

Interaction between anchoring and framing in the reading of annual financial reports: experimental evidence

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Abstract

Objective: To investigate the occurrence of anchoring and framing effects in the reading and interpretation of annual financial reports and to examine whether the interaction between these biases acts as a modulating mechanism.

Method: An experiment was conducted using a between-subjects factorial design, with four experimental conditions and the control group. A total of 151 undergraduate students were used as proxies for nonprofessional investors. Data were collected online using eye tracking and analyzed using multivariate analysis of variance (MANOVA) and Games-Howell post hoc tests.

Results: The framing effect was observed only in the groups exposed to the high anchor and in the control group, which was not exposed to the anchor. In the groups that viewed the low anchor, the framing did not manifest consistently, suggesting a potential inhibitory effect. The anchoring effect was not identified.

Contributions: Although the literature has documented the robustness of anchoring and framing effects, investigations of their interaction have mostly focused on consumption decisions, with heterogeneous results. The findings of this study indicate that anchoring can modulate framing, suggesting that cognitive biases do not operate in isolation when financial reports are read. This reinforces the need for integrated approaches to research on these phenomena in behavioral accounting and finance.

Keywords: Behavioral finance; Cognitive biases; Anchoring effect; Framing effect; Financial reports.

1 Introduction

Financial information is fundamental to investment decision-making. Investors, however, are exposed to multiple information cues simultaneously, such as numerical values, texts, graphs, indicators, and financial statements. Depending on how these cues are presented and processed, they can influence investors' perceptions, judgments, and decisions (Loughran, 2018; Tauni et al., 2017).

Since investors operate under bounded rationality (Simon, 1955; Hirshleifer & Teoh, 2003), their perceptions can be affected by cognitive biases (Kahneman, 2011; Teovanović et al., 2015). Among these biases, the anchoring and framing effects are particularly relevant and have been widely documented in different financial contexts. Anchoring refers to the tendency to use an initial value as a reference for later estimates (Tversky & Kahneman, 1974). Framing, in turn, concerns the influence of how information is presented on perceptions and decisions (Tversky & Kahneman, 1981).

Despite the robust evidence for these effects, the literature tends to examine them in isolation (Haselton et al., 2015; Hirshleifer, 2015; Yoon et al., 2019). Although relevant, this approach may not reflect the complexity of the real-world informational context to which investors are exposed. In actual decision-making settings, the simultaneous presence of multiple information cues may lead one effect to modulate another, thereby changing the intensity of its influence.

Although anchoring and framing have been widely investigated across several areas, the analysis of their interaction in the reading of financial reports remains underexplored. Furthermore, studies focus predominantly on the decision-making stage, observing final judgments or choices made by participants, without directly examining the perceptual stage of information processing. This stage is fundamental, as perception precedes judgment and influences the subsequent interpretation of information (Pleger & Villringer, 2013).

Given this gap, this study aims to investigate the occurrence of anchoring and framing effects in the reading and interpretation of annual financial reports and to examine whether the interaction between these biases alters their manifestation. To this end, eye tracking was used, as it allows the objective measurement of visual attention allocation while participants read these reports (Duchowski, 2017; Holmqvist & Andersson, 2017). Through metrics such as fixations and saccades in specific areas of interest, it becomes possible to examine how information cues are processed before explicit judgments are formed.

This study expands the understanding of the behavioral dynamics involved in reading financial reports by focusing on the interaction between cognitive biases. The results indicate that the isolated manifestation of certain biases may not be reproduced when multiple information cues are presented simultaneously, which reinforces the need for more integrated approaches in accounting and behavioral finance research.

2 Theoretical framework

2.1 Anchoring effect

The anchoring effect is one of the most robust and reliable cognitive biases in psychology (Furnham & Boo, 2011; Yoon et al., 2019). It refers to the tendency to adopt an initial value, called the anchor, and use it to estimate subsequent values or interpret later information (Epley & Gilovich, 2001; Kahneman, 1992; Tversky & Kahneman, 1974). When people unconsciously adopt an initial value, they tend to produce biased estimates because adjustments from the anchor are typically insufficient (Jacowitz & Kahneman, 1995; Tversky & Kahneman, 1974).

Anchors can be self-generated or externally provided. Self-generated anchors are established by individuals themselves, based on their knowledge and experience (Epley & Gilovich, 2001; Jacowitz & Kahneman, 1995). Externally provided anchors, in turn, are derived from external stimuli presented by an experimenter or another source (Strack & Mussweiler, 1997; Adaval & Wyer, 2011). In both cases, System 1, which is intuitive and fast (Wason & Evans, 1974; Evans & Stanovich, 2013), tends to react automatically by relating the anchor to available information or memories. This process occurs unconsciously, but adjustment can be carried out consciously through System 2, which is deliberative and slower.

According to Kahneman (2011), the anchoring effect occurs in two ways: through priming and through adjustment. Priming relies on System 1 and leads individuals to automatically associate the estimate with the initial value through associative coherence (Strack & Mussweiler, 1997). Adjustment, in turn, relies on System 2, as individuals intentionally attempt to adjust the initial value to reach the most accurate value. However, even when carried out consciously, adjustment tends to be insufficient to reach an accurate estimate (Tversky & Kahneman, 1974).

