Skill, effort, luck:

The impact of rankings on risk-taking

in a social setting*

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Abstract Social comparisons and rankings in the wealth distribution impact risk-taking decisions. We provide experimental evidence that rankings have a differential impact on risk-taking decisions based on what aspect individuals are ranked. We observe the largest rank-based differences when individuals are ranked based on their effort or on skill. Compared to individuals who ranked first, individuals who ranked third in these settings increase their risk-taking by, on average, 17.39 percentage points (pp). In luck-based rankings, the effect size is significantly smaller (11.34 pp).

Keywords: decision under risk, risk-taking, social ranking, peer effects

EFM Classification: 720, 320

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1 Introduction

Rankings matter in many different domains ranging from life satisfaction to financial decision-making. While a large body of literature discusses the impact of financial comparisons on individuals' risk-taking decisions (e.g., Gortner and van der Weele, 2019; Kirchler et al., 2018; Klocke et al., 2022; Lindskog et al., 2022; Schwerter, 2022), less attention has been paid to the source of the ranking that allows for social comparisons. In this paper, we argue that there is a differential impact of social comparisons depending on what determines the ranking. We hypothesize that rankings based on skill or effort activate ranking-induced risk-taking to a larger degree and therefore lead to stronger differences in investment behavior depending on rank. We provide experimental evidence to support this notion.

People constantly engage in social comparisons to decrease the feeling of *social uncertainty* (Festinger, 1954). The literature provides convincing evidence that people integrate comparisons on, e.g., consumption choices, into economic decision-making as a source of utility. For example, Abel (1990) discusses the "keeping up with the Joneses" effect and names other people's consumption as one possible source of consumption habit formation. Fehr and Schmidt (1999) and Bolton and Ockenfels (2000) develop models where individuals have preferences regarding comparisons with others, which determine their economic decisions jointly with their preferences about their own consumption. Boyce et al. (2010) argue that individuals' life satisfaction decreases if they know that other people have higher income. Schoenberg and Haruvy (2012) point out that social comparisons of financial investments result in a lower level of satisfaction with one's performance.Fliessbach et al. (2007) provide neuroscientific evidence that social comparisons activate reward-related brain regions. Given this evidence, it is not surprising that a large body of literature finds evidence to support the notion that social comparisons have important repercussions for risk-taking.

Rankings are an explicit form of social comparisons. Individuals and observers learn who is better off than others and who is lagging behind. While the literature offers

supporting evidence for the notion that rankings influence risk-taking, it has not yet been investigated whether there is an impact of the rank determinant on risk-taking as many studies (see, e.g., Linde and Sonnemans, 2012; Schwerter, 2022) randomly assign endowments and, thus, ranks. We find that the source of a ranking matters for risk-taking and, accordingly, impacts (economic) decision-making.

In this paper, we consider rank-determining factors to be luck, skill, and effort. The key distinction between these three factors is the degree of an individual's influence. The outcome of a ranking based on luck is completely outside of the control of the individual and is, therefore, exogenous. A ranking purely based on luck allows individuals to blame external factors for a low ranking and thereby impede the internalization of negative emotions (see literature on biased self-attribution by, e.g., Fischhoff and MacGregor, 1982; DeLong et al., 1991). In contrast, low rankings based on individually influenceable (endogenous) factors more likely result in a negative emotional impact. Although individuals may still try to blame external factors for failure, it may require more effort to shift the blame. Consequently, the utility impact of the ranking is larger for a ranking based on factors within the realm of individual influence. Skill and effort are (to some degree) under the control of the individual. Skill is endogenous in the long run, but usually not in the short-run; while the required skills for a particular challenge are not under the immediate control of an individual in a given situation, we usually expect that individuals can improve their skill levels in the long-run. Finally, effort is completely endogenous and can be influenced easily and to a high degree. No matter what the task at hand is, one can always exert oneself.

In three incentivized treatments, we rank participants based on factors that are either randomly assigned (luck treatment) and therefore exogenous or endogenous (skill treatment and effort treatment). In the skill treatment, we rank participants based on their results on a financial literacy test, and in the effort treatment, we rank participants based on their score on a real effort task. We choose financial literacy as it provides an economic context and is highly relevant for a large array of economic decisions. According to Atkinson and Messy (2012) "[f]inancial literacy is rapidly being recognized as a core

skill".[1] Unlike in the luck treatment, in the latter treatments, ranking is not completely exogenous and not solely based on a random mechanism. Knowing their rank, participants solve a standard-portfolio problem based on Gneezy and Potters (1997). Consistent with the literature, we find participants with lower rankings to be more risk-taking (e.g., Linde and Sonnemans, 2012; Nieken and Sliwka, 2010; Schwerter, 2022; Kirchler et al., 2018, 2020; Hillebrandt and Steinorth, 2020). Adding to the literature and in line with our hypothesis, we find that risk-taking at lower ranks is more pronounced in the skill treatment and in the effort treatment than in the luck treatment. With respect to effect sizes, we find that individuals who rank third in the effort or skill treatment increase their risk-taking by 17.39 percentage points (pp), on average, relative to that of individuals who rank first. This effect size amounts to only 11.34 pp in luck-based rankings.

Our findings have important implications for a better understanding of the impacts of rankings on risk-taking. Being ranked low based on luck impacts risk-taking substantially less than being ranked based on skill or effort. In many situations, even those that extend beyond economic decision-making, individuals' performances are measured in relation to others'; this may be related to their abilities or effort. For example, in school, children are ranked by a comparison of their grades. Our findings indicate that low rankings related to personal abilities or effort may increase risk-taking, for example, by increasing the prevalence of cheating. Similar situations may arise in the workplace. Importantly, effect sizes may be larger than the literature based on random rankings suggests.

The remainder of the paper proceeds as follows. In the next section, we develop our hypotheses. Section 3 presents the experimental design and introduces our variables. We discuss our findings in Section 4. The final section concludes the paper.

[1]Note that financial literacy can also be considered to be partial knowledge, in line with OECD/INFE (2020). Knowledge, just like a particular skill, is context specific and can be influenced in the long term but not in the short term. Accordingly, the key aspects of a skill that are important for our study also apply to knowledge.

2 Literature and hypotheses

Social comparisons are an important aspect of human interaction. In contrast to the assumption based on homo economicus that individuals think and act exclusively from an economic point of view, comparing ourselves to others impacts our utility. Festinger (1954) argues that people engage in social comparisons to decrease a feeling of social uncertainty. Kuziemko et al. (2014) coin the term *last-place aversion* and show that individuals have strong preferences for not being placed last. Fliessbach et al. (2007) show that social comparisons activate reward-related brain regions.

Thus, rankings that compare one individual with other individuals have important repercussions for financial decision-making and risk-taking. If the ranking correlates to future income, for example, homo economicus will take the ranking into account for her decision making. Consider a workplace setting where rankings are utilized to determine compensation, job termination, and career advancement. The extensive literature on managerial risk-taking (for example, Bodnar et al., 2019; Devers et al., 2008; March and Shapira, 1987) shows how compensation schemes and career concerns affect risk-taking decisions. Yet, this literature primarily focuses on the question of how monetary incentives from a ranking-induced anticipated future income stream impact current risk-taking decisions. For example, managers may take on riskier projects when they hold stock options that become valuable when the firm's stock price exceeds a certain threshold but they are not exposed to the downside of their decisions.

However, rankings may also impact risk-taking in settings that go beyond an impact on future consumption and when the ranking is not correlated with future income (Gortner and van der Weele, 2019; Hillebrandt and Steinorth, 2020; Linde and Sonnemans, 2012; Andraszewicz et al., 2022). A large stream of literature investigates the direct impact of rankings on risk-taking rather than focusing on the impact of the financial consequences of potential rankings on risk-taking. The general consensus in this literature is that individuals take more risks when they are placed lower in the rankings (Kuziemko et al., 2014; Schwerter, 2022). Based on this discussion, we derive our baseline hypothesis as

follows:

Hypothesis 1. *Lower rankings lead to higher risk-taking.*

The main contribution of our paper is to investigate whether there is a differential impact of rankings on risk-taking depending on the factor that determines the ranking. In general, rankings can be determined by various factors. For example, rankings can be determined by the skill set of all participants in the ranking, by the effort that all participants in the ranking invest in a particular task, or by sheer luck (see also Holmström, 1999).

