

Exploring Entrepreneurship with Experimental Economics

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Abstract: Entrepreneurs are frequently modeled as having different traits from non-entrepreneurs which drives differences in who chooses to become an entrepreneur. A large body of non-incentivized survey evidence has explored this assumption empirically, but with limited success. The methodology of experimental economics presents a promising, complementary avenue to help understand this disconnect. This chapter presents an overview of the methodology of experiments in economics and explores how they have been used to examine how entrepreneurs make decisions in both individual and strategic decision-making settings.

Keywords: Entrepreneurship, Economic Experiments, Behavioral Economics, Individual Decisions, Strategic Decisions, Entrepreneur Characteristics

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1. Introduction

Exploring how the individual characteristics of entrepreneurs differ from the general population has been a popular topic dating back to the 18th century when Richard Cantillon first described entrepreneurs as individuals with a higher tolerance for risky decisions ('Essai sur la Nature du Commerce en General,' 1755). Modern-day economists have continued to explore entrepreneurship through formal mathematical models where unique entrepreneurial characteristics remain an important assumption. For example, Khilstrom and Laffont (1979), following the work of Knight (1921), model entrepreneurship as arising from individuals with unique risk and ambiguity tolerances, while Lucas (1978) models entrepreneurs as individuals with higher managerial talent; an approach that has also continued in more recent literature (e.g. Buera et al. 2011; Moll, 2014).

Of course, modeling entrepreneurs as having different individual characteristics is only useful if entrepreneurs are *actually* different – a question which can only be answered using empirical methods. To date, the majority of empirical work examining this question has relied on traditional survey methods, but there is a growing trend to examine entrepreneurial traits using the tools of experimental economics. One reason for the shift is that much of the survey-based research of entrepreneurial traits has not found robust evidence of differences (Shane, 2003), with the exception of risk preferences (Koudstaal et al., 2015).

The natural starting points are experiments designed to measure traits such as risk preferences, time preferences, and ambiguity preferences. This stems in part from the theoretical motivation outlined above, but also because measuring these preferences has been an important component of economics experimental research more generally (Andersen et al., 2008; Charness et al., 2013; Andreoni et al., 2015; Gneezy and Imas, 2017). These types of experiments are categorized within the individual decision-making context since decisions and outcomes are not interdependent with other strategic actors. Examining individual decisions in a controlled laboratory framework allows the experimenter to precisely measure preferences, a critical part of the underpinnings for any economic model of entrepreneurial decision-making.

In addition to individual decision-making settings, experimental investigations of differences in behavior between entrepreneurs and non-entrepreneurs in strategic settings is a fast growing body of research. Strategic settings, where decisions and outcomes depend on the decisions of others, have a long history in economic experiments (see Kagel and Roth, 1995; and Kagel and Roth 2016 for comprehensive reviews). Within the domain of entrepreneurship, experiments have been used to measure a number of traits that play important roles in strategic settings such as trust, cooperation, and competitive preferences.

In either context, the experimental approach is ideal to examine decision making because it allows for more control over the environment where decisions are made. Naturally occurring field data is not as clean, nor as easily observable. For example, an entrepreneur choosing whether to engage in a risky decision in the field is subject to a variety of influential external factors. They may have a spouse that has input over whether they should quit their job and pursue a start-up, or an existing entrepreneur may have a partner with whom they jointly

make decisions. A properly designed experiment removes these potentially confounding elements. Experiments can also mimic a field setting of interest while allowing researchers to gather data that would typically be unobservable in the field. For example, suppose a researcher is interested in how entrepreneurs build their founding teams. While one would be able to observe members chosen by an entrepreneur in field data, it may be substantially more difficult to gather data on those *not* selected. It is optimal to understand all sides of decision-making, and experimental settings – while simplified – can help overcome this limitation of the field.

Since using the methodology of experimental economics to examine entrepreneurial decision-making is relatively new, Section 2 offers a methodological discussion about economics experiments, including a discussion on what differentiates experiments in economics from other fields.¹ While this is a general discussion, it highlights important aspects of the methodology for the reader who is less familiar. We conclude the methodological section with a return to entrepreneurship, exploring issues commonly faced when running experiments in entrepreneurship. In section 3 we discuss some key results that experimental economics has contributed to the entrepreneurship literature. This is divided into two categories: individual decisions and strategic decisions. The majority of work in the area of individual decision-making has focused on risk preferences and the results for differences between entrepreneurs and non-entrepreneurs are mixed. Within the strategic decision-making branch of the literature, the results provide more evidence for differences between entrepreneurs and non-entrepreneurs. A relatively large number of papers have examined competitive preferences, which mostly point towards the result that entrepreneurs are more competitive. In section 4, the chapter concludes with a summary discussion and avenues for future research.

