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Overconfidence and optimism in business decision-making: Scale development and validation

Excesso de confiança e otimismo na tomada de decisão empresarial: Desenvolvimento e validação de escalas

Exceso de confianza y optimismo en la toma de decisiones empresariales: Desarrollo y validación de escalas

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Abstract
This study aims at developing and validating a scale for measuring overconfidence and optimism in the context of business decisions, with an emphasis on instrument validity. Although overconfidence and optimism are two of the most researched biases in the field of Behavioral Finance, the limits, and intersections between them lack clarity in the available literature and research. The optimism and overconfidence bias items emerged as provisional responses to the following question: In what situations do the optimism and overconfidence biases manifest themselves in the decision making of managers? Exploratory and confirmatory factor analyses were used to create a 13-item scale to measure these biases in the behavior of decision makers. The results of the factor analyses have generated a two-factor structure. The model for measuring the biases of optimism and overconfidence in investment decisions demonstrated a good fit of the model, adequate reliability, convergent validity, and discriminant validity. Optimism obtained the highest average score, followed by overconfidence. The present study resulted in a research instrument capable of identifying the influence of overconfidence and optimism biases in managers' decision making in organizations. The questionnaire can be used in other empirical studies on behavioral finance, business decision making, and investment decisions.
Keywords: Overconfidence; Optimism; Decision making; Scale validation.

Resumo
Este estudo tem como objetivo desenvolver e validar uma escala para medir o excesso de confiança e otimismo no contexto de decisões empresariais, com ênfase na validade do instrumento. Embora o excesso de confiança e o otimismo sejam dois dos vieses mais pesquisados no campo das finanças comportamentais, os limites e as interseções entre eles carecem de clareza na literatura e nas pesquisas disponíveis. Os itens de viés de otimismo e excesso de confiança surgiram como respostas provisórias à seguinte questão: Em quais situações os vieses de otimismo e excesso de confiança se manifestam na tomada de decisão dos gestores? Análises fatoriais exploratórias e confirmatórias foram usadas para criar uma escala de 13 itens para medir esses vieses no comportamento dos tomadores de decisão. Os resultados das análises fatoriais geraram uma estrutura de dois fatores. O modelo para medir os vieses de otimismo e excesso de confiança nas decisões de investimento demonstrou um bom ajuste do modelo, confiabilidade adequada, validade convergente e validade discriminante. O otimismo obteve a pontuação média mais

alta, seguido pelo excesso de confiança. O presente estudo resultou em um instrumento de pesquisa capaz de identificar a influência dos vieses do excesso de confiança e do otimismo na tomada de decisão dos gestores nas organizações. O questionário pode ser usado em outros estudos empíricos sobre finanças comportamentais, tomada de decisões de negócios e decisões de investimento.
Palavras-chave: Excesso de confiança; Otimismo; Tomada de decisão; Validação de escalas.

Resumen
Este estudio tiene como objetivo desarrollar y validar una escala para medir el exceso de confianza y el optimismo en el contexto de las decisiones empresariales, con énfasis en la validez del instrumento. Aunque el exceso de confianza y el optimismo sean dos de los sesgos más investigados en el campo de las finanzas conductuales, los límites y las intersecciones entre ellos carecen de claridad en la literatura y la investigación disponibles. Los ítems de optimismo y sesgo de exceso de confianza surgieron como respuestas provisionales a la siguiente pregunta: ¿En qué situaciones se manifiestan los sesgos de optimismo y exceso de confianza en la toma de decisiones de los gerentes? Se utilizaron análisis factoriales exploratorios y confirmatorios para crear una escala de 13 ítems para medir estos sesgos en el comportamiento de los tomadores de decisiones. Los resultados de los análisis factoriales han generado una estructura de dos factores. El modelo para medir los sesgos de optimismo y exceso de confianza en las decisiones de inversión demostró un buen ajuste del modelo, adecuada confiabilidad, validez convergente y validez discriminante. El optimismo obtuvo la puntuación media más alta, seguido del exceso de confianza. El presente estudio resultó en un instrumento de investigación capaz de identificar la influencia de los sesgos de exceso de confianza y optimismo en la toma de decisiones de los gerentes en las organizaciones. El cuestionario se puede utilizar en otros estudios empíricos sobre finanzas conductuales, toma de decisiones comerciales y decisiones de inversión.
Palabras clave: Exceso de confianza; Optimismo; Toma de decisiones; Validación de escalas.