In this paper, we argue that the source of the ranking is an important aspect in regard to its impact on individuals' risk-taking. (Forsyth, 2008) described the tendency of humans to externalize failure while internalizing success as self-serving bias. Positive outcomes are usually internalized and attributed to individual ability and effort, while negative outcomes are externalized and, for example, attributed to bad luck. This happens regardless of the true reason for their failure or success, as failure undermines self-confidence, while attributing success to oneself boosts self-esteem (see, e.g., Forsyth, 2008, for an overview). For example, individuals tend to credit themselves for past success while blaming external factors (i.e., bad luck) for failure (Fischhoff and MacGregor, 1982; DeLong et al., 1991).

Mitchell et al. (2020) examine the drivers of striving to move up in social rankings and find that situations in which individuals' self-esteem or competence is threatened appear to drive the desire for a higher social rank. When individuals' low ranking is explicitly based on their effort or abilities, they may find it more difficult to externalize their failure or low performance. More likely, individuals will internalize their failure. This may lead to lower utility and self-esteem. Consequently, individuals are willing to increase their risk-taking to gain additional utility and increase their self-esteem with an improved ranking. Fessler (2001) argues that higher risk-taking is related to the goal of achieving higher social status, i.e., a higher rank in the respective hierarchy.

Based on individuals' ability to externalize their ranking, we argue that the emotional impact of rankings is more pronounced when the ranking is based on individuals' skill or

effort, which are both endogenous to the individual. This leads to lower utility and an increased willingness to take risks than in the context of a ranking based on exogenous factors, such as luck. Thus, we hypothesize as follows:

Hypothesis 2. *Lower rankings have a larger impact on risk-taking when the ranking is not completely based on exogenous factors.*

Given that rankings based on endogenous factors are more influential, a natural question to ask is whether risk-taking differs for individuals who are ranked based on their skill or their effort. Everybody is able to show effort in a given task. Showing effort, therefore, easily impacts individual performance, especially in a low-skill task. In a skill-related task, however, individual performance is more difficult to influence (Weiner, 1985). Each individual has acquired certain skills in the past. If one faces a task not related to those acquired skill sets, the resulting outcome is less under the control of the individual than is a task based purely on effort. Therefore, we expect that the negative emotional impact of a low ranking based on skill is less pronounced than that of a low ranking based on effort. The individual can blame her skill ranking on "bad luck" in the sense that the necessary skill set was not among those skills that she has acquired in the past and thereby utilize the self-serving bias (Forsyth, 2008).

Thus, for rankings based on skill, individuals may still find ways to (at least partly) externalize their negative emotions. However, for rankings based on effort, individuals may find it more difficult to maintain their self-esteem by externalizing the outcome. This leads to lower utility. Lower utility leads to increased risk-taking. In addition, individuals can use increased risk-taking as an approach to compensate for the negative emotional impact, as risk-taking might lead to higher social status (Fessler, 2001). Therefore, we expect higher risk-taking among those ranked low based on effort than among those ranked low based on skill.

A second argument is based on Weiner (1985), who differentiates emotions based on their attribution to past outcomes. He differentiates between outcomes that are related to self-controllable causes and outcomes that are not in direct control of the self. Guilt and

shame are affects related to outcomes based on one's controllable causes, while anger is related to outcomes fully under the control of others. Guilt and shame are further differentiated by the attributions of past actions. Weiner states that people tend to feel shame for failure in situations in which they are limited by low abilities, while guilt is a subsequent reaction to failures attributable to low effort. Effort in a particular situation can more readily be adapted than one's abilities. Therefore, effort is under one's own control to a greater extent.

Shame and guilt differ not only in terms of past attributions but also in terms of their resulting action. People who feel shame tend to show defensive behavior (Gilbert, 2000). They try to hide their results and express the desire to be unobserved, which results in motivational inhibition. Guilt, in contrast, although it is highly related to shame and cannot always be objectively separated from shame, promotes motivational action. That is, people act in a more pronounced manner to help overcome their earlier failure (Wicker et al., 1983; Cohen et al., 2011). Kouchaki et al. (2014) experimentally test the effect of guilt on risk-taking and find that guilt appears to lead to more optimistic perceptions of risks and an increased likelihood of engaging in risky behavior. Thus, we hypothesize as follows:

Hypothesis 3. *Lower rankings have a larger impact on risk-taking when the ranking is based on effort than on skill.*

Finally, we discuss the impact of personality traits on the influence of rankings on individuals' risk-taking. A plethora of studies has examined the impact of personality traits on decision-making (see, e.g., Lauriola and Levin, 2001; Busic-Sontic et al., 2017). Based on this literature, we study the question of whether particular personality traits mitigate or strengthen the impact of rankings on risk-taking. In particular, we ask whether individuals with higher levels of entitlement and a more pronounced tendency to engage in social comparisons adjust their risk-taking more in reaction to a ranking.[2]

[2]Initially, we set out to investigate the impact of three personality traits, adding individuals' need for affiliation in social settings to the list. However, our measure to capture individuals' need for affiliation shows rather poor reliability, preventing us from testing the associated hypothesis. Thus, we refrain from developing the omitted hypothesis here to preserve space.

Psychological entitlement describes an individual's stable feeling of deserving more than others (Campbell et al., 2004). In the case of rankings, entitled individuals may expect to be ranked at the top. If individuals find themselves in the bottom ranks instead, they may experience a contrast between their sense of entitlement and the feedback that they receive. This cognitive dissonance needs to be reduced (Festinger, 1957). The dissonance can be solved by either adjusting the individuals' feeling of entitlement or by adjusting the social rank. Furthermore, a high level of entitlement is considered detrimental in social situations and linked to competitive choices. We expect individuals to engage in higher risk-taking to improve their payoff in comparison to that of their peers and thereby reduce their cognitive dissonance. We measure individual's entitlement by using the entitlement scale by Campbell et al. (2004).

Tesser et al. (1988) argue that in social comparisons, a low rank threatens one's self-evaluation and therefore might trigger action. Action helps to maintain a positive self-evaluation. Social comparisons are helpful to evaluate and improve the self and therefore individual self-esteem or self-confidence. While people in general appear to have a tendency to engage in social comparisons (Festinger, 1954), individuals differ in the degree of their urge to compare themselves with others (Gibbons and Buunk, 1999). Therefore, we hypothesize as follows:

Hypothesis 4. *a. Lower rankings have a larger impact on risk-taking when the individual has a more pronounced level of entitlement.*

b. Lower rankings have a larger impact on risk-taking when the individual has more pronounced relative preferences.

3 Methodology and data

3.1 Experimental design

We examined individuals' risk-taking in a social setting using a preregistered online experiment.[3] First, we measured individuals' risk preferences. Participants completed a Holt and Laury (2002) risk aversion elicitation task.[4] In addition, participants self-reported their perceived willingness to take risks using an eleven-point scale (Dohmen et al., 2011).

Next, all participants completed a financial literacy quiz, which contained ten questions. As the results of the financial literacy quiz were used to generate a ranking between participants in one of the treatments, we additionally asked participants to answer an estimation question to avoid ties. The participants had 150 seconds to answer all questions.

Following the financial literacy quiz, all participants completed a real effort task. We displayed random letter sequences for participants to type into a nearby text field and submit their reply. We ensured that copy-and-paste of the letter sequences was not possible by displaying the sequences as graphics rather than as plain text. We asked the participants to complete as many sequences within 90 seconds as possible. The participants had to submit one sequence before the next sequence became available.

