

# Risk, Uncertainty and Entrepreneurship: Evidence From a Large Lab-in-the-Field Experiment

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## Abstract

We measure differences in attitudes towards risk and uncertainty between entrepreneurs, managers and employees in a large scale experiment. Theory predicts that entrepreneurs are a distinct breed in terms of their more positive attitude towards risk and uncertainty. Many empirical studies have tested this prediction, employing various measures of risk (i.e. experimental and survey based) and uncertainty, various definitions of the entrepreneur and different control groups. Their results are mixed. Our large scale lab-in-the-field-experiment combines most of the design features of previous studies: an incentivized experimental and a survey based measure of risk, measures of related measures of uncertainty, i.e., ambiguity aversion and loss aversion, various control groups (including managers) and definitions of (successful) entrepreneurs. Thus, we can reconcile the previous mixed results. Based on experimental measures, entrepreneurs and managers have similar attitudes towards risk (but are both less risk averse than employees). In their own perception, though, entrepreneurs are also less risk averse than managers. Their lower self-assessed risk aversion is associated with a lower objectively measured loss aversion than managers have.

**Key words:** Entrepreneurs, managers, risk aversion, loss aversion, ambiguity aversion, lab-in-the field experiment

**JEL codes:** . . .

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# 1. Introduction

One of the most salient dimensions of entrepreneurship is risk and uncertainty. This is the topic of our study. Economic theory predicts that entrepreneurs, as business owning residual claimants, are less averse towards risk and uncertainty than others (Cantillon, 1755; Knight, 1921; Kirzner, 1973 and Kihlstrom and Laffont, 1979). Entrepreneurs are the people that assume business risks in the most uncertain environments. Their income, wealth, satisfaction and social status are dependent on the outcomes of their decisions in uncertain situations.<sup>1</sup> On top of that, most of the entrepreneurs' investment portfolio's are totally undiversified (Moskowitz and Vissing-Jorgensen, 2002), also due to capital constraints in the market for entrepreneurial finance.<sup>2</sup> Notwithstanding this theoretical prediction that is supported by common sense, the body of empirical evidence on risk, uncertainty and entrepreneurship is rather mixed (see Holm et al., 2013, Appendix Table). We perform an empirical study about risk, uncertainty and entrepreneurship using a survey and a large lab-in-the-field experiment among 910 entrepreneurs, 397 managers and 981 employees.

The recent study by Holm et al. (2013) is most related to ours. They also perform a large scale lab-in-the-field experiment with incentives to determine how attitudes towards risk and uncertainty distinguish entrepreneurs from others (in China). They distinguish between strategic and unstrategic risk. Strategic risk covers measures of trust and competition. Unstrategic risk is measured in terms of risk aversion and ambiguity aversion. They find that entrepreneurs are more willing to assume strategic risk but not to assume risks lacking a strategic (interactive) character. Our study is distinct from theirs in three ways. Most importantly, we compare entrepreneurs (in a Western country as opposed to China) to managers as well as employees and not to the (local) population at large. Second we use both a survey based and an experimental measure of risk aversion. Third, we also measure loss aversion and show that this is the most important difference between entrepreneurs and managers in the domain of risk and uncertainty. In general, our study can be characterized by the following distinguishing features.

First, we elicit peoples' risk attitudes using *two* measures of risk that are different in a vital sense: one is an 'objective' measure which is incentivised and experimental, based on multiple pricelist (MPL) elicitation (in the style of Holt and Laury, 2002). The other is 'subjective', i.e., survey based and self assessed (Dohmen et al., 2011). Both are the 'golden standard' in their categories and have been extensively validated and used.<sup>3</sup> So far, studies testing differences in risk attitudes between

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<sup>1</sup>For further reference, see e.g., Cantillon (1755); Say (1803); Knight (1921); Petersen and Rajan (1994); Berger and Udell (1998); Heaton and Lucas (2000); Moskowitz and Vissing-Jorgensen (2002); Gentry and Hubbard (2004); Heaton and Lucas (2004) and Parker (2009).

<sup>2</sup>E.g., Evans and Jovanovic (1989); Holtz-Eakin et al. (1994a,b); Hvide and Møen (2010); Fairlie and Krashinsky (2012) and Schmalz et al. (2013)

<sup>3</sup>See Filippin and Crosetto (2014) for a meta-analysis of studies all using the Holt and Laury measure relating risk to gender and Dohmen et al. (2007), Bonin et al. (2007), Caliendo et al. (2009), Lonnqvist et al. (2011) and Beauchamp et al. (2012) for a validity test of the Dohmen et al. (2011) measure. Overall, the Dohmen question scores highly on re-test reliability within-person and has been shown to be virtually stable over re-test intervals ranging from three weeks up to almost two years (see Dohmen et al., 2007 and Lonnqvist et al., 2011).

entrepreneurs and others have either used an incentivized experimental measure in the Holt and Laury style or a non-incentivized self-assessed survey based measure (Dohmen et al., 2011, or something inferior or equivalent). Interestingly, all studies using experimental measures of risk aversion find no difference between entrepreneurs and the control group, whereas most of the other studies do find differences supporting the notion that entrepreneurs are less risk averse. By using both measures we can, unlike previous studies, contribute to the explanation of the mixed findings so far.<sup>4</sup>

Second, besides comparing entrepreneurs and others with respect to risk, we also try to understand in what related aspects entrepreneurs and managers are different. We consider loss aversion, allowing an asymmetric effect of losses and gains on peoples' utility and, ambiguity aversion, i.e. probabilities are unknown and there is genuine uncertainty in the Knightian sense. These two aspects complete the picture of differences in dealing with uncertainty.<sup>5</sup> By relating the three incentivized experimental measures of uncertainty (risk, loss and ambiguity aversion) to the survey based self-assessed measure of risk aversion we can extend our understanding of the relationship between objective and subjective measures of risk. For instance, we show that subjects' views of what is risk aversion is a mixture of what economists call risk, loss and ambiguity aversion.

Third, we use a double control group. We compare the decisions of entrepreneurs under risk and uncertainty not to a control group consisting of the general population, but we use two well defined control groups, one of managers and one of employees.<sup>6</sup> We are especially interested in the first control group. Behavioral characteristics of managers and entrepreneurs have been compared to each other in various studies (e.g. Brockhaus, 1980; Schere, 1982; Begley, 1995; Busenitz and Barney, 1997 and Stewart Jr. et al., 1999) because the two groups are arguably very similar. Both are responsible for strategic and complex decisions and are managing the employees in their companies, if any. Therefore they are likely to be similar in terms of many (observable) aspects, such as education, age, and labor market participation. We actually observe that the managers and entrepreneurs in our sample are indeed very similar, whereas the differences in background characteristics with employees are sizeable. If these differences extend to unobserved characteristics, such as motivation, perseverance or wealth, no fair comparison can be made between entrepreneurs and non-entrepreneurs. Therefore employing two

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<sup>4</sup>Examples of studies using Holt and Laury style elicitation of risk attitude are Elston and Harrison (2006); Macko and Tyszka (2009); Sandri et al. (2010); Burmeister-Lamp et al. (2012) and Holm et al. (2013). Examples of studies on risk and entrepreneurship using non-experimental measures of risk attitude are Hull et al. (1980); Brockhaus (1980); Caird (1991); Begley (1995); Koh (1996); Sarasvathy et al. (1998); Stewart Jr. et al. (1999); Van Praag and Cramer (2001); Uusitalo (2001); Cramer et al. (2002); Djankov et al. (2006, 2007) and Caliendo et al. (2010).

<sup>5</sup>We are not aware of any other studies that have rigorously compared entrepreneurs and managers in their degree of loss aversion. The closest study is Gächter et al. (2010) who graphically show that entrepreneurs are less loss averse on average than others in the risky choice category. It also shows that managers appear less loss averse than blue-collar workers but not than white-collar workers. Furthermore, ambiguity aversion has been compared for entrepreneurs with students and non-entrepreneurs by Koh (1996), Macko and Tyszka (2009) and Holm et al. (2013) and for entrepreneurs with managers by Schere (1982). With the exception of Holm et al. (2013), who do not report a significant difference, the general finding seems to be that entrepreneurs are better able to cope with ambiguous situations than both managers and non-entrepreneurs.