2. What is an economics experiment?

Economics experiments involve individuals making decisions with real implications (rather than hypothetical) in an economic setting where the researcher controls and systematically varies key elements of the environment. Economics experiments can be used to test theoretical models, to identify empirical regularities that can inform new models, or to design economic institutions. A traditional laboratory economics experiment begins with recruiting participants, typically undergraduate students, to a designated space such as a computer lab. Participants are not informed of the purpose of the experiment to avoid selection effects and they are given a small payment for showing up. Participants receive instructions for the experimental decisions that they will make and are provided with an opportunity to ask questions. The precise decisions depend on the environment of interest. For example, an experiment designed to measure risk preferences may ask participants to choose their most preferred lottery from a series of lotteries, which would then be played out for real monetary rewards. Or, an auction experiment would involve participants receiving an initial

¹ Economics experiments to examine issues in entrepreneurship are new, but economics experiments are not. Roth (1993) provides an early history of economics experiments, dating many incentivized experiments to the early 1950s (e.g. Rousseas and Hart, 1951; Mosteller and Noguee, 1951; Flood, 1954)

endowment of money, which they would use to bid in an auction against other participants in the experiment. At the end of an experiment, participants are paid the show-up fee in addition to the payoffs resulting from their decisions.

More recently, laboratory experiments have shifted away from the traditional brick and mortar laboratory towards an online setting. Part of the reason for that shift is to access non-student populations, an important factor in designing experiments to study entrepreneurial populations. The main downside of moving from a traditional laboratory to the online setting is a loss of control over the environment; in particular, the lack of ability to control outside options (i.e. working on something other than the experiment). In our opinion, increased access to populations of interest justifies this loss of control.

It is worth noting that there also exists a large and growing literature on field experiments. Of particular interest are “natural” field experiments (Harrison and List, 2004), where researchers manipulate an element of a naturally occurring environment while keeping study participants unaware that they are involved in a research project.² Field experiments are an important part of experimental economics, but lie beyond the scope of this chapter.

2.1. Do incentives matter?

Economics is not unique in its use of experiments to study behavior, but a set of research norms have developed that make the economics approach distinctive.³ One hallmark of a modern-day economics experiment is the use of monetary incentives, which are directly aligned with the choices being made rather than a fixed payment for participation in the experiment.⁴

Why do incentives matter? The debate revolves around how to generate sincere responses. Economists argue that incentives are necessary because economic theories are based on how people respond to incentivized environments (Croson, 2005). Differences in surveyed responses under incentives and no incentives were demonstrated by Prior et al. (2005) and Bullock et al. (2015) who found that even small incentives, like one USD for a correct answer, generated differences in responses on politically motivated, but fact-based questions. In other words, individuals answered more truthfully (sincerely) when incentivized. The key take-away is that the lack of incentives creates an environment where the researcher loses some control over what motivates behavior. Of course, it is possible that people will respond

² An example of this type of experiment in the entrepreneurship literature would be Project GATE, which was a large scale field experiment conducted in the United States by the U.S. Small Business Administration (SBA), designed to examine the effects of business training on entrepreneurial outcomes. Participants signed up for free business training through the program, but were informed that the program had limited space and participation would be determined by a lottery. This framing was intended to keep the environment as naturalistic as possible (limited space by constraints in program size, not because of experimental design), so that participants were not directly aware that they were randomized to an experimental treatment (Fairlie et al., 2015).

³ Croson (2005) provides a comprehensive comparison of economics experiments versus psychology experiments, as well as a comparison to management research.

⁴ Economics experiments also differ from other fields in that they typically do not use extra credit for participation with student participants, as this could lead to a number of issues with distorted incentives (e.g. poorly performing students value the experience more highly than others who are performing well). Economists also strongly discourage the use of any deception in experiments (Cooper, 2014).

sincerely to non-incentivized questions in other contexts (Dohmen et al., 2011), but placing external incentives ensures that the motivating incentives are aligned with what the researcher is trying to examine.

Turning to the literature on entrepreneurship, given that the bulk of research has used non-incentivized surveys, it is important to examine how incentives may influence results. In decision-making under risk, there is a relative consensus in the surveyed literature that entrepreneurs classify themselves as more risk taking than the general population (see e.g. Van Praag and Cramer, 2001; Ahn, 2010; Caliendo et al., 2014). However, when this has been examined under incentivized experimental frameworks, little support is found for differences in risk tolerance. These results do not necessarily invalidate the survey results, but it is important to continue to work to understand why entrepreneurs perceive themselves (as evidenced by the surveys) as more risk tolerant than they actually are when placed into an incentivized environment. We explore these results in more depth in section 3.1.

