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Analyzing and Explaining the Forecasting Bias that Occurred on Initial Public Offerings that Took Place in Brazil

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Abstract Initial Public Offerings have been a rich field for both academic and market analyses. Often, financial institutions conduct evaluations and projections on the company intending to go public to meet the demand for information from potential investors. Accurate budgeting and indicators are critical for a successful IPO. However, many companies end up with a significant gap between projected values and actual results, constituting projection errors, and the market penalizes newly listed companies for significant underperformance. Our objective is to analyze the discrepancies between the projected numbers obtained during the analysis performed by various Equity Research Companies during the IPO process and the actual numbers performed by the companies in different time-lapses. This study measures the forecast error of the IPO, based on the difference between the indicator forecast and the real indicator. We analyzed EBITDA, revenues and net income in the period between 2004 and 2020. This article uses a quantitative approach to provide greater precision in results on IPO forecast performance. Cross-sectional secondary data was used, including revenue, earnings before interest, taxes, depreciation, and amortization (EBITDA) and net profit of Brazilian companies. The period analyzed was between 2004 and 2020. The results show that Equity Research Companies make error forecasts and make forecasts more optimistic. There are statistical differences between estimated values and real values at a level of 5% for revenue and EBITDA and 1% for net income, both in t test (average difference), and Wilcoxon test (median difference). Based on this, the hypothesis that the analyst makes the forecast more optimistic than the real performance can't be rejected.

Keywords: *IPO, overpricing, underpricing*

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1. Introduction

Initial Public Offerings (IPOs) have been a rich field for both academic and market analyses. Often, financial institutions conduct evaluations and projections on the company intending to go public to meet the demand for information from potential investors. Accurate budgeting and indicators are critical for a successful IPO. However, many companies end up with a significant gap between projected values and actual results, constituting projection errors, and the market penalizes newly listed companies for significant underperformance [1].

An initial public offering brings a company's shares to the public for the first time and anticipates mass participation during the subscription period [2]. When a company wishes to issue shares for the first time, it has to select the optimal timing for the offering to sell shares with proper valuation [3]. Thus, the company must carefully evaluate market conditions, financial projections, investor sentiment, and other relevant factors before proceeding with the IPO.

Companies that have completed a successful IPO know the process involves the complete transformation of the people, processes and culture of the organization from a private enterprise to a public one [4].The success of an IPO is not limited to the issuance of shares alone; it is a complex journey that requires meticulous preparation.Companies recognize the importance of relying on the expertise of Ibs investment banks (IB) and Equity Research Firms to navigate successfully through this transition, ensuring that the transformation of the company is smooth and effective, enabling a successful transition.

On the other hand, IBs may exert pressure on equities analysts to produce favorable reports on the stocks of their clients, even if the evidence does not support such findings In other words, it may be optimistic if the forecast in the prospectus is greater than the actual profits presented in the company's first annual report [2]. The nature of the difference between actual and predicted values can lead to long-term implications. This is because optimistic reports generate more revenue for IBs. This might lead to consumers overpaying for stocks, which

would ultimately result in financial losses for such individuals

The public capital market is still incipient in Brazil compared to developed countries such as the UK, USA, China, and Germany. Indeed, many Brazilian companies are accessing the public markets as a long-term funding source, searching for both equity and debt. When the companies open capital, they wait for the stocks to be positively priced [5]. Therefore, the Equity Research Companies can make optimismtic forecasts, but the companies, in real market, can't show a good performance. In this regard, the research problem arises: What are the discrepancies between the projected numbers for the analysis of the IPO process and the real numbers performed by the Equity Research Companies ?

The literature focuses on the impact of the accounting decision before the offering on longterm returns [6] or after, based on indicators, for example, profitability, revenues, and EBITDA [2]. The research that discusses the difference between forecast performance in an IPO and performance after the capital open is scarce. Deepening the identification of specific responses to the provision of information to investors considering investing in an IPO can provide insights into investors' decision-making processes [7].

Thus, our objective is to analyze the discrepancies in the projected numbers obtained during the analysis performed by various Equity Research Companies during the IPO process and the actual numbers performed by the companies in different timelapses. Since 2000, thousands of debt operations, such as debentures, have taken place as hundreds of Initial Public Offerings. For managers and shareholders, considering an IPO is becoming more feasible in the past years, as Brazilian investors are growing aware of the benefits of value investing, reducing the dependence on international investors to buy Brazilian companies' stocks.

