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Fast and Slow Investments in Asset Markets: Influences on Risk Taking

Abstract

The aim is to investigate whether elevated risk taking in asset market experiments driven by rank-based performance incentives decrease if removing a time limit on choices and minimizing complexity of strategic optimization. In a scenario experiment, business school students (n=123) acting as investment managers in a fund company make investments at self-paced rates. The results show that investments are influenced by rank-based compensations implemented as a relative comparison standard but not that risk taking is elevated. The motive to minimize losses relative to others appears to counteract risk taking, particularly if poor performance is penalized by reducing the fixed income.

Key words: Mutual fund industry, Performance evaluation, Financial risk taking
Fast and Slow Investments in Asset Markets: Influences on Risk Taking

Introduction

Performance-based compensations are common in the mutual fund industry (Ma, Tang, and Gomez 2018). Examples are rank-order tournaments that fund companies implement by offering higher salaries to investment managers whose performance ranks highest, at the same time as placing those whose performance ranks lowest at risk of demotion or even losing their jobs (Chevalier and Ellison 1999; Kempf, Ruenzi, and Thiele 2009). Although the purpose is to induce competition to improve the investment managers’ performance, a drawback is that the competition may inadvertently result in elevated risk taking (Brown, Harlow, and Starks 1996; Chevalier and Ellison 1997; James and Isaac 2000).

Gärling, Fang, and Holmen (2019a) propose that the elevated risk taking in rank-order tournaments is caused by over-confidence driven by a motivated-reasoning bias to judge oneself to be better than the competitors (Alicke and Govurum 2005; Moore 2007; Schoenberg and Haruvy, 2012). Another related explanation is that non-monetary benefits of winning augment economic incentives (Dijk, Holmen, and Kirchler 2014; Kirchler, Lindner, and Weitzel 2019). Kuziemko et al. (2014) show that avoid being last is a possible motive to increase risk taking. Suggesting that risk taking is believed to be a winning strategy, Eriksen and Kvaløy (2017) and Schedlinsky, Sommer, and Wohrman (2016) find that in trying to defeat others, participants make risky choices even if it is not a dominant strategy.

In actual asset markets, traders make decisions within seconds after new information arrives (Busse and Green 2002). This feature is preserved in laboratory asset market experiments (for reviews, see Noussair and Tucker 2013; Palan, 2013; Powell and Shestakova, 2016). Ferri, Ploner, and Rizzolli (2016) show that, in an asset market experiment, risk taking and mispricing are higher compared to when choices are forced to be slower. If traders are asked to maximize their performance relative to others to win prizes, the demand to strategically optimize choices augments the complexity of choices (Eriksen and Kvaløy 2017; Schedlinsky, Sommer, and Wohrman 2016). An even stronger effect of limited choice time may therefore be expected. In this paper we report an experiment in which participants play the role of investment managers in a fund company offering their employees rank-based performance compensations. The aim is to investigate whether elevated risk taking is reduced or eliminated if no time limit is imposed on choices and strategic optimization is simplified. The results show that for no time limit a relative comparison standard (the stock market index or the average-ranked competitor’s performance) does not increase risk taking compared to when there is no relative comparison standard.

In the next section, we first review asset market experiments documenting that rank-based performance incentives increase risk taking, then experiments showing how limited choice times may affect financial risk preferences. In a following section, we derive the hypotheses tested in the experiment presented thereafter. The paper finishes with a discussion of the experimental results and their implications.
Previous research

Risk taking in asset market experiments

Many rank-order tournament experiments (for a review, see Dechenaux, Kovenock, and Sheremeta 2015) investigate optimal effort choices by observing participants choose between outcome distributions with different means associated with costly effort. Choices between outcome distributions with different variances (e.g. risky and safe outcomes) have less frequently been investigated. Nieken and Sliwka (2010) referred to such experiments as risk-taking tournaments. In this subsection our focus is limited to review studies of how performance-based incentives influence risk taking in asset market experiments.

Kirchler, Lindner, and Weitzel (2019) investigate in an asset market experiment how rank-based incentives influence risk taking by finance professionals. Markets consisting of groups of six are randomly assigned to one condition in which payments are based on individual performance, in addition to the payments based on individual performance participants are in another condition informed about how their performance ranks in the group, and in a third condition participants are also paid a prize depending on their rank (winner receiving half the prize, second best one third, third best one sixth, and remaining three nothing). The results show that more investments are made in a risky asset than in a risk-free asset when ranks are disclosed whether or not being payment-related. In contrast, the results are different for a heterogeneous group of students. In the same asset market experiment with reduced stakes, the students make more investments in the risky asset only when ranks are payment-related. Ranks are thus sufficient to increase the finance professionals’ risk taking, whereas payments need to be provided to increase students’ risk taking. The latter finding is however different in another experiment (Dijk, Holmen, and Kirchler 2014) in which business school students in groups of ten construct portfolios from stocks with positively (more risky) or negatively (less risky) skewed return distributions. Information about ranks after each period has similar effects on risk taking whether or not the ranks are associated with monetary payments.

