Status, Control Beliefs, and Risk-Taking*

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Abstract

We show that relative standing in the wealth distribution shapes individuals' willingness to take risks. Using a large-scale representative survey, we manipulated respondents' perceived relative standing by randomly varying the range of response categories when asking about their wealth level. Respondents who are induced to perceive their relative wealth 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 heterogeneity in individual-specific 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 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 relativistic foundation of risk preferences is therefore essential to predicting behavioral responses to relative concerns across domains. Yet, empirical evidence on this relativistic foundation remains scarce.

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 minimal. The relative attractiveness of choices that entail different degrees of risk may depend on the decision maker's initial position and taste for relative improvements. Recent theoretical work made progress in modeling the interdependence between relative concerns and risk-taking by explicitly incorporating considerations for status and rank into the utility function (Robson, 1996; Becker, Murphy and Werning, 2005; Ray and Robson, 2012; Kuziemko et al., 2014; Hopkins, 2018). Most of this work confirms the Friedman-Savage conjecture that risk-taking mainly occurs in the middle of the distribution where status gains are likely substantial.[2] Newer work, on the other hand, predicts that risk-taking happens at the bottom of the distribution, where rewards from risk-taking can be significant.

The first contribution of our study is to present representative evidence of the causal link from relative wealth to risk-taking. Our findings challenge the theoretical predictions in the tradition of Friedman and Savage (1948) and instead suggest a concentration of risk-taking at the lower end of the distribution. The second contribution we make is to delve deeper into the 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

[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 relationship between wealth rank and risk-taking behavior. They construct a utility function with concave and convex parts; such that large enough gambles might induce people to accept risk to move up the wealth distribution. Gregory (1980) has illustrated how relative comparisons can rationalize Friedman and Savage's argument.

focus on locus of control, which is the individual disposition to perceive life outcomes as within one's control or, alternatively, as predominantly the result of luck or fate (Rotter, 1966). We show that this belief system moderates the relationship between relative standing and risk-taking and discuss the underlying reasons below.

Our two contributions build on an experiment we implemented 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. More precisely, we measure risk-taking through an easy-to-understand lottery choice task that is well suited for eliciting risk preferences in general population samples and that allows us to estimate individual risk aversion parameters using a standard utility function framework. We face two major empirical challenges in credibly testing the impact of relative standing on risk preferences. 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.[3] That is, we take respondents' rank in the wealth distribution as given and manipulate their *perceived* relative standing in the wealth distribution.

For this purpose, we ask respondents about their net wealth and randomly vary the range of response categories of the question. We build here on research in social psychology, showing that response scales carry information about the population distribution (e.g., Schwarz et al., 1985; Haisley, Mostafa and Loewenstein, 2008). 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 the 20th percentile and the highest category starting at the 60th percentile (control condition). The randomization ensures that the objective income and wealth distribution is the same across treatment and control while it creates, at the same time, exogenous variation in perceived relative standing that we can use to isolate its causal

[3]Evidence, for example for the US, suggests that individuals have limited knowledge about the wealth distribution and systematically underestimate wealth inequality (Norton and Ariely, 2011). Related, people tend to underestimate their relative income rank nationally and globally but adjust these beliefs in response to information about their actual ranks (e.g., Cruces, Perez-Truglia and Tetaz, 2013; Karadja, Mollerstrom and Seim, 2017; Fehr, Mollerstrom and Perez-Truglia, 2022*b*,*a*).

effect on risk-taking. To illustrate, consider, 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. Thus, the treatment condition induces a perception of low relative standing: respondents feel that their wealth is at the lower end of the distribution and further away from the top, whereas this is not the case in the control condition.

Our "first-stage" results confirm this intended variation in perceptions and show that the wider wealth intervals in the treatment condition led the overwhelming majority of respondents to locate themselves at the lower end of the distribution and perceive a larger gap to the top. Focusing on relative income to minimize possible anchoring and demand effects, we show that treated respondents estimate a 29 percent higher household income threshold for being richer than 90 percent of others compared to non-treated respondents. In addition, we complement the "first-stage" evidence with a manipulation check using a different study sample to show that the intervention affects relative wealth perceptions but not absolute wealth perceptions. This manipulation check demonstrates that treated respondents think they rank lower in the wealth distribution than non-treated respondents (and are thus poorer than others) and that the treatment shifts the perceived wealth level at the top but not in the middle of the distribution. Together, this shows that the treatment condition induced a feeling of low relative standing in the wealth distribution.

We present two main findings. First, we find that our intervention translates into a sizable treatment effect. That is, treated respondents who are induced to perceive their relative 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 a shift of 19 percent relative to the control group mean and implying less risk aversion. This finding resonates with recent theoretical models predicting risk-taking at the bottom of the distribution—for example, Hopkins (2018) models relative concern as a competition for societal rewards. Rewards are allocated according to spending on conspicuous consumption, which makes fair gambles particularly attractive for individuals at the lower end of the initial wealth distribution. Taking more risk is their only option for rising in the wealth hierarchy.

Second, the treatment effect is driven by control beliefs. This individual-specific belief system forms early in life and has a significant degree of short- and medium-term stability (Cobb-

Clark and Schurer, 2013; Fitzenberger et al., 2021). We argue that control beliefs shape the response to relative standing for two reasons. First, psychological research suggests that 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 (e.g., Testa and Major, 1990; Aspinwall and Taylor, 1993; Buunk and Gibbons, 2007; Fiske, 2011). We present direct evidence from the SOEP of the positive relationship between external control beliefs and interest in relative comparisons. Given that external control beliefs are negatively correlated with a range of important life outcomes, this may, in part, reflect that the 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 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 reasonable extent on the availability of alternatives, such as investments in human capital or increased effort on the job. However, an external belief system may render these options less attractive as they rely more on one's efforts and abilities. In the spirit of Borghans et al. (2008), a person's locus of control can thus act as a (perceived) constraint on the set of strategies available to improve relative standing.

Consistent with this idea, we find that respondents who are more inclined to believe that life outcomes are a matter of luck and fate (external locus of control) substantially increase their risk-taking, as predicted. In contrast, respondents believing in having control over their lives do not respond to our treatment. Moreover, 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. This heterogeneous response to relative concerns provides a novel perspective on the attractiveness of risk-taking at the bottom that theoretical models do not account for.

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 (Big 5, self-control, and optimism), emotions, and socio-demographic characteristics do not moderate the observed relationship. Moreover, 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 affects how much richer others are. At the aggregate level, this

[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., 2022).

notion of relative deprivation is 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 linked to lower risk aversion and that external control beliefs moderate this relationship.

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; 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).[5] 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 familiar and natural experience, namely the relative position 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; Kirchler, Lindner and Weitzel, 2018; Schwerter, 2020).[6] The experiments in this literature let participants make risky decisions involving their laboratory earnings and randomly vary whether the earnings or relative ranking 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 mitigates concerns about experimenter demand effects and does not need to rely on randomly assigned income ranks but endogenously creates social comparisons concerning individuals' standing in the economic hierarchy of society.[7] In this

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

[6]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; Alaoui and Penta, 2022).

[7]Kuziemko et al. (2014) demonstrate that, even if randomly assigned, such income ranks matter for risk-taking

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 on social comparisons 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 are key 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, 2021). While a current debate in this field is whether preferences and personality traits are complements or substitutes in explaining economic behavior (Becker et al., 2012; Jagelka, 2020), we focus on how individual-specific beliefs moderate social factors that shape risk preferences. In a related fashion, other work has shown that LoC is related to prosocial behavior (Andor et al., 2022), job search (Caliendo, Cobb-Clark and Uhlendorff, 2015), job training (Caliendo et al., 2022), and investment decisions (Pinger, Schäfer and Schumacher, 2018). Our findings illustrate that psychological primitives can play an essential role in explaining heterogeneity in risk preferences.

