

## Confirmation bias in managerial decision-making: an experimental study with managers and accountants

*Viés de confirmação na tomada de decisão gerencial: um estudo experimental com gestores e contadores*

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### Keywords

Confirmation bias.  
Decision-making.  
Behavioral economics.  
Managers.  
Accountants.

### Abstract

This study aimed to analyze the presence of confirmation bias in managers and accountants in a managerial decision-making process, as well as to analyze whether the manner in which economic-financial information is presented influences the confirmation bias of these individuals in their decisions. We used the experimental methodology to meet the objective of this research, applied to a sample of 86 accountants, 68 managers, and 118 people with several activities (control group). The results showed that most managers and accountants have confirmation bias in managerial decision-making processes, that type (positive or negative) and level (simple or complex) factors of information do not influence the confirmation bias in the managerial decision-making and that negative information may influence the confirmation bias in choosing the most significant information.

### Palavras-chave

*Viés de confirmação.  
Tomada de decisão.  
Economia comportamental.  
Gestores.  
Contadores.*

### Resumo

*O trabalho teve como objetivo analisar a presença do viés de confirmação em gestores e contadores em um processo de tomada de decisão gerencial, bem como analisar se a forma com que as informações econômico-financeiras são apresentadas influencia o viés de confirmação desses indivíduos em suas decisões. Para atender ao objetivo da pesquisa, utilizou-se a metodologia experimental, aplicada a uma amostra de 86 contadores, 68 gestores e de 118 pessoas com atividades diversas (grupo controle). Os resultados demonstraram que a maioria dos gestores e dos contadores apresentaram viés de confirmação em processos de tomada de decisões gerenciais, que os fatores tipo (positiva ou negativa) e nível (simples ou complexa) não influenciam o viés de confirmação na tomada da decisão gerencial e que a informação negativa pode atenuar o viés de confirmação na escolha da informação mais importante.*

### Article information

Received: November 18, 2019  
Approved: July 28, 2020  
Published: July 30, 2020

### Practical implications

Managers and accountants are subject to confirmation bias. Therefore, the work contributes in a practical way by serving as a parameter for the architecture and creation of economic-financial statements, as well as structures that can minimize the effects of confirmation bias and improve the decision-making process.

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## 1 INTRODUCTION

In order to demonstrate that behavioral, cognitive, and emotional factors influence in the decisions of human beings, the field of behavioral economics has grown (Camerer & Loewenstein, 2004; Costa, Carvalho, & Moreira, 2019; Thaler, 2016), demonstrating that these factors affect the individual's behavior, exceeding the assumption of perfect rationality. This scientific field seeks in psychology the concepts of cognitive biases, suggesting that individuals' rationality is biased (Kahneman & Tversky, 1979; Tversky & Kahneman, 1974).

Cognitive biases are systematic deviations from the mind that affect decision-making processes (Tversky & Kahneman, 1974), mainly because human beings strongly deviate from their decisions in some situations, presenting inconsistent or irrational preferences (Summerfield & Tsetsos, 2015). Thus, several biases can influence both managers' behavior and decisions (Schade & Koellinger, 2007) and can lead managers to detrimental decisions to the business (Fellner & Krügel, 2012).

The confirmation bias stands out for placing excessive emphasis on the individuals' beliefs, making them underestimate information that evidence positions contrary to theirs, which impairs the decision, and, thus, being considered a (Allahverdyan & Galstyan, 2014), problematic aspect of human reasoning that deserves attention (Nickerson, 1998).

Confirmation bias has been studied in sequential or simultaneous manner in which the information is presented to the decision-maker (Jonas, Schulz-Hardt, Frey, & Thelen, 2001), in environments in which individuals make decisions based on information acquired with real consequences (Jones & Sugden, 2001), in situations where the arguments are presented fluently or not fluently aiming to decrease the bias (Hernandez & Preston, 2013), in financial decisions about good and bad information (Duong, Pescetto, & Santamaria, 2014), in the presence of bias in financial discussion forums (Park, Konana, Gu, Kumar, & Raghunathan, 2013), in the resolution of tax problems (Cloyd & Spilker, 2000), in the perception of managers about psychic distance (Baack, Dow, Parente, & Bacon, 2015), in the use of information on public management performance (Baekgaard & Serritzlew, 2016), in the judgment of accountants on the application of accounting standards (Perera, Chand, & Mala, 2019), and in the audits (O'Reilly, Reisch, & Leitch, 2017).

Nevertheless, confirmation bias is one of the least studied biases in the area of behavioral economics, which demonstrates that studies relating this bias to the management and the financial decision-making are still necessary and promising for the area (Costa, Carvalho, Moreira, & Prado, 2017).

Based on the literature, the individual is subject to confirmation bias (Nickerson, 1998), which assumes that accountants (O'Reilly et al., 2017; Perera et al., 2019) and managers (Baack et al., 2015) are also subject. However, it remains uncertain whether the confirmation bias also presents itself when these subjects use economic and financial information in management decisions. Thus, the influence of human behavior on decisions enables a discussion about the relationship of confirmation bias in the use of economic-financial information in managerial decision-making processes.

