The Effect of Performance Measures on Risk in Capital Investment Decisions

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ABSTRACT

We conduct an experiment to examine the separate and interactive effects of individuals' risk preferences and two commonly-used performance measures – return on investment (ROI) and residual income (RI) – on the riskiness of capital investment decisions. We predict and find that the use of ROI as a performance measure leads to riskier choices as compared to RI, and that this effect tends to be concentrated in relatively more risk-averse individuals. We also provide process evidence that reveals some of the ways in which performance measures affect individuals' decisions. Our results are consistent with theory from psychology (security-potential/aspiration theory), in that ROI potentially induces more risk-taking by enabling individuals to more easily satisfy aspirations for a positive performance measure outcome than RI, thus freeing them to focus more on striving for high outcomes. Collectively, our results contribute to literature examining the effects of accounting information and performance measures on managers' risk-taking behavior.

Keywords: Risk; performance measures; capital investment; performance evaluation

1. Introduction

In competitive environments, firms must pursue innovation and growth opportunities in order to be successful, and these opportunities involve risk (e.g., Shapira 1995; Sarasvathy, Simon, and Lave 1998; Bouchikhi and Kimberly 2001). While firms typically have a large portfolio of projects that help diversify away many project-specific risks, managers have a more limited set of projects and, as a result, are less able to diversify their risk (Fama 1980; Jensen and Murphy 1990). This leads to managers choosing less risky projects than firms would prefer (Lintner 1965; Lambert 1986; Hirshleifer and Suh 1992; Holmström 1999).[1] Pay-for-performance incentive compensation is a common mechanism that firms utilize to address this agency problem and encourage managers to make risky investments (e.g., Kreilkamp, Matanovic, Sommer, and Wöhrmann 2019), but despite this and other methods of aligning incentives, firms still often struggle to induce managers to make investments that are optimal from the firm's perspective (Jensen and Meckling 1976; Thaler 2015).

Prior research in accounting has examined whether controls such as performance benchmarks (Chow, Kohlmeyer, and Wu 2007), bonus incentives (Drake and Kohlmeyer 2010), and compensation caps (Kreilkamp, Matanovic, Schmidt, and Wöhrmann 2018) affect managers' risk-taking. Recent studies have also begun to investigate whether, and to what extent, the reporting of accounting information affects capital investment (e.g., Roychowdhury, Shroff, and Verdi 2019). Consistent with this line of inquiry, we examine the impact on capital investment decisions of managers' risk preferences and the performance measure used to evaluate project outcomes. Specifically, we investigate whether managers' capital investment decisions differ

[1] Research suggests that managers' reluctance to invest in risky projects is also due to the fact that managers usually have a shorter horizon than owners, which may also cause them to underinvest in risky long-term projects (Holmström 1999).

when their performance is evaluated using return on investment (ROI) as compared to when using residual income (RI), two common performance measures used by firms. Understanding how these common performance measures may affect individuals' perceptions of risk – as well as how they may interact with individuals' inherent preferences for risk – is important because identifying and understanding the factors that influence investment decisions may help firms resolve agency frictions and motivate managers to pursue levels of risk more in line with the firm's preference.

Theory and research suggest that individuals have differing appetites for risk (e.g., Pratt 1964; Slovic 1972a; Weber and Milliman 1997; Dohmen, Falk, Huffman, Sunde, Schupp, and Wagner 2005, 2011), and we expect these natural preferences to affect capital investment decisions such that relatively risk-seeking individuals will pursue riskier projects as compared to relatively risk-averse individuals. From a wealth maximization perspective, the performance measure used to report outcomes should not affect individuals' decisions as the measure does not change the underlying economics of any possible outcome. However, based on goal theory (e.g., Locke and Latham 1990; Brown and Latham 2000), we expect that individuals will internalize these performance measures and adopt them as their goal and, as a result, the performance measures will affect risky decisions. Moreover, based on security-potential/aspiration (SP/A) theory from psychology (e.g., Lopes 1987; Lopes and Oden 1999), we expect that ROI may make projects appear less risky and more certain to meet individuals' aspiration levels, and thus lead individuals to pursue more risk as compared to when RI is the performance measure. Finally, we expect that – due to differences in the relative importance of factors like minimum versus maximum payoffs and the likely perspective from which risky decisions are made – the effect of performance measures on risky choice will be concentrated in relatively risk-averse individuals.

We use a controlled laboratory experiment to examine how individuals' risk preferences

and the use of performance measures affect individuals' risky investment choices. In our experiment, participants act as a division manager for a firm and make a series of capital investment decisions, receiving compensation based on the outcomes of the projects they choose. Five different capital projects are presented to participants in a pairwise manner. All capital projects have the same expected value and the same expected compensation to the manager, but vary in terms of the risk (variance) of the project outcomes. We manipulate between-participants whether the outcomes of the projects are reported using either ROI or RI. We measure individuals' risk preferences using a previously-validated questionnaire item adapted from prior research (e.g., Dohmen et al. 2005, 2011).

Results of our experiment are in line with our expectations. We find that individuals with greater inherent preferences for risk pursue riskier projects in a capital investment setting. Furthermore, consistent with our predictions, we find that managers' investment decisions are affected by the different performance measures used to evaluate project outcomes, in that the use of ROI leads individuals to pursue more risk as compared to the use of RI. We also find that the effect of performance measures interacts with individuals' risk preferences, such that ROI induces more risk-taking primarily in relatively risk-averse individuals. Finally, consistent with SP/A theory, we find evidence that this effect of performance measures on risk-averse individuals is due to the ways in which ROI makes projects appear less risky and more likely to meet individuals' minimum aspiration levels, thus "freeing" them up to focus on – and pursue – greater (and riskier) outcomes.

Our results have several important implications for research and practice. We document that individuals' inherent preferences for risk affect their decisions in our capital investment setting, adding to the generalizability of related theory and research in risk that uses similar

measures of risk preference (e.g., Dohmen et al. 2011). In addition, we provide evidence that – on average – evaluating investment projects using ROI leads to riskier project choices than when evaluating projects using RI. This result suggests that, in addition to aligning managers' compensation with firm objectives, firms also need to consider the accounting measures used to report performance. Literature from practice suggests that RI or economic value added (EVA) are better measures of performance than ROI (e.g., Stewart 2013) because they encourage managers to invest in profitable projects that might be rejected if evaluated with ROI, which is typically referred to as the "underinvestment problem" (e.g., Datar and Rajan 2019). However, our results suggest that, while the underinvestment problem may still exist, the problem may not be as acute as once thought given that ROI may induce more risk-taking by managers – an effect that may help explain why ROI is frequently used by firms despite its potential drawbacks.

Our finding that ROI induces greater risk-taking primarily in risk-averse individuals adds an important descriptor to the potential relationship between performance measures and risk-taking. Since theory and research suggest that managers are generally risk-averse (e.g., Jensen and Meckling 1976, etc.), this result further highlights the practical implications of using ROI to evaluate performance for any firm struggling to induce sufficient risk-taking in risk-averse managers. Relatedly, our finding that ROI may make projects appear less risky and more certain to meet individuals' aspiration levels sheds light on some of the ways in which individuals' perceptions of risk can be altered by the choice of performance measures. In doing so, our study extends literature that examines the effect of performance reporting on capital investment decisions (e.g., Bushman and Smith 2001; Roychowdhury et al. 2019) by identifying and isolating a specific mechanism through which accounting performance information affects risky capital investments. Since innovative, breakthrough ideas are inherently risky, and managers often choose

safe projects at the expense of more risky opportunities (e.g., Wisemand and Gomez-Mejia 1998; Kunz and Pfaff 2002), our findings suggest that the choice of the appropriate performance metric may be one low-cost solution to this common agency problem.

The remainder of this paper is organized as follows. The next section discusses relevant literature and develops our hypotheses. Section three describes the experimental research design, section four presents the results, and section five provides a summary and discussion.