Next, we randomly assigned the participants to groups of three and ranked them within their group. The rankings were either determined randomly, based on the results of the financial literacy quiz, or based on the results from the real effort game. The ranking determinant was randomly assigned to the groups. We informed the participants about their ranking. Based on their ranking, the participants received an endowment of \$10, \$7, or \$5. They also learned about their peers' ranks and endowments. Subsequently, the participants decided how much of their endowment to invest in a risky asset (Gneezy and Potters, 1997). With equal probabilities, the participants' investment either was

[3]AEA RCT registered in December 2021: https://doi.org/10.1257/rct.8653.
[4]We used ready-to-use oTree apps from Holzmeister (2017).

multiplied by 2.5 or was lost. The participants did not have to invest anything and could choose an investment amount of zero.

Following the investment decision, we surveyed the participants with regard to their age, gender, and various personality traits. In particular, we elicited their psychological entitlement (Campbell et al., 2004), their need for affiliation (Steers and Braunstein, 1976), and their tendency to compare themselves to others (Gibbons and Buunk, 1999). Additionally, we asked the participants about their financial experience and statistical knowledge. As a final task, the participants answered an exit survey in which we asked them whether they believed that we had an agenda and, if so, what our agenda was.

Finally, the return to the risky investment was realized, and the participants were informed about their compensation for the experiment. The participants received their portfolio value after the lottery was played out.

Appendix A contains a full overview of the experiment.

3.2 Treatment

We randomly assigned participants to groups of three and then ranked the participants relative to each other within their group. We determined rankings randomly, based on the results from the financial literacy quiz, or based on the results of the real effort task. This yielded three distinct treatment groups: *skill*, *effort*, and *luck*.[5] Independent of their assigned treatment, all participants faced the financial literacy quiz and participated in the real effort game. We thereby created a between-subjects design. The treatment groups only differed in the ranking determinant.

3.3 Procedure

We used *CloudResearch* (Litman et al., 2017) to conduct our experiment online. CloudResearch has an extensive international database of users from various age groups and professions

[5]In the event of a tie between two participants within one group, we randomly determined their ranks.

based on Amazon's MTurk. As one of the largest online panel providers, CloudResearch offers a pool of more than 50 million users. So-called *Turkers* qualify for CloudResearch via a standardized procedure to monitor fraudulent records. In this way, CloudResearch ensures a high-quality sample.

We publicly posted the link for our experiment on CloudResearch and allowed users to participate anonymously in December 2021 and February 2022. Each Turker was allowed to participate only once. We restricted the sample to users located in the United States and did not employ additional filter criteria to allow for a heterogeneous sample. The experiment was implemented in oTree (Chen et al., 2016). To avoid careless responding from participants, we included a simple attention check in our survey (Oppenheimer et al., 2009). In particular, we asked subjects to choose a specific element on a Likert scale. Overall, 608 respondents completed the survey; 604 respondents passed the attention check. The average time to complete the experiment was 12 minutes, and the average compensation amounted to \$8.42. The minimum payoff was \$1, and the maximum was \$25.

The study was reviewed and approved by the German Association for Experimental Economic Research e.V. (https://gfew.de/ethik/iUtnQW5G) prior to the experiments.

3.4 Variables

We used several variables to test our hypotheses. In the following, we describe our variables:

Risky investment. Risky investment is our dependent variable. It denotes the fraction of participants' endowment that they invested in the risky asset.

Rank. Rank is our main variable of interest. It designates a participant's rank within their group ranging from the top rank, one, to the bottom rank, three.

In addition to our main variables, we used several variables to capture individuals' financial literacy, their effort, and their usual risk preferences.

Financial literacy. We asked the participants to answer ten questions that aimed to measure their financial literacy within 150 seconds. Using the replies, we generated a financial literacy score by counting the number of correctly answered questions.

Effort. We asked participants to type as many text sequences as possible into a nearby text field within 90 seconds. We used the number of correctly typed sequences as our real effort score. As a secondary measure for effort, we use the number of attempts, regardless of whether they were correct; we call this variable *Effort try*.[6]

Risk-taking. We controlled for participants' self-reported willingness to take risks (*Risk-taking*) (Dohmen et al., 2011). As a secondary measure for risk propensity, we used a Holt and Laury (2002) risk-elicitation task (*Holt & Laury*).

We further controlled for participants' demographics, i.e., their *age* and gender. *Male* is a dummy variable that is equal to 1 if a participant is male and 0 otherwise. *Non-binary* is a dummy variable that is equal to 1 if a participant identifies as non-binary and 0 otherwise. Additionally, we inquired about the participants' self-reported *investment experience* and their *statistical knowledge* on a five-point scale ranging from 1 to 5.

Finally, we asked the participants to complete various questionnaires. We measured psychological entitlement using the scale from Campbell et al. (2004). We aggregated the answers to a single variable *Entitlement* using the average (Cronbach's alpha = 0.92). We measured individuals' relative preferences using the 6-item Iowa-Netherlands Comparison Orientation Measure (INCOM) scale (Gibbons and Buunk, 1999). Again, we aggregated the answers to a single variable *INCOM* using the average (Cronbach's alpha = 0.83). According to Gibbons and Buunk (1999), the scale measures the degree to which people engage in comparisons, which differs from one person to the next.

We summarize all variable definitions in Table A.1 in the Appendix.

[6]Note that a page could only be submitted once participants typed something into the text field.

4 Results

We first discuss some summary statistics, which are split by treatment and rank in Table 1. We combine the endogenous rankings (effort and skill) into a treatment labeled *combined*. Our first observation is that individuals' risk-taking increases in rank. Across all treatments, we find that *risky investment* is smallest for individuals with the highest rank and largest for individuals with the lowest rank. The means range from .3488 (effort treatment) to .3704 (skill treatment) for Rank 1 and from .4776 (luck treatment) to .5376 (skill treatment) for Rank 3. The differences are statistically significant, with t-statistics ranging from 2.4418 (luck treatment) to 3.5423 (skill treatment). Similarly, non-parametric Mann–Whitney U tests show p-values smaller than .01 for all treatments. Thus, the table provides the first evidence that risk-taking increases in rank, supporting Hypothesis 1.

Table 1

Briefly considering the differences between treatments, we find that for both the luck and effort treatments, risk-taking increases monotonically in rank. However, for the skill treatment, we find no differences in risk-taking between Rank 1 and Rank 2 but significantly higher risk-taking for Rank 3.

Before we move to multivariate analyses, we first study summary statistics by treatment to ensure that our findings are not driven by differences between subjects in our treatments (see Table 2). On average, our participants were 35 years of age. Half of our participants were male. The average willingness to take risks was approximately 5, and the average financial literacy was 6.3. Participants tried to complete, on average, 16.5 effort tasks and correctly answered 15.2. Almost all participants passed the attention check, with only four participants failing the test.

Table 2

We find almost no differences between treatment groups. The only exceptions are a slightly higher share of male participants in the luck treatment than in the skill treatment and differences in the effort that participants showed. Participants in the luck treatment tried to complete slightly more effort tasks and were also slightly more successful in correctly completing them. These differences are statistically significant at the 5% level. All other differences are not statistically significant or economically meaningful. We control for these differences in our multivariate regressions.

Table 3 summarizes the regression results.[7] We study the impact of rank on risk-taking for the full sample (Column 1) and the individual treatment groups (Columns 2–5). We control for individuals' overall willingness to take risks, their financial literacy, their effort, and their personality traits. In addition, we control for participants' age and gender. The coefficients of interest are *Rank* 2 and *Rank* 3, which indicate the differences in risk-taking for participants who rank second or third from that in the baseline (participants who ranked first).

Table 3

The full sample results in Column 1 indicate that participants with Rank 2 invest, on average, 6.96 pp more in the risky asset (t-statistic of 2.5538), while participants with Rank 3 invest, on average, 16.19 pp more in the risky asset (t-statistic of 5.7961). This indicates that risk-taking increases with regard to rank and is particularly pronounced for the bottom rank—in line with Hypothesis 1. The control variables show that a higher general willingness to take risks (*Risk-taking*) is correlated with a higher risky asset share, in line with expectations. We do not observe significant coefficients for our gender and age group dummies (not tabulated).

