

Cognitive and motivational bias in Budgetary Decision Making: Experimental Evidence in the Public Sector

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Abstract

Objective: To investigate how various cognitive and motivational biases affect decisions regarding budget expenditure and public administration. The nature of the experimental task consisted of manipulating hypothetical decision-making situations, in a realistic scenario, with the aim of verifying whether the biases: anchoring, status quo, framing and overconfidence were manifested in the managers' responses.

Method: A within-participants experiment was carried out, with data collected through a survey applied to members of the college of directors - managers, with more than five years in the role. The independent variable "knowledge" was manipulated, and "experience" measured, using concrete situations.

Results: It was found that managers' decision-making and their judgments about the execution of public expenditure were influenced by cognitive and motivational biases; certifying that managers were overconfident, even when making wrong decisions.

Contributions: For behavioral public administration, progress in management policies and organizations implies advances in managerial decision-making. The expansion of the scope, so that the manipulations carried out reflect real decision-making situations, allows us to understand how those responsible for the execution of expenses in the managed units actually decide on the allocation of resources.

Keywords Cognitive and motivational biases; execution of public expenditure; making of decision; theory of prospect, expected utility theory.

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Introduction

How do cognitive and motivational biases influence managers' decision-making about budget execution, given their knowledge and experience of public spending?

It is true that decision making is inherent to the manager and, in the public sector, prior knowledge of management and the public budget can contribute to this activity. However, having prior knowledge does not guarantee that decisions will be free of risks and uncertainties (Buchanan & O'Connell, 2006; Vis, 2011).

Even though systematic errors are common and predictable, predictability itself makes it possible to mitigate them when previously identified (Feitosa et al., 2014).

The theory of expected utility (von Neumann & Morgenstern, 2004) suggests that the decision maker will choose the option where the expected utility is greatest, regardless of the value of that option, demonstrating that people's preferences are rational, with reason being the path to the optimum decision.

On the other hand, according to Feitosa et al. (2014), understanding the decision-making process as not strictly rational shows that decision-makers use heuristics when the time available is limited, and these can become a cognitive bias when applied inappropriately.

Understanding how biases affect the decisions of public managers implies understanding the application of public resources that will have an impact on public policies and consequently on the service provided to the community (Bellé et al., 2018), if not on the formulation of the public policy itself (Strassheim, 2021).

A number of studies have been carried out to analyze biases in the decision-making of managers and civil servants. Bellé et al. (2018) tested a wide variety of cognitive biases and the results showed systematic deviations from rationality. A similar study was carried out by Nagtegaal (2022), aimed at managers and civil servants in the United Kingdom, focusing only on the anchoring bias, indicating and recommending as future research, to be carried out in real scenarios or the natural decision-making field of the participants, and related to the management of public organizations.

Initially, we sought to investigate whether the findings of Bellé et al. (2017, 2018) and Nagtegaal (2022) would be confirmed in the Brazilian reality. In this way, this study contributes to the understanding of the decision-making process in public management in an economy outside Europe and at the same time emerging, with the potential to propose measures that mitigate problems arising from

the occurrence of cognitive biases, such as those found by these authors.

In a second step, this research contributes to highlighting the reflection of this range of biases analyzed in the international research by Bellé et al. (2017, 2018) and Nagtegaal (2022), in a natural decision-making scenario, in a group of managers linked to education, who assume the highest positions in the public organization researched.

Finally, this study contributes to the practice of public management by considering that deviations from rationality in the decision-making process should be taken into account in the projections of public policies; in the minimum criteria for the selection of managers, required to take office, both through election and appointment; improvement of internal procedures and management systems, the role of the technical support team in decision-making; in addition to being able to be replicated in the Federal Institutes in Brazil (IFs), 682 Units (MEC, 2023), Brazilian public universities, as it deals with concrete and real issues about the execution of expenses.

Added to these contributions is the fact that having a high level of training does not mean the absence of errors in decisions, even though systematic errors are common and predictable. Predictability itself makes it possible to mitigate them when they are identified in advance (Feitosa et al., 2014).

Thus, the general objective of this study is to verify the effect of anchoring, status quo, framing and overconfidence on public budget decisions made by managers at the Federal Institute of Bahia (IFBA).

2 Theoretical framework

2.1 Previous literature

Expected utility theory (Neumann & Morgenstern, 1945) was the dominant model before the 1940s for describing decision making with a focus on rational decision.

Since 1974, mainly with the research in experimental and cognitive psychology by Kahneman and Tversky (1979), prospect theory has violated the idea that human beings are capable of mastering rationality. This position was defended by classic research into decision-making, which originated in the economic sciences and led to the concept of rationality being re-examined (Tonetto et al., 2006). Discovering patterns that were not recognized by the defenders of rational decision-making, such as the identification of self-control as an essential sense for rational decision-making and emotion as detrimental to

self-control, as well as the unknown (Baratella, 2007).

Currently, studies have focused on the attributes of human cognition and the role of heuristics in decision-making (Libby et al., 2002), considered mental rules that simplify a decision-making process, speeding up the processing of information, especially in a faster world, where agile decisions are becoming imperative (Baratella, 2007).

These rules are usually based on the decision-maker's common sense or previous experience (Pimenta et al., 2012), so that difficult questions can be answered in a simple way (Strassheim, 2021). For political scientists, individuals often make decisions using heuristics when faced with incomplete information or uncertainty (Vis, 2019).

Every time a heuristic is applied inappropriately in a decision-making process, a bias arises (Tonetto et al. 2006). For Kahneman and Tversky (1979), according to our cognitive system, we are programmed and prone to fall victim to decision-making biases. Asking the wrong questions, combined with limited knowledge and optimism, can threaten the confidence of choices (Buchanan, 2006). The root of cognitive biases lies in the noise of the information processed by individuals, while motivational biases occur when decisions are made that are inconsistent with long-term interests thanks to the temporary motivation exposed to the decision-maker, making decisions biased, where a short-term concern harms or reduces the expected long-term result (Feitosa et al., 2014).

The overconfidence motivational bias is considered a cognitive illusion, in which people tend to make systematic errors, which can be present in decision-making, judgments, as well as influencing daily activities and behavior (Baratella, 2007). It occurs when individuals' confidence judgments are higher than the relative frequencies of the assertions in the questions involving decision-making. Consequently, there may be decisions that are not good, because the decision-makers fall short of objectively rational behavior (Feitosa et al., 2014).