Fang et al. (2017) perform an asset market experiment in which business school students trade a single risky asset. Their performance is in each period compared to three others. In one condition referred to as a winner-takes-all tournament, only the best performing participant receives a prize, whereas in another condition referred to as an elimination contest, the three best performers share the prize, thus making the fourth participant the single loser. Participants are either playing the roles of investment managers earning the rank-based payments or ordinary traders earning the returns of their investments. In the winner-takes-all tournament, investment managers invest more whereas in the elimination contest they invest less in the risky asset than ordinary traders do.

Ferri, Ploner, and Rizzolli (2016) show in an asset market experiment that if participants’ sell and buy choices are delayed by 10 sec in one condition, the results differ from another condition in which the choices are not delayed. In the condition with no delay the prices overshoot and in the condition with delay undershoot fundamental values. The results also suggest that risk taking is initially more frequent in the no delay than in the delay condition. However, two other studies
show that elevated risk taking induced by rank-based performance incentives may not be eliminated by longer choice times. Schedlinsky, Sommer, and Wohrman (2016) conduct a multi-period experiment in which participants in each period choose how much of an initial endowment to invest in a risky or risk-free option. In different conditions the return of investments in the risky option is a high or low gain versus nothing. The low probability of the gain always makes the expected value of the investment negative. A prize is in each period awarded one winner in 4-person groups. The results show that participants maximize the gain outcomes by investing instead of choosing to not invest which would optimize their chance to win the prize. Since 60 sec are allowed for the investment choices, the results are not likely to be influenced by a limited choice time. Eriksen and Kvaløy (2017) conduct a similar experiment in which undergraduates with no imposed time limit make repeated independent choices of keeping an endowment or investing a fraction by taking a higher risk of losing than winning. When competing in four-person groups for a prize to a winner with the largest endowment, the participants more frequently choose to invest despite that the expected value is negative and the dominant strategy is to not invest.

Addressing the question of whether performance-based incentives increase risk taking if not depending on comparisons with peer performance, Holmen, Kirchler, and Kleinlercher (2014) and Kleinlercher, Huber, and Kirchler (2014) investigate effects of percentages of returns exceeding a benchmark (referred to as convex incentives). An asset market experiment is conducted in which business school students trade a risky asset. In Holmen, Kirchler, and Kleinlercher all participants have convex incentives (earning a percentage larger than 100% of the returns) in one condition, earning the returns (referred to as linear incentives) in another condition, and earning either convex or linear incentives in a third condition. In the latter condition participants with convex incentives are more risk taking than those with linear incentives. Fabretti et al. (2017) replicate these results in generalizing an agent-based simulation to features of actual asset markets not represented in the experiment, including a larger number of participants, differences in endowments and liquidity constraints, and differences in risk aversion. Kleinlercher, Huber, and Kirchler (2014) investigate whether risk taking is influenced by penalties for not exceeding the benchmark. The results show that risk taking is reduced by penalties compared to convex or linear incentives.

In summary, performance-based monetary incentives increase risk taking in asset market experiments and the results suggest that ranks have incentive values independently of monetary payouts. Limited choice time may play a role for elevated risk taking, but more time does not decrease risk taking if it does not result in that an optimizing strategy is selected.

**Effects of limited choice time on financial risk preferences**

To examine influences of limited choice time on financial risk taking when there is no competition with others, several laboratory experiments assess risk preferences based on choices between gambles with monetary outcomes versus sure monetary outcomes. In one experiment with student participants, Kocher, Pahlke, and Trautman (2013) investigate effects of limited choice time on risk preferences for gambles with either gains, losses, or both gains and losses. The results replicate the reflection effect (Kahneman and Tversky 1979) in demonstrating risk
aversion for gains and risk taking for losses when there is no time limit, but when there is a time limit (median choice times $\approx 2$ sec compared to $\approx 6$ sec) risk aversion is observed for both gains and losses. The results for the mixed gambles suggest that loss aversion increases when there is a time limit.