This relationship — and the fact that the accountant in addition to preparing accounting reports, assists the manager in decision-making (Rieg, 2018) — raises the need to understand whether the architecture (Thaler & Sunstein, 2008) and how (Tversky & Kahneman, 1981) this type of information is presented increases or decreases the incidence of confirmation bias. Thus, the following problem arises: is the confirmation bias in management decisions of accountants and managers influenced by the way in which economic and financial information is presented?

This work emerges aiming to analyze the presence of confirmation bias in managers and accountants in a managerial decision-making process, as well as analyzing whether the type (positive or negative) and the level (simple or complex) of economic-financial information influence the confirmation bias presented by these individuals in their decisions.

Finally, the results show that most managers and accountants are subjected to confirmation bias, the type and level of information does not influence the confirmation bias in the decision-making, and negative information can influence the confirmation bias in the choice of the most important information to make the decision. Thus, this work contributes by bringing results not yet evidenced by the literature and by serving as a parameter for the construction of economic-financial statements that can minimize the effects of confirmation bias.

## 2 LITERATURE REVIEW

According to Schwind, Buder, Cress, and Hesse (2012), the explanation for confirmation bias can be found in the Cognitive Dissonance Theory Festinger (1957), since information that disagree with an individual's position can lead to a cognitive dissonance. Cognitive dissonance is a negative and uncomfortable state that compels people to avoid or to reduce the contact with information that does not confirm their beliefs, thus preferring information that support their positions. Thus, some evidence indicate that the availability of information (Tversky & Kahneman, 1974) influences cognitive dissonance (Shantha Gowri & Ram, 2019).

Confirmation bias occurs in two forms, i.e.: by acquiring information and/or by assimilating it (Allahverdyan & Galstyan, 2014). The acquisition of selective information is consistent with previous beliefs, expectations, and hypotheses and, on the other hand, the assimilation of information in a biased manner increases confidence in previous beliefs, expectations, and hypotheses (Park et al., 2013). Considering these alternatives, the formation or modification of an opinion are related to cognitive restructuring, and it can be considered as a learning process (Schwind et al., 2012).

The study of Jonas et al. (2001) highlighted the relevance of seeking biased information and this study revealed an increase in confirmation bias when the search for information was sequentially performed instead of simultaneously performed. In another study, Jones and Sugden (2001) found strong evidence of the presence of confirmation bias in the acquisition of information for decision-making with real financial consequences and demonstrated that the information—interpreted as the confirmation of a hypothesis—increases the individuals' confidence in the hypothesis, even if this information does not have much value.

Hernandez and Preston (2013)—in order to analyze whether the lack of fluency of the arguments can decrease the confirmation bias—observed that when the ease of processing an argument was reduced, the effect of the confirmation bias was also reduced. On the other hand, Perera et al. (2019) study suggests that the request for a justification or presentation of guidelines for the decision to be made mitigates the confirmation bias. Furthermore, the authors found evidence that accountants present the confirmation bias on the application of accounting standards.

In an audit of financial statements, O'Reilly et al. (2017) demonstrated that auditors show greater confirmatory evidence when they receive positive information from reliable sources and when negative information originates from not-so-reliable sources. Furthermore, the study of Baack et al. (2015) showed that managers are likely to process information that confirms their original beliefs by reviewing their perceptions of psychic distance and risk. Regarding tax issues, Cloyd and Spilker (2000) noted that legal professionals are less prone to confirmation bias than accounting professionals.

Moreover, Park et al. (2013) they investigated how investors value information reported in forums and how some news affected investor' trading behavior. The results showed that when investors have a positive opinion about stocks, they tend to seek positive messages about them, whereas, if the view is negative, investors sought negative messages in the forum. Furthermore, authors observed that investors who have a greater knowledge of the market are more predisposed to Confirmation Bias. Also, Duong et al. (2014) study evidences that investors are less affected by the value of good information, whereas they react fairly to bad information and those who invest in attractive stocks react less to bad information, efficiently and confidently processing good information.

## 3 EXPERIMENTAL DESIGN

The study was carried out with an experimental research applied to Brazilian managers and accountants, to understand whether the type and level of economic and financial information influence the confirmation bias of these individuals. The sample—after eliminating incomplete answers—was composed of 86 accountants, 68 managers, and 118 people with various activities, who formed the control group.

The experiment has as an intrinsic factor the professional profile of the research subject (accountant, manager, and control group) and the type of economic and financial information and the level of information as experimental treatment factors. The type of information is composed of information of a positive nature (may positively influence the decision) and negative information (may negatively influence the decision). Positive information is related to revenue and profit growth and negative with declining sales and losses. The level of information is formed by simple and complex information. The simple information is presented in a table format and the complex information about the form of the Balance Sheet and Income Statement (Appendix B).

Based on the experimental factors, it is a factorial experiment, type 2 x 2, creating four different treatments, according to Table 1 (Dean & Voss, 1999), which causes a combination of four distinct applications of treatments.

**Table 1.** Treatments applied to the research subjects

Treatment	Level of Information	Type of Information
Treatment 1	Simple	Positive
Treatment 2	Simple	Negative
Treatment 3	Complex	Positive
Treatment 4	Complex	Negative

Source: Authors, based on Dean e Voss (1999).

Treatments were applied through the Internet (Skitka & Sargis, 2006), and the draw of one of the treatments (Table 1) was randomly performed for each individual, ensuring that the results were not influenced by unknown sources (Dean & Voss, 1999).