The cognitive bias of anchoring, on the other hand, is identified when you need to estimate something and you're not sure of the correct answer, so you adopt whatever number or anchor is nearby as a starting point (Baratella, 2007).

Two models are used to obtain the effects of anchoring: the traditional one and the Jacowitz and Kahneman method (1995). In the traditional method, participants are directed to perform two consecutive tasks, aiming for a comparative judgment and a final estimation. An anchor is defined and the participants are directed to respond, and their response may be greater or less than the anchor, and then they need to show a final response, which is usually influenced by the anchor given at the beginning

(Luppe & Ângelo, 2010).

In Jacowitz and Kahneman's method (1995), three groups are extracted from the same population, in the first of which calibration is adopted (without the influence of the anchor with uncertain values, providing the degree of confidence), and in the other two groups, the respondents make their estimates after judging an anchor (Luppe & Ângelo, 2010). Therefore, even an irrelevant anchor combined with an arbitrary number provided by the researcher can result in a biased judgment (Tonetto et al., 2006).

The status quo can be considered an anomaly, or value asymmetry, relating to loss aversion (Kahneman et al., 2000). An empirical result qualifies as an anomaly if it is difficult to "rationalize", or if implausible assumptions are required to explain it within the paradigm (Kahneman et al., 2000, p. 193). Regardless of the best outcome, when there are several attractive alternatives for a decision-maker, they tend to prefer the status quo (Bellé et al., 2018).

In framing, respondents are asked questions that focus on the same outcome, but one question involves choosing between a positive option and a negative one. Individuals tend to react differently to the same information or significantly change their preferences depending on how it is presented or formulated (Bellé et al., 2018; Tversky & Kahneman, 1981).

National (Feitosa et al., 2014; Lucena et al., 2021; Luppe & Ângelo, 2010; Tonetto et al., 2006) and international studies (Bellé et al., 2017, 2018; Strassheim 2021; Kahneman et al., 2000; Lucena et al., 2021; Nagtegaal, 2022; Tversky & Kahneman, 1981; Vis, 2011, 2019) have portrayed deviations in rational decision-making through biases.

2.2 Developing hypotheses

2.2.1 Hypothesis 1

Based on research by (Baratella, 2007; Gigerenzer et al., 1991; Klayman et al., 1999), Feitosa et al. (2014) prepared a questionnaire in which each manager was asked to state the correct answer to each question and mark the estimated interval for their level of confidence regarding the assertion in the question. In order to assess this bias, the accuracy index (AI) of the participants was calculated by relating it to the average of the confidence scale estimates (NC), seeking to assess whether $AI=NC$ through a test of averages. The results showed that the managers surveyed were overconfident.

In line with these studies, which demonstrated the presence of the cognitive illusion of overconfidence in the behavior of the subjects surveyed, and in order

to investigate whether the behavior of IFBA managers, through their decision-making, is influenced by this motivational bias, the following hypothesis was developed:

H1: IFBA managers are overconfident in budget decisions.

To test this hypothesis, the IA and NC of each manager will be compared.

2.2.2 Hypothesis 2

LLuppe and Ângelo (2010) carried out an experiment with undergraduate students to identify anchoring in the decision-making process of consumers in the perception of prices of products and services, involving three groups of a population (one with calibration and two with anchors), using an anchoring index (AI), which showed the influence on the participants' judgments in estimating prices, with low anchors being more effective than high ones.

Bellé et al. (2018) tested different anchors aimed at Italian civil servants and managers, on the maximum number of days that a municipality's employees should respond to citizens' emails. The research found considerable deviations in the rational decision-making of public servants, with a greater influence of the high anchor.

On the status quo, Bellé et al. (2018) designed two experiments to test the effect of multiple alternatives offered to public officials, assuming that responses would change to the status quo as viable alternatives increased. Using logistic regression, it was found that the chances of maintaining the status quo were higher than when more alternatives were presented.

Tversky and Kahneman (1981) presented illustrations of individuals' preference reversals, showing the effect of framing variations (positive and negative), in a scenario in which participants were preparing for the problem of Asian disease and programs were laid out for respondents to choose from. The study showed that in choices involving gains, people tend to be risk-averse, while in those involving losses, people tend to take the risks.

Bellé et al. (2018), investigating framing, found that civil servants preferred the program with a certain outcome to the one with a probabilistic outcome. The chances of choosing the right option in the positive framework were higher than in the negative framework, demonstrating loss aversion.

Based on this research, the following hypothesis was drawn up:

H2: IFBA managers' decision-making on annual budget planning and expenditure execution is influenced by cognitive and emotional biases. This test will consider whether AI = NC and AI = 0%, an alternative and

probabilistic option.

2.2.3 Hypothesis 3

In Brazil, the public budget and its preparation go through six stages: planning, programming, budgeting, execution, control and evaluation (MF, 2008b).

In Brazil, budget execution and public management must comply with various regulations, such as Law 4.320/64 (Financial Law), the Fiscal Responsibility Law (LRF), Complementary Law 101/2000, the Multi-Year Plan (PPA), the Budget Guidelines Law (LDO), the Annual Budget Law (LOA), and Law 14.133/21, which deals with tenders.

Tendering is the selection procedure (external phase). However, there are previous stages, such as the planning of the contract (internal phase), consisting of the preliminary technical study (ETP), terms of reference (TR) or basic project (PB), prepared by civil servants formally designated by the competent authority, according to law 14.133/2021. In the FIs, the competent authority is the top management. Therefore, in order to approve ETP, TR, PB, public notice, it is assumed that they must have knowledge of these stages.

The execution of expenditure goes through three stages: commitment, settlement and payment, the first and third of which require the signature of the authorizing officer. Next comes management compliance, which consists of certifying the acts and facts related to budgetary, financial, accounting and asset execution, to verify that the records made by the UG were supported by the rules and legislation (MF, 2008a).

Managers therefore have a range of responsibilities that require knowledge of issues related to the execution of public spending, from planning to accountability.

There are various aspects of human behavior when faced with budget information, such as: belief, emotion, values, overconfidence, which influence decision-making, bias in financial and budget information and the behavior of decision-makers, which can make it erroneous and even affect organizational control (Lima Filho & Bruni, 2013).