Anchoring, therefore, can occur consciously or unconsciously (Wegener et al., 2010), although the adoption of the anchor occurs unconsciously (Kahneman, 2011). Increased System 2 activity, however, tends to reduce reliance on the adjustment heuristic, thereby reducing anchoring effects (Adaval & Wyer, 2011). Even so, studies such as Mussweiler (2001) and Yoon and Fong (2019) have demonstrated the persistence of the anchoring effect over prolonged periods, from days to weeks, between exposure to the initial value and subsequent judgment or decision-making, highlighting the strength of this effect in certain situations.

In the field of finance, the anchoring effect has been demonstrated in the decision-making and behavior of analysts and investors. Ashour and Hao (2019) found that stock analysts based their earnings per share forecasts on the industry average, without making sufficient adjustments. Bouteska and Regaieg (2019) observed that financial market analysts remained anchored to prior data and made insufficient adjustments, even after companies released new results. Raut et al. (2020) found that individual investors were significantly influenced by cognitive biases, including the anchoring effect. Byun et al. (2020) demonstrated that investors adopted the 52-week high of lottery-type stocks as an anchor, and this reference point affected stock buying and selling behavior.

Given this context, it is reasonable to expect that the reading and interpretation of annual financial reports may be influenced by this bias. The presentation of values at the beginning or at specific points in these reports can lead investors to anchor their estimates to these values and distort the interpretation of subsequent information, resulting in biased judgments and suboptimal decisions.

Based on these considerations, the following hypothesis was formulated:

H1. The presentation of a hypothetical share price at the beginning of the financial report influences participants' estimates of the company's financial performance, even after they are exposed to different types of information, such as textual information, graphs, financial statements, and financial indicators.

2.2 Framing effect

The framing effect, documented by Tversky and Kahneman (1974), refers to the idea that perceptions and decisions can be influenced by how a situation or problem is formulated, as well as by the decision-maker's subjective interpretation, which is shaped by their norms, habits, and personal characteristics (Tversky & Kahneman, 1981).

According to Chong and Druckman (2007) and Druckman (2001), this phenomenon may occur through equivalence framing, in which the same information is presented in different but logically equivalent forms, such as gains and losses or risky and certain options (Tversky & Kahneman, 1981, 1986), or through emphasis framing, in which certain aspects of a situation are highlighted at the expense of others (Bullock & Vedlitz, 2017; Rasinski, 1989).

According to Levin et al. (2002), the framing effect can take three basic forms: risk framing, in which different levels of risk are presented (Diederich et al., 2020; Tversky & Kahneman, 1986); attribute framing, in which a single characteristic of an object or event is presented in different ways (Jain et al., 2020); and goal framing, in which the goal of an action or behavior is presented in different ways (Lee & Pounders, 2019; Min et al., 2013).

Given the various forms of this phenomenon, studies in behavioral finance have demonstrated its influence on the perceptions and decisions of financial agents. Hillenbrand and Schmelzer (2017) showed that agents expect lower return variability, invest more and gather less accurate information when visual distractions are present in investment disclosure. Linciano et al. (2018) found that different types of data, whether historical or prospective, and presentation formats, such as textual, numerical, and graphical information, influence investors' perception of the risk of financial products. Henry and Peytcheva (2018) concluded that investors evaluate company performance more accurately when information is framed in a way that is consistent with financial results.

Ceravolo et al. (2019) found that the colors red and blue, together with personality traits, influenced the reading and judgment of financial reports. Cantarella et al. (2023), in turn, found that framing financial product information in terms of gains versus losses, in interaction with incidental emotions such as fear and excitement, influenced investment decisions.

In this study, emphasis, attribute, and consistency framing were used to analyze the possible influence of the framing effect in interaction with the anchoring effect. To this end, textual and graphical information was presented in a manner consistent or inconsistent with the financial statements and indicators.

Thus, based on the theoretical evidence, the following hypothesis was formulated:

H2. The presentation of textual and graphical financial information, whether consistent or inconsistent with the company's financial performance, influences how nonprofessional investors read and interpret financial reports.

2.3 Studies on the interaction between anchoring and framing effects

To investigate the interaction between the anchoring and framing effects, searches were conducted in the Scopus and Web of Science databases in December 2024, using the following search string: (“anchoring effect” OR “anchoring bias”) AND (“framing effect” OR “framing bias”). The searches returned 33 and 19 records, respectively. Of these, 18 were duplicates and were removed.

Of the remaining 34 publications, six mentioned the anchoring and framing effects, but did not address them. Another seven studies were theoretical and did not empirically test the occurrence of these biases. The remaining 21 studies used some type of experimental design and, of these, only five, listed in Table 1, investigated the interaction between the anchoring and framing effects.