The experiment exposed the research subjects to situations in which they had to decide between opening or not a branch of a company. The experiment occurred in two phases, the first phase presented the information that circulated on media about a case of a company with a branch similar to the one that the individual would propose to open (Figure B1). After presenting the case, two questions were asked:

*Would you open the branch based on the information presented?*

*Which is the most important information to decide whether open a branch or not?*

In the second phase of the experiment, participants randomly received information related to economy and finances, regarding one of the four treatments. After performing an analysis of the information received, the individual was directed to answer the two questions once more.

When deciding whether to open the branch or not, the participant manifests the confirmation bias when the response in both first and second phase of the experiment are equal. This response variable was called "Confirmation in Decision" and a value 1 is assigned to it when the individual manifests the confirmation bias and the value 0 when the bias is not manifested.

Regarding the most significant information for decision-making, bias is manifested when the response provided in the first phase of the experiment is equal to the response provided in the second phase. Thus, this variable was called "Confirmation in Information," being attributed to it the value 1 for cases in which the confirmation bias was manifested and the value 0 for cases that did not present bias.

Firstly, the statistical approach was composed of performing a descriptive analysis of the data by cross tabulations between the variables responses Confirmation in the Decision and Confirmation in the Information and the experimental factors Profile (managers, accountants, and control group), Type of Information (Positive or Negative) and Level of Information (Simple or Complex). Furthermore, the Chi-square Test was performed to identify whether there is an association or dependence between variables and factors.

Moreover, the independence test was used for the variables responses with the log-linear model and the logistic regression associated with the Wald test was performed to analyze whether there are influences of the factors on the variables that characterize the confirmation bias.

#### 4 RESULTS AND DISCUSSIONS

Os resultados identificaram que na primeira fase do experimento, dos 272 participantes, 172 indivíduos tomaram a decisão de abrir o ramo. Na primeira fase do experimento, os resultados identificaram que, dos 272 participantes, 172 indivíduos tomaram a decisão de abrir o ramo e 115 disseram que a informação mais importante para abrir um ramo é lucro e prejuízo. Na segunda fase, 171 pessoas escolheram abrir o ramo e 149 consideraram que a informação mais importante é lucro e prejuízo (Apêndice A).

The independence test was performed to analyze whether there is influence between variables. For the variable Confirmation in the Decision, the p-value of the  $\chi^2$  Test (0.1854760) was higher than the regular significance levels, implying that there is independence between variables, demonstrating that explanatory variables do not affect the occurrence of the dependent variable. Similarly, the p-value of the  $\chi^2$  (0.2621766) for the presence of interaction is higher than the regular significance levels, indicating that there is no interaction between the confirmation in the decision variable and the studied factors. Thus, Table 2 demonstrates the analysis of the cross-reference of the variable Confirmation in the Decision with the experimental factors.

**Table 2.** Cross-reference of the variable Confirmation in the Decision with the experimental factors

Factor	Description	Confirmation in the Decision				Total
		YES		NO		
		Quantity	%	Quantity	%	
Profile <sup>a</sup>	Accountant	65	75.6%	21	24.4%	86
	Manager	51	75.0%	17	25.0%	68
	Control Group	75	63.5%	43	36.4%	118
	TOTAL	191	70.2%	81	29.8%	272
Type <sup>b</sup>	Positive	102	72.9%	38	27.1%	140
	Negative	89	67.4%	43	32.6%	132
	TOTAL	191	70.2%	81	29.8%	272
Level <sup>c</sup>	Simple	99	67.8%	47	32.2%	146
	Complex	92	73.0%	34	29.8%	126
	TOTAL	191	70.2%	81	29.8%	272
Treatment <sup>d</sup>	1 (Sim./Pos.)	51	68.0%	24	32.0%	75
	1 (Sim./Neg.)	48	67.6%	23	32.4%	71
	3 (Com./Pos.)	51	78.5%	14	21.5%	65
	4 (Com./Neg.)	41	67.2%	21	32.4%	61
	TOTAL	191	70.2%	81	29.8%	272

<sup>a</sup> Chi-square = 4.429 / p-value = 0.109 (Profile)

<sup>b</sup> Chi-square = 0.959 / p-value = 0.327 (Type)

<sup>c</sup> Chi-square = 0.877 / p-value = 0.349 (Level)

<sup>d</sup> Chi-square = 2.784 / p-value = 0.426 (Treatment)

Source: Authors.

According to Table 2, out of the 272 surveyed, 191 (70.2%) manifested confirmation bias, in agreement with the literature (Baack et al., 2015; Duong et al., 2014; O'Reilly et al., 2017; Perera et al., 2019), when confirming their decisions to open or not the branch and 29.8% did not present the bias for they did not confirm their previous decision. Furthermore, it is observed that most accountants (75.6%) and managers (75.0%) manifested the confirmation bias remaining with their decision to open the branch or not and 63.5% of the control group also presented the bias. In addition, it is observed, by the Chi-square Test, that there is no association or dependence between the variables Profile and Confirmation in the Decision (p-value = 0.109), Type and Confirmation in the Decision (p-value = 0.327), Level and Confirmation in the Decision (p-value = 0.349) and Treatment and Confirmation in the Decision (p-value = 0.426), confirming the independence test.