<sup>6</sup>Many studies have used rather unspecified control groups, such as Van Praag and Cramer (2001); Uusitalo (2001); Cramer et al. (2002); Elston and Harrison (2006); Djankov et al. (2006, 2007); Macko and Tyszka (2009); Caliendo et al. (2010); Sandri et al. (2010); Burmeister-Lamp et al. (2012) and Holm et al. (2013)

relatively (and one very) similar control groups allows a cleaner test of (behaviorial) differences between entrepreneurs and others. Using the two control groups may also show to what extent differences are related to the control group used.<sup>7,8</sup>

Fourth, following the heated debates in the literature about who is an entrepreneur (see for instance Parker, 2009; Levine and Rubinstein, 2012 or Henrekson and Sanandaji, 2014) we replicate our main result upon using various alternative definitions of the entrepreneur. In our basic sample, an ‘entrepreneur’ is someone who founded, inherited or has taken over a company that he/she is currently (co-)managing and has at least 5% of the firm shares.<sup>9</sup> We use alternative (sub)samples that are based on ‘stricter’ definitions of entrepreneurship (see Lindquist et al., 2013) that are then arguably more successful and thus more similar to the ‘Schumpeterian’ entrepreneur. Subsamples used include (i) incorporated entrepreneurs (Levine and Rubinstein, 2012), making up almost half of the sample, (ii) entrepreneurs with above median numbers of employees and (iii) entrepreneurs with above average income. In comparable ways, we also use one standard and various more selective definitions of our control groups. Managers are defined as employees in firms not started up by the respondent having at least two direct reports under their responsibility. The stricter definitions limit the sample to (i) CEO’s (17%), (ii) above median numbers of direct reports and, (iii) above median managerial income earners. Finally, employees are the people who work in organizations and do not belong to the groups of entrepreneurs and managers .

Our findings tell the following story. Entrepreneurs perceive themselves as more risk tolerant than managers who are, in turn, more risk tolerant than employees. This ranking is consistent with most of the previous studies using subjective risk measures. However, based on the objective MPL risk measure, entrepreneurs and managers have similar risk attitudes (and are less risk averse than employees). We reconcile these different findings for the two risk measures based on further analyses. We relate the subjective risk measure to all three experimental measures. All of them are strongly related to what people assess to be their risk attitude. Obviously, subjects have a notion of ‘risk’ that is different from economists, and more a mixture of risk and uncertainty. Hence, not only could distinct risk attitudes of managers and entrepreneurs explain the differences in their self-assessed risk aversion, these differences may also relate to differences in loss and/or ambiguity aversion. When analyzing the differences in loss and ambiguity aversion across the three groups, we show that loss aversion is the missing piece. Whereas all three groups have similar degrees of ambiguity aversion, entrepreneurs have a significant lower level of loss aversion than the two other groups. All these results are independent

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<sup>7</sup>Many studies that have compared entrepreneurs and managers are relatively old and rely on small samples and self-assessed measures of risk attitude. The overall findings are mixed, too. Brockhaus (1980) and Busenitz and Barney (1997) found no differences between the two groups, whereas both Begley (1995) and Stewart Jr. et al. (1999) report lower levels of risk aversion among entrepreneurs than managers. Furthermore, a meta-analytical review by Stewart Jr. and Roth (2001) concludes that managers are more risk averse than entrepreneurs, although this conclusion is challenged by Miner and Raju (2004) who conclude that the role of risk propensity in entrepreneurship remains unresolved.

<sup>8</sup>In a comparison of managers and employees, Graham et al. (2013)) show that managers have a lower risk aversion than the lay population.

<sup>9</sup>Five percent is the percentage ownership that the tax authority calls ‘a substantial interest’. However, we find that 88% (65%) of the entrepreneurs in our sample holds at least 30% (51%) of the company shares.

of the definitions we use of entrepreneurs and managers. In some cases, limiting the sample to more successful entrepreneurs strengthens the results.

We think it is rather intuitive that entrepreneurs are indeed different from managers in the way they deal with risk and uncertainty and that the difference is related to how losses 'loom larger than corresponding gains' (Kahneman and Tversky, 1979, 1984; Tversky and Kahneman, 1992). The entrepreneur's position is one in which much more is at stake to be lost than in the role of a manager. Kahneman and Tversky citation.

In what follows, Section 2 discusses data, design and measurement issues. Section 3 shows the empirical findings. Section 4 provides a discussion and conclusion.

## 2. Design, measurement and sampling

We aim at using a design and sample that meet five conditions. First we wish to use (golden) standard survey and experimental measures of risk aversion. Second, complementary to the standard risk measures are incentivized measures of loss and ambiguity aversion. Third, we aim at obtaining a large sample of entrepreneurs, managers and employees in Europe (Netherlands), so that we may obtain precise measures. Fourth, we wish to use incentives that are strong enough to elicit effort from the target group and, fifth and finally, the sample should enable the creation of meaningful subsamples of (more successful) entrepreneurs and managers.

### 2.1 Measurement of risk, loss and ambiguity aversion

Entrepreneurship is associated with risk bearing, uncertainty and (gains and) losses. The very classic and influential economists and philosophers who laid the foundation of thinking about entrepreneurship all but Schumpeter defined the entrepreneur as a risk bearer (Cantillon, 1755; Say, 1803; Marshall, 1930) or, explicitly as an uncertainty bearer (Knight, 1921) or as agents who are less inclined to avoid losses (Knight, 1921; Marshall, 1930).<sup>10</sup> Before digging into the specific measures used, we first provide intuitive definitions of the three concepts studied and the differences between them.

*Risk aversion* is a concept with a very specific meaning in economics. It is the willingness of people

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<sup>10</sup>Cantillon (1755) who was the earliest philosophic thinker about entrepreneurship defined the entrepreneur as a risk bearer as a consequence of buying (selling) at uncertain prices. Say's entrepreneur (1803) is a risk bearer because of the risk of losing capital and reputation due to the likelihood of failure. Hence, Say defines entrepreneurship in terms of the risk of losses rather than of gains. Marshall's view on entrepreneurship (1930) is the most common one: entrepreneurs are responsible for assuming the business risks associated with their enterprise. Marshall also acknowledges that a few extremely high prices will have a disproportionately great attractive force (Marshall, 1930, p. 554) "because risk lovers are more attracted by the prospects of a great success than they are deterred by the fear of failure" (Van Praag, 1999, p. 319). Thus, also Marshall pays particular attention to loss aversion. Knight (1921) was the first to explicitly distinguish between risk and true uncertainty (ambiguity). He defines the entrepreneur as the particular kind of individual who bears uncertainty because business decisions practically never concern calculable probabilities (Van Praag, 1999, p. 322).

to sacrifice expected payoffs to circumvent taking risks. In other words, it measures the extent to which the utility of a guaranteed payoff (for instance 50) is higher than the utility derived from a proposition with the same expected reward obtained with risk (for instance 100 with 50% probability and 0 with 50% probability based on the flip of a coin). Risk aversion is involved in decision making situations where a probability can be assigned to each possible outcome of the situation.

*Loss aversion* refers to the notion that decision makers prefer to avoid losses to acquiring gains. Loss aversion was first demonstrated by Tversky and Kahneman in their prospect theory (Kahneman and Tversky, 1979, 1984). Loss aversion implies that losing 50 will decrease utility or satisfaction by more than the increase of utility or satisfaction that is associated with a (windfall) gain of 50. Loss aversion explains the endowment effect (Kahneman et al., 1990): the fact that people value the goods and assets they own higher than identical goods and assets they do not own.

*Ambiguity aversion* is also known as uncertainty aversion and refers to a preference for risks with known probabilities to risks with unknown probabilities (true Knightian uncertainty), e.g., Ellsberg (1961) and Holm et al. (2013). Ambiguous events have a greater degree of uncertainty than risky events because not only is the outcome uncertain but also the probability of the realization of that outcome and, as a consequence, the expected payoff.