1. Introduction

Decision making in organizations is studied in several areas of knowledge. Although most studies are limited to the management field, several studies of psychology, computer science, communication, ethics, engineering, economics, information science, among other fields, have been conducted. The financial theories that currently address decision making in organizations are Modern Finance and Behavioral Finance. Modern Finance theory assumes that economic agents make purely rational decisions based on the market efficiency hypothesis and the expected utility theory. Conversely, Behavioral Finance theory assumes that economic agents do not make purely rational decisions and their decisions are influenced by biases and heuristics (Tversky & Kahneman, 1974). In this way, the decision making by managers, whether the decision to buy shares, investment and financing decisions, and mergers and acquisitions, would be affected by the behavioral and cognitive characteristics of each individual.

The influence of biases and heuristics on individuals' decision making can vary in terms of the characteristics of these decision makers and the environment in which the individual exists. For example, Choi et al. (2013) found that different national cultures can result in different levels of overconfidence. Weber and Hsee (2000) also found that national cultures generate different results in terms of the quality of probability judgment, risk perception, risk preference, and decision making regarding the evaluation of business opportunities. Behavioral finance theory suggests that, at the individual level, decision makers—chief executive officers (CEOs), investors, entrepreneurs, shareholders, etc.—are usually optimistic and overconfident (Choi et al., 2013; Goel & Thakor, 2008), that is, they consistently have biases of overconfidence and optimism. These two biases are studied/researched extensively in academia due to their effect on business results: while these biases stimulate innovations and the creation of new businesses (Bar-Yosef & Venezia, 2014), they can also lead to wrong business decisions (Trejos et al., 2019).

Most recent studies dealing with overconfidence and optimism in the context of decision making, are based on experiments and simulation of hypothetical situations, often linked to stock investments (Bakar & Yi, 2016; Choi et al., 2013; Fast et al., 2012; Hwang et al., 2020). Other metrics identified for the biases studied were based on the optimistic tone of the statements of the presidents of the organizations studied, on the use of proxies such as investments in R&D (Vivian & Xu, 2018); cognitive maps (Fatma et al., 2020) or combined confidence indexes (Tekin, 2019). Thus, this study aims at validating a

research instrument that can identify the biases of overconfidence and optimism in business decision making, especially in the context of investment decisions.

2. Literature Review

Overconfidence bias was first addressed in cognitive psychology research and experiments (Trejos et al., 2019). It was found that individuals overestimate their ability to predict the future and the precision of the information they have in a given situation, that is, individuals with the bias of overconfidence overestimate their decision-making ability in real situations (Tversky & Kahneman, 1974; Pompian, 2006).

Lobão (2012) states that the overestimation of one's own ability without any foundation is the most frequent bias in decision making. He further states that individuals can exhibit overconfidence in two ways: (a) in decision making, with them thinking they can better predict the future than reality allows them, that is, they are overconfident in their predictions; and (b) after decision making, when assessing the problem generated, that is, they tend to overestimate their abilities and/or the quality of the information they have. Thus, they do not consider the possibilities of investment losses.

Glaser and Weber (2007), Moore and Healy (2008), and Bar-Yosef and Venezia (2014) classified overconfidence into three different types: (a) over-precision or calibration of probabilities; (b) overestimation or optimism; and (c) overestimation or over-placement. Over-precision or calibration occurs when individuals are overconfident that their estimate is high or assign a low estimate to the event that they consider to be wrong. Overestimation or optimism occurs when individuals overestimate their ability to have good performance in tasks, are optimistic about future events, and expect better things to happen to them compared to their peers and believe in pure luck events. Overestimation or over-placement concerns the placement of the individual in relation to the other, that is, it occurs when the more experienced individuals are more overconfident than the less experienced ones.

With regard to investment decision making, Kimura (2003, p. 5) indicates two consequences of this bias: (a) it can lead investors to believe that they have comparative advantages in the analysis and evaluation of assets in relation to the market, maintaining losing positions; and (b) it can lead to overexposure to certain assets, in view of the investors' skewed belief that their position in the asset will lead to considerable future gains, causing an inadequate investment diversification due to the concentration on certain assets of the portfolio.