2 Research Design

We run our study in the German Socio-Economic Panel (SOEP), a nationally representative longitudinal study of German households (see Goebel et al., 2018, for more details). The SOEP includes an Innovation Sample (SOEP-IS), which consists of several independent and representative samples. Researchers can propose their own modules in one or more of these samples. Participating households in the SOEP-IS 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 prevents information look-up and communication within households (for more detailed information, see Richter and Schupp, 2015).

behavior in a lab setting.

2.1 Design of the Survey Module and Measures

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

Locus of Control. 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 agree or disagree 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).[8] 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 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. While using a single measure for LoC makes the interpretation more straightforward, other measures differentiate explicitly between external and internal LoC scores. As discussed in more detail in Section 3.4, our heterogeneity results do not depend on the choice of the construction of the measure for LoC.

Treatment Manipulation. The second part contains our treatment manipulation intending to induce variation in the perceived relative standing in the wealth distribution. For this purpose, we explain the concept of net wealth and ask respondents to indicate their net wealth using five predefined wealth categories. We randomly vary the range of available response categories (see Table 1). Half of the respondents receive categories with wide intervals (treatment condition), i.e., *less than €275,000; €275,001 to €468,000; €468,001 to €722,000; €722,001 to €989,000; more than*

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

€989,000. The other half of respondents are assigned to the control condition with 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*.[9]

This manipulation builds on research showing that response scales inevitably carry information about the population distribution. Specifically, psychological and survey research suggests that respondents use their own location on the scale to determine their place in the distribution (e.g., Schwarz et al., 1985; Rockwood, Sangster and Dillman, 1997; Menon, Raghubir and Schwarz, 1997; Bertrand and Mullainathan, 2001). In our case, the lowest interval in the treatment condition covers 80 percent of the German net wealth distribution, implying that 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. Therefore, the treatment induces respondents to perceive their relative wealth as low, which is not the case in the control condition. At the same time, the random assignment to the two conditions ensures that the actual distribution of income and wealth is, on average, the same in both groups, thus keeping absolute wealth levels constant.

Several features of the manipulation are worth highlighting. First, 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). Second, the treatment variation in perceptions is non-persistent in nature but allows us to isolate the causal effect of relative concerns on risk-taking. Third, respondents receive information about the wealth distribution in the control and treatment groups. Consequently, the treatment variation comes from differences in this information and is orthogonal to prior perceptions about relative wealth and other unobserved and observed individual characteristics. This is also important for analyzing heterogeneity in LoC as perceived relative wealth may depend on individual characteristics (such as LoC).

Risk-Elicitation Task. Directly after the wealth categorization, respondents participate in a risk-preference elicitation task. We use a choice set that requires respondents to make a single choice from a set of six gambles (Binswanger, 1980; Eckel and Grossman, 2002). Each gamble has an equal chance of yielding a low or a high payoff. While the first gamble guarantees respondents a payoff

[9] We constructed the intervals based on the most recent data on the German wealth distribution at the time of the survey. The upper bounds of the intervals correspond to the 20th, 30th, 40th, and 60th percentile of the distribution in the control condition and 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).

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), yet still rich enough to obtain detailed utility information.[10] We incentivized the task by randomly selecting one in ten respondents and paying them the outcome of their chosen gamble. It is also important to note that while the lottery stakes are sizeable, they are likely insufficient to generate large jumps along the wealth distribution. However, we can rationalize the results if we consider relative wealth informative of more short-term relative consumption budgets.[11]

2.2 Data

Setting and Implementation. We collected data from a representative sample of 1,115 individuals using the 2017 wave of the SOEP-IS (Sample I3). Our study requires that respondents participate in the risk-preference elicitation task. Because respondents could refuse to do so, we included 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).[12] In Section 3.4, 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 entire 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, 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 schooling, vocational training, and university education.[13] In addition, we include the

[10] 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.

[11] 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.

[12] Respondents could not condition their participation on the lottery stakes because they only received some general explanation of the elicitation task before they had to indicate their participation decision.

[13] We use this scheme instead of years of schooling because of the early tracking in German schools the same years of schooling do not necessarily mean the same level of educational attainment.

educational background of both parents by using eligibility for attending university (a completed *Abitur*) as a proxy for their educational attainment. We also control for baseline risk using a qualitative measure of general risk aversion measured on a scale from 0 to 10 (very willing to not willing to take risks) before the treatment. Finally, we construct a wealth measure from household information on assets and housing following Fuchs-Schündeln and Schündeln (2005) and consider homeownership, which is the most important component of wealth in Germany below the top 1% of the wealth distribution (Schröder et al., 2020), as a proxy for wealth.

Balance. In Table A3, we present p-values from a set of linear regressions assessing the balance of observables by treatment status. The results of these regressions (including an F-test for joint significance of all variables) indicate that the treatment and control groups are very similar along these observables. Nevertheless, we will show all empirical results with and without covariates. Finally, in Table A4, we present the same exercise for LoC and other personality traits. Again, the table indicates that these traits are well-balanced across the treatment and control groups.

3 Main Results

3.1 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 wealth. 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.

Respondents' categorizations are also reflected in their absolute wealth. For example, the average wealth in the lowest treatment category (ranging to the 80th percentile) is about €127,000, comparable to the average wealth of €126,000 in the four lowest control categories that range up to the 60th percentile. Similarly, the average wealth in the highest control category is close to the level in the four highest treatment categories (€ 427,000 vs. € 370,000).[14] This alignment of sorting in absolute wealth across conditions in our data implies that respondents do have an accurate assessment of their own absolute level of wealth. Thus, our treatment manipulation is unlikely to have an effect on perceptions of absolute wealth.

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 demand effects and anchoring, we deliberately focused on respondents' perceptions about the relative income distribution and placed the question in a subsequent and unrelated survey module.[15] We ask respondents to estimate the household income above which they are richer than 90 percent of other households. If the treatment successfully induced a perception of lower relative standing in the wealth distribution, 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 29 percent higher compared to what untreated respondents think (column 1).

We complement these first-stage results with a separate manipulation check to provide more direct evidence of how our intervention affects behavior (see Section A.1 for more implementation details). More precisely, we show that our treatment affects how respondents perceive the overall wealth level (i.e., the median and 90th wealth percentile) and their relative position in the wealth distribution. Columns 2–4 in Table 2 show the results from this exercise. The estimates for the net wealth at the median and 90th percentile are higher among treated respondents (columns 2 and 3). However, the effect on the 90th percentile is substantially more pronounced and significant, implying that treated respondents perceive an asymmetric shift in the distribution at the upper end.[16] The last column shows how respondents compare their net wealth to other households: treated respondents think they rank significantly lower in the wealth distribution than non-treated respondents and thus perceive themselves as poorer.[17] These findings further illustrate that the

[14]We see a similar pattern if we look at homeownership as a proxy for wealth, which is not surprising given the strong correlation between wealth and homeownership ($\rho = 0.58$).

[15]Both measures should alleviate concerns that the "first stage" merely reflects numerical anchoring effects (or demand effects) because it is assumed that 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.

[16]In Section 3.4 and Appendix A.2, we elaborate further on the link of relative comparisons to inequality. We provide evidence for a link between inequality and individuals' risk preferences and show that this link is moderated by control beliefs.