## **Risk aversion**

We use two measures of risk aversion, one is experimental and the other is survey based. Our experimental measure is obtained by using the multiple price list (MPL) format of Dohmen et al. (2010), which is based on Holt and Laury (2002). Participants are confronted with a list of ten decisions between two options, one is risky with known probabilities (Option A) and the other is safe (Option B). Similar to Dohmen et al. (2010), Option A is in each of the ten cases: gaining €300 with a 50% chance or gaining €0 with a 50% chance. The safe option on the other hand (Option B) gradually increases from €25 to €250 (see figure 1). Instead of asking each participant to reveal their preferences for every decision, we asked each participant to indicate their switching point, if any.<sup>11</sup> For example, a possible answer that could be selected was “I prefer Option A in decision 1 and Option B in 2-10”. Risk-neutrality is implied in this setup by a switching point from Option A to Option B at the 6th decision (€150 for sure), i.e. when one selected “I prefer Option A in decisions 1-5 and Option B in 6-10”.

The second measure of risk aversion is copied from Dohmen et al. (2011). Participants indicate their willingness to take risks in general, and in various domains such as their career and financial matters. This provides a measure of an individual’s self-perceived willingness to take risks in different

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<sup>11</sup>Enforcing a switching point, and enforcing strict monotonicity and transitivity, had no systematic effect (Andersen et al., 2006). Others have also adapted MPL formats to eliciting a switching point from the respondents rather than having them make separate and similar decisions in a row (see e.g. Dohmen et al., 2011 and Gneezy and Pietrasz, 2013). We opted for using switching points because the experiment includes multiple MPL formats and we assume that entrepreneurs, managers and employees are (more) time-constrained (than students in a laboratory who have given up the hour of the experiment anyway).

domains. In our survey, we included their measure of willingness to take risks (in general, career and financial matters) on a 0-10 scale, where 0 stood for “Not at all willing to take risks” and 10 for “Very willing to take risks”.<sup>12</sup>

### **Loss aversion**

Loss aversion, or the tendency that losses loom larger than corresponding gains (Kahneman and Tversky, 1979, 1984; Tversky and Kahneman, 1992), was measured by means of the MPL applied by Fehr and Goette (2007) and Gächter et al. (2010), which in essence is like the Holt and Laury price list but also includes negative payoffs. In this case, Option A consists of a 50% probability of receiving €6 and a 50% probability of losing an amount between €1 - €10. When selecting the safe option (Option B), participants receive €0 (see figure 2). Again, we are interested in the respondents’ switching points. Overall, the small stakes in these lotteries ensure that it is not risk aversion that explains the choice behavior in these decisions, as risk aversion in such small-stake lotteries would imply extreme degrees of risk aversion in high-stake gambles (e.g. Rabin, 2000; Wakker, 2005; Fehr and Goette, 2007 and Wakker, 2010). Rabin (2000) therefore argues that under expected utility theory, people should be risk neutral in such gambles. We emphasize in our survey that selecting Option A entails a real loss of money.

### **Ambiguity aversion**

The measure of ambiguity aversion that we use is taken from Fox and Tversky (1995) and Gneezy and Pietrasz (2013), using an MPL structure again and respondents are requested to indicate their switching point. Each of the ten times, we present participants with an Urn A with 50 red balls and 50 black balls, and an Urn B which has an unknown distribution of red and black balls. The selection of Urn A pays off €300 if a red ball is drawn (50% chance) and €0 if it is black (also 50% chance). If participants choose to select Urn B, payments vary between €250 and €475 if a red ball is drawn and is €0 in the case of a black ball, see Figure 3.

## **2.2 Sampling**

According to Holm, Opper and Nee (2013, p. 1676), obtaining a large-scale experiment involving hundreds of entrepreneurs and managers “would be a demanding undertaking anywhere in the world. Owners and CEOs of established firms are rarely willing to devote their scarce time to time-consuming academic studies.” They mention that some earlier studies solved this problem by studying the self-employed, others by using small (convenience) samples, whereas they themselves have gone to China to perform an incentivized experiment with affordable monetary awards among a sample of 700 private

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<sup>12</sup>In the design of the questionnaire, this question was widely spaced from the incentivized risk measure, which came first. The question about willingness to take risk in general is of main interest, the ones about career and financial matters are used for robustness checks.

enterprises, excluding start-ups and small-scale household firms, and a random sample of 200 individuals (control group). They do admit that their control group is not ideal and that “the ideal control group would be one that is identical to the entrepreneurs except that they are not entrepreneurs” (p. 1677). We selected a different route to obtain a large scale sample in a Western country including a control group rather similar to the group of entrepreneurs.

We decided to bring the lab to the field and obtain responses from participants online. This practice is not uncommon when aiming to a substantial response from the field (see e.g., DeMartino and Barbato, 2003; Block and Koellinger, 2009; Graham et al., 2013). We were able to reach qualifying participants through our extensive network, the Amsterdam Center for Entrepreneurship (ACE). Through ACE we managed to collaborate with big and active organizations of entrepreneurs and managers. For entrepreneurs, we collaborated with “Synpact”, a company that has the digital Rolodex of a random selection of small and medium sized enterprises, including 15,000 entrepreneurs in the Netherlands. The Rolodex is supported by frequent contact through a large offer of training programs and conferences. The 15,000 entrepreneurs all received an invitation to participate in the online research and a link to the questionnaire and experiments.<sup>13</sup> For managers, whom we view as a possibly close to ideal control group, we collaborated with a large and highly reputed training center (“De Baak”), which is part of the largest and influential employers organization (“VNO-NCW, MKB-Nederland”) in the Netherlands. The training center was willing to send our invitation to participate in the research (plus link to the survey and experiments) to all managers they have in file, a total of 5,888. The same invitation and survey were sent to a sample of 7,850 employees, which were recruited via a Dutch market research agency with access to over 70,000 Dutch employees.

Invitations to participate in the research were sent out to the groups of entrepreneurs and managers on October 1 (Round 1), to the employees on November 4 (Round 2). All groups had exactly 14 days to respond (the due date was communicated in the letter) and non-respondents at that stage received a reminder after 7 days. Out of all people who received the mailing, 910 entrepreneurs, 397 managers and 981 employees completed the survey. Response rates were thus in the range of 6-12%. These are comparable to the European response rates in e.g. Graham et al. (2013) and earlier experiences by Synpact (with simpler tasks for the respondents). A comparison of respondents with non-respondent based on the available observables (age and gender) yields that the responding groups of entrepreneurs and managers are not significantly different from non-respondents. For the responding employees, however, females were slightly oversampled (53 per cent versus 47 per cent).

### **Incentives**

Respondents were requested to first complete two parts of incentivized games and then fill out the survey, including the subjective measure of risk aversion and several background questions.<sup>14</sup> All

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<sup>13</sup>See Appendix A for the translated letter.

<sup>14</sup>The first part of incentivizes games (Part 1) was designed to obtain proxies for overoptimism while the second part (Part 2) aimed at eliciting preferences such as risk and loss aversion. This paper only reports about the second part. Part 1 about overoptimism will be used in combination with other data to be obtained from a repeat research (partly



participants first received instructions about what to expect in general, and the reward structure. Instructions also included examples and practice rounds to get familiar with the experimental setup. The total questionnaire took on average 14 minutes (the online version was able to register this), including possible breaks that people took while online. Except for the general risk question, all decisions in our survey were made incentive compatible and thus had real financial consequences if one was selected as prize winner.<sup>15</sup> This was clearly communicated.

