.112	-0.178	-0.129*	-0.044
	(0.150)	(0.165)	(0.418)	(0.457)	(0.078)	(0.079)
Married	-0.173	-0.341**	0.914**	1.305***	0.001	0.152*
	(0.150)	(0.163)	(0.416)	(0.454)	(0.078)	(0.079)
Self employed	0.444	0.071	-0.733	0.217	-0.073	0.120
	(0.343)	(0.361)	(0.969)	(1.005)	(0.178)	(0.174)
Unemployed	-0.761**	-0.539	1.624*	1.167	0.626***	0.186
	(0.311)	(0.349)	(0.876)	(0.968)	(0.160)	(0.168)
Retired	-0.109	-0.222	0.408	0.373	0.012	-0.025
	(0.164)	(0.250)	(0.459)	(0.699)	(0.085)	(0.121)
East Germany	-0.121	-0.135	0.736	0.851	0.112	0.010
	(0.190)	(0.195)	(0.535)	(0.545)	(0.099)	(0.094)
Citizenship (Non-German)	0.180	0.258	-0.682	-0.766	0.177	0.192
	(0.376)	(0.378)	(1.058)	(1.053)	(0.195)	(0.182)
Satisfaction with Health	0.063*	0.027	-0.157*	-0.058	-0.071***	-0.006
	(0.034)	(0.041)	(0.095)	(0.114)	(0.017)	(0.020)
Life Satisfaction	0.085*	0.073	-0.181	-0.176	-0.165***	-0.102***
	(0.047)	(0.056)	(0.132)	(0.156)	(0.023)	(0.027)
General Risk (Baseline)	-0.195**	-0.179**	0.566***	0.522**	0.073*	0.040
	(0.077)	(0.078)	(0.219)	(0.218)	(0.039)	(0.038)
Optimism	-0.058	-0.120	0.155	0.315	-0.205***	-0.159***
	(0.076)	(0.081)	(0.212)	(0.224)	(0.038)	(0.039)
Observations		446		446		446

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

Dependent variables are the lottery choice in columns 1-2, the CRRA parameter ρ (with higher values indicating less tolerance for risk) in colums 3-4, and Locus of Control (with higher values indicating higher control beliefs – external LoC) in columns 5-6. Data from control group only, interval regressions in columns 3-4 and otherwise OLS regressions (with standard errors in parentheses). 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) and *Homeowner* identifies respondents who own their house or apartment. *Female, Married, Self-employed, Unemployed, and Retired* are indicator variables. *East Germany* is an indicator for respondents who live in East Germany. *Citizenship* indicates non-German citizenship status. *Satisfaction with health* is measured one a scale from 0 (completely dissatisfied) to 10 (completely satisfied). *Life Satisfaction* 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 (very willing to take risks) to 10 (not at all willing to take risks), standardized using the sample mean and standard deviation. *Optimism* is measured on a scale from 1 (optimistic) to 4 (pessimistic) and recoded such that higher values reflect more optimism.

Table A6: 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)	-0.147	5.062	1,092
	(0.185)	(0.079)	

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

	Treatment	Control	N
General Risk (Baseline)	-0.014	4.922	199
	(0.330)	(0.244)	

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 difference in general risk aversion between participating and non-participating respondents, from regressing general risk aversion at baseline on an indicator of non-participation. Panel c) displays the difference in general risk aversion of non-participating respondents in treatment versus control (column Treatment), from regressing general risk aversion at baseline on a treatment indicator using non-participating respondents only. *General Risk (Baseline* is measured at baseline on a scale from very willing to take risks (0) to not very willing to take risks (10).

Table A7: ATE – Adjusting for General Attitudes towards Risk

	CRRA Parameter			
	(1)	(2)	(3)	(4)
Treated	-0.518*	-0.546*	-0.533*	-0.556*
	(0.283)	(0.279)	(0.289)	(0.285)
General Risk (Baseline)			0.347**	0.299**
			(0.145)	(0.146)
Covariates	No	Yes	No	Yes
Observations	914	914	893	893
Log-Likelihood	-2077.43	-2058.05	-2026.44	-2007.64

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 ρ (with lower values indicating higher tolerance for risk). *General Risk* coded as z-score of answers to the general risk question in the SOEP, with higher values indicating more 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, life satisfaction, and region (East/West Germany).