2.2. Experiments with entrepreneurs

A difficulty faced in experiments studying entrepreneurship is gaining access to entrepreneurs as participants. Some have attempted to circumvent this issue by testing student populations with an interest in entrepreneurship (Barbosa et al., 2018; Jiang and Capra, 2018), but depending on the question, student populations may not be the most appropriate population to examine. For example, if one seeks to test for trait differences between entrepreneurs and non-entrepreneurs using students as the non-entrepreneur comparison group, a misclassification may arise as the student population likely includes individuals who eventually will select into entrepreneurship as a career path. Even if this issue is accounted for by asking future entrepreneurial intentions from the students, it is also possible that students have not developed a clear understanding of their own career preferences. Moreover, differences may develop over time with exposure to entrepreneurship rather than being an inherent trait. Cooper and Saral (2013) demonstrated that entrepreneurs had a strong preference for working alone rather than in teams, but this preference was only significantly different from the comparison population for long-term entrepreneurs. This points to the value of longitudinal studies that can separate out differences that cause selection into entrepreneurship versus differences caused by exposure to entrepreneurship, but such studies are notoriously difficult to conduct given typical attrition rates. Barbosa et al. (2018) approached this issue by using a subset of students and entrepreneurs enrolled in an entrepreneurship program at a prominent business school in France. The comparison group was comprised of students who were also enrolled in the business school. They tracked the participants after a period of two years to see who stayed/became an entrepreneur and even within this short period there was substantial change in status. The majority of those who chose to become entrepreneurs demonstrated an initial interest in entrepreneurship, but there was also a group of entrepreneurs that emerged from the “initially not interested” group.

In the next section, we discuss the results of the experimental literature on entrepreneurship. Our focus is on laboratory experiments and artefactual experiments (or lab-in-field

experiments) that are traditional laboratory experiments run on a nonstandard (non-student) subject pool (Harrison and List, 2004). We focus on results related to high growth entrepreneurship rather than necessity entrepreneurship.⁵

3. Experimental results in entrepreneurship

The experimental literature studying entrepreneurship can be divided into two main categories. The first focuses on measuring the characteristics of the entrepreneur using established methods in individual decision-making tasks (e.g. risk aversion, time preferences, ambiguity aversion). The second group focuses on decision-making in strategic settings, where individuals make decisions in an interdependent environment and the combinations of these decisions will affect everyone's eventual outcome (e.g. the prisoner's dilemma game).

3.1. Individual decision-making

Individual decision-making experiments are aimed at using the observed decisions in an incentivized environment to reveal underlying preferences. For entrepreneurship, the most frequently studied preference is risk tolerance.

How entrepreneurs make decisions under uncertainty is one of the fundamental characteristics assumed to differ between entrepreneurs and non-entrepreneurs and a number of incentivized experimental protocols have been developed to measure these preferences. One of the more commonly chosen environments in the study of entrepreneurial decision-making is the multiple price list (MPL). In this format, participants are presented with a list of pairs of gambles. They make choices for all pairs on the list, and then typically one is randomly selected for payment.

An example of the MPL used by Holt and Laury (2002) is shown in Table 1. In each decision, the individual chooses between option A which has a low variance of payoffs and option B which has a higher variance of payoffs. The possible outcomes are held constant across all pairs, but the probabilities are varied. The switch point between Option A and B indicates the degree of risk aversion (i.e. switching after the 5th decision in Table 1 indicates risk aversion).

The experimental evidence on higher risk tolerance for entrepreneurs is mixed. Andersen et al. (2014) used the MPL approach in an artefactual experiment conducted on Danish entrepreneurs recruited at an entrepreneurship trade fair. They found no significant difference in the risk profiles of those who claim self-employed status and a similar comparison group drawn from the general Danish population.

Using a similar approach, but studying a different population, Jiang and Capra (2018) also found no significant differences between those that were categorized as "active" entrepreneurs and the comparison group of non-entrepreneurs. In both of these studies, however, it is important to examine the comparison group. Andersen et al. (2014) recruited the comparison group from the same trade fair as the entrepreneurs, so while they did not

⁵ Field experiments and lab-in-the-field experiments are frequently employed to study issues related to necessity entrepreneurship in a developmental context, see e.g. Berge et al (2015) and Aflagah et al (2022).

classify themselves as entrepreneurs it is possible that they may have had an interest given their choice to attend the fair; and in Jiang and Capra (2018) the comparison group was recruited from entrepreneurship classes. In both of these studies it is possible that the comparison groups were not dissimilar enough on entrepreneurial dimensions to draw strong conclusions on true differences between entrepreneurs and non-entrepreneurs.

