# Excess entry, ambiguity seeking, and competence: An experimental investigation

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**Abstract**

Excess entry refers to the high failure rate of new entrepreneurial ventures. Economic explanations suggest "hit and run" entrants and risk-seeking behavior. A psychological explanation is that people (entrepreneurs) are overconfident in their abilities (Camerer & Lovallo, 1999). Characterizing entry decisions as ambiguous gambles, we alternatively suggest – following Heath and Tversky (1991) – that people seek ambiguity when the source of uncertainty is related to their competence. Overconfidence, as such, plays no role. This hypothesis is confirmed in an experimental study that also documents the phenomenon of reference group neglect. Finally, we emphasize the utility that people gain from engaging in activities that contribute to a sense of competence. This is an important force in economic activity that deserves more explicit attention.

Keywords: Ambiguity, Competence, Excess entry, Entrepreneurship, Overconfidence

JEL classification: C91, L10

## 1. Introduction

Each year sees the creation of many new businesses across a wide range of industries. In the U.S., for example, Small Business Administration datasets suggest that, in any year, 10%-12% of all firms are new entrants (Dennis, 1997). In Europe, Geroski (1995) documented that up to 100 new firms enter each of the 87 classifications of British manufacturing industries annually and, over five-year periods, the rate of entry averaged between 41% and 52% even in industries characterized by high entry barriers (Malerba & Orsenigo, 1996).[1] Individuals as well as firms create many new enterprises. In 1995, for instance, over 6 million people started a business in the U.S. although, interestingly, of these only 35% were women. In the European Union, the comparable figure is even smaller – 28% (European Commission, 2004). Survival rates of new businesses are, however, low. After five years, about 75% no longer exist (Bernardo & Welch, 1997). Indeed, even successful entrants may take more than a decade to achieve sizes comparable to average incumbents.

Despite large failure rates, entrepreneurs seem to remain confident in their own chances of success. For example, Cooper, Woo, and Dunkelberg (1988) found that 81% of a sample of 2,994 entrepreneurs believed that their chances of success were at least 70%, and one-third believed they were certain to succeed. When asked about others, however, only 39% believed that the chances of *any* business *like theirs* succeeding were 70% or more.

The purpose of this paper is to investigate the phenomenon of so-called "excess entry" and is organized as follows. We first discuss conventional explanations of excess entry that have used both economic and psychological rationales with a special emphasis on the latter. In particular, we challenge the notion that excess entry results from the cognitive bias of overconfidence (Kahneman, Slovic, & Tversky, 1982; Camerer & Lovallo, 1999). Instead, we propose that the entrepreneurial entry decision can be likened to accepting an ambiguous gamble (i.e., where probabilities are unknown, cf. Ellsberg, 1961) and that, following Heath and Tversky's (1991) competence

[1] The rate of entry is defined as the number of new firms divided by the total number of incumbent and entrant firms with activities in that year (Geroski, 1995). The data underlying the stylized facts listed by Geroski are taken from the UK Census of Production and from cross-country comparisons like the study by Cable and Schwalbach (1991).

hypothesis, people are willing to accept ambiguous gambles when they believe that outcomes depend on their own knowledge or skill. We test this – and related – hypotheses in an experiment in which we manipulate both confidence and the relevance of competence and require participants to choose between ambiguous and non-ambiguous gambles. In brief, we find that participants are more ambiguity-seeking when their self-perceived competence is relevant; however, such choices are not affected by whether participants are over- or underconfident. We also find evidence of what Camerer and Lovallo (1999) termed "reference group neglect," i.e., participants use information that only relates to their own level of performance to make inferences about relative performance in a group of peers. Finally, we discuss our results in the context of entrepreneurial entry decisions as well as analogous situations where people make important decisions based on feelings of competence.

## 2. Previous explanations and related literature

Explanations of the excess entry phenomenon have been grounded in both economics and psychology.

The standard economic story is that high profits attract entry and entrants bid away these profits, eventually pushing the industry into a long run equilibrium with no excess returns and a given number of firms. Similarly, whenever profits fall below "normal" levels, exit occurs and this depopulation of the industry raises profitability for the survivors back to equilibrium. From this perspective, failures are "hit and run" entrants that have only a small chance of success in the limited period when the industry exhibit extra profits. Starting a new business therefore makes sense at those moments when potential entrepreneurs receive positive feedback from the market.

Alternatively, starting a business can be framed as facing a gamble where the probability of winning is extremely low but the payoff for success is very large. This explanation enlarges the former perspective by accounting for uncertainty, information, and risk attitudes in determining

entry decisions. This can result in excess entry with respect to a limited and unknown market capacity and consequently individual failures.