[17]Related, when asked how their wealth situation compares to other German households, in the treatment condition,

intervention affects relative wealth perceptions but not absolute wealth perceptions.

In summary, we take these results as evidence that exposing respondents to wider wealth intervals in the treatment condition generated a very strong "first stage," significantly shifting respondents' views about whether their relative standing in the wealth distribution is low or not.

3.2 Average Treatment Effect

We now analyze how perceived relative standing in the wealth distribution impacts respondents' willingness to take risks. To investigate this effect, we follow standard practice in the literature and assume that individuals 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).[18] 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. 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 model the unobserved risk preference parameters as a latent variable that is linear in its covariates:

$$CRRA_i^* = \tau \times Treatment_i + \beta_1 \times BaselineRisk + \mathbf{X_i'}\boldsymbol{\beta}_2 + \epsilon_i, \quad (1)$$

where *Treatment* is an indicator for being induced to think that one's own wealth is at the lower end of the wealth distribution, Baseline Risk is a qualitative risk measure elicited prior to the treatment, and **X** includes a constant term and our standard set of socio-demographic variables, as outlined in Section 2.2 (see also Table A3).

Assuming $\epsilon \sim \mathcal{N}(0, \sigma_\epsilon^2)$, we can use the mapping of observed lottery choices into theoretical intervals of CRRA values to estimate the parameters of model (1) by maximum-likelihood. For example, the choice of lottery 3 is consistent with a CRRA parameter on the interval $[0.821, 1.74]$.

only 22 percent say it is better or much better (compared to 30 percent in the control condition, t-test, $p < 0.01$).

[18] 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).

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., $Pr(0.821 \leq CRRA_i^* < 1.74)$. Note that this estimation procedure is tightly linked to an ordered probit model. The difference lies only in the fact that we construct the intervals for the latent variable, $CRRA_i^*$, based on economic theory, whereas in an ordered probit model, we would additionally need to estimate these boundaries. In Section 3.4, we present evidence that our results do not depend on this specific functional form of utility.

Risk Parameters. In a first step, we estimate the parameters of model (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 are 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).

Next, we relate our incentivized measure of risk preferences to the qualitative baseline risk measure. 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 this relationship as well. We see a strong correlation between our incentivized risk measure (which differs from the validation instrument in the previous literature) and baseline risk. 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 on risk preferences, we repeat the estimation of (1) for the full study sample. Table 3 presents the estimates. Column (1) includes a treatment indicator, baseline risk attitudes, and a constant, whereas column (2) also adjusts for our set of covariates. Following the theoretical reasoning above, the treatment effect is negative, indicating a decrease in risk aversion. Unsurprisingly, given the random assignment, the estimated effect is similar in both cases. The estimates point to a reduction in the measured CRRA parameter of roughly 0.53-0.56. Compared to the control group mean of 2.86, this amounts to a change of about 19 percent. Figure 1 illustrates the result from column

(2). It shows a sizeable shift of the predicted CRRA parameter ρ towards lower values in the treatment condition, meaning less risk aversion. In line with the structural estimates from Table 3, we show that respondents in the treatment group have a five percentage points lower propensity to choose the safe lottery, offering a sure payoff of 50€, relative to a mean of 23% in the control group ($p = 0.047$, see Table A6). Together, this is evidence of less risk aversion if respondents perceive to be at the lower end of the wealth distribution.

To put the result into perspective, we 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 two 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.

3.3 Moderating the Effect: Locus of Control

We now turn to our second contribution and identify the respondents who are particularly likely to respond to relative concerns with increased risk-taking. As indicated earlier, psychological research suggests that low self-esteem and a feeling of little control over life outcomes (external LoC) are associated with a higher tendency to engage in social comparisons. Using data from the SOEP-IS, Figure 2 illustrates this relationship and confirms that the inclination to compare oneself to others increases with more external control beliefs.[19] This higher inclination to comparisons can emerge from a need to improve well-being and self-esteem through favorable social comparisons (Wills, 1981), which is more relevant to people with external control beliefs as their utility gains are presumably larger than that of internal people.[20] Therefore, inducing a feeling of low relative wealth likely triggers a stronger response among external people because more risk-taking is their only way to improve relative standing and well-being.

[19]We draw here on the Social Comparison Scale that measures an individual's disposition towards making social comparisons. This scale is part of a different and independent SOEP-IS sample ($N = 1,388$), and thus we cannot link the scale directly to our respondents (see notes of Figure 2 for more detail).

[20]Consistent with this, Figure A3 shows that the perceived wealth rank is positively related to self-esteem and negatively related to perceived monetary needs.

Descriptives. The median LoC score in our sample is 3 (average: 3.13, see Figure A1 for the distribution of LoC). The distribution of LoC indicates that the majority of respondents have internal control beliefs, which confirms previous findings from the SOEP (e.g., Nolte et al., 1997). In Table A5 (columns 5–6) and Figure A2, 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, which is associated with more external control beliefs for our qualitative and incentivized measure of risk.[21]

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 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 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.[22] 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 deviation 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 sociodemographic 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.

[21] 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 holding 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).

[22] Figure A4 shows that this effect is concentrated at respondents with an above-median LoC.

3.4 Robustness

We next address concerns about internal validity and provide evidence that our findings are robust to various alternative specifications and explanations. Specifically, we show that non-compliance with the risk elicitation measure is unlikely to bias our estimates and that 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, including baseline risk aversion (see Table A3). Therefore, it is unlikely that the main effects are driven by differential selection with respect to pre-treatment risk aversion. Second, in Table A7 we provide further evidence that non-participation in the risk-elicitation task is orthogonal to the randomly assigned treatment status. In particular, we show that non-participation in the risk-elicitation task does not differ across conditions (panel a.) and that baseline risk aversion is the same across respondents and non-respondents (panel b.) and treatment and control (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).[23] While this reduces

[23] 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.

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 emotions in moderating the treatment effect, we follow the same approach as in our analysis of personality traits above. In Table A11, we re-estimate regression (2) and control for anger, fear, and a combined measure of happiness and sadness.[24] 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 of 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.[25] 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).

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.

[24]The SOEP-IS routinely asks how often respondents experienced anger, fear, happiness, and sadness in the four weeks prior to the interview. 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).

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

Alternative Outcome Measures. Following the literature, we impose a specific functional form – constant relative risk aversion – on respondents' risk preferences. We provide two exercises to show that our results depend neither on the functional form nor the resulting estimation strategy. First, we can construct a binary risk measure for choosing the safe lottery, which does not impose any functional form. As indicated in Section 3.2, treated respondents display a lower likelihood of choosing the safe lottery than non-treated respondents (see Table A6). Second, we use the midpoint of the CRRA intervals and estimate a linear regression. While this alternative approach is less demanding in terms of distributional assumptions than interval regressions, it does not account for censoring and does not reflect uncertainty about the exact value in the interval. We present results from such regressions in Table A14. Qualitatively our conclusions do not change. Individuals with external control beliefs 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 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.

Inequality. In Section A.2, 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.