Larwood and Whittaker (1977) evince that CEOs who have an overconfidence bias generate better results than others, including riskier projects, thus causing a "better than average" effect. Malmendier and Tate (2005, 2008) found that overconfident CEOs tend to make more investments and acquisitions that destroy the value in companies. Corroborating these findings, Galasso and Simcoe (2011) and Hirshleifer et al. (2012) observed that overconfident CEOs can benefit shareholders by generating positive results for the company through investments in risky projects and exploring opportunities for growth through innovation. They identified that overconfident CEOs tend to be more successful in innovation and invest more in innovation and patents, thereby increasing research and development spending.

Scholars such as Fast et al. (2012) and Tost et al. (2012) studied the association between decision making in the presence of overconfidence bias and the power experienced by CEOs in organizations. Their findings show that CEOs with decision making power are more confident and seek information that can generate positive results, leading to an overestimation of forecasts. They further state that CEOs who are overconfident and have decision making powers tend to disregard advice from within and outside the organization, which can cause errors in decision making.

Lei and Wu (2010) found that the overconfidence bias of CEOs correlates positively with corporate mergers and acquisitions, that is, a CEO with such a bias tends to make potentially destructive mergers and acquisitions for the company. Therefore, the resolution proposed by the authors is to create an independent board of directors to improve control over the

CEO.

Finally, overconfidence arises in several situations and influences decision making mainly when individuals recognize their ability to understand situations of uncertainty. At that moment, the bias of overconfidence affects decision making and can lead to a wrong decision (Kahneman & Tversky, 1979). Specifically, about these abilities, Kafayat (2014) determined that self-commitment to a given project, self-declaration of proficiency, over optimism, and the better-than-average effect are characteristics of overconfident individuals and can negatively affect decision making.

The finance literature defines optimism bias as the overestimation of the probability of positive events and the underestimation of the probability of negative events (Abdeldayem & Sedeek, 2018). This bias can be noticed in managers who constantly seek debt financing for their companies (Antonczyk & Salzmann, 2014).

According to Pompian (2006), there is a trend in which many investors are inclined to be more optimistic about the market, the economy, and the possibility of positive results for the investments made. Graham et al. (2013) state that economic agents have optimistic and overconfident prospects for future projects, initially using internal financing and then third-party capital.

As per Lovallo and Kahneman (2003), the bias of optimism leads individuals to overestimate future situations, believing they can generate a positive return while underestimating or regarding it as unlikely that future investments will obtain negative results. This is also reflected by Barros (2005), who associates the bias of optimism with an exaggerated view that considers that positive events are more likely to occur than negative events.

Kafayat (2014) compared entrepreneurs and investors and stated that entrepreneurs are more optimistic about forecasting future results than investors, which is one of the causes of entrepreneurs' financial problems. Therefore, it is necessary to analyze the risks in their operations, thus establishing a balance between optimism and realism. (Barros, 2005; Pompian, 2006).

The results of the study conducted by Barros and Silveira (2008) indicate that the behavioral approach offers an understanding of corporate decisions. Cognitive biases lead individuals to make mistakes during the decision-making process, and when faced with a risky condition, they are unable to make the best decision (Prado et al., 2010).

Managers display reckless behavior, quickly deciding on future projects and ignoring risks when they exhibit overconfidence and optimism biases (Barros, 2005). Although both biases have different concepts, most researchers study them as complementary when the concepts are approached in the context of decision making (Bortoli & Soares, 2019).

Studies conducted by Antonczyk and Salzmann (2014) and Silva et al. (2017) revealed the influence of overconfidence and optimism on the formation of companies' capital structure, mainly on the board of directors. Wang and Zhou (2017) conducted a study in China on the role of managers' overconfidence in making irrational investments and observed a positive relationship between managers' overconfidence and overinvestment.

According to Hwang et al. (2020), the greater the power of the CEO to act within a company, the greater the chances of that CEO exhibiting overconfidence and optimism biases. An overconfident CEO is more likely to close new deals and make new acquisitions. According to the study, this overconfidence may result in the CEOs making wrong decisions regarding mergers and acquisitions.

Kafayat (2014), with the main objective of illustrating the impact of behavioral biases in the rational decision making of investors, found that investors in Islamabad, Pakistan, are influenced by behavioral biases such as overconfidence, optimism, and self-attribution, making it impossible for them to make rational decisions. This study also revealed an internal relationship between the three biases.