Kirchler et al. (2017) investigate a population-based sample and three samples of students from different universities in a study of financial risk preferences when choice times are limited. Fast (<7 sec) intuitive choices are compared to delayed ($\geq 7$ or $\geq 20$ sec) deliberate choices. Risk preferences are measured for gambles with monetary outcomes, either gains, losses, or both gains and losses. The reflection effect is observed for a time limit, whereas the effect is reduced for delays. No effect of time limit is observed on loss aversion.

Another finding reported by Saqib and Chan (2015) is that a time limit reverses the reflection effect. In several experiments employing Mechanical Turk workers, the hypothesis is tested that for limited choice time the reference point in Prospect Theory’s value function (Kahneman and Tversky, 1979) shifts from status quo to the outcome (gain or loss) with the highest nominal value. A lower sure gain then becomes less preferred resulting in risk taking for gains, whereas a lower loss becomes more preferred, thus resulting in risk aversion for losses.

Bechera and Damasio (2005) propose that feelings act as “somatic risk markers”. Others likewise propose that feelings influence risky choices (Loewenstein et al., 2001), and still others that if choice time is limited, feelings frequently substitute for analysis (Finucane et al. 2000; Kempf, Merkle, and Niessen-Ruenzi 2013). In Persson et al. (2018) students are asked to make choices within 7 sec or after a delay of 7 sec between a sure gain (loss) and an equal probability of obtaining a larger gain (smaller loss) or nothing. Only when choice time is limited, a positive relationship is observed between risk taking for losses and a physiological index of feelings (skin conductance).

In summary, the reviewed laboratory experiments performed to assess financial risk preferences based on choices between gambles provide no unequivocal support for that limited choice time increases risk taking. Support is obtained for that a time limit causes deviations from expected value and influences feelings.

**Hypotheses**

A time limit tends to result in that traders in asset market experiments increase risk taking (Ferri, Ploner, and Rizzolli 2016). If a limited choice time impairs deliberate decision making, an additional possible explanation of elevated risk taking evoked by rank-based performance incentives (Fang et al. 2017; Kirchler, Lindner, and Weitzel 2019) is an inability to choose an dominant strategy (Eriksen and Kvaløy, 2017; Schedlinsky, Sommer, and Wohrman, 2016). Laboratory experiments assessing financial risk preferences appear not to increase risk taking when a time limit is imposed but to result in choices deviating from expected value (Kirchler et al. 2017; Kocher, Pahlke, and Trautman 2013), as well as to increase the influence of feelings (Persson et al. 2018). Time limits may also make trading decisions in asset markets more influenced by feelings. An example is that Andrade, Odean, and Lin (2015) in inducing feelings
by video clips find that excitement is associated with larger bubbles, while fear does not appear to play any role. Furthermore, the experiments by Eriksen and Kvaløy (2017) and Schedlinsky, Sommer, and Wohrman (2016) suggest that the strategic complexity makes participants take more risk. In our experiment we investigate whether minimizing strategic complexity reduces elevated risk taking. In order to facilitate deliberate decision making preceding investment choices, we do not impose a time limit and we extend participants’ opportunity to judge the investment options before making a decision.

In the experiment, business school students play the role of investment managers in fund companies that offer rank-based performance compensations. Their task is to use hypothetical cash to invest in stocks that according to a normal distribution of returns are expected to increase the value of their portfolio (similarly to the procedure used by Duxbury and Summers 2004). The positive expected value of the return distribution is varied in three steps for high or low risk (variance). Strategic optimization is simplified in that the fund company sets a comparison standard for the change of the portfolio value relative to peers’ performance. Above the standard a non-monetary or a hypothetical monetary reward proportional to the increase in portfolio value is offered, and below a hypothetical monetary penalty proportional to the decrease in portfolio value is imposed. Before making an investment choice, participants are asked to judge how beneficial the investment options are for the fund company. In order to not impose a time limit, all phases of the experiment are self-paced. Risk taking is assessed both as the frequency of investments and the difference between the frequency of investments in high-risk stocks (return distributions with larger variance) and low-risk stocks (return distributions with smaller variance) with the same expected values. We propose the following hypotheses:

Consistent with the results of previous research (Eriksen and Kvaløy 2017; Fang et al. 2017; Kirchler, Lindner, and Weitzel 2019; Kuziemko et al. 2014; Schedlinsky, Sommer, and Wohrman 2016), risk taking (investments) would in our experiment increase below the relative comparison standard despite that the expected value is lower, and more investments would be made in high-risk than in low-risk stocks. We conjecture that elevated risk taking is counteracted by both removing a time limit on choices and minimizing strategic complexity. We therefore propose hypothesis $H_1$ that investments are more frequent above than below the relative comparison standard. We also expect (hypothesis $H_2$) that investments are more frequent in low-risk stocks than investments in high-risk stocks.