Table 1

Studies on the interaction between anchoring and framing effects

Study	Study objective	Interaction between anchoring and framing effects
Bayat et al. (2023)	Investigate trust and reciprocity behaviors in cooperative relationships, considering framing (positive or negative in relation to giving and receiving), the order of events (giving first and receiving later, or vice versa), and anchors (levels of trust and social scenarios).	Positive framing of information about trust in a first situation led to greater reciprocity behaviors. Anchoring to information from the first situation, however, eliminated the framing effects in the second situation. The order of presentation—trust or reciprocity first—also influenced participants' behavior.
Chen and Wang (2023)	Examine the influence of real estate market information framing (positive or negative), anchoring (high or low price), and personality traits (optimism or pessimism) on home purchase decisions in the context of the COVID-19 pandemic.	Exposure to negative framing and high or low prices influenced willingness to pay a relatively low price in the low-optimism group. The other combinations of these factors were not significant.
Tanford et al. (2019)	Examine whether anchoring effects, represented by high versus low initial prices, and budget framing, represented by high versus low budgets, affect perceived value and willingness to pay in accommodation contexts	Exposure to a high initial price and high-budget framing increased willingness to pay for accommodations compared with situations in which only one of these factors was present.
Wu and Cheng (2011)	Examine whether the framing of a product description, whether positive or negative, and the presentation of anchors, represented by high or low prices in banners, influence consumers' online purchasing behavior.	Positive framing of product attributes, together with exposure to a high price, most strongly influenced consumers' attitudes, purchase intention, and willingness to pay.
Zeng et al. (2024)	Analyze how the presentation of information, whether positive or negative, together with positive anchors related to the potential benefits of the policy, influences perceptions of fairness and acceptance of a new retirement policy in China.	Positive information, combined with anchors that highlighted benefits, resulted in greater acceptance of the retirement policy and stronger perceptions of fairness. When presented negatively, even with positive anchors, information about the policy generated lower acceptance and stronger perceptions of unfairness.

Source: Prepared by the authors.

As shown in Table 1, these studies analyzed the interaction between anchoring and framing effects in different contexts, especially purchasing decisions and consumer behavior. Although this interaction was identified in all studies, the findings collectively show that, in some cases, as in Bayat et al. (2023) and Chen and Wang (2023), exposure to the anchor influenced the framing effect, whereas in other studies (Tanford et al., 2019; Wu & Cheng, 2011; Zeng et al., 2024), the framing of information influenced anchoring. These studies therefore suggest that both effects can act as modulators, enhancing, reducing, or neutralizing each other's influence, depending on the situation and context.

From a practical point of view, these findings have direct implications for situations in which individuals are exposed to multiple information cues, such as when reading annual financial reports. Subtle informational cues, such as the presentation of an anchor or message framing—favorable or unfavorable, for example—can affect perceptions, judgments, and decisions. Thus, the interaction between these biases is relevant because it influences how information is assimilated and interpreted.

Despite this, as shown in Table 1, few studies have investigated this interaction. Furthermore, these studies have focused on decision-making outcomes, such as attitude, acceptance, and willingness to pay, without directly examining the initial stage of information processing. Unlike these studies, the present work investigates the perceptual stage involved in reading annual financial reports, using objective metrics of visual attention and perception. Thus, its contribution lies in testing whether these biases act as modulating variables, influencing one another's occurrence and intensity in the reading and interpretation of financial reports by nonprofessional investors.

Based on the robust evidence for these biases (Furnham & Boo, 2011; Kahneman, 2011; Yoon et al., 2019) and their possible interactions, the following hypotheses were formulated:

- H3.** The anchoring effect influences the occurrence of the framing effect in the reading and interpretation of annual financial reports.
- H4.** The framing effect influences the occurrence of the anchoring effect in the reading and interpretation of annual financial reports.

3 Methodological Procedures

The study adopted an explanatory approach and used the experimental method (Montgomery, 2017), with the application of the eye-tracking technique. Perception and visual attention data were analyzed quantitatively.

The study involved 151 undergraduate Business Administration students with at least theoretical knowledge of financial statement analysis. The participants, from two institutions in the inland region of São Paulo state, one public and the other private, had already completed at least one course on the analysis and interpretation of financial statements and performed the experimental task between December 2020 and January 2021.

The students were used as proxies for nonprofessional investors, in line with procedures adopted in studies such as Ceravolo et al. (2019), Elliott et al. (2007), Hillenbrand and Schmelzer (2017), and Stanovich and West (2008). The choice of this participant group is also justified by the fact that university students have relatively homogeneous physiological characteristics, which is especially relevant in experiments involving eye tracking (Holmqvist & Andersson, 2017).

Table 2 presents the sample characteristics collected through the pre-experimental questionnaire

Table 2

Distribution and characteristics of the sample by experimental group

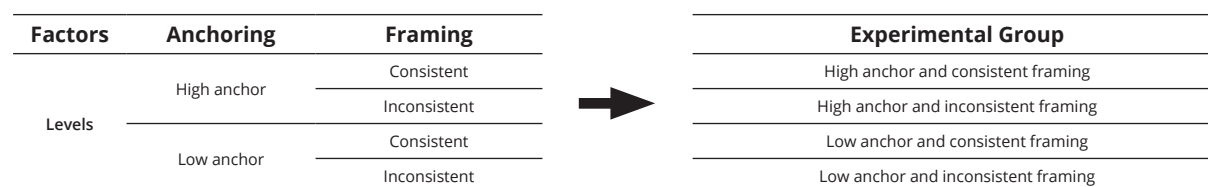
Characteristics	Experimental groups				
	A	B	C	D	E (Control)
Number of participants	30	31	30	30	30
Sex					
Male	56.67%	41.94%	56.67%	60.00%	43.33%
Female	43.33%	58.06%	43.33%	40.00%	56.67%
Age (years)					
Mean	22.57	22.48	22.40	22.57	22.53
Standard deviation	2.36	2.61	2.24	3.17	2.22
Nationality					
Brazilian	96.67%	96.77%	100.00%	100.00%	96.67%
Other	3.33%	3.23%	0.00%	0.00%	3.33%

Source: Prepared by the authors.