Studies often address the overconfidence and over optimism biases jointly because it is difficult to identify them separately, because, in both biases, individuals seek positive results in decision making (Kafayat, 2014). Academicians such as

Gervais et al. (2003), Hirshleifer (2001), and Shiller (2005) suggest that overconfidence and optimism can lead individuals to overestimate their knowledge, which negatively influences decision making, resulting in suboptimal decisions. Therefore, this study features a scale separating the optimism and overconfidence biases to help decision makers identify these biases and improving their decisions.

3. Methodology

The present study is characterized as a field research, with theoretical-empirical approach and use of the quantitative method (Sampieri, Collado & Lucio, 2006). As a part of the present study, a survey was conducted using a structured questionnaire to collect primary data from the managers of Brazilian companies. The respondents were individuals who make decisions within their companies: executives, owners, partners, businessmen, and managers of companies of varied sizes and segments. Empirical data for the analysis was collected according to the availability of managers to respond to the questionnaire. One hundred fifty responses were obtained, meeting the minimum of five observations for each variable of the model (Hill & Hill, 2006).

The process of developing the scale was based on theories relevant to the constructs (Haynes et al., 1995). The optimism and overconfidence bias items emerged as provisional responses to the following question: In what situations do the optimism and overconfidence biases manifest themselves in the decision making of managers? As a result, 16 statements were developed to measure the biases in the behavior of decision makers. The statements consist of positive statements; and the presence and magnitude of the biases follow the same proportion of the scale.

The statements formulated to measure the overconfidence bias express the notion of Trejos et al. (2019) that overconfidence manifests itself in two ways: in decision making, when the decision maker overestimates his ability to plan an action; and after making a decision. The indicators OC2, OC4, OC5, and OC7 aim at identifying whether managers overestimated their decision-making ability at a given time, leading them to believe that they had comparative advantages in their companies; the items OC1, OC3, OC8, and OC9 aim at identifying the managers who think they can better predict the future well over the current situation allows, both in decision making and decision making in investment in real assets. The nine statements referring to overconfidence and their acronyms are exhibited in Table 1.

Table 1 - Statements of overconfidence bias.

Item	***Statements***
OC1	Regarding the ability to assess the viability of projects in my area of expertise, I consider myself to be above the average of other managers.
OC2	When making new investments, I faithfully believe in my estimates for the project.
OC3	I fully trust my abilities when making decisions and managing my business.
OC4	I always use my forecasting abilities when investing in new businesses/products.
OC5	When I analyze past experiences, I realize that my abilities when investing are above the average of other managers in my area of expertise.
OC6	I am successful in the industry in which I work.
OC7	I have always had confidence when making new investments.
OC8	I always have confidence in all my decisions.
OC9	I realize that my abilities when making decisions are above the average of other managers in my area of expertise.

Source: Authors (2021)

To measure the managers' optimism bias, seven statements simulating optimism in investment decisions were developed. Items OP1, OP2, and OP6 aim at identifying the optimism bias in decisions in the past to invest in real assets that would provide the best possible result and projected results for the future, that is, underestimating the probabilities of

unfavorable events. Items OP3, OP4, OP5, and OP7 aim at identifying the internal perspective (Lovallo & Kahneman, 2003) of managers when they overestimate the favorable events while making a decision. These items focus on the manager's personal involvement in decision making. The seven statements referring to this bias and its acronyms are shown in Table 2.

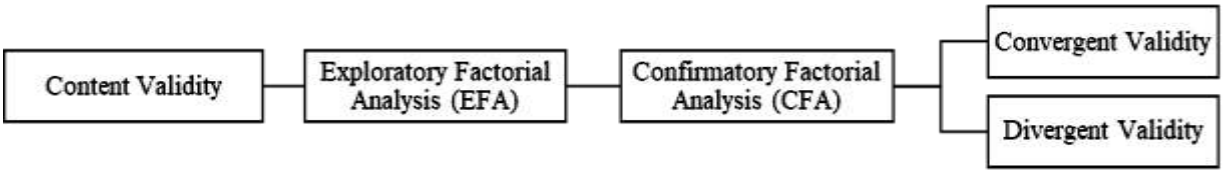
Table 2 - Statements of optimism bias.

Item	***Statements***
OP1	Past investment decisions provided the best outcome possible.
OP2	In past investment decisions, I was optimistic about the results projected for the future.
OP3	I try to avoid pessimistic thoughts.
OP4	I usually expect more good things to happen with my investments than bad things.
OP5	I usually expect more good things to happen when I am making decisions than bad things.
OP6	I have always been optimistic about investment decisions made in the past.
OP7	I always think that I will make the right decisions.