4 Conclusion

We have presented evidence for the causal link between relative concerns and risk-taking. This lends empirical credibility to a long-standing hypothesis that social components, such as status or relative position concerns, are important determinants of risk preferences. At the same time, our results challenge recent theoretical models predicting risk-taking in the middle of the distribution in response to relative concerns (e.g., Becker, Murphy and Werning, 2005; Ray and Robson, 2012). In fact, our evidence points to more risk-taking at the lower end, which is in line with papers showing that gains from improving relative standing are stepper at the bottom of the distribution (Kuziemko et al., 2014; Hopkins, 2018). Taken at face value, our results, however, highlight that the phenomenon could be widespread across the entire wealth distribution as long as one's *perceived* standing is low. This may have implications for an extensive range of economic behavior, such as saving, investment, and consumption decisions, 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 a 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 risks 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 modeling 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 cannot discriminate between the two interpretations, our findings highlight that control beliefs are essential components in the relativistic foundation of risk preferences and that their origin and implications consequently merit further study.

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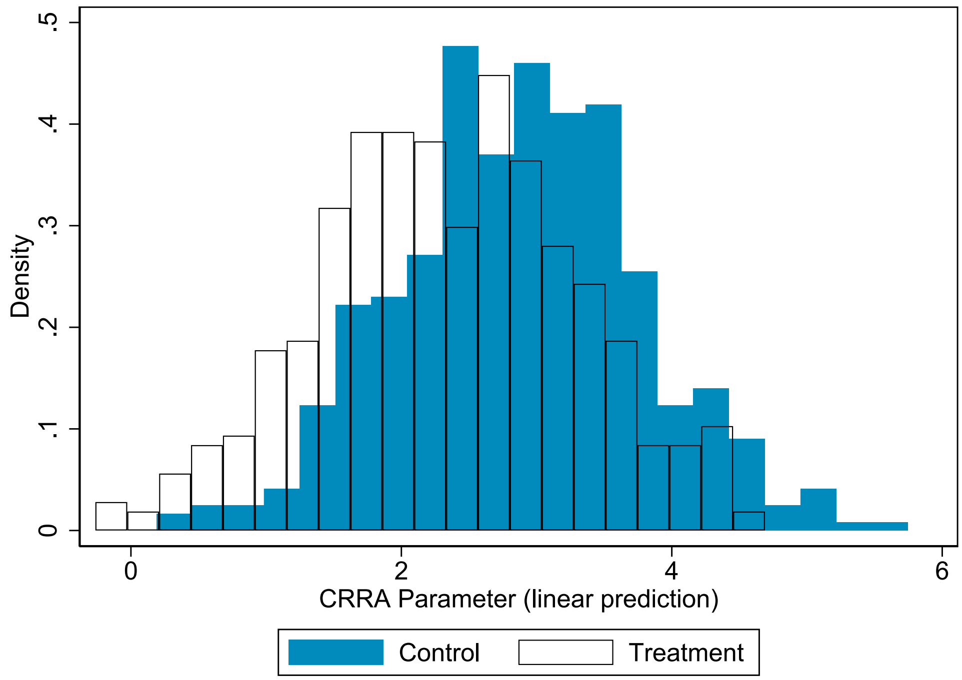
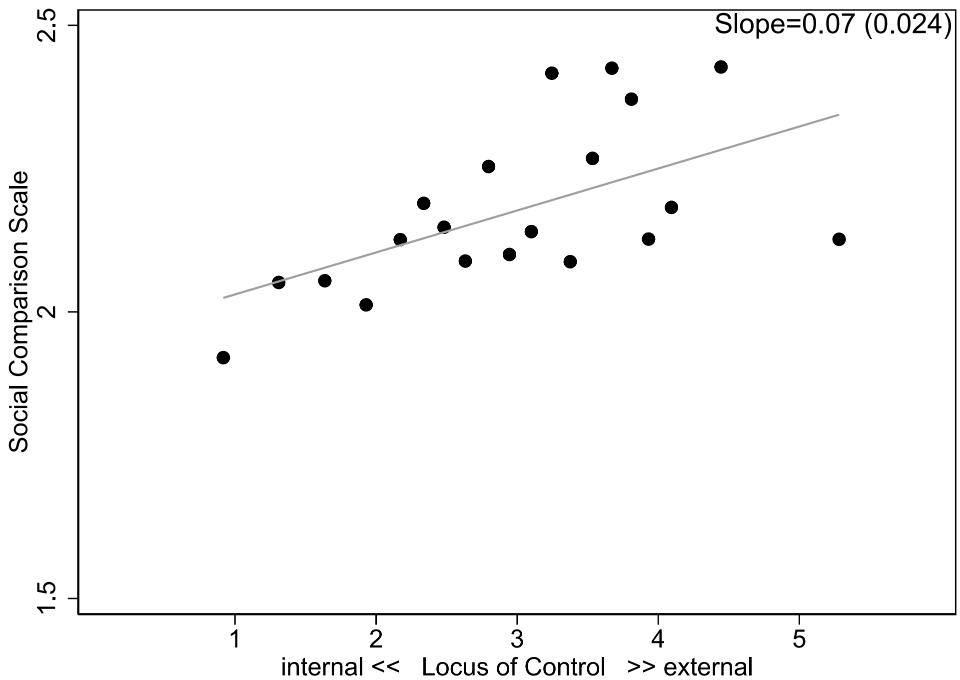
Figures

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), baseline risk aversion, homeownership, satisfaction with health, and region. Lower values of ρ indicate higher tolerance for risk. Data: SOEP-IS Sample I3.

Figure 2: Locus of Control and Relative Comparisons



Notes: Binned scatterplots of LoC and relative comparisons using data from a different representative SOEP-IS sample ($N = 1,388$). LoC is proxied by the belief that *life is mostly controlled by fate* and the belief that *working hard enough likely results in a good life*; we constructed an equally weighted index of these two beliefs with higher values indicating more external beliefs. Relative comparisons are measured with a short version of the Social Comparison Scale (Schneider and Schupp, 2011), which is an equally weighted index of three statements about a person's tendency to engage in social comparisons with higher values indicating higher dispositions towards social comparison. The statements are *I often compare myself with others with respect to what I have accomplished in life*, *I often compare my social skills and popularity with those of other people*, and *I always pay very strong attention to how I do things compared to others*. All measured on a scale from 1 (disagree strongly) to 5 (agree strongly). Control variables include age, gender, education, parents' education, equivalized net income, marital status, household size, employment status (self-employed, unemployed, retired), baseline risk aversion, homeownership, satisfaction with health, life satisfaction, and region (East/West Germany). Data: SOEP-IS Sample I2/I4.

Tables

Table 1: Wealth Categories by Treatment

Control Group		Treatment Group	
Wealth Category (in €)	*% responses*	*Wealth Category (in €)*	*% responses*
<2,500	27.05	<275,000	79.01
2,501 – 11,000	20.00	275,001 – 468,000	12.74
11,001 – 27,000	11.59	468,001 – 722,000	5.19
27,001 – 112,000	16.82	722,001 – 989,000	1.65
>112,000	24.55	>989,000	1.42

Notes: Wealth categories used in the two conditions and share of observed responses in each category. Upper bounds taken from 2014 Household Finance and Consumption Survey (HFCS, Deutsche Bundesbank, 2016). Data: SOEP-IS Sample I3.