Regarding the type of information, Table 2 shows that 72.9% of the participants, who received positive information, confirmed their decisions to open or not the branch and that 67.4% of those who received negative information expressed confirmation bias. Regarding the level of information, it can be observed that 67.8% of the subjects who received simple information expressed the confirmation bias for because they validated their decisions to open or not the branch and 73.0% of those who received complex information also confirmed their decisions.

Regarding the treatments, 68.0% of the participants who received treatment 1 presented confirmation bias, because they confirmed their decision to open the branch or not. Regarding treatment 2, 67.6% confirmed their decision. Out of those who received treatment 3, 78.5% expressed confirmation bias. Finally, 67.2% of those who received treatment 4 confirmed their decisions. Thus, it is noteworthy that the highest percentage of participants presenting confirmation bias are those who received complex and positive information, suggesting that positive information may generate greater confirmatory predisposition (O'Reilly et al., 2017).

Regarding the variable Confirmation in Information, the independence test demonstrated (p-value 0.02795159) dependence between variables. Similarly, the p-value of the  $\chi^2$  test (0.06498860) evidenced that there is interaction between the variable Confirmation in the Information and the studied factors, demonstrating that the experimental factors affect the Confirmation in Information. Thus, Table 3 demonstrates the analysis of the cross-reference of the variable Confirmation in the Decision with the experimental factors.

**Table 3.** Cross-reference of the variable Confirmation in the Decision with experimental factors

Factor	Description	Confirmation in the Information				Total
		YES		NO		
		Quantity	%	Quantity	%	
Profile <sup>a</sup>	Accountant	50	58.1%	36	41.9%	86
	Manager	40	58.8%	28	41.2%	68
	Control Group	51	43.2%	67	56.8%	118
	TOTAL	141	56.8%	131	43.2%	272
Type <sup>b</sup>	Positive	78	55.7%	62	44.3%	140
	Negative	63	47.7%	69	52.3%	132
	TOTAL	141	56.8%	131	43.2%	272
Level <sup>c</sup>	Simple	73	50.0%	73	50.0%	146
	Complex	68	54.0%	58	46.0%	126
	TOTAL	141	56.8%	131	43.2%	272
Treatment <sup>d</sup>	1 (Sim./Pos.)	43	57.3%	32	42.7%	75
	1 (Sim./Neg.)	30	42.3%	41	57.7%	71
	3 (Com./Pos.)	35	53.8%	30	46.2%	65
	4 (Com./Neg.)	33	54.1%	28	45.9%	61
	TOTAL	141	56.8%	131	43.2%	272

<sup>a</sup> Chi-square = 6.207 / p-value = 0.045 (Profile)

<sup>b</sup> Chi-square = 1.736 / p-value = 0.188 (Type)

<sup>c</sup> Chi-square = 0.427 / p-value = 0.514 (Level)

<sup>d</sup> Chi-square = 3.749 / p-value = 0.290 (Treatment)

Source: Authors.

Table 3 shows that out of the 272 participants in the study, 51.8% presented confirmation bias because they maintained the opinion that a certain information is the most significant to make the decision and that 48.2% did not maintain their decisions. Furthermore, it can be observed that 58.1% of the accountants confirmed their beliefs and 58.8% of the managers also expressed the confirmation bias, highlighting the control group, in which only 43.3% of the participants confirmed the choice of their information. There is an association or dependence between the variables Profile and Confirmation in the Information (p-value 0.045), suggesting that the profile may affect the choice of information. Furthermore, there is no association or dependence between the variables Type and Confirmation in the Information (p-value 0.188), Level and Confirmation in the Information (p-value 0.514), and Treatment and Confirmation in the Information (p-value 0.290).

Out of the participants who received positive information, 55.7% confirmed their choices and 47.7% of those who received negative information also expressed confirmation bias, suggesting that negative information highly influences the decision-making. Regarding the level of information, 50% of the participants who received simple information confirmed their choices and 54% of those who received complex information also confirmed their preferences.

In relation to the treatments, 57.3% of the participants who received simple and positive information confirmed their belief in the choice of information and 42.3% of those who received simple and negative information also confirmed. In addition, 53.8% of the participants presented confirmation bias when receiving complex and positive information and 54.1% also presented it when receiving complex and negative information.

Considering that, the confirmation bias was incisively presented regarding the decision to open or not the branch (Table 2) and more leniently in relation to the use of information to open or not the branch (Table 3). Therefore, it can be inferred that people tend to maintain a decision, regardless of the information available, because they are subject to confirmation bias. Regarding the most significant information, it is observed that the manifestation of confirmation decreased due to the availability of a set of new economic and financial information, which, in a way, caused some of the participants to change their opinions regarding the most significant information, however, without changing their decision to open the branch or not. Therefore, it is suggested that—regardless of the type and level of information available to make a decision—individuals tend to confirm their beliefs in the initial decisions (Jones & Sugden, 2001), by evaluating new information consistently with pre-existing beliefs (Allahverdyan & Galstyan, 2014).

An analysis of the cross-reference between the variables Confirmation in the Decision and Confirmation in the Information was elaborated, to ensure the participants' manifestation of confirmation bias, according to Table 4.

**Table 4.** Cross-reference of the control variable in the information with the variable Confirmation of the Decision

Characteristic	Confirmation in the Decision		Total	
	YES	NO		
Confirmation in the Information	YES	109 40.1%	32 11.8%	141 56.8%
	NO	82 30.1%	49 18.0%	131 43.2%
Total		191 70.2%	81 29.8%	272 100.0%

Chi-square = 7.027 / p-value = 0.008

Source: Authors.

