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Overconfidence in Managerial Decision-Making among Brazilian Accountants and Managers: An Experimental Study

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Abstract

The aim of this work is to analyze, by means of an experiment, if the type (positive or negative) and the level (simple or complex) of financial information influence of overconfidence of entrepreneurs and accountants in a managerial decision-making process. The design consists of a 2 x 2 factorial experiment, with four treatments, with the type and level of accounting information as experimental factors. The research was applied to a sample of 68 managers, 86 accountants, and 118 people with different activities (control group). The results showed that the majority of participants present the Overconfidence bias, in the first test, without differentiation of information. They also presented significant evidence that overconfidence can be influenced by the type of information, but not by its level. Moreover, the analysis suggested that the profile of the participants influences the confidence in the projections conducted. The research has shown that the type of financial information influences the overconfidence of entrepreneurs and accountants.

Keywords: overconfidence, decision-making, financial information, behavioral economics, behavioral finance, managerial decision-making

1. Introduction

While also trying to understand the influence of behavioral and cognitive aspects in decision-making, behavioral research intends to study how individuals interact with or influence other individuals, organizations, markets, and society (Birnberg & Ganguly, 2012). This is found in the fields of economy and behavioral finance (Costa et al., 2019). To understand this influence, the terms heuristics and biases started being discussed in economy and finance to identify their influence on financial and managerial decisions (Tversky & Kahneman, 1974).

Heuristics are considered simplifications and mental shortcuts that reduce decision-making time and allow people to solve complex problems with less mental effort (Caputo, 2014). Such simplifications can lead to cognitive biases recurrent in decision-making (Tversky & Kahneman, 1974). As an example, it can be said that people tend to have more confidence in their judgments when using only part of the information available, or when ignoring and acting on impulse in favor of what they believe to be true (García, 2013). Also, they may be vulnerable to cognitive bias during the decision-making stage: information acquisition, evaluation, and comparative judgment formation (Shin & Kim Sang, 2019).

Therefore, people tend to become more confident regarding their knowledge and abilities, increasing their ignorance about the associated risk. This excessive confidence in decisions is characterized as a cognitive bias called overconfidence (Kumar & Goyal, 2015).

Research regarding overconfidence in decision-making has opened a promising path to understanding decisions related to the choices of accounting and management policies (Habib & Hossain, 2013). Therefore, overconfidence plays an important role in corporate and entrepreneurial behavior (Hsieh et al., 2014). It may be beneficial when deciding to become a manager but it is harmful when making decisions in response to setbacks (Trevelyan, 2008).

Research related to overconfidence in corporate policies, including accounting, as well as in the decision-making process, is important. Such overconfidence may lead individuals to an erroneous notion of their abilities (Hilary & Hsu, 2011). It may lead them to harmful decisions (Fellner & Krügel, 2012) or induce them to make decisions that can destroy the company's value (Ahmed & Duellman, 2013). This increases their ignorance about the risks associated with the decision, even influencing the logic and rationality of the decision to be taken (Kumar & Goyal, 2015).

In addition, the related literature has shown that business managers are overconfident in the estimate of cash flows (Ahmed & Duellman, 2013), the projects' return on investment (Malmendier & Tate, 2005), mergers and acquisitions (Malmendier & Tate, 2008), the possibility of overconfidence-related losses (Camerer & Lovallo, 1999), the cost allocation systems (Jermias, 2006), the stock and financial markets (Ben-David et al., 2013; Biais et al., 2005; Merkle, 2017), the forecasts about the financial market (Liu & Tan, 2021) and the earning management (Hsieh et al., 2014).

It should be emphasized that the overconfidence bias is one of the most analyzed behavioral biases by researchers in economics and finance, as this is related to investment decisions and return forecasts (Merkle & Weber, 2011). Overconfidence is found in decision-making and entrepreneurship studies (Engelen et al., 2015; Invernizzi et al., 2017; Koellinger et al., 2007; Simon & Shrader, 2012), is one of the most studied biases in the field of behavioral finance (Costa et al., 2017). With this, Goldfarb et al. (2012) explain that the overconfidence role in management decisions and companies' performance is a field of research to understand the way behavior influences the managerial decision-making process.

According to the literature above, the decision-maker can use heuristics and biases to simplify the decision-making process (Tversky & Kahneman, 1974). This unfurls a discussion on the relationship between the available financial information and the decision-making process. And if such information influences the overconfidence of the decision-maker of those who help them. The studies by Costa et al. (2018) and Costa et al. (2020) used financial information to assess the anchoring and confirmation biases in the decision of managers and accountants. Therefore, the present work establishes a difference when using financial information in the analysis of overconfidence in management decisions.

However, we consider that the literature still lacks studies reporting the influence of financial information in overconfidence, during the managerial decision-making process. Especially when these decisions are related to accountants and managers. Thus, analyzing the overconfidence of managers and accountants is necessary, particularly because the accountant assists the manager in the interpretation of accounting and financial information and making decisions (Rieg, 2018).

In this study, we advocate testing the relevance of the financial information's type and complexity in the overconfidence level of individuals when facing managerial decision-making processes. More specifically, to verify if the incidence of such bias in managers and accountants increases or decreases, as the information highlighted may have positive or negative tendencies. Also, a simple or complex way to present it may cause changes in the confidence displayed by the decision-maker. This is supported by the theory of choice architecture, which assumes that the way information is presented to the individual indirectly influences the decision (Thaler & Sunstein, 2008).

There is evidence that managers tend to defer responding to bad news and that accounting conservatism mitigates the damaging effect of overconfidence (Hsu et al., 2017). This relationship, and the fact that the accountant, besides preparing accounting reports, assists the manager in decision-making (Rieg, 2018), poses several issues. We need to understand if the choice architecture (Thaler & Sunstein, 2008) and the way (Tversky & Kahneman, 1981) this type of information is presented increase or decrease overconfidence incidence. The following question emerges: does overconfidence, shown by managers and accountants in managerial decision-making processes, change when facing the complexity and the type of financial information available?

This work intends to analyze, through an experiment, if the type (positive or negative), and the level (simple or complex) of financial information, such as sales revenue projections, operating expenses, and results, can influence the overconfidence of managers and accountants in the managerial decision-making process.