The top management of a public institution is also part of the political elite, who, according to Vis (2019), make judgments and decisions that are different from the ordinary citizen's environment and usually have support staff in order to make more precise decisions.

In view of the discussions in the articles presented in this section and the list of responsibilities inherent in the top management of FIs, the third hypothesis was developed:

H3: The characteristics shown in the demographic questions regarding managers' experience and knowledge of public management interact with the possible systematic errors as an effect of the overconfidence bias. For this analysis, it is expected that demographic aspects will not interact with possible systematic errors as an effect of overconfidence bias.

3 Methodology

3.1 Research delimitation

The population of participants is located in the more than 682 IFs that currently exist in Brazil, which have a college of leaders (CODIR), a higher body, according to Law No. 11.892/2008.

The purpose of the IFs, which are made up of campuses and rectories, is to bring together the Teaching, Research and Extension tripod, providing technical, technological

and vocational education, as well as higher education. Each of the 22 campuses surveyed and the Rectory is a Management Unit (UG) and is responsible for carrying out expenditure in the following phases: bidding, contracting, commitment, settlement and payment.

To carry out this research, we considered the natural members of CODIR, the Institutions top management, made up of 28 public managers, 1 Rector, 5 pro-rectors and 22 general directors of the IFBA Campuses, as the research sample. Of these managers, 27 responses were completed and analyzed, representing 96.43% of the total surveyed

The experimental design was within participants (Shadish, Cook & Campbell, 2002), in which participants with many homogeneous characteristics (demographic issues and control variables), were exposed to the same experimental conditions and each member served as their own control.

Figure 1: Schematization of the study variables (Libby Box)

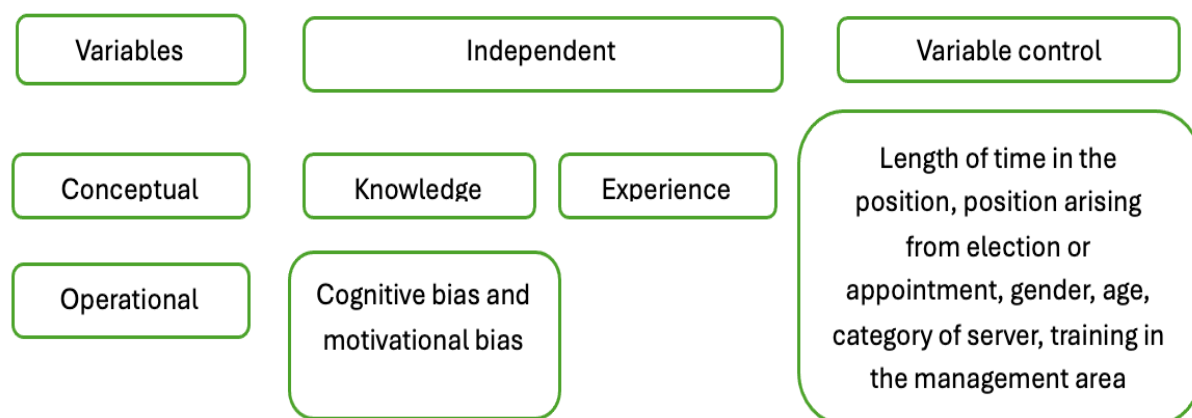


Figure 1 - own elaboration adapted from the Libby Box predictive validity framework model (libby et al., 2022)

The manipulations were simulated using a structured questionnaire (Appendix A) in order to observe the effect

of already presumed causes in a real decision-making scenario.

Table 1: Summary of questions and bias manipulations

Experimental factor (levels)	Scenario - question num-ber	Previous studies with similar issues
Experimental factor (levels)	Scenario - question num-ber	Previous studies with similar issues
Overconfidence	1 a 5	(Feitosa et al., 2014)
Anchoring	6 a 8	(Bellé et al., 2017, 2018; Feitosa et al., 2014; Luppe & Ângelo, 2010; Nagtegaal, 2022)
Status quo	9 e 10	(Bellé et al., 2018; Kahneman et al., 2000)
Framing (positive)	11	(Bellé et al., 2018; Tversky & Kahneman, 1981)
Framing (negative)	12	(Bellé et al., 2018; Tversky & Kahneman, 1981)

The independent variable "Experience" was measured in the post-experimental questions, as shown in Table 1.

Demographic questions: gender, age, position, classification/typology were classified according to MEC decree no. 713/2021.

3.2 Data Collection and Analysis Procedures

CODIR meetings take place in a hybrid format, and data was collected in two stages: 1 face-to-face meeting on 17/10/2023, with 14 participants, and 1 online meeting from 27/11/2023 to 15/12/2023, using Google Forms, with 13 participants.

In the face-to-face collection, each participant received an envelope and had the opportunity to read the scenario presented, and then answer the experimental task distributed at random.

To avoid noise, since they were in the same room, the order of the questions was changed, without interfering with the result, so that one respondent didn't look at another's answer.

3.3 Data Processing and Statistical Tests

3.3.1 Bias Motivational Overconfidence (I)

To manipulate this bias, the questions were adapted from Feitosa et al. (2014). In the 5 dichotomous questions presented, managers were instructed to choose the answer according to their level of confidence in the correct answer. After each question, there was a table with levels of confidence for them to mark their answers, with 0 being no confidence and 10 being total confidence.

For each assertion, the manager obtained an accuracy index (AI), made up of the ratio between the number of correct questions and the total number of questions, generating a score that ranged from 0 to 10.

To assess this bias, the number of expected correct answers was taken into account, along with the confidence level chosen by the participant for each question. The difference between what the manager expects to get right (according to the confidence percentage scale) and the total number of correct answers will indicate their overconfidence.

The average of the scale values of the 5 questions answered was called the NC. So, if a participant had an NC value of 9.4, answering 4 questions correctly, their IA was 8. This showed that this manager would have an overconfidence of 1.4, which would give him a percentage of 14% self-confidence in his decisions.

It sought to assess whether $AI = NC$ (the hit rate is equal to

the average of the confidence scale values), consequently carrying out a test of means for two related samples.

