ARTICLE

Opportunity or Illusion? Risk Perception in Opportunity Evaluation

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ABSTRACT

This article describes research conducted to determine which variables influence the opportunity evaluation by emerging market entrepreneurs. The study was conducted with quantitative research techniques, using data from 124 entrepreneurs in micro and small Brazilian enterprises. Hypotheses were tested with confirmatory analyses and using Structural Equations Modelling. According to previous research, results demonstrated that the smaller the perceived risk, the more positively the entrepreneurs will evaluate opportunities, affecting their propensity to act. However, the results of tests to measure correlations between the occurrence of cognitive biases and other variables were not significant, contradicting previous work that has stated that correlations exist. The findings support the concept that variables ignored when analysing our decision-making process are relevant to the result of our decisions. Besides, they may result in inconsistent illusions that can lead the decision-maker into unwarranted confidence in their capacity to understand whether an assessment of opportunity, which is inherent to the entrepreneurial process, is truly an opportunity or an illusion.

KEYWORDS
Entrepreneurial cognition, Risk perception, Limited rationality, Judgment under uncertainty

Oportunidade ou Ilusão? Percepção de Risco na Avaliação de Oportunidades

RESUMO

Este artigo descreve uma pesquisa realizada para determinar quais variáveis influenciam a avaliação de oportunidades por empreendedores de mercados emergentes. O estudo foi realizado com técnicas de pesquisa quantitativa, utilizando dados de 124 empreendedores de micro e pequenas empresas brasileiras. As hipóteses foram testadas com análises confirmatórias e usando Modelagem de Equações Estruturais. De acordo com pesquisas anteriores, os resultados demonstraram que quanto menor o risco percebido, mais positivamente os empreendedores avaliarão as oportunidades, afetando sua propensão a agir. No entanto, os resultados dos testes para medir as correlações entre a ocorrência de vieses cognitivos e outras variáveis não foram significativos, contrariando trabalhos anteriores que afirmavam a existência de correlações. Os achados apoiam o conceito de que variáveis ignoradas ao analisar nosso processo decisório são relevantes para o resultado de nossas decisões. Além disso, pode resultar em ilusões inconsistentes as quais podem levar o tomador de decisão a uma confiança injustificada em sua capacidade de entender se uma avaliação de oportunidade, inerente ao processo empreendedor, é realmente uma oportunidade ou uma ilusão.

PALAVRAS-CHAVE

Cognição empreendedora, Percepção de risco, Racionalidade limitada, Julgamento sob incerteza

1. INTRODUCTION

There has been considerable research interest in cognitive biases and their relationship with the entrepreneurial process over the last twenty years, and they are currently seen as playing a central role in the complex network of factors and variables that influence the entrepreneurial process (Zhang & Cueto, 2017). Sarasvathy (2013) has attempted to understand these relationships at increasing levels of sophistication.

In response to the subject's relevance, researchers studying entrepreneurship are increasingly attempting to understand the relationship between these cognitive biases and a series of other constructs, including risk perception and evaluation of opportunities while planning to launch a firm or start-up. Zhang and Cueto (2017) point out that these studies can basically be classified into two categories: those that attempt to understand which factors these biases affect, and those that investigate which factors can affect these biases. This study focuses on the first of these issues, seeking evidence that these biases affect risk perception and, consequently, opportunity evaluation.

Mainly, the entrepreneurial process always starts with an evaluation of opportunities, leading on to acquisition of resources, and strategy development, before culminating in performance (Shane & Eckhardt, 2003). It is therefore worthwhile to attempt to understand which variables affect opportunity evaluation, since it is the first step in the entrepreneurial process and so can influence the entire process.

Theoretical and empirical evidence demonstrates that the smaller the perceived risk, the more positive the way entrepreneurs evaluate opportunities and that, at least in part, cognitive biases influence the variation in this perception (Aramvalarthan et al., 2014; Brooks, 2011; Simon et

al., 2000). This relationship has important implications for entrepreneurial practice, since the results suggest that entrepreneurs are incapable of acting in a perfectly rational manner and, therefore, are incapable of reliably dealing with an action logic and with tools, such as business plans, that depend to a great extent on the individual judgment of the decision maker when evaluating opportunities. In contrast, they support utilization of experimental methodologies, such as effectuation logic (Sarasvathy, 2001), which is less dependent on self-perception and more dependent on experimentation.

The behavioural view of the entrepreneurs studied in this paper is initially derived from the theory of Limited Rationality proposed by Herbert Simon (1957). Decisions are functions of behavioural factors and not merely as functions of the pursuit of economic maximization proposed by traditional economic theory. The so-called "Economic Man", fully rational in his choices and decisions, is called into question and the relativity involved in individual choices is taken into consideration. This new view assumes that individuals do not possess pure rationality because of characteristics inherent to themselves, such as limited cerebral processing capacity and excessive information in the environment (Simon, 1957). From a similar perspective, Kahneman and Tversky (1974) introduced the concept of Heuristics and Cognitive Biases. Heuristics can be understood in a simplified manner as mental "rules of thumb" that humans use to make decisions in complex situations. When evaluating whether the price of a property is reasonable, for example, it is not feasible to study the prices of all the houses in the area to make the correct decision. Therefore, what the decision maker does is to conduct an analysis that takes into consideration opinions that are important and then take a decision based on the available data.

This article uses confirmatory analyses to test whether, in a context in which there is a scarcity of resources (as is the case in Brazil), the theoretical model from Simon et al. (2000) and Aramvalarthan et al. (2014) will produce similar results in regions with less favourable socioeconomic development. It also seeks to verify whether unobservable variables related to the context influence the relationship between cognitive biases and entrepreneurs' risk perception and, consequently, influence their evaluation of opportunities.