Source: Authors (2021)

The responses to each of the statements were obtained using a ten-point scale ranging from strongly disagree to totally agree. The averages were calculated for each of the statements to identify biases in the decision-making processes. The questionnaire was validated, and its reliability was assessed. Figure 1 indicates the steps in the validation process for this instrument.

Figure 1 - Internal validation process.



Source: Adapted from Haynes et al. (1995)

According to the model proposed by Haynes et al. (1995), content validity is determined by the degree of representativeness or relevance of the evaluated concept. Five professionals working in the following segments were consulted to improve the items of the scale: accounting services, textile manufacturing, gifts factory, and wind energy. They did not suggest any changes to the content or the number of indicators. After the first stage was completed, questionnaires were distributed to individuals responsible for decision making within companies, and the data collected were subjected to factor analysis. Exploratory Factor Analysis was applied to detect the smallest possible number of factors that could explain a greater variability of the data, and since the indicators load in all of the factors, it was observed whether the indicators constructed for each construct converged to it. Subsequently, Confirmatory Factor Analysis was applied to assess the quality of the fit of the model to the correlational structure of the indicators.

Exploratory Factor Analysis (EFA) was performed using principal component analysis along with orthogonal varimax rotation. The criteria used in this study to choose the number of factors, the latent root and the percentage of variance, indicated the same number of factors, that is, the factors with an eigenvalue greater than or equal to one and a significant percentage of variance explained were chosen. The items converged on two factors consistent with the theory of origination - optimism and overconfidence.

4. Results

The survey was conducted with 150 respondents, all professionals and/or managers from different segments of the Brazilian market, according to the description of the methodology. Of the 150 respondents, eighty-six (57.3%) were male, while the remaining sixty-four (42.7%) were female. The education level with highest representation was higher education (44.7%), followed by specialization/MBA (24.7%) and master's degree (6.0%). It is worth noting that few respondents indicated having a doctorate degree or post doctorate, 2.7% and 0.7%, respectively. A total of 40% of the respondents reported that the sector of their businesses was commerce, followed by services (31.3%) and industry (28.7%). It is noteworthy that the position of partner-director represents 80.7% of the sample. When the professionals/managers were asked if their company operates in more than one business area, 62.7% responded affirmatively, indicating the possibility of diversifying the company. The average age of the respondents was approximately forty-six years. The companies have been in business for an average of twenty-three years, and the average time working for the company was sixteen years. The length of time that researchers work in the company is indicative of their experience in management positions.

The options exposed above indicate that the data collected is appropriate for the AFE technique. The KMO indicator had a value of 0.931, which indicates excellent adequacy of the sample size for factor analysis. This finding is supported by Bartlett's sphericity test ($\chi 2$ = 1960.32; p-value = 0.000); and the analysis of the anti-image matrix, in which all indicators obtained values varying between 0.899a and 0.963a. The item OC6 was eliminated from the components, as it had a factor load divided between two factors. Following this, factor analysis was performed. The indicators of the EFA after the removal of item OC6 indicated the adequacy of the data to the technique. The analysis of the anti-image matrix revealed measures of sample adequacy (MSA) ranging between 0.895a and 0.959a. The new values of the KMO test and Bartlett's sphericity test are presented in Table 1, along with the factor loads, the eigenvalue, the explained variance, and the reliability measure of the two extracted factors. Thus, it was considered that the EFA with 15 items had adequate measures, and the factors analysis was performed.

Table 3 - Results of the Exploratory Factor Analysis.

Components	Overconfidence		Optimism
OC7	0.813		
OC5	0.805		
OC3	0.803		
OC2	0.777		
OC8	0.758		
OC9	0.752		
OC1	0.722		
OC4	0.673		
OP1			0.845
OP2			0.820
OP6			0.786
OP5			0.757
OP3			0.757
OP7			0.743
OP4			0.726
Cronbach's Alpha	0.941		0.939
Eigenvalue	8.748		2.079
Explained Variance	58.32%		13.86%
KMO	0.928	Bartlett’s Test (p-value)	0.928

Source: Authors (2021)

The results in Table 1 indicate that the items for each construct converged with the factors with factorial loads above 0.673, which indicates that they are significant for the sample size studied. Table 4 presents the correlation between the items that constitute the overconfidence factor. The mean values and standard deviations corresponding to each item are in the main diagonal, highlighted in bold, while the correlations between the factor indicators are expressed in the other cells. There is no evidence of multicollinearity, and the correlations between the items are positive and significant.