The majority of participants, 53.01%, indicated that they did not invest frequently and had little investment experience, and 76.77% stated that they did not use financial reports to make investment decisions. Furthermore, participants reported having predominantly conservative or moderate investment profiles, and none indicated acting as a professional investor. According to Kang et al. (2018), Li et al. (2020), Pascual-Ezama et al. (2018), Sharma (2006), and Stålnacke (2019), these are common characteristics of nonprofessional investors, which support characterizing the sample as having a profile similar to that of this type of investor.

Because this study focuses on perception, it was limited to ensuring that participants had at least basic knowledge of financial statement analysis, so that they could adequately understand the information presented in the experimental task. It is recognized, however, that other factors may influence the interpretation of financial statements, such as financial literacy and investment experience, as well as behavioral aspects. Therefore, not considering these aspects represents a possible limitation of this study.

For the experiment, a between-subjects factorial design was adopted (Montgomery, 2017), with two factors and two levels each, as shown in Figure 1.



Source: Prepared by the authors

Figure 1. Factors, levels, and experimental groups

The experiment therefore comprised four experimental conditions and one control group: A (high anchor and consistent framing), B (high anchor and inconsistent framing), C (low anchor and consistent framing), D (low anchor and inconsistent framing) and E (control group: no exposure to the anchor and consistent framing).

The variables defined for the study are detailed in Table 3. Eye-tracking metrics were analyzed by area of interest (AOI).

Table 3

Variables definitions and explanations

Variable	Explanation	Definition
Independent		
Belief	Belief about the performance of the financial market, measured in the pre-experimental questionnaire, using a nine-point scale, ranging from 1 (sharp decline) to 9 (sharp growth).	Ordinal variable
Anchoring	0 = absence of anchor; 1 = low anchor (share price of 12.11); and 2 = high anchor (share price of 89.97).	Nominal variable
Framing	0 = favorable framing, inconsistent with the financial statements and financial indicators; and 1 = unfavorable framing, consistent with the same accounting data.	Nominal variable
Dependent		
Total fixation duration	Period during which the eyes remain relatively still on an object or AOI, ranging from 100 to 500 ms. It reflects the time required to process information at the fixation point and plan the next saccade (Rayner, 1998). In this study, a minimum duration of 100 ms was adopted for fixations.	Continuous variable
First fixation duration	Initial fixation time required to recognize and identify an object or AOI. The longer this duration, the greater the relevance attributed to the object of visual attention tends to be (Duchowski, 2017).	Continuous variable
Saccade count	Number of saccades, that is, very rapid movements used to reposition gaze from one fixation point to another within an AOI (Duchowski, 2017; Rayner, 1998).	Discrete variable
Performance 1, 2, and 3	Participants' perception of the evolution of the company's financial performance after viewing each stimulus: textual and graphical information, financial statements, and financial indicators. This variable was measured using a scale from -100% to +100%, with 10% intervals.	Continuous variable

Source: Prepared by the authors.

For the experiment, eye tracking was performed using the RealEye online platform (RealEye, n.d.). This technique was adopted because it provides visual attention metrics that are well established in the literature (Duchowski, 2017; Holmqvist & Andersson, 2017) and appropriate to the objective of the study.

The RealEye platform was chosen because it offered the necessary features for the research, had a user-friendly interface, had been referenced in previous studies (Federico & Brandimonte, 2019; Jain et al., 2021; Wisiecka et al., 2022, among others) and was compatible with the study's budget constraints. Developed in JavaScript, the platform adopts an appearance-based method to detect gaze position and uses artificial intelligence to improve the quality of eye tracking. Its accuracy is approximately 4.17° and its sampling rate can reach 60 Hz (Papoutsaki et al., 2016). This rate, however, is usually lower, around 30 Hz, due to environmental and participant-related factors.