The survey resulted in 124 questionnaires. The sample was entirely made up of entrepreneur-owners of small businesses, all of whom had created their own firms and who were chosen at random from a list maintained by the "Business to Business" program from Brazilian small and micro businesses support services (SEBRAE), which conducts a regular exercise to map micro and small businesses in Brazil. It is important to point out that this study is focused on owner-managers, and not exclusively on entrepreneurs from recent start-ups. This is important because it extends the scope of the decision-making processes studied to entrepreneurs who are already experienced and who may base their decisions on different processes and biases from those of entrepreneurs who have recently set up their businesses.

The sphere of practice offers important insights. The first of these, as covered in the prior literature, relates to the risks of running an enterprise using strategies, such as business plans, that demand too many resources and, rather than stimulating experimentation, lead the entrepreneur to assess opportunities in a manner that is not entirely rational, believing to an unwarranted extent in the risk perceived when evaluating opportunities. The second complements the first, proposing that, in countries with limited resources, the decision-making process tends to suffer from more limitations to rationality because of the variables mentioned above or unobservable variables.

2. THEORETICAL BACKGROUND

Kahneman and Lovalo (1993) suggest that entrepreneurs are not more risk-prone, but just perceive risk differently. The risk involved is a central element in the decision to undertake. Understanding the mechanism of variation of this perception in the individual meets the new locus of research in entrepreneurship (Mullins et al., 2002). Thus, when evaluating the same situation, entrepreneurs perceive the risk to a lesser degree than non-entrepreneurs (Nutt, 1993). Therefore, it is the variation in risk perception − and not risk propensity − that may explain why some individuals create businesses while others do not (Palich & Bagby, 1995). Individuals who perceive less risk are more likely to start a venture (Palich & Bagby, 1995; Simon et al., 2000). Finally, the evaluation of opportunities under risky conditions focuses on the cognitive process of entrepreneurs (Keh et al., 2002).

It is clear, therefore, that the topic of entrepreneurship is no longer prescriptive and only establishes general characteristics for entrepreneurs; and became descriptive, to better understand the individual, more specifically describing how the entrepreneur's decision-making process takes place, shifting the locus of research from the outside, general, to the inside, individual. In this context, understanding the functioning of entrepreneurial cognition, its biases, and limitations, seeking to understand what entrepreneurs are subject to and how biases influence the entrepreneur, is of natural importance for the advancement of research in entrepreneurship.

In view of other studies (e.g., Simon et al., 2000; Aramvalarthan et al., 2014), this work seeks to establish a relationship between cognitive biases, risk perception, and assessment of opportunities by decision makers, corroborating the literature that points out the rationality mechanisms of the entrepreneur. In this way, it becomes relevant to understand why and how risk perception varies among individuals. In this section, the construction of hypotheses proposes that cognitive biases offer an explanation as to why the perception of risk varies among individuals and influences their assessment of opportunities.

2.1. THE INFLUENCE OF RISK PERCEPTION ON OPPORTUNITY EVALUATION

The perception of entrepreneurial risk is the evaluation of the one who will make the risk decision inherent in the search for entrepreneurial behaviour (Nabi & Linán, 2013). Evidence shows that there is a correlation between the way that opportunities are perceived and the way that they are evaluated (Chao, 2011; Pleggenkuhle-Miles et al., 2013; Zhang & Cueto, 2017). Within entrepreneurship, studies have reported data that confirm this. It has long been known that more than 90% of entrepreneurs believe that their ventures have a greater probability of success than of failure (Cooper et al., 1988), but recent data demonstrate that around 25% of Brazilian companies do not survive more than two years (Sebrae, 2013).

Other researchers (e.g., Palich & Bagby, 1995; Simon et al., 2000; Simon et al., 2000) suggested that people who perceive less risk are more likely to take advantage of business opportunities, possibly because they make a more positive assessment of the opportunity. Schilbach et al. (2016) demonstrated that cognitive limitations and judgments tend to be impacted negatively to a greater extent in settings in which resources are scarce, suggesting that many variables, whether known or not, influence a person's decision-making process.

In view of the extremely important role of opportunity evaluation, since it affects all other stages of the entrepreneurial process (Shane & Eckhardt, 2003; Workman, 2012; Zhang & Cueto, 2017), researchers have emphasized the need to clarify the relationships between risk

perception and opportunity evaluation and other important variables, such as, cognitive biases, and have highlighted the relevance of testing them in different contexts in which they may have an influence.

- **H1:** In a socioeconomic context in which there is greater scarcity of resources compared to developed countries, low risk perception is associated with positive evaluation of business opportunities.

2.2. Cognitive biases

Understanding cognitive biases is strategic to the study of entrepreneurship because they influence firms' performance and the returns obtained when investing in opportunities, especially in entrepreneurial settings, which are replete with uncertainties (Arend et al., 2016). The literature consistently suggests that success is directly related to making correct judgments when taking decisions (Abatecola, 2014; Hoghart & Karelaia, 2012). As well, both internal and external aspects affect decision making, due to how each entrepreneur reacts to such facts (Massa et al., 2020).

For at least four decades, it has been known that people's decision-making processes are susceptible to countless cognitive biases and heuristics (Kahneman & Tversky, 1974). It is relevant to attempt to understand how risk perception varies in the decision-making process, which this is an extensive area of research that has been explored in differing contexts and with a variety of models (e.g., Simon et al., 2000; Aramvalarthan et al., 2014). However, no work was identified in which tests were conducted in socioeconomic settings in which resources are scarce, such as in Brazil.

This study tests the effects of three of these cognitive biases on risk perception and opportunity evaluation in the scenario, inherent to Brazil and other emerging markets. The biases selected for study were defined by the decision to employ the model proposed by Simon et al. (2000), because of its coherence and rigor, although the illusion of control bias has been excluded due methodological considerations explained below.

2.3. Overconfidence

People almost always start their businesses with absolute confidence that there is no chance of failing (Cooper et al., 1988) even when faced with the evidence that failure is the rule, not the exception. These discoveries are not recent, but, over the last twenty years, studies of cognitive biases have intensified (Zhang & Cueto, 2017).