2. Theory and Hypotheses

Managers' Risk Aversion

Our study examines managers' willingness to invest in risky projects. In classical decision theory, "risk" reflects the variation in the distribution of possible outcomes related to a decision or choice – i.e., there is uncertainty about which outcome in a distribution of outcomes will occur. However, the distribution of outcomes and the probability of each outcome's occurrence are known (Knight 1921). For example, when a coin is flipped, it is known that the coin can only land on one of two possible outcomes (i.e., heads or tails) and each possible outcome has a fifty percent likelihood of occurring. Risk in this context represents the uncertainty as to whether the coin will land on heads or tails.[2]

Early studies examining managers' risk tolerance suggest that managers are generally risk averse (e.g., Cyert and March 1963), and theory highlights why this is potentially problematic in a principal-agent setting (e.g., Jensen and Meckling 1976; Mauer and Ott 2000). While owners can typically diversify the risk associated with their investment in a firm and face a long horizon, managers are less able to diversify any risk associated with the negative effect of the firm's poor

[2] Risk is typically measured by using either a non-linear utility function for money or through the variance of the probability distribution of possible gains and losses associated with an alternative (Pratt 1964; Arrow 1965).

performance on their own compensation and usually face a shorter time horizon. As a result, managers' risk aversion might lead them to invest in less risky projects than the set of projects that would be optimal from the firm's (owners') perspective (Fama 1980; Lambert 1986; Jensen and Murphy 1990; Stanton 1998).

Prior research has examined certain factors that may affect managers' risky investment, finding that equity incentives and differences in bonus structure can incentivize more risk-taking by managers (e.g., Hershleifer and Suh 1992; Coles, Daniel, and Naveen 2006). Recent studies have also investigated how the reporting of accounting information affects capital investment (see Roychowdhury et al. 2019 for a review), suggesting that accounting reports change managers' information sets and thus their investment choices. We contribute to this literature by examining whether managers' risky decisions are affected by different accounting performance measures, either on average or in a manner that interacts with managers' inherent preferences for risk. Given that firms struggle to get managers to take sufficient risk (e.g., Thaler 2015; Zimmerman 2019), it is important to understand factors that may aid firms in these efforts, particularly for relatively risk-averse managers.

Risk Preferences

Theory and research suggest that individuals have certain preferences for risk across virtually any domain, including financial decisions, and that these preferences can widely differ between individuals. While the results of some lab studies have spurred debate that preferences may be malleable, there is evidence that individuals' risk preferences can be relatively stable across time within any particular context (e.g., Pratt 1964; Slovic 1972a, 1972b, 1999; Cole 1998; Holt and Laury 2002; Choi et al. 2007; Dohmen et al. 2011).

Research has also identified individual characteristics that relate to risk preference, finding

– for example – that risk appetite tends to be lower in older individuals (similar to a "horizon" issue in agency settings) and that, on average, women tend to take less risk than men (e.g., Slovic 1999; Eckel and Grossman 2002; Charness and Gneezy 2012). In addition, certain personality traits have been shown to have an association with risk. Sensation-seeking, aggressiveness, and extraversion are all positively associated with risk-taking, while other traits such as conscientiousness are negatively associated with risk (e.g., Levenson 1990; Zuckerman and Kuhlman 2001; Weber and Johnson 2008). Since individual managers vary along all of these dimensions, and thus their general risk preferences, it is important to understand how and in what situations these preferences may differentially affect risk-taking.

Fundamentally, individuals' risk preferences will affect their risky choices in two separate but related ways. First, individuals will vary in the amount of assessed risk they are willing to take in pursuit of desired outcomes. That is, even if two individuals were to assess a risky choice in exactly the same way, an individual who is relatively more risk-seeking will be willing to take on more (expected) risk relative to an individual who is relatively more risk-averse, *ceteris paribus*.

Second, individuals' risk preferences may differentially affect their initial assessments of risk. Theory in psychology explains how individuals' risky decisions are asymmetric for gains as compared to losses and depend upon a starting or reference point at the time of the decision (Kahneman and Tversky 1979; Lopes 1987; Zou, Scholer, and Higgins 2019). Individuals' preferences for risk may alter this perceived reference point and/or the perceived likelihoods and attractiveness of outcomes, in that relatively risk-averse individuals are likely to give far more weight to small probability low-end outcomes (i.e., emphasizing "worst case" scenarios), while risk-seeking individuals are more likely to emphasize high-end or "best case" outcomes (e.g., Slovic 1964; Kahneman and Tversky 1979; Weber and Milliman 1997; Lopes 1987; Simon,

Houghton, and Aquino 2000; Gino and Margolis 2011; Zou et al. 2019). Based on prior research, we expect individuals who are relatively more risk-seeking to choose riskier capital investments than individuals who are relatively more risk-averse. Since there is no question that this relation should hold in an investment setting, on average, we do not make a formal prediction pertaining to this effect. However, finding support for a positive relation between risk preference and risk-taking would provide assurance that the measure of risk preference we use (Dohmen et al. 2005, 2011) is in fact capturing individual differences in attitudes toward risk as intended, and that the risk contained in our capital investment setting is appropriate for studying the potential interactive effects of performance measures and risk preferences.

Performance Measures

Firms often include performance standards in determining employees' compensation in order to motivate them to take actions consistent with the firm's goals, and choosing the manner in which to measure performance is a critical component of firm management (Merchant and Manzoni 1989; Bonner and Sprinkle 2002). The decisions to measure performance and to create a performance standard are both value-creating choices that are commonly made simultaneously (Jensen and Meckling 1976; Zimmerman 2019). When firms are considering capital investments, there are usually thresholds that must be met before an investment is made. For example, many firms use measures such as Net Present Value, ROI, and EVA to evaluate potential investments, and set minimum standards for required return or value created (Stewart 2013; Datar and Rajan 2019). Such thresholds are put in place to motivate, reward, and evaluate employees, and to ensure that firms receive an acceptable rate of return for the capital they invest in projects.

While there are numerous studies that examine how the level of a performance standard or budget standard affects behavior, many of these studies focus on either effort or the reporting of

results (e.g., Chow 1983; Waller and Chow 1985; Webb, Williamson, and Zhang 2013; Newman 2014; Arnold and Gillenkirch 2015) and, as a result, the effect of performance measures on managers' risk-taking behavior remains under-researched.

There are a few studies in accounting that examine whether performance measures affect risky decisions (e.g., Sprinkle, Williamson, and Upton 2008; Chen, Kim, Li, and Zou 2020). For example, in an experimental setting, Sprinkle et al. (2008) find a U-shaped relation between budget levels and risk taking. Specifically, the authors find that low budgets provide the flexibility to take greater risks, whereas (moderately) high budgets induce individuals to make less risky decisions to ensure budget attainment and extremely high (stretch) budgets force individuals to assume greater risk to have any chance of attaining the target. Consistent with the experimental results in Sprinkle et al. (2008), Chen et al. (2020) use data from CEOs' annual bonus plans and find large-scale evidence of a similar U-shaped relation between target difficulty and risk-taking. These results suggest that the budget threshold may affect individual decision-making behavior, a finding that we explore further in our study.

From a motivational standpoint, there are multiple reasons why individuals' decisions will be affected by standards or thresholds. First, if compensation is tied directly to attainment of the threshold, individuals are extrinsically motivated to take action that they believe gives them the best chance of achieving or exceeding the standard. Second, there is an extensive literature on goal setting that suggests that individuals are motivated by obtaining goals or standards and that individuals receive utility when accomplishing goals even when it does not affect their compensation (e.g., Locke and Latham 1990; Brown and Latham 2000) – suggesting that such standards are likely to provide intrinsic motivation as well.

Performance Measures – Thresholds and Security-Potential/Aspiration Theory

Consistent with goals affecting behavior, both Chen et al. (2020) and Sprinkle et al. (2008) find that a budget threshold can affect risk taking behavior. We extend literature in this and related areas by investigating whether managers' behavior is differentially affected by measuring performance (and establishing the threshold) using different performance measures (RI or ROI). While the selection of different performance measures to evaluate project outcomes does not affect the underlying economics of the potential decision, there are several differences between RI and ROI that may impact individuals' investment choices. From a risky investment standpoint, it is more likely that RI returns a negative outcome than ROI. This is due to the fact that any project outcome lower than the cost of capital will result in a negative outcome under RI, but not necessarily under ROI.[3] As such, evaluation using RI should make the firm's performance threshold more salient and – all else equal – may push individuals toward less risky investment choices in an effort to avoid these below-threshold (negative) outcomes.