The precalculated average earnings per winning respondent are around €300. Incentives are such that participants can earn a maximum of €675 (€200 in Part 1 and €475 in Part 2) and a minimum of €90 (€100 in Part 1 and -€10 in Part 2), depending on their choices and luck.<sup>16</sup> The luck component consist of three elements: decisions involve a random draw whenever a participant selects a risky or ambiguous option. Second, in each of the two parts, only one decision is randomly selected for payment and total payment equals the sum of these two amounts. Such a procedure is quite common in the literature (see e.g. Laury, 2006 and Dohmen et al., 2011) and is according to Azrieli et al. (2012) the only incentive-compatible way to utilize the MPL method. Third, only a random selection of participants are selected as winners and actually paid out. Given a limited budget and the income levels of the participants we chose to pay out substantial (instead of very small) amounts to a few (instead of all) randomly selected participants.<sup>17</sup> In round 1 we randomly selected 2 winners from each day's completed participants' files in the first week and one winner per day in the second week. This resulted in 21 prizewinners in round 1 in total. In the second round, we paid out 5 participants. Overall, chances that one was paid out were 1/62 in the first round and 1/196 in the second round. This was unknown to the participants (and ourselves) beforehand.

Furthermore, in order to further foster trust and truthful reporting, all prize winners as well as all random draws in the experiments and the selection of winning decisions were performed by a civil-law notary who also monitored a legitimate course of the payouts. The full survey is available upon request.

### Definition of subsamples

The qualifying characteristics for inclusion in the entrepreneur sample were the following. 'Entrepreneurs' are all people who have founded, inherited or taken over a company that they are currently (co-)managing. We also classified participants as 'entrepreneurs' who obtained firm ownership over a company within 5 years after start-up and who are currently its (co-)manager. Below, we will show

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using the same samples of entrepreneurs, managers and, employees).

<sup>15</sup>Evidence indicates that incentive-compatibility in risk elicitation matters (see e.g., Holt and Laury, 2002). Moreover, as put forward by Charness et al. (2013): "... If measures of risk preferences are to be associated with actual risk-taking behavior, their elicitation should be incentivized in order to ensure that choices reflect true underlying attitudes toward risk."

<sup>16</sup>The €100 of Part 1 was considered the base fee to circumvent that participants might end up with negative overall payoffs, given the incentive compatible measure of loss aversion. Any incurred losses were deducted from this number. See Eckel and Grossman (2008) for a similar design.

<sup>17</sup>The 'pay enough or don't pay at all' strategy Gneezy and Rustichini (2000) generates results that are similar to using the alternative procedure of paying smaller amounts to all participants Laury (2006).

that the sample of entrepreneurs includes a varied group of entrepreneurs from which various subsamples can be formed. Individuals qualify for inclusion in the sample of ‘managers’ if they are employed by an organization that they did not start up themselves and have at least two subordinates for whom they are directly responsible. We also classify project managers as managers in case they have overall responsibility of their projects and at least two direct reporting lines. People belong to the group of ‘employees’, finally, if they are employed by an organization and do not belong to the first two groups.<sup>18</sup>

### 2.3 Data description

Table 1, panel A shows the sample descriptive statistics ( $N = 2288$ ) of the measures of risk, loss and, ambiguity aversion. Panel B of the same table shows the correlations between the same variables, i.e., the two measures of risk, and the loss and ambiguity aversion measures. The survey measure of risk aversion is reversely coded, i.e. it is a measure of risk appetite. Although the levels of the different measures are not comparable, Panel A shows that all four measures are based on the same number of valid observations and that the experimental measures have a larger intra sample variation than the survey based measure of risk attitude. All measures have scores using the complete spread of their scale. Panel B shows that the correlations between the measures are all rather low. The correlation with the highest absolute value is between the two measures of risk attitude. The survey based measure of risk attitude is also correlated significantly with both of the other experimental measures, but to a lower degree. The low correlations between the three experimental measures indicate that these measures succeed in measuring various behavioral aspects of risk and uncertainty.

< INSERT TABLE 1 HERE >

Table 2 shows the descriptive statistics of some characteristics that are used to define stricter subsamples of (more successful) entrepreneurs and managers (and employees). Panel A shows the income distribution of each of the three samples according to the answer categories used in the questionnaire. Entrepreneurs are over-represented in both tails of the income distribution, relative to managers, which is a common observation (Hamilton, 2000) and an indicator of a larger cross-sectional income spread. We do not observe substantial differences between the average *level* of the entrepreneurial and managerial incomes. Both are higher than the income level of employees. For entrepreneurs and managers, the median income is in the category of €50,001-€75,000 (as a benchmark, the modal income in 2013 was €33,500). For employees the median value falls in a lower category, i.e., €25,001-€50,000. For all groups we will analyze subsamples of above median income earners.

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<sup>18</sup>Participants who are both entrepreneurs and managers or employees and therefore eligible for multiple subsamples were instructed to select the one generating most of their income.

Panel B shows that 82% of the entrepreneurs in our sample are the founder of their firms, a commonly used definition of entrepreneurs (one of our ‘stricter’ definitions). 14 percent of the firms have been acquired through a takeover and in four percent of the cases in our sample, the entrepreneurs have bought themselves into the business they currently (co-)manage within five years after its start-up. For managers we are interested in subsamples of CEO’s (17%, albeit possibly of small firms) and all managers except those who are responsible for projects rather than people (18%).

Panel C shows that 20% (38%) of the entrepreneurs are currently managing and leading young firms in their start-up (survival) phase. Some studies define entrepreneurs exclusively as the owner/managers of start-ups (e.g., Brockhaus, 1980; Busenitz and Barney, 1997), whereas other studies explicitly take them out (Holm et al., 2013). We shall use the same distinctions to test the robustness of our results against using various definitions of the entrepreneur. Panel C also shows that almost half of the entrepreneur sample consists of incorporated business owners. This enables us to limit the sample of entrepreneurs to incorporated business owners consistent with, for instance, Levine and Rubinstein (2012). The right handside of Panel C shows the age and size distributions of the firms that managers and employees work for. As expected these distributions are similar, but different from the age and size distribution of entrepreneurial firms. The latter are younger (see panel C) and smaller (see Panel D). As a robustness check we shall split the samples of managers and employees according to the age and size distribution of their firms. Managers and employees in smaller and younger, i.e., more entrepreneurial firms, may be more similar to entrepreneurs.

Panel D of Table 2 shows the distribution of the number of employees supervised by entrepreneurs and managers. Seventeen percent of the entrepreneurs in our sample have zero employees and 43% have at most one. We shall adopt a stricter definition of entrepreneurship based on the number of employees they employ (cf. e.g. Tag et al., 2013). We can apply a similar sample restriction for managers.

Table 3 compares background characteristics of the three subsamples. Entrepreneurs and managers are similar in terms of the most commonly used background characteristics: their age, the percentage of females as well as their experience and school background (although managers are somewhat more likely to have a university degree and entrepreneurs to have a bachelor degree from a college). Employees are different in terms of their background characteristics than the other two groups (but still much more similar than a random snapshot from the population): they are somewhat younger (mean age is 41), more likely to be female and they have lower educational degrees, on average.

To summarize, Table 1 shows that the three objective measures of risk, loss and ambiguity aversion have a sufficient spread in our sample to run regression analyses and the low correlations between them support the idea that the measures measure different behavioral characteristics. All three of them are correlated with the subjective measure of risk appetite, risk aversion more strongly than the others. Table 2 shows that the samples of entrepreneurs, managers and, to a lesser extent, employees are suitable for the creation of subsamples based on stricter, alternative, also commonly used definitions

of entrepreneurs, managers and employees. In that way we can test how robust our results are against using alternative definitions. Table 3, finally, shows that entrepreneurs and managers are similar in terms of the most important background characteristics whereas employees are not so similar. We now turn to the results.

### 3. Results

#### 3.1 Main results

Before turning to the more rigorous empirical analyses, we first discuss Table 4 showing the means of the four measures of risk and uncertainty for each of the three groups of interest.