Table 4 - Metrics of overconfidence indicators.

	OC1	OC2	OC3	OC4	OC5	OC7	OC8	OC9
OC1	**6.85 (2.14)**	–	–	–	–	–	–	–
OC2	0.617	**7.04 (2.19)**	–	–	–	–	–	–
OC3	0.738	0.735	**6.89 (2.31)**	–	–	–	–	–
OC4	0.660	0.666	0.637	**6.91 (2.24)**	–	–	–	–
OC5	0.603	0.706	0.654	0.520	**6.83 (2.12)**	–	–	–
OC7	0.652	0.719	0.725	0.662	0.709	**6.79 (2.30)**	–	–
OC8	0.651	0.680	0.717	0.630	0.690	0.671	**6.85 (2.15)**	–
OC9	0.619	0.621	0.677	0.604	0.716	0.734	0.622	**7.13 (2.05)**

Source: Authors (2021)

Table 5 indicates the metrics of the seven indicators of optimism. The main diagonal is the mean values and standard deviations corresponding to each item of the factor, while the correlations between the indicators of the factor are expressed in the other cells. The analysis of the correlation matrix shows no evidence of multicollinearity and the correlations were positive and significant with values between 0.611 to 0.757. The analysis of the standard deviation of the items indicates little dispersion of the data in relation to the mean.

Table 5 - Metrics of optimism indicators.

	OP1	OP2	OP3	OP4	OP5	OP6	OP7
OP1	**7.05 (2.33)**	–	–	–	–	–	–
OP2	0.752	**7.18 (2.28)**	–	–	–	–	–
OP3	0.723	0.627	**7.03 (2.35)**	–	–	–	–
OP4	0.677	0.667	0.652	**7.22 (2.23)**	–	–	–
OP5	0.757	0.694	0.668	0.620	**7.19 (2.06)**	–	–
OP6	0.737	0.731	0.746	0.628	0.611	**7.27 (2.19)**	–
OP7	0.675	0.738	0.689	0.678	0.668	0.675	**6.90 (2.28)**

Source: Authors (2021)

The descriptive statistics of the indicators were calculated and presented in Tables 4 and 5 providing an in-depth view of the effect of biases on the behavior of the managers. It can be observed that the average values of the indicators are well above the midpoint (5), and it can be inferred that the investment decisions made by managers are partially influenced by the optimism and overconfidence biases. Analyzing each factor separately, it is observed that the average values of the indicators of optimism bias were higher than the indicators of overconfidence bias.

Once the convergence of the indicators to the factors was analyzed, a confirmatory factor analysis (CFA) was performed to confirm the factorial structure of the data (Kaur & Sharma, 2015). Two models were estimated: model 1 includes all the indicators resulting from the EFA. The modification indices indicated cross-loading in indicators OC5 and OP7, which were extracted in model 2. Absolute fit, incremental fit and parsimonious indices were used to assess the quality of the fit of the models. Table 6 indicates that the fit indexes of the confirmatory model meet the parameters accepted by the academic community.

Table 6 - Model Fit Indices.

Fit Indices	Model 1	Model 2	Reference values *
$\chi 2$ (p-value)	193.255 (0,000)	110.89 (0.000)	p-value < 0,05
$\chi 2$/df	2,171	1.733	< 5
TLI	0.934	0.963	> 0,90
GFI	0,957	0.975	> 0,90
NFI	0,902	0.931	> 0,80
CFI	0,944	0.969	> 0.90
RMSEA	0,08	0.007	< 0,08
PCFI	0,80	0.795	> 0.60
SRMR	0,041	0.003	< 0,05
ECVI	1,702	1,273	The lower the better
AIC	8224,57	7211,84	The lower the better

Source: Adapted from Marôco (2010).