As can be seen, 40.1% of the individuals expressed confirmation bias, both in the decision to open or not the branch, regarding the importance of information to make this decision. In addition, 30.1% of the participants confirmed their decision, however they did not confirm the most important information and 11.8% confirmed the most important information, but did not confirm the decision. Finally, only 18% did not confirm their beliefs in the decision and use of information. In addition, an association or dependence between the variables Confirmation in the Decision and Confirmation in the Information occurs (p-value 0.008), which suggests that one variable affects the other, i.e., most individuals who confirmed their belief in the decision to open the branch continued to use the same information to support their initial decision.

In addition, logistic regression was performed for the variables Confirmation in the Decision and Confirmation in the Information and the Wald test for the individual factors. Table 5 demonstrates logistic regression and Table 6 demonstrates the Wald test for the variable Confirmation in Decision.

**Table 5.** Logistic Regression for the variable Confirmation of Decision

Factor	Estimate	S E	Z-value	P-value	Odds Ratio
(intercept)	1.20554	0.31059	3.881	0.000104***	3.338550
profile2	-0.03441	0.37866	-0.091	0.927599	0.966177
profile3	-0.66307	0.32242	-2.057	0.039728**	0.515265
factortype1	-0.35759	0.27249	-1.310	0.190149	0.699356
factorlevel1	0.32157	0.27329	1.177	0.239336	1.379289

Source: Authors.

Notes: \*\*\* < 0.01; \*\* < 0.05; \* < 0.10. Factors: profile2 (manager); profile3 (control group); factortype1 (negative information); factorlevel1 (complex information).

Table 5 shows that the only statistically significant factor (p-value 0.039728) was the profile 3 (control group). Table 6 presents the Wald test for individual factors in relation to the variable Confirmation in Decision.

**Table 6.** Wald test for individual factors in relation to Confirmation in Decision

Factor	Degree of Freedom	Chi Square Test	p-value
Profile	2	5.5686	0.06177*
factortype	1	1.7165	0.19015
factorlevel	1	1.3845	0.23934

Source: Authors.

Notes: \*\*\* < 0.01; \*\* < 0.05; \* < 0.10.

As presented, both logistic regression and Wald test suggested that the factors type and level of information did not influence the confirmation bias of accountants and managers regarding the branch opening, evidencing that the way in which economic and financial information are presented does not attenuate bias. Furthermore, the Wald test (Table 6) shows that only the profile factor (p-value 0.06177) has a statistically significant influence on Confirmation of the Decision. Moreover, according to Table 5, the estimated parameter for the Control Group (profile3) indicates that the chance of participants of control group making the decision that implies confirmation bias is 51.52% lower than the chance of the accountants making the same decision.

Therefore, it can be noted that regardless of the profile, individuals are subject to confirmation bias (Allahverdyan & Galstyan, 2014; Nickerson, 1998) and those who have a lower familiarity with economic and financial information can mitigate the bias, especially when compared to the professional who produces this type of information, as accountant (Cloyd & Spilker, 2000; Park et al., 2013).

Then, logistic regression was performed for the variable Confirmation in the Information according to Table 7 and the Wald test was carried out for individual factors in relation to the variable Confirmation in Decision, as presented in Table 8.

**Table 7.** Logistic regression for the variable Confirmation of Decision

Factor	Estimate	S E	Z-value	P-value	Odds Ratio
(intercept)	0.46733	0.27518	1.698	0.0895*	3.338550
profile2	0.03587	0.33233	0.108	0.9141	0.966177
profile3	-0.68840	0.29356	-2.345	0.0190**	0.515265
factortype1	-0.42892	0.25125	-1.707	0.0878*	0.699356
factorlevel1	0.22980	0.24987	0.920	0.3578	1.379289

Source: Authors.

Notes: \*\*\* < 0.01; \*\* < 0.05; \* < 0.10. Factors: profile2 (manager); profile3 (control group); factortype1 (negative information); factorlevel1 (complex information).

Table 7 shows that the factors profile3 (control group) and type1 (negative information) were statistically significant (p-values 0.0190 and 0.0878, respectively). Table 8 presents the Wald test for individual factors in relation to the variable Confirmation in Decision.

**Table 8.** Wald test for individual factors in relation to Confirmation in Decision

Factor	Degree of Freedom	Chi Square Test	p-value
Profile	2	7.6597	0.02171**
factortype	1	2.9143	0.08780*
factorlevel	1	0.8458	0.35775

Source: Authors.

Notes: \*\*\* < 0.01; \*\* < 0.05; \* < 0.10.

Regarding the variable Confirmation in Information, the Wald test for the factors (Table 8) demonstrates that the profile factor (p-value 0.02171) and the type of information factor (p-value 0.08780) have a significant influence on the variable Confirmation of Information. Furthermore, the parameter estimated in Table 8 indicates that the chance of control group participants choose information for decision-making implying confirmation bias is 51.52% lower than that of the accountants, which confirms the premise that knowledge on the subject predisposes the individual to confirmation bias.