Columns 2 to 5 focus on the different treatments. Across all treatments, we find more pronounced risk-taking for participants with Rank 3. The effect sizes, however, seem to be different, with coefficients for the endogenous treatments (combined 20.67 pp; skill 19.83 pp; effort 21.76 pp) being larger than those for the luck treatment (8.63 pp),

[7]We show the Pearson correlation coefficients in Table A.2 in the Appendix.

thereby providing the first evidence in favor of Hypothesis 2. We shed more light on these differences in Table 4. Additionally, across all treatments, the coefficients on Rank 2 are smaller than those for Rank 3. However, the coefficients on Rank 2 are statistically significant only in the combined and effort treatments (8.29 pp; 13.96 pp), while the other treatments feature smaller coefficients that are statistically not different from zero.

Table 4

We focus on the differences between treatments in Table 4. We employ two variables to study the differences. In Columns 1 to 4, we use *Rank*. Column 1 again highlights the significant influence of rank on risky investment. Columns 2 and 3 highlight differences across treatments. Luck is the baseline treatment, and the interaction coefficients capture the differences between the combined treatment and the effort and skill treatments and the baseline. While overall a lower rank yields a higher *risky investment* of 4.79 pp, the interaction coefficients are positive; however, only the combined and the effort interaction coefficients are significantly different from zero (10% level, t-statistics of 1.8962 and 1.6769, respectively).

In Columns 5 to 8, we particularly focus on the differences between ranks 1 and 3. Column 5 shows a 15.11 pp higher share of risky assets for Rank 3 than for Rank 1 across all treatments. Columns 6 and 7 then focus on the differences across treatments and show that this effect is more pronounced for the endogenous rankings (combined, 13.34 pp, t-statistic of 2.2878). The effect is driven by both the effort (11.66 pp, t-statistic of 1.6423) and skill treatments (14.92 pp, t-statistic of 2.1664). Overall, we conclude that risk-taking differs across treatments, with the increase in risk-taking in rank being larger for the effort and skill treatments than for the baseline luck treatment. This provides supporting evidence for Hypothesis 2.

Turning to Hypothesis 3, we test the impact of rank on risk-taking between the skill and effort treatments. We expect a low ranking based on effort to have a larger effect on risk-taking than a ranking based on skill. As described above, we find a stronger impact on risk-taking of these two rankings than of the luck treatment. Considering Table 1, the

difference in means for the *risky investment* between the top and bottom ranks is 16.72 pp and 17.88 pp, respectively. However, only in the effort treatment is the difference in *risky investment* significantly different between the top and middle ranks. The regressions by treatment in Columns 4 and 5 of Table 3 yield similar results.

In Columns 4 and 8 of Table 4, we elaborate further on this difference. We conduct multiple regressions for a sub-sample that contains only the skill and effort treatments. Skill is the baseline for both regression models. Column 4 shows a coefficient of 0.0102 with a t-statistic of 0.2607 for *Effort* · *Rank*. The coefficient is not economically significant. In Column 8, we report the regression results for the impact of Rank 3 versus Rank 1. While we find a high coefficient for the *Rank 3 vs. Baseline Rank 1* variable, the coefficient for the interaction variable *Effort treatment* · *Rank 3 vs. Baseline Rank 1* yields a size of 0.0147 with a t-statistic of 0.1709. The regression results yield no significant differences between the skill and effort treatments. Therefore, we find no clear evidence to support the third hypothesis.

We study the robustness of our findings in Table 5 and use alternative measures for participants' effort and overall willingness to take risks. In Column 1, we use the number of effort tasks that participants completed to proxy their effort, regardless of whether these were completed correctly or incorrectly. The alternative measure does not alter our conclusions. In Column 2, we use the Holt & Laury risk elicitation task to proxy for participants' overall willingness to take risks (instead of the Dohmen et al. (2011) scale). We exclude all participants who did not provide consistent results. Again, our conclusions remain the same. Finally, in Column 3, we use the Holt & Laury risk elicitation task as an alternative attention check and exclude all participants who did not reply consistently but use our baseline risk measure from Dohmen et al. (2011). Again, the results are consistent and support our conclusions.

Table 5

Next, we turn to Hypothesis 4 and the impact of personality on our results. We argue that in particular, participants who score high on the entitlement score increase their

risk-taking in their rank. We summarize the results in Columns 1 and 2 of Table 6. While we do not find statistically significant results in the low (LO) entitlement model, we observe that the effort treatment in particular shows a positive coefficient in the (high) HI entitlement model (*Effort treatment* · *Rank*, 10.29 pp, t-statistic of 2.1019). A t-test on the difference in the interaction coefficients between the HI and LO entitlement models, however, yields no statistical significance (t-statistics of -1.6043) for the *Effort treatment* · *Rank* variable. The difference between the interaction coefficients for the skill treatment is also not statistically significant (t-statistic of -0.0364). Overall, the evidence does not support the notion that a high level of entitlement moderates the impact of one's rank on risk-taking (Hypothesis 4a).

Table 6

In Columns 3 and 4, we study Hypothesis 4b and the role of the INCOM scale in the relationship between rank and risk-taking. The results are similar to our observations on entitlement. In the high INCOM model (Column 4), we observe a positive interaction coefficient for the effort treatment (*Effort treatment* · *Rank*, 8.58 pp, t-statistic of 1.7595). Examining the difference in coefficients between the low and high INCOM models, we find no statistically significant difference (t-statistic of -0.8975 for the skill treatment and -0.6543 for the effort treatment). Overall, these results do not provide evidence that an individual's personality may moderate the impact of rankings on risk-taking.

To alleviate concerns that our findings may be driven by experimenter demand effects (Zizzo, 2010), we ask the participants what they believed the goal of the study was. Then, we eliminate all the participants who correctly identified the goal of the study and repeat our main analysis (see Table A.3 in the Appendix). Our conclusions remain unchanged.

Finally, we address the concern that imperfect randomization between treatments (in particular with respect to gender; see Table 2 and our discussion above) drives our findings. We interact the treatment indicators with a male dummy variable to capture systematic differences in the share of male participants between treatments and summarize the results in Table A.4 in the Appendix. Again, our conclusions remain unchanged.

5 Discussion

Individuals routinely engage in social comparisons. Rankings are an explicit form of social comparison and allow one to quantify one's position. They take place in many situations; for example, one compares oneself to others due to a natural drive, or in some contexts, there may be explicit rankings, as in sports, for example. School rankings take place when children compare their grades with those of others. Rankings can also be used in institutionalized settings such as tournaments to enhance the performance of participants. Research has shown that rankings impact economic decision-making beyond the decision on the optimal amount of effort to invest to maximize outcomes from ranking; rankings also impact risk-taking in subsequent risk-taking decisions (as shown by, e.g., Bault et al., 2008; Dijk et al., 2014; Schwerter, 2022). We add to this literature by showing not only that rankings impact risk-taking but also that the factors that individuals are ranked on play an important role.

In an incentivized experiment, we examine the effect of rankings on risk-taking. In line with prior findings, we find higher risk-taking among individuals at lower ranks than among their peers at higher ranks. We add to the understanding of how rankings impact risk-taking by showing that the determinant of a ranking matters; rankings impact risk-taking less when they are based on luck (exogeneous) than when they are based on factors within the realm of influence of the individuals (endogeneous). In line with our hypothesis, we find that risk-taking by those positioned in the bottom ranks is more pronounced in the skill and effort treatments, i.e., situations in which the externalization of a low ranking may be more difficult. Turning to different factors within the realm of influence of the individual, our findings yield no indication that either effort or skill has a larger impact.

Psychological entitlement and one's tendency to engage in social comparisons may influence the perception about one's rank and its impact on risk-taking. In particular, individuals who score high on *entitlement* and *INCOM* (relative preferences) may show higher risk-taking when positioned in the bottom ranks than individuals who score low

on these two personality traits. Our results do not provide evidence in support of this notion.