As first pointed out by Oskamp (1965), confidence is the capacity of producing positive effects, such as motivation to undertake a venture, but in excess it can produce catastrophic results and can be responsible for entrepreneurs going bankrupt and for other difficulties. Therefore, overconfidence may be an important reason for the failure of many ventures (Griffin & Varey, 1996).

Busenitz and Barney (1997) have published work showing that entrepreneurs are excessively confident when compared to the managers of large companies. Cooper et al. (1988) have also provided evidence that entrepreneurs believe that the probability of success is higher than the probability other people would estimate. Krizan and Windschitl (2007) produced an ideal model in which the process of estimating the probability of the outcome of an event is divided into

three distinct phases. The first is the search for evidence. In the second stage, this evidence is evaluated in relation to conscious and unconscious perceptions. And, in the last stage, a response is formed, which will reflect the pessimistic or optimistic expectations of the decision maker.

Generally, decision makers consider each decision to be unique, ignoring negative statistics related to similar actions in the past. People may be aware of statistical data that demonstrate the reality of certain situations, such as the mortality rate of new-born enterprises, and yet simply ignore them because they believe they have superior abilities to others (Camerer & Lovallo, 1999). This fact further increases the relevance of understanding of whether degrees of confidence is a variable that is, by itself, able to influence an individual's perception of risk, since there is no consensus on the direct influence the overconfidence bias may have on the way people perceive risks (Aramvalarthan et al., 2014; Hoghart & Karelaia, 2012; Lowe & Ziedonis 2006; Simon et al., 2000). However, it has been shown that entrepreneurs can treat their assumptions as facts and so these can interfere with their perception of risk (Simon et al., 2000) and consequently influence their evaluation of opportunities.

- **H2:** In a socioeconomic context in which there is greater scarcity of resources compared to developed countries, Overconfidence reduces an individual's risk perception during the process of opportunity evaluation.

2.4. THE LAW OF SMALL NUMBERS

Ignoring sample size when arriving at conclusions has been extensively documented (Benjamin et al., 2014) and attributed to the cognitive bias known as the Law of Small Numbers. Many types of error are attributed to this common failure of judgment, including the tendency to believe that a personal success implies a greater chance that the next action has a higher probability of success than it has, the so-called Hot Hand and Gambler's fallacies, which explain that this tendency to ignore the sample size remains despite the decision makers' experience in their specialties (Benjamin et al., 2014). Confirmatory evidence of this was provided in a study by Miller and Sanjurjo (2016).

The Law of Small Numbers was first described by Kahneman and Tversky (1973), who claimed that people only use statistical data correctly when no other information is provided, i.e., when non-quantitative information is not available (such as cases and examples of success witnessed by the decision maker previously). The law of small numbers describes generalization of conclusions from a sample with a small number of members that does not represent the entire population (Shane & Eckhardt, 2003). This tendency can be observed among people involved in the entrepreneurial process. They spend a great deal of time conversing with friends, relatives, and acquaintances who have some experience in the area they are researching. During this process, much of the information they obtain is treated as true and is generalized to all cases.

It is not a new discovery that random statistical samples can safely be used to make inferences about a population, but decision makers tend to ignore both the information in these statistical data and the sample size, preferring to take into consideration their own observations and personal experiences of specific phenomena (Kahneman & Tversky, 1974). Entrepreneurs and businessmen are not immune to the tendency to generalize conclusions from small samples. Since

this process is not representative of the entirety, it can influence one`s risk perception, reducing it, and increasing a tendency to start new ventures hastily (Simon et al., 2000).

- **H3:** In a socioeconomic context in which there is greater scarcity of resources compared to developed countries, the Law of Small Numbers reduces an individual's risk perception during the process of opportunity evaluation.

2.5. THE PLANNING FALLACY

When predicting the results of projects that involve risk, decision makers take decisions based on undue optimism, underestimating costs, and overestimating benefits. In this process, they imagine scenarios of success, but close their eyes to failures and calculation errors. As a result, they favour initiatives that are unlikely to run to schedule, or produce the expected results, or even ever be completed. This point of view means that people very often (but not always) take on risky projects, because they are excessively optimistic about the probabilities they will face (Kahneman, 2003; Wickham, 2003). The current debate in the literature about this bias is related to which mechanisms influence the calibration of these decisions. Factors such as experience, memory, quantity of tasks estimated, and time taken to complete each task appear frequently in the literature as variables that influence the degree of occurrence of this bias (Halliday, 2016; Min & Arkes, 2012; Smith et al., 2014).

The term Planning Fallacy was also introduced to the literature by Kahneman and Tversky (1979). By nature, this is a bias that relates to a tendency where people overestimate their capacity to fulfil a task in the future, even when they have considerable experience of past failures on which to base their schedule programming. Managers who produce annual plans are almost always unable to keep scheduling and complete all the activities they have planned (Kahneman & Tversky, 1979).

According to Kahneman and Lovallo (1993), people tend to construct future scenarios, considering the information they have on hand. But why do they ignore relevant information about the past? Evidence shows that predictions are, by their nature, focused on the future and, because of this, there are mechanisms that prevent people from looking backwards with greater clarity. More recent debates have introduced other variables into this relationship, such as experience, memory, number of tasks estimated, and task execution time (Halliday, 2016; Min & Arkes, 2012; Smith et al., 2014). There is consensus in the literature that the Planning Fallacy can lead to underestimation of risks and overestimation of the probability of success of a venture. Since opportunity evaluation is always focused on the future, highly complex, and uncertain, people are vulnerable to the effects of the planning fallacy.

- **H4:** In a socioeconomic context in which there is greater scarcity of resources compared to developed countries, the Planning Fallacy reduces an individual's risk perception during the process of opportunity evaluation.

2.6. THE MEDIATING CHARACTER OF RISK PERCEPTION

Studies of risk perception can be classified according to their different perspectives and, within these, the term risk can be understood in different ways: as something bad, as a way of measuring the probability of something, because of a given action of risk, or as the potential for something

to go wrong (Slovic & Weber, 2002). Therefore, we define risk perception as the perception of the probability of success of a venture that is being evaluated.