Moreover, the estimated parameter for the factor type indicates that a participant exposed to negative information has 69.94% less chance of making a decision that characterizes the confirmation bias, suggesting that the information presented in a negative way can mitigate the confirmation bias (Duong et al., 2014; O'Reilly et al., 2017).

## 5 CONCLUSION

The work aimed to analyze the presence of Confirmation Bias in managers and accountants in a managerial decision-making process, as well as to analyze whether the manner in which economic and financial information is presented influences the Confirmation Bias. Therefore, by an experiment, the Confirmation Bias in the decision to open or not a branch of a company and in the search for information to make the decision were analyzed.

Out of the participants, 70.2% confirmed the initial decision to open the branch or not, thus manifesting the Confirmation Bias, 51.8% chose the same information in the two phases of the experiment and 40.1% maintained their initial position of both opening the branch regarding the choice of information. Thus, the results confirm that accountants and managers are subject to confirmation bias in decision-making, regardless of the type and level of economic and financial information used.

Moreover, the profile was the only factor that influenced the confirmation bias in the decision to open or not the branch and, compared to the accountants, individuals who did not have a greater familiarity with economic and financial information had a lower chance of making a decision that implied the presence of this bias. Furthermore, the results suggested that the profile and type of information influenced the Confirmation Bias in the choice of information, demonstrating that control group individuals presented a decreased chance of being subject to bias, compared to the accountants. In complement, participants exposed to negative information were less likely to make a decision that characterized the Confirmation Bias.

Considering the aforementioned aspects, we conclude that the way the economic and financial information was presented did not significantly influence the Confirmation Bias in the managerial decision-making process of accountants and managers and that only negative information attenuated the bias in these individuals.

Thus, this work empirically contributes to its field of knowledge by filling an existing gap: analyze whether economic and financial information influences the confirmation bias in managerial decision-making of accountants and managers. Furthermore, the results corroborate the literature, confirming that managers and accountants are subject to confirmation bias in their decisions and they contribute in an unprecedented manner demonstrating that the way information is presented does not influence the confirmation bias. Therefore, the work contributes in a practical way by serving as a parameter for the architecture and creation of economic-financial statements, as well as structures that can minimize the effects of confirmation bias and improve the decision-making process. For future studies, it is suggested to use the choice architecture (Thaler & Sunstein, 2008) and the framing bias (Tversky & Kahneman, 1981) for the production of information that mitigate the confirmation bias in managerial and financial decisions.

Because it is an experimental methodology, some limitations were observed in the sample and in the number of researched per profile, caused by the experiment complexity and the lack of interest of people in participating in the research. Moreover, because it is a complex experiment carried out with humans, not every variables could be controlled or measured and, considering the size and nature of the sample, it is possible that extrapolation of the results is not valid for other groups of professionals or populations. However, due to the novelty and contribution of the study, the results can be used as a basis for conducting new experiments to deepen the knowledge about the subject.

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**How to cite this paper**

Costa, D. F.; Carvalho, F. de M.; Moreira, B. C. de M.; & Silva, W. S. (2020). Confirmation bias in managerial decision-making: an experimental study with managers and accountants. *Revista de Contabilidade e Organizações*, 14:e164200. DOI: <http://dx.doi.org/10.11606/issn.1982-6486.rco.2020.164200>

## APPENDIX A

### Exploratory Data Analysis

Table A1 shows the number of individuals who participated in the experiment by profile and gender. As one can observe, 31.7% of the sample was composed of accountants, 25% by managers and 43.3% by other professionals or students.

**Table A1.** Frequency of experiment participants by professional profile and gender

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

Source: Authors.

Table A2 shows the frequency of individuals who proposed to open or not the branch. Thus, 63.2% of the participants answered that they would open the branch in the first phase of the experiment and 62.9% said they would open the branch in the second phase. On the other hand, 36.8% and 37.1% of the surveyed answered that they would not open the branch in the first and second phase of the experiment, respectively.

**Table A2.** Frequency of responses to open or not the branch

Branch Opening	Stage 1		Stage 2	
	Quantity	%	Quantity	%
Yes	172	63.2%	171	62.9%
No	100	36.8%	101	37.1%
TOTAL	272	100.0%	272	100.0%

Source: Authors.

Table A3 analyzes the frequency of the response of individuals in relation to the most important information to open a branch in both phases of the experiment. For 42.3% of the participants, the most significant information in the first phase was Profit or Loss, remaining as the most significant for 54.8% in the second phase. The second most significant information was Sales, reaching 27.2% and 27.6% of participants in the first and second phase, respectively. Notably, the information "Profit or Loss" increased in significance in the second part of the experiment, after receiving the economic and financial information.

**Table A3.** Frequency of responses to the most significant information to open a branch

Most Significant Information	Stage 1		Stage 2	
	Quantity	%	Quantity	%
SALES	74	27.2%	75	27.6%
Operating Expenses	28	10.3%	22	8.1%
Profit or Loss	115	42.3%	149	54.8%
GDP	22	8.1%	5	1.8%
Inflation	31	11.4%	12	4.4%
Interest Rate	2	0.7%	9	3.3%
TOTAL	272	100.0%	272	100.0%

Source: Authors.

## APPENDIX B

### Detailing the Experiment

The experiment was designed to be carried out on the internet, with a website created exclusively for this purpose. To this end, a computerized system was built, simulating a business environment, in which the information was presented to the participants in two phases. Participation was totally spontaneous within the criteria of research ethics and to avoid biased responses. The experiment was approved by the Research Ethics Committee of the Federal University of Lavras — UFLA.