Similar to Baratella (2007), the statistical method chosen was the student's t-test. Initially, the significance of the overconfidence of AI over NC was statistically verified, followed by an F-test and Z-test to compare the variances of the means.

3.3.2 Bias Cognitive Anchoring (II)

An anchoring index (AI), adapted from Luppe and Ângelo (2010), was used to measure the movement of the median of the anchored subjects towards the anchor (eq. 1).

$$AI = \frac{\text{median}(\text{high anchor}) - \text{median}(\text{medium anchor}) - \text{median}(\text{low anchor})}{\text{high anchor} - \text{medium anchor} - \text{low anchor}} \quad (1)$$

The AI values vary between 0 (no anchor effect) and 1 (answers that coincide with the anchors), so the closer the result is to 1, it indicates that the subjects were influenced by the anchors in the questions.

3.3.3 Status Quo Cognitive Bias (III)

To analyze the Status Quo, two questions were presented with a similar theme, adapted to the managers' reality. Choosing the insurance indicated as the standard in both questions represented the status quo.

In the proposals, there was an option to answer "yes" if the standard policy was chosen, or "no" otherwise. For analysis purposes, the "yes" variable took the value 1 and the "no" variable the value 0. The logistic regression model was constructed (eq. 2):

$$\log\left(\frac{Pi}{1 - Pi}\right) = \left(\frac{\frac{ni}{Ni}}{1 - \frac{ni}{Ni}}\right) \quad (2)$$

In the model, the equation $Pi = \frac{ni}{Ni}$ represents the number of choices made by participants for the event of interest (status quo), or the event of no interest (alternative issue), divided by the total number of participants in the survey (Ni). The result of $\log\left(\frac{Pi}{1 - Pi}\right)$, transformed into a Neperian logarithm represents the chances of choosing the status quo or alternative issue.

3.3.4 Cognitive Bias Framework (IV)

It showed a scenario with experimental factors, at the positive and negative levels, presenting a "certain" and a "probabilistic" outcome as alternatives.

The same logistic regression model described in equation

2 was used for this bias

In the model, the equation $Pi = \frac{ni}{Ni}$, represents the number of choices made by participants for the event of interest (probability of success), or for the event of no interest (probability of failure), divided by the total number of participants in the survey (Ni).

The result of $\log\left(\frac{Pi}{1-Pi}\right)$, transformed into a Neperian logarithm represents the chances of taking the risk or being risk averse.

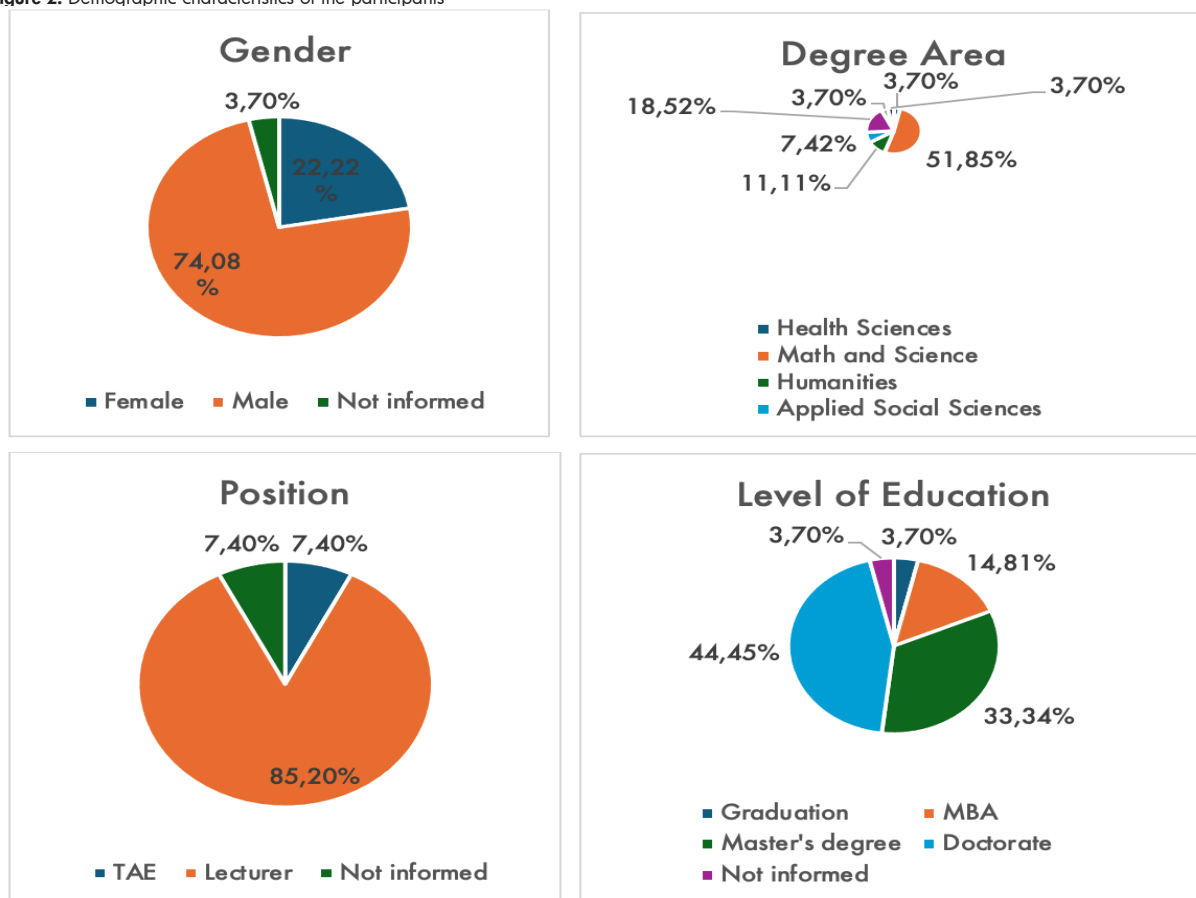
4 Analysis of results

4.1 Post-experimental questions

Academic training was one of the relevant factors for assessing knowledge and experience, along with the independent variables.

Applied social sciences, at first glance, would seem to be an ideal training area, as the curriculum includes essential subjects for managerial functions, but training in this area accounted for only 7.42%.