Table A8: Results for Inverse Probability Re-Weighting

	CRRA Parameter					
	(1)	(2)	(3)	(4)	(5)	(6)
Treated	-0.565*	-0.566*	-0.546*	-0.554*	-0.581**	-0.527*
	(0.296)	(0.291)	(0.289)	(0.292)	(0.294)	(0.294)
Treated x LoC	-0.953***	-0.966***	-0.899***	-0.959***	-0.959***	-0.869***
	(0.314)	(0.311)	(0.309)	(0.310)	(0.315)	(0.313)
LoC	0.621**	0.415*	0.301	0.411	0.430*	0.297
	(0.244)	(0.251)	(0.255)	(0.252)	(0.260)	(0.261)
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
Observations	893	893	886	892	859	853
Log-Likelihood	-2420.38	-2398.97	-2374.66	-2397.24	-2298.54	-2278.40

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, life satisfaction, 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 aversion. *Big 5* consist of *Openness, Conscientiousness, Extraversion, Agreeableness, and Neuroticism*, which are standardized to a mean of zero and standard deviation of 1. *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 A9: Heterogeneous Effects - Locus of Control & Other Personality Traits

	CRRA Parameter					
	(1)	(2)	(3)	(4)	(5)	(6)
Treated	-0.525*	-0.538*	-0.507*	-0.524*	-0.548*	-0.485*
	(0.282)	(0.278)	(0.276)	(0.278)	(0.282)	(0.280)
Treated x LoC	-0.917***	-0.924***	-0.882***	-0.914***	-0.915***	-0.856***
	(0.284)	(0.279)	(0.278)	(0.279)	(0.283)	(0.284)
LoC	0.589***	0.404*	0.321	0.395*	0.435*	0.330
	(0.209)	(0.214)	(0.218)	(0.215)	(0.224)	(0.228)
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
Observations	914	914	907	913	879	873
Log-Likelihood	-2071.99	-2052.39	-2033.81	-2050.75	-1974.40	-1958.52

Notes: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.
Interval regressions with standard errors in parentheses. Dependent variable is the CRRA parameter ρ (with lower values indicating higher tolerance for risk). *LoC* is the z-score of a single index for locus of control, constructed as detailed in Table A2. Higher values correspond to more external beliefs. Covariates include: age, gender, education, parents' education, equivalized net income, marital status, household size, employment status (self-employed, unemployed, retired), citizenship, homeownership, satisfaction with health, life satisfaction, and region (East/West Germany). *Big 5* consist of *Openness, Conscientiousness, Extraversion, Agreeableness, and Neuroticism*, which are standardized to a mean of zero and standard deviation of 1. *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 A10: Heterogeneous Effects – Other Personality Traits

	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)	(0.205)	(0.201)	(0.203)	(0.201)
Observations	914	914	913	910	912	913	879
Log-Likelihood	-2073.02	-2076.07	-2075.34	-2067.68	-2072.76	-2074.53	-2001.00

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

Interval regressions with standard errors in parentheses. Dependent variable is the CRRA parameter ρ (with lower values indicating higher tolerance for risk). "Interaction Effect" is the interaction between Treated and the corresponding personality trait indicated on top of a column, while "Level Effect" corresponds to the association between personality trait and dependent variable. All personality traits are standardized to have a mean of zero and standard deviation of one. Columns 1-5 show the *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 - Locus of Control & Emotions