Studies by Daniel et al. (1998), Klayman et al. (1999), Fellner and Krügel (2012), Gloede and Menkhoff (2014), Bar-Yosef and Venezia (2014), Invernizzi et al. (2017), Seifzadeh et al. (2021) and Hsu et al. (2017) assess the overconfidence in the use of information during the decision-making process. However, the present study fills an existing gap by using accounting information in the assessment of overconfidence in accountants and managers. More precisely, it helps by assessing whether the type (negative or positive information) and the level (simple or complex information) influence overconfidence in the management decision-making process.

Thus, this study contributes to the literature by pointing out that positive financial information increases the overconfidence of managers and accountants in managerial decisions, whilst negative information decreases overconfidence. In addition, it contributes to a new way of evaluating overconfidence in the use of accounting information in the management decision process. This work can be a factor for the definition of financial statements that may minimize the effects of overconfidence and serve as a premise for the application of the Nudge theory (Thaler & Sunstein, 2008). This way, managers can use the information to improve their decisions.

2. The Essence of Decision Making: Theoretical Background

2.1 Overconfidence in Decision Making

The overconfidence bias, i.e., an unwarranted belief in the intuitive reasoning of a cognitive and judgment ability (Pompian, 2012), has been widely studied by psychology since the 1960s (Habib & Hossain, 2013). The term was first described by Oskamp (1965) in the work called *Overconfidence in Case-Study Judgments,* published in 1965 (Busenitz & Barney, 1997). In economy and finance, overconfidence reached its hallmark in the 1990s and 2000s, respectively (Habib & Hossain, 2013).

Overconfidence is not only apparent but also a consequence of a psychological bias. Consequently, this leads people to have much confidence in their abilities (Merkle & Weber, 2011) by refusing to process all the information available (Ludwig & Nafziger, 2011). This is found in children's cognitive and motor skills (Da Silva et al., 2015). For Russo and Schoemaker (1992), the cognitive causes of overconfidence are availability, anchorage, confirmation, and retrospective biases.

This way, overconfidence has been shown in the excessive confidence in the estimation of one's performance (*overestimation)*, of one's performance concerning others (*overplacement)*, and in the excessive application of estimation on future uncertainties (*miscalibration* or *overprecision)* (Fellner & Krügel, 2012; Gloede & Menkhoff, 2014;

Moore & Healy, 2008; Peón et al., 2015).

For Lévy-Garboua et al. (2018), individuals can also learn to be overconfident and, in some cases, they can do so even before learning an associated skill.

In the field of finance, professionals have also shown overconfidence in their performance (Gloede & Menkhoff, 2014), in accounting forecasts and financial indicators during investments (Bar-Yosef & Venezia, 2014), as well as the positive past performance to predict future results (Libby & Rennekamp, 2012). Also, research has revealed that overconfident investors negotiate excessively, achieving smaller returns. Men are also more prone to overconfidence than women, since the former negotiate more than the latter, presenting a worse performance in their returns (Barber & Odean, 2001).

Menkhoff et al. (2013) indicated that individual investors have a higher level of overconfidence than institutional investors. Also, they suggested that overconfidence seems to increase with age and decrease with experience.

Moreover, studies have shown that overconfidence is higher due to the influence of positive emotions, such as mood and happiness than for negative emotions, such as anger, fear, and sadness, (Ifcher & Zarghamee, 2014; Merkle & Weber, 2011). Also, people who seek higher-risk loaning strategies have a more aggressive behavioral profile, presenting higher overconfidence levels (Peón et al., 2015). Overconfidence can persist because of the entrepreneur´s overconfident behavior (Bernardo & Welch, 2001).

Overconfidence has also been observed in business decisions. For Li et al. (2020), overconfidence can affect how managers make their decisions. In turn, this can influence the company’s decisions. The study by Hsieh et al. (2014) showed that, before the Sarbanes Oxley Act of 2002, overconfident CEOs were more engaged in managing results than less confident counterparts. Also, the results showed that the earnings management trends by overconfident CEOs decreased with the implementation of the aforementioned law.

Furthermore, Libby and Rennekamp (2012) noted that experienced managers believe that other managers tend to overestimate expectations, contributing to the company's positive performance. Also, overconfidence exists when forecasting future profits. Heaton (2002) points out that individuals can be optimistic about their predictions since they believe that they have great control over the company’s performance. The greater the feeling of control and the commitment to the company, the greater the optimism in the projections. In addition, experienced professionals tend to have a higher level of overconfidence than those with no experience (Bar-Yosef & Venezia, 2014).

In their study, Invernizzi et al. (2017) show that entrepreneurs are subject to making overconfident budget forecasts, which are directly associated with the company's failure. The authors noted that overconfidence is found in the EBITDA and equity forecasts and is associated with an entrepreneur's financial difficulties. Using an experiment and a survey with experienced financial managers, the work by Libby and Rennekamp (2012) provides

evidence that at least one additional factor in the decision about forecasting may be managerial overconfidence, caused by the use of past positive performance to explain current positive performance.

2.2 Overconfidence in the Use of Information

Regarding the use of information, Daniel et al. (1998) noted that investors tend to react more promptly to private information and become more confident than when the information is public. Also, more conservative accounting information makes the manager recognize the problem and seek solutions early (Hsu et al., 2017). With this, Hsu et al. (2017) demonstrated that companies that adopt accounting conservatism, whilst having managers with excessive confinement, tend to perform better. On the other hand, consolidated managers are more likely to provide less legible financial statements (Seifzadeh et al., 2021)

Other studies have found a relationship between overconfidence and the information type, whether public or private. In this sense, Daniel et al. (1998) developed a theory that combined investor confidence and self-attribution bias, noting that investors react more to private information and become more confident than when information is public. Furthermore, while using financial information, Liu and Tan (2021) found that overconfident individuals made less accurate stock price predictions.

Thus, in behavioral economics and finance models, overconfidence is used to explain the different instances of harmful decision-making, since the decision-maker may be oblivious to the excessive reliability that he has on the results of private information (Fellner & Krügel, 2012).

Regarding the use of information, the results of Gloede and Menkhoff (2014) indicated that fundamental analysis has a significant negative impact on the overconfidence of fund managers. As this is a complex analysis, this result corroborates Bar-Yosef and Venezia (2014) findings, when saying that the complexity of the task reduces overconfidence.

According to Gloede and Menkhoff (2014), this occurs because managers use complex analytical methods instead of simple techniques. Even if they rely on good luck, the sophistication of the analysis reduces the overconfidence bias. Also, the authors analyzed that overconfidence is related to the herding effect, as both are influenced by risk aversion, in addition to being driven by market opinion.