Over recent decades the literature on entrepreneurship has been attempting to understand the relationships between cognitive biases and many different constructs, including risk perception and opportunity evaluation (Zhang & Cueto, 2017). Risk perception is a subjective and multidimensional construct, important in entrepreneurship since its influence on opportunity evaluation, which is the first step in the entrepreneurial process (Shane & Eckhardt, 2003). There is evidence of an inversely proportional relationship between risk perception and opportunity evaluation. In other words, the greater the risk perceived in the venture under analysis, the worse the assessment of investing resources in the opportunity. This is one of the reasons to completely understand which other characteristics affect variations in risk perception.

The model proposed by Simon et al. (2000) tests whether risk perception mediates the relationship between cognitive biases and opportunity evaluation (Keh et al., 2002), considering a complex mechanism in which biases affect opportunity evaluation through their influence on entrepreneurs' risk perception. There is also more recent work (Aramvalarthan et al., 2014), part of the debate in the field of decision-making process studies, that attempts to understand which variables can be affected by cognitive biases (Bryant, 2007; Zhang & Cueto, 2017).

- **H5:** In a socioeconomic context in which there is greater scarcity of resources compared to developed countries, the relationship between cognitive biases and opportunity evaluation is mediated by the level of risk perception.

3. METHODS

3.1. CONSTRUCTS

A study by Keh et al. (2002) also employed a cognitive approach to examine what impacts on opportunity evaluation within the entrepreneurial process, using a model comprising three independent variables (Overconfidence, Belief in the Law of Small Numbers, and the Planning Fallacy), a mediating variable (Risk Perception), two control variables (Demographic Data and Risk Propensity) and one dependent variable (Opportunity Evaluation).

Since these are latent variables, our study uses the constructs described below to group the results of questionnaire items. Except for the independent variable Illusion of Control, the same constructs as used by Keh et al. (2002) are employed here and the criteria and scales proposed by these authors are also utilized. The decision was taken to exclude the variable Illusion of Control from the final version because it was considered that it is beyond the study's scope of analysis, which is the influence of optimism and of generalization on the other variables studied. Keh et al. (2002) employed multivariate regression and our paper employs Structural Equations Modelling (SEM), with the aid of confirmatory factor analysis of the results obtained in earlier works (Aramvalarthan et al., 2014; Keh et al., 2002; Simon et al., 2000). Even though SEM is widely used in behavioural research, results may not converge or, even if they do, the algorithm may bring parameter estimates that are not reliable, due to the characteristics of the empirical dataset.

Opportunity Evaluation (OE): opportunity evaluation is measured using a short case study, with three questions measuring how the interviewee evaluates the opportunity described in the

case study. The model employs a scale ranging from 1 to 7, where 1 indicates that the interviewee agrees completely with the situation described, and 7 indicates complete disagreement.

Risk Perception (PR): participants' risk perception is assessed in this study using four questions about the case study. The response scale has seven items varying from 1 to 7, where 1 indicates that respondent disagree completely, and 7 indicates agree completely.

Overconfidence (OC): drawing on a model proposed by Russo and Schowmaker (1992), 10 general questions are used, since entrepreneurs take decisions based on varied sources of information (Kaish & Gilad, 1991). There is one correct response to each question. The respondents are requested to estimate an interval between the minimum and maximum values within which they believe there is a 90% chance that the correct response lies. Respondents who answer more than 10% of the questions incorrectly are defined as acting with overconfidence. For the purposes of statistical analysis, after calculating the results, a value of 0 will be assigned to those who acted overconfidently and a value of 1 for those who did not.

Belief in the Law of Small Numbers (LSN): respondents are requested to list three passages on which they based their decision to act and explain why they chose them. The researcher analyses the responses and codes respondents who do not mention statistical reasons with the value 1 and those who do with the value 0. Items that do not fit either possibility will be excluded.

Planning fallacy (PF): two questions were used to capture use of past entrepreneurial experiences when assessing the risk of a new venture idea. The first item identifies whether the respondent believes that their entrepreneurial experience would be helpful when assessing the risk of a new venture and the second determines the probability that the respondent would employ experience in businesses of a different nature to assess a new venture. Once more, the response scale used has seven items varying from 1 (disagree completely) to 7 (agree completely).

Control Variables: the questionnaire collected demographic information (gender, educational level, and age) and risk propensity analyses were also conducted, and the results used as a control variable. The control variable was coded 0 to indicate lower propensity to risk and 1 to denote greater propensity to risk.

Table 1 shows the main references and metrics used, defining the variables in an operational manner.

The chosen constructs are suitable for the study as they allow us to represent a scenario in which a man with market experience seeks to evaluate an opportunity to undertake (Appendix A). The case contains information that encourages and discourages the decision maker to act strategically considering the potential of the enterprise and allows that, through the survey, the influence of risk perception in this process can be measured by the specific constructs and which cognitive biases surveyed the decision makers presented.

Table 1
Descriptive variables

Variable	Metric	Support
Opportunity Evaluation (OE)	A unidimensional scale with three questions* measured from a 1 to 7 Likert configuration.	Kruger (1993); Sandberg and Hench (1999); Krueger and Bazeal (1994); and Krueger (2000).
Risk Perception (PR)	A unidimensional scale with four questions* measured from a 1 to 7 Likert configuration.	Das and Teng (1997); Allinson and Hayes (2000); Sitkin and Pablo (1992); Simon et al. (2000); and Forlani and Mullins (2000).
Overconfidence (OC)	Dummy: "0" to those who acted overconfidently "1" for those who did not, out of 10 questions*.	Haller (2013); Simon et al. (2000); and Russo and Schoemaker (1992).
Belief in the Law of Small Numbers (LSN)	Dummy: "0" to those who base their arguments in statistical terms and "1" otherwise.	Simon et al. (2000); Golder and Tellis (1993); and Busenitz and Barney (1997).
Planning fallacy (PF)	A unidimensional scale with two questions* measured from a 1 to 7 Likert configuration.	Kahneman and Lovallo (1993) and Zietsma (1999).