Table 2: First-Stage Effects of Treatment and Manipulation Check

	First Stage	Manipulation Check		
	(1)	(2)	(3)	(4)
	Income Top 10%	Median net wealth	Wealth Top 10%	Rel. Wealth
Treated	0.293**	0.240	0.483**	-0.172***
	(0.139)	(0.148)	(0.231)	(0.062)
Sample	SOEP-IS	respondi	respondi	respondi
Observations	865	987	987	987

Notes: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.
GLM regressions (gamma-log; columns 1–3) and OLS regression (column 4) with standard errors in parentheses. First stage based on SOEP-IS Data and manipulation check based on respondi sample (see Section A.1). The first-stage dependent variable ("Income Top 10%") is the estimated threshold for being in the top 10% of the pre-tax household income distribution in Germany ("In your estimation, what gross annual income do you need to be in the top 10 percent of German households?"). "Median net wealth" is the estimate of the median of the wealth distribution ("What do you think is the net wealth of the household in the middle of the ladder?"); "Wealth Top 10%" is the estimated net wealth at the 90th percentile ("What do you think is the required net wealth to belong to the 10% richest households (i.e. to be on the top rung of the ladder)?"); "Rel. wealth" is a respondent's perceived rank in the wealth distribution ("What do you think is the share of households in Germany that have less net wealth than your household?"), which is standardized to zero mean and unit variance. Covariates include age, gender, education, parents' education, equivalized net income, marital status, household size, employment status (self-employed, unemployed, retired), homeownership, and region (East/West Germany). Data: SOEP-IS Sample I3 and respondi.

Table 3: Main Treatment Effects

	CRRA Parameter			
	(1)	(2)	(3)	(4)
Treated	-0.531*†	-0.561**†	-0.535*†	-0.551**†
	(0.282)	(0.279)	(0.281)	(0.277)
Treated x LoC			-0.953***	-0.952***
			(0.283)	(0.278)
LoC			0.566***	0.385*
			(0.208)	(0.213)
Baseline Risk	0.357**	0.313**	0.374***	0.342**
	(0.141)	(0.142)	(0.142)	(0.141)
Constant	2.865***	3.496***	2.885***	3.747***
	(0.199)	(1.068)	(0.198)	(1.083)
Covariates	No	Yes	No	Yes
Observations	914	914	914	914
Log-Likelihood	-2074.25	-2055.64	-2068.51	-2049.49

Notes: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$; † $p < 0.05$, p-value from randomization inference (5000 replications).

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), homeownership, satisfaction with health, life satisfaction, and region (East/West Germany). Data: SOEP-IS Sample I3.

Appendix – For Online Publication Only

Status, Control Beliefs, and Risk-Taking

Dietmar Fehr and Yannick Reichlin

A.1 Manipulation Check

Setup. After the main study, we conducted a separate survey experiment to illustrate through which channel our intervention affects risk-taking. In the initial survey, we only implemented a basic test of how the intervention affects relative standing because we had to economize on the limited survey time and wanted to minimize demand and anchoring effects. Therefore, the goal of this second survey was to directly measure the impact of the intervention on (i) respondents' perceived relative position in the wealth distribution and (ii) the perceived wealth level. For this purpose, we recruited a new sample ($N = 987$) through *respondi*, an internationally well-known panel provider, since we no longer had access to the SOEP-IS. We implemented a short survey (median duration six minutes), in which we randomized respondents into treatment and control conditions using the same intervention as in the initial survey. That is, we either presented five wealth categories with wide intervals (treatment) or small intervals (control), and respondents had to indicate into which category their net wealth falls. Note that we updated the upper bounds of the intervals according to the latest available wealth data for Germany (see Table A17).

We are mainly interested in two potential channels through which the intervention may affect risk-taking. First, we test the relative standing channel through a qualitative and a quantitative question. Specifically, we ask how respondents perceive their wealth situation relative to other households and how they perceive their relative rank in the German wealth distribution.

1. Compared to most other households in Germany, would you say that your wealth situation is ...? *[much worse, worse, the same, better, much better]*
2. What do you think is the share of households in Germany that have less net wealth than your household?

   0 percent (%) means that all households have more net wealth than your household and 100 percent (%) means that no household has more net wealth.

Second, we test to what extent the intervention affects how respondents perceive the wealth distribution. We address this issue by eliciting the perceived net wealth at the 50th and 90th percentile of the wealth distribution. To familiarize respondents with this rather involved task, we first explain the meaning of wealth distribution, how one can partition the distribution into ten equally-sized bins, and what the median and 90th percentile is. To ease understanding, we illustrate this graphically with the help of a ladder with nine rungs that indicates the bottom 10% households, the median household, and the top 10% households. Subsequently, respondents estimate the net wealth of the median household and the top 10% household using a slider displaying values according to the function $Y = 500 * e^{(0.045 * steps)}$, where steps correspond to the slider range from 0 to 200.

3. Now suppose we rank all households in Germany from lowest to highest net wealth and divide this ranking into 10 equal sections as shown on the ladder. On the ladder, the 10% poorest households would then be on the bottom rung and the 10% richest households on the top rung. The household in the middle divides the ranking into two halves, i.e. 50% of the households are richer, and 50% are poorer than the household in the middle.

4. What do you think is the net wealth of the household in the middle of the ladder?

5. You just estimated that the household in the middle of the ladder has a net wealth of *[estimated median]*€.
   What do you think is the required net wealth to belong to the 10% richest households (i.e. to be on the top rung of the ladder)?

The survey concludes with a few questions on socio-economic characteristics and attitudes, including LoC, self-esteem, and income adequacy.

Results. The results from this manipulation check show that the treatment effect on the 90th income percentile that we discuss in Section 3.1 carries over to perceptions about the wealth level. Table 2 displays the results. In columns 2–3, we show that treated respondents estimate a higher median and 90th percentile of the German household wealth distribution than non-treated respondents. However, the effect on the 90th percentile is significantly more pronounced, which illustrates an asymmetric shift of the perceived distribution with a larger perceived gap to the very top among treated respondents. In Appendix A.2 below, we elaborate further on the link between inequality, relative comparisons, and risk-taking.

In column 4, we show that treated respondents rank themselves significantly lower in the wealth distribution than non-treated respondents. We observe a similar pattern for our qualitative measure of relative wealth (question 1). Only about 22 percent say their wealth situation is better or much better than that of other German households compared to 30 percent in the control condition (t-test, $p < 0.01$). Therefore, the manipulation check further illustrates that the intervention affects relative wealth perceptions but not absolute wealth perceptions.

Finally, Figure A3 shows a strong and positive correlation between perceived wealth rank and self-esteem and a negative relationship with income adequacy (i.e., a higher rank translates into less need for money). These correlations are consistent with the idea that favorable relative comparisons boost self-perceptions and that the utility gains of such comparisons are larger for people at the lower end than at the top of the distribution.

A.2 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., 2018) and the World Value Survey (Inglehart et al., 2014).

Global Preference Survey (GPS). The GPS contains a validated risk measure, elicited in nationally representative samples of 76 countries spanning some 90% of the world's population. The risk measure is a weighted average of a qualitative self-assessment of risk tolerance akin to the qualitative measure in the SOEP (see section 3.4) and a quantitative measure of a sequence of lottery choices. We focus here on the aggregated level and compare national-level summary statistics of the risk measure with a national-level measure of inequality, the Gini index, taken from the World Bank's World Development Indicators (WDI). The two measures are significantly correlated (p=0.005) with a Pearson correlation coefficient of 0.33, suggesting that in more unequal countries, the population is, on average, more risk-tolerant (see also a recent working paper by Pickard, Dohmen and van Landeghem (2023)). 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 to 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.[26] 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.[27]