Conversely, Grieco and Hogarth (2009) found that the participants were overconfident in difficult tasks and lacked confidence in easy tasks. On the other hand, individuals were overconfident when dealing with easy tasks and insecure when tackling difficult tasks. For Klayman et al. (1999), differences in overconfidence between domains and individuals point to systematic effects of information content, information processing, and the relationship between them.

As indicated by Zacharakis and Shepherd (2001), a greater information volume can make individuals believe that they are making better decisions, indicating an increase in their

confidence level in decisions. In this sense, the authors point out that the type of information can influence the overconfidence level presented by decision-makers, even though this does not reflect in effectively better decisions. Thus, familiarity, the amount of information (more or less detailed), and its type can increase individuals' overconfidence in their predictions (Bar-Yosef & Venezia, 2014; Zacharakis & Shepherd, 2001).

Although it is observed, overconfidence can be minimized in some situations. The theory cognitive dissonance theory (Festinger, 1957) explains that, in the face of two different situations that do not coincide, there will be dissonance, leading the individual to look for consistencies that approve his decisions. Therefore, manipulations in cognitive dissonance can reduce overconfidence (Blanton et al., 2001), suggesting that the information availability (Tversky & Kahneman, 1974) and the architecture of choice and nudges (Thaler & Sunstein, 2008) can influence cognitive dissonance (Shantha Gowri & Ram, 2019), consequently curbing overconfidence (Tasoff & Letzler, 2014).

Furthermore, Invernizzi et al. (2017) proved that it is possible to reduce overconfidence by increasing entrepreneurs' educational levels and using accounting systems or budget control.

3. Methodology

3.1 Experimental Participants

Experimental research (Appendix A) was conducted among Brazilian accountants and SME managers to investigate the impact of financial information on their confidence levels. The research aimed to determine whether the type (positive or negative) and level (simple or complex) of financial information, such as sales revenue projections, operating expenses, and results, can affect overconfidence in these individuals.

The experiment was carried out online, through a computerized system that simulates a business environment. The research subjects would have to decide whether or not to open a subsidiary of a fictitious company. This made-up environment serves both to evidence the presence of overconfidence in the situation addressed, while also to analyze whether the type and level of financial information can influence the disclosure of overconfidence.

The study relied on the voluntary participation of a sample, after eradicating incomplete answers. In the experiment, they identified themselves as accountants (86 participants), managers (68 participants), and people with different activities (118 participants), which constituted the control group. This sample is deemed non-probabilistic for accessibility. The sample size and the difference in the number of individuals per profile are caused by the complexity of the experiment and people's lack of interest in participating in it. Researching the relationship between the manager and the accountant is necessary because the latter prepares the accounting information and supports the former in making decisions (Rieg, 2018). Also, the control group was proposed to improve the experiment's validity.

This sample was obtained after sharing the experiment (Appendix A) on different social media platforms and emails sent to different professionals in Brazil. The data were

electronically and anonymously and the professional profile was controlled in each group. After agreeing to the Free and Informed Consent Form, the participants started the experiment, approved by the Ethics Committee.

3.2 Data Collection Instrument

We built a computerized system for measuring the overconfidence bias in a simulated business environment to apply the experiment and data collection. The information was presented to respondents in a decision-making process on whether or not to open a subsidiary of a company, as detailed in Appendix A. In addition, internet-based research can collect data on the actual behaviors, expanding the research's scope beyond the samples that only use university and laboratory studies (Gosling & Mason, 2015).

Specifically, the experiment was built in two phases. These took place according to the details available in Appendix A – placing the research subjects in a situation in which they had to make a managerial decision to open or not a subsidiary of a fictitious company in a different location of the head office. The first phase consisted of presenting the participant with a case broadcast by the media about a company that operates in a similar industry. The second phase comprised the presentation of financial information from the company.

In the experiment's first phase, all participants were given the same information and had to make a percentage projection on sales revenue, operating expenses, and the result (profit or loss) of the branch to be opened. After that, they were asked to assign, on a scale of 0 (little confidence) to 5 (much confidence), a degree of confidence concerning the estimates made.

In the experiment's second phase, the participants were given financial information from the last three years of the fictitious company's headquarters. The information presented to the participants in the second phase was based on Costa et al. (2018) and Costa et al. (2020). This information was presented differently to the participants about its form and content. Thus, the type and level of financial information were considered experimental treatment factors, as shown in Table 1.

Table 1. Factors used in the experiment

Experimental factors	Definition
Professional profile	Accountants
	Managers
	Control group (other professionals and students)
Type of information	Positive
	Negative
Level of information	Simple
	Complex

Note. Outlined by the authors based on Costa et al (2018, 2020).

The "type of information" factor was composed of information of a positive and negative nature. Positive information can positively influence the decision, such as an increase in revenue and profit over the three years informed; and negative information can negatively influence the decision, such as decreased revenue and losses, during the same period. On the other hand, the "level of information" factor was formed by simple and complex information concerning how the information is made available and how the volume of information is presented to individuals. All this aligned with the choice architecture theory (Thaler & Sunstein, 2008). Simple information is presented in tables and complex information is in Balance Sheets and Income Statements.

The professional profile, of both managers and accountants, was considered as an intrinsic factor of the experiment (Table 1). Furthermore, the experiment had a control group constituted of several professionals and students.

3.3 Experimental Design

Four different treatments were generated based on the factorial experiment of the 2x2 type, information type and level, according to Table 2 (Dean & Voss, 1999). When including the intrinsic factor – the professional profile –, this is a factorial experiment, with a fixed effect, encompassing three factors with experimental factors – information type and level –, having two levels each (Dean & Voss, 1999).

Therefore, the participants – such as accountants and managers – and the control group were exposed, in a random way, to four treatments related to the treatment factors level and type, with the value 0 being assigned for simple information; value 1 for complex information; value 0 for positive information; and value 1 for negative information. The first treatment has simple information (factor level = 0) and positive information (factor type = 0); the second treatment has simple information (factor level = 0) and negative information (factor type = 1); the third treatment has complex information (factor level = 1) and positive information (factor type = 0); and, finally, the fourth treatment has complex information (factor level = 1) and negative information (factor type = 1). The treatments can be observed in Table 2.

Table 2. Details of the treatments applied to the research's subjects.

TREATMENTS	LEVEL OF INFORMATION	TYPE OF INFORMATION
Treatment 1	Simple (0)	Positive (0)
Treatment 2	Simple (0)	Negative (1)
Treatment 3	Complex (1)	Positive (0)
Treatment 4	Complex (1)	Negative (0)

Note. Outlined by the authors based on Costa et al (2018, 2020).