Note: *Appendix.

3.2. POPULATION, SAMPLE, AND PARTICIPANTS

The study population comprises micro and small entrepreneurs who participate in the SEBRAE "Business-to-Business" program. This study is, therefore, focused on owner-managers of firms. Preparatory to the study, a pre-test was conducted with 17 entrepreneurs selected by convenience by the authors. There were no problems with interpretation of the questions during the pre-test.

For the study proper, a survey was conducted based on the model proposed by Keh et al. (2002). As mentioned above, the sample was selected by using a database from the SEBRAE "Business-to-Business" program, obtained from the SEBRAE chapter in the south of the state of Minas Gerais (Brazil). This program is intended to foster entrepreneurship and maps in details the small businesses in each region of Brazil. The database has approximately three thousand, five hundred firms listed for the south of Minas Gerais. Five hundred firms were selected at random. The researchers contacted the owners of these five hundred firms by telephone inviting them to take part in the study. The survey containing the research questions was then sent by e-mail and by post. As an incentive to participation, respondents were entered a draw to win a tablet.

One hundred and eighty of the five hundred surveys sent out were returned and one hundred and twenty-four of these were fit for use, with questions answered in the appropriate manner. The remainder were excluded because they did not meet the minimum requirements, such as number of responses.

3.3. Data analysis procedures

In view of the elevated number of relations, interactions between constructs were analysed simultaneously using structural equations modelling (SEM). Initially, factor analysis was employed to examine the validity of the constructs when variables were grouped. Once this had been accomplished, descriptive analysis data were combined with the data obtained in the factor analysis, and then Analysis of Variance (ANOVA) was used to test whether constructs are influenced by the control variables studied.

The aim of the confirmatory factor analysis is to group the variables selected into a single factor, with an eigenvalue greater than 1.00 (according to the Kaiser criterion). Each variable should have a factor loading greater than 0.70 (in modulus), which should result in communalities of 50% or greater, which has been identified as the minimum value for test reliability. Finally, variance extracted should also be greater than 50%. The criteria for SEM fit are those recommended by Hair et al. (2009) as the minimum needed for reasonable confidence in the results, such as comparative fit index (CFI) and normed fit index (NFI) greater than 0.90 and root mean square error of approximation (RMSEA) less than 0.08.

The final stage of data analysis was to use structural equations modelling (SEM) to test the research hypotheses. These tests were run with AMOS 18.

4. RESULTS

4.1. Descriptive analysis

The most important characteristics surveyed were age of the firm; gender of the interviewee; age of the interviewee, and the educational level of the interviewee. The first step was to determine the mean age of the firms interviewed. Only one respondent was surveyed from each firm and so each is represented by one person, who is the founder of the enterprise. The results for age of firms in the sample showed that cases ranged from 1 to 38 years since founding. Mean age was 12.07 years, and both mode and median were 11 years. The results also showed that the great majority of interviewees, around 80%, were male.

The age of participants was also analysed. It is important to point out that this age is the age of respondents on the survey date, not the age they were when they started the business. The sample included cases of 40-year-old interviewees whose firms were 18 years old and 56-year-olds with 1-year-old firms. The mean age of interviewees was 43.4 years. The age range was from 20, for the youngest, to 71 for the most experienced. Median age was 44 years, and mode was 48 years.

4.2. Factor analysis

The constructs and variable structure used in this study have been tested in previous studies (Keh et al., 2002). Nevertheless, this article attempts to confirm the results and explore the data using Exploratory and Confirmatory Factor Analysis. Table 2 lists the indicators of validity and reliability for each of the constructs.

It can be observed from Table 2 that the factor loading coefficients were high, greater than or close to 0.70, which was a minimum condition for remaining in the tests. Just one variable (Q12) was below the cut-off, at 0.62. Nevertheless, this variable was maintained because the coefficient was acceptable. It is of note that the latent variable Planning Fallacy only contained

two observed variables, which is undesirable for an analysis of this type. However, it was decided to retain this latent variable with two supported observable variables (Byrne, 2013; Little et al., 1999). The authors recognize that this condition is not ideal, but that, in some cases, as in this article, the detrimental effect on the analysis is minor.

After the exploratory factor analyses had been completed, additive scales were constructed from the variables considered valid and the factor loadings, with correlations between variables. It is then possible to treat each factor as a single score per interviewee and to conduct further tests that can contribute to the analyses. The correlation matrix for the factors against the personal characteristics of the interviewees is shown below (q23 to q27, with characteristics such as educational level, age, gender, and age of firm).

Table 2
Exploratory factor analysis

Variable	LSN	PF	RP	OE
Q1	0.808313			
Q2	0.804287			
Q3	0.985289			
Q4		0.795272		
Q5		0.795272		
Q9			0.800888	
Q10			0.789248	
Q11			0.822170	
Q12			0.620920	
Q13				0.898932
Q14				0.898329
Q15				0.784357
Explanatory Variable	**2.325838**	**1.264913**	**2.325838**	**2.230289**
Proportion Total	**0.761474**	**0.632457**	**0.581459**	**0.743430**
Cronbach	**0.83**	**0.43**	**0.74**	**0.83**

Note: The table shows Exploratory Factor Analysis used to test the validity and reliability of the data, while Confirmatory Factor Analysis was used to test the extent to which this sample adheres to the model proposed previously. It is therefore possible to compare the results of previous work with the case studied here. A total of five factors were tested. One of these factors only had one variable loaded onto it, so this was added to the model as an observed variable.
Source: Authors.

4.3. STRUCTURAL EQUATIONS MODELLING − SEM

Consultation of the indicators for the model without mediation showed that none of the relationships between OE and the cognitive biases were significantly different to zero at 5%. Therefore, the results relating to H2, H3, and H4, the hypotheses that test these correlations, are inconclusive. Hypothesis H5 was that Risk Perception mediates the relationship between cognitive biases and opportunity evaluation, but a basic assumption for confirmation of a hypothesis of mediation is that the independent variables have relationships with the dependent variable significantly different from zero, and this was not the case in these tests. Table 3 lists the coefficients.