Relatedly, Security-Potential/Aspiration (SP/A) theory from psychology suggests that individuals employ a two-factor decision-making approach to evaluating alternatives when facing uncertainty (Lopes 1987; Lopes 1990; Lopes 1995; Lopes and Oden 1999). This theory proposes that individuals evaluate alternatives based on the probability of meeting a minimum aspiration level (the "security potential" that the alternative provides). As a result, individuals place the greatest weight on outcomes that fall short of their aspiration level, leading them to focus on worst case scenarios and behave in a risk-averse manner. In the event that the minimum aspiration level is met or individuals cannot differentiate among alternatives, then individuals will be free to focus

[3] For example, assume that a firm has a required rate of return of 10% on capital investments and the firm is considering an investment of $700 that yields an expected profit of $50. Performance under RI would be $-20 ($50 - ($700 × 10%). Performance under ROI would be 7.14% ($50 ÷ 700).

on the highest potential payoffs.

Prior research in accounting (e.g., Sprinkle et al. 2008) suggests that individuals may adopt budgets/targets as their aspiration level and, as discussed earlier, theory suggests individuals may set additional goals for themselves that are not tied to any external reward, compensation, or recognition (Locke and Latham 1990). In financial decisions, it is not unlikely that individuals set goals of above-zero or strictly avoiding "losses" (e.g., Kahneman and Tversky 1979; Locke and Latham 1990; Zou et al. 2019). That is, individuals' minimum aspiration level may be avoiding a negative outcome, which as mentioned previously is achieved at a lower absolute project outcome if ROI is the performance measure being used – thus freeing individuals to pursue greater (and riskier) outcomes if ROI is the performance measure used.

Finally, it is possible that ROI and RI could affect the perceived riskiness or attractiveness of projects due to the ways in which they frame specific project outcomes and/or the range of possible outcomes for a project. For example, since ROI is expressed as a percentage of the capital investment required, its use as a performance measure will essentially scale individual outcomes and compress the absolute range between lowest and highest outcomes relative to using RI as the performance measure. This may cause outcome ranges evaluated using ROI to appear less variable (risky), and extreme outcomes to appear less so, as compared to the same outcomes evaluated using RI. All else equal, these factors could lead individuals to choose riskier projects when ROI is the performance measure used. Based on the preceding discussion, we predict the following:

HYPOTHESIS 1: *The riskiness of managers' investment decisions will be affected by different performance measures, such that managers make riskier choices when ROI – as opposed to RI – is the performance measure used.*

Performance Measures and Risk Preferences

The previous hypothesis proposes that the riskiness of managers' investment decisions will

be affected by different performance measures, an effect we expect to obtain on average. However, it is likely that this effect could differ depending on individuals' inherent preferences for risk. As discussed previously, individuals vary significantly in their preferences for risk and these preferences may affect the perceived riskiness or attractiveness of capital project options and the factors that are most heavily weighted by the individual when making the risky choice (e.g., Pratt 1964; Lopes 1987; Slovic 1999; Dohmen et al. 2011).

For example, our discussion above suggests that ROI (relative to RI) may make project outcomes appear less risky due to the way the measure scales and compresses outcomes and the way it may allow individuals to meet their minimum aspiration level of a positive outcome more easily. However, risk-seeking individuals may not be as affected by this difference because their aspiration level is likely higher to begin with than relatively risk-averse individuals – i.e., their aspiration is something greater than simply avoiding a loss or negative outcome. Thus, they are likely to enter the risky decision more focused on top-end outcomes and maximizing possible payoffs (Kahneman and Tversky 1979; Lopes 1987; Weber and Milliman 1997; Zou et al. 2019).

Similarly, SP/A theory suggests risk-seeking individuals are "potential-minded" and thus more likely to enter the risky decision with an optimistic focus and striving for best case scenarios, and thus will be more likely to weight greater possible outcomes more heavily despite low probabilities of attainment. In contrast, relatively risk-averse individuals are by nature more "security-minded" and more likely to enter the decision with a pessimistic focus and a goal of trying to avoid worst case scenarios, and will therefore weight lower possible outcomes more heavily despite any low probabilities of attainment (e.g., Slovic 1964; Lopes 1987; Weber and Milliman 1997; Lopes and Oden 1999; Gino and Margolis 2011).[4]

[4] This type of potential individual difference is also described in theory and research on regulatory focus, which suggests that, in a risky choice context, relatively risk-averse individuals are more likely to approach the decision with

Finally, relatively risk-seeking individuals tend to rate higher on measures of aggressiveness and sensation-seeking and may receive significant utility – even a chemical "rush" in the brain – from the risky decision itself (e.g., Levenson 1990; Zuckerman and Kuhlman 2001; Weber and Johnson 2008). All else equal, these risk-seeking individuals will be more comfortable in the risky decision setting and more comfortable pursuing greater risk in pursuit of greater payoffs, and so it is likely that their decision-making process will be less affected by the use of different performance measures as compared to relatively risk-averse individuals. Based on the factors just discussed, we predict the following:

HYPOTHESIS 2: *The effect of performance measures on managers' risky investment decisions will be greater for relatively risk-averse managers than for relatively risk-seeking managers.*

3. Method

Design & Participants

To study the effects of performance measures and individuals' risk preferences on risky choice, we conduct an experiment in which participants act as division manager for a firm and make a series of capital investment decisions, receiving compensation based on the outcomes of the capital projects they choose to implement. We manipulate between-subjects the performance measure used to evaluate the outcomes of project selections as either residual income (RI) or return on investment (ROI), and measure participants' general risk preferences, as described below.

In total, five different capital projects were presented to participants in a pairwise manner. For each project, we hold constant: the number of possible outcomes (10), the shape of the distribution of outcomes (bi-modal), and the expected value of the project ($202.50 in generated

a "prevention" focus (prioritizing the avoidance of worst-case outcomes), whereas relatively risk-seeking individuals are more likely to approach the decision with a "promotion" focus (striving for best-case outcomes) (e.g., Weber and Milliman 1997; Gino and Margolis 2011).

project income).[5] Projects differ in their range of possible outcomes and the inherent level of risk in the project, as measured by the variance of project outcomes. The projects, pictured in Figure 1 in order of increasing risk, were constructed based on prior work in psychology that has used similar tools – framed as lotteries – to evaluate individuals' risky choices in a variety of settings (see e.g., Lopes 1984; Schneider and Lopes 1986).

(FIGURE 1)

One hundred individuals from Amazon's Mechanical Turk (MTurk) internet marketplace were recruited for the experiment through a publicly announced Human Intelligence Task (HIT), where all United States-based MTurk workers with historical HIT approval ratings of at least 98% were eligible to participate.[6] Participants were paid a $2.00 participation fee, as well as additional compensation as outlined below, to complete the experiment. Total compensation averaged $6.63 across all conditions, with a range of $3.30-$9.65.[7]

Procedures

The experiment consisted of three parts: (1) instructions and a brief knowledge check to ensure participants understood the task and compensation, (2) the work and project selection tasks, and (3) a post-experiment questionnaire (PEQ).

In the first part of the experiment, participants reviewed a set of instructions that explained the task and the manner in which compensation would be determined. These instructions also provided the division manager performance evaluation context in which participants would be

[5] We choose to use a single bi-modal distribution of outcomes because: (1) holding distribution shape constant helps disentangle potential effects of individual risk preferences and performance measures on individuals' risky choice, and (2) a distribution of project outcomes of this type is likely to occur in practice in a capital investment setting.
[6] Approval for the study was obtained from the institutional review board for human subjects research at the authors' institution. The web application was programmed using the oTree platform (Chen, Schonger, and Wickens 2016).
[7] The low end of the compensation range of $3.30 equates to approximately $7.92 per hour, which is still above conservative estimates for effective online wage rates (Paolocci, Chandler, and Ipeirotis 2010; Farrell, Grenier, and Leiby 2017).

making their decisions, noting the division's required return on capital investments (i.e., the performance threshold) and providing a definition and description of the performance measure that would be used to evaluate project selections. Participants were also presented with sample project information in order to become familiar with the information they would see for each project while making their selections, which included the project's ten possible outcomes in terms of raw dollars (income), the resultant performance measure (ROI or residual income), and the likelihood (% chance) of each outcome being obtained through a random draw – as pictured in Figure 1.

After completing a brief knowledge check that tested participants' understanding of their assigned performance measure and the manner in which project outcomes and compensation were to be determined, participants completed the work and project selection task. This task consisted of five periods, and each period operated in the following manner. To begin, participants completed a letter-number decoding task, as used in Brown, Sprinkle, and Way (2019), to earn the right to make their project selection. Specifically, participants had up to two minutes to decode four strings of letters into numbers using an on-screen decoding key.[8] After submitting their decoding work, participants were presented with one of the following five pairs of projects (as pictured in Figure 1), randomly ordered: Project 1/Project 2, Project 1/Project 5, Project 2/Project 3, Project 3/Project 4, and Project 3/Project 5. Pairings were selected in an attempt to disentangle the various motivations for individuals' risky choices and any effects of the performance measure used to evaluate outcomes, as discussed in more detail below.