Table 1 MPL Risk Aversion Measure (Holt and Laury, 2002, p. 1645)

| Option A | Option B | Expected payoff difference |
|---------------------------------|--------------------------------|----------------------------|
| 1/10 of \$2.00, 9/10 of \$1.60 | 1/10 of \$3.85, 9/10 of \$0.10 | \$1.17 |
| 2/10 of \$2.00, 8/10 of \$1.60 | 1/10 of \$3.85, 9/10 of \$0.10 | \$0.83 |
| 3/10 of \$2.00, 7/10 of \$1.60 | 1/10 of \$3.85, 9/10 of \$0.10 | \$0.50 |
| 4/10 of \$2.00, 6/10 of \$1.60 | 1/10 of \$3.85, 9/10 of \$0.10 | \$0.16 |
| 5/10 of \$2.00, 5/10 of \$1.60 | 1/10 of \$3.85, 9/10 of \$0.10 | -\$0.18 |
| 6/10 of \$2.00, 4/10 of \$1.60 | 1/10 of \$3.85, 9/10 of \$0.10 | -\$0.51 |
| 7/10 of \$2.00, 3/10 of \$1.60 | 1/10 of \$3.85, 9/10 of \$0.10 | -\$0.85 |
| 8/10 of \$2.00, 2/10 of \$1.60 | 1/10 of \$3.85, 9/10 of \$0.10 | -\$1.18 |
| 9/10 of \$2.00, 1/10 of \$1.60 | 1/10 of \$3.85, 9/10 of \$0.10 | -\$1.52 |
| 10/10 of \$2.00, 0/10 of \$1.60 | 1/10 of \$3.85, 9/10 of \$0.10 | -\$1.85 |

Sandri et al. (2010) also examined the decisions of entrepreneurs compared to a student comparison group and found no differences in risk aversion, using the MPL method. The incentives were increased for the entrepreneur sample and there is evidence that decisions under low monetary gains may not precisely predict decisions under higher monetary gains (Holt and Laury, 2002; Harrison et al., 2005). If higher stakes resulted in a higher measured level of risk aversion, this may have muted any potential observed differences under the same payment scheme.

The last study that we want to highlight, which also found a null result when testing for different risk attitudes, is a large-scale artefactual field experiment in China by Holm et al. (2013). They again used the MPL approach to measure risk preferences. A notable feature of this design is the large sample of 700 entrepreneurs from relatively successful businesses. Comparing the risk profiles of this population against the control group, matched on gender and age, they found no significant differences in risk tolerance.

In contrast to the above results, three studies found evidence that entrepreneurs were more risk taking. Elston et al. (2005) compared risky decisions between entrepreneurs and non-entrepreneurs in a MPL format. They differentiated between full-time entrepreneurs and those reporting as part-time entrepreneurs. Full-time entrepreneurs were more risk tolerant than non-entrepreneurs, but the same did not hold for part-time entrepreneurs, where no differences were found. Masclet et al. (2009) compared a population of entrepreneurs to university students and salaried employees and found that the entrepreneurs were more willing to take risks than both of the comparison groups. Finally, Koudstaal et al. (2015) also found that their large sample of entrepreneurs (approximately 900) were less risk averse compared to salaried employees, but when that sample was compared against a more comparable group of managers, no differences emerged.

In sum, the experimental evidence is mixed. This partially contradicts much of the non-incentivized survey evidence that has found that stated preferences often differ between entrepreneurs and others. As a starting point to help understand these differences, Koudstaal et al. (2015) also gathered non-incentivized survey data on risk preferences. In line with previous non-incentivized surveyed results, entrepreneurs self-reported as more risk seeking than the non-entrepreneurs, standing in contrast to the incentivized results the authors found. In an exploratory analysis, they found that loss aversion, where individuals overweight the experience of a loss over the comparative gain, is predictive of the surveyed results. They conjecture that the problem may be in the interpretation of the questions by the respondents. In the surveyed measures, even though respondents were asked about risk aversion, they were likely framing the question more broadly than the survey intended, including behavioral measures such as loss aversion in their self-report.

In addition to risk aversion, other important individual characteristics may differ between entrepreneurs and the general population. Within uncertain environments, entrepreneurs may have less aversion to losses and ambiguity. As mentioned above, loss aversion models an individual who puts more weight on losses than gains relative to some reference point (Kahneman and Tversky, 1979). Ambiguity arises when the probabilities of outcomes are unknown and entrepreneurs are hypothesized to have a higher tolerance for ambiguity (Knight, 1921). Koudstaal et al. (2015) looked at loss aversion and ambiguity aversion using a sample of over 2000 participants from the Netherlands, with entrepreneurs and a comparison sample of both managers and employees. Because of the large sample, they were able to refine the type of entrepreneur into different classes – incorporated entrepreneurs versus others that classified themselves as having only ownership in a company. Both loss aversion and ambiguity aversion were measured using an MPL format. The key difference in the loss aversion task is that some of the gambles were changed to negative payoffs. To measure ambiguity aversion, it was necessary to induce uncertainty in the probabilities of outcomes. The task chosen by Koudstaal et al. to measure ambiguity aversion was a two urn decision task. In one urn, the distribution of the color of the balls was known and in the second urn the distribution of colors remained hidden. Payoffs depended on the urn selected and the color of the ball drawn; the MPL varied the payoff in the urn with the unknown

distribution.⁶ Individuals with higher levels of ambiguity aversion should switch from the known distribution urn to the unknown distribution urn later in the MPL. Koudstaal et al. (2015) found that entrepreneurs were significantly less loss averse than managers and employees, but ambiguity aversion was not found to differ significantly between these groups.