	CRRA Parameter					
	(1)	(2)	(3)	(4)	(5)	(6)
Treated	-0.525*	-0.538*	-0.547**	-0.537*	-0.538*	-0.549**
	(0.282)	(0.278)	(0.278)	(0.277)	(0.278)	(0.277)
Treated x LoC	-0.917***	-0.924***	-0.919***	-0.921***	-0.923***	-0.911***
	(0.284)	(0.279)	(0.279)	(0.278)	(0.279)	(0.278)
LoC	0.589***	0.404*	0.431**	0.367*	0.407*	0.402*
	(0.209)	(0.214)	(0.215)	(0.214)	(0.216)	(0.216)
Covariates	No	Yes	Yes	Yes	Yes	Yes
Happiness Index	No	No	Yes	No	No	Yes
Anger	No	No	No	Yes	No	Yes
Fear	No	No	No	No	Yes	Yes
Observations	914	914	914	914	914	914
Log-Likelihood	-2071.99	-2052.39	-2051.74	-2050.34	-2052.39	-2048.80

Notes: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.
Interval regressions with standard errors in parentheses. Dependent variable is the CRRA parameter ρ (with lower values indicating higher tolerance for risk). *LoC* is the z-score of a single index for locus of control, constructed as detailed in Table A2. Higher values correspond to more external beliefs. Covariates include: age, gender, education, parents' education, equivalized net income, marital status, household size, employment status (self-employed, unemployed, retired), citizenship, homeownership, satisfaction with health, life satisfaction, and region (East/West Germany). *Emotions* indicate the frequency of feeling *happy, sad, angry, and fearful* in the last four weeks and is measured on a scale from very rarely (1) to very often (5). *Happiness Index* is an unweighted index of happiness and sadness computed as $(happiness - sadness)/2 + 3$ to equal the range of the other emotions (Anger and Fear).

Table A12: Heterogeneous Effects - Emotions

	CRRA Parameter		
	(1) Happiness Index	(2) Anger	(3) Fear
Treated	-2.698*	-0.567	-0.882
	(1.405)	(0.822)	(0.622)
Interaction Effect	0.589	0.013	0.196
	(0.372)	(0.283)	(0.304)
Level Effect	-0.249	0.348*	0.031
	(0.257)	(0.193)	(0.222)
Observations	914	914	914
Log-Likelihood	-2076.16	-2074.26	-2076.82

Notes: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.
Interval regressions with standard errors in parentheses. Dependent variable is the CRRA parameter ρ (with lower values indicating higher tolerance for risk). "Interaction Effect" is the interaction between Treated and the corresponding emotion indicated on top of a column, while "Level Effect" corresponds to the association between emotion and dependent variable. *Emotions* indicate the frequency of feeling *happy, sad, angry, and fearful* in the last four weeks and is measured on a scale from very rarely (1) to very often (5). *Happiness Index* is an unweighted index of happiness and sadness computed as $(happiness - sadness)/2 + 3$ to equal the range of the other emotions (Anger and Fear).

Table A13: Heterogeneous Effects - Socio-economic Characteristics

	CRRA Parameter			
	(1) Female	(2) Unemployed	(3) Income	(4) Education
Treated	-0.297	-0.456	-3.731	-0.989
	(0.411)	(0.290)	(4.370)	(0.755)
Interaction Effect	-0.416	-0.834	0.430	0.127
	(0.563)	(1.270)	(0.577)	(0.191)
Level Effect	1.166***	1.588*	-0.741*	-0.391***
	(0.397)	(0.836)	(0.402)	(0.134)
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 variable is the CRRA parameter ρ (with lower values indicating higher tolerance for risk). "Interaction Effect" is the interaction between Treated and the corresponding emotion indicated on top of a column, while "Level Effect" corresponds to the association between emotion and dependent variable. *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 A14: Main Treatment Effects – Lottery Choice

	Lottery Choice					
	(1)	(2)	(3)	(4)	(5)	(6)
Treated	0.148	0.155	0.150	0.151	0.164	0.148
	(0.105)	(0.105)	(0.105)	(0.105)	(0.106)	(0.107)
Treated x LoC	0.253**	0.261**	0.246**	0.258**	0.255**	0.233**
	(0.106)	(0.105)	(0.106)	(0.105)	(0.107)	(0.108)
LoC	-0.202***	-0.126	-0.111	-0.123	-0.144*	-0.117
	(0.078)	(0.080)	(0.083)	(0.081)	(0.085)	(0.087)
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
Observations	914	914	907	913	879	873