< INSERT TABLE 4 HERE >

The first column shows that entrepreneurs are more likely to take risks in general than managers. Managers, in turn, are significantly more likely to take risks in general than employees.<sup>19</sup> Two sample t-tests confirm that the differences between entrepreneurs and employees, entrepreneurs and managers, and managers and employees are all highly significant (all p-values are  $< 0.001$ ).<sup>20</sup>

The second column shows that the experimental measure of risk aversion is not significantly lower for entrepreneurs when compared to employees. Both entrepreneurs and managers are significantly less risk averse than employees. The rest of the table shows that the raw differences in terms of loss aversion show a similar pattern: entrepreneurs are least loss averse, followed by managers and employees. However, for loss aversion in contrast to risk aversion, the difference between entrepreneurs and managers is significant, whereas the difference between managers and employees is not. The last column of Table 4 reveals an unexpected pattern: Entrepreneurs and managers, who are equally ambiguity averse, are more ambiguity averse than employees.

Table 5 shows the output of ordered probit regressions for each of the four behavioral variables. Control variables, such as age, gender, education, experience and income are included. Columns 'a' shows the results excluding some arguably endogenous variables, i.e., education, experience and income, whereas columns 'b' include those as explanatory variables (analogous to e.g. Dohmen et al.,

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<sup>19</sup>The same results are obtained for the other domains measured, i.e., financial risk and career risk.

<sup>20</sup> Ranksum and Kolmogorov-Smirnov tests generate the same results.

2010).

< INSERT TABLE 5 HERE >

Table 5 paints a similar picture as did Table 4. The first estimation equation shows that entrepreneurs view themselves as less risk averse than managers (see the Wald test in the last row of the table), whereas both entrepreneurs and managers are less risk averse than employees, given their observed background characteristics. These findings are largely consistent with previous studies using survey based measures of risk aversion. The second set of estimates supports the view arisen from Table 4 that entrepreneurs are making similar decisions as managers do when playing games about risk in an experimental and incentivised environment. Although they view themselves as more risk-taking than managers, they are not really. Again we find that both entrepreneurs and managers are less risk averse than employees with similar background characteristics. The third set of results shows that one behavioral characteristic is unique for entrepreneurs: a lower level of loss aversion (than both managers and employees). The fourth and final set of results indicate that the differences between employees on the one hand and entrepreneurs and managers on the other hand in terms of ambiguity aversion disappear when including (more) controls in the equation. Apparently, entrepreneurs, managers and employees that are comparable in terms of their age, gender, education, income and the like don't show differences in their attitudes towards ambiguity (or uncertainty). This result was also obtained by Holm et al. (2013).

The control variables have also different associations with the survey based measure of risk than with all three experimental measures. Older people claim to be less willing to take risks in general (consistent with Dohmen et al. 2011) but none of the three experimental measures is significantly associated with age. Females are less risk taking according to the survey based measure (also consistent with Dohmen et al., 2011) but the Holt and Laury measures are no different for females than for males. The latter result is largely consistent with the conclusion from a recent meta-analysis about gender differences in risk attitudes elicited by this type of games (Filippin and Crosetto, 2014).<sup>21</sup>

We conclude from Tables 4 and 5 that entrepreneurs and managers are different from employees in terms of their risk attitude, both when measured subjectively and objectively. However the difference that is the focus of our attention is the one between entrepreneurs and managers. Entrepreneurs claim

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<sup>21</sup> Also for education we find the expected negative effect using the survey-based Dohmen measure of risk appetite, (cf. Harrison et al., 2007), but no significant effect when using any of the experimental measures. Finally, Table 5 shows that people with higher incomes view themselves as less risk-averse (by comparison; in Dohmen et al., 2010 the effect of household income is the same but just insignificant). Interestingly, higher income people are less loss averse according to the experimental measure but not less risk or ambiguity averse. These results are not included in the table.

to have a lower level of risk aversion than managers but their actual behavior does not support that difference according to an experimental measure of risk aversion that economists use widely. When considering related experimental measures, entrepreneurs and managers turn out to be different in terms of loss aversion. Entrepreneurs are less averse to losses than both managers and employees. The latter two groups are similarly loss averse. These results indicate that what really differentiates entrepreneurs from others is loss aversion, but that respondents might mix up these kinds of concepts that are very subtly different from each other.

Table 6 shows that the subjective assessments of respondents' risk attitudes are correlated not only with the experimental risk measure, but also with the two other experimental measures, i.e., of loss and ambiguity aversion. All three coefficients in the ordered probit regression on risk aversion are highly significant and have the expected sign (minus). The measure of risk has the highest (negative) association with the self-assessed risk attitude, but both loss and ambiguity aversion play a large part too in the explanation of the self-assessed value. The result is the same in each of the three columns, i.e., both without (column 1) and with (column 2) controls for entrepreneur and managers. In column three all three coefficients are calculated separately for managers and entrepreneurs (by including interactions with these dummy indicators), where the benchmark is the subsample of employees. The associations between the subjective assessment of risk and the objective measures are similar for managers and employees (the coefficients of the interacted variables with 'manager' all lack statistical significance). However for entrepreneurs, there are some notable differences. The association with risk aversion is lower than for the rest of the sample, but the relationship remains significantly different from zero (p-value = 0.03). The latter does not hold for ambiguity aversion, though; here a similar test shows that for entrepreneurs we cannot reject the null hypothesis that ambiguity aversion does not impact willingness to take risks (p-value = 0.52). All in all, the results in column 3 indicate that entrepreneurs base their self-assessment of risk appetite on their loss aversion, more than on their risk or ambiguity aversion. For managers and employees this is not the case. A low level of loss aversion is the distinguishing feature of entrepreneurs and they associate this with having a higher risk appetite than others.

< INSERT TABLE 6 HERE >

Overall we draw two conclusions from this analysis: (1) subjective assessments of risk attitude proxy for more than just risk aversion and (2) there is a greater divergence between subjective assessments of risk attitude and behavioral observations for entrepreneurs than for others. Entrepreneurs associate loss aversion with risk aversion.

### 3.2 Robustness Checks

In this section we will first test to what extent the results remain the same when using alternative, in fact “stricter” definitions of entrepreneurs and managers. Table 7 displays the main result of Table 5, using various alternative definitions. Thus, each coefficient is obtained in a separate regression (see Table 5 for the specifics of these regressions).

< INSERT TABLE 7 HERE >

For entrepreneurs we use a set of stricter definitions, in congruence with the literature earlier mentioned. We use the subsets of (i) entrepreneurs with an incorporated firm, thereby mainly excluding the own-account self-employed, (ii) entrepreneurs with an above median number of fulltime equivalent employees in their company and (iii) entrepreneurs with above median incomes, (iv) entrepreneurs that have founded their business, instead of obtaining it through takeover or buy-in, (v) entrepreneurs in the survival phase (firm age  $\leq 5$  years) and (vi) entrepreneurs past their survival phase (firm age  $> 5$  years).<sup>22</sup> Panel A of Table 7 shows the results of confronting the data with these alternative definitions of the entrepreneur. For managers and employees we employ the original samples. Its last line shows the result of Table 5 again.

The panel shows a clear pattern consistent with the findings in Table 5. Whatever definition of the entrepreneur is used, entrepreneurs assess themselves as more risk taking than both managers and employees. Using objective measures of risk and uncertainty, the data show again that entrepreneurs and managers are equally risk averse, but less so than employees. The only notable and significant difference with the benchmark appears when limiting the sample to incorporated entrepreneurs. They are significantly less risk averse than both managers and employees.<sup>23</sup> Loss aversion is the one behavioral feature that distinguishes entrepreneurs from managers. The results in table 5 turn out to be robust against using various (stricter) definitions of (successful) entrepreneurship.

Panel B of Table 7 shows the results upon varying the definition of a manager (and using the baseline samples of entrepreneurs and employees). Again we find that the main results remain, irrespective of the definition used. We restrict the sample to (vii) CEO’s or general managers (as opposed to project managers), (viii) CEO’s exclusively, (ix) managers with more than the medium number of direct reports (x) managers with above median managerial income, and (xi) managers in firms that are older than 15 years old. The stricter definitions used do not only restrict the sample to more successful managers but also, in some cases, to managers that can reasonably be expected to be more different

<sup>22</sup>We also analyzed subsamples of entrepreneurs based on their share ownership (for instance a minimum of 30% or 50%) leaving the main result unchanged.