These explanations grounded in economics assume full rationality on the part of agents. In contrast, psychological explanations suggest two kinds of "mistakes." One is the phenomenon of "competitive blind spots," that is, agents fail to appreciate how many competitors they will face. The second is overconfidence, a phenomenon that has been documented in many contexts (Einhorn & Hogarth, 1978; Kahneman, Slovic, & Tversky, 1982; Klayman, Soll, Gonzalez-Vallejo, & Barlas, 1999). Agents may forecast competition accurately but fail in evaluating their own chances of success. Specifically, the decision to enter is taken even if negative industry profits are expected because of a belief in succeeding where others will fail.

Camerer and Lovallo (1999) tested the overconfidence hypothesis experimentally in a game designed to mimic entry decisions. Specifically, $N$ participants decide simultaneously to enter a market with a pre-announced capacity of $c$ participants ($N > c$) where payoffs depend on participants' ranks (i.e., of those choosing to enter, the highest-ranked participant receives the largest payoff, the lowest-ranked participant, the smallest payoff). Ranks were established in two ways at the end of the experiment (i.e., after all choices had been made): one at random, and the other on the basis of relative performance on a test (skill). When making entry decisions, however, participants knew how ranks would be established, i.e., according to relative skill or at random. Camerer and Lovallo tested for overconfidence by comparing entry rates between the random and skill conditions and found significant effects – greater entry under the skill condition. They also found greater skill/random differences among participants who had selected themselves into the skill condition, a finding they term "reference group neglect," i.e., if payoffs depend on *relative* performance, participants who self-select into the skill condition (because they believe they are "above average") should realize that other self-selecting participants are also likely to be "above average." Apparently, however, they do not.

Camerer and Lovallo claim that their results are consistent with overconfidence in that, whereas participants had accurate expectations concerning the number of competitors (*c*), the differential entry rates between the skill and random conditions provided evidence of overconfidence in their relative skill.[2] However, we believe there is an alternative explanation that is based on how people react to making choices in the face of ambiguity.

## 3. Ambiguity, task difficulty, and reference group neglect

*Ambiguity*. The effects of ambiguity – or uncertainty about probabilities – on choice was dramatically illustrated by Ellsberg (1961) and has continued to attract scholarly attention since that time (see, e.g., Einhorn & Hogarth, 1986; Hogarth & Kunreuther, 1989; Heath & Tversky, 1991; Camerer & Weber, 1992; Fox & Tversky, 1995; Van Dijk & Zeelenberg, 2003; Wakker, 2004). We take the view here that the entrepreneurial entry decision is inevitably clouded by ambiguity. That is, whereas agents may have some ideas about the probabilities of new businesses failing, we believe it unlikely that they are able to characterize the probabilities relevant to their specific businesses. Agents are confronted with decisions under ambiguity as opposed to risk per se.[3]

In the classic Ellsberg (1961) ambiguity paradigm, a person must choose between two gambles with identical payoffs. However, whereas the probabilities associated with the payoffs are known in one case, they are unknown in the other. Results typically indicate ambiguity aversion, i.e., choice of the gamble with known probabilities. Ambiguity seeking, however, is not unknown and is associated with small probabilities of winning or large probabilities of losing (Einhorn & Hogarth, 1986).

Heath and Tversky (1991) made an important advance in understanding ambiguity by noting how people's reactions varied depending on the source of ambiguous probabilities. Specifically, they showed that if the ambiguous probabilities reflected knowledge (or skill) of the individual,

[2] Camerer and Lovallo also asked their participants to estimate the number of entrants on each round. For most participants, forecasts were unbiased.

[3] In his empirical studies of managerial risk taking, Shapira (1995) notes that, in ambiguous circumstances, managers pay little attention to assessing uncertainty explicitly.

then people tended to make choices that were ambiguity seeking. For example, consider choosing between two gambles where one depends on the outcome of a random device (the non-ambiguous choice) and the other that of football games (the ambiguous choice). The basic finding is that people who consider themselves "expert" in football select the ambiguous choice; those who are not "expert" select the random device. Heath and Tversky referred to this as the competence hypothesis and it is closely related to the phenomenon that people prefer to bet on outcomes of their own physical skills (e.g., throwing darts) rather than equally likely outcomes that are determined by chance (Cohen & Hansel, 1959. See also Langer 1976; Koehler, Gibbs & Hogarth, 1994).