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

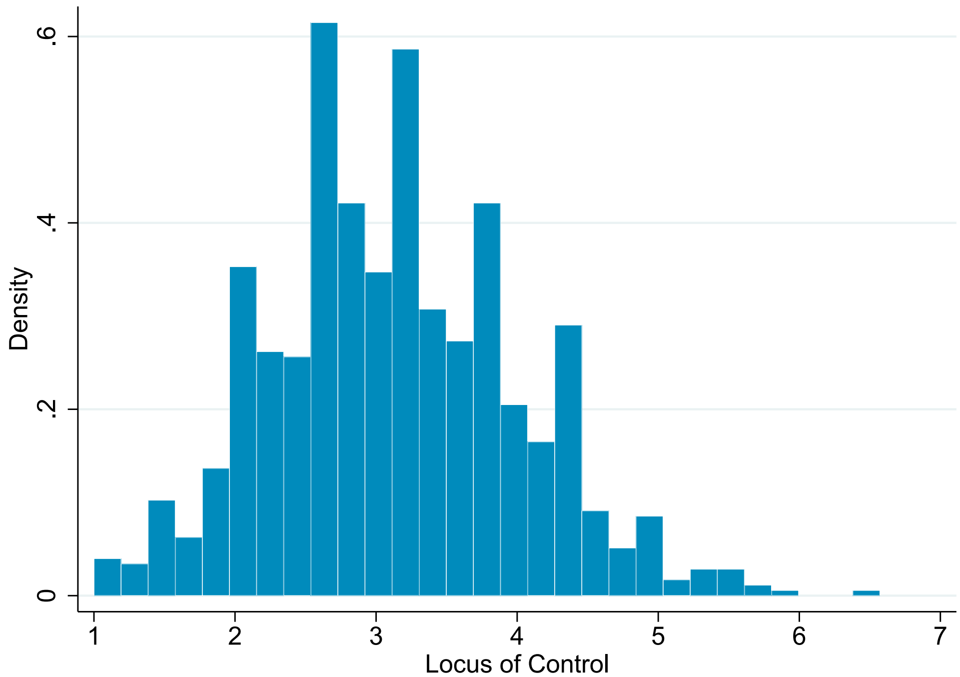
[26]The risk measure is only elicited in waves 5 (2005 – 2009) and 6 (2010 – 2014), which leaves us with a sample of 145,206 individual observations, coming from 71 countries and spanning 12 years.

[27]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.

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 one's frame of reference shapes this relationship, i.e., a (perceived) low relative standing causes a much greater willingness to take risks.

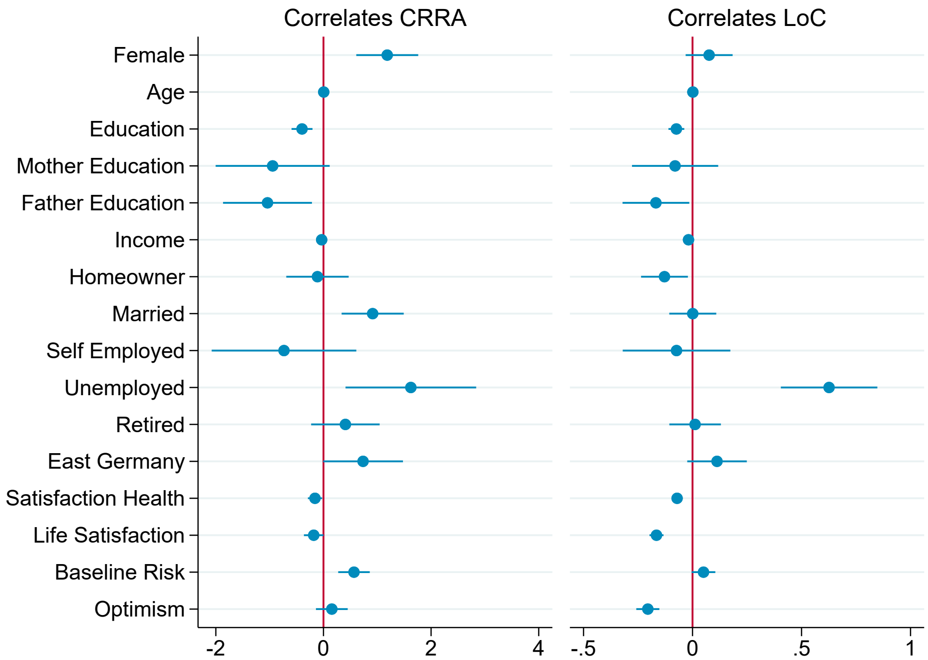
A.3 Additional Figures

Figure A1: 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. Data: SOEP-IS Sample I3.

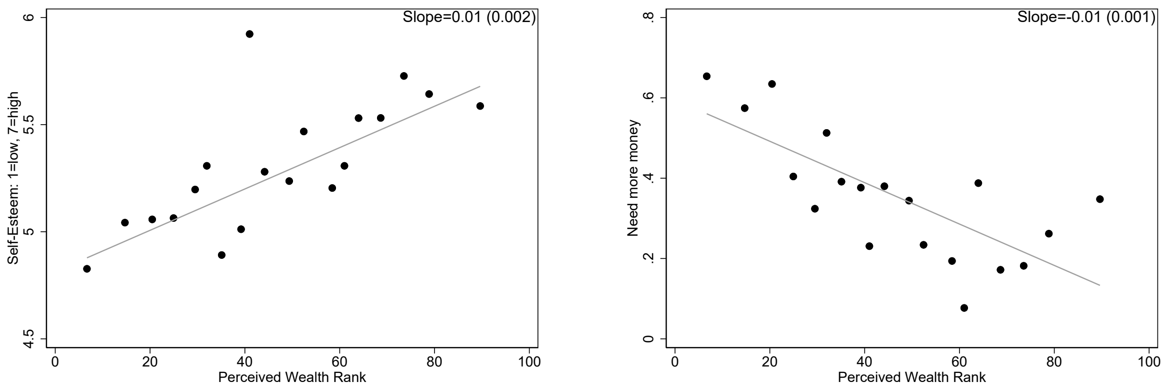
Figure A2: Correlates of Risk and Locus of Control



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. *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). *Baseline 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. Data: SOEP-IS Sample I3.

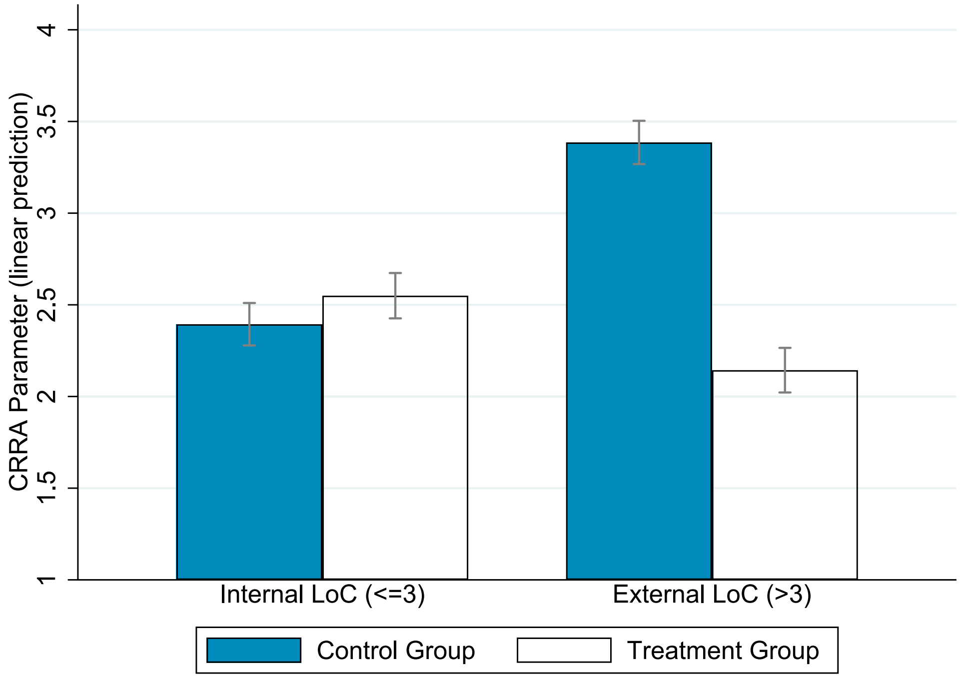
Figure A3: Perceived Relative Wealth Rank and Self Perceptions

(a) Self-esteem (b) Income adequacy



Notes: Binned scatterplot of perceived relative wealth rank and self perceptions using data from the manipulation check ($N = 987$). Panel (a) displays the relationship between perceived relative rank and self-esteem measured by agreement with statement *"I have a positive attitude towards myself"* on a scale from 1 (disagree) to 7 (agree). Panel (b) displays the relationship with income adequacy (*"Need more money to be able to live a satisfying life – yes/no"*). Data: respondi

Figure A4: 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), baseline risk aversion, 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. Data: SOEP-IS Sample I3.