<sup>23</sup>To support this finding we ran a similar regression using the sample of entrepreneurs only showing that incorporated as well as above median income earning entrepreneurs are less risk averse than other entrepreneurs.

from entrepreneurs than average, such as the ones employed in older firms. Again, the last line of the panel shows the result for managers copied from Table 5, i.e., the benchmark.

Panel C finally tests some of the alternative definitions against each other. Whether we compare entrepreneurs of incorporated firms with CEO's (i) or whether we compare entrepreneurs and managers with larger spans of control (ii) or higher than median incomes (iii), the results remain very similar to the main result according to the Wald statistics in each of these cases.<sup>24</sup>

Another robustness check is based on the idea that many people are belonging to one of the groups at the time of measurement, but may have been part of another group in the past or will be in the future. In other words, the distinction between the three groups in terms of typology is not black-white. Possibly, the differences between the 'pure' groups are larger when taking into account that some individuals belong to 'gray' areas. Appendix B shows the result from analyses that take this into account. Appendix Table B1 shows that 71% of the entrepreneurs in the sample have been managers in the past and nine percent is currently wage employee or manager besides being a business owner. Moreover 17 (10) percent of the managers (employees) is also an entrepreneur (on the side). whereas 12 (9) percent of the managers (employees) have been so in the past. Apparently, people move out of and (especially) into entrepreneurship in the course of their professional lives.<sup>25</sup> Appendix Table B2 shows that the effects found in Table 5 (and 7) do not change when accounting for past and current positions in the other groups. The coefficients of the controls that distinguish the gray groups from the 'pure' groups have the expected signs (diminishing the main effect), but they are not significant.

## 4. Conclusion

*[to be completed]*

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<sup>24</sup>We also employed a stricter definition of employees by limiting that subsample to above median income earners (effectively cutting off the lowest category of the 26% of wage employees earning incomes lower than 25,000 euro's, see Table 2). Again the results were the same.

<sup>25</sup>As explained in the footnote of Appendix Table B1, the span of control of the past managerial and entrepreneurial positions have been measured too.



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## Tables

**Table 1:** Descriptive Statistics of the Measures of Risk, Los, and Ambiguity Aversion

<i>Panel A: Means</i>	Observations	Mean	St. dev.	Minimum	Maximum
Risk Aversion					
- Survey measure <sup>1</sup>	2288	6.33	1.79	0	10
- Experimental measure	2288	5.38	2.76	0	10
Loss Aversion	2288	5.05	2.65	0	10
Ambiguity Aversion	2288	5.74	3.64	0	10

<i>Panel B: Correlations</i>	Risk Aversion (Survey)	Risk Aversion (Objective)	Loss Aversion	Ambiguity Aversion
Risk Aversion				
- Survey measure <sup>1</sup>	-			
- Experimental measure	-0.17	-		
Loss Aversion	-0.12	0.05	-	
Ambiguity Aversion	-0.05	-0.05	-0.01	-

<sup>1</sup> Reverse coded

This table shows the descriptive statistics of the two measures of risk attitude, loss aversion and ambiguity aversion. The survey measure of risk appetite is between 0 - 10, where 0 represents “Not at all willing to take risks” and 10 represents “Very willing to take risks”. The experimental measure of risk aversion is equal to the number of safe decisions made in the 10 decisions, and ranges from 0 to 10. Hence, more risk averse participants have a higher score. Similarly, loss aversion measures the number of safe decisions made in the loss aversion multiple price list (range: 0-10). Ambiguity aversion (range: 0-10) is equal to a participant’s number of non-ambiguous decisions in the multiple price list for ambiguity. The higher the value, the more ambiguity averse is the person.

**Table 2:** Descriptives of Variables to Define Sample Splits within Entrepreneurs, Managers and, Employees

	Entrepreneurs (N = 910)		Managers (N = 397)	Employees (N = 981)
<i>Panel A: Income</i>				
< €25,000	23%	< €25,000	2%	26%
€25,001 - €50,000	20%	€25,001 - €50,000	17%	58%
€50,001 - €75,000	19%	€50,001 - €75,000	34%	12%
€75,001 - €125,000	20%	€75,001 - €125,000	36%	3%
€125,001 - €200,000	11%	€125,001 - €200,000	8%	1%
€200,001 - €300,000	4%	€200,001 - €300,000	2%	0%
€300,001 - €400,000	1%	€300,001 - €400,000	0%	0%
> €400,000	2%	> €400,000	1%	0%
<i>Panel B: Entrepreneur/Manager characteristics</i>				
Founder	82%	CEO	17%	-
Business taken over	14%	General Manager	65%	-
Joined the firm within 5 yrs	4%	Project Manager	18%	-
<i>Panel C: Firm characteristics</i>				
Start-up phase (0 - 3 yrs)	20%	Firm age $\leq$ 5 yrs	5%	6%
Survival phase (0 - 5 yrs)	38%	Firm age 6 - 50 yrs	50%	55%
		Firm age > 50 yrs	45%	39%
Incorporated	49%	Firm size $\leq$ 25 FTE	13%	19%
Sole proprietorship	38%	Firm size 26 - 1000 FTE	53%	50%
Other	13%	Firm size > 1000 FTE	34%	31%
<i>Panel D: Management level</i>				
Employees:		Direct reports:		
0	17%	2 - 5	45%	-
1	26%	6 - 10	30%	-
2 - 5	25%	11 - 25	19%	-
6 - 10	10%	26 - 50	4%	-
11 - 25	11%	More than 50	2%	-
26 - 50	5%			
51 - 100	4%			
101 - 500	1%			
More than 500	1%			

**Table 3:** Background Characteristics of Entrepreneurs, Managers, and Employees

	Entrepreneurs	Managers	Employees
Age	47.36 <sup>a</sup>	46.45 <sup>c</sup>	41.24 <sup>a,c</sup>
Female (dummy)	0.25 <sup>a</sup>	0.28 <sup>c</sup>	0.53 <sup>a,c</sup>
Education (highest degree):			
- High School	4%	2%	3%
- Lower intermediate vocational degree	12%	11%	34%
- College education	46%	42%	42%
- University education	38%	45%	21%
Number of observations	910	397	981

- a) Significant difference between entrepreneurs and employees at the 5% level (two-sample t-test)
- b) Significant difference between entrepreneurs and managers at the 5% level (two-sample t-test)
- c) Significant difference between managers and employees at the 5% level (two-sample t-test)

**Table 4:** Raw Differences in Risk, Loss, and Ambiguity Aversion of Entrepreneurs, Managers and Employees

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	Willingness to take risks in general	Risk Aversion	Loss Aversion	Ambiguity Aversion
Entrepreneurs	6.88 <sup>a,b</sup>	5.03 <sup>a</sup>	4.77 <sup>a,b</sup>	5.88 <sup>a</sup>
Managers	6.31 <sup>b,c</sup>	5.17 <sup>c</sup>	5.08 <sup>b</sup>	5.90 <sup>c</sup>
Employees	5.81 <sup>a,c</sup>	5.78 <sup>a,c</sup>	5.29 <sup>a</sup>	5.54 <sup>a,c</sup>

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a) Significant difference between entrepreneurs and employees at the 5% level (two-sample t-test)

b) Significant difference between entrepreneurs and managers at the 5% level (two-sample t-test)

c) Significant difference between managers and employees at the 5% level (two-sample t-test)

See the note below Table 1 for the definitions of the variables.