Our view is that whereas Camerer and Lovallo (1999)'s findings may reflect overconfidence, they are also remarkably consistent with Heath and Tversky's (1991) competence hypothesis.[4] This, in turn, raises the issue as to the extent to which overconfidence, ambiguity seeking, or both are the drivers of entry decisions

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Insert Figure 1 about here

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Figure 1 specifies the possible effects of overconfidence and the competence hypothesis. That is, we envisage the four possibilities generated by the effects of two levels of overconfidence (yes and no) and two levels of competence (yes and no). To test which of the four cells applies, there is a need to manipulate experimentally both competence and overconfidence. In the experiment reported below, we test for competence by comparing rates of ambiguity seeking in the presence and absence of competence (our experimental and control groups). We also test the effects of overconfidence by manipulating the level of confidence that people have in their own ability (through administering hard and easy versions of a test). Moreover, by asking people how well they performed on the test, we obtain direct measures of confidence. In short, although Figure 1

[4] The concepts of overconfidence and self-perceived competence are sometimes confused. By overconfidence we mean having more belief in a proposition than is warranted by empirical reality. This is typically assessed in the literature using the concept of calibration (i.e., events with probabilities of x% should occur x% of the time where $0 \leq x \leq 100$. See, e.g., Klayman et a., 1999). Thus, a person could be overconfident in her self-assessed competence if her belief about her level of competence exceeds, say, that of a reference group of peers or the skill level needed to achieve a specific task.

summarizes four hypotheses concerning the effects of overconfidence and the competence effect, we choose to test one in particular (cell 2), namely: ambiguity seeking behavior (e.g., entrepreneurial entry decisions) is fostered by the competence effect and is unrelated to overconfidence. More formally,

*Hypothesis 1*: People make more ambiguous choices when ambiguous probabilities are related to domains in which they feel competent. Overconfidence per se plays no role.

*Task difficulty*. There is empirical evidence showing that entry tends to be more challenging in sectors where advertising intensity, capital intensity and minimum efficient scale are high, while barriers usually fall with industry size and industry growth[5]. Nonetheless, entry rates appear to be quite similar across sectors that exhibit different levels of both structural and behavioral barriers. (Acs & Audretsch, 1989; Highfield & Smiley, 1987). This observation motivates our second hypothesis that the level of ambiguous choices (e.g., entry decisions) is independent of the relative difficulty of the task people face, where degree of difficulty depends on the set of abilities and competences required by the specific task. Specifically,

*Hypothesis 2:* The rate of ambiguous choices is unaffected by whether the tasks people face are relatively easy or difficult.

*Reference group neglect*. If feelings of competence affect ambiguity-seeking behavior, then the assessment of individual skill levels is clearly an important dimension of the entrepreneurial entry decision. This is particularly the case when outcomes depend on relative as opposed to absolute skill levels such as in Camerer and Lovallo's (1999) experiments and, we suspect, in competitive business environments.

There is a considerable literature that suggests that most people consider themselves "above average" on a number of important skills such as driving cars (see, e.g., Svenson, 1980). However, by itself, this literature gives little indication of how people come to reach these assessments. One

[5] Bresnahan and Reiss (1988) examined market size as a determinant of entry, establishing limits to the range of market sizes which are populated by monopolists, duopolists and so on; Hause and Du Reitz (1984) uncovered a positive relation between entry and market growth; Geroski and Murfin (1991) identified a positive correlation between advertising and entry.

clue, offered by Camerer and Lovallo (1999), is that people mistake feedback about their own *absolute* level of performance as being relevant to their performance *relative* to their peers. Why does this occur? One possible explanation could be a sampling or availability bias (Tversky & Kahneman, 1973). For example, consider assessing your driving ability relative to your peers. Clearly you are aware of the "bad" and "good" outcomes of each of your own trips (i.e., with and without incidents). However, in thinking about your peers, you are probably disproportionally influenced by their bad outcomes since you are more likely to hear about these than the good ones. At the same time, there are other situations where we know *cognitively* that the absolute level of performance does not convey information about *relative* performance. As a case in point, consider receiving a mark in a course where you know grades are determined by a pre-determined curve. Despite this knowledge, it is difficult not to feel competent (and thus optimistic) if you receive a high mark and incompetent (and thus pessimistic) if you receive a low mark. We suspect that such feelings are particularly salient in ambiguous situations.

This leads to our third hypothesis,

*Hypothesis 3:* People interpret feedback about their absolute individual level of performance as being relevant to assessing their relative performance in a group (reference group neglect).

## 4. Experimental design

The experimental design involved experimental and control groups who, first, took a test, and then made a series of choices between ambiguous and non-ambiguous gambles. The main difference between the two groups was that participants in the experimental group were told that the ambiguous probabilities depended on how well they had performed in the test relative to their fellow participants. Specifically, each experimental participant's ambiguous probability of success was determined by their percentile in the distribution of test scores.

The experiment was conducted in several phases (see also instructions in the Appendix). First, participants undertook a test in which they were asked to answer 20 general knowledge and

logic questions in a multiple choice format. There were two experimental groups: one had to choose between two possible answers (the "easy" condition); the other had to choose between five possible answers (the "hard" condition). After completing the test, participants were required to estimate the number of questions they had answered correctly. (Their remuneration depended on the number of correctly answered questions.)

Second, participants were given the option of leaving the experiment or to continue in a task that would involve choosing between gambles where they could actually lose money. They were informed that they would face twelve choices in all, and that at the end of the experiment, their remuneration would depend on playing out the consequences of one of their choices selected at random.