Figure 2: Demographic characteristics of the participants



The fact that most of the respondents hold a doctorate is a characteristic evidenced by the fact that the elective position of director/dean requires this prerequisite. By way of experience, Law 11.892/2008, in addition to a doctorate, requires a minimum of two (2) years in a management position or function at the institution, or having successfully completed a training course for the exercise of a management position or function.

However, at the IFs, teachers usually take on managerial roles linked to course coordination and areas related to teaching, research and extension. While administrative

technicians (TAE) carry out activities linked to administration, budget and financial management, accounting, assets, governance, contracts, purchasing and bidding.

Another way of assessing managers' knowledge was to find out which of the 7 strategic training courses related to public management they had: Public Governance (GOVP) - 63%, followed by Public Management (GP) - 52%, Conflict Management (GC) - 48%, Performance Indicators (ID) - 26%, Introduction to Public Budgeting (IOP) - 22%, Administrative Bids and Contracts (LC) - 19% and Accountability (PC) - 0%. The fact that the majority of

managers do not have a PC draws attention to the fact that most of them are expenditure managers, dealing with their own budgets, as well as credits from parliamentary/bench amendments, which require detailed accountability.

Having strategic training and/or length of service in the position, combined with training and control variables, would be relevant, especially in questions involving bias (I), since knowledge and experience in the execution of public spending would be essential for them to get the questions right. And if they don't have a degree in management, the ideal would be to have as much training as possible.

Table 3: Descriptive statistics for managers' training (CG)

Training for Managers (CG)	
Average	2,30
Median	2,00
Minimum	0,00
Maximum	5,00
Standard deviation	1,38

Based on the answers given by the civil servants and their limited knowledge of training, which could have influenced their answers, having several years in management positions does not mean that they are management/administration positions.

The average length of service at the institution was 15 years, ranging from 9 to 50 years. 77.78% of those surveyed had been elected to management positions.

In their current position, (81.48%) have between 2 and 4 full years in office, which presumes from the length of the mandate, especially in elected positions, that each mandate will be for 4 years, and can be up to 8 years.

4.2 Experimental questions

4.2.1 Motivational Overconfidence Bias

To analyze the results, the variables used to diagnose bias were IA and NC, as per 3.3.1.

The descriptive statistics shown in table 4 suggest that the NC of managers is higher than the IA, with a higher degree of confidence than the IA and the standard deviation of this variable is almost double that of the NC variable.

Table 4: Descriptive statistics of the variables to measure overconfidence (n=27)

	AI	NC
Average	7,26	8,67
Median	8,00	8,80
Minimum	2,00	6,40
Maximum	10,00	10,00
Standard deviation	2,09	0,97

To test the hypothesis that the means between AI and NC are different, Student's t-test was initially used, but it was rejected with 5% confidence, corresponding to the normal distribution of the AI and NC variables.

Subsequently, a non-parametric test for dependent samples was carried out, in which the Z-statistic was -3.179, significant at 5%, rejecting the hypothesis that IA and NC have equal means and medians, consequently inferring that there is overconfidence in the managers surveyed.

4.2.2 Cognitive Bias Anchoring

To analyze the results, the diagnostic variable was AI bias, as per 3.3.2.

As the survey questions asked for estimates in percentages, the values of 0 and 1 mean 0% and 100% respectively, so that AI equal to 0% shows no anchoring and above 0% shows how close or influential the managers' estimates of the anchors are in percentages and how influential the anchoring bias is.

It was intentional to determine the topics of the questions in this experiment, with one question focusing on the IFBA's general budget compared to the MEC's, because although it is common for managers to talk about the budget, in this dimension it would be more difficult to measure its real values or percentages.

The second dealt with accounts payable, a common theme in the day-to-day lives of managers, and especially because many of them are authorizing officers, who are responsible for indicating the entry of accounts payable. Setting the anchor at 50% was intentional, since accounts payable should be the exception, usually made up of expenses relating to the month of December of the previous year, and even though the campuses receive extra budget at the end of the year, and the purchasing processes are committed many times at the end of the year, the value in practice would be far from 50%, so choosing a percentage close to the anchor was not in line with reality.

The third issue, although not in the day-to-day lives of

managers, is a relevant topic that involves public asset management and in which most of them are directly responsible, which is the regularization of real estate.

Table 5: Statistics of the estimates and statement of the IA

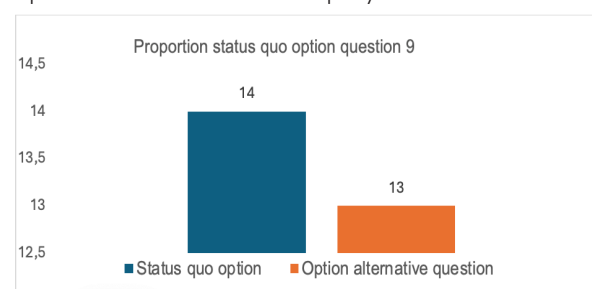
QUESTÕES:	ÂNCORAS	MEDIANAS	AI	TIPO DE ÂNCORA
What is your best estimate of the percentage that the IFBA budget represents in the total MEC budget?	0,40%	0,20%	50,00%	LOW
What is your best estimate of the percentage of the total balance of commitments entered annually in accounts payable over the total IFBA budget?	50%	20%	40,00%	AVERAGE
What is your best estimate for the percentage of the total balance of IFBA's built properties that are effectively regularized, reflecting the reconciliation of balances in SIAFI/SPIUNET?	95%	75%	78,95%	HIGH
AVERAGE	48,47%	31,73%	56,32%	

The overall average for all types of anchors was 56.32%, with the influence of all anchors being greater than that of the high anchor.

4.2.3 Status Quo Cognitive Bias

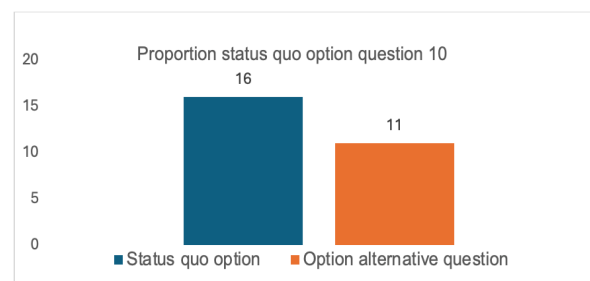
To analyze the results, a logistic regression showed the proportion of managers choosing the status quo over the alternatives presented, as shown in 3.3.3.