Notes: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.
OLS regressions with standard errors in parentheses. Dependent variable is the midpoint of CRRA intervals (see Table A1, for the left- and right-censored interval, we use the upper and lower bound). Lower values indicate 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). *Big 5* consist of *Openness, Conscientiousness, Extraversion, Agreeableness, and Neuroticism*, which are standardized to a mean of zero and standard deviation of 1. *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 A15: Heterogeneous Effects – Separate Internal and External LoC

	CRRA Parameter					
	(1)	(2)	(3)	(4)	(5)	(6)
Treated	-0.522*	-0.538*	-0.503*	-0.523*	-0.540*	-0.477*
	(0.281)	(0.278)	(0.276)	(0.277)	(0.281)	(0.280)
Treated x External Scale	-0.804***	-0.816***	-0.773***	-0.805***	-0.851***	-0.780***
	(0.287)	(0.282)	(0.282)	(0.282)	(0.287)	(0.288)
External Scale	0.541***	0.337	0.233	0.327	0.380*	0.253
	(0.207)	(0.210)	(0.217)	(0.210)	(0.223)	(0.228)
Treated x Internal Scale	-0.279	-0.246	-0.287	-0.236	-0.035	-0.085
	(0.285)	(0.282)	(0.281)	(0.281)	(0.289)	(0.289)
Internal Scale	-0.026	0.001	0.080	-0.010	-0.098	-0.037
	(0.204)	(0.207)	(0.207)	(0.207)	(0.212)	(0.213)
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
Observations	914	914	907	913	879	873
Log-Likelihood	-2071.44	-2052.19	-2033.59	-2050.55	-1974.56	-1958.74

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

Interval regressions with standard errors in parentheses. Dependent variable is the CRRA parameter ρ (with lower values indicating higher tolerance for risk). External and internal scale constructed as in Table A2. Both are standardized z-scores. Covariates include: age, gender, education, parents' education, equivalized net income, marital status, household size, employment status (self-employed, unemployed, retired), citizenship, homeownership, satisfaction with health, and region (East/West Germany). *Big 5* consist of *Openness, Conscientiousness, Extraversion, Agreeableness, and Neuroticism*, which are standardized to a mean of zero and standard deviation of 1. *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.

A.3 Income Inequality and Risk Taking

Our analysis in the paper has focused on how perceived low standing in the wealth distribution shapes risk taking. In this section we provide evidence that the patterns in our data also apply if we take our relativistic approach to the societal level and look at the relationship between inequality and risk taking. There is a natural link from inequality to relative wealth as the distribution of wealth has implications for how much richer or poorer others are (Yitzhaki, 1979). It can be shown that relative rank (as a notion of relative deprivation), at the aggregate level, translates into the product of average income and Gini coefficient (Yitzhaki, 1979; Hey and Lambert, 1980). We focus here on income inequality as information on income is more broadly available than data on wealth. The reported findings are based on the 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 4.4) 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.[21] Table A16 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.[22]

In summary, these results illustrate that our evidence has broader significance: it aggregates up to the societal level and extends beyond perceptions. The WVS results indicate that countries with greater income inequality are characterized by less risk aversion in the population and that there is substantial heterogeneity in these preferences along individual-specific beliefs. 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 relative standing causes a much greater willingness to take risks.

[21] 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.

[22] That actual inequality is related to risk taking behavior suggests that prolonged periods of high or low inequality may have lasting effects on behavior (see e.g., Malmendier and Nagel (2011) and Roth and Wohlfart (2018) for evidence on the impact of economic conditions, such as recessions or inequality, during the formative years on preferences.

Table A16: Cross-Country Regressions: Inequality and Locus of Control (LoC)

	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 × 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. Indicate how much freedom of choice and control you feel you have over the way your life turns out (Scale from 1 – "a great deal" – to 10 – "none at all")." *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).

A.4 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?*