Our findings have important implications for our understanding of how rankings impact the decision-making of individuals. In job settings, rankings are utilized to enhance performance and determine compensation and career advancement. In tournament settings, rankings usually come with economic incentives to make participants invest higher effort levels in competitions. We show not only that rankings impact risk-taking but also that the source of rankings influences the impact of rankings on risk-taking. Our findings have important implications in settings where rankings are routinely utilized. Going back to the job setting, for example, our findings predict higher risk-taking in a subsequent investment decision of a fund manager who ranked low in an effort-based ranking. Thus, a firm must closely monitor subsequent investment decisions or add risk-reducing incentives for individuals who rank low based on effort.

Conflicts of interest All authors declare that they have no conflicts of interest.

Ethics approval All procedures involving human participants performed in the studies were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards. The study was reviewed and approved by the German Association for Experimental Economic Research e.V. (https://gfew.de/ethik/iUtnQW5G).

Informed consent Informed consent was obtained from all individual participants included in the study.

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Table 1: Summary statistics for the risky investment decision

Treatment	Rank	Mean	SD	N	t-tests	Mann-Whitney-U
Luck	1	0.3642	0.2886	76	-	-
Luck	2	0.4263	0.3182	70	-1.2319	0.3609
Luck	3	0.4776	0.2666	67	-2.4418	0.0059
Combined	1	0.3591	0.2630	147	-	-
Combined	2	0.4135	0.3076	139	-1.6017	0.1593
Combined	3	0.5330	0.2799	109	-5.0431	0.0000
Skill	1	0.3704	0.2662	70	-	-
Skill	2	0.3613	0.2692	68	0.19928	0.9199
Skill	3	0.5376	0.2678	59	-3.5423	0.0004
Effort	1	0.3488	0.2614	77	-	-
Effort	2	0.4634	0.3347	71	-2.3071	0.0409
Effort	3	0.5276	0.2961	50	-3.4784	0.0006

The table reports summary statistics for the risky investment decision by treatment group and rank. The columns *Mean* and *SD* show the mean and standard deviation of the risky investment, respectively. t-tests reports the test statistics for unpaired two-sample t-tests. For each treatment group, the risky investment decisions of Rank 2 and Rank 3 are compared to Rank 1. *Mann-Whitney-U* reports the p-values for unpaired two-sample Mann-Whitney-U tests. For each treatment group, the risky investment decisions of Rank 2 and Rank 3 are compared to Rank 1.

Table 2: Summary statistics

	Panel A: Summary statistics				Panel B: t-tests		
	Full	Luck	Skill	Effort	Luck vs. Skill	Luck vs. Effort	Skill vs. Effort
Mean (risky investment)	0.4242	0.4203	0.4174	0.4351	0.1036	0.4978	0.6019
SD (risky investment)	0.2925	0.2945	0.2778	0.3055	0.5905	0.3723	0.9437
Risk-taking	5.02467	4.8873	5.0964	5.1010	0.8259	0.8522	0.0178
Financial literacy	6.3059	6.4601	6.3299	6.1161	0.5970	1.6234	0.9822
Effort	15.2056	15.8685	14.5685	15.1263	2.0252	1.1531	0.8800
Effort_try	16.4803	17.2066	15.7563	16.4192	2.3511	1.2777	1.0905
Entitlement	3.0181	3.0099	3.0000	3.0449	0.0774	0.2665	0.3284
INCOM	3.3245	3.3380	3.3614	3.2736	0.2979	0.8134	1.0188
Mean (age)	35.2697	34.9531	35.5432	35.3384	0.5195	0.3387	0.1757
Share male	0.4918	0.5399	0.4416	0.4899	2.0436	1.0112	1.0085
Share non-binary	0.0082	0.0047	0.0102	0.0101	0.6339	0.6339	0.0000
Attention check passed	604	212	195	197	0.0587	0.0516	0.0072
N	608	213	197	198	-	-	-

The table reports summary statistics for the overall sample and each treatment group separately in Panel A. Panel B reports the test statistics for unpaired two-sample t-tests between the treatment groups. Luck vs. Skill compares the luck and skill treatment groups. Luck vs. Effort compares the luck and effort treatment groups. Skill vs. Effort compares the skill and effort treatment groups.

Table 3: The impact of rank on risk-taking

	Dependent variable: Risky investment				
	Full	Luck	Combined	Skill	Effort
(Intercept)	0.0786	0.0165	0.0524	0.1670	−0.0704
	(0.8554)	(0.1018)	(0.4870)	(1.0819)	(−0.4408)
Rank 2	0.0696	0.0528	0.0829	0.0257	0.1396
	(2.5538)	(1.0635)	(2.4644)	(0.5577)	(2.5552)
Rank 3	0.1619	0.0863	0.2067	0.1983	0.2176
	(5.7961)	(1.9309)	(5.5413)	(2.8412)	(3.5285)
Risk-taking	0.0318	0.0285	0.0343	0.0412	0.0278
	(6.2415)	(3.0789)	(5.6374)	(5.5768)	(2.9220)
Financial literacy	0.0010	0.0084	−0.0015	−0.0056	−0.0024
	(0.1630)	(0.6973)	(−0.2109)	(−0.4461)	(−0.2214)
Effort	0.0028	0.0021	0.0050	0.0056	0.0057
	(1.5007)	(0.6381)	(2.2577)	(1.9729)	(1.3529)
INCOM	0.0336	0.0609	0.0250	0.0306	0.0225
	(2.1676)	(1.9135)	(1.3971)	(1.4359)	(0.8289)
Entitlement	−0.0057	0.0016	−0.0094	−0.0285	0.0057
	(−0.6037)	(0.0862)	(−0.8525)	(−1.9885)	(0.3592)
Additional controls: age, gender	Yes	Yes	Yes	Yes	Yes
Adj. R^2	0.1261	0.0975	0.1519	0.2126	0.0979
Num. obs.	605	212	393	196	197

The table presents the results of our full sample and the sub-sample regression analyses for each treatment group. *Full* presents the results for our overall sample. *Luck, Skill, Effort* present the results for the regressions of the respective sub-samples. *Combined* presents the combined results for the skill and effort treatments. Variable definitions can be found in Table A.1 in the Appendix. t-statistics are reported in parentheses.

Table 4: Differences between treatments

	Dependent variable: Risky investment							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
(Intercept)	0.2804	0.0353	0.0330	−0.0621	0.3609	0.0235	0.0199	0.0180
	(9.7976)	(0.3500)	(0.3235)	(−0.4654)	(19.9030)	(0.2204)	(0.1851)	(0.1319)
Rank	0.0748	0.0478	0.0479	0.0981				
	(5.4465)	(2.1498)	(2.1505)	(3.5283)				
Combined		−0.0971				−0.0412		
		(−1.5820)				(−1.0408)		
Combined · Rank		0.0546						
		(1.8962)						
Skill treatment			−0.1097				−0.0472	
			(−1.5281)				(−1.0298)	
Effort treatment			−0.0889	0.0079			−0.0360	−0.0193
			(−1.2256)	(0.0978)			(−0.7829)	(−0.3802)
Skill · Rank			0.0537					
			(1.5773)					
Effort · Rank			0.0578	0.0102				
			(1.6769)	(0.2607)				
Rank 3 vs. Baseline Rank 1					0.1511	0.0957	0.0964	0.2193
					(5.4896)	(2.1302)	(2.1434)	(3.6692)
Combined · Rank 3 vs. Baseline Rank 1						0.1334		
						(2.2878)		
Skill treatment · Rank 3 vs. Baseline Rank 1							0.1492	
							(2.1664)	
Effort treatment · Rank 3 vs. Baseline Rank 1							0.1166	0.0147
							(1.6423)	(0.1709)
Risk-taking		0.0320	0.0321	0.0341		0.0329	0.0332	0.0331
		(6.2883)	(6.2364)	(5.5888)		(5.7965)	(5.7839)	(4.7950)
Financial literacy		0.0025	0.0028	−0.0014		0.0095	0.0105	0.0016
		(0.3892)	(0.4036)	(−0.1786)		(1.3682)	(1.3683)	(0.1608)
Effort		0.0032	0.0032	0.0051		0.0044	0.0041	0.0081
		(1.7228)	(1.6537)	(2.1536)		(1.9355)	(1.7082)	(2.7592)
INCOM		0.0342	0.0350	0.0265		0.0282	0.0280	0.0103
		(2.2151)	(2.2805)	(1.4843)		(1.5172)	(1.4975)	(0.4752)
Entitlement		−0.0065	−0.0067	−0.0090		−0.0112	−0.0115	−0.0083
		(−0.6815)	(−0.7031)	(−0.8273)		(−1.0507)	(−1.0807)	(−0.6709)
Additional controls: age, gender	No	Yes	Yes	Yes	No	Yes	Yes	Yes
Adj. R^2	0.0410	0.1293	0.1280	0.1510	0.0681	0.1530	0.1489	0.1713
Num. obs.	608	605	605	393	399	396	396	254