Table 3
Relationships Between Cognitive Biases and Opportunity Evaluation

			Estimate	S.E.	C.R.	P
OE	←	LSN	-0.220	1.664	-0.132	0.895
OE	←	OC	-0.173	0.385	-0.449	0.654
OE	←	PF	0.095	0.155	0.610	0.542

Note: The table shows the coefficients for the relationships between cognitive biases and Opportunity Evaluation, together with the estimates, standard errors, critical ratios, and p-values.
Source: Authors.

It will be observed that all p-values are greater than 0.05. The model therefore fails to reject the null hypotheses of relationships equal to zero. Even though the coefficients are not equal to zero, these hypotheses cannot be accepted because there is insufficient evidence to reject the null hypotheses. The overall significance of the model was 10.2, although some indicators of fit, such as CFI and RMSEA, had values within the minimum acceptable range.

The second stage of SEM analysis was to test for relationships between cognitive biases and Risk Perception. Hypotheses H2, H3, and H4 were in this phase of SEM. The values are in Table 4.

Table 4
Values, Standard Errors, and Significance of Relationships

			Estimate	SE	CR	p
RP	←	LSN	2.744	1.862	1.474	0.140
RP	←	OC	0.082	0.315	0.259	0.796
RP	←	PF	-0.103	0.145	-0.710	0.478

Note: The table shows the values for the relationships and for the standard errors (SE) and significances (CR and p).
*Source:* Authors.

Certain additional tests were conducted, such as removal of non-significant variables, but the mean significance of the model did not change. Therefore, none of these hypotheses, H2, H3, or H4, was accepted as significant, since the coefficients were not significant and, therefore, equal to zero. The results are therefore inconclusive. Some of these results may be due to the relationship between sample size and number of degrees of freedom. With small samples the variance tends to be greater and a limited number of degrees of freedom can lead to false negative results. The final model proposed in this paper is illustrated in Figure 1.

The mediation hypothesis is not plausible because the results for relationships between the cognitive biases and OE, without RP, were inconclusive. The results for the full model are Table 5.

With relation to hypothesis H1, it can be observed that Risk Perception has a significant negative association with Opportunity Evaluation (p-value < 0.05). It is therefore possible to accept H1 as the best alternative, since the null hypothesis is rejected. All these values are associated with indicators of fit within the recommended limits of acceptability for a valid model, such as a CFI greater than 0.90 and an RMSEA less than 0.1. We ran a power test on G*Power software to calculate the power of these findings, and the null hypothesis of H1 showed a 97.82% to correctly rejected.

In the Table 6 is illustrated a summary of the hypotheses.
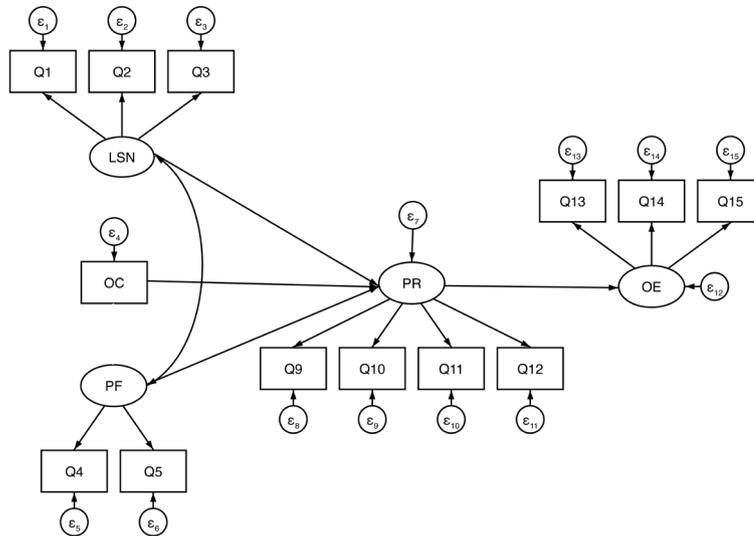
Figure 1. Path Diagram for Full Model
Note: The figure shows the final model was constructed. In each construct, the amounts of the latent variables are presented, as well as their respective identification, which are: Opportunity Evaluation (OE), Risk Perception (PR), Overconfidence (OC), Belief in the Law of Small Numbers (LSN), Planning fallacy (PF) and Question (Q).
Source: Authors.

Table 5
Results of Full Model

			Estimate	SE	CR	p
RP	←	LSN	2.663	1.839	1.448	0.148
RP	←	OC	0.090	0.314	0.286	0.775
RP	←	PF	-0.103	0.145	-0.708	0.479
OE	←	RP	-0.315	0.135	-2.345	0.019

Note: The table shows the results of the final model, constructed to test the hypothesis of mediation (H5) and the relationship between Risk Perception (PR) and Opportunity Evaluation (OE) (the H1). Included, the standard errors (SE) and significances (CR and p).
Source: Authors.

Table 6
Summary of Results Obtained

Hypothesis	Proposed Relationship	Result Expected	Conclusions
H1	RP → OE	Negative	Validated
H2	OC → RP	Negative	Rejected
H3	LSN → RP	Negative	Rejected
H4	PF → RP	Negative	Rejected
H5	Mediation of RP	Mediation	Rejected

Note: The table shows the hypotheses raised in this paper were tested and the results obtained are summarized. Not only are the hypotheses recalled, but the Expected Results and Conclusions of the research are also reported.
Source: Authors.

5. DISCUSSION OF THE RESULTS

The aim of this study was to employ confirmatory analysis to test, in a different context, the relationship between cognitive biases, risk perception, and opportunity evaluation. Results did not confirm the feasibility of generalization of the theoretical model proposed by Simon et al. (2000) when tested in the Brazilian setting, suggesting, in common with work by Finucane et al. (2000) and Schilbach et al. (2016), that there are other important variables missing from the model that had an influence on the study results and affect the decision-making process in contexts in which resources are scarce. Age, Experience, and Educational Level were tested as control variables, but none of these variables had any influence on the result.