The treatments, according to Table 2, were applied to the research subjects in a random way (Dean & Voss, 1999), using a computerized system that randomly selects one of the four existing treatments for each participant, whether they are accountants, managers, or participants in the control group, as soon as they enter the experiment link.

3.4 Measuring Research Variables

The overconfidence was measured through two response variables, gathered from a minimum (MIN) and maximum (MAX) estimates (Russo & Schoemaker, 1992) of the revenue, operating expenses, and the result (profit or loss). And, immediately after, based on the indication of the level of confidence in the estimates (Fischhoff et al., 1977). Thus, the overconfidence indicators were constructed from the interval between the minimum and maximum estimate of a variable (Fellner & Krügel, 2012; Invernizzi et al., 2017).

To obtain the first variable, the research subject was asked to conduct minimum and maximum estimates of the sales revenue, operating expenses, and result in two phases: the first without the influence of the type and level factors; and the second with the influence of these factors. From these estimates, we obtained an Overconfidence Index (OI) for each projection (sales revenue, operating expenses, and result), in the experiment's two phases, using the following formula:

$$OI = \frac{|MAX| - |MIN|}{|MAX|} \quad (1)$$

OI is a continuous variable between 0 and 1, in which the closer to 0, the greater the overconfidence. This proximity to 0 indicates that the confidence intervals are too narrow, causing an overestimation of the knowledge accuracy, named *miscalibration* (Fellner & Krügel, 2012). Oppositely, the closer the index is to 1, the smaller the overconfidence.

Based on the individual obtainment of the indexes, a General Overconfidence Index (GOI) was obtained for each phase, using the average obtained between the indexes found in the projections of sales revenue (OI_v), operating expenses (OI_d), and result (OI_r), in the following way:

$$GOI = \frac{OI_v + OI_d + OI_r}{3} \quad (2)$$

The second response variable represents the overconfidence level *(OL)* of the researched subject. This was obtained from the statement of the researched individual on his confidence in the estimates, characterized as a continuous variable in a 0-5 scale, in which the closer to 5, the greater the overconfidence, and the closer to 0, the smaller the overconfidence. The confidence statement was conducted for all of the projections made in the first and second phases using a confidence statement for the estimates of sales revenue *(OLv)*, operational expenses *(OLd)*, and the result *(OLr)*. From this, the General Overconfidence Level *(GOL)*

was found in each of the experiment phases through the average overconfidence levels found in each estimate. Overconfidence in estimating one's performance is known as overestimation (Moore & Healy, 2008; Peón et al., 2015).

3.5 Data Analysis Procedure

The statistical approach consisted of implementing the analysis of variance model (ANOVA) and the approximate permutation tests to assess the relationships between the response variables and the factors under analysis in the experiment's two phases (Phase 1 and Phase 2). This division of the experiment into different phases was intended to help analyze the influence of the factors Type of Information and Level of Information in the Overconfidence of the participants. Only the second phase of the experiment dealt with the influence of such experimental treatment factors.

All the interactions of the three factors, under scrutiny in the analysis of variance procedures and the approximate permutation tests, were incorporated: professional profile (accountant, manager, and others), type of information (positive or negative), and level of information (simple or complex). In most cases, both the graphical analysis and the formal testing of the residues of the variance analysis models provided strong evidence of the non-normality of the residual distribution. With this being said, only the p-values of the approximate permutation tests will be reported.

The approximate permutation tests are valid alternatives concerning the variance analysis. The assumptions of normality or random sampling are violated and also where there is evidence of the presence of outliers (Hayes, 1998). For the approximate permutation tests, the maximum number of possible sampled permutations was established at ten million and up until the standard error was less than 0.01% of the estimated *p*-value.

All analyses were implemented using the R language (R Core Team, 2017) and some libraries were developed for this language, particularly the *lmPerm package* developed by Wheeler and Torchiano (2016).

4. Results and Discussion

The research resulted in 272 participants, with 86 accountants (profile 1), 68 managers (profile 2), and 118 people in the control group (profile 3). Table 3 indicates the number of individuals who participated in the experiment by profile and gender.

Table 3. Frequency of experiment participants by professional profile and gender

Gender/Profile	Accountant	Manager	Control Group	Total
Male	56	60	87	203
Female	30	8	31	69
Total	86	68	118	272

Note. Outlined by the authors.

Table 3 shows that 31.72% of the sample was composed of accountants, 25% of managers, and 43.38% of other types of professionals or students. On the other hand, the number of men participating was 74.63% and women 25.36%. The values indicated overconfidence in the General Overconfidence Index (GOI) and the General Overconfidence Level.

We must highlight that the General Overconfidence Level (GOL) is obtained using the average of Overconfidence Levels in each experiment phase, ranging between 0 and 5. The closer to 5, the greater the overconfidence. On the other hand, the General Overconfidence Index (GOI) is the average of the overconfidence indexes obtained in each phase of the experiment, ranging between 0 and 1. The closer to 0, the greater the overconfidence.

Table 4 displays the mean and average values observed in GOL and GOI for both experiment phases, as well as a percentage of individuals who presented values higher than 2.5 for the GOL and smaller than 0.5 for the GOI.

Table 4. Results of the average overconfidence level

Variables	Median Observed	Average values observed	Individuals who presented GOL ≤ 0.5 and GOI ≥ 2.5
General Overconfidence Index (GOI) - Phase 1	0.48	0.48	56%
General Overconfidence Level (GOL) - Phase 1	3.62	3.54	91%
General Overconfidence Index (GOI) - Phase 2	0.33	0.33	82%
General Overconfidence Level (GOL) - Phase 2	3.63	3.51	87%

Note. Outlined by the authors.

Table 4 shows that the mean values observed for GOI were marginally lower than 0.5 in the first and second phases. Furthermore, the mean values verified for the GOL were greater than 2.5, suggesting that the subjects may present overconfidence in their self-statements of confidence in projections. According to the criteria used, 56% and 82% of the participants displayed possible overconfidence in the GOI in the first and second phases, respectively. Also, 91% and 87% of individuals displayed possible overconfidence in the GOL, respectively, in the two phases of the experiment, aligned with the literature (Bar-Yosef & Venezia, 2014; Fellner & Krügel, 2012; Gloede & Menkhoff, 2014; Invernizzi et al., 2017; Ludwig & Nafziger, 2011).