The two possible projects to consider were always presented as Project A and Project B, where the ordering of the two projects was also randomly determined. Furthermore, a

[8] Across all conditions and periods, this task took participants an average of 59 seconds. While participants were not explicitly prevented from making project selections if they did not complete the decoding work, only two of the one hundred participants did not attempt to complete the decoding work, and overall accuracy across all other participants was 97%. All inferences reported below in the results section are identical if these two participants are excluded.

compensation schedule appeared below the project information to remind participants of the manner in which project outcomes equated to compensation, and this information was presented using ROI or RI depending on the participant's condition. Participants then had an unlimited amount of time to view the pair of projects before indicating which of the two projects they would prefer to implement in their division, and were then advanced to the next period. To prevent the results of any individual project selection from influencing subsequent choices, participants did not learn the outcome of any project until the end of the experiment. We measure risky choice (*ProjectRisk*) repeatedly for each participant as 0 (1) if the participant chose the less (more) risky of the two projects presented in any given pair. For some analyses we construct a single measure of participants' overall risky choice (*RiskScore*), which is the number of times (0-5) that the participant selected the more risky of the two projects presented.

As noted earlier, participants received bonus compensation based on the randomly-drawn outcomes of the five projects they selected for implementation in their division. Specifically, participants received \$0.20 if the outcome of a project they selected just met the division's required rate of return of 10% on a capital investment of \$700 (i.e., residual income of \$0), and an additional \$0.20 for each additional 10% (residual income of \$70) returned by that project. As such, the range of possible bonuses for each project varied from a low of \$0.20-\$0.80 for the least risky project (Project 1 in Figure 1) to \$0.00-\$1.80 for the most risky project (Project 5 in Figure 1).

After completing the work and project selection task, participants completed a brief post-experiment questionnaire. The questionnaire asked participants to rate the difficulty and enjoyment of their tasks, as well as the overall importance of minimum/maximum project outcomes and the bonus threshold as determined by their particular performance measure. The questionnaire also collected certain demographic items, provided a free-response opportunity for participants to

explain how they went about making their project selections, and elicited participants' stable risk preferences (included in later analyses as *RiskAttitude*) using the following item, scaled 0-10 and adapted from prior research (Dohmen et al. 2005, 2011): *In general, would you consider yourself someone who is fully prepared to take risks, or do you try to avoid taking risks?*[9]

Project Selections

Each of the five pairs of projects that participants were presented with was selected in an attempt to illustrate potential effects of the two accounting performance measures, as well as other factors such as differences in range of outcomes or likelihood of obtaining bonus compensation, on individuals' risky choices. For example, consider the pairing of Projects 1 and 2 (as pictured in Figure 1). Project 1 is the least risky project. It is guaranteed to achieve an outcome above the firm's performance threshold (i.e., positive RI or ROI 10% return), and thus return a bonus to the participant of at least $0.20, and has a 50% chance of returning a bonus of $0.20-$0.40 (cumulative probability of all outcomes less than project income of $215 under both performance measures). Project 2 has greater risk (variance) than Project 1, and it has a 39% chance of returning income of greater than $280, which would result in RI (ROI) of greater than $210 (40%) and thus generate a bonus of at least $0.80 to the participant.[10] However, the project has an 11% chance of returning an outcome that falls short of the firm's performance threshold and results in a $0.00 bonus for the participant. These below-threshold outcomes result in a performance measure that is less than zero when RI is used to evaluate outcomes (-$10, -$50) but not when ROI is used to evaluate outcomes

[9] Participants' risk preferences were also measured using a compensated series of ten gambles in which participants chose between two lotteries – A and B – of differing risk (Holt and Laury 2002; Brown, Farrington, and Sprinkle 2016). Some prior research suggests that an uncompensated measure of general risk attitude displays better test-retest stability and is a better predictor of actual risk-taking behavior than compensated measures often framed as lotteries (Dohmen et al. 2005, 2011). The results we present below are robust to measuring participants' stable risk preferences using the compensated gambles just described.

[10] The 39% chance is the cumulative probability of income equal or greater than 305 in Project 2.

(9%, 3%). As such, it is possible that a greater proportion of individuals whose performance is evaluated using ROI will select Project 2 over Project 1 than those whose performance is evaluated using RI, if the appearance of the below-zero outcomes in the RI condition makes the option less attractive than when evaluated using ROI.

As discussed in the development of our hypotheses, SP/A theory would also suggest that project selection may be driven – at least in part – by managers' aspiration of attaining a positive outcome. In addition to comparison 1 vs. 2, comparisons 1 vs. 5 and 2 vs. 3 potentially allow for the testing of this effect, as in both cases the riskier of the two projects has a significantly higher proportion of positive outcomes when ROI is used as the performance measure. If managers' aspiration for a positive outcome is better met because of this difference, thus freeing them up to pursue higher possible outcomes with the riskier of the two options, we may observe more individuals choosing the riskier project when ROI is their performance measure as compared to when RI is their performance measure. We examine this notion further in our results section below.

4. Results

Descriptive Statistics and Overall Risk-Taking

Table 1 presents descriptive statistics related to the five project selection pairs that participants face. Panel A separates participants by condition only, while Panel B separates participants first by a mean split of our continuous measure of general risk preference (*RiskAttitude*), as defined earlier.[11] We use this split for descriptive and illustrative purposes but retain the continuous measure of risk preference for our formal hypothesis tests. Figure 2 illustrates

[11] Consistent with theory and research suggesting that individuals are risk-averse on average, we find that our *RiskAttitude* measure has a mean of 4.56, and that just 13 of our 100 participants have *RiskAttitude* values of 8+ on our scale of 0-10. Of our 100 participants, 42 (58) have below-mean (above-mean) values of *RiskAttitude*. For ease of exposition, we refer to the groups created by this split as "risk-averse" and "risk-seeking." This categorization is made more on a relative, rather than an absolute, basis in order to create groups of reasonable size. Thus, we retain our continuous measure of *RiskAttitude* for tests of hypotheses and where possible in additional analyses.

overall risk-taking by condition and the mean split of *RiskAttitude*, and suggests potential separate and interactive effects of risk preference and performance measure on individuals' overall risk-taking, as explored below in formal tests of our hypotheses.

(TABLE 1)

(FIGURE 2)

As shown in Panel A of Table 1, the proportion of risky projects chosen was lower overall when RI was used as the performance measure (45%) than when ROI was the performance measure (53%). Panel A of Table 1 also shows that the influence of performance measures on risky project selection likely depends on the specific pair of projects being compared, as expected. Panel B of Table 1 shows that the effects of performance measures on managers' tendency to select risky projects is greater for individuals who are relatively risk-averse. That is, for risk-averse individuals the frequency of the riskier project being selected is greater under ROI than RI (48% versus 37%) but there is little difference for individuals who are more risk seeking (55% versus 52%), where performance measures do not appear to affect the frequency of the riskier project being selected. We examine these differences more formally in the tests of our hypotheses.

Panel B also suggests that our *RiskAttitude* measure is capturing general preferences for risk as intended, with greater risk-taking observed by participants whose *RiskAttitude* was above the mean and were thus categorized as relatively risk-seeking (52% RI, 55% ROI) as compared to those categorized as relatively risk-averse (37% RI, 48% ROI). To formally test this relation, we construct a logistic regression model of the following form: $ProjectRisk = \alpha + \beta_1 RiskAttitude + \varepsilon$, where *ProjectRisk* is a repeated-measure and equals one (zero) if the participant chose the more (less) risky of the two projects presented in any period. Standard errors are clustered by participant. Untabulated results of this model show a significant positive effect of *RiskAttitude* on *ProjectRisk*

(0.14, $p < 0.01$), and thus confirm that the continuous measure of risk preference we use has the expected relation with actual risk-taking behavior in our capital investment setting.

Tests of Hypotheses

Our first hypothesis (H1) predicts that project investment decisions will be affected by the performance measure used to evaluate project outcomes, with return on investment (ROI) leading to more risk-taking than residual income (RI). We test H1 by estimating a logistic regression model with *ProjectRisk* as the dependent variable and *ROICondition* as a dichotomous independent variable. *ProjectRisk* equals one (zero) if the participant selected the riskier (less risky) of the two project options in a particular period. *ROICondition* equals one (zero) if the participant was in the ROI (RI) condition. As shown for Model (1) in Table 2, *ROICondition* is positive (0.32) and marginally significant ($p = 0.07$), providing some support for H1.