Model 2, which had fewer indicators in the optimism and overconfidence factors, had better absolute and incremental fit indices and comparison indices (AIC and ECVI) compared to model 1. Therefore, it was decided to continue the study with model 2, including seven items for overconfidence and six indicators of optimism. The strength of the measurement model can be demonstrated by convergent and discriminant validity measures (Hair et al., 1998). Convergent validity measures the extent to which items in a latent factor correlate positively with other items in the same factor. Three criteria were used to assess convergent validity: standardized path loadings, the composite reliability coefficient (CRC), and the average variance extracted (AVE). The method of Fornell and Larcker (1981) was used to assess discriminant validity. The average variance extracted from each construct was compared with the shared variance; Discriminant validity is observed when AVE is greater than the square of the covariance between two constructs. The criteria for evaluating the convergent and discriminant validity of model 2 are presented in Table 7.

Table 7 - Path loadings, AVE, and CRC.

	Optimism	Overconfidence	R^2	Sig.
OP1	0.890		0.792	0.000
OP2	0.837		0.700	0.000
OP3	0.824		0.678	0.000
OP4	0.773		0.598	0.000
OP5	0.812		0.660	0.000
OP6	0.837		0.701	0.000
OC1		0.803	0.645	0.000
OC2		0.827	0.684	0.000
OC3		0.870	0.757	0.000
OC4		0.781	0.609	0.000
OC7		0.848	0.719	0.000
OC8		0.809	0.655	0.000
OC9		0.788	0.621	0.000
AVE	0.687	0.616	OP ↔ OC	0.652
CRC	0.929	0.918		

Source: Authors (2021).

The analysis of the values in Table 7 indicates that all standardized path loadings were statistically significant and

greater than 0.70; CRC was higher than 0.70 and the AVE values of the constructs were higher than the reference value 0.50, meeting the criteria for convergent validity. The square of the covariance between the constructs (0.452) is lower than the AVE values of the model constructs, thus suggesting that the research model has discriminant validity. In summary, the model for measuring the optimism and overconfidence biases in investment decisions indicated a good fit of the model, adequate reliability, convergent validity, and discriminant validity.

5. Discussion and Research Implications

Overconfidence and optimism are the most addressed and documented cognitive biases in financial literature and are among the biases that most influence managers in decision making (Yoshinaga et al., 2008). Some scholars who use the Behavioral Finance theory defend the model in which these two biases are related, that is, an optimistic individual will tend to be overconfident, while another theory addresses these biases separately, considering them different from each other (Barros & Silveira, 2008). The results of the factor analysis indicate that managers are influenced by the bias of overconfidence and optimism and that these biases are different from each other.

The average for overconfidence of managers was 6.923, with a standard deviation of 0.121. This indicates that in the context of decision making on investments in real assets, managers showed overconfidence in their abilities in managing their company and making decisions based on the analysis of project feasibility, considering themselves above average. Overestimating decision-making capacity and the quality of the projections of returns may lead these managers to make investments below an optimum point: the capital invested will not generate the best possible result and may even incur losses. Overconfident managers may also maintain a position of loss of investment for a certain time, believing that they will have future returns.

The overconfidence bias in managers was represented by statements that indicate that the manager overestimated his abilities when making decisions in past situations and while predicting future situations. A similar study conducted by Wang and Zhou (2017) revealed that the overconfidence of managers is associated with excess of investments by companies, as the bias influences managers to act in a non-rational way. More specifically, considering the indicators of overconfidence, this result corroborates the findings of Bakar and Yi (2016), Gumus and Dayioglu (2015), Hirshleifer (2015) and Hwang et al. (2020), who inferred that the overconfidence bias is related to the constant tendency of individuals to excessively value their abilities and knowledge, overestimating them and their results and the quality and accuracy of the information they hold. The results also corroborate with Barros (2005), who reported that overconfident managers believe they have more abilities and competence than other managers in the market where they work and are more likely to take on larger and riskier projects, as they become less conservative when they invest in their projects, being more prone to taking risks (Gervais et al., 2011).

Optimism obtained an overall average of 7.157, with a low standard deviation (0.095), which indicates that most managers tend to overestimate the positive results arising from the decisions, with the tendency to disregard the unfavorable results. The research findings demonstrate the strong participation of optimism in decision making about assets in organizations: the indicators implying that managers were optimistic when making investment decisions in the past are among the indicators with highest averages in this construct. Barros (2005) believes that the optimism bias influences managers to have a positive attitude, trusting in the success of the project in which they invested and disregarding a possible failure. With averages greater than 7, the other indicators of optimism suggest an optimistic perspective assumed by managers, overestimating the benefits of projects and underestimating costs. These characteristics are known as illusory optimism, that is, when the optimism bias distorts the projections of gains and losses, and managers make non-rational decisions (Lovallo & Kahneman, 2003).