Figure 1 shows the average behavior of GOI and GOL for professional profiles concerning the four treatments, using a graphical exploratory analysis. The averages for the GOI were less than 0.5, revealing the overconfidence of most participants in all treatments. Thus, overconfidence is observed in estimates of future uncertainties (miscalibration) in accountants, managers, and the control group, as described by Moore and Healy (2008), Fellner and Krügel (2012), and Peón et al. (2015). Regarding GOL, we observe that the averages in all treatments were higher than 2.5, demonstrating the participants' overconfidence in their projections. Once more, this evidence suggests that the participants are overconfident about the estimate of their performance (overestimation), consistent with the findings of (Moore & Healy, 2008; Peón et al., 2015).

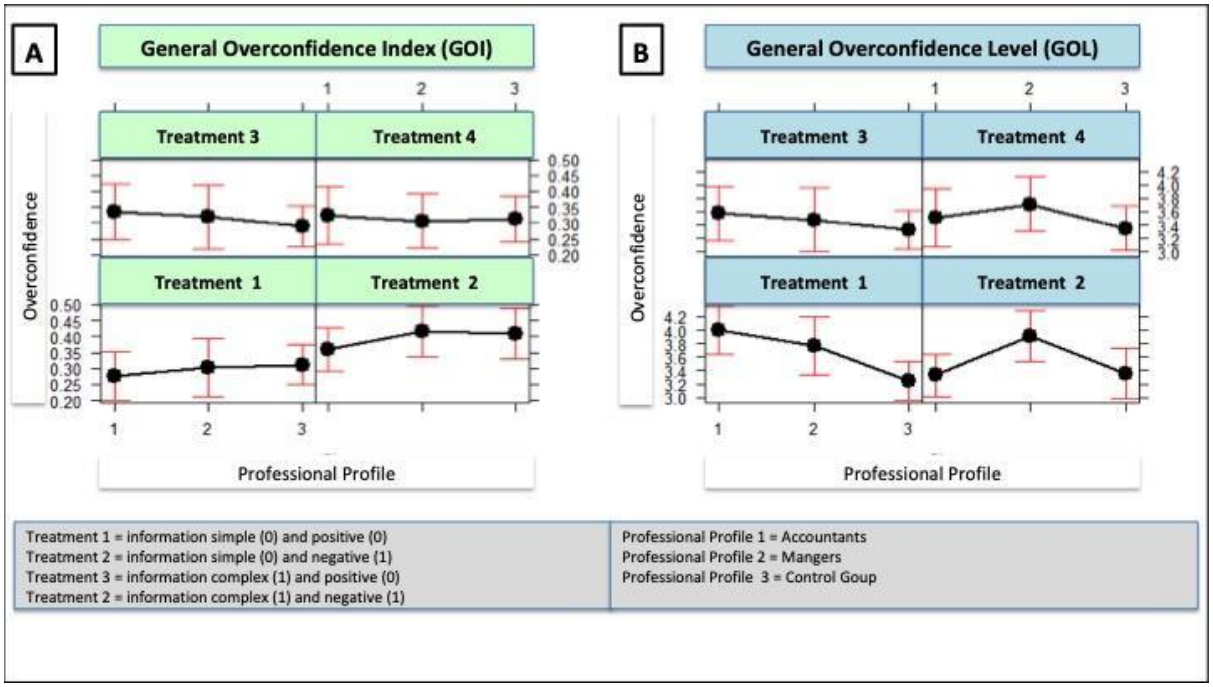

Figure 1. Effects graphic when comparing the averages of the GOI and the GOL for each group of participants concerning the treatments

Note. Outlined by the authors through the *R output*.

Figure 1 (A) shows that, in the third treatment, the control group obtained greater

overconfidence and the counters lower than one. In the fourth treatment, the means presented no differences. Also, both the first and second treatments show greater overconfidence in accountants. We observe also that the highest averages of the GOI are in the second treatment. The possible justification for this result is the presence of negative information, evidenced by a level of simplified information. The results still show that, for a complex level of information (treatments 3 and 4), regardless of whether the information is positive or negative, the averages were quite similar. This cannot be observed when the level of information is simple (treatments 1 and 2), suggesting that complex information can make it difficult to interpret the information.

On the other hand, through Figure 1 (B), the results show that the lowest GOL in all treatments is found in the control group and that the averages are similar in the four treatments. This may be justified by these people's modest familiarity with accounting and financial information. It should be noted that the accountants showed greater overconfidence when the information was positive (treatments 1 and 3). The managers showed greater overconfidence when the information was presented negatively (treatments 2 and 4). In this sense, the evidence suggests that accountants have more experience with accounting information, in addition to being more conservative (Hsu et al., 2017). This may lead to greater overconfidence when the information is positive and less when negative. About this, (Menkhoff et al., 2013) found evidence that experience lowers overconfidence.

To assess if the factors under analysis influence the overconfidence indexes observed and defined as response variables, approximate permutation tests for all interactions of the factors were implemented (Profile, Type and Level). These approached the response variable General Overconfidence Index, in Phases 1 and 2 of the experiment, having as its main focus the second phase, since it was influenced by the treatment factors Type and Level. Thus, Table 5 shows the approximate p-values for the interactions obtained in Phase 1 and Phase 2 of the experiment.

Table 5. ANOVA and Approximate Permutation Test for the response variable General Overconfidence Index (GOI)

Factors	PHASE 1									
	Anova					Permutation Test				
	Df.	Sum Sq.	Mean Sq.	F value	*p*-value	Df.	Sum Sq.	Mean Sq.	Inter.	*p*-value
Type	1	0.055	0.054	1.388	0.2400	1	0.090	0.090	1e+07	0.1311
Type x Level	1	0.002	0.001	0.043	0.8360	1	0.013	0.013	1e+07	0.5577
Factors	**PHASE 2**									
	Anova					Permutation Test				
	Df.	Sum Sq.	Mean Sq.	F value	*p*-value	Df.	Sum Sq.	Mean Sq.	Inter	*p*-value
Type	1	0.170	0.170	4.930	0.0273**	1	0.144	0.144	1083	0.0849*
Type x Level	1	0.143	0.143	4.132	0.0431**	1	0.149	0.149	230	0.3043

Notes: ** < 0.01; ** < 0.05; * < 0,10

Note. Outlined by the authors.