Holm et al. (2013) also investigated ambiguity in the MPL format where the first option was always a sure payoff and the second option was a lottery with unknown probabilities. They found no differences in tolerance to ambiguity.

Elston et al. (2005) examined entrepreneurial decision making under uncertainty in a bidding task developed by Holt and Sherman (1994). This task provides a measure of joy of winning, defined as an individual obtaining a higher level of utility simply by winning that is above any payoff from winning. They were also able to measure if entrepreneurs were more likely to suffer from judgmental errors in statistical reasoning, which may be likely to arise if entrepreneurs tend to have more optimistic views. While bidding in an auction is typically considered a strategic decision, in this version participants were not bidding against another bidder, rather they were bidding against a random mechanism determined by a card draw. Full-time entrepreneurs were found to exhibit joy of winning in the bidding game relative to part time entrepreneurs and non-entrepreneurs, but did not suffer systematically from judgment errors.

Moving away from uncertain environments, time preferences have been identified as an important characteristic that may likely differ for entrepreneurs relative to the general population. This hypothesis is based on empirical regularities of entrepreneurship, such as the waiting time associated with any profitability emerging from a start-up and low initial earnings (Evans and Leighton, 1989). Andersen et al. (2014) measured time preferences for their Danish entrepreneurial population at the same time that they measured risk preferences. They found that entrepreneurs are significantly more patient than a comparison group of non-entrepreneurs. The approach used to measure time preferences is similar to that of risk in that participants are given a list of two different payment options that they must choose between. The first option is always a faster payment (e.g. immediately, or in one month) while the second option is a longer wait (> 1 month), but higher payoff. At some point, the participants should shift from the faster payoff to a delayed payoff because the payoff for waiting has increased to such a degree that it is worth it for the individual to switch. This methodology is used to elicit discount rates. Andersen et al. (2014) found that entrepreneurs are more patient than their comparison group of non-entrepreneurs. Jiang and Capra (2018) also examined time preferences, but found no differences between entrepreneurs and the comparison group

⁶ Specifically, the participants were presented with Urn A which had 50 red and 50 black balls and Urn B which showed “?” red and “?” black balls. The first decision paid 300 Euros if the participant chose Urn A and a randomly selected ball from this urn was red. If the participant instead chose Urn B and the selected ball was red, the participant would earn 250 Euros. The remaining 9 decisions held the Urn A payoff constant and increased the red ball payoff for Urn B by 25 Euros in each subsequent decision. The last decision payoff reached the maximum of 475 for a red draw from Urn B. Koudstaal et al. directly asked for the switch point in the MPL rather than asking participants to make a series of decisions.

of non-entrepreneurs. A key difference in these two papers is that Andersen et al. used risk preferences to estimate time preferences while Jiang et al. did not. Previous work by Andersen et al. (2008) showed that estimating time preferences without also controlling for risk preferences produced biased results.

Sandri et al. (2010) focused on optimal stopping decisions. While the experiment was not designed to explicitly measure time preferences, the issues are somewhat related. They examined disinvestment choices to help understand why start-up founders often stay in projects too long. Their sample included high-tech entrepreneurs and a comparison sample of students as well as some non-entrepreneur/non-students. Participants made decisions about whether or not to continue a project with uncertain returns or to abandon the project for a known outside option payoff. Both groups exhibited a bias towards exiting later than was optimal, but significant differences in stopping decisions and risk preferences were not found between groups. However, the entrepreneur payoffs were scaled up which may have influenced choice behavior and consequently mitigated differences.

3.2. Strategic decision-making

One of the main benefits of running an economics experiment to study entrepreneurship is the ability to observe strategic decision making in a controlled setting that would otherwise be difficult to observe in the field. Arguably, a strength in strategic decision-making is of utmost importance to anyone venturing into entrepreneurship.

For economists, strategic decisions necessarily imply that the decisions and outcomes are interdependent with other actors. In the entrepreneurial context, this implies that what the entrepreneur chooses to do will influence not only his own outcomes, but also the outcomes of others and vice versa. As a result, this path of the literature relies heavily on game theoretic analysis to lay the theoretical foundations for behavior and draws on an extensive history of testing these types of models in laboratory settings (Kagel and Roth, 1995; Kagel and Roth, 2016)

The most frequently studied strategic environments measure preferences for competition. The two main approaches to study competitive preferences are the market entry game of Camerer and Lovo (1999) and the tournament choice game of Niederle and Vesterlund (2007). These experimental designs are summarized below in the context of the papers that have used them.