The results for optimism in the decision-making process corroborate findings from previous studies conducted with different methodologies. The results indicate that under the effect of optimism, managers tend to reformulate these past negative situations, which leads them to persist in the face of adversity (Coelho, 2010; Gibson & Sanbonmatsu, 2004). The wrong decision to persist in a business that does not generate the expected results have significant negative implications for economic growth and resource efficiency and is one of the main negative consequences mentioned by Coelho, (2010). According to her, under the effect of optimism, managers tend not to take precautions or correct the course of actions when dealing with risky decisions. The present study corroborates the findings of Dölarslan et al. (2017), Harris and Hahn (2011) and Meyer (2014). The results of the qualitative study conducted by Dölarslan, et al. (2017) indicate that people perceive their own future as more positive than the average and judge negative events as less likely to happen to themselves than to other people in general. When studying the effect of optimism on the decision to close a business, Meyer (2014) identified two ways in which optimism significantly influences the motivation of decision makers: during planning and forecasting and as the project approaches its end. In the latter, decision makers believe that a project will deliver better returns after the project is completed. Finally, Harris and Hahn (2011) state that optimism is likely to co-occur with other phenomena, such as the fallacy of planning or overconfidence, with entrepreneurs being one of the subgroups of people who are often optimistic.

The managerial implications of this study are related to the proposal of alternatives to contend with managers' overconfidence and optimism by identifying the overconfidence in estimating the probability of success of projects or business continuity planning, modification of business plan or production line, and so on, as well as overestimating the accuracy of the information available, which may not correspond to reality, generating unrealistic forecasts and estimates.

Organizations must avoid spending financial and economic resources due to poor forecasting and/or unrealistic estimates by managers who are influenced by the biases analyzed. Therefore, companies should consider analyzing the behavior of the decision-making body, as eliminating overconfidence and optimism biases can be a challenging task (Kahneman and Riepe, 1998).

A solution to mitigate the effects of bias in decision making would be to shift the responsibility of decision making throughout the business life or during the project (Meyer, 2014) to force the manager to constantly reflect on the past, present, and future decisions to improve them.

6. Conclusion

This study aimed at constructing a scale to identify the overconfidence and optimism biases in business decision making. Statements based on theory were developed to identify the presence of biases in making investment decisions in the context of organizations. One hundred fifty Brazilian managers responsible for making business decisions participated in the study.

The research findings showed two different and independent constructs, one referring to the overconfidence bias and the other referring to the optimism bias. Both constructs indicated reliable and significant indicators for the respective scales in EFA and CFA, with no multicollinearity between the items of the extracted factors. According to Dölarslan et al. (2017), cognitive factors play a crucial role in the way the risks related to investment decisions are perceived. In this study, the results indicate a reliable and valid scale for identifying these biases in managers and entrepreneurs, enabling them to be aware of their behavior in decision making moments. Ignoring the effects of optimism and overconfidence on investment decisions can be a decisive factor in choosing a harmful alternative to the business.

This study increases the understanding of these biases, as it helps managers to identify and address them to mitigate their effects. When making decisions in economically and financially viable projects, managers should be careful not to overestimate their abilities under the influence of overconfidence bias and the projection of the results by envisioning a more

optimistic scenario than the most likely scenario. This study assists in understanding the optimism bias by helping to assess the effectiveness of past investment decisions and whether the bias appeared when the decisions were made, further identifying whether the results were beneficial to the business and the presence of bias in future decision making.

The behavioral financial literature has addressed these factors over the years. The results obtained in this study corroborate with previous research, which reveals the influence of behavioral biases, especially overconfidence and optimism, in managers' decision making in companies.

Therefore, it can be considered that the present study achieved its objective as it resulted in a research instrument capable of identifying the influence of overconfidence and optimism biases in managers' decision making in companies. The questionnaire can be used in other studies on behavioral finance, business decision making, and investment decisions.

The construction of the scale was aimed at individual decision makers, that is, these constructs cannot be used in group decisions, which is one of the limitations of the study. Another limitation is that the study only identified biases in decision making, thus not allowing to propose solutions to mitigate these biases.

Future studies should address the relationship between the influence of these biases in business decision making and the gender of managers, the position held, education level, length of time working in the sector, sector in which the company operates, and financially measure the correct and incorrect decisions which were influenced by biases.

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