A.4 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); **?**. 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. Data: SOEP-IS Sample I3.

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
Log(wealth)	10.49	10.10	0.492
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
Satisfaction with Health	6.79	6.62	0.273
Life Satisfaction	7.61	7.62	0.922
Baseline Risk	5.04	5.11	0.643
$Prob > F$			0.59

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), *Homeowner* identifies respondents who own their house or apartment, and *Log(wealth)* is the log of the estimated wealth level of the household. *Female, Married, Self-employed, Unemployed, and Retired* are indicator variables. *East Germany* is an indicator for respondents who lived in East Germany before 1990. *Satisfaction with health* is measured on a scale from 0 (completely dissatisfied) to 10 (completely satisfied). *Life Satisfaction* is measured on a scale from 0 (completely dissatisfied) to 10 (completely satisfied). *Baseline 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). Data: SOEP-IS Sample I3.

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	0.257
Self Control	-0.04	-0.06	0.773
$Prob > F$			0.966

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). Data: SOEP-IS Sample I3.

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***	-0.332**	1.185***	0.887**	0.076	0.039
	(0.149)	(0.149)	(0.415)	(0.408)	(0.078)	(0.073)
Age	0.001	0.005	0.005	-0.006	0.002	0.002
	(0.004)	(0.006)	(0.011)	(0.017)	(0.002)	(0.003)
Education	0.169***	0.121**	-0.399***	-0.318**	-0.074***	-0.045
	(0.050)	(0.056)	(0.140)	(0.154)	(0.026)	(0.028)
Mother has Abitur	0.226	-0.230	-0.944	0.419	-0.080	0.113
	(0.275)	(0.312)	(0.765)	(0.857)	(0.143)	(0.154)
Father has Abitur	0.363*	0.286	-1.040*	-0.690	-0.168	-0.064
	(0.213)	(0.235)	(0.596)	(0.647)	(0.111)	(0.116)
Income (net/month)	0.013*	0.000	-0.033*	-0.006	-0.018***	-0.011***
	(0.007)	(0.008)	(0.020)	(0.022)	(0.004)	(0.004)
Home owner	0.111	0.097	-0.112	-0.191	-0.129*	-0.061
	(0.150)	(0.161)	(0.418)	(0.442)	(0.078)	(0.079)
Married	-0.173	-0.348**	0.914**	1.314***	0.001	0.149*
	(0.150)	(0.160)	(0.416)	(0.439)	(0.078)	(0.079)
Self employed	0.444	0.058	-0.733	0.297	-0.073	0.101
	(0.343)	(0.356)	(0.969)	(0.982)	(0.178)	(0.175)
Unemployed	-0.761**	-0.575*	1.624*	1.196	0.626***	0.262
	(0.311)	(0.337)	(0.876)	(0.930)	(0.160)	(0.166)
Retired	-0.109	-0.222	0.408	0.404	0.012	-0.024
	(0.164)	(0.245)	(0.459)	(0.677)	(0.085)	(0.120)
East Germany	-0.121	-0.118	0.736	0.793	0.112	0.001
	(0.190)	(0.192)	(0.535)	(0.532)	(0.099)	(0.095)
Satisfaction with Health	0.063*	0.022	-0.157*	-0.039	-0.071***	0.004
	(0.034)	(0.040)	(0.095)	(0.109)	(0.017)	(0.020)
Life Satisfaction	0.085*	0.067	-0.181	-0.157	-0.165***	-0.123***
	(0.047)	(0.054)	(0.132)	(0.149)	(0.023)	(0.027)
Baseline Risk	-0.195***	-0.183**	0.567***	0.546***	0.050	0.028
	(0.075)	(0.075)	(0.211)	(0.209)	(0.039)	(0.037)
Optimism	-0.058	-0.114	0.155	0.305	-0.205***	-0.137***
	(0.076)	(0.079)	(0.212)	(0.217)	(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. *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). *Baseline 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. Data: SOEP-IS Sample I3.

Table A6: Treatment Effect on the Propensity to Choose the safe Lottery Option

	Full Sample		Above Median LOC		Below Median LOC	
	(1)	(2)	(3)	(4)	(5)	(6)
Treated	-0.052*	-0.053**	-0.130***	-0.138***	0.024	0.025
	(0.027)	(0.026)	(0.038)	(0.038)	(0.037)	(0.037)
Constant	0.230***	0.171*	0.275***	0.083	0.190***	0.260
	(0.020)	(0.100)	(0.030)	(0.129)	(0.025)	(0.167)
Covariates	No	Yes	No	Yes	No	Yes
Observations	914	914	452	452	462	462
R^2	0.00	0.04	0.03	0.08	0.00	0.05

Notes: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.
OLS regressions with robust standard errors in parentheses. The dependent variable is an indicator for choosing lottery 1 (sure pay-off of 50€), instead of any other lottery option (see Table A1). Columns (1) and (2) use the full sample for the estimation. Columns (3) and (4) limit the sample to individuals with above median locus of control (externals), whereas columns (5) and (6) restrict the sample to those with below median locus of control values (internals). Even columns include 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), homeownership, qualification for university (Abitur) of mother and father, and baseline risk aversion. Data: SOEP-IS Sample I3.

Table A7: Non-participation in the survey module

Panel a.)			
Non-participation in treatment and control			
	Treatment	Control Mean	N
Non-participation	0.030	0.165	1,115
	(0.023)	(0.016)	
Panel b.)			
Baseline difference in risk aversion between participation and non-participation			
	Non-participation	Participation	N
Baseline Risk	-0.152	5.078	1,115
	(0.185)	(0.078)	
Panel c.)			
Baseline difference in risk aversion of non-participators in treatment and control			
	Treatment	Control	N
Baseline Risk	0.004	4.923	201
	(0.328)	(0.242)	

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 baseline risk aversion between participating and non-participating respondents from regressing baseline risk aversion on an indicator of non-participation. Panel c) displays the difference in baseline risk aversion of non-participating respondents in treatment versus control (column Treatment) from regressing baseline risk aversion on a treatment indicator using non-participating respondents only. *Baseline Risk* is measured prior to the treatment on a scale from very willing to take risks (0) to not very willing to take risks (10). Data: SOEP-IS Sample I3.