Although according to hypothesis $H_1$ risk taking does not increase for rank-based performance incentives, the results may still differ in line with some other findings in previous research. Holmen, Kirchler, and Kleinlercher (2014) and Kleinlercher, Huber, and Kirchler (2014) show that risk taking increases for performance-dependent payments that do not entail comparisons with peers. Rank-based performance incentives may still boost increases in risk taking (Kirchler, Lindner, and Weitzel 2019). In our experiment, the market index is compared to the average-ranked competitor’s performance as the relative comparison standard. Since the latter would appear more accurately represent the performance of the competitors than the former, it may influence more participants and therefore have a stronger effect on investments. Thus, we propose hypothesis $H_3$, that if the relative comparison standard is the average-ranked
competitor’s performance, investments would be more frequent above and less frequent below the relative comparison standard than if it is the market index.

Dijk, Holmen, and Kirchler (2014) and Kirchler, Lindner, and Weitzel (2019) find that in asset market experiments, non-monetary rank-based performance incentives have the same or stronger effects on risk taking than monetary incentives. Kleinlercher, Huber, and Kirchler (2014) show that risk taking decreases when performance not exceeding a benchmark is penalized. A penalty (a reduced fixed hypothetical salary) may evoke a stronger aversion toward losing than non-monetary losses relative to peers (Gärling et al. 2019b, Experiment 1). We therefore propose hypothesis H4 that risk taking is lower below the relative comparison standard when a penalty is imposed, whereas performance-related (hypothetical) monetary incentives does not increase risk taking more than non-monetary incentives above the relative comparison standard.

Method

Emails are sent to students enrolled in business administration and economics programs at the undergraduate and master levels at two Swedish business schools. The students are invited to participate in an online study of financial investments in asset markets. They receive detailed information about participation in the study (as described below). Of the students contacted, 305 access the website with the experimental material. Three questions are posed to assess the students’ knowledge of the stock market (“Do you own stocks or shares in stock funds [excluding funds in the mandatory pension system]?”, “How frequently do you inform yourself about the stock market?”, “How much knowledge do you feel you have about stocks and stock funds?”). After answering these questions, 156 students drop out. The remaining participants are informed that their task is to play the role of an investment manager in a fund company. Another 26 drop out after having rated the value for the fund company of six investment options (stock shares in companies). Questions asked in a pilot study to those dropping out at this stage suggest that after reading the instructions, answering the knowledge questions, and initially rating the investment options, they feel that doing the experiment is too demanding or require knowledge they lack. In independent t-tests, the dropouts’ answers to the knowledge questions do not differ significantly (p>.25) from the answers by those choosing to participate. Of the remaining 123 participants (61.8% men, median age 24 years within a range from 19 to 62 years) who complete the experiment, 92 (74.8%) report owning stocks, 29 (23.6%) that they inform themselves regularly and 63 (51.2%) occasionally about the stock market (e.g. share prices, market forecasts, and company acquisitions and mergers), and 10 (8.1%) indicate that they have much, 29 (23.6%) rather much, and 62 (50.4%) some knowledge about stocks and stock funds.

In the e-mail invitations, participants are informed that the study takes about 15 minutes to complete, that they are free to quit whenever they wish, that the data only will be used for research purposes, that their identity will not be disclosed, and that they are not offered any compensation except that they will later receive information about the study and the aggregated results. Additional information include what device they may use, that they are required to find a quiet place to individually answer all questions without being interrupted, and how to access the website with the experimental material. The majority of participants (75) use stationary computers, laptops, or pads, the remaining (48) use smartphones. Median time for answering the
questions is 642 sec with a quartile range of 211 sec. After having finished the experiment, participants report their sex, age, main study program, and number of semesters at the university.

The experiment is programmed in Qualtrics (www.Qualtrics.com). The participants are instructed to imagine being employed by a fund company to manage a stock portfolio worth 10 million Swedish crowns (1 SEK is approximately equal to 0.12 USD and 0.10 Euro at the time of the study) (the instructions translated into English are given in Appendix). Their current task is to buy stocks for a sum of SEK 175,000 in one of six companies. A normal distribution indicates how many percent from 0 to 6 (steps of 0.5%) and how much from SEK 0 to SEK 600,000 (steps of SEK 50,000) their portfolio is expected to increase after next quarter if they buy stocks in the company. Figure 1 shows that the distributions vary in expected value (2.5% or SEK 250,000; 3% or SEK 300,000; 3.5% or SEK 350,000), and for each expected value the standard deviation is either 0.5% or 1% (expressed as 95% confidence intervals). The distributions are described in the text as well as shown graphically above the table displaying the increases in percent and SEK. The 95% confidence intervals are shown in the graphs. The six investment options are first presented in individually randomized orders asking the participants to indicate how good or bad buying the stocks would be for the fund company. They select a number on a scale from -3 (maximally bad) to 3 (maximally good).