Third, the participants remaining in the experiment faced a series of six choices between non-ambiguous and ambiguous gambles where the probabilities of the latter were determined as described above. In addition, participants were informed of this fact. We describe these gambles below.

Fourth, the participants received feedback as to the number of questions they had answered correctly on the test.

Fifth, participants were required to choose again between the same pairs of six gambles, albeit in a different random order.

Sixth, participants faced the consequences of playing out one of their choices that was determined randomly and were remunerated accordingly. Participants in the experimental group completed a post-experimental questionnaire.

Participants were recruited through notices on the campus of Universitat Pompeu Fabra and the experiment was conducted on computers in the experimental economics laboratory in that university using the z-Tree software program (Fischbacher, 1999). Participation in the experimental condition involved four groups of fifteen persons where two groups received the easy test and two the hard test. In the control condition, participation involved six groups varying in size between

five and ten persons. Control group participants did not take the same test as the experimental group and only made choices between the six gambles once. Experimental instructions presented the choice task as an additional optional activity for control participants so that they would not see any connection between the test and the choice task. Otherwise, control and experimental participants were remunerated in exactly the same way (performance on test and consequences of randomly chosen gambles).

*Choice tasks*. Participants were faced with a series of choices between two gambles. One of these gambles (non-ambiguous) provided a 50% chance of winning money and a 50% chance of losing money where the expected value was 1€. The other gamble (ambiguous) also involved sums to be won or lost but the probabilities were not specified. Experimental participants had, of course, been told that their individual probabilities depended on their relative performance on the test; control participants were simply informed that the probabilities were unknown.

Each choice could therefore be characterized by a 50/50 gamble to win or lose (*w: l*) versus an ambiguous gamble to win or lose (*w′: l′*). Thus, for example, the choice between a 50/50 gamble paying (3€:1€) and an ambiguous gamble paying (3€:1€) can be described by the notation "3:1 vs. 3:1" (i.e., 50/50 on the left, ambiguous on the right).

Column headings in Table 1 describe the six choices used to assess participants' preference for ambiguity. As noted above, we maintained the expected value of all six non-ambiguous gambles equal to 1€; however, we varied the amounts involved (from 3:1 to 5:3) and whether outcomes were symmetric or asymmetric, e.g., "3:1 vs. 3:1" or "3:1 vs. 5:3". This strategy of asking participants to make several choices in order to assess their attitudes toward ambiguity was guided by considerations in psychometric theory that demonstrate the reliability of constructs measured by multiple indicators (see, e.g., Ghiselli, Campbell & Zedeck, 1981).

*Participants*. The experimental and control groups were homogenous as to age (means of 20.5 and 20.9 years, respectively, with little variance) with almost as many male as female participants. In terms of type of studies, the groups could be divided into two categories: business

and economics vs. other social sciences and humanities. The experimental and control groups had 65% and 43% in the first category, respectively. On average, experimental (control) participants earned 7.03€ (7.15€) from the experimental sessions.

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Insert Tables 1 and 2 about here
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## 5. Results

Tables 1 and 2 provide an overview of the main results of the experiment. Table 1 shows the proportions of ambiguous choices made by participants of the experimental and control groups for the six different situations distinguishing choices made prior to and after receiving feedback. Overall, the proportions of ambiguous choices made by experimental participants prior to and after feedback were 47% and 45%, respectively. The analogous figure for the controls was 33%. Because the experimental participants faced the same situations twice, we consider that the pre-feedback responses provide the more relevant test. Indeed, the proportions of these ambiguous choices by participants in the experimental group exceed those of the control group for all six decisions and, in three cases, the differences in proportions are statistically significant ($p < .05$) using independent parametric tests for differences in proportions.

As noted earlier, we provided participants with six choices so that we could develop a reliable measure of ambiguity preference. We therefore coded each choice in binary fashion (ambiguous = 1, non-ambiguous = 0) and summed these indicators to create an ambiguity score by participant. By definition, the scores can range from 0 to 6 (the larger the score, the greater ambiguity preference). The mean indicators provide two results: there is no significant difference between the mean pre-and post-feedback indicators of the experimental group (2.89 and 2.79) but there are statistically significant differences between these means and those of the control group (1.94).

Overall, results support the competence hypothesis that people make more ambiguous choices when ambiguous probabilities are related to domains in which they feel competent. This therefore supports the first part of Hypothesis 1. The second part of the hypothesis relates to possible effects of confidence.