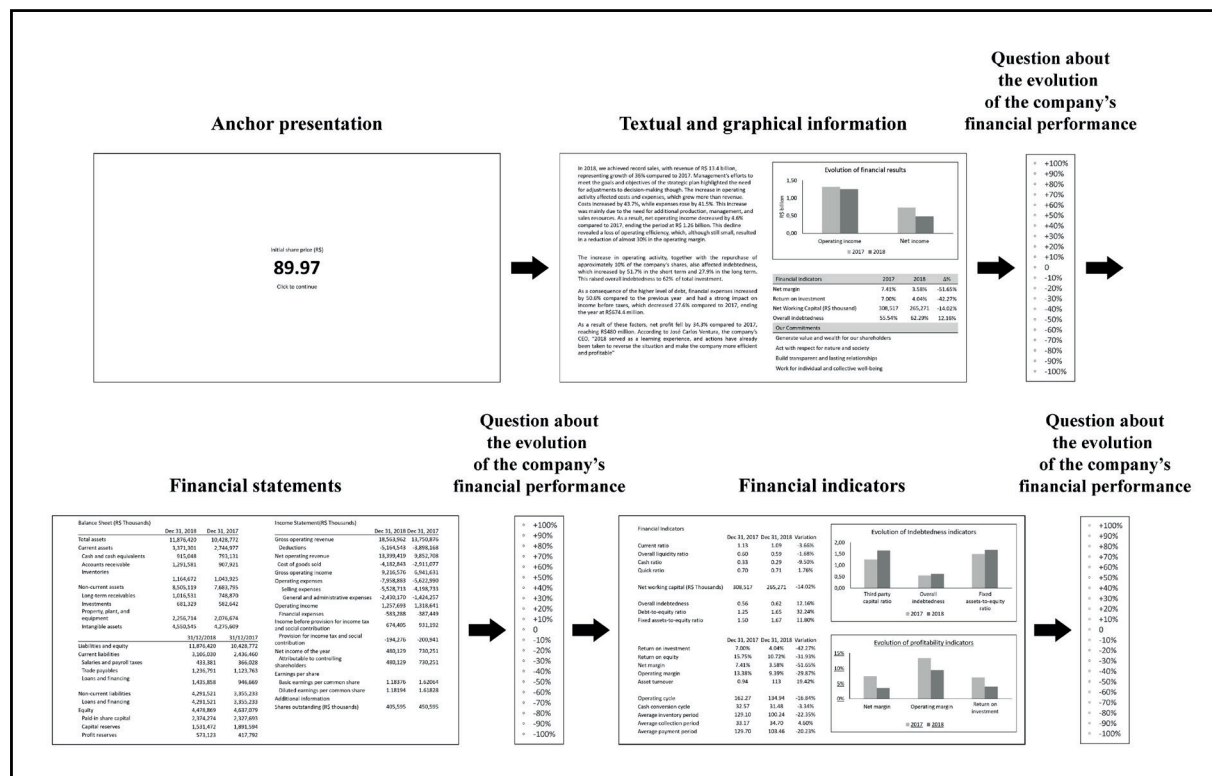
Online eye-tracking technology is recent and has been increasingly used in studies such as Federico and Brandimonte (2019), Menges et al. (2018), Papoutsaki et al. (2016), and Wisiecka et al. (2022), among others. Online eye-tracking platforms use participants' own computer webcams to track eye movements under ambient lighting and allow the experimental task to be performed remotely (Holmqvist & Andersson, 2017; Menges et al., 2018).

3.1 Procedures and experimental task

The students were contacted by email and, after agreeing to the Informed Consent Form, were randomly assigned to one of the experimental groups or to the control group. They then received instructions and a link to participate in the study. By clicking on this link, they were directed to the pre-experimental questionnaire and then to the experimental task on the RealEye platform.

Calibration was performed on the platform and consisted of measuring gaze direction at 40 points on the screen, calibrating the eye-tracking reading for each participant. After calibration, the experimental task began. The sequence of the experimental task is detailed in Figure 2. The full-size stimuli are available on the OSF.io platform at <https://osf.io/txpcf/files/zgfh7>.

The experimental task, as shown in Figure 2, consisted of the following stimuli: (1) share price, adopted as an anchor and manipulated as either a low price (12.11) or a high price (89.97), with values close to those of the scale used for Performance 1, 2, and 3, which ranged from -100% to +100%, with 0 representing no change; (2) textual and graphical information, framed either consistently, with emphasis on unfavorable information, or inconsistently, with emphasis on favorable information, in relation to financial statements and indicators, which showed a decline in the company's financial performance; (3) financial statements, which were the same for all experimental conditions; and (4) financial indicators, including liquidity, debt, profitability and activity indicators, presented numerically and as variations, and also the same for all groups.



Source: Prepared by the authors.

Figure 2. Sequence of the experimental task (Group A – high anchor and consistent framing)

The AOIs, marked in the stimuli, are detailed in Table 4.

Table 4

Areas of interest (AOIs) adopted in the study

Stimulus	AOI	AOI name	Description	AOI Size (AOI x Stimulus)
2	1	Textual	Textual financial information	50%
2	2	Graphical	Graph showing financial data	25%
2	3	Financial indicators table	Table containing financial indicators	25%
3	4	Assets	Assets section of the Balance sheet	25%
3	5	Liabilities	Liabilities and equity section of the balance sheet	25%
3	6	Income statement	Income statement	50%
4	7	Liquidity indicators	Group of liquidity indicators	< 25%
4	8	Debt indicators	Debt indicators	< 25%
4	9	Profitability indicators	Profitability Graph	< 25%
4	10	Activity indicators	Activity indicators	< 25%
4	11	Debt Graph	Graph showing debt indicators	25%
4	12	Profitability graph	Graph showing profitability indicators	25%

Source: Prepared by the authors.

The order of the stimuli was kept constant across all experimental conditions. The experimental task lasted up to 10 minutes and was similar in duration and complexity across all groups, differing only in the share price used as the anchor, which was presented in the first stimulus, and in the framing of the financial information, which was presented in the second stimulus.

Participants in the control group performed the same experimental task but were not exposed to the share price used as the anchor and viewed financial information with consistent framing. Before the experimental task, these participants were allowed to examine the financial indicators without a time limit, so that they would be better able to estimate the evolution of the company's financial performance, and possibly be less affected by the biases under investigation.