![Insert Figure 1 about here](image)

The investment options are then presented again in new individually randomized orders and the participants are asked to choose to buy or not buy the stocks followed by selecting a number on a scale from 0 (indifferent between buy or not buy) to 3 (much better to buy or not buy). The participants are informed that only one of their choices is executed because of the competition with other buyers but that they do not know which one. If the cash is not invested, it may be invested later when more information is available. It is saved at an annual risk-free interest rate of 1%. The participants are also told at this point that after completion of all choices, one of their choices will be chosen randomly, and if they invested in the stocks, the change in the worth of their portfolio is disclosed to them privately.

The participants are randomly assigned to one of seven conditions before making the investments. In one condition referred to as control no additional information is given. In two other conditions referred to as no payment the information is added that last quarter the market index (no payment/index) or average-ranked fund company’s portfolio (no payment/rank) increased by 3%. In two other conditions referred to as bonus payment the instructions explain that the fund company competes with other fund companies to attract investors and that they therefore pays a bonus of 20% of the increase above the 3% increase of the market index (bonus payment/index) or average-ranked fund company’s portfolio (bonus payment/rank). In the remaining two conditions referred to as penalty the bonus is the same but a deduction is made from the fixed monthly salary by 20% of the decrease below the 3% increase of the market index (penalty/index) or average-ranked fund company’s portfolio (penalty/rank). As Figure 1 shows, in the bonus payment or penalty conditions a row is added in the table below the graph to disclose the bonuses or bonuses and penalties.
Results

Table 1 summarizes the results. The first row shows the mean initial ratings of the stocks made before the choices. The ratings are transformed linearly to range from 1 (maximally bad) to 7 (maximally good) with 4 defined as “neither good nor bad”. The following rows show for each condition the proportion of choices to invest, mean preference ratings associated with choices to invest or not invest, and median choice times. The preference ratings made on the scale from 0 (indifferent) to 3 (chosen option much better) are transformed by \((2\text{Choice} – 1)\text{Rating}+4\) (with choice coded 1 for buying and 0 for not buying). The transformation results in a scale ranging from 1 (maximal preference for choice to not invest) to 7 (maximal preference for choice to invest) with 4 indifference between invest or not invest. It may be seen that in each row the mean ratings increase with the expected value and are lower for low-risk stocks (lower standard deviation of the return distribution) than high-risk stocks (higher standard deviation of the return distribution) except for the two lowest expected values in one of the penalty conditions. A repeated-measures analysis of variance (ANOVA) performed on the initial ratings shows that the means increase significantly with the expected value, \(F(2,232)=57.24, p<.001\), and decrease significantly for the low-risk stocks compared to the high-risk stocks, \(F(1,116) = 17.72, p<.001\).

The difference between the ratings of the high-risk and low-risk stocks increases with expected value as substantiated by a significant interaction, \(F(2,244)=6.36, p<.002\). A mixed-model ANOVA including condition as a between-group factor is performed on the ratings of preference for the choice to invest or not invest. The increase with expected value is significant, \(F(2,232)=94.98, p<.001\), as well as the decrease for the low-risk stocks compared to the high-risk stocks, \(F(1,116)=34.68, p<.001\), and the interaction showing that the difference between the high-risk and low-risk stocks increases with the expected value, \(F(2,232)=3.18, p=.043\). The main effect of condition is significant, \(F(6,116)= 3.78, p =.002\). Below we report \(t\)-tests of planned contrasts to examine hypotheses \(H1-H4\).

A mixed-model ANOVA including condition as a between-group factor is performed on the ratings of preference for the choice to invest or not invest. The increase with expected value is significant, \(F(2,232)=94.98, p<.001\), as well as the decrease for the low-risk stocks compared to the high-risk stocks, \(F(1,116)=34.68, p<.001\), and the interaction showing that the difference between the high-risk and low-risk stocks increases with the expected value, \(F(2,232)=3.18, p=.043\). The main effect of condition is significant, \(F(6,116)= 3.78, p =.002\). Below we report \(t\)-tests of planned contrasts to examine hypotheses \(H1-H4\).