To estimate over- or underconfidence, recall that prior to making the first set of six choices, the experimental participants were asked to estimate their scores on the test, i.e., number of correct responses. Thus, the difference between participants' estimates and actual scores can be used to measure over- and underconfidence.[6] Our results indicate that participants in the hard condition were, on average, overconfident, whereas those in the easy condition were, on average underconfident. Moreover, the differences between these means was significant (2.40 vs. -1.81, $t = 4.86$, $p < .001$). On the other hand, there was no difference in the pre-feedback ambiguity scores of the two groups (3.16 and 2.63, $t = 1.05$, $p = .299$. See Table 2). In addition, at an individual level, the correlation between confidence and pre-feedback ambiguity scores was small and insignificant ($r = 0.17$). Thus, we conclude that ambiguity seeking was unrelated to overconfidence and this supports the second part of Hypothesis 1. In short the joint effects of confidence and competence on ambiguity seeking are best represented by cell 2 of Figure 1 (i.e., effects of competence but not of overconfidence).

Table 2 also summarizes the data necessary for testing Hypothesis 2. Specifically, comparing the hard and easy conditions, there are no significant differences between mean scores for the pre-feedback score ($t=1.05$, $p = .299$) nor for the total score ($t = -1.80$, $p = .077$) however the differences between the post-feedback scores is significant ($t = -4.11$, $p < .001$). The first two results support Hypothesis 2, namely that the level of ambiguous choices is unaffected by whether people's prior experiences in the relevant domain have been relatively easy or difficult.

[6] Estimates greater than actual scores indicate overconfidence. Estimates smaller than actual scores indicate underconfidence.

To test the effect of reference group neglect (Hypothesis 3), we need to specify how people should react to individual feedback on their absolute level of performance when future prospects depend on their performance level relative to their peers or competitors. We maintain that feedback on individual level performance provides no information concerning performance relative to a peer group and thus should be ignored in determining future actions. As a common example, consider a student who receives a score on a test when she knows that her grade depends on performance relative to her classmates. By itself, the score provides no information as to the grade.

Operationally, therefore, reference group neglect is demonstrated if participants change their choices in the direction suggested by their individual feedback. As noted above, prior to making the first set of six choices, participants estimated their scores on the test. Moreover, participants in the hard group overestimated their scores whereas those in the easy group underestimated their scores. Thus, reference group neglect is demonstrated if participants in the hard group decrease ambiguity seeking after receiving feedback whereas participants in the easy group increase ambiguity seeking after receiving feedback. As shown in Table 2, this is exactly what happened. In the hard condition, the pre- and post-feedback means were 3.16 and 1.72, respectively ($t = 4.04$, $p < .001$), whereas in the easy condition they were 2.63 and 3.78 ($t = -2.86$, $p = .008$). These results therefore support Hypothesis 3 concerning the presence of reference group neglect.

Parenthetically, in the post-experimental questionnaire participants were asked to assess their skill in answering the general knowledge questionnaire relative to their peers. They were given five options from "much worse than others" to "much better than others" with a mid-point of "similar to others." A large majority of participants (76%) checked this latter category. Participants were also asked to estimate in quantitative terms their relative position in the distribution of scores. Their mean judgment implied an overall probability of success of 0.58 (see also below). Thus, when asked participants acknowledged that their competence was similar to their peers. On the other hand, at the individual level the correlation between individual estimates and actual ambiguous probabilities was small and negative ($- 0.30$, $p < .05$).

It is legitimate to question whether our results might have been biased in some manner. One possible source is self-selection induced by those participants in the experimental group who elected to make the choices as opposed to leaving the experiment. Were there differences between the experimental and control groups on this dimension? Three classes of variables are relevant. One concerns demographic characteristics (age, gender, and type of studies), the second how successful participants had been on the tests, and the third is the possible effect of selection on the actual probabilities that experimental participants faced in the ambiguous choices.

Our data indicated no effects for age (as noted above the groups were quite homogeneous on this dimension) or type of studies. We did, however, find a gender effect in the experimental group. Specifically, the pre-feedback ambiguity scores of men were greater than those of women (3.50 vs. 2.27, $p < .05$), but this did not occur in the control group. Interestingly, it was predominantly women who dropped out of the experiment prior to the choice tasks – all eight participants in the experimental group and nine of 13 in the control group.

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Insert Table 3 about here

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As shown in Table 3, self-selection to the choice tasks in both the experimental and control groups was affected similarly by how well participants had performed in their respective tests. However, precisely because participants with low scores exited the experiment, the mean probability that experimental participants actually faced for ambiguous choices was 0.58 or slightly greater than 0.50. To check the possible effect of this on the competence hypothesis (first part of Hypothesis 1), we eliminated 8 participants with the largest scores on the test such that the mean ambiguous probability for the remaining 44 participants was precisely 0.50. We then checked differences in mean ambiguity scores between these 44 experimental participants and the controls. The difference on the means ambiguity scores between the pre-feedback condition and the controls remained statistically significant (2.77 vs. 1.94, $p = .013$) although this was not true of the

difference between the post-feedback mean and the controls (2.26 vs. 1.94, p = .200). However, as noted above, we consider the pre-feedback mean to be the more relevant comparison.[7]

*Rationality of decisions*. To what extent could participants' decisions be explained by a rational model? More specifically, were participants' decisions congruent with maximizing expected value?