To reduce the influence of other biases, the name of the company on which the reports were based, Natura S.A., and any information that could allow it to be identified were omitted, thereby avoiding familiarity bias (Huberman, 2001) and home bias (Feldstein & Horioka, 1980). Visual distractors, such as logos, banners, and colors, were also excluded (Hillenbrand & Schmelzer, 2017). The study also sought to avoid salience in the textual elements (Huang et al., 2018) by keeping the background white and presenting the information in black, with graphical elements shown in grayscale. In the textual elements, the same typeface and font size were used, except for the anchor, which was presented in a larger, bold font.

Before the experiment was conducted, the experimental task was tested by 18 graduate students or professors from participating institutions, who reported that no significant changes were needed.

4 Results

The dataset comprised 151 observations for each AOI, totaling 1,812 observations. Observations with missing data were excluded. Low-quality observations, defined as those with a sampling rate below 20 Hz (Holmqvist & Andersson, 2017), were also removed, as were observations with a stimulus-viewing time below 45,000 ms, according to criteria defined by the researchers.

Multivariate analysis of variance (MANOVA) (Wilks, 1932) was used for data analysis. MANOVA is a robust and widely used method for identifying differences between groups across multiple metric dependent variables, considering categorical independent variables (Hair et al., 2018; Montgomery, 2017).

Outliers were identified using Mahalanobis distance (Mahalanobis, 1936) and removed. After this procedure, the average sample size per experimental group was approximately 20 observations ($\sigma = 1.9$), and the average number of observations per AOI was approximately 102 ($\sigma = 6.2$).

Although the MANOVA assumptions of equality of variance matrices and data normality were not met, MANOVA was still considered appropriate (Montgomery, 2017; Pituch & Stevens, 2016), given the sample size and the robustness of Pillai's trace test (Hair et al., 2018; Pillai, 1955).

4.1 Presentation and discussion of MANOVA results

The MANOVA results, based on Pillai's trace test, are presented in Table 5.

Table 5
MANOVA results

AOI	Value	F	df	Error df	Sig.
1	0.553	2.757	24.000	412.000	0.000
2	0.585	2.858	24.000	400.000	0.000
3	0.545	2.628	24.000	400.000	0.000
4	0.588	2.902	24.000	404.000	0.000
5	0.567	2.671	24.000	388.000	0.000
6	0.599	2.937	24.000	400.000	0.000
7	0.621	2.787	24.000	364.000	0.000
8	0.584	2.651	24.000	372.000	0.000
9	0.548	2.486	24.000	376.000	0.000
10	0.590	2.366	24.000	328.000	0.000
11	0.621	2.725	24.000	356.000	0.000
12	0.550	2.419	24.000	364.000	0.000

Source: Prepared by the authors.

The results show significant multivariate differences (p -value < 0.05) in all AOIs, indicating an effect among the experimental groups. To identify for which variables and between which groups the effects occurred, the Games-Howell post hoc test (Games & Howell, 1976) was used, as it is suitable for situations in which the assumptions of normality and homogeneity of variances are violated.

The results of the Games-Howell test indicate that only the Performance 1 variable, measured immediately after the presentation of textual and graphical information (stimulus 2), showed statistically significant differences ($p\text{-value} < 0.05$) between the groups. The eye-tracking metrics, as well as the Performance 2 and Performance 3 variables, did not show significant differences ($p\text{-value} > 0.05$), indicating that the experimental manipulation did not alter the pattern of visual attention or perceptions after exposure to the financial statements (stimulus 3) and financial indicators (stimulus 4). Thus, the observed effects refer exclusively to the influence of the anchor and/or the initial framing of the information, and not to the consistency between texts, graphs, financial statements, or financial indicators.

Table 6 details the results of the Games-Howell test for the Performance 1 variable. The highlighted values indicate the groups that differed from one another; these differences may have been influenced by the cognitive biases under investigation.