(TABLE 2)

Our second hypothesis (H2) predicts an interaction between risk preference and performance measure such that the effect of the performance measure will be concentrated in relatively risk-averse individuals. To test H2 we construct a logistic regression model with a dependent variable of *ProjectRisk* and independent variables of *ROICondition*, *RiskAttitude* (both as defined earlier), and an interaction between the two variables (*ROICondition x RiskAttitude*).

Consistent with H2, Model (2) in Table 2 reveals a negative (-0.13) and marginally significant interaction between ROICondition and *RiskAttitude* ($p = 0.085$). This finding is also consistent with the flattening of the risk line in Figure 2 for participants in the ROI condition.[12]

[12] In a separate data collection, two hundred individuals from Amazon's Mechanical Turk (MTurk) internet marketplace were recruited for a similar project selection task as described in this study, featuring projects that differed in the shape of the distribution of their outcomes (similar to Lopes (1984) and Schneider and Lopes (1986)). These projects also varied in risk, as measured by variance of outcomes, but held expected value constant. In untabulated results of that data collection, we find identical inferences for our main findings and hypotheses in that risk is increasing in individuals' measured risk preference, while individuals who are presented with ROI as their

Moreover, results from this model also suggest conditional positive main effects for *RiskAttitude* ($p < 0.01$) and *ROICondition* ($p < 0.05$).[13]

To provide additional insight into the factors that affect project selections, we construct three additional logistic regression models and include as covariates items from the post-experiment questionnaire to disentangle individual differences. Model (3) in Table 2 includes all participants and all covariates, while Models (4) and (5) are estimated separately for relatively risk-averse and risk-seeking participants (based on a mean split of *RiskAttitude*), respectively. As can be seen in Table 2, results of Model (3) are inferentially identical to Model (2), with the significance of the coefficients on *RiskAttitude*, *ROICondition*, and the interaction term (*ROICondition x RiskAttitude*) all increasing. In addition, these results suggest some additional factors that appear to affect project selection. Specifically, Model (3) finds that participants more concerned with the firm's performance threshold and maximum payoffs choose riskier projects (0.10 and 0.12, respectively, both p's < 0.05), while participants more concerned with minimum payoffs choose less risky projects (-0.05, $p = 0.07$). In addition, the results from Model (3) suggest that as the difference in range or the difference in outcomes above the performance threshold between two projects being considered increases, individuals are more likely to choose the less risky project (-0.02 and -0.01, respectively, both p's < 0.05). Conversely, as the difference in maximum payoffs between two projects increases, individuals are more likely to choose riskier projects to chase the larger payoffs (0.05, $p < 0.01$).[14]

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performance measure make riskier investments (H1), an effect that is concentrated in relatively risk-averse individuals (H2). We focus on the data in the current study because holding the shape of the distribution of project outcomes constant maintains tighter experimental control necessary to begin to identify factors that affect risky decisions.

[13] In untabulated results, we use Model (2) results to examine the predicted probabilities of *ProjectRisk* at each of the 11 values of *RiskAttitude*, by *ROICondition*, akin to tests of the simple effects of *ROICondition*. The pattern of results suggests that, consistent with our Figure 2, individuals in the ROI condition select riskier projects than those in the RI condition at lower values of *RiskAttitude* (0-5) only.

[14] Consistent with prior research (e.g., Charness and Gneezy 2012), we find some evidence that females take less risk than males ($p = 0.07$, one-tailed), and that gender can predict one's general risk preference ($p = 0.08$, one-tailed). In

Results of Models (4) and (5) suggest differences in the factors most likely to affect project selection depending on whether the individual is relatively more risk-averse as compared to risk-seeking. Specifically, results suggest that the effect of the performance measure on risk-taking (wherein ROI leads to riskier project selection than RI) is concentrated primarily in relatively risk-averse individuals. Moreover, the perceived importance of maximum payoffs and differences in the portion of project outcomes below the bonus threshold appear to affect risky choice for more risk-averse individuals only (0.18 and 0.02, both p's < 0.05), while the perceived importance of minimum payoffs and the range difference between two projects appear to affect risky choice for more risk-seeking individuals only (-0.11 and -0.003, both p's < 0.08). Results also suggest that differences in salience of the performance threshold affect risky choice for individuals regardless of their risk preference. Since our theory suggests that the performance measures could alter individuals' perceptions of potential project outcomes and their importance, we further examine potential direct and indirect effects of RI and ROI on risky project selection through these perceptual variables in the additional analysis section.

In sum, our main results suggest that individuals' inherent risk preferences play a significant role in the risk they choose to pursue in a capital investment setting. Our results also suggest that these risky decisions are affected the performance measure used to evaluate project outcomes, with the use of ROI leading individuals to take more risk than the use of RI. Finally, our results suggest an interaction between these two factors, such that the effects of the performance measure are most concentrated in relatively more risk-averse individuals.

untabulated results, we add gender to Models (1), (2), and (3). The effect of gender is marginally significant (p = 0.09, one-tailed) in Model (1), and insignificant in the other models (both p's > 0.18), suggesting that any effect of gender is likely subsumed by our measure of general risk preference. In these analyses, we find no effect of age on risk-taking (all p's > 0.17).

Additional Analyses

Process Model

To further examine the effects of performance measures on risky project selection, we construct a multi-group structural equation model (SEM). The model splits participants into two groups based on their measured risk preference – risk-averse or risk-seeking, as defined previously. The model estimates the effect of the performance measure (*Condition*) on the number of periods in which the participant chose the riskier of the two project options (*RiskScore*), both directly and through the following potential mediators: Threshold salience, negative affect (Williams and Voon 1999), project choice difficulty, importance of maximum payoff, importance of minimum payoff, and importance of proportion of outcomes above the bonus threshold, all measured via post-experiment questionnaire items.[15] As discussed previously, RI and ROI may differentially affect individuals' perceptions of these factors and/or change the salience of each factor in the process of choosing between alternatives. The model is a good fit for the data, with an insignificant chi-square test ($p = 0.31$) and measures of fit (error) (CFI = 0.96; RMSEA = 0.05) above (below) generally accepted levels (Kline 2011). Model results are presented in Figure 3, with one-tailed p-values reported for paths with directional expectations.

(FIGURE 3)

Before discussing potential mediating results observed in the model, we note that the total effect (direct effect + all indirect effects) of ROI on risk-taking is positive and marginally significant for risk-averse individuals (0.59, $p = 0.07$) and insignificant for risk-seeking individuals (0.18, $p = 0.62$), consistent with earlier results and with our H2. Also consistent with earlier results,

[15] In untabulated results, we use the binary repeated-measure of risk (*ProjectRisk*) discussed previously as the primary dependent variable in our model and specify logit regression links between this variable and its predictors, with standard errors clustered by participant. All reported inferences are identical.

SEM results show that ROI decreases the perceived importance of the firm's performance threshold relative to RI for both risk-averse and risk-seeking individuals (-1.47 and -1.48, respectively, both p's < 0.05). This result is consistent with our theory that ROI permits individuals to more easily meet minimum aspiration levels of avoiding losses, and thus the performance threshold of 10% ROI is less salient to individuals. Stated differently, the firm's performance threshold of $0 in RI likely overlaps completely with individuals' minimum aspiration levels and is thus very salient. As the perceived importance of the threshold increases, so does risk for both groups (RA = 0.17, p < 0.05; RS = 0.15, p < 0.01), suggesting that RI has a positive indirect effect on risk-taking through these perceptions. Consistent with earlier results, Figure 3 also shows that ROI has a direct positive effect on risk-taking for risk-averse individuals only (0.78, p < 0.05).[16]

With regard to risk-averse individuals, SEM results also show that ROI decreases the difficulty of the project selection decision (-0.18, p < 0.05) and increases the perceived importance of maximum project payoffs (0.39, p = 0.08).[17] Moreover, ROI decreases the perceived importance of both minimum project payoffs (-1.80, p < 0.05) and the proportion of project outcomes above the bonus threshold (-0.90, p = 0.07). Consistent with our theory, these results suggest that ROI may make individuals' minimum aspiration level more easily reachable (increasing the "security-potential" of the alternative under the tenets of SP/A theory), which in turn may make the alternative appear less risky relative to RI, freeing individuals up to focus less on bottom-end

[16] Prior research suggests self-reported perceptions are often imperfect because individuals may lack the ability to fully identify or attribute all of the factors involved in their decisions or behavior (e.g., Ajzen and Fishbein 1977; Hofmann, Gawronski, Gschwendner, Le, and Schmitt 2005; Conner, Perugino, O'Gorman, Ayres, and Prestwich 2007), which may help explain the direct effect we observe of ROI on risk-taking.