The tests of hypothesis \(H1\) and \(H2\) are performed on averages of and differences between the preference ratings of the high-risk and low-risk stocks with the same expected values. Figure 2 (left graph) shows that in support of hypothesis \(H1\), the mean ratings indicate that the frequency of investments are higher above than below the relative comparison standard (coinciding with the 3% expected value). The linear increase with expected value is significant \((p<.001)\) and not significantly different \((p=.253)\) from the linear increase in the control condition \((p=.001)\). Except for the highest expected value, the means are significantly lower than in the control condition \((2.85 \text{ versus } 3.83, 3.88 \text{ versus } 4.58, \text{ and } 4.94 \text{ versus } 5.39; ps=.003, .026, \text{ and } .170)\). Hypothesis \(H2\) is confirmed by the results displayed in the right graph showing that on average investments in the low-risk stocks are preferred to investments in the high-risk stocks. This preference is stronger below than above the relative comparison standard as shown by a significant linear decrease \((p<.009)\). The reversed linear increase in the control condition is not significant \((p=.794)\). The mean differences are significant for the lowest expected value \((-1.33 \text{ versus } -0.35; p<.001)\).
$p=.038$) but not for the higher expected values (-1.17 versus -0.58 and -1.00 versus -1.02; $ps=.242$ and .970).

The results do not support Hypothesis H3 but lend support to hypothesis H4. The left graph in Figure 3 plots the differences in mean preference ratings between the average-ranked competitor’s performance and the market index. The means for the two highest expected values are, contrary to hypothesis H3, larger for the market index than the average-ranked competitor’s performance. Neither these mean differences or the mean difference for the lowest expected value are however significant (2.83 versus 2.87, 3.92 versus 3.84, and 5.13 versus 4.73; $ps=.875, .762,$ and .112). The right graph shows plots of the preference ratings averaged for the different relative comparison standards. Consistent with hypothesis H4, below the relative comparison standard the ratings are lower in the penalty condition. The mean in the penalty condition differs significantly from the means of no payment and bonus payment for the two lowest expected values (2.48 versus 3.04 and 3.44 versus 4.11; $ps=.035$ and .008) but not for the highest expected value (4.81 versus 5.00; $p=.481$). The mean differences between no payment and bonus payment are not significant (3.15 versus 2.93, 4.32 versus 3.89, and 5.04 versus 4.96; $ps=.448, .114,$ and .760).

Insert Figure 3 about here

Discussion

The results show that in the experimental conditions investments are more frequent above and less frequent below the relative comparison standard, and that investments in low-risk stocks are preferred to investments in high-risk stocks. In comparison with the control condition with no relative comparison standard, investments are less frequent. These results failing to demonstrate elevated risk taking are obtained, as we hypothesize, when no time limit is imposed on choices$^2$ and strategic complexity is minimized.

Failing to support one of the hypotheses, information about the performance of the average-ranked competitor’s performance does not have a different influence than the market index. A stronger effect is expected if participants consider the former to more accurately represent the competitors’ performance. However, the difference is arguably not large since the market index is influenced by the competitors’ performance. Although comparisons with the highest or lowest ranked competitor would possibly have a stronger effect (Schoenberg and Harvuy, 2012), it may still be more important that a relative comparison standard is set by the fund company than the its nature. This is consistent with the findings in previous research of similar effects of incentives not based on ranks (Holmen et al. 2014; Kleinlercher et al., 2014) compared to incentives based on ranks (e.g. Fang et al. 2017; Kirchler, Lindner, and Weitzel 2019).

We find that the relative comparison standard is adopted as a reference point (Kahneman and Tversky 1989) in that, as noted, risk taking (investment) is more frequent above and less frequent below. Additional evidence is that consistent with the reflection effect (Kahneman and Tversky
the investments in the high-risk stocks are more frequent compared to investments in the low-risk stocks below than above the relative comparison standard. The experimental design did not separate the effect of presenting information about the relative comparison standard (with and without offering performance-related monetary consequences) from the instructions to play the role of investment manager. Therefore, we cannot conclusively exclude that the information about the relative comparison standard did not by itself lead to the adoption of it as a reference point. Either information about a relative comparison standard evokes a competitive motivation or participants comply with their beliefs about what they are supposed to do.