Table 6

Results of the Games-Howell test for Performance 1 variable

AOI	Group	A	B	C	D	E	AOI	Group	A	B	C	D	E
1	A	-	0.000	0.509	0.000	0.535	7	A	-	0.000	0.943	0.001	0.636
	B	0.000	-	0.019	0.245	0.000		B	0.000	-	0.008	0.621	0.000
	C	0.509	0.019	-	0.218	0.038		C	0.943	0.008	-	0.047	0.252
	D	0.000	0.245	0.218	-	0.000		D	0.001	0.621	0.047	-	0.000
	E	0.535	0.000	0.038	0.000	-		E	0.636	0.000	0.252	0.000	-
2	A	-	0.000	0.482	0.000	0.764	8	A	-	0.000	0.967	0.001	0.589
	B	0.000	-	0.017	0.299	0.000		B	0.000	-	0.012	0.519	0.000
	C	0.482	0.017	-	0.171	0.067		C	0.967	0.012	-	0.069	0.348
	D	0.000	0.299	0.171	-	0.000		D	0.001	0.519	0.069	-	0.000
	E	0.764	0.000	0.067	0.000	-		E	0.589	0.000	0.348	0.000	-
3	A	-	0.000	0.446	0.000	0.585	9	A	-	0.000	0.862	0.001	0.449
	B	0.000	-	0.019	0.233	0.000		B	0.000	-	0.024	0.302	0.000
	C	0.446	0.019	-	0.241	0.026		C	0.862	0.024	-	0.168	0.145
	D	0.000	0.233	0.241	-	0.000		D	0.001	0.302	0.168	-	0.000
	E	0.585	0.000	0.026	0.000	-		E	0.449	0.000	0.145	0.000	-
4	A	-	0.000	0.244	0.000	0.792	10	A	-	0.000	0.818	0.001	0.732
	B	0.000	-	0.049	0.036	0.000		B	0.000	-	0.025	0.251	0.000
	C	0.244	0.049	-	0.553	0.033		C	0.818	0.025	-	0.184	0.231
	D	0.000	0.036	0.553	-	0.000		D	0.001	0.251	0.184	-	0.000
	E	0.792	0.000	0.033	0.000	-		E	0.732	0.000	0.231	0.000	-
5	A	-	0.000	0.322	0.000	0.868	11	A	-	0.000	0.821	0.002	0.703
	B	0.000	-	0.059	0.166	0.000		B	0.000	-	0.023	0.573	0.000
	C	0.322	0.059	-	0.447	0.062		C	0.821	0.023	-	0.119	0.156
	D	0.000	0.166	0.447	-	0.000		D	0.002	0.573	0.119	-	0.000
	E	0.868	0.000	0.062	0.000	-		E	0.703	0.000	0.156	0.000	-
6	A	-	0.000	0.329	0.000	0.716	12	A	-	0.000	0.842	0.001	0.550
	B	0.000	-	0.034	0.036	0.000		B	0.000	-	0.038	0.810	0.000
	C	0.329	0.034	-	0.443	0.042		C	0.842	0.038	-	0.127	0.118
	D	0.000	0.036	0.443	-	0.000		D	0.001	0.810	0.127	-	0.000
	E	0.716	0.000	0.042	0.000	-		E	0.550	0.000	0.118	0.000	-

Note: significance level = 0.05.

Source: Prepared by the authors.

Table 7 presents the summarized results of the Games-Howell test for the other dependent variables, considering all AOIs. The results indicate no statistically significant differences ($p\text{-value} > 0.05$) in comparisons between the experimental groups.

Table 7

Results of the Games-Howell test for the other variables

Variable	p-value range	
Total fixation duration	0.092	1.000
First fixation duration	0.086	1.000
Saccade count	0.083	1.000
Performance 2	0.089	1.000
Performance 3	0.148	1.000

Note: significance level = 0.05.

Source: Prepared by the authors.

Given the absence of statistical significance in the other variables, as shown in Table 7, the analysis of the results focused only on the Performance 1 variable. As shown in Table 6, the results of the Games-Howell test for this variable indicate the occurrence of the framing effect. The Performance 1 variable was measured after the presentation of stimulus 2, which contained textual and graphical financial information framed consistently with the financial statements and indicators for experimental groups A, C, and E (control), and inconsistently for groups B and D.

Although the study sought to examine the framing effect in relation to information consistency, the Performance 1 variable was measured before participants viewed the financial statements and indicators, that is, before they could perceive the information as consistent or inconsistent with the accounting data. Thus, the observed framing refers only to exposure to the information in stimulus 2, which was framed favorably (inconsistently) or unfavorably (consistently) in relation to the company's financial performance.

The results of the Games-Howell test for the Performance 1 variable, presented in Table 6, indicate that the occurrence of the framing effect varied according to exposure to the anchor. In general, this effect was clearly observed in the groups exposed to the high anchor (A and B) and in the control group (E), which was not exposed to the anchor. In contrast, it was not possible to identify a consistent pattern of occurrence of the framing effect in the groups exposed to the low anchor (C and D).

Among the groups that viewed the high anchor, group A, which was exposed to unfavorable information, differed across all AOIs only from groups B and D, which viewed favorable information, evidencing a clear influence of framing. Group B, in turn, differed from groups A, C, and E, which were exposed to unfavorable information, across all AOIs in stimuli 2 (textual and graphical financial information) and 4 (financial indicators). In stimulus 3 (financial statements), however, group B also differed from group D, which was exposed to the same framing, in AOIs 4 (assets) and 6 (income statement), and did not differ from group C, which was exposed to the opposite framing, in AOI 5 (liabilities and equity).

The control group (E) showed a pattern similar to that of the groups exposed to the high anchor. Even though this group did not view the anchor and was presented with unfavorable information, it differed mainly from groups B and D, which were exposed to the opposite framing, in most AOIs. However, in AOIs 1 (textual information) and 3 (table containing financial indicators and commitments) of stimulus 2, and in AOIs 4 and 6 of stimulus 3, the control group also differed from group C, which was exposed to the same type of framing.

A different pattern was observed in the groups exposed to the low anchor. Group C, which was presented with unfavorable information, showed the greatest heterogeneity. This group differed from those exposed to the opposite framing only in AOI 7 (liquidity indicators). In the other AOIs, group C did not differ from group D, and in AOI 5, it did not differ from group B, both of which were exposed to favorable information. Furthermore, group C showed differences in relation to the control group, which was exposed to the same framing, in AOIs 1, 3, 4, and 6.