[17] In untabulated results, we find no differences in average decision time as a function of performance measure or general risk preference (all p's > 0.41). However, for individuals categorized as relatively risk-averse, we do find evidence that average decision time for individuals evaluated using RI exhibits less variation than decision time for those evaluated using ROI (p < 0.01), and is directionally lower. In addition, we find some evidence that relatively risk-averse individuals evaluated using RI enjoy the selection task more than those evaluated using ROI (p = 0.09). One possible explanation for these effects is that risk-averse individuals evaluated using ROI are making selections that are less in line with their "natural" risk preferences, which may cause some internal conflict.

outcomes and more on top-end or maximum outcomes, thus leading to the pursuit of more risk.

Turning to risk-seeking individuals, the ROI performance measure does not affect project choice difficulty or the perceived importance of either maximum or minimum payoffs, as compared to RI (all p's > 0.28). However, opposite to risk-averse individuals, the ROI measure increases the perceived importance of the portion of project outcomes above the bonus threshold (0.90, $p < 0.05$), which increases risk-taking (0.14, $p < 0.05$). ROI also decreases negative affect for these individuals (-0.70, $p = 0.09$), which results in a positive indirect effect on risk-taking (0.11, $p = 0.08$). In sum, the use of ROI exhibits some positive indirect effects on risk-taking for risk-seeking individuals, but these effects are not large enough to lead to overall differences in risk-taking as compared to the use of RI. These results are consistent with the possibility discussed earlier that risk-seeking individuals are likely "potential-minded" and already focused on the top-end payoffs in any risky decision, and/or that they gain utility from pursuing risk, and thus are not as affected by the use of different performance measures as risk-averse individuals.

Project Type

As discussed in the development of our hypotheses, the effect of the ROI and RI performance measures on managers' risky project choices may be driven by managers' aspiration of achieving a positive outcome. To test this notion, we examine whether the effect of performance measures on managers' risk-taking is driven by project choices in which the different performance measures result in different proportions of positive outcomes. ROI has a significantly higher proportion of positive outcomes than RI for project comparisons 1 vs. 2, 1 vs. 5, and 2 vs. 3, but this is not true for the other project comparisons (3 vs. 4 and 3 vs. 5). If the effect of the ROI and RI performance measures on managers' risky project choices is driven by managers' aspiration of achieving a positive outcome, the effect is most likely to be observed in these project comparisons.

While descriptive results in Table 1 suggest this is the case, we formally test this expectation using a logistic regression model with *ProjectRisk* as the dependent variable and the interaction between the indicator variables *ROICondition* and *ProjectType* as the independent variables of interest. *ProjectType* equals one if the specific project comparison is 1 vs. 2, 1 vs. 5, or 2 vs. 3, and zero for any other project comparison. Since our theory predicts that the effect of performance measures is likely concentrated in risk-averse individuals, we perform this test using only that group of participants. As shown in model results in Table 3, the interaction between *ROICondition* and *ProjectType* is positive and marginally significant (0.88, p = 0.08).[18] This result is consistent with our theory and earlier results and suggests that ROI can motivate greater risk-taking, perhaps because it enables individuals to more easily reach minimum aspiration levels, thus allowing them to focus more on striving for top-end outcomes.

5. Conclusion

We conduct an experiment to examine how managers' risk preferences and the performance measure used to evaluate project outcomes separately and interactively affect managers' selections of risky capital projects. As expected, we find that relatively risk-seeking individuals choose riskier capital projects as compared to relatively risk-averse individuals. We predict and find that the use of ROI to evaluate project outcomes leads individuals to select more risky projects as compared to when RI is used to evaluate project outcomes, an effect that is concentrated in relatively risk-averse individuals. Finally, we provide evidence that these effects can be explained at least in part by the tenets of security-potential/aspiration (SP/A) theory, and that ROI may spur more risk-taking due to the manner in which it makes project alternatives appear

[18] Our theory suggests this effect would not likely hold for risk-seeking individuals. In untabulated results, we find no effect of the interaction between *ProjectType* and *Condition* on *RiskyChoice* for these individuals (0.23, p = 0.64).

less risky compared to RI, thus freeing (risk-averse) individuals to pursue the greater payoffs typically associated with riskier investment choices.

Our study makes several contributions to accounting literature and practice. We add to the growing body of research that examines the effects of performance reporting on capital investment decisions (e.g., Bushman and Smith 2001; Roychowdhury et al. 2019) by identifying and isolating a specific mechanism through which accounting performance information affects risky investments. Moreover, our findings that ROI induces individuals to take on increased risk – particularly those who are relatively risk-averse – suggests one possible reason for the relative frequency of ROI as a chosen performance measure in practice even though RI is often thought to be a superior performance measure. That is, because RI can cause managers to reduce their propensity to choose risky projects (as compared to ROI), firms may use ROI to induce a greater amount of risk-taking from their managers. Our findings suggest that the choice of the appropriate performance metric may be a low-cost solution to this common agency problem.

Our findings are also subject to limitations that could be further examined in future research. First, participants in our experiment made project selections in a repeated pairwise manner. This design choice was a necessary first step in disentangling some of the factors involved when managers make decisions between risky project alternatives. Future research could examine how our results may change if participants were making choices between more than two alternatives. Second, our findings held constant the expected outcomes of the projects being compared to allow us to better isolate the possible effects of different performance measures. Future research could test how varying the expected outcomes of possible projects may affect the degree to which individuals are affected by different performance measures when making risky choices.

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Table 1
Panel A – Portion of Individuals Choosing the Riskier Project by Condition and Project Comparison

Condition	1 v. 2	3 v. 4	1 v. 5	2 v. 3	3 v. 5	Total
Residual Income	46%	42%	48%	34%	54%	45%
ROI	68%	36%	60%	40%	60%	53%

Panel B - Portion of Individuals Choosing the Riskier Project by Risk Preference, Condition, and Project Comparison

Risk Preference	Condition	1 v. 2	3 v. 4	1 v. 5	2 v. 3	3 v. 5	Total
Risk-Averse							
	Residual Income	39%	43%	26%	22%	52%	37%
	ROI	53%	37%	53%	42%	58%	48%
Risk-Seeking							
	Residual Income	52%	41%	67%	44%	56%	52%
	ROI	77%	35%	65%	39%	61%	55%

Notes:
Table 1 illustrates the portion of individuals that chose the riskier of the two projects in each project pair (as shown in Figure 1). Panel A groups participants by experimental condition (the performance measure used to evaluate participants' project selections). Panel B groups participants by experimental condition and by risk preference categorization, which was measured with a post-experiment question asking participants to indicate their general attitude toward risk (e.g., Dohmen et al. 2005, 2011). A mean split of this measure was used to categorize participants as relatively risk-averse or risk-seeking, with 42 (58) participants being categorized as risk-averse (risk-seeking). In the residual income condition, 23 (27) participants are categorized as risk-averse (risk-seeking), while 19 (31) participants are categorized as risk-averse (risk-seeking) in the ROI condition.