An additional explanation of why we did not observe more risk taking is that avoid being defeated is a stronger motive than defeating others (Fang et al. 2017; Kuziemko et al. 2014). Aversion toward losing to the competitors is therefore a possible explanation of that investments below the relative comparison standard are less frequent compared to no relative comparison standard. In asset market experiments where there is time limits on choices and strategic complexity, the possibility of losing to competitors may become less salient than in our experiment. Our results also suggest that salience may be strengthened by a penalty of losing a fraction of the fixed salary, which may happen in actual competitions among investment managers in fund companies (Chevalier and Ellison 1999; Kempf, Ruenzi, and Thiele 2009). The penalty effect is also consistent with the results of Gärling et al. (2019, Experiment 1) and Kleinlercher et al. (2014). In contrast, a bonus payment does not increase investments above the relative comparison standard compared to no performance-related payment. This is in agreement with the results of experiments (e.g. Dijk, Holmen, and Kirchler 2014; Kirchler, Lindner, and Weitzel 2019) showing effects of ranks unrelated to payments. Foregoing an income increase is also likely to be less painful than losing an income (Kahneman & Tversky, 1979).

Additional research is motivated to examine the role of limited choice time and strategic complexity for elevated risk taking in asset market experiments that implement rank-based performance incentives. Our experiment does not make possible to distinguish between these two factors. Although previous research (Eriksen and KvalØy 2017; Schedlinsky, Sommer, and Wohrman 2016) suggests that a time limit is not a necessary factor, it may still interact with strategic complexity by preventing deliberate information processing preceding choices. It is also important to determine the degree to which our results generalize to actual performance by investment managers in fund companies. Although Kirchler, Lindner, and Weitzel (2019) show that in asset market experiments finance professionals are more influenced by rank-based performance incentives than a heterogenous group of students, this may not apply to the business school students in our experiment since their backgrounds may be more similar to the finance professionals’ backgrounds.

Schedlinsky et al. (2017) raise the issue of how to suppress elevated risk taking without eradicating the beneficial effects of rank-based incentives to improve performance. In a tournament experiment similar to Schedlinsky et al. (2016) described above, they show that an ethical code and required justification decrease risk taking. In the present experiment we do not observe elevated risk taking. Our results instead highlight that less risk taking than desired may
not either be in the interest of the fund company. The problem that still asks for a solution is therefore how to align investment managers’ interest with fund companies’ interest.

Notes

1. Following Kühberger, Schulte-Mecklenbeck, and Perner (2002), we consider it more adequate to increase the realism of the investments by expressing cash, returns and compensations in hypothetical sums of money similar to what is common in the mutual fund industry. Incentivizing participants with small sums of real money would likely have abolished the realism. In addition to the information about the study and its aggregated results, in order to maintain the realism participants also privately receive information about their own performance directly after finishing the experiment.

2. Note that the observed median choice time in our experiment is 25 sec which is substantially higher than in the no delay condition of Ferri, Ploner, and Rizzolli (2016).
Appendix (Instructions)

Thank you for agreeing to participate. We ask you to first answer some questions about your knowledge of the stock market, then to judge the value of stocks and decide to buy or not. Finally, we ask a number of other questions about you. In total we expect this will take about 15 minutes.

Initial rating of investment options

Imagine being employed by a fund company to manage a stock portfolio that today is worth SEK 10 million. Your task is to buy stocks in companies such that the worth of your portfolio increases. For this you have SEK 175,000. If you do not invest the cash, it is saved at an annual 1% risk-free interest rate.

On the following pages you will receive information about six different companies (A, B, C, D, E, and F) presented in random order. Buying stocks in the companies is expected to increase the worth of your portfolio after next quarter. For each company you will be informed with how much in percent and SEK the portfolio worth increases if you use all your cash to buy stocks. We ask you to judge how good or bad this would be for the fund company.

When you have finished this task, the information about the companies will be presented again asking you to choose to buy or not buy the stocks.

{Example company A: Expected value 2.5%, standard deviation 0.5%}

The graph and table below shows that if you use all your capital of SEK 175,000 to buy stocks in this company, the most likely increase of your portfolio is 2.5% (SEK 250,000) and in 95% of cases the increase is between 1.5% (SEK 150,000) and 3.5% (SEK 350,000).

Rate how good or bad the investment is for the fund company to use the capital of SEK 175,000 to buy stocks in this company. Select 3 if it is maximally good, 2 if it is very good, 1 if it is good, 0 if it is neither good nor bad, -1 if it is bad, -2 if it is very bad, and -3 if it is maximally bad.

Choice of investment

{Control condition [No payment/index | No payment/rank]}

On the following pages we now ask you to buy stocks in the companies A, B, C, D, E, and F (presented in another random order). By using your capital to buy stocks, the worth of your portfolio is expected to increase.
Because you compete with other buyers in the market, only one of your choices will be executed. Since you do not know which one, make all your choices as if they will be executed. When you have made all your choices, we will randomly select one company and inform you how much your portfolio worth increased if you bought stocks in this company.