Group D, which was exposed to favorable information and the low anchor, showed a similar pattern. This group differed from groups A, C, and E, which were exposed to unfavorable information, only in AOI 7. In the other AOIs, it differed only from groups A and E, showing no differences in relation to group C. Furthermore, group D differed from group B, which was exposed to the same framing, in AOIs 4 and 6. Thus, as observed in group C, a consistent pattern of occurrence of the framing effect was not identified in this group.

Taken together, the results suggest that the interaction between the anchoring and framing effects influenced participants' perceptions. The framing effect was clearly observed in the groups exposed to the high anchor and in the control group, which was not exposed to the anchor. In contrast, exposure to the low anchor seems to have affected the occurrence of this effect, since groups C and D did not show a consistent pattern of differences between distinct framing conditions, except in AOI 7, where both were clearly influenced by framing.

These results differ from evidence reported in previous studies, such as Cantarella et al. (2023), Ceravolo et al. (2019), Henry and Peytcheva (2018), Hillenbrand and Schmelzer (2017), Linciano et al. (2018) among others, which demonstrated the influence of the framing effect on the perceptions and decisions of financial agents.

Since the occurrence of cognitive biases has been widely documented in the literature (Ellis, 2018; Kahneman, 2011), such effects are expected to manifest consistently. However, the results of the present experiment indicate that, in the presence of a low anchor, the framing effect was altered, which was not clearly observed under exposure to the high anchor or in the absence of an anchor.

This finding suggests that the interaction between cognitive biases can modify how financial information is perceived and interpreted and may even reduce or alter the manifestation of certain effects in specific contexts. However, the mechanisms that explain this dynamic are not yet fully established in the literature. Therefore, future studies that adopt different experimental designs or use other types of financial information may help clarify this phenomenon.

Based on these results, only Hypothesis 3 could not be rejected, highlighting the influence of the anchoring effect on the framing effect in the reading and interpretation of financial reports by nonprofessional investors. Although the framing effect was observed, it did not occur as a function of the consistency or inconsistency between the textual and graphical financial information and the financial statements and indicators. Hypothesis 2 was therefore rejected.

Regarding Hypothesis 1, no evidence of the anchoring effect was found. The presentation of the share price, with hypothetical values close to the scale used for the Performance 1, 2, and 3 variables, which ranged from -100% to +100%, with 0 representing no change, did not anchor participants' estimates of the company's performance, even after exposure to different types of financial information. Thus, Hypothesis 1 was also rejected.

Finally, no evidence was found of the influence of the framing effect on the anchoring effect in the reading and interpretation of financial reports. Thus, Hypothesis 4 was also rejected.

5 Conclusion

The results of this study indicated the occurrence of the framing effect, with variation according to exposure to the anchor. While the groups exposed to the high anchor and the control group, which was not exposed to the anchor, were strongly influenced by the framing of financial information, no consistent pattern of occurrence of this effect was identified in the groups exposed to the low anchor. This suggests that exposure to the anchor may alter how information is perceived and processed. In contrast, no evidence of the anchoring effect or of the influence of framing on this effect was found.

These findings suggest that cognitive biases can interact with one another, altering their occurrence and intensity in certain informational contexts. In this way, the results contribute to the behavioral finance literature by indicating that the isolated analysis of biases may not adequately capture the cognitive processes involved in interpreting financial information. In the context investigated, the presence of a low anchor inhibited the occurrence of the framing effect, highlighting the interaction between the biases.

These findings differ from evidence reported in previous studies, such as Cantarella et al. (2023), Ceravolo et al. (2019), Henry and Peytcheva (2018), Hillenbrand and Schmelzer (2017), and Linciano et al. (2018), which demonstrated the influence of the framing effect on the perceptions and decisions of financial agents. While most of these studies investigated cognitive biases in final decision-making contexts, the present study contributes by examining the perceptual stage of reading financial reports, showing that the interaction between biases may already occur in the initial stages of information processing.

From a practical point of view, the results suggest that nonprofessional investors may interpret financial information differently depending on the presence of anchors or how the information is presented. Awareness of these effects can help investors adopt a more critical stance when analyzing financial reports and reduce the influence of unintentional cognitive factors on their decisions.

Furthermore, the findings have implications for companies and regulatory bodies. The way financial information is presented, including the use of anchors, the emphasis placed on certain indicators, and the organization of information, can influence report users' initial perceptions. Therefore, companies and regulators can consider these aspects when developing disclosure practices that promote a more reliable and rational interpretation of financial information.

This study also has limitations that must be considered. The sample was composed of Business Administration students, who were used as proxies for nonprofessional investors, which may limit the generalizability of the results. Furthermore, the experiment used a specific set of financial information and a particular experimental design, which may have influenced how biases manifested in the analyzed context.

Given this, future research may expand the investigation by using different types of participants, other formats for presenting financial information, or different experimental designs. Additional studies may also further explore the cognitive mechanisms underlying the interaction between biases, contributing to a more comprehensive understanding of how these effects influence the reading and interpretation of financial reports.

In summary, this study contributes to the literature by showing that the interaction between cognitive biases can influence how financial information is perceived and interpreted. By investigating the perceptual stage of reading financial reports through objective visual attention metrics, the research expands the understanding of the cognitive processes involved in the analysis of accounting information, indicating that the influence of these biases may depend on the informational context in which they are presented.

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