One way of conceptualizing this issue is to ask whether participants chose the ambiguous gambles when their individual probabilities of success were greater than 0.50. This was the case for three (five) of the six pre-feedback (post-feedback) choices ($\chi^2$ tests, $p < .05$). It is an open question as to whether one considers this behavior as conforming or not with expected value.

Table 4 illuminates the issue further by showing the correlations between ambiguity scores (pre-, post-, and total) and three measures of probability of success. These are, first, individuals' actual probabilities of success ("probability") based on relative test scores (that, of course, they did not observe), second, estimated number of correct answers, and third, actual number correct.

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Insert Table 4 about here

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The pattern of correlations indicate little difference between probability and estimated correct for weakly predicting pre-feedback scores. However there is a big impact of number correct on post-feedback choices (this, in turn is highly correlated with actual probability). Above we showed that participants exhibit reference group neglect. However, these correlations show that, after receiving feedback, decisions were more consistent with expected value than before (compare, for instance, the correlations between ambiguity scores before and after receiving feedback).

## 6. Discussion

Our experimental results show, first, that ambiguity seeking is positively related to feelings of competence but unrelated to overconfidence. Second, ambiguity seeking is also unrelated to task

[7] Supporting the notion that there was no connection between ambiguous probabilities and test scores in the control group, the correlation between these variables was - 0.19 (ns).

difficulty. Third, we provide additional evidence of reference group neglect (Camerer & Lovallo, 1999).

Our laboratory experiment was stimulated by the empirical, economic phenomenon of excess entry and thus it is legitimate to ask how well our task simulates the decisions of entrepreneurs. We propose three arguments. First, participants were given the opportunity of withdrawing from the experiment that required choosing between gambles and which could result in their losing money. Thus, although there might have been a "demand effect" to stay in the experiment (most stayed), we made efforts to bias selection toward those who are more entrepreneurial in nature. At one level, the remaining participants could have been thought of as gambling with "house money" (Thaler & Johnson, 1990). However, it was significant that the participants who dropped out scored less well on the tests (i.e., had lower relevant abilities) and were largely female (81%). We have no solid information as to whether people with "lesser" abilities are less likely to become entrepreneurs but, as noted in the introduction, this is the case for women who are generally observed to be more risk averse than men. For example, women tend to hold portfolios with less risk than men (Jianakoplos & Bernasek, 1996; Merrill Lynch, 1996) and to be less confident in male-oriented domains (Beyer & Bowden, 1997). Financial markets are also populated by more men than women (Merrill Lynch, 1996).

Second, we asked our participants to face not one but several choices that contrasted known "50/50" gambles with both ambiguous counterparts and options that varied outcomes. This procedure clearly provides a more effective measure of ambiguity seeking than a single choice. These choices could also be thought of as representing decisions between investments with known outcomes (similar to bonds) and more speculative opportunities (similar to equities).

Third, although our experiment differed in many ways from that of Camerer and Lovallo (1999), we achieved similar results (effects of competence and reference group neglect). One important difference was that we explicitly measured confidence. This produced results consistent with the so-called "hard-easy" effect in the psychological literature on probability assessment

where people have been found to be underconfident for "easy" questions and overconfident for "hard" ones (see, e.g., Juslin, 1994). Once again, the finding in our experiment that ambiguity seeking is unrelated to test difficulty (and thus whether participants were over- or underconfident) emphasizes the imperfect connection between beliefs and actions (see also Table 4) and the importance of feelings of competence.

Parenthetically, economists and psychologists differ in their treatment of overconfidence. By assuming that agents are or are not rational, the former do not assess the source of overconfidence directly. For the latter, people who exhibit overconfidence suffer a dual burden in that, in addition to reaching erroneous conclusions, they lack the meta-cognitive skill necessary to evaluate their own performance.

A major contribution of this paper has been to highlight the importance of self-assessed competence in the decision making process. What therefore – and particularly in ambiguous situations – are the sources of such assessments? As emphasized by our findings, people will use information that becomes available to them even if they interpret this incorrectly and demonstrate reference group neglect. In fact, there are many areas in addition to entrepreneurship where relative performance is much more important than absolute performance. Consider, for example, sports, performing arts, markets for lawyers, CEOs, and academics. And yet, whereas our participants explicitly recognized that their knowledge (skill) was on average similar to their peers (in the post-experimental questionnaire), they failed to use this insight when making their decisions (i.e., they acted as if their own performance was all that mattered).