Other factors inherent to the economies of developing countries such as Brazil may also potentially be relevant. The first of these is the prevalence of necessity entrepreneurship, which is still elevated if compared to other countries where these theories have been tested. Necessity entrepreneurship has a series of inherent characteristics, such as low levels of technical training and qualifications (Singer et al., 2014). Additionally, the Global Entrepreneurship Monitor (2016) analyses countries' phase of economic development in three categories, evaluating many different variables, such as political environment, access to education and to capital, structural conditions, and physical and social norms, and in all categories analysed, Brazil is below average for the 60 countries analysed.

In sum, our paper suggests that Risk Perception is not related with other behavioural bias, such as Fallacy Planning, Overconfidence and Law of Small Numbers. At least not in this sample of entrepreneurs. More research should be done to try to better understand how Risk Perception correlates with other individual characteristics, again using real entrepreneurs as a set of data. Another finding of this paper is about the relation of Risk Perception leading to Opportunity Evaluation. We found a negative relation (p-value < 0.05) suggesting that the bigger the Risk Perception, the smaller the Opportunity Evaluation. In other words, entrepreneurs find opportunities where risks do not pop up in the eyes. This evidence finds support in the literature (e.g., Kraft et al., 2022). While Risk Perception plays an important role on the opportunity evaluation of the entrepreneurs, which will lead them to invest in businesses, we still need more clarity on the variables influencing this risk perception.

Notwithstanding, the survey found that, in the opinion of approximately 80% of the population sampled, being an entrepreneur affords social status and good career opportunities and, according to 54% of another sample of the Brazilian population, entrepreneurial capability is a favourable factor, which is a significantly higher proportion than was found in other countries (Singer et al., 2014). The results corroborate the evidence that demographic, economic, and social issues influence the way in which Brazilians perceive risk and, consequently, evaluate opportunities. It is therefore a question of prudence not to assume the generalizability of models that have only been applied in specific social contexts, such as the model proposed by Simon et al. (2000), which was replicated in this study.

The person's perception of risk influences the opportunity assessment. This subjectivity is potentially dangerous to the way opportunities are evaluated: when considering ventures, it must be borne in mind that it is inherently impossible for the human brain to completely free itself from failures of judgment and therefore it is worth employing strategies that modify the decision-making process as a means of dealing better with these judgments (Russo & Schoemaker, 1992).

Likewise, it is known that risk aversion reduces entrepreneurial intent. Risk-avoiding individuals undertake less ventures, just as those with a high level of risk aversion exhibit less confidence to recognize business opportunities (Zhang & Cain, 2017).

6. CONCLUSIONS

This study supports initiatives to identify all biases that influence the decision-making process of entrepreneurs. As a basis for the literature, this study focuses on owner-managers, and not exclusively on recent start-up entrepreneurs. This is relevant since decision-making processes - although considered exhaustively at the birth of firms - can be applied to already experience entrepreneurs who, not only can but base their decisions on processes and biases different from those of entrepreneurs who set up their businesses recently.

Experimental models of entrepreneurial activity (such as effectuation logic in which learning is employed through interaction, based on the logic of control) reduce dependence on the entrepreneur's personal evaluations and the quantity of resources involved in the process, proving more appropriate to conducting the entrepreneurial process within the behavioural decision-making paradigm. It is interesting that since Sarasvathy (2013) herself originated the theory, there have been few studies in the literature on entrepreneurship relating these concepts and stating the importance of considering cognitive biases and their implications. A logic of action based on control appears to be more appropriate than any other logic based on predictions and causal attributions, such as Business Plans, for example (Sarasvathy, 2001). Lastly, we showed that when firms have greater managerial controls over aspects that bias behaviour this will provide a greater behavioural bias, even when, if there is a low risk, it is better to have people who perform this measurement.

The greater the perceived risk, that is, and the more identified and transparent it is, the more positively entrepreneurs will evaluate opportunities and the better the result in the propensity to act perception (Aramvalarthan et al., 2014; Brooks, 2011; Simon et al., 2000). Therefore, this study contributes to elucidating that the risks of managing an enterprise must be evaluated (also) through strategies that encourage experimentation, unlike processes, and business plans, for example, which tend to evaluate in a manner that does not possess pure rationality.

Firms, through their managers – who perceive risk differently (Kahneman & Lovalo, 1993) - have resources and forms of diagnosis that will capture biases and, the variation of risk perception (Mullins et al., 2002), will benefit when they offer training so that management is more adequate, avoiding negative impacts. Interdisciplinary, it is also possible to see benefits at the time of a valuation, in the sense of not only looking at the aspects of the firm's cash management, but also at the behavioural aspect of those who founded the target company, thus obtaining intrinsic management information, for better future driving.

Furthermore, the findings of this study support the concept that variables we ignore when analysing our decision-making process are relevant to the result of our decisions and may result in inconsistent illusions that can lead the individual decision maker into an unwarranted confidence in their own capacity to understand whether an assessment of opportunity, which is inherent to the entrepreneurial process, is truly an opportunity or an illusion. This ignorance about which factors influence the process is even greater in settings in which resources are scarce, such as in Brazil and other emerging markets. Any form of testing before committing resources is potentially

an instrument to increase the likelihood of success in the entrepreneurial process. Finally, the study contributed to the literature on entrepreneurship in countries with limited resources, that the decision-making process leads to greater limitations of rationality.

Further studies in different settings and including variables related to the samples' specific contexts are essential to investigate which factors influence risk perception in opportunity evaluation, which was beyond the scope of this paper. Still, it is possible to carry out the survey of behavioural biases and hypothesize whether these are positively related to the survival of companies. This discussion also has important contributions to make to the field of decision-making with relation to the entrepreneurial process.