The experiment exposed the participants to situations in which they had to decide between opening or not a company branch. The experiment occurred in two phases, the first phase presented the information usually seen on media about a case of a company with a branch similar to the one that the individual would propose to open (Figure B1). Then, the following questions were asked:

*Would you open the branch based on the information presented? The response options were “yes” or “no”.*

*Which is the most important information to decide whether open a branch or not? The response options were: Sales, Operating Expenses, Profit or Loss, GDP, Inflation or Interest Rate.*

After that, participants were directed to the second phase of the experiment, randomly receiving (by a computational draw) the information of each of the four treatments: 1) simple and positive information; 2) simple and negative information; 3) complex and positive information; and 4) complex and negative information.

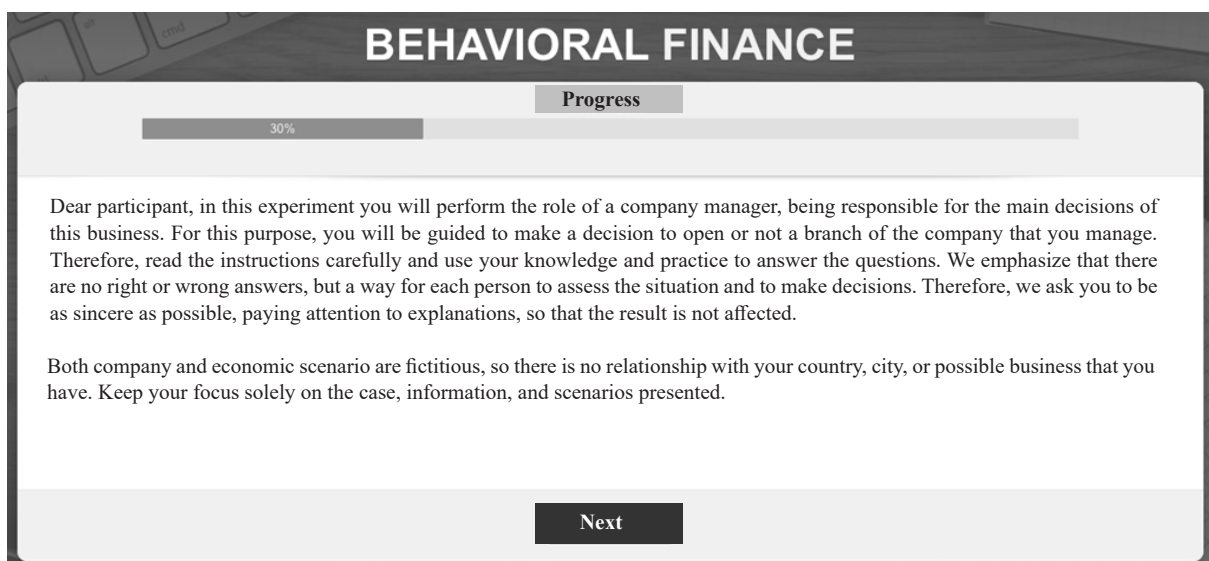
The type of information is composed of information of a positive nature (may positively influence the decision) and negative information (may negatively influence the decision). Positive information is related to revenue and profit growth and decreased expenses (Figure B2 and Figure B4) and negative information is related with decreased sales, increased expenses, and losses (Figure B3 and Figure B5). The level of information is composed of simple and complex information, related to the manner in which the information is made available and how the volume of information is presented to individuals. Simple information is presented in a table format (Figure B2 and Figure B3) and the complex information in the Balance Sheet and the Income Statement (Figure B4 and Figure B5).

Participants directed to Treatment 1 received the information present in Figure B2, those belonging to Treatment 2 received the information according to Figure B3, those who were exposed to Treatment 3 obtained the information in Figure B4 and, finally, the respondents of Treatment 4 received information according to Figure B5.

Then, participants were asked to answer the following questions again:

*Would you open the branch based on the information presented? The response options were “yes” or “no”.*

*Which is the most important information to decide whether open a branch or not? The response options were: Sales, Operating Expenses, Profit or Loss, GDP, Inflation or Interest Rate.*



**Figure B1.** Start screen of the experiment.

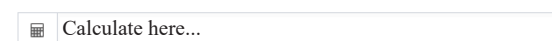
In order to support your decision whether to open a branch or not, annual information about the Parent Company and the economic data are presented below:

 Calculate here...

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%

**Figure B2.** Economic and financial information (simple and positive) presented for treatment 1

In order to support your decision whether to open a branch or not, annual information about the Parent Company and the economic data are presented below:

 Calculate here...

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%

**Figure B3.** Economic and financial information (simple and negative) presented for treatment 2

The balance sheet and income statement of the parent company related to the last three exercises years are presented below to support your decision of opening or not the branch:

 Calculate here...