On the other hand, whereas our participants' interpretation of their feedback was flawed, it could be argued that in many naturally occurring situations the reference group with which performance should be compared is not obvious. Imagine, for example, that you are starting a new consulting business. What is the appropriate reference group for you? All consulting firms? Consulting firms in specific geographical regions? Consulting firms in specific niches? And so on. Clearly, entrepreneurs will achieve more realistic expectations if they calibrate their feedback with

relevant others but, as noted, interpretation could differ depending on which relevant group is selected. We suspect that in many such situations, including career choices, people rarely have accurate information about their potential competitors. Moreover, given high levels of ambiguity, many entry decisions are undoubtedly influenced by emotional considerations (Loewenstein, Weber, Hsee & Welch, 2001; Slovic, Finucane, Peters & MacGregor, 2002).

An intriguing question raised by our study is the relation between ambiguity seeking and overconfidence. At one level, these could be thought to be the same but, as shown here, ambiguity seeking can also be present when people are underconfident provided feelings of competence are involved. One way of interpreting these results is to suggest that people gain utility from taking part in activities in which they feel competent even if they are aware of the true probabilities of success. Indeed, the notion that using and developing one's competences is by itself highly motivating is well-established in psychology (see, e.g., White, 1959). As an example, consider the findings that show that people prefer to gamble on their skill in playing darts as opposed to "equivalent" random events (Cohen & Hansel, 1959). Moreover, people have been observed to bet more in situations where they roll the dice compared to when the same dice are rolled by a third party (Koehler, Gibbs, & Hogarth, 1994). The value of being an active – as opposed to passive – participant is an important element of the human condition, and becoming an entrepreneur is one way of gaining control over one's life. Similarly, many people – even with little talent – choose professions that allow them to demonstrate competence even if they fail to earn well let alone reach prominence (consider, e.g., the arts, academia, or professional sports). Finally, we also suspect that, as a group, entrepreneurs receive additional utility from the thrill of competition and/or experience attraction to chance (Albers, Pope, Selten, & Vogt, 2000).

Our study highlights the important role that self-assessed competence can play in stimulating economic activity. At one level, this is obvious when one considers the important role played by education where the acquisition of even general knowledge leads to the acquisition of specific skills and competences. However, one can also think of mechanisms that spuriously

generate feelings of competence that are subsequently realized through self-fulfilling prophecies (Merton, 1948). Consider, for example, the vast sums of money that firms spend on management education particularly in prestigious institutions. Curiously, few rigorous attempts are ever made to evaluate the economic consequences of such expenditure. However, it is clear that managers feel more competent as a result of attending such programs and, this, by itself, may well more than justify the cost. Similarly, and on a smaller scale, it is well-known fact that providing positive feedback to employees can increase their sense of competence and hence productivity.[8]

In short, feelings of competence are an important driver of entrepreneurial activity. Thus, we believe that an important task for future economic research is to elucidate the mechanisms through which feelings of competence are gained as well as the conditions under which these subsequently become functional or dysfunctional.

[8] See, e.g., work on self-efficacy by Wood and Bandura (1989a; 1989b).

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Table 1 -- Proportions of ambiguous choices

| | Situations | | | | | | | Mean ambiguity scores |
|---|---|---|---|---|---|---|---|---|
| | 3:1 vs. 3:1 | 3:1 vs 4:2 | 3:1 vs 5:3 | 4:2 vs 4:2 | 4:2 vs. 5:3 | 5:3 vs. 5:3 | Means | |
| Experimental group | | | | | | | | |
| Pre-feedback | 0.54 | 0.37** | 0.44 | 0.62** | 0.42 | 0.50** | 0.47 | 2.89^ |
| Post- feedback | 0.52 | 0.42** | 0.56* | 0.42 | 0.42 | 0.44* | 0.45 | 2.79^^ |
| Control group | 0.42 | 0.19 | 0.39 | 0.31 | 0.33 | 0.31 | 0.33 | 1.94 |

Notes:

1. Statistically significant differences in proportions (experimental vs. control group)
   * $p < .10$
   ** $p < .05$

2. Statistically significant differences in means (experimental vs. control group)
   ^ $p = 0.005$
   ^^ $p = 0.014$

Table 2 -- Ambiguity scores for hard and easy groups

| | Mean ambiguity scores | | |
|---|---|---|---|
| | Hard | Easy | Overall means |
| Pre-feedback | 3.16 | 2.63 | 2.89 |
| Post-feedback | 1.72 | 3.78 | 2.79 |
| Total | 4.88 | 6.41 | |

Table 3 -- Performance of participants in tests

Number of questions answered correctly

| | Mean % correct[1] | n |
|---|---|---|
| Experimentals[2] | | |
| Chose to continue | 55 | 52 |
| Chose not to continue | 46 | 8 |
| Controls[2] | | |
| Chose to continue | 39 | 36 |
| Chose not to continue | 27 | 13 |

Notes:
1. To facilitate comparison, numbers of correct answers have been converted to percentages.
2. The differences between choosing and not choosing to continue are statistically significant in both groups.
   For experimentals, $z = 2.106$, $p = .017$.
   For controls, $z = 2.746$, $p = .003$.