One of the first papers to use economic experiments to study entrepreneurial behavior in a strategic setting was Elston et al. (2005). Their focus was on competition as well as overconfidence. Using a population of entrepreneurs recruited from two entrepreneurship conventions in the US, they examined decisions in the market entry game developed by Camerer and Lovo (1999). In this game, all players were given an initial monetary stake and then given the choice to enter into a competitive market with other players who were also given the same entry choice. If they chose to enter the market, the initial stake was given up, otherwise the stake was kept and they did not participate in the market. Payment in this market was competitive and based on performance on a task (answering general trivia

questions). In addition to measuring a preference for competition through the entry choice, incentivized questionnaires also allowed the researchers measure overconfidence as participants were asked to predict the number of entrants and to guess one's relative rank in performance on the task.

Elston et al. found that full-time entrepreneurs did not demonstrate overconfidence about their performance on the task nor did they exhibit excessive entry compared to the non-entrepreneurs. However, this study used general trivia as the task. If overconfidence is domain specific, perhaps entrepreneurs are overconfident about their ability to successfully run a business *in their particular industry of expertise*. This type of experiment would not capture domain specific overconfidence. What these results do suggest is that general overconfidence, across domains, was not likely for this sample of entrepreneurs. Moreover, the participants were recruited at a conference for entrepreneurship, so it is also plausible that some of the participants who labeled themselves as non-entrepreneurs may have still exhibited some interest in entrepreneurship and hence the characteristics of an entrepreneur.

In contrast to Elston et al. (2005), a number of papers have identified differences in competitive preferences. Barbosa et al. (2018) found significant differences for entrepreneurs in a competitive game setting based on Niederle and Vesterlund (2007). Participants were asked to solve a series of summation problems where they would add five two-digit numbers in timed stages. In the first stage, all participants were paid a piece rate for correct answers. In the second stage, they were asked to complete the same task, but in this case they would be entered into a tournament with three other participants and only the winner would make a positive payoff. In the final stage, participants were given a choice of playing under a piece rate or in a tournament against the stage two performance of three other people. This matching design element is key to eliminate selection effects. They found that current entrepreneurs are significantly more willing to compete, as are individuals with intentions to become entrepreneurs in the future when compared to the non-entrepreneur baseline group.

Holm et al. (2013) tested for differences in competitive preferences using a combination of the MPL approach with the pay scheme choice of Niederle and Vesterlund (2007). In a series of decisions, participants could choose between a certain payoff and entering into a competition with another participant. In both cases, the task for payment required answering quiz questions correctly. In one treatment, they competed against one other player, and in another they competed against three other participants. Entrepreneurs were more willing to compete, with the strongest differences between entrepreneurs and non-entrepreneurs emerging with a higher number of competitors.

Urbig et al. (2020) recruited participants in a shopping mall in Germany to choose between competitive or piece rate schemes on two different types of tasks. In one case, the task was rolling a die (random, no skill) and in the other, it was a skilled-based math task. Both the entrepreneurs and "potential" entrepreneurs were more likely to choose competitive payment schemes across both tasks, with higher levels of entry observed in the random task than the skill-based task.

Balafoutas et al. (2021) conducted a lab-in-the-field experiment in Vietnam and found that entrepreneurs only exhibited preferences for competition when choices were revealed publically. When choices were kept private, entrepreneurs exhibited a lower willingness to compete than salaried workers. They explain this difference by a motivation to maintain reputations as an entrepreneur. Interestingly, tracking the performance of the entrepreneurs in a six-month follow-up, they found evidence that entrepreneurs that are more competitive had self-reported higher profits. It is also worthwhile to note that this study may be more linked to necessity entrepreneurship, so there may be differences in the competitive nature of these types of entrepreneurs, but evidence from Berge et al. (2015) suggests that even in the necessity entrepreneurship setting, differences in competitive preferences occur.

Moving away from competitive preferences, a number of studies have placed entrepreneurs into a variety of strategic games designed to measure social preferences, including trust games and games developed to measure cooperativeness (e.g. public goods, battle of the sexes).

Holm et al. (2013) measured trust using an MPL format where the first option was always a trust game between a trustor and a trustee and the second option was a random lottery over the same payoffs. If the trustor selected the trust game option, the trustee was allowed to choose between two payoff schemes; the first payment scheme gave the trustor 15 CNY and the trustee 55 CNY, while the second payment scheme gave the trustor 580 and 50 for the trustee. If the second lottery option was chosen instead of the trust game, a lottery over the same payoff schemes from the trust game determined the final payoffs. The MPL decreased the probability from a 100% chance of the second payoff scheme in the first decision down to 10% in the final decision. There is a large potential gain for the trustor – *if the trustee is trustworthy*. If the trustee is purely self-interested they would choose the higher payoff for themselves at a large cost to the trustor. Holm et al. observed strong differences in the trust game, with entrepreneurs exhibiting more trust as they were more willing to accept the other individual making the decision over payoffs.