The table reports results of OLS regression analyses. Models 1-3 contain the full sample. Models 4 and 8 test for the difference between the skill and effort treatments. In Models 5-8, only the top and bottom ranks are tested against each other, while the middle rank is removed from the analyses. Variable definitions can be found in Table A.1 in the Appendix. t-statistics are reported in parentheses.

Table 5: Alternative risk-taking and effort measures

	Dependent variable: Risky investment		
	(1)	(2)	(3)
(Intercept)	0.1272	0.6482	0.1583
	(1.5215)	(6.6331)	(1.8296)
Rank	0.0446	0.0280	0.0377
	(1.9860)	(1.1363)	(1.5779)
Skill treatment · Rank	0.0567	0.0741	0.0666
	(1.6583)	(2.0009)	(1.8085)
Effort treatment · Rank	0.0590	0.0735	0.0695
	(1.7056)	(1.9297)	(1.8918)
Skill treatment	−0.1122	−0.1473	−0.1346
	(−1.5593)	(−1.9675)	(−1.7771)
Effort treatment	−0.0932	−0.1487	−0.1329
	(−1.2806)	(−1.9170)	(−1.7521)
Risk-taking	0.0312		0.0325
	(6.2510)		(6.0427)
Holt & Laury		−0.0399	
		(−6.0520)	
Financial Literacy	0.0027	−0.0005	0.0021
	(0.3936)	(−0.0670)	(0.2791)
Effort		0.0019	0.0035
		(0.8774)	(1.6784)
Effort try	0.0040		
	(1.9786)		
Additional controls: age, gender	Yes	Yes	Yes
Adj. R^2	0.1244	0.1316	0.1277
Num. obs.	606	537	537

The table reports the results of alternative specifications of OLS regression models. In model (3), participants who answered the Holt & Laury task inconsistently were excluded. Variable definitions can be found in Table A.1 in the Appendix. *t*-statistics are reported in parentheses.

Table 6: Personality traits

	Entitlement		INCOM	
	LO	HI	LO	HI
(Intercept)	0.0640	0.2634	0.0526	0.1790
	(0.5578)	(2.3234)	(0.4443)	(1.6394)
Rank	0.0439	0.0366	0.0528	0.0507
	(1.4588)	(1.1743)	(1.6416)	(1.6364)
Skill treatment · Rank	0.0543	0.0568	0.0210	0.0662
	(1.0423)	(1.2906)	(0.3979)	(1.4839)
Effort treatment · Rank	−0.0078	0.1029	0.0239	0.0858
	(−0.1596)	(2.1019)	(0.4882)	(1.7595)
Skill treatment	−0.1062	−0.1236	0.0179	−0.1806
	(−0.9977)	(−1.3095)	(0.1637)	(−1.8869)
Effort treatment	0.0131	−0.1676	0.0201	−0.1738
	(0.1295)	(−1.6573)	(0.1916)	(−1.7512)
Risk-taking	0.0425	0.0220	0.0213	0.0368
	(5.6836)	(3.1430)	(2.8660)	(5.3487)
Financial literacy	0.0151	−0.0116	0.0006	0.0032
	(1.3978)	(−1.2628)	(0.0601)	(0.3335)
Effort	−0.0005	0.0057	0.0063	0.0030
	(−0.1853)	(2.2388)	(2.1742)	(1.1242)
Additional controls: age, gender	Yes	Yes	Yes	Yes
Adj. R^2	0.1337	0.1206	0.0792	0.1610
Num. obs.	281	324	291	314

This table presents the regression results of sub-sample analyses by personality traits. For each personality trait, i.e., entitlement and INCOM, the sample is split at the median. LO represents the sub-sample below the median value, and HI represents the sub-sample for median or higher values for each of the personality traits, respectively. Variable definitions can be found in Table A.1 in the Appendix. t-statistics are reported in parentheses.

Appendix

Table A.1: Variable definitions

Variable	Definition
Dependent variables	
Risky investment	Participant's invested share of their endowment in the risky investment alternative, based on Gneezy and Potters (1997).
Treatments	
Luck treatment	Baseline treatment. Participants are randomly assigned a rank within their group.
Skill treatment	Participants are ranked relative to each other within their respective group of three based on their score in the financial literacy quiz.
Effort treatment	Participants are ranked relative to each other within their respective group of three based on their score in the real effort task.
Combined treatment	Participants are ranked by endogenous factors. Participants in the skill and effort treatments are considered.
Control variables	
Rank	Participants' rank within their group relative to the other participants in the group. The rank depends on either financial literacy skill, effort, or is assigned randomly. The rank determining factor is assigned randomly to each group of three participants. Rank ranges from 1 to 3. Rank 1 is the top rank within the group, and Rank 3 is the bottom rank in the group.
Age	6-level scale measuring the participants' age.
Male	Dummy variable that takes the value of 1 if the participant is male, and 0 otherwise.
Financial literacy	Participant's score in the financial literacy quiz. Measured as the number of correctly answered financial literacy questions ranging from 0 to 10.
Effort	Participant's score in the real effort task. Measured as the number of correctly entered random letter sequences. Open-ended scale.
Effort try	Participant's alternative score in the real effort task. Measured as the number of entered random letter sequences, incorrect entries are included.
Risk-taking	Participant's self-reported risk attitude. 11-point scale based on Dohmen et al. (2011).
Holt & Laury	Participant's risk aversion elicited via a multiple pricing list following Holt and Laury (2002).
INCOM	6-item scale using a short version of the Iowa-Netherlands Comparison Orientation Measure (Gibbons and Buunk, 1999). Measured on a 5-point Likert scale.
Entitlement	9-item scale measuring psychological entitlement (Campbell et al., 2004). Measured on a 7-point Likert scale.
Study goal	Dummy variable that takes the value of 1 if participants correctly identified the study goal and 0 otherwise.
Attention	Dummy variable that takes the value of 1 if participants passed the attention check and 0 otherwise.

Table A.2: Pearson's correlation table

	Risky investment	Rank	Risk-taking	Holt & Laury	Financial literacy	Effort	Effort try	INCOM	Entitlement
Risky investment									
Rank	0.2063***								
Risk-taking	0.2894***	0.0146							
Holt & Laury	-0.2710***	-0.0373	-0.2915***						
Financial literacy	-0.0532	-0.2777***	-0.0558	-0.0577					
Effort	0.0260	-0.1887***	-0.0386	-0.0137	0.2323***				
Effort try	0.0437	-0.1959***	-0.0145	-0.0076	0.2164***	0.9679***			
INCOM	0.0748	-0.0778	0.0049	-0.0752	-0.0573	0.0482	0.0551		
Entitlement	0.0656	0.0729	0.2389***	-0.0732	-0.1585***	-0.1510***	-0.1527***	0.2138***	
Age	-0.1079**	-0.0082	-0.1365***	-0.0805	0.2130***	-0.2958***	-0.3072***	-0.1807***	-0.0483

This table presents pairwise Pearson correlation coefficients. Variable definitions can be found in Table A.1 in the Appendix. Asterisks indicate significance levels: $p < .001$ ***, $p < .01$ **, $p < .05$ *.