**Table 5:** Risk -, Loss -, and Ambiguity Aversion of Entrepreneurs, Managers and Employees

Dep. variable:	(1a)	(1b)	(2a)	(2b)	(3a)	(3b)	(4a)	(4b)
	Willingness to take risk	Willingness to take risk	Risk Aversion	Risk Aversion	Loss Aversion	Loss Aversion	Ambiguity Aversion	Ambiguity Aversion
Entrepreneur	0.655*** [12.43]	0.614*** [8.31]	-0.261*** [-5.05]	-0.254*** [-3.42]	-0.200*** [-3.89]	-0.251*** [-3.47]	0.104** [1.99]	0.00279 [0.04]
Manager	0.256*** [4.23]	0.194** [2.38]	-0.203*** [-3.32]	-0.219*** [-2.73]	-0.0929 [-1.52]	-0.0101 [-0.12]	0.120* [1.88]	0.0715 [0.83]
Age	-0.0299** [-2.20]	-0.0348** [-2.10]	-0.0206 [-1.51]	-0.0261 [-1.61]	-0.0128 [-0.98]	-0.00711 [-0.46]	0.00616 [0.47]	0.0130 [0.86]
Age squared	0.000237 [1.57]	0.000246 [1.38]	0.000246 [1.60]	0.000317* [1.77]	0.000154 [1.03]	0.000112 [0.64]	-0.000112 [-0.76]	-0.000183 [-1.10]
Female	-0.234*** [-4.98]	-0.147*** [-2.70]	0.0311 [0.66]	-0.00468 [-0.09]	0.0612 [1.31]	0.0224 [0.40]	-0.00155 [-0.03]	-0.0174 [-0.31]
Controls for education, experience, and income	NO	YES	NO	YES	NO	YES	NO	YES
<i>N</i>	2288	1805	2288	1805	2288	1805	2288	1805
Log lik.	-4235.2	-3307.9	-5055.4	-3956.6	-4920.8	-3848.6	-4919.7	-3826.6
ENT=MAN <sup>1</sup>	< 0.001***	< 0.001***	0.31	0.60	0.06*	< 0.01***	0.80	0.36

1) This row reports the p-values of Wald tests on  $\beta(\text{ENTREPRENEUR}) = \beta(\text{MANAGER})$ .

Most variables have been defined earlier. The categorical variables 'education' and 'income' have been summarized into one variable instead of using a set of dummies. the education variable takes on the value 0 if the highest attained level is high school or lower, 1 if secondary education is obtained at a higher level, 2 if a participant has college education and 3 if the participant has a university degree. Income has been collapsed into one continuous variable of which the natural log has been taken, using the midpoints of the categories (and 1 million euro for the upper category). Experience measures the years of experience as entrepreneur, manager, and employee, respectively. Significance at the 10% level is denoted by \*, 5% by \*\*, and 1% by \*\*\*, with t-statistics reported in parentheses. Standard errors are robust.

**Table 6:** Relationship between Risk -, Loss -, and Ambiguity Aversion and Willingness to Take Risks

Dependent variable:	(1) Willingness to take risks in general	(2) Willingness to take risks in general	(3) Willingness to take risks in general
Risk Aversion	-0.107*** [-7.36]	-0.0880*** [-6.20]	-0.118*** [-5.44]
Loss Aversion	-0.0724*** [-4.71]	-0.0579** [-3.90]	-0.0601** [-2.42]
Ambiguity Aversion	-0.0318*** [-3.03]	-0.0363*** [-3.56]	-0.0503*** [-2.97]
Entrepreneur		1.005*** [12.64]	0.363 [1.39]
Entrepreneur x Risk Aversion			0.0729** [2.40]
Entrepreneurs x Loss Aversion			0.00330 [0.10]
Entrepreneur x Ambiguity Aversion			0.0409* [1.83]
Manager		0.448*** [4.51]	0.386 [1.03]
Manager x Risk Aversion			0.0322 [0.78]
Manager x Loss Aversion			-0.0119 [-0.29]
Manager x Ambiguity Aversion			-0.00983 [-0.34]
Constant	7.453*** [60.33]	6.825*** [51.07]	7.089*** [34.41]
<i>N</i>	2288	2288	2288
Log lik.	-4522.4	-4443.2	-4437.6

All variables have been defined earlier. Significance at the 10% level is denoted by \*, 5% by \*\*, and 1% by \*\*\*.

**Table 7:** Differences in Risk Attitude using Stricter Definitions of Entrepreneurs and Managers

Dependent variable:	(1) Willingness to take risks in general	(2) Risk Aversion	(3) Loss Aversion	(4) Ambiguity Aversion
<i>Panel A: Subsets of Entrepreneurs, all Managers &amp; Employees</i>				
i) Incorporated (N = 446)	0.702 <sup>a,b</sup> [7.84]	-0.442 <sup>a,b</sup> [-3.78]	-0.400 <sup>a,b</sup> [-3.43]	0.0772 [0.65]
ii) Above median no. of employees (N = 401)	0.730 <sup>a,b</sup> [7.41]	-0.282 <sup>a</sup> [-2.59]	-0.270 <sup>a,b</sup> [-2.46]	0.0831 [0.75]
iii) Above median ent. income (N = 377)	0.613 <sup>a,b</sup> [5.63]	-0.404 <sup>a,b</sup> [-3.86]	-0.109 [-1.60]	-0.119 [-0.91]
iv) Founder (N = 757)	0.598 <sup>a,b</sup> [7.71]	-0.218 <sup>a</sup> [-2.81]	-0.280 <sup>a,b</sup> [-3.68]	0.0107 [0.75]
v) In survival phase (firm age $\leq$ 5 years, N= 347)	0.640 <sup>a,b</sup> [6.01]	-0.257 <sup>a</sup> [-2.54]	-0.258 <sup>a,b</sup> [-2.65]	-0.0421 [-0.39]
vi) Not in survival phase (firm age $>$ 5 years, N= 563)	0.611 <sup>a,b</sup> [7.44]	-0.239 <sup>a</sup> [-2.88]	-0.249 <sup>a,b</sup> [-2.98]	-0.00130 [-0.02]
$\beta$ (entrepreneur) in table 5:	0.614 <sup>a,b</sup>	-0.254 <sup>a</sup>	-0.251 <sup>a,b</sup>	0.00279
<i>Panel B: Subsets of Managers, all Entrepreneurs &amp; Employees</i>				
vii) CEO or general manager (N = 324)	0.218 <sup>b,c</sup> [2.53]	-0.274 <sup>c</sup> [-3.27]	-0.0442 <sup>b</sup> [0.52]	-0.00621 [-0.08]
viii) CEO (N = 66)	0.319 <sup>b,c</sup> [2.40]	-0.367 <sup>c</sup> [-2.57]	-0.0203 <sup>b</sup> [0.40]	-0.0866 [-0.55]
ix) Above median no. of dir. reports (N = 219)	0.197 <sup>b,c</sup> [2.31]	-0.259 <sup>c</sup> [-3.04]	-0.0484 [-0.49]	0.0830 [0.79]
x) Above median man. income (N = 155)	0.202 <sup>b,c</sup> [1.97]	-0.370 <sup>c</sup> [-3.22]	-0.00958 <sup>b</sup> [-0.06]	0.00935 [0.07]
xi) Manager in a firm that is $>$ 15 years old (N = 316)	0.195 <sup>b,c</sup> [2.22]	-0.247 <sup>c</sup> [-2.86]	-0.0330 <sup>b</sup> [-0.38]	0.125 [1.35]
$\beta$ (manager) in table 5:	0.194 <sup>b,c</sup>	-0.219 <sup>c</sup>	-0.0101 <sup>b</sup>	0.0715
<i>Panel C: Combinations of A&amp;B</i>				
i) vs. viii); p-values Wald tests	$<$ 0.001	0.57	0.01	0.67
ii) vs. ix); p-values Wald tests	$<$ 0.001	0.59	0.17	0.73
iii) vs. x); p-values Wald tests	$<$ 0.001	0.25	0.04	0.46
Control variables	YES	YES	YES	YES
a) Significant difference between (subset of) entrepreneurs and employees at the 5% level (Wald test)				
b) Significant difference between (subset of) entrepreneurs and (subset of) managers at the 5% level (Wald test)				
c) Significant difference between (subset of) managers and employees at the 5% level (Wald test)				

## APPENDIX

### Appendix A: Example Survey Cover Letter (translated)

Dear relation of ACE,

Since its establishment in 2006, the Amsterdam Center for Entrepreneurship (ACE) has been conducting high-quality research in the field of entrepreneurship. We aim to continue this ambition into the future.