This study measures the forecast error of the IPO, based on the difference between the indicator forecast and the real indicator. We analyzed EBITDA, revenues and net income in the period between 2004 and 2020. The results show that Equity Research Companies make error forecasts and make forecast more optimistic These results are aligned with [4,8] that these banks have an interest in the IPO and will succeed in securing their subscription rate and keeping good relationships with the companies of the IPO. Furthermore, the companies have an interest in enhancing the evaluation of the market to maximize the resources captured.

This study makes contributions to the literature on IPOs by analyzing the discrepancies between the projected numbers obtained during the analysis performed by various Equity Research Companies during the IPO process and the actual numbers reported by the companies at different time intervals. While existing literature focuses on the impact of accounting decisions before and after the offering on long-term returns, this study is one of the few to specifically discuss the difference between forecast performance in an IPO and actual performance after going public.

It is imperative for managers to deeply understand the option of going public as a source of funding for their companies, which could be used for organic and inorganic growth and expansion. It is also vital that such managers know the risks and opportunities of doing so, allowing them to make better and more educated decisions. This research contributes to the literature and to the capital markets community (shareholders, managers, investors) as it brings to light a crucial aspect of the IPO: the conflict of interests of the parties involved that leads to bias in forecasts and, thus, in pricing. There are parties leaving money at the table and parties profiting. The intent is to demonstrate who each party is.

2. Literature Review

2.1. Initial Public Offerings and IPO Pricing

IPO is a moment of transition between two periods in company's ownership structure [8] and the primary sale of stock to the public [9]. Furthermore, in IPO funds are raised by corporations to meet financial needs. Based on this, possible advantages of going public include improved financial condition and liquidity, increased capital to sustain growth and innovation, enhanced corporate image, and better future financing opportunities [4]. However, according to Go, potential drawbacks of going public include holding a lower stake in the company and loss of privacy; limits on management's freedom to act; the demands of periodic reporting; and increased disclosure requirements.

Pricing decision for an IPO is critical [8]. When calculating the price of an IPO, a number of factors are examined. In addition to firm's performance, market conditions, investor demand, and size of the offering, other elements that may influence the price of an IPO include investor demand and the size of the offering [10]

The process of "book- building" is the most common way to price an IPO, with the corporation issuing its shares at several prices, and investors specify the number of shares they intend to purchase at each price [11]. Next, the firm evaluate the bids and set the price at the level of most significant demand, so optimizing the offering's worth. However, there are other ways of pricing. Furthermore, there are others three main mechanisms for a company to price its shares on an IPO, those being performing an auction and establishing a fixed price, and blended pricing options involving the mix of the three.

Companies going through an initial public offering will often pick their lenders in advance. A significant majority of CFOs, namely 74%, expressed that they considered the quality of the research department to be a highly critical, if not the most vital, factor when selecting a lead underwriter [12]. Acquisition of influential analyst coverage is the primary motivation for changing underwriters between IPO and secondary offerings [13]. 55% of respondents od Womack´s research who had switched underwriters mentioned improvements in the research department's/ quality analysts and reputation as a motivation for the move. Apart from general underwriter repute, this was the most commonly cited reason.

This suggests that issuers are actively looking for high-quality research departments and analysts to assist with their banking needs.Besides, there is no indication that analyst recommendations promoted mandates for IBs [14].

Hence, literature implies that when picking an underwriter, executives prioritize effectiveness of the bank, and efficiency of the research department. The underwriting company is not "purchased" by issuing biased or unduly bullish research by their equity researchers.

It's been common knowledge that sell-side analysts almost never propose selling stock and that there were virtually no "sell" recommendations issued until 2003. In a study based on data collected between 1989 and 1991, it was found that "buy" suggestions were seven times more prevalent than "sell" ones and that recommendations to "buy" result in a 3.0 percent gain in price, while recommendations to "sell" result in a 4.7 percent fall. In addition, after the first price reaction, prices continue to drift in the same direction for a few more months [13].