Table A.3: Demand effects

	Dependent variable: Risky investment			
	(1)	(2)	(3)	(4)
(Intercept)	0.2836	0.0256	0.0081	0.0081
	(9.5895)	(0.2419)	(0.0739)	(0.0735)
Rank	0.0726	0.0459		
	(5.1596)	(1.9749)		
Skill treatment · Rank		0.0496		
		(1.4261)		
Effort treatment · Rank		0.0603		
		(1.6739)		
Rank 3 vs. Baseline Rank 1			0.1707	0.0945
			(5.7967)	(2.0116)
Skill treatment · Rank 3 vs. Baseline Rank 1				0.1413
				(2.0072)
Effort treatment · Rank 3 vs. Baseline Rank 1				0.1204
				(1.6260)
Skill treatment		−0.0934	0.0246	−0.0410
		(−1.2640)	(0.7465)	(−0.8684)
Effort treatment		−0.0919	0.0130	−0.0408
		(−1.2045)	(0.3883)	(−0.8451)
Risk-taking		0.0305	0.0311	0.0320
		(5.7105)	(5.2855)	(5.4592)
Financial literacy		0.0007	0.0066	0.0094
		(0.0931)	(0.9132)	(1.2110)
Effort		0.0038	0.0040	0.0046
		(1.8700)	(1.7779)	(1.9204)
INCOM		0.0357	0.0264	0.0270
		(2.2694)	(1.3674)	(1.4152)
Entitlement		−0.0029	−0.0052	−0.0071
		(−0.3019)	(−0.4737)	(−0.6435)
Adj. R^2	0.0387	0.1178	0.1296	0.1361
Num. obs.	578	575	378	378

The table presents results from OLS regression analyses. Participants who correctly identified the study goal were excluded. Variable definitions can be found in Table A.1 in the Appendix. t-statistics are reported in parentheses.

Table A.4: Robustness: Gender randomization

	Dependent variable: Risky investment			
	(1)	(2)	(3)	(4)
(Intercept)	0.2258	0.0234	0.0164	0.0170
	(5.7316)	(0.2298)	(0.1530)	(0.1577)
Rank	0.0778	0.0479		
	(5.5857)	(2.1363)		
Rank 3 vs. Baseline Rank 1			0.1730	0.0949
			(5.9912)	(2.0968)
Male	0.0801	0.0450	0.0363	0.0370
	(2.0272)	(1.1270)	(0.7886)	(0.8092)
Skill treatment · Male	−0.0110	−0.0290	−0.0132	0.0007
	(−0.1966)	(−0.5471)	(−0.2059)	(0.0106)
Effort treatment · Male	0.0017	−0.0031	−0.0051	−0.0105
	(0.0300)	(−0.0565)	(−0.0805)	(−0.1653)
Skill treatment · Rank		0.0510		
		(1.4866)		
Effort treatment · Rank		0.0578		
		(1.6673)		
Skill treatment · Rank 3 vs. Baseline Rank 1				0.1534
				(2.1996)
Effort treatment · Rank 3 vs. Baseline Rank 1				0.1201
				(1.6796)
Skill treatment	0.0122	−0.0889	0.0284	−0.0490
	(0.3355)	(−1.1514)	(0.6410)	(−0.8682)
Effort treatment	0.0239	−0.0892	0.0165	−0.0341
	(0.5900)	(−1.1426)	(0.3556)	(−0.5985)
Financial literacy		0.0025	0.0069	0.0104
		(0.3628)	(0.9638)	(1.3295)
Effort		0.0032	0.0035	0.0042
		(1.6342)	(1.6075)	(1.7464)
Risk-taking		0.0326	0.0324	0.0332
		(6.3277)	(5.6371)	(5.7895)
INCOM		0.0361	0.0282	0.0285
		(2.3578)	(1.4825)	(1.5199)
Entitlement		−0.0067	−0.0099	−0.0119
		(−0.7094)	(−0.9332)	(−1.1069)
Additional controls: age	Yes	Yes	Yes	Yes
Adj. R^2	0.0508	0.1291	0.1395	0.1473
Num. obs.	601	600	392	392

The table reports OLS regression results for a robustness analysis to control for imperfect randomization of gender across treatments. Variable definitions can be found in Table A.1 in the Appendix. *t*-statistics are reported in parentheses.

A Experimental design

Welcome

Thank you for participating in today's study!

During the study you will be confronted with various decisions. Please imagine being in the situation respectively and answer all questions truthfully. Additionally, you are required to answer several questions about yourself and your knowledge in different contexts.

Before you will be able to start, please carefully read the following instructions:

- Note that we do not have access to your personal information and that your participation is anonymous.
- You can decide to quit the study at any time during your participation by closing your browser window.
- During the study you will not be able to change your answers once you have submitted a page. You cannot navigate to prior pages using your browser.
- You will receive a performance-based compensation upon completing the study. The average compensation is $8.
- It will take you about 20 minutes to fully complete the study.
- Note that there will be attention checks throughout the study.

Please press "Next" to acknowledge that you have read and agreed with the conditions as stated above. If you do not agree with the conditions, please close your browser window.

***

Please choose!

Are you generally a person who is willing to take risks or do you try to avoid taking risks? On an 11-point Likert scale ranging from “not at all willing to take risks” to “very willing to take risks”.

- Not at all willing to take risks
- 1
- 2
- 3
- 4
- 5
- 6
- 7
- 8
- 9
- Very willing to take risks

***

Please choose!

Please pick a nickname.

« text field »

Please choose an avatar.

- Avatar 1
- Avatar 2
- Avatar 3
- Avatar 4
- Avatar 5

***

Instructions

In the following 10 decisions are presented on your screen. Each decision is a choice between "Option A" and "Option B". While the payoffs of the two options are fixed for all decisions, the chances of the payoff for each option will vary. Please imagine that you are offered "Option A" and "Option B" and make your choices accordingly.

To summarize: You will make 10 choices; for each decision you will have to choose between "Option A" and "Option B". You may choose A for some decision rows and B for other rows.

***

Option A	**Option B**
• \$2.00 with a probability of 10.00%, \$1.60 otherwise	• \$3.85 with a probability of 10.00%, \$0.10 otherwise
• \$2.00 with a probability of 20.00%, \$1.60 otherwise	• \$3.85 with a probability of 20.00%, \$0.10 otherwise
• \$2.00 with a probability of 30.00%, \$1.60 otherwise	• \$3.85 with a probability of 30.00%, \$0.10 otherwise
• \$2.00 with a probability of 40.00%, \$1.60 otherwise	• \$3.85 with a probability of 40.00%, \$0.10 otherwise
• \$2.00 with a probability of 50.00%, \$1.60 otherwise	• \$3.85 with a probability of 50.00%, \$0.10 otherwise
• \$2.00 with a probability of 60.00%, \$1.60 otherwise	• \$3.85 with a probability of 60.00%, \$0.10 otherwise
• \$2.00 with a probability of 70.00%, \$1.60 otherwise	• \$3.85 with a probability of 70.00%, \$0.10 otherwise
• \$2.00 with a probability of 80.00%, \$1.60 otherwise	• \$3.85 with a probability of 80.00%, \$0.10 otherwise
• \$2.00 with a probability of 90.00%, \$1.60 otherwise	• \$3.85 with a probability of 90.00%, \$0.10 otherwise
• \$2.00 with a probability of 100.00%, \$1.60 otherwise	• \$3.85 with a probability of 100.00%, \$0.10 otherwise

***

Your financial expertise

On the next page you will face various questions on your financial expertise. Please answer the questions by choosing the correct answer. You will have 150 seconds to complete the questions.

***

Your financial expertise

Time left to complete this page: « timer »

Imagine that the interest rate on your savings account was 1% per year and inflation was 2% per year. After 1 year, would you be able to buy:

- More than today with the money in this account?
- Exactly the same as today with the money in this account?
- Less than today with the money in this account?
- Do not know

Suppose you had $100 in a savings account and the bank adds 2% per year to the account. How much money would you have in the account after five years if you did not remove any money from the account?