According to Table 5, the Permutation Test results indicate that, in Phase 2 of the experiment, there is evidence that the type of information (p-value = 0.0849), whether positive or negative, impacts the average of the Overconfidence Indexes of the projections. The interactions between the remaining factors were not statistically significant. As expected, the main effects and interactions were not significant in the experiment's first phase, not providing evidence that they influence the mean of the Overconfidence Index. After all, the information presented to the participants was the same, not being influenced by both type and level.

Approximate permutation tests were also implemented on the indexes found in the estimates of sales revenue, operating expenses, and result in the two phases of the experiment. As displayed in Table 6, the only significant factor was the type of information (p-value = 0.000) for the projection of the result (profit or loss) in the experiment's second phase. The other factors and their interactions were not statistically significant for the estimates of the result of the sales revenue and operating expenses in the two phases of the experiment.

Table 6. ANOVA and Approximate Permutation Test for the response variable Overconfidence Index on the Projection of Result (OI_R)

Factors	**PHASE 1**									
	Anova					**Permutation Test**				
	Df.	**Sum Sq.**	**Mean Sq.**	**F value**	***p*-value**	**Df.**	**Sum Sq.**	**Mean Sq.**	**Inter.**	***p*-value**
Type	1	0.061	0.060	0.885	0.3480	1	0.077	0.077	1e+07	0.2887
Factors	**PHASE 2**									
	Anova					**Permutation Test**				
	Df.	**Sum Sq.**	**Mean Sq.**	**F value**	***p*-value**	**Df.**	**Sum Sq.**	**Mean Sq.**	**Inter**	***p*-value**
Type	1	1.457	1.457	22.61	0.0000 ***	1	1.442	1.442	1e+07	0.000 ***

Notes: ** < 0,01; ** < 0,05; * < 0,10

Note. Outlined by the authors.

According to this argument, we noticed that the Overconfidence Index that influenced the General Confidence Index the most was the index obtained in the projections of the result, during the experiment's second phase.

The other response variable tested was the General Overconfidence Level, consisting of the participants' statement on their level of confidence in their estimates (*overestimation)* of the variables result, sales revenue, and operating expenses. Under which the implemented

approximate permutation test included all the interactions of the factors (Profile, Type and Level) for the experiment's two phases. Table 7 indicates that the main effect of the profile factor and the interaction between the profile and the type were significant for the two phases of the experiment. The other interactions were not statistically significant.

Table 7. ANOVA and Approximate Permutation Test for the variable General Overconfidence Level (GOL)

Factors	**PHASE 1**									
	Anova					**Permutation Test**				
	Df.	**Sum Sq.**	**Mean Sq.**	**F value**	***p*-value**	**Df.**	**Sum Sq.**	**Mean Sq.**	**Inter.**	***p*-value**
Profile	2	4.30	2.147	3.246	0,0405 **	2	3.618	1.808	1e+07	0.0656 *
Profile x Type	2	3.18	1.591	2.405	0.0922 *	2	2.219	1.109	1e+07	0.1868
Factors	**PHASE 2**									
	Anova					**Permutation Test**				
	Df.	**Sum Sq.**	**Mean Sq.**	**F value**	***p*-value**	**Df.**	**Sum Sq.**	**Mean Sq.**	**Inter**	***p*-value**
Profile	2	8.90	4.449	5.883	0.0031 ***	2	7.681	3.840	5000	0.0004 ***
Profile x Type	2	4.44	2.218	2.933	0.0550 *	2	3.457	1.728	781	0.1652

Notes: ** < 0,01; ** < 0,05; * < 0,10

Note. Outlined by the authors.

Also, using this variable (profile), we observe that the accountants, managers, and the control group present, on average, overconfidence in the two phases of the experiment. However, the results show differences between the averages of General Overconfidence Levels of managers and those in the control group. This result is observed in the first phase of the experiment: managers have, on average, greater overconfidence (3.6767) in their projections than the control group (3.4005); and the Overconfidence Level of managers and the control group did not differ significantly from accountant's average Overconfidence Level (3.6320).

Moreover, in the experiment's second stage, the accountants also presented a higher Overconfidence Level (3.7438) in their projections than the control group (3.3130). In contrast, the accountants' average (3.5937) did not present a significant difference from those of the managers and the control group. We noticed that the managers have the highest confidence in their estimates, which may be connected to their managerial standpoint (Schade & Koellinger, 2007), reinforcing the statements of Ahmed and Duellman (2013). These mention that managers tend to overestimate the cash flows and future returns.

We also analyzed whether the Overconfidence Level influenced the general Overconfidence Level in estimates of sales revenue, operating expenses, and results. As displayed in Table 8, the only statistically significant variables were the profile and the interaction of the profile with the type of information for the Overconfidence Level on the Result Projection.

Table 8. ANOVA and Approximate Permutation Test for the variable Overconfidence Level on the Result Projection (OL_r)

Factors	**PHASE 1**									
	Anova					**Permutation Test**				
	Df.	**Sum Sq.**	**Mean Sq.**	**F value**	***p*-value**	**Df.**	**Sum Sq.**	**Mean Sq.**	**Inter.**	***p*-value**
Profile	2	6.9	3.425	2.770	0.0645 *	2	5.22	2.610	1e+07	0.1221
Profile x Type	2	8.2	4.111	3.325	0.0375 **	2	6.38	3.189	1e+07	0.0767 *
Factors	**PHASE 2**									
	Anova					**Permutation Test**				
	Df.	**Sum Sq.**	**Mean Sq.**	**F value**	***p*-value**	**Df.**	**Sum Sq.**	**Mean Sq.**	**Inter**	***p*-value**
Profile	2	10.9	5.432	4.223	0.0157 **	2	9.58	4.791	1e+07	0.0253 **
Profile x Type	2	6.7	3.328	2.588	0.0771 *	2	5.44	2.720	1e+07	0.1236

Notes: ** < 0,01; ** < 0,05; * < 0,10

Source: Outlined by the authors.

As displayed in Table 8, there is evidence that the participant's profile may influence the scoring average given by each participant to the confidence level in each one of the projections conducted for the result in the experiment's second stage. In the first phase, the p-value was approximately 0.1221 and, in the second phase, the p-value for the ANOVA was 0.0157. The Tukey Multiple Comparison Test (p-value 0.0192), in the experiment's second phase, also provides evidence that there are significant differences between the Overconfidence Levels means in the managers' result projection (3.7650) when compared to the control group (3.2870). This shows that the managers have more overconfidence than the control group. The average confidence of accountants (3.5940) has no significant difference concerning the managers and the control group.