Barbosa et al. (2018) placed their subject pool into a number of well-known strategic environments including the sender/receiver game to measure trust (Dickinson, Masclet, and Villeval, 2015), the 11-20 game to measure strategic sophistication (Arad and Rubinstein, 2012), and a public goods game to measure cooperation (Fischbacher, Gächter, and Fehr, 2001). None of these games resulted in significant differences between their entrepreneurial types (current and future entrepreneurs, and non-entrepreneurs) at the time of measurement. The original participants were also contacted two years after the initial laboratory experiments to track how their entrepreneurial status changed and to determine if any of the measured characteristics influenced this change. They found that contributions in the public goods game were positively associated with a higher level of entrepreneurial activity.

Cooper and Saral (2013) conducted an experiment with entrepreneurs and non-entrepreneurs in a public goods environment designed to model team production. In their game, players worked either for a team or for themselves. Working for a team generates a higher return per unit of output but these returns are split via a revenue sharing scheme. In the initial phases of

the experiment, individuals were exogenously assigned to individual production followed by team production. The theoretical prediction is zero contributions to the team (free-riding), but the social optimum is for everyone to contribute to the group. Participants were then asked whether they would like to play as an individual or in a team. Specifically, they bid for their preferred style of play. Long-term entrepreneurs bid significantly more to not play in teams, yet they were no worse as teammates in terms of contributions to the team. These results suggest a preference for autonomy, but not one that is based on differing cooperative behavior within teams.

Continuing on the theme of cooperativeness, Holm et al. (2019) studied strategic interaction with CEOs of firms in China in three different two-player games: prisoner's dilemma, chicken, and battle of the sexes. The prisoner's dilemma game presents an interesting tension where an individual must choose between making a decision for the social optimum versus making a decision more aligned with the non-cooperative Nash equilibrium prediction. The chicken game presents a decision-making situation where the player needs to choose whether to yield to the other player in what is considered an "anti-coordination" game. Players who yield have lower payoffs, but choosing not to yield when the other player also chooses not to yield leads to exceptionally low payoffs for all. It could be considered a game of dominance, but if played against someone who is also "hawkish" it can lead to a very bad outcome. The battle of the sexes game is also a coordination game. Agreeing on a decision with the other player leads to the best payoff, but a tension arises as each of the two possible coordination points is preferred by different players. Holm et al. found that the entrepreneurs' behavior significantly differed from the comparison group of non-entrepreneurs. They played more cooperatively in the prisoner's dilemma, and less aggressively in both the chicken and battle of the sexes games.

The above evidence highlights that entrepreneurs often make different strategic decisions than non-entrepreneurs in incentivized environments. The majority of evidence points to competitive preferences as differing, which aligns with the idea that choosing to be an entrepreneur and establishing a new business is a highly competitive endeavor. Turning to social preferences, a priori it is not as clear how the social preferences of entrepreneurs should differ from those of the general population. Do entrepreneurs have stronger social preferences because they create employment opportunities and economic growth, or are they more interested in the personal profit motive without regard to others and in fact may exhibit anti-social activities (Baumol, 1990)? The evidence, while limited, appears to suggest that entrepreneurs have social preferences that are similar to other non-entrepreneurs although possibly more pro-social.

4. Conclusion

The belief that the entrepreneur has unique characteristics that set them aside from the general working population has fueled a large body of both theoretical and empirical research. A growing trend on the empirical side has been the use of the experimental economics methodology to test for differences. This literature has two main branches. The first examines individual decision-making where studies have primarily tested for differences

between non-entrepreneurs and entrepreneurs in risk taking. The resulting evidence is mixed. Some studies find evidence in favor of the entrepreneur taking more risks and others find no differences. In addition to risk, other preferences such as ambiguity aversion, loss aversion, and time preferences have been examined, although to a lesser extent than risk preferences. Time preferences appear to be the most likely of the characteristics to differ for entrepreneurs, but additional studies are needed to draw strong conclusions. Unfortunately, measuring time preferences in an incentivized manner requires the ability to track and pay participants over time, a task that is already difficult without the added constraint that a subset of the sample must be entrepreneurs. Nevertheless, it is likely an important and interesting path for future research on individual decision-making in the experimental entrepreneurship literature.