Figure 2: Choice of cheapest vehicle insurance policy (status quo), by most expensive alternative vehicle insurance policy.



The results of a logistic regression revealed that the chance of maintaining the status quo is 7.41% higher than when presented with an alternative question

Figure 3: Choosing the most expensive student insurance policy (status quo) over the cheapest alternative student insurance policy.



The results of a logistic regression revealed that the chance of maintaining the status quo is 37.47% higher than when presented with an alternative question.

4.2.4 Cognitive Framing Bias

To assess this bias, a scenario was presented with an experimental factor at positive and negative levels. The questions were adapted from the study by Tvesky and Kahneman (1981), which uses this bias to portray the problem of Asian disease, combined with Bellé et al. (2018), which also used the study by these authors as a basis. In the specific case of this research, the objectively equivalent questions, but with a different presentation, set out the information structured positively (probability of success) and negatively (probability of failure), highlighting in *italics* the text that reflects the framing bias, were adapted to the day-to-day reality of managers, portraying a current issue with worldwide repercussions, which was the COVID-19 pandemic, where managers had to make several decisions that had an impact on the academic community.

To analyze the results, a logistic regression showed the proportion of managers choosing the alternative with a certain outcome over the probabilistic one, with one question having a negative focus and the other a positive one, according to 3.3.4.

Figure 4: Choice of the right outcome option (negative framing), by probabilistic outcome.

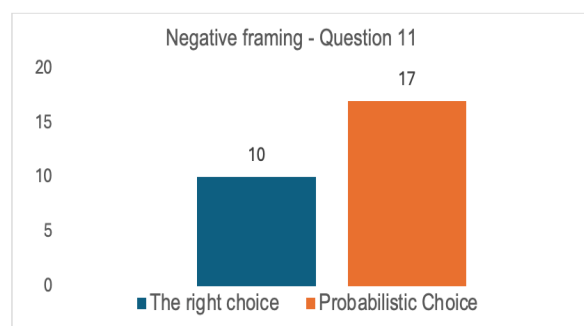
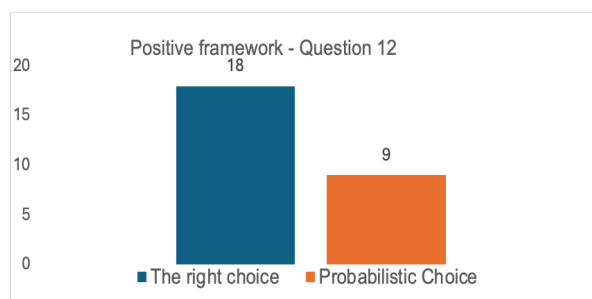


Figure 4 shows the proportion of participants who chose the right choice option $N = 10$, who preferred to adopt program A in which 4,000 students will not receive food aid, given a negative framework; by choice of probabilistic outcome, $N = 17$, in opting for program B, so that there is a one-third probability that no student will stop receiving food aid, and a two-thirds probability that 6,000 students will not receive food aid.

The results of a logistic regression revealed that the chance of those surveyed choosing to take risks (probabilistic choice in the negative framework) is 53.06%, accepting that 4000 students will not receive food aid is less acceptable than the chance that two out of three of the total number of students will not receive food aid.

Figure 5 shows the proportion of participants who chose the right choice option (positive framing) $N = 18$, who preferred adoption to program Where 1,500 students will receive the equipment, by choice of probabilistic outcome, adoption of program B, so that there is a one-third probability that 4,000 students will receive the equipment, and a two-thirds probability that no students will receive the equipment.

Figure 5: Choosing the right outcome option (positive framing) by probabilistic outcome.



The results of a logistic regression revealed that the chance of respondents choosing the right outcome (positive framing) represented 69.31%, demonstrating risk aversion, since the prospect of 1500 students receiving the equipment is more attractive than a risky prospect, consequently there would be a one in three chance of 4000 students receiving the equipment.

The proportion of risk-averse managers was higher under a positive framework (0.67) than under a negative one (0.37), $p < 0.005$. The results of the logistic regression indicated that the chances of choosing the right thing over the gamble were 69.31% higher under a positive framing compared to a negative one ($p < 0.005$).

4.3 Analysis of the Hypotheses

4.3.1 H1 - IFBA managers are overconfident

The rejection of H_0 when $IA = NC$, by the t-student and z-tests, implies the existence of overconfidence in CODIR managers.

Based on the results found in item 4.2.1, there is a difference between the averages of IA and NC , with NC having a higher average indicating an incidence of overconfidence, showing that IFBA managers are overconfident

As a theoretical implication, the findings corroborate previous studies (Baratella, 2007; Feitosa et al., 2014), which showed a reflection of the overconfident motivational bias in the decision making of those surveyed, increasing the use of a realistic scenario.

4.3.2 H2 - IFBA managers' decision-making on annual budget planning and expenditure execution is influenced by cognitive and emotional biases

In order to analyze this hypothesis, it was necessary to relate all the results found regarding the three cognitive biases (anchoring, status quo and framing), as well as the motivational overconfidence bias.

Based on the results found in section 4.2.2, the average IA of the three questions was 56.32%, showing that the managers' estimates were influenced by the anchors presented, rejecting H_0 .

As for the status quo bias, the results of a logistic regression revealed that the chance of maintaining the status quo in the first question (vehicle insurance) is 7.41% and in the second question (student insurance) is 37.47% higher than when presented with an alternative question, rejecting H_0 .

Regarding framing bias, the results of a logistic regression showed that (53.06%) chose to take risks in the negative framing, while (69.31%) were risk-averse in the positive framing, rejecting H_0 .

As a theoretical implication, regarding the influence of the anchoring bias, the findings are in line with the results found by (Bellé et al., 2017, 2018; Feitosa et al., 2014; Luppe & Angelo, 2010; Nagtegaal, 2022); regarding the status quo with the results found by Kahneman et al. (2000) and Bellé et al. (2018); regarding framing with the results found by (Bellé et al., 2018; Kahneman & Tversky, 1979), extending these studies regarding the realistic decision-making scenario.

Based on the analysis of the reflection of all the biases studied in this research, hypothesis 2 is accepted, showing that IFBA managers' decision-making on annual budget

planning and expenditure execution was influenced by cognitive and emotional biases.