Table A8: Results for Inverse Probability Re-Weighting

	CRRA Parameter					
	(1)	(2)	(3)	(4)	(5)	(6)
Treated	-0.570**	-0.603**	-0.603**	-0.606**	-0.611**	-0.611**
	(0.290)	(0.284)	(0.284)	(0.285)	(0.288)	(0.289)
Treated x LoC	-0.895***	-0.933***	-0.933***	-0.938***	-0.923***	-0.923***
	(0.300)	(0.297)	(0.297)	(0.297)	(0.304)	(0.304)
LoC	0.584**	0.373	0.373	0.385	0.394	0.394
	(0.228)	(0.236)	(0.236)	(0.236)	(0.248)	(0.248)
Covariates	No	Yes	Yes	Yes	Yes	Yes
Big 5	No	No	No	No	No	No
Optimism	No	No	No	Yes	No	Yes
Self-Control	No	No	No	No	Yes	Yes
Observations	914	914	914	914	879	879
Log-Likelihood	-2470.68	-2445.21	-2445.21	-2445.09	-2345.77	-2345.77

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), 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. Data: SOEP-IS Sample I3.

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

	CRRA Parameter					
	(1)	(2)	(3)	(4)	(5)	(6)
Treated	-0.525*	-0.551**	-0.551**	-0.554**	-0.555**	-0.552**
	(0.282)	(0.277)	(0.277)	(0.277)	(0.281)	(0.281)
Treated x LoC	-0.917***	-0.952***	-0.928***	-0.955***	-0.937***	-0.916***
	(0.284)	(0.278)	(0.279)	(0.278)	(0.283)	(0.284)
LoC	0.589***	0.385*	0.330	0.393*	0.409*	0.346
	(0.209)	(0.213)	(0.218)	(0.215)	(0.224)	(0.227)
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	914	914	879	879
Log-Likelihood	-2071.99	-2049.49	-2047.34	-2049.43	-1972.53	-1969.60

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), baseline risk aversion, homeownership, satisfaction with health, life satisfaction, region (East/West Germany), 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. Data: SOEP-IS Sample I3.

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	-0.561**	-0.571**	-0.563**	-0.564**	-0.562**	-0.558**	-0.559**
	(0.278)	(0.279)	(0.279)	(0.278)	(0.279)	(0.279)	(0.282)
Interaction Effect	-0.119	0.048	0.059	0.307	0.078	-0.300	-0.170
	(0.280)	(0.278)	(0.283)	(0.282)	(0.278)	(0.284)	(0.282)
Level Effect	0.309	0.150	-0.038	-0.115	0.043	0.191	0.284
	(0.200)	(0.199)	(0.211)	(0.206)	(0.203)	(0.206)	(0.205)
Observations	914	914	914	914	914	914	879
Log-Likelihood	-2054.04	-2054.89	-2055.62	-2055.01	-2055.43	-2055.04	-1978.04

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. Data: SOEP-IS Sample I3.

Table A11: Heterogeneous Effects - Locus of Control & Emotions

	CRRA Parameter					
	(1)	(2)	(3)	(4)	(5)	(6)
Treated	-0.525*	-0.551**	-0.561**	-0.549**	-0.551**	-0.563**
	(0.282)	(0.277)	(0.277)	(0.277)	(0.277)	(0.276)
Treated x LoC	-0.917***	-0.952***	-0.946***	-0.947***	-0.950***	-0.937***
	(0.284)	(0.278)	(0.278)	(0.278)	(0.278)	(0.277)
LoC	0.589***	0.385*	0.415*	0.348	0.391*	0.388*
	(0.209)	(0.213)	(0.214)	(0.214)	(0.215)	(0.215)
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	-2049.49	-2048.63	-2047.42	-2049.47	-2045.55

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), baseline risk aversion, 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). Data: SOEP-IS Sample I3.

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). Data: SOEP-IS Sample I3.

Table A13: Heterogeneous Effects - Socio-economic Characteristics

	CRRA Parameter			
	(1)	(2)	(3)	(4)
	Female	Unemployed	Income	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. Data: SOEP-IS Sample I3.

Table A14: Main Treatment Effects – Interval Midpoint

	CRRA Parameter (midpoint)					
	(1)	(2)	(3)	(4)	(5)	(6)
Treated	-0.486*	-0.498*	-0.491*	-0.501*	-0.508*	-0.498*
	(0.279)	(0.278)	(0.278)	(0.278)	(0.283)	(0.283)
Treated x LoC	-0.929***	-0.953***	-0.940***	-0.956***	-0.950***	-0.940***
	(0.280)	(0.278)	(0.279)	(0.278)	(0.284)	(0.286)
LoC	0.561***	0.385*	0.310	0.392*	0.400*	0.321
	(0.206)	(0.213)	(0.218)	(0.214)	(0.225)	(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	914	914	879	879

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), baseline risk aversion, 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. Data: SOEP-IS Sample I3.

Table A15: Heterogeneous Effects – Separate Internal and External LoC

	CRRA Parameter					
	(1)	(2)	(3)	(4)	(5)	(6)
Treated	-0.523*	-0.553**	-0.550**	-0.555**	-0.549*	-0.544*
	(0.281)	(0.277)	(0.276)	(0.277)	(0.281)	(0.280)
Treated x External Scale	-0.790***	-0.818***	-0.793***	-0.820***	-0.853***	-0.833***
	(0.287)	(0.281)	(0.282)	(0.282)	(0.286)	(0.286)
External Scale	0.535***	0.311	0.236	0.315	0.351	0.272
	(0.207)	(0.209)	(0.216)	(0.210)	(0.222)	(0.226)
Treated x Internal Scale	-0.279	-0.253	-0.270	-0.253	-0.045	-0.050
	(0.285)	(0.281)	(0.281)	(0.281)	(0.289)	(0.289)
Internal Scale	-0.025	-0.007	0.021	-0.005	-0.105	-0.077
	(0.204)	(0.206)	(0.207)	(0.206)	(0.211)	(0.212)
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	914	914	879	879
Log-Likelihood	-2071.57	-2049.45	-2047.29	-2049.42	-1972.80	-1969.92

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), baseline risk aversion, 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. Data: SOEP-IS Sample I3.

Table A16: Inequality and Locus of Control

	Risk Aversion			
	(1)	(2)	(3)	(4)
Inequality: Gini	-1.185**	-0.756*	-0.169	-0.275
	(0.456)	(0.431)	(0.364)	(0.367)
Inequality x LoC	-0.482**	-0.322**	-0.295***	-0.278**
	(0.200)	(0.160)	(0.110)	(0.118)
LoC	0.253***	0.161***	0.164***	0.157***
	(0.075)	(0.060)	(0.043)	(0.046)
Constant	0.447**	-0.264	-0.286*	-0.323**
	(0.171)	(0.233)	(0.145)	(0.132)
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	0.11	0.12

Notes: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.
OLS regressions on the relationship between income inequality and risk aversion using data from the *World Value Survey*. Standard errors, clustered at the country level, in parentheses. 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, and employment status. *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). Data: World Values Survey: wave 5 and 6.

Table A17: Wealth Categories by Condition – Manipulation Check

Control Group	**Treatment Group**
Up to 3,000€	Up to 334,000€
3,001€ to 11,800€	334,001€ to 555,400€
11,801€ to 31,200€	555,401€ to 861,600€
31,201€ to 131,000€	861,601€ to 1,292,100€
More than 131,000€	More than 1,292,100€

Notes: Wealth categories used in the control and treatment condition. Upper bounds taken from 2017 Household Finance and Consumption Survey (HFCS, Deutsche Bundesbank, 2019).

A.5 Survey Module – SOEP-IS

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 do you need to be in the top 10 percent of German households?*