Table 4 -- Correlations between ambiguous choices and possible explanatory variables

| Correlations with: | Probability | Estimated correct | Number correct |
|---|---|---|---|
| Ambiguity scores | | | |
| Pre | 0.377** | 0.328* | 0.102 |
| Post | 0.580** | 0.028 | 0.718** |
| Total | 0.604** | 0.210 | 0.534** |

* $p < .05$
** $p < .01$

Figure 1 -- Possible effects of overconfidence and competence

| Competence effect | | Overconfidence: Yes | Overconfidence: No |
|---|---|---|---|
| | Yes | 1.Both effects operate | 2. Only competence effect |
| | No | 3. Only overconfidence | 4. Neither effect operates |

## Appendix – Experimental instructions

(Translated from Spanish)

Thank you for participating in this experiment about decision making behavior that is part of a research project. What you earn will depend on your skill as well as the skill of your peers.

Please follow the instructions carefully. You have the opportunity to gain more than the 3 € that are already assured by your participation in the experiment. As from now until the end of the experiment you are not allowed to talk amongst yourselves. Raise your hand if you have a question and one of the instructors will attend to you. Please, do not ask in a loud voice. Thank you. The rules are the same for all participants.

**Experimental procedure**

The experiment consists of 3 phases.

Phase 1 consists of a set of 20 general knowledge questions. Each question is independent of the others. For each question, you have to decide between A and B.* Your earnings at the end of the experiment depend on the accuracy of your responses. You will earn 0.25 € for each question that you answer correctly.

Phase 2 is optional. You can

- claim all the money that you have earned up to this point (that is, the initial 3 € and what you earned from the questionnaire) and go directly to Phase 3 or
- modify your earnings by way of considering 12 pairs of gambles ( 2 groups of 6 pairs) and for each pair choosing one of two possible options. You have to decide between Option 1 and Option 2 for the 12 pairs of gambles. The gambles give you the chance to gain or lose certain sums of money. Each gamble involves different amounts of euros: you can gain between 3 and 5 euros and lose between 1 and 3 euros. The chances of winning or losing in

* These are the instructions for the "easy" experimental condition. In the "hard" condition, participants had to choose one of five possible answers.

these gambles can be the same for all the participants or depend on your own skill – compared to the skill of your peers – in the questionnaire of Phase 1.

After you have chosen between each pair of gambles, one of the gambles that you have chosen will be selected and you will face the consequences of that gamble. The money depending on the outcome of this gamble will be added to (if you win) or subtracted from (if you lose) your earnings from Phase 1 (that is the initial 3 € plus your earnings from the questionnaire). Thus, when you choose each gamble, remember that it can be the one that is selected and that your final earnings can depend on its outcome!

In Phase 3, we ask you to complete a general questionnaire.

**Phase 1**

This phase consists of 20 multiple-choice questions. For all the questions you have to decide between A and B. (See last footnote.*) Your earnings depend on the correctness of your responses: you will receive 0.25 € for each correct answer. You have a maximum of 45 seconds to give each response: if you indicate no choice between A and B, your answer will be considered wrong.

At the end of this questionnaire, we will ask you to estimate the number of questions you answered correctly.

**Phase 2**

This phase is optional. You can decide between:

(a) keeping all the money you have earned up until now (that is the initial 3€ plus your earnings from the questionnaire) and go directly to Phase 3; or

(b) participate in a game where you can influence your own earnings by way of choosing between two gambles, called Option 1 and Option 2, for 12 pairs of gambles. The gambles give you the possibility of winning between 3 and 5 euros and losing between 1 and 3 euros. Your probability of winning or losing in these gambles can be the same

as the probabilities for your peers (Option 1) or can depend on how well you answered the questionnaire in Phase 1 relative to your peers (Option 2). Your probability of winning will be equal to your percentile. Specifically, if you were at the 90th percentile of the distribution of points, your probability of winning would be 0.90; if you were at the 50th percentile of the distribution of points, your probability of winning would be 0.50 (that is at the middle); if you were at the 30th percentile of the distribution of points, your probability of winning would be 0.30; and so on.

Remember that your percentile indicates the percentage of participants who obtained less points than you!

All the participants have the same opportunity.

If you choose (a), go to Phase 3.

If you choose (b), you have to decide between Option 1 and Option 2 for each pair of gambles. At the end, one of the gambles that you have chosen will be drawn at random and your final earnings will depend on the outcome of that gamble.

**Phase 3**

In the third phase we ask you to complete a general questionnaire. One of the instructors will give it to you.

When you have completed the general questionnaire of Phase 3, we will give you the sum that you have earned in Phases 1 and 2 plus the fixed fee of 3€.

Thank you for your participation!