4.3.3 H3 - The characteristics shown in the demographic questions regarding managers' experience and knowledge of public management interact with possible systematic errors as an effect of overconfidence bias.

interact with possible systematic errors as an effect of overconfidence bias.

The post-experimental questions sought to list the personal and professional characteristics of the participants; to measure the reflection of knowledge and experience in matters related to public management, more precisely, those that could influence decision-making regarding budget planning and the execution of public expenditure, as per item 4.1.

The questions related to overconfidence bias were manipulated so that answering them correctly would require knowledge and/or experience in matters related to budgetary, financial and accounting management, tenders and contracts, decisions that are inherent to the top management.

To assess the impact of training and time in the job on managers' answers to questions 1 to 5, a correlation test was carried out, as shown in Table 6:

Table 6: Correlation of the variables of knowledge and experience with AI and NC

	Time Mana- gerial func-tions	Time function	Training	AI	NC
Time Managerial functions	1				
Time function	0,3115	1			
Training	0,3169	0,0678	1		
AI	-0,0613	-0,1533	0,0620	1	
NC	-0,0695	0,0599	0,0742	-0,2099	1

Table 6 shows that training interferes with AI as well as NC, and the length of time in the job (current and previous) had no influence on AI.

Considering the analysis of hypotheses 1 and 2, the reflection of the biases in the managers' judgments, and the knowledge and experience demonstrated in 4.1 and 4.3.3, combined with the correlation test of IA and NC with the variables linked to training and knowledge, we suggest rejecting H0.

5 Conclusion

This research tested a range of cognitive biases derived from prospect theory and motivational bias in the context of public expenditure execution, by carrying out a

laboratory experiment.

It investigated how public managers, who are natural members of IFBA CODIR, make decisions, considering their knowledge and experience in the face of the biases presented, manipulating hypothetical and concrete situations in a real decision-making scenario.

The design was of the within-participants type and data was collected by means of a survey, obtaining 27 valid responses, representing 96.43% of the sample surveyed. Three hypotheses were developed, as shown in section 4.3. The results allowed us to conclude that the managers' judgments were influenced by the biases studied (anchoring, status quo, overconfidence framework), and that they were overconfident, given the confidence intervals greater than 7, even on wrong questions. In all the econometric analyses, H0 was rejected, demonstrating a statistically significant result.

The analysis of the post-experimental questions showed that, because most of the positions are filled through an electoral process, the managers' training is usually not linked to the management area, and they also have little training in the area according to 4.1.

These findings raise the question of whether the prerequisites of the law creating the FIs are sufficient to support the responsibilities inherent to the public manager, such as authorizer of expenses, competent authority for authorizing and approving the stages of the bidding process, management conformist, responsible for indicating accounts payable, responsibilities that are parachuted in after the appointment ordinance.

This study replicates previous studies, expanding on a gap by analyzing the reflection of a range of biases in a natural decision-making scenario, contributing to the understanding of the decision-making process in public management in an economy outside Europe.

It contributes to the theoretical, academic, professional and organizational perspective of Public Institutions, and to the Institution researched, having internal validity, and can be an instrument for future analysis as to the importance of training the Institution's top management in order to mitigate problems arising from the occurrence of the biases found.

As a limitation, the experiment was initially carried out in person, where everyone was attending a meeting and gradually answering the questionnaire while being observed by the researcher. As for online respondents, there was the risk of not knowing whether they had consulted documents and/or technical people to answer the questionnaire. However, the analysis was initially carried out separately (face-to-face and online), to see

if there would be a difference in the results, with one collection being influenced by bias but the other not, thus jeopardizing internal validity. This did not occur, which is why only one analysis was presented

Given the number of IFs in Brazil and the fact that their organizations are governed by specific and standardized legislation, although the research does not contribute to external validity, it is not possible to assess whether the characteristics of the managers, the specificities of the institutions and the region in which they are located are the same. Further research could replicate this study in other IFs and Public Universities, as well as collecting data on senior management support teams and the role of these teams in managers' decision-making.

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Appendix A- Scenario

Questions 1 to 5 included an alternative (c) for respondents to indicate the confidence interval, as shown below:

On a scale of 0 to 10, indicate your confidence in choosing the best option. 0 for no confidence and 10 for total confidence.

0	1	2	3	4	5	6	7	8	9	10
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1. Consider that you are currently the director, pro-rector or rector of the IFBA and you come across a research call for proposals from your UG, which states that the budget credit available for the call for proposals can be used to purchase machinery and equipment. While you're analyzing it, after a question from a teacher who proposed the call for proposals to receive the researcher aid, the call for proposals has already been published, the selection process has taken place, the results have been announced, and the teachers who were awarded the call are waiting for the credit to start. However, when the budget credit was decentralized to your unit, you noticed that the credit came in the nature of a cost expense, in this case, which option do you choose?

- a) ☐ Informs the bidder that they will be able to buy machinery and equipment because the public notice authorizes it as the maximum standard.
- b) ☒ Informs the applicant that they will not be able to purchase machinery and equipment.

2. Consider that you are at the end of the 2023 financial year (December), and your Business Unit has received an extra costing budget. You are able to use part of the budget to pledge materials, but you no longer have any processes that can be pledged. In this case, what do you choose?

- a) ☐ Requests the budget sector to reinforce the commitments for the ongoing cleaning, surveillance and driver contracts, in order to use the balance to pay the expenses for January 2024.
- b) ☒ Returns the budget credit and justifies it.

3. Consider that the sports court at your UG needs renovating. You, as manager, have already set aside a budget for the refurbishment. However, after the ETP, in addition to the renovation, which at first would not add value to the court or expand it, the need was revealed: to cover the court, expand the bathroom so that an accessible bathroom could be built, break the wall at the entrance to the court and expand it by 4 m². Your UG has no investment budget credit. In this case, which option do you choose?

- a) ☐ Authorizes the process as a reform, with funding.
- b) ☒ Authorizes the process to proceed as a reform, but requests that the credit be changed from funding to

investment/capital expenditure.

4. Consider that there is going to be an institutional event at your UG, your team intends to bring in renowned speakers, there is the option of speakers who are part of other federal universities, but there are also other speakers linked to private institutions, and the organizing committee of the event prefers the participation of speakers from the latter institutions. As a manager, which option do you choose?