The second branch of experimental economics research related to entrepreneurship examines strategic decision-making. The majority of studies have focused on competitive preferences. In contrast to the individual decision-making environments where evidence of differences between entrepreneurs and non-entrepreneurs is mostly mixed, there is good evidence in favor of entrepreneurs having different, specifically more competitive preferences in strategic decision-making environments. The literature has also examined a number of other traits in strategic environments such as trust, cooperativeness, and strategic sophistication. Perhaps the most surprising finding is the emerging evidence that entrepreneurs may have more pro-social preferences than others. Holm et al. (2019) found that entrepreneurs were more socially minded in strategic games than would have otherwise been predicted, and Barbosa et al. (2018) found evidence that individuals who were more cooperative were more likely to become more entrepreneurial in the future. The evidence is limited but social preferences appear to be an area of growing importance for future research.

Examining the behavior of entrepreneurs using the methodology of economics experiments is a relatively new approach and so the number of studies is limited. More studies (data) are needed to firmly establish differences between entrepreneurs and non-entrepreneurs. The path of least resistance would be replication studies in those areas that appear potentially fruitful, such as individual time preferences or competitive preferences in strategic settings. While the lack of novelty of a replication study has been a past hindrance in the social sciences, more recently the push for experiment replication is becoming more pronounced (Camerer et al., 2016).⁷

On a more exploratory front, there are a number of important characteristics that have not been addressed experimentally. Shane and Venkataraman (2000, p. 217) highlight that “entrepreneurship is concerned with the discovery and exploitation of profitable opportunities.” Economics experiments have recently been carried out to study the discovery

⁷ Some journals have made a call for replication results. For example, the Journal of the Economic Science Association (JESA) states the following under its aims and scopes, “JESA will focus on publishing....article types that are important yet under-represented in the experimental literature (i.e., replications, minor extensions, robustness checks, meta-analyses, and good experimental designs even if obtaining null results).” Retrieved April 14, 2022 from <https://www.springer.com/journal/40881/aims-and-scope>

of ideas under the broad domain of creativity (Charness and Grieco, 2018; Dutcher and Rodet, 2022). These protocols could be adapted easily to examine the link between entrepreneurship and creativity, which remains a critical gap in our understanding.

The existing literature that we have reviewed also suggests that social preferences may play an important role in defining the entrepreneur that a priori, under the traditional model of a strictly self-interested profit maximizing entrepreneur, would not have been predicted. Social preferences is large umbrella term and there are there are a number of well-established protocols in experimental economics, in addition to traits examined thus far, that may be of particular interest for entrepreneurship studies. One example would be the measurement of inequality aversion and fairness preferences, which may be important given the role of the entrepreneur as a job creator and employer. There are also prominent examples of successful entrepreneurs with a history of large donations to charitable causes, such as Bill Gates, Jeff Bezos, and Michael Bloomberg. Aside from direct financial contributions, successful entrepreneurs have also been known to volunteer valuable time in mentoring programs for future entrepreneurs. These examples suggest that charitable preferences may be linked with entrepreneurship, but whether this type of social preference is distinct for the entrepreneur or simply a result of high income is an open question.

The last dimension that may be relevant to the discussion of social preferences links to the substantial increase in social entrepreneurship globally, where the entrepreneur targets business opportunities with positive social change (e.g. poverty mitigation or environmental impact). The rise in social entrepreneurship may simply be a response to consumer demand, but there is evidence that stronger social preferences may be unique to these types of entrepreneurs. Ganguili et al. (2021) examined the role of social priming and selection in a field experiment run in collaboration with a UK support agency for social entrepreneurship. The experiment manipulated the framing of incentives between social (intrinsic motivation) and financial (extrinsic motivation). Nascent social entrepreneurs that were recruited under financial motivations put in more initial effort, but were less successful than those recruited under intrinsic, pro-social motivations in a one-year follow-up. While this experiment did not directly test social preferences, it does provide an interesting teaser for the role social preferences may play.

The last research avenue we would like to discuss is likely the most important in terms of pushing the agenda forward. The vast majority of experimental entrepreneurship research has examined the question of whether or not entrepreneurs are different from non-entrepreneurs by examining cross sectional data, and what we have proposed above continues along this same theme. Without a doubt, cross-sectional research misses important aspects of the process of becoming an entrepreneur, which evidence has suggested is a driver of some differences between entrepreneurs and non-entrepreneurs and may actually be more important than inherent characteristics (Cooper and Saral, 2013). To tackle this issue one can approach the question longitudinally starting with easier to reach populations, such as students, and track the students in the process of career choice post-graduation. This has the added benefit of solving one of the main problems addressed earlier, namely finding

entrepreneurs to participate, as long as the sampled population is large enough to produce enough entrepreneurs. Longitudinal studies will allow for differentiation in the question of whether or not the process of becoming an entrepreneur drives changes in the person, or whether the characteristics themselves play a role in the individual selecting into entrepreneurship, or perhaps both. In other words, it allows for a more causal approach to identifying the specific traits that matter for entrepreneurs.

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