{Example company A: Expected value 2.5%, standard deviation 0.5%}

The graph and table below shows that if you use all your capital of SEK 175,000 to buy stocks in this company, the most likely increase of your portfolio is 2.5% (SEK 250,000) and in 95% of all cases between 1.5% (SEK 150,000) and 3.5% (SEK 350,000). [The market index increased with 3% last quarter. The average-ranked fund company’s portfolio increased with 3% last quarter.] If you do NOT buy the stocks, you can instead use your capital to buy stocks later when you have more information.

Insert Figure A2 here

If you choose to BUY indicate on the scale below how much better this choice is compared to NOT BUY. If you instead choose NOT BUY indicate on the same scale how much better this choice is compared to BUY. 0 means that your chosen alternative (BUY or NOT BUY) is neither better nor worse than the not chosen alternative (NOT BUY or BUY), 1 that is slightly better, 2 that it is clearly better, and 3 that it is much better.

<table>
<thead>
<tr>
<th>I DO NOT BUY</th>
<th>I BUY</th>
</tr>
</thead>
</table>

| 0 | 1 | 2 | 3 |

{Bonus condition/index | Bonus condition/rank [Penalty condition]}

On the following pages we now ask you to buy stocks in the companies A, B, C, D, E, and F (presented in another random order). By using your capital to buy stocks, the worth of your portfolio is expected to increase.

Your fund company competes with other fund companies to attract investors. It is therefore important according to the company that the worth of your portfolio exceeds a 3% increase of the market index last quarter or the average-ranked fund company’s portfolio last quarter. By buying the stocks, the worth of your portfolio may increase above this. If the increase is more than 3%, a bonus of 20% of the difference is added to your fixed monthly salary. [If the increase is less than 3%, 20% of the difference is deducted from your fixed salary.]

Because you compete with other buyers in the market, only one of your choices will be executed. Since you do not know which one, make all your choices as if they will be executed. When you have made all your choices, we will randomly select one company and inform you how much your portfolio worth increased if you bought stocks in this company.

{Example company A: Expected value 2.5%, standard deviation 0.5%}
The graph and table below shows that if you use all your capital of SEK 175,000 to buy stocks in this company, the most likely increase of your portfolio is 2.5% (SEK 250,000) and in 95% of all cases between 1.5% (SEK 150,000) and 3.5% (SEK 350,000). The market index increased with 3% last quarter and you can in the table see how this affects your compensation for the different possible increases of the worth of your portfolio. If you do NOT buy the stocks, you can instead use your capital to buy stocks later when you have more information.

Insert Figure A3 here

If you choose to BUY indicate on the scale below how much better this choice is compared to NOT BUY. If you instead choose NOT BUY indicate on the same scale how much better this choice is compared to BUY. 0 means that your chosen alternative (BUY or NOT BUY) is neither better nor worse than the not chosen alternative (NOT BUY or BUY), 1 that is slightly better, 2 that it is clearly better, and 3 that it is much better.

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0 1 2 3
References


Table 1. Proportion choices to invest (p), mean preference ratings of choices to invest (M), and median choice times in sec (CT) for investment options having return distributions with different expected values and standard deviations presented in the different conditions.

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<th>2.5%/1%</th>
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<th>3%/0.5%</th>
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<th>3%/1%</th>
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<th>3.5%/0.5%</th>
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<tr>
<td></td>
<td>P</td>
<td>M</td>
<td>CT</td>
<td>p</td>
<td>M</td>
<td>CT</td>
<td>p</td>
<td>M</td>
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<td>CT</td>
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Figure Captions

Figure 1. The expected values (thick bars) and 95% confidence intervals (distances between thin bars equal to 4 standard deviations) associated with the return distributions of stocks in the companies A to E. (Returns for left broken line corresponds to the investment, returns for right broken line corresponds to the relative comparison standard.)

Figure 2. Means and 95% confidence intervals of preference ratings of choices to invest or not invest (left graph) and differences between preference ratings of investments in high-risk and low-risk stocks (right graph) plotted against expected values for conditions with relative comparison standard and control condition with no relative comparison standard.

Figure 3. Means and 95% confidence intervals of preference ratings of choices to invest or not invest plotted against expected values for the relative comparison standard average-ranked competitor and market index (left graph) and for no payment, bonus payment, and penalty conditions (right graph).
Figure 1
Figure 2
Figure 3
Figure A1
Figure A2
### Figure A3

![Normal Distribution Chart](image)

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