BALANCE SHEETS ended on December 31 (in reais)							
ASSET	2013	2014	2015	LIABILITY	2013	2014	2015
<b>Current Asset</b>				<b>Current liability</b>			
Waivability	46,300	41,400	90,600	Suppliers	72,600	86,000	190,900
Accounts Receivable	86,900	116,900	164,500	Obligations to employees	1,100	3,800	7,600
Inventory	115,100	195,200	287,900	Payable Tax	3,550	8,550	12,950
<b>Total current asset</b>	<b>248,300</b>	<b>353,500</b>	<b>543,200</b>	Loans	63,000	21,900	17,200
<b>Non-current asset</b>				<b>Total current liability</b>	<b>140,250</b>	<b>120,250</b>	<b>228,650</b>
Investments		300	300	<b>Non-current liability</b>			
Fixed assets	43,800	37,600	31,700	Long-term Loan		44,300	29,700
Intangible asset	1,150	1,150	1,150	<b>Total non-current liabilities</b>		<b>44,300</b>	<b>29,700</b>
<b>Total of non-current asset</b>	<b>44,950</b>	<b>39,050</b>	<b>33,150</b>				
				<b>Owners' equity</b>			
				Capital Stock	70,000	70,000	70,000
				Appropriated retained earnings	83,000	158,000	248,000
				<b>Total Owners' Equity</b>	<b>153,000</b>	<b>228,000</b>	<b>318,000</b>
<b>Total Asset</b>	<b>293,250</b>	<b>392,550</b>	<b>576,350</b>	<b>Total liability + Owners' equity</b>	<b>293,250</b>	<b>392,550</b>	<b>576,350</b>

INCOME STATEMENT FOR THE EXERCISES OF (in reais)			
	2013	2014	2015
<b>GROSS PROFIT</b>	<b>460,000</b>	<b>600,000</b>	<b>780,000</b>
(-) Deduction of Gross Income			
(-) Sales Tax	(37,000)	(54,000)	(78,000)
<b>= NET REVENUES</b>	<b>423,000</b>	<b>546,000</b>	<b>702,000</b>
(-) Cost of Merchandise Sold	(280,000)	(360,000)	(482,000)
<b>= GROSS PROFIT</b>	<b>143,000</b>	<b>186,000</b>	<b>220,000</b>
(-) Operating expenses	(78,000)	(100,000)	(120,000)
<b>= PROFIT/LOSS BEFORE THE FINANCIAL RESULT</b>	<b>65,000</b>	<b>36,000</b>	<b>100,000</b>
(+/-) Financial Result	(2,000)	(11,000)	(10,000)
<b>= PROFIT OR LOSS OF THE EXERCISE</b>	<b>63,000</b>	<b>75,000</b>	<b>50,000</b>

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 years	7%	6%	5%
Interest rate (accrued in 12 months) in the past three years	11%	10%	9%

**Figure B4.** Economic and financial information (complex and positive) presented for treatment 3.

BALANCE SHEETS ended on December 31 (in reais)							
ASSET	2013	2014	2015	LIABILITY	2013	2014	2015
<b>Current Asset</b>				<b>Current liability</b>			
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 Tax	3,550	8,550	9,950
<b>Total current asset</b>	<b>248,300</b>	<b>283,500</b>	<b>393,200</b>	Loans	63,000	51,900	68,200
<b>Non-current asset</b>				<b>Total current liability</b>	<b>163,250</b>	<b>176,250</b>	<b>275,650</b>
Investments		300	300	<b>Non-current liability</b>			
Fixed assets	43,800	37,600	31,700	Long-term Loan	30,000	44,300	51,700
Intangible asset	1,150	1,150	1,150	<b>Total non-current liabilities</b>	<b>30,000</b>	<b>44,300</b>	<b>51,700</b>
<b>Total of non-current asset</b>	<b>44,950</b>	<b>39,050</b>	<b>33,150</b>				
				<b>Owners' equity</b>			
				Capital Stock	70,000	70,000	70,000
				Appropriated retained earnings	30,000	32,000	29,000
				<b>Total Owners' Equity</b>	<b>100,000</b>	<b>102,000</b>	<b>99,000</b>
<b>Total Asset</b>	<b>293,250</b>	<b>322,550</b>	<b>426,350</b>	<b>Total liability + Owners' equity</b>	<b>293,250</b>	<b>322,550</b>	<b>426,350</b>

INCOME STATEMENT FOR THE EXERCISES OF (in reais)			
	2013	2014	2015
<b>GROSS PROFIT</b>	<b>780,000</b>	<b>700,000</b>	<b>630,000</b>
(-) Deduction of Gross Income			
(-) Sales Tax	(78,000)	(70,000)	(63,000)
<b>= NET REVENUES</b>	<b>702,000</b>	<b>630,000</b>	<b>567,000</b>
(-) Cost of Merchandise Sold	(540,000)	(490,000)	(440,000)
<b>= GROSS PROFIT</b>	<b>162,000</b>	<b>140,000</b>	<b>127,000</b>
(-) Operating expenses	(140,000)	(126,000)	(120,000)
<b>= PROFIT/LOSS BEFORE THE FINANCIAL RESULT</b>	<b>22,000</b>	<b>14,000</b>	<b>7,000</b>
(+/-) Financial Result	(12,000)	(12,000)	(10,000)
<b>= PROFIT OR LOSS OF THE EXERCISE</b>	<b>10,000</b>	<b>2,000</b>	<b>(3,000)</b>

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 years	<7%	6%	5%
Interest rate (accrued in 12 months) in the past three years	11%	10%	9%

**Figure B5.** Economic and financial information (complex and negative) presented for treatment 4