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AUTHOR'S CONTRIBUTION

RM: Conceptualization: Lead; Investigation: Lead; Methodology: Equal; Resources: Lead; Writing – original draft: Equal. **TA:** Conceptualization: Supporting; Formal analysis: Supporting; Investigation: Supporting; Methodology: Equal; Resources: Supporting; Supervision: Lead; Writing – original draft: Supporting. **RBP:** Data curation: Supporting; Formal analysis: Supporting; Project administration: Supporting; Validation: Supporting; Visualization: Supporting; Writing – review & editing: Lead. **JL:** Conceptualization: Supporting; Data curation: Lead; Formal analysis: Lead; Investigation: Supporting; Methodology: Supporting; Project administration: Supporting; Resources: Supporting; Supervision: Lead; Validation: Lead; Writing – original draft: Supporting; Writing – review & editing: Supporting.

CONFLICTS OF INTEREST

The authors have no conflicts of interest to declare.

APPENDIX

SURVEY

PART A

Fábio is a successful manager with four years of experience in a multinational. Prior to that he worked at a medium-sized local company for five years. The idea of being his own boss, taking calculated risks and making a fortune excited him. So, he's thinking about starting his new business.

He had an idea and decided to ask around to see if it was a good idea. He has had very positive responses from some potential clients and potential partners who know well the industry he would like to invest in. Fabio doesn't have the resources to carry out in-depth market research to find out where the business would work, and published data is too generalized to be useful. However, he feels that the business can be profitable based on the responses he has gotten from potential customers and partners. He is excited about starting the venture, even though he has no experience in this market or in entrepreneurship.

There are few multinationals in the same market, but they do not operate in the segment that Fábio intends to operate. However, he feels that multinationals can enter his market if his business is successful, and that he cannot do anything about it. He's also not sure if the market is growing or if it's already mature. If the market has already reached maturity, it is likely that your business will be pushed out of the market if multinationals enter it. If the market continues to grow, the new business will be able to survive the entry of multinationals into its market segment. Also, he found that there are only a few small businesses that continue to survive in this industry.

Fábio estimates that he will need at least 300,000 Brazilian reais to finance his new business, but he has only 80,000 Brazilian reais in savings. He needs to go to the bank or find a partner to get the rest of the money he needs.

Now, based on the text, answer the following questions:

Risk Perception (PR)

Q9) Overall business risk is high.	1	2	3	4	5	6	7
Q10) The probability of failure is high.	1	2	3	4	5	6	7
Q11) The founder can lose a lot of money.	1	2	3	4	5	6	7
Q12) There is great uncertainty in predicting how well the business will do.	1	2	3	4	5	6	7

Note: Scale from 1 to 7, where "1" is completely disagree and "7" is completely agree.

Opportunity Evaluation (OE)

Q13) I consider this business an opportunity.	1	2	3	4	5	6	7
Q14) This business opportunity is worth considering.	1	2	3	4	5	6	7
Q15) This business is viable given the situation exposed.	1	2	3	4	5	6	7

Note: Scale from 1 to 7, where "1" is completely disagree and "7" is completely agree.

Belief in the Law of Small Numbers (LSN)

Respondents are requested to write three reasons that led them to believe that the character Fábio would or would not be successful in his business. The responses were coded with "1" respondents who do not mention statistical reasons with the value "1" and those who do with the value "0". Items that do not fit either possibility will be excluded.

PART B

Please answer the following questions considering your personal perceptions of your business.

Planning fallacy (PF)

Q4) I believe that past entrepreneurial experiences help to assess the degree of risk of a new business.	1	2	3	4	5	6	7
Q5) I believe that the fundamental issues for running different types of business are similar.	1	2	3	4	5	6	7

Note: Scale from 1 to 7, where "1" is completely disagree and "7" is completely agree.

Overconfidence (OC)

Please answer the questions below, considering answer intervals that give you 90% certainty that your answer is correct. Data are according to the 2010 Brazilian census.

1. What is the estimated population of the State of Acre? Between _ and _ inhabitants (733.559)
2. What is the territorial extension of the State of Acre? Between _ and _ km² (164.123,04 km²)
3. Among the population residing in the State of Acre, what is the number of Apostolic Roman Catholics? Between _ and _ inhabitants (381.007)
4. Among the inhabitants, what is the number of inhabitants aged 60 or over? Between _ and _ inhabitants (46.799)
5. What is the number of permanent households in the State of Acre? Between__ and__ households (190.644)
6. What is the number of municipalities in the State of Acre? Between _ and _ households (22)
7. How many people with foreign nationality reside in the State of Acre? Between _ and _ inhabitants (932)
8. What is the population density of the State of Acre? Between_ and _ inhabitants per km² (4,47)
9. In the State of Acre, what is the number of households with income between ½ and 1 minimum wage? Between _ and _ households (26.644)
10. What is the number of married people in the State of Acre? Between__ and__ inhabitants (149.098)

Note: Respondents who answer more than 10% of the questions incorrectly are defined as acting with overconfidence. For the purposes of statistical analysis, after calculating the results, a value of "0" will be assigned to those who acted overconfidently and a value of "1" for those who did not.

Risk propensity

Please fill in the items below according to your preference, choosing between alternatives "a" and "b"

1. a. 80% chance to win 40,000 Brazilian reais
    b. Receive 32,000 Brazilian reais for sure

2. a. Receive 30,000 Brazilian reais for sure
    b. 20% chance to win 150,000 Brazilian reais

3. a. 90% chance to win 200,000 Brazilian reais
    b. Receive 180,000 Brazilian reais for sure

4. a. Receive 16,000 Brazilian reais for sure
    b. Have a 10% chance of winning 160,000 Brazilian reais

5. a. 50% chance to win 50,000 Brazilian reais
    b. Receive 25,000 Brazilian reais for sure

Demographic Data

1. How old is the business in which you operate?
    _____ year(s)

2. What is your level of education?
    ( ) Incomplete high school
    ( ) Complete high school
    ( ) Incomplete graduation
    ( ) Complete graduation
    ( ) Postgraduate studies

3. Sex
    ( ) Male
    ( ) Female

4. Age
    _____ years