- More than $102
- Exactly $102
- Less than $102
- Do not know

Considering a long time period (for example, 10 or 20 years), which asset described below normally gives the highest return?

- Savings account
- Stocks
- Bonds
- Do not know

Do you think that the following statement is true or false? "If you buy a 10-year bond, it means you cannot sell it after 5 years without incurring a major penalty."

- True
- False
- Do not know

If interest rates rise, what will typically happen to bond prices?

- They will rise
- They will fall
- They will remain the same
- There is no relationship between bond prices and the interest rate.

Do you think that the following statement is true or false? "Buying a single company's stock usually provides a safer return than a stock mutual fund."

- True
- False
- Do not know

Do you think that the following statement is true or false? "A 15-year mortgage typically requires higher monthly payments than a 30-year mortgage, but the total interest paid over the life of the loan will be less."

- True
- False
- Do not know

Suppose you have $100 in a savings account and the interest rate is 20% per year and you never withdraw money or interest payments. After 5 years, how much would you have in this account in total?

- More than $200
- Exactly $200
- Less than $200
- Do not know

Which of the following statements is correct? If somebody buys the stocks of firm B in the stock market?

- S/he owns a part of firm B
- S/he has lent money to firm B
- S/he is liable for firm B's debts
- S/he can vote on shareholder resolutions
- None of the above
- Do not know

You invest $500 to buy $1,000 worth of stock on margin (that is, you borrowed $500 from your broker to purchase stock). The value of the stock drops by 50%. You sell it. Approximately how much of your original $500 investment are you left with in the end?

- $500
- $250
- $0
- Don't know

Suppose you owe $3,000 on your credit card. You pay a minimum payment of $35 each month. At an Annual Percentage Rate of 12% (or 1% per month), how many months would it take to eliminate your credit card debt if you made no additional new charges? « text field »

***

See the following task

In this part of the experiment you will see various randomly selected letter sequences. You will have 90 seconds to type as many sequences as possible. For each sequence, please exactly type the shown sequence in the field below. Each character has to be correct. All characters are letters, there are no numbers. Once you have entered your sequence, click the "Next" button or press the enter key to see the next sequence.

Please see the following example. Note that you cannot enter anything here.

Please type in sequences
Type the shown sequence below into the field below and click "Next" or hit the Enter Key
eUhJk
« textfield »

Once you are ready, please click "Next" below to start the task.

***

Time left to complete this page: « timer »

Please type in sequences
Type the shown sequence below into the field below and click "Next" or hit the Enter Key
dkUib (Note: letter sequences are pictures, copy & paste is disabled)
« textfield »

***

(Wait page)

For the following part of experiment, you will be randomly matched into a group of three participants. Please wait until your group members complete the first part of the experiment.

***

Meet your peers!

Player 1 & Player 2

Avatar (Player 1) & Avatar (Player 2)

You are randomly matched in a group with Player 1 and Player 2 who also participate in this study.

Next, you will see how you performed in entering the correct letter sequences compared to Player 1 and Player 2. (Other treatments: Next, you will see how you performed in answering the questions on your financial expertise compared to Player 1 and Player 2. Next, you will see how you have been randomly ranked within your group with Player 1 and Player 2.) Then, you will be able to invest your earned endowment. Please see the details on the next page.

***

Your results

Your group's ranking:

Player 1	**You**	Player 2
Rank 1	Rank 2	Rank 3
$10.00	$7.00	$5.00

In your **effort to type the correct sequences** (Other treatments: In your financial literacy, Randomly), you ranked in the middle of your group members Player 1 and Player 2.

Based on your ranking, you receive an endowment of $7.00. Now, consider the following investment opportunity:

With a probability of 50% you will either lose your investment or your investment will be multiplied by 2.5.

You may invest any part of up to your whole endowment. Please state how much of your endowment $7.00 you are investing. Your final payoff for this experiment will depend on how your investment plays out.

Activate the slider by clicking it.

« Slider »

For your currently chosen investment, you may earn the following:

Negative outcome:	Positive outcome:
« Negative outcome is shown here »	« Positive outcome is shown here »

***

Coin flip

Imagine you take place in a game of chance.

A fair coin is flipped 4 times. The first throw was tails, the second heads, the third heads again.

What do you think is the probability for the coin to show heads in the next throw?

Activate the slider by clicking it.

« Slider »

***

Please answer the following questions.

What is your age?

- 18 to 24
- 25 to 34
- 35 to 44
- 45 to 54
- 55 to 64
- 65 or older

What is your gender?

- Male
- Female
- Non-binary

***

Please answer the following questions.

What is your study major?

- Finance or closely related
- Business Administration or closely related
- Economics or closely related
- Other

What is your highest level of education?

- Highschool / GED
- Undergraduate degree
- Graduate degree
- MBA
- Other Non-MBA
- Ph.D. or higher
- Prefer not to say

***

Please answer the following questions.

How do you rate your investment experience?

- low
- rather low
- medium
- rather high
- high

How do you rate your statistical knowledge?

- low
- rather low
- medium
- rather high
- high

Do you currently invest money in stocks, bonds, mutual funds, or other financial instruments?

- Yes
- Not currently, but I used to invest
- No

***

Please choose!

Here are number of characteristics that may or may not apply to you. Please choose the answers that apply to you to indicate the extent to which you agree or disagree with that statement.

	Strong disagreement	Moderate disagreement	Slight disagreement	Neither agreement or disagreement	Slight agreement	Moderate agreement	Strong agreement
I honestly feel I am just more deserving than others.	○	○	○	○	○	○	○
Great things should come to me.	○	○	○	○	○	○	○
If I were on the Titanic, I would deserve to be on the first lifeboat!	○	○	○	○	○	○	○
I demand the best because I am worth it.	○	○	○	○	○	○	○
I do not necessarily deserve special treatment.	○	○	○	○	○	○	○
I deserve more things in my life.	○	○	○	○	○	○	○
People like me deserve an extra break now and then.	○	○	○	○	○	○	○
Things should go my way.	○	○	○	○	○	○	○
I feel entitled to more of everything.	○	○	○	○	○	○	○

***

Please choose!

Here are number of characteristics that may or may not apply to you. Please choose the answers that apply to you to indicate the extent to which you agree or disagree with that statement.

	Never	Almost never	Seldom	Sometimes	Usually	Almost always	Always
When I have a choice, I try to work in a group instead of by myself.	○	○	○	○	○	○	○
I pay a good deal of attention to the feelings of others at work.	○	○	○	○	○	○	○
I prefer to do my own work and let others do theirs.	○	○	○	○	○	○	○
I express my disagreements with others openly.	○	○	○	○	○	○	○
I find myself talking to those around me about non-business related matters.	○	○	○	○	○	○	○

***

Please choose!

Here are number of characteristics that may or may not apply to you. Please choose the answers that apply to you to indicate the extent to which you agree or disagree with that statement.

	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
I always pay a lot of attention to how I do things compared with how others do things.	○	○	○	○	○
I often compare how I am doing socially (e.g., social skills, popularity) with other people.	○	○	○	○	○
I am not the type of person who compares often with others.	○	○	○	○	○
Please choose "Neither agree nor disagree"!	○	○	○	○	○
I often try to find out what others think who face similar problems as I face.	○	○	○	○	○
I always like to know what others in a similar situation would do.	○	○	○	○	○
If I want to learn more about something, I try to find out what others think about it.	○	○	○	○	○

***

Please answer the following questions!

	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
I did understand the questions in this study well.	○	○	○	○	○

Do you think the researchers in this study had an agenda? If yes, please state what do you think the research agenda was.

«text field»

***

Thank you for participating in our study!

Based on your effort in fulfilling the given task you were assigned the middle rank in your group. Based on this ranking, you received an endowment of $7.00. You invested $2.20 of your endowment and earned $0.00 from your investment. Therefore you final payoff for today's experiment amounts to $4.80.

Your secret completion code: "ExampleCode"

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