That's why we have initiated a new large-scale study in collaboration with Synpact and VNO-NCW De Baak, which explores differences in decision-making between entrepreneurs, managers and employees. We would greatly appreciate it if you would be willing to participate in our new unique study, which includes making choices that have real financial consequences. While your participation will predominantly be an important contribution to science, the results of this research will also be used to develop training material for entrepreneurs, managers and employees.

Our questionnaire is online and will take no longer than 20 minutes of your time. Depending on your decisions and luck, you can win an amount up to €675 if you are selected as a prize winner. To avoid any conflicts of interest, a civil-law notary will monitor the drawing of the prize winners, and will make sure that the draw obliges with all legal requirements.

We are very enthusiastic about the value of such insights and we strongly believe that the study outcomes can also be beneficial for you. We will therefore offer interested respondents the opportunity to receive a free individual report containing the main results of this study. However, for this report to be really valuable we need the participation of many people. That is, we need you.

We look forward to hearing from you. To participate please click on the link below:

[https://uvafeb.qualtrics.com/SE/?SID=SV\\_2mnigp2XTFh3xXL](https://uvafeb.qualtrics.com/SE/?SID=SV_2mnigp2XTFh3xXL)

Can we kindly request you to finalize the survey before October 16th? Since VNO-NCW De Baak, Synpact and ACE are jointly sending out this survey, it might be that cross-postings will occur. Our sincere apologies for this in advance. We only require your participation once.

**Appendix B1: Cross-Occupational Experience of Entrepreneurs, Managers and Employees**

	Entrepreneur	Manager	Employee
% with Managerial Experience in the past	70.7	-	-
Level of past Managerial Experience (scale: 1-5)	1.72	-	-
% that is also Employee now	9.0	-	-
% that is also Entrepreneur now	-	16.9	10.1
Level of current entrepreneurial experience (scale: 1-8)	-	1.81	1.33
% with entrepreneurial experience in the past	-	12.1	8.9
Level of past entrepreneurial experience (scale: 1-8)	-	2.33	1.71

The 'level of managerial experience' is measured based on a question about the number of directly reporting subordinates when and if entrepreneurs were managers beforehand. The answering categories that we coded 1 to 5, respectively, are 2-5 // 6-10 // 11-25 // 26-50 // More than 50. The 'level of entrepreneurial experience' measure is based on the categorized answers to managers and employees how many fulltime equivalent people they employed when they were entrepreneurs. This question was posed only to those who had been entrepreneurs in the past. Answer categories were: 0 // 1-4 // 5-10 // 11-25 // 26-100 // 101-250 // 251-1,000 // More than 1,000 employees. The first answer (0) corresponds with a value of 1, the second answer (1-4) with a value of 2, and so on.


**Appendix B2: Cross-Occupational Experience and Risk, Loss and Ambiguity Aversion**

Dependent variable:	(1) Risk Aversion	(2) Loss Aversion	(3) Ambiguity Aversion
Entrepreneur	-0.351*** [-4.30]	-0.257*** [-3.27]	0.0621 [0.75]
Entrepreneur x Also employee (YES=1; NO=0)	0.198 [1.64]	-0.165 [-1.25]	0.0205 [0.15]
Entrepreneur x Level of past mgmt experience (=0 if none)	0.0315 [1.24]	0.0355 [1.36]	-0.0525* [-1.80]
Manager	-0.264*** [-3.16]	-0.00826 [-0.10]	-0.0309 [-0.34]
Manager x Also entrepreneur (YES=1; NO=0)	0.0679 [0.47]	-0.0556 [-0.45]	0.0599 [0.42]
Manager x Level of past ent. experience (=0 if none)	0.00435 [0.08]	-0.0169 [-0.37]	0.0740 [1.22]
Employee x Also entrepreneur (YES=1; NO=0)	-0.127 [-1.09]	-0.126 [-1.25]	-0.0921 [-0.81]
Employee x Level of past ent. experience (=0 if none)	0.00542 [0.21]	0.0113 [0.37]	-0.0436 [-1.53]
Control variables	YES	YES	YES
<i>N</i>	1805	1805	1805
Log lik.	-3967.6	-3863.3	-3837.4
Entrepreneur = Manager <sup>1</sup>	0.31	< 0.01***	0.33

1) This reports the p-value of the Wald test 'entrepreneur' = 'manager'.

This table reports risk -, loss -, ambiguity aversion, overoptimism and overplacement of entrepreneurs, managers and employees, including controls for cross-occupational experiences and interactions. All variables have been defined in Appendix Table B or before. Control variables are the same as in Table 5. Significance at the 10% level is denoted by \*, 5% by \*\*, and 1% by \*\*\*, with t-statistics reported in parentheses. Standard errors are robust.

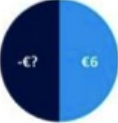
## Figures

	Option A	Option B
		€ ?
<b>Decision 1</b>	€300 with a probability of 50%	€25 for sure
<b>Decision 2</b>	€300 with a probability of 50%	€50 for sure
<b>Decision 3</b>	€300 with a probability of 50%	€75 for sure
<b>Decision 4</b>	€300 with a probability of 50%	€100 for sure
<b>Decision 5</b>	€300 with a probability of 50%	€125 for sure
<b>Decision 6</b>	€300 with a probability of 50%	€150 for sure
<b>Decision 7</b>	€300 with a probability of 50%	€175 for sure
<b>Decision 8</b>	€300 with a probability of 50%	€200 for sure
<b>Decision 9</b>	€300 with a probability of 50%	€225 for sure
<b>Decision 10</b>	€300 with a probability of 50%	€250 for sure

Looking at these 10 decisions, which of the answers below is most applicable to you?



Figure 1: Measure of Risk Aversion

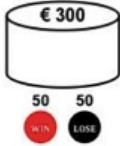
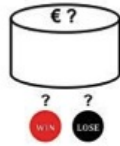
	Option A	Option B
		€ 0
<b>Decision 1</b>	I lose €1 with a probability of 50% I gain €6 with a probability of 50%	I receive €0
<b>Decision 2</b>	I lose €2 with a probability of 50% I gain €6 with a probability of 50%	I receive €0
<b>Decision 3</b>	I lose €3 with a probability of 50% I gain €6 with a probability of 50%	I receive €0
<b>Decision 4</b>	I lose €4 with a probability of 50% I gain €6 with a probability of 50%	I receive €0
<b>Decision 5</b>	I lose €5 with a probability of 50% I gain €6 with a probability of 50%	I receive €0
<b>Decision 6</b>	I lose €6 with a probability of 50% I gain €6 with a probability of 50%	I receive €0
<b>Decision 7</b>	I lose €7 with a probability of 50% I gain €6 with a probability of 50%	I receive €0
<b>Decision 8</b>	I lose €8 with a probability of 50% I gain €6 with a probability of 50%	I receive €0
<b>Decision 9</b>	I lose €9 with a probability of 50% I gain €6 with a probability of 50%	I receive €0
<b>Decision 10</b>	I lose €10 with a probability of 50% I gain €6 with a probability of 50%	I receive €0

Looking at these 10 decisions, which of the answers below is most applicable to you?



Figure 2: Measure of Loss Aversion



	<b>Urn A</b> (100 balls)  Probability of red ball: 50%	<b>Urn B</b> (100 balls)  Probability of red ball: ?%
<b>Decision 1</b>	€300 if it is red	€250 if it is red
<b>Decision 2</b>	€300 if it is red	€275 if it is red
<b>Decision 3</b>	€300 if it is red	€300 if it is red
<b>Decision 4</b>	€300 if it is red	€325 if it is red
<b>Decision 5</b>	€300 if it is red	€350 if it is red
<b>Decision 6</b>	€300 if it is red	€375 if it is red
<b>Decision 7</b>	€300 if it is red	€400 if it is red
<b>Decision 8</b>	€300 if it is red	€425 if it is red
<b>Decision 9</b>	€300 if it is red	€450 if it is red
<b>Decision 10</b>	€300 if it is red	€475 if it is red

Looking at these 10 decisions, which of the answers below is most applicable to you?



**Figure 3:** Measure of Ambiguity Aversion