- a) ☐ Accepts the choice of the organizing committee and requests that speakers be hired from private institutions.
- b) ☒ Requests that speakers from federal universities be invited and that the process for paying per diems and tickets be requested.

5. Consider that your campus has a cafeteria where school meals are prepared. However, the amount for the purchase of food decentralized by the FNDE does not meet the demand of the campus. The nutrition department has asked you, as the manager, to include a supplement in the budget plan to purchase more foodstuffs. Which option do you choose as manager?

- a) ☐ Provides part of the budget credit available for campus costs, which is normally used for basic campus maintenance, to supplement the purchase of foodstuffs for the cafeteria.
- b) ☒ Direct the demand to the sector responsible for student assistance, so that they can verify the possibility of supplementing the budget credit to meet the demand for the cafeteria with resources from a specific Student Assistance action.

6 The IFBA's annual budget, which corresponds to the entire budget to cover personnel expenses (payroll for active and inactive civil servants), costing expenses (basic maintenance expenses), investment expenses (acquisition of equipment, collection...), is part of the MEC's budget, which is defined annually by the LOA, and may vary from one financial year to the next.

- a) In your opinion, is the percentage that the IFBA's 2023 budget represents in the MEC's total 2023 budget higher or lower than 0.40%? _____.
- b) What is your best estimate of the percentage that the IFBA budget represents in the total MEC budget? ____ %.

7 As a rule, the budget follows the principle of budget annuality. As the budget is decentralized and the procurement processes are ready for commitment, it is expected that the expenditure will be executed during the course of the financial year. However, in practice, often because the processes are ready towards the end of the year, or because of budget blockages and cuts, or because some December expenses are not known until the following year, some commitments are usually entered

as unpaid obligations.

a) In your opinion, is the percentage of the total balance of commitments entered annually in accounts payable higher or lower than 50% of the total IFBA budget? ____.

b) What is your best estimate of the percentage of the total balance of commitments entered annually in accounts payable over the total IFBA budget? ____ %.

8 Real estate is part of the IFBA's assets. All units, constructions/works carried out, improvements and land must be recorded in the asset control and accounting systems. When a construction project is completed, the property must be regularized, the work delivered, among other requirements, so that later the accounting transfer of works in progress to Real Estate can be carried out, consequently reconciling the SIAFI/SPIUNET balances and avoiding costs for the Administration and undervaluation of the IFBA's assets.

a) In your opinion, is the percentage of the total balance of IFBA's built properties that are effectively regularized, reflecting the reconciliation of balances in SIAFI/SPIUNET, higher or lower than 95% of IFBA's properties? ____.

b) What is your best estimate for the percentage of the total balance of IFBA real estate built that is effectively regularized, reflecting the reconciliation of balances in SIAFI/SPIUNET? ____%.

9 Suppose an ETP is being carried out to take out insurance for IFBA vehicles, consider the possibility of choosing between a cheaper insurance policy which restricts the right to sue and a more expensive policy with an unrestricted right to sue. The planning committee indicates the cheaper policy as the default. Will you choose the standard policy?

a) ☐ Yes b) ☐ No.

10 Suppose an ETP is being carried out to take out insurance for IFBA students, consider the possibility of choosing between a cheaper insurance policy, with coverage for technical visits among other demands, but which restricts the right to sue, and a more expensive policy with an unrestricted right to sue. The planning committee indicates the more expensive policy as the default. Will you choose the standard policy?

a) ☐ Yes b) ☐ No.

11 Imagine that Brazil is preparing for another COVID-19 pandemic and consequently it is estimated that the budget of educational institutions (student assistance) will be cut, and that probably 6,000 IFBA students as a whole will not receive food aid. Two programs are proposed:

- If program A is adopted, 4,000 students will not receive food aid;

- If program B is adopted, there is a one-third probability that no student will stop receiving food aid, and a two-thirds probability that 6,000 students will not receive food aid.

Which of the two programs do you prefer? ☐ Program A
☐ Program B

12 Imagine that IFBA is going through a time similar to the pandemic, and face-to-face classes will be suspended, necessitating a return to remote teaching, with many students not having access to the Internet or a computer/cell phone to attend classes. Consequently, it is estimated that the IFBA budget will be supplemented to purchase tablets for students, but probably 4,000 IFBA students will not receive the equipment, due to the budget not being sufficient. Two internal programs, to be discussed in CODIR to reduce the impact of the numbers of students who will not receive the equipment or even avoid it, are proposed:

- If program A is adopted, 1,500 students will receive the equipment;

- If program B is adopted, there is a one-third probability that 4,000 students will receive the equipment, and a two-thirds probability that no students will receive the equipment.

a) Which of the two programs do you prefer? ☐ Program A
☐ Program B

POST-EXPERIMENTAL QUESTIONS

Sociodemographic questions

How old are you? _____.

What's your gender?

☐ Male

☐ Female

☐ I do not wish to inform you

What was the last (completed) level of your schooling?

☐ High school

☐ Graduation

☐ Specialization

☐ Master's degree

☐ Doctorate

What is your educational background?

☐ Agricultural Sciences

☐ Biological Sciences

☐ Health Sciences

☐ Exact Sciences

☐ Humanities

☐ Applied Social Sciences

☐ Engineering

☐ Linguistics, Literature and Arts

☐ Other

☐ Not applicable

Which category of civil servant do you fall into?

☐ TAE

☐ Teacher

According to the demographic structure of the IFBA division, based on the criteria considering the typology in which it provides for the number of teachers versus TAE, the Campus or Management Unit where you currently work as a manager falls into which structure?

☐ 200

☐ 350/200 (teacher/TAE)

() 90/60 (teachers/TAE)

() 70/45 (teacher/TAE)

() 20/13 (teacher/TAE)

Check the qualifications you have.

() Introduction to public budgeting

() Public Governance

() Public Management

() Accountability

() Tenders and administrative contracts

() Conflict management

() Performance indicators

How many years (complete) have you been in your current position? _____

How many (complete) years have you held management positions in this organization? _____

How many (complete) years have you worked in this organization? _____.

Is the position you currently hold elected or freely appointed?

() Election () Free appointment