Table 2
Project Selection Determinants

Dependent Variable = *ProjectRisk* = 0/1 Repeated Measure for Individual Project Selections	**(1) All participants**	**(2) All participants**	**(3) All participants**	**(4) Risk-Averse**	**(5) Risk-Seeking**
Intercept	-0.53* (0.35)	-1.10*** (0.38)	-3.04*** (0.80)	-4.27*** (1.25)	-1.45 (1.40)
RiskAttitude		0.21*** (0.07)	0.24*** (0.08)	0.27** (0.12)	0.06 (0.22)
ROICondition	0.32* (0.22)	1.83** (0.48)	1.11*** (0.49)	2.79*** (0.70)	-0.75 (1.46)
RiskAttitude×ROICondition		-0.13* (0.10)	-0.17** (0.10)	-0.81*** (0.26)	0.12 (0.24)
Importance of performance measure threshold			0.10** (0.05)	0.18** (0.08)	0.11** (0.05)
Importance of max payoff			0.12*** (0.05)	0.18*** (0.06)	0.03 (0.07)
Importance of min payoff			-0.05* (0.03)	0.05 (0.05)	-0.11** (0.05)
Importance of proportion of outcomes above bonus threshold			0.11** (0.06)	0.11* (0.08)	0.13* (0.08)
Difference in portion of outcomes below threshold between projects			-0.01*** (0.01)	0.02** (0.01)	-0.01 (0.01)
Range difference between projects			-0.02** (0.01)	0.00 (0.00)	-0.003* (0.002)
Max payoff difference between projects			0.05*** (0.01)	0.01** (0.00)	0.008*** (0.003)

Notes:
Table 2 presents the results of logistic regression models that examine the effect of performance measure, risk preferences, and other factors on risky project selections. The dependent variable in each model is 0 (1) if the participant chose the riskier of the two projects presented to them in any particular period. Standard errors are clustered by participant to account for this repeated measure. Models (1) through (3) include all participants, while Models (4) and (5) separate participants into relatively risk-averse and risk-seeking individuals, based on a mean split of the risk attitude (preference) measure. *, **, and *** represent significance at $p < 0.10$, $p < 0.05$, and $p < 0.01$, respectively.

1. *RiskAttitude* (0-10) – Participants' self-reported tendency to be willing to take risks (Dohmen et al. 2005, 2011).
2. *ROICondition* – 0 (1) for participants in the residual income (return on investment) condition.
3. *RiskAttitude*×*ROICondition* – An interaction between *RiskAttitude* and *ROICondition*.
4. Importance of performance measure threshold (-5 to 5) – Participants' agreement with the following in the residual income (return on investment) condition: "My project selection decisions were influenced by trying to achieve positive residual income (my division's required return on investment)."
5. Importance of max payoff (0-10) – Participants' response to a PEQ item measuring the influence of the maximum project payoff in choosing between projects.
6. Importance of min payoff (0-10) – Participants' response to a PEQ item measuring the influence of the minimum project payoff in choosing between projects.
7. Importance of proportion of outcomes above bonus threshold (0-10) – Participants' response to a PEQ item measuring the influence of the proportion of project outcomes that returned a bonus greater than $0.00 in choosing between projects.
8. Difference in portion of outcomes below threshold between projects – The difference between the two projects in a particular comparison in the likelihood of achieving an outcome below the firm's performance threshold of $0 RI (10% ROI).
9. Range difference between projects – The difference between two projects in a particular comparison of the range in project outcomes (maximum project outcome – minimum project outcome).
10. May payoff difference between projects – The difference between two projects in a particular comparison in the maximum project outcome achievable.

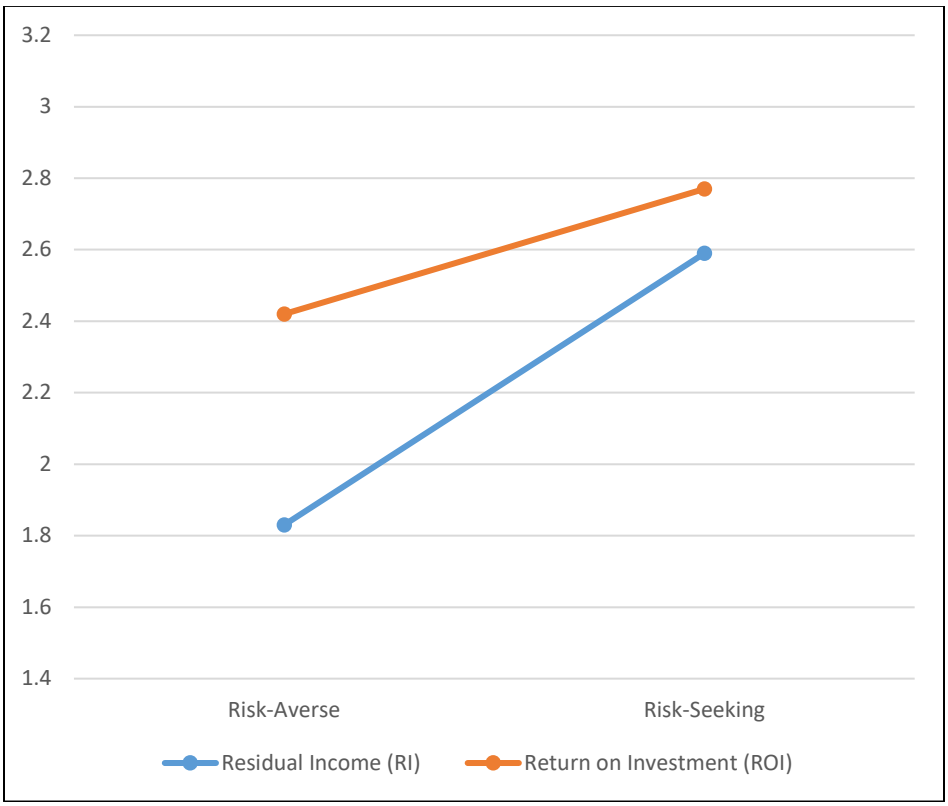
Table 3 **Effect of Performance Measure and Project Type on Project Selection**	
Dependent Variable	**0/1 Individual Project Selections = *ProjectRisk***
Intercept	-0.09 (0.29)
ROICondition	-0.02 (0.46)
Project Type	-0.81** (0.41)
ROICondition×Project Type	0.88* (0.62)

Notes:
Table 3 presents the results of a logistic regression model that examine the effect of performance measure and project type on risky project selections for risk-averse individuals. The dependent variable is 0 (1) if the participant chose the riskier of the two projects presented to them in any particular period. Standard errors are clustered by participant to account for this repeated measure. Project type equals 1 for the two project comparisons in which ROI results in a significantly higher proportion of project outcomes being positive as compared to RI (3 of the 5 comparisons), and 0 otherwise (2 of the 5 comparisons). All other variables are as defined previously. *, **, and *** represent significance at $p < 0.10$, $p < 0.05$, and $p < 0.01$, respectively.

FIGURE 1
Projects, as seen by participants and ordered from least-risky to most-risky