4. Conclusion

The research intended to analyze, through an experiment, if the type (positive or negative) and the level (simple or complex) of financial information influence the overconfidence of accountants and managers in a managerial decision-making process.

To achieve it, the response variables were obtained through the experiment: overconfidence index and overconfidence level. The results of the analysis of variance and the approximate permutation test provided evidence that the type of information can influence the average of the General Overconfidence Index; also, the profile of the participants can influence the average General Overconfidence Level. Moreover, it is possible to observe that the result (profit or loss) projection has more influence on the Overconfidence Index and Level than sales revenue and operating expenses projections.

It is also observable that the accountants, managers, and control group presented themselves as overconfident in the projections of accounting variables, which is compatible with Invernizzi et al. (2017). Furthermore, there is also the confidence statement in such projections, suggesting the presence of overconfidence in estimates about future uncertainties (miscalibration) and overconfidence in the estimation of one's performance (overestimation) (Fellner & Krügel, 2012; Gloede & Menkhoff, 2014; Moore & Healy, 2008; Peón et al., 2015).

Also, it can be inferred that the type of information influenced overconfidence. In other words, the positive information increased the overconfidence in the projections. The negative information decreased the overconfidence presented by the participants. These differences are more noticeable when the information is related to the result (profit or loss). This finding is consistent with the fact that more conservative information mitigates the negative effect of overconfidence (Hsu et al., 2017). Moreover, it was found that the profile of the individual (manager, accountant, or control group) influenced the confidence of the individuals in their projections, displaying a significant difference in the averages of managers concerning the ones in the control group. This proves that managers are more confident than other professionals (control group) who are not involved in managerial activity. No significant differences were found in confidence in the projections of accountants concerning managers and other professionals.

We conclude that the type of information influences the overconfidence of accountants and managers. Positive information increases the overconfidence of these professionals and negative information reduces the overconfidence in the managerial decision-making process. Also, we conclude that there is no significant evidence that the level of information (simple or complex) influences the overconfidence of accountants and managers when making management decisions.

Therefore, this work contributes theoretically to an existing gap by analyzing whether financial information influences the overconfidence of accountants and managers in a managerial decision-making process. In addition, this study contributes by presenting a methodological alternative to analyze overconfidence in the use of accounting information.

The limitations are found in the size of the sample obtained and the difference in the number of researches by profile caused by the experiment's complexity and the people's lack of interest in participating in it.

Future studies should use different methods to test whether the type and complexity of information are related to overconfidence estimation. New studies should also keep delving into how accountants and managers should lead with the type of information to improve the decision-making process. Also, future studies should apply the experiment to different samples and use other types of information to verify the consistency of these main results. Finally, since it is a complex experiment with human beings, not all variables could be controlled or measured, given the size and nature of the sample. The extrapolation of the results may not be valid for other groups of professionals or populations. However, due to the study's originality and contribution, the results can be used as a basis for conducting new experiments to deepen the knowledge on the subject.

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APPENDIX A – Detailing the Experiment

If presented to the individual in the first phase of the experiment.

There is a small retail company operating in your city that has been established for five years and has competitors in the local market. To expand the business, one option is to open a subsidiary in another city. Recently, the media reported on a successful small business in the same sector, which is growing with average monthly revenue of R$175,000.00 and average monthly expenses of R$150,000.00. The company's average monthly net profit is R$25,000.00. The report also noted that the GDP growth rate for the last 12 months is 3%, and the cumulative inflation for the same period is approximately 5%.

Questions to measure the overconfidence in the first phase of the experiment

Question 1. Based on the case reported in the media, please provide the minimum and maximum percentage forecasts for the variables listed below for the upcoming year. This information will be used as a parameter for determining whether to open a subsidiary for your company. Please note that we do not have any additional information at this time.

Sales Forecast

Minimum:_____%
Maximum: _____%

Mark, on a 1 to 5 scale, your level of confidence in the sales forecast (in which 1 is no confidence and 5 is total confidence).

1 | 2 | 3 | 4 | 5

Expenses Forecast

Minimum:_____%
Maximum: _____%

Mark, on a 1 to 5 scale, your level of confidence in the expenses forecast (in which 1 is no confidence and 5 is total confidence).

1 | 2 | 3 | 4 | 5

Outcome Forecast (Profit or Loss)

Minimum:_____%
Maximum: _____%

Mark, on a 1 to 5 scale, your level of confidence in the outcome forecast (in which 1 is no confidence and 5 is total confidence).

1 | 2 | 3 | 4 | 5

Question 2. How would you rate your ability to make business forecasts compared to other

entrepreneurs? Please rate yourself on a scale of 1 to 5, with 1 being much worse and 5 being much better. Please use the table below to indicate your rating.

1 | 2 | 3 | 4 | 5

Financial information presented to the participants of the research in the second phase of the experiment.

During this stage of the experiment, the financial information is impacted by the Level (simple or complex) and Type (positive or negative) factors. Treatment 1 provides simple and positive information, Treatment 2 provides simple and negative information, Treatment 3 provides complex and positive information, and Treatment 4 provides complex and negative information. These treatments are assigned to participants randomly using a specially designed system, as shown in Tables A.1, A.2, A.3, and A.4.

Table A.1: Financial information (simple and positive) presented in the second phase of the experiment for Treatment 1.

INFORMATION	2013	2014	2015
Parent company gross sales revenue for the past three years	460,000.00	600,000.00	780,000.00
Parent company operating costs in the past three years	78,000.00	100,000.00	120,000.00
Parent company profit in the past three years	63,000.00	75,000.00	90,000.00
GDP (accrued in 12 months) of the past three years	2%	4%	3%
Inflation (accrued in 12 months) in the past three years	7%	6%	5%
Interest rate (accrued in 12 months) in the past three years	11%	10%	9%

Table A.2: Financial information (simple and negative) presented in the second phase of the experiment for Treatment 2.

INFORMATION	**2013**	**2014**	**2015**
Parent company gross sales revenue for the past three years	780,000.00	700,000.00	630,000.00
Parent company operating costs in the past three years	140,000.00	126,000.00	120,000.00
Parent company earnings and loss in the past three years	10,000.00	2,000.00	(3,000)
GDP (accrued in 12 months) of the past three years	2%	4%	3%
Inflation (accrued in 12 months) in the past three years	7%	6%	5%
Interest rate (accrued in 12 months) in the past three years	11%	10%	9%

Table A.3: Financial information (complex and positive) presented in the second phase of the experiment for Treatment 3.