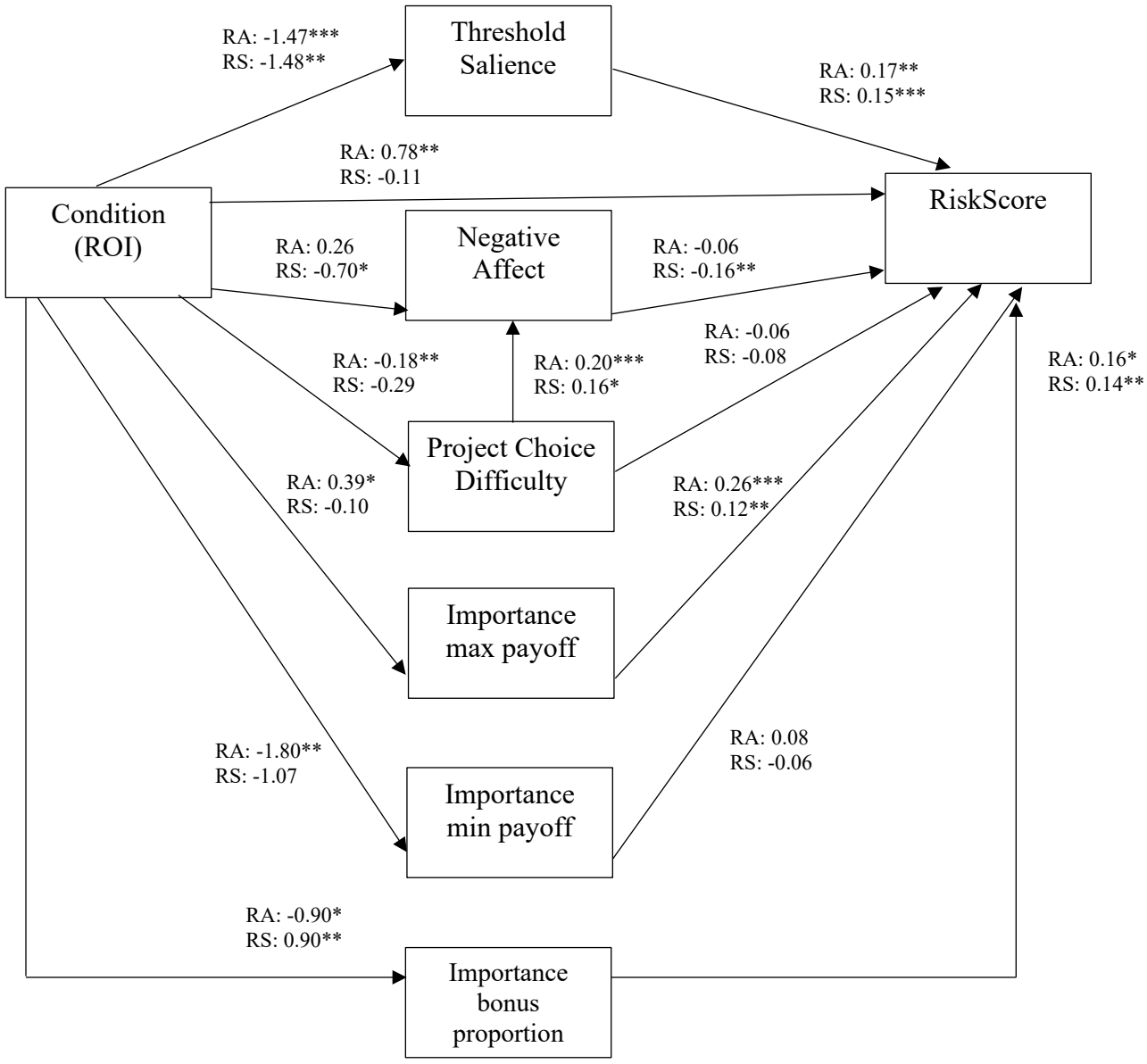
	Residual Income	ROI
1	Possible Income / Likelihood / Residual Income 315 I (1%) $245 290 IIIIIIIII (10%) $220 265 IIIIIIIIIIIIIIIIIIIIIIIII (28%) $195 240 IIIIIIIII (10%) $170 215 I (1%) $145 190 I (1%) $120 165 IIIIIIIII (10%) $95 140 IIIIIIIIIIIIIIIIIIIIIIIII (28%) $70 115 IIIIIIIII (10%) $45 90 I (1%) $20	Possible Income / Likelihood / Return on Investment 315 I (1%) 45% 290 IIIIIIIII (10%) 41% 265 IIIIIIIIIIIIIIIIIIIIIIIII (28%) 38% 240 IIIIIIIII (10%) 34% 215 I (1%) 31% 190 I (1%) 27% 165 IIIIIIIII (10%) 24% 140 IIIIIIIIIIIIIIIIIIIIIIIII (28%) 20% 115 IIIIIIIII (10%) 16% 90 I (1%) 13%
2	Possible Income / Likelihood / Residual Income 390 I (1%) $320 350 IIIIIIIII (10%) $280 305 IIIIIIIIIIIIIIIIIIIIIIIII (28%) $235 260 IIIIIIIII (10%) $190 220 I (1%) $150 180 I (1%) $110 140 IIIIIIIII (10%) $70 100 IIIIIIIIIIIIIIIIIIIIIIIII (28%) $30 60 IIIIIIIII (10%) -$10 20 I (1%) -$50	Possible Income / Likelihood / Return on Investment 390 I (1%) 56% 350 IIIIIIIII (10%) 50% 305 IIIIIIIIIIIIIIIIIIIIIIIII (28%) 44% 260 IIIIIIIII (10%) 37% 220 I (1%) 31% 180 I (1%) 26% 140 IIIIIIIII (10%) 20% 100 IIIIIIIIIIIIIIIIIIIIIIIII (28%) 14% 60 IIIIIIIII (10%) 9% 20 I (1%) 3%
3	Possible Income / Likelihood / Residual Income 485 I (1%) $415 450 IIIIIIIII (10%) $380 405 IIIIIIIIIIIIIIIIIIIIIIIII (28%) $335 310 IIIIIIIII (10%) $240 205 I (1%) $135 140 I (1%) $70 65 IIIIIIIII (10%) -$5 0 IIIIIIIIIIIIIIIIIIIIIIIII (28%) -$70 -10 IIIIIIIII (10%) -$80 -70 I (1%) -$140	Possible Income / Likelihood / Return on Investment 485 I (1%) 69% 450 IIIIIIIII (10%) 64% 405 IIIIIIIIIIIIIIIIIIIIIIIII (28%) 58% 310 IIIIIIIII (10%) 44% 205 I (1%) 29% 140 I (1%) 20% 65 IIIIIIIII (10%) 9% 0 IIIIIIIIIIIIIIIIIIIIIIIII (28%) 0% -10 IIIIIIIII (10%) -1% -70 I (1%) -10%
4	Possible Income / Likelihood / Residual Income 485 I (1%) $415 450 IIIIIIIII (10%) $380 415 IIIIIIIIIIIIIIIIIIIIIIIII (28%) $345 275 IIIIIIIII (10%) $205 200 I (1%) $130 145 I (1%) $75 80 IIIIIIIII (10%) $10 25 IIIIIIIIIIIIIIIIIIIIIIIII (28%) -$45 -65 IIIIIIIII (10%) -$135 -300 I (1%) -$370	Possible Income / Likelihood / Return on Investment 485 I (1%) 69% 450 IIIIIIIII (10%) 64% 415 IIIIIIIIIIIIIIIIIIIIIIIII (28%) 59% 275 IIIIIIIII (10%) 39% 200 I (1%) 29% 145 I (1%) 21% 80 IIIIIIIII (10%) 11% 25 IIIIIIIIIIIIIIIIIIIIIIIII (28%) 4% -65 IIIIIIIII (10%) -9% -300 I (1%) -43%
5	Possible Income / Likelihood / Residual Income 695 I (1%) $625 555 IIIIIIIII (10%) $485 415 IIIIIIIIIIIIIIIIIIIIIIIII (28%) $345 275 IIIIIIIII (10%) $205 135 I (1%) $65 60 I (1%) -$10 35 IIIIIIIII (10%) -$35 0 IIIIIIIIIIIIIIIIIIIIIIIII (28%) -$70 -70 IIIIIIIII (10%) -$140 -210 I (1%) -$280	Possible Income / Likelihood / Return on Investment 695 I (1%) 99% 555 IIIIIIIII (10%) 79% 415 IIIIIIIIIIIIIIIIIIIIIIIII (28%) 59% 275 IIIIIIIII (10%) 39% 135 I (1%) 19% 60 I (1%) 9% 35 IIIIIIIII (10%) 5% 0 IIIIIIIIIIIIIIIIIIIIIIIII (28%) 0% -70 IIIIIIIII (10%) -10% -210 I (1%) -30%

FIGURE 2
Risky Project Selection by Risk Preference and Condition



Notes:
Figure 2 illustrates the average number of periods in which participants chose the riskier of two project options, by condition and risk preference. Risk preference is defined by a mean split of participants' general attitude toward risk, as measured by a post-experiment questionnaire item adapted from prior research (Dohmen et al. 2005, 2011), where risk-averse (RA) includes participants below the mean and risk-seeking (RS) includes participants above the mean.

FIGURE 3
Multi-Group Structural Equation Model of the Effects of Performance Measures on Risky Project Selection



*, **, *** represent significance at $p < 0.10$, $p < 0.05$, and $p < 0.01$, respectively (one-tailed tests for directional predictions). The model fits the data well. Overall goodness of fit: $\chi 2 = 24.74$ ($p = 0.31$). CFI = 0.96. RMSEA = 0.05.

1. Condition – 0 (1) represents participants in the residual income (return on investment) condition.
2. RiskScore (0-5) – The number of periods in which the participant chose the riskier of two project options.
3. Threshold Salience (-5-5) – Self-reported importance of the firm's performance threshold (positive residual income or above-minimum return on investment) in choosing between project options.
4. Negative Affect (0-10) – Average of three questionnaire items measuring participants' negative affect, adapted from prior research (e.g., Watson, Clark, and Tellegen 1988).
5. Project Choice Difficulty (0-10) – Self-reported difficulty in choosing between project options, with higher numbers indicating more difficulty.
6. Importance Max Payoff (0-10) – Self-reported importance of maximum project payoffs in choosing between project options.
7. Importance Min Payoff (0-10) – Self-reported importance of minimum project payoffs in choosing between project options.
8. Importance Bonus Proportion (0-10) – Self-reported influence of the proportion of project outcomes that returned a bonus greater than $0.00 in choosing between projects.