BALANCE SHEETS ended on December 31							
							in Reais
ASSET	**2013**	**2014**	**2015**	**LIABILITY**	**2013**	**2014**	**2015**
Current Asset				**Current liability**			
Waivability	46,300	41,400	90,600	Suppliers	72,600	86,000	190,90
Accounts Receivable	86,900	116,90	164,50	Obligations to	1,100	3,800	7,600
Inventory	115,10	195,20	287,90	Payable Tax	3,550	8,550	12,950
				Loans	63,000	21,900	17,200
Total current asset	**248,30**	**353,50**	**543,20**	**Total current liability**	**140,25**	**120,25**	**228,65**
Non-current asset				Non-current liability			
Investments	-	300	300	Long-term Loan		44,300	29,700
Fixed assets	43,800	37,600	31,700	Total non-current		44,300	29,700
Intangible asset	1,150	1,150	1,150				
Total of non-current	**44,950**	**39,050**	**33,150**	**Owners' equity**			
				Capital Stock	70,000	70,000	70,000
				Appropriated retained	83,000	158,00	248,00
				Total Owners' Equity	**153,00**	**228,00**	**318,00**
Total Asset	**293,25 0**	**392,55 0**	**576,35 0**	**Total liability + Owners' equity**	**293,25 0**	**392,55 0**	**576,35 0**

INCOME STATEMENT FOR THE EXERCISES OF			in Reais
	2013	**2014**	**2015**
GROSS PROFIT	460,000	600,000	780,000
(-) Deduction of Gross Income			
(-) Sales Tax	(37,000)	(54,000)	(78,000)
= NET REVENUES	**423,000**	**546,000**	**702,000**
(-) Cost of Merchandise Sold	(280,000)	(360,000)	(482,000)
= GROSS PROFIT	**143,000**	**186,000**	**220,000**
(-) Operating expenses	(78,000)	(100,000)	(120,000)
= PROFIT/LOSS BEFORE THE FINANCIAL RESULT	**65,000**	**36,000**	**100,000**
(+/-) Financial Result	(2,000)	(11,000)	(10,000)
= PROFIT OR LOSS OF THE EXERCISE	**63,000**	**75,000**	**90,000**

INFORMATION	2013	2014	2015
GDP (accrued in 12 months) of the past three years	*2%*	4%	*3%*
Inflation (accrued in 12 months) in the past three	7%	**6%**	*5%*
Interest rate (accrued in 12 months) in the past	**11%**	10%	*9%*

Table A.4: Financial information (complex and negative) presented in the second phase of the experiment for Treatment 4.

BALANCE SHEETS ended on December 31							in Reais
ASSET	**2013**	**2014**	**2015**	**LIABILITY**	**2013**	**2014**	**2015**
Current asset				**Current liability**			
Waivability	46,300	41,400	90,800	Suppliers	95,600	112,000	191,900
Accounts Receivable	86,900	86,900	114,500	Obligations to employees	1,100	3,800	5,600
Inventory	115,100	155,200	187,900	Payable Taxes	3,550	8,550	9,950
				Loans	63,000	51,900	68,200
Total Current Asset	**248,300**	**283,500**	**393,200**	**Total Current Liability**	**163,250**	**176,250**	**275,650**
Non-current asset				**Non-current liability**			
Investments	.	300	300	Long-term loan	30,000	44,300	51,700
Fixed assets	43,800	37,600	31,700	Total of non-current	30,000	44,300	51,700
Intangible asset	1,150	1,150	1,150				
Total of non-current asset	**44,950**	**39,050**	**33,150**	**Owners' equity**			
				Capital Stock	70,000	70,000	70,000
				Profit Reserves	30,000	32,000	29,000
				Total Owners' Equity	**100,000**	**102,000**	**99,000**
Total Asset	**293,250**	**322,550**	**426,350**	**Total liabilities + Owners' equity**	**293,250**	**322,550**	**426,350**

INCOME STATEMNET FOR THE EXERCIESES OF			in Reais
	2013	**2014**	**2015**
GROSS REVENUE	780,000	700,000	630,000
(-) Deduction from Gross Revenue (-) Taxes on sales	(78,000)	(70,000	(63,000)
= NET REVENUE	**702,000**	**630,000**	**567,000**
(-) Cost of merchandise sold	(540,000)	(490,000)	(440,000)
= GROSS PROFIT	**162,000**	**140,000**	**127,000**
(-) Operating expenses	(140,000)	(126,000)	(120,000)
= PROFIT AND LOSS BEFORE THE INCOME STATEMENT	**22,000**	**14,000**	**7,000**
(+/-) Financial Result	(12,000)	(12,000)	(10,000)

INFORMATION	**2013**	**2014**	**2015**
GDP (accrued in 12 months) of the past three	*2%*	***4%***	3%
Inflation (accrued in 12 months) in the past three	*<**7%***	***6%***	5%
Interest rate (accrued in 12 months) in the past	**11%**	10%	***9%***
= PROFIT OR LOSS OF THE EXERCISE	**10,000**	**2,000**	**(3,000)**

Questions to assess the overconfidence in the second phase of the experiment

Question 3. After reviewing the pertinent data for the company's matrix and economic indicators, please identify the projected minimum and maximum currency ($) forecasts for the following variables for the upcoming year, provided the subsidiary remains in operation. Note that the minimum forecast pertains to the smaller value of growth or decline, while the maximum forecast pertains to the larger value of growth or decline.

Sales Forecast

Minimum:_____
Maximum: _____

Mark, on a 1 to 5 scale, your level of confidence in the sales forecast (in which 1 is no confidence and 5 is total confidence).

1 | 2 | 3 | 4 | 5

Expenses Forecast

Minimum:_____
Maximum: _____

Mark, on a 1 to 5 scale, your level of confidence in the expenses forecast (in which 1 is no confidence and 5 is total confidence).

1 | 2 | 3 | 4 | 5

Outcome Forecast (Profit or Loss)

Minimum:_____
Maximum: _____

Mark, on a 1 to 5 scale, your level of confidence in the outcome forecast (in which 1 is no confidence and 5 is total confidence).

1 | 2 | 3 | 4 | 5

Question 4. When it comes to forecasting information about your business, how do you rate yourself compared to other entrepreneurs? Please rate your ability on a scale of 1 to 5, with 1

being much worse and 5 being much better.

1 | 2 | 3 | 4 | 5