2.2. Investment Banking, Equity Researchers and Pricing Bias

The tendency for investors to overreact due to an excessive bias towards anticipation of a new offering and the excitement typically associated with an IPO leads to over-reaction bias [15] and Equity markets, including IPO pricing, are influenced by a variety of behavioral biases [14]. Behavioral biases that investors have, such as overconfidence, are cited as their explanation for the phenomenon of underpricing of IPO stock. Price jumps observed when trading opens could also be attributed to investors' unwarranted optimism. The same behavioral biases that influence the price phenomena of an IPO might also explain the following low returns during the first few years of trading in the security.

Earnings forecast error (AFE), is the disparity between actual results and the consensus estimate of market experts [16]. AFE can be broken down into a predictable component (strategic biases in earnings forecasts, when analysts intentionally bias their forecasts to curry favor with management) and an unpredictable component (the market's reaction to the forecast) [17]. Investors underreact to both the predictable and unpredictable parts, while the latter under-react to only the unpredictable part, suggesting that even seasoned investors need time to process news that is out of the ordinary [8].

Many studies [18,19,20] show a correlation between the final prediction error and organizational factors that account for the cross-sectional heterogeneity of reactions about share value after unexpected earnings. The likelihood of a negative impact on shares by unexpected earnings is reduced by temporary institutional shareholders that hold their positions [20]. Coupled with the finding that negative profit surprises of high-growth companies are typically followed by substantial declines in equity value, [19] indicates that high-growth firms commonly outperform expectations.

Lead underwriter analysts issue 50% more "buy" recommendations than unaffiliated analysts at the end of the post-IPO quiet period [21]. Michaely examined IPOs over a comparable period to investigate if share value is influenced by whether research advice was issued by the analyst who worked for the IPO's lead underwriter. The market seems deceived by biased suggestions of underwriter researchers [21]. Securities suggested by associated analysts underperform those advised by unaffiliated analysts significantly two years after an IPO. The effect was attributable to bias rather than a lack of expertise on the part of the connected analysts by analyzing the performance of recommendations of equities for which these same IBs were not the lead underwriter, suggesting that analysts are subject to bias that the stock market cannot account for [21].

Nevertheless, some publications imply that the market can consider the biases of associated analysts when determining a share price. The beginning of analyst coverage following the quiet period is associated with a significant 4% price increase compared to a 0.1% price increase for companies that do not obtain analyst coverage. The price hike happens in the days just before the conclusion of the quiet period, which is consistent with the market accurately anticipating the commencement of analyst coverage [9]. While [21] found that an analyst's affiliation with the lead underwriter moderated the price increase, [9] found the opposite true.

The underlying reason for such conflicts was investigated to show whether the market reacts differently based on the type of sell-side, the accuracy of analysts' earnings estimates, and the biases in their recommendations. IBs, brokerage-only houses (without IB operations), and independent researchers are three categories into which the authors classify sell-sides. Prominent IBs analysts are the least optimistic about their profit forecasts compared to other sell-sides. Compared to the other two categories, IBs analysts have the highest accuracy rate in their predictions. There is no bias from analysts and the market is unaware of such bias. Evidence shows that analyst buy/sell recommendations are biased, yet the market appears to recognize and correct this bias.

2.3. Analyst Forecast, Underpricing and Overpricing

Underpricing is the percentage difference between the price at the IPO and the after-market share price where supply meets demand [15]. Underpricing can be attributed to asymmetric information economic models (issuer more informed than the market and underwriter’s clients/ institutional investors with broader information than individual ones, thus creating bias) [8]. Behavioral economics explanations (include people being influenced by what others are doing, fear of missing out, fad-effect), macro environment (fear of being sued by investors who lose money and the maintenance of the reputation of the underwriting for good IPOs where investors profit out) and ownership/control (lower price will draw attention from a more significant number of investors meaning the maintenance of control by the issuer) [10].

In an equilibrium market, investors who believe the price to be high will sell; investors who believe the price to be too low will buy. The key outcome of this trading is the market price of the stock. Thus, the dynamic interaction between investors regarding the underlying valuation of the company shapes the trajectory of the stock's price in its early days as a publicly traded entity.

Regarding overpricing (the opposite of underprincing), it is driven mainly by speculative actions of traders, with significantly higher overpricing observed in markets where traders displayed more intense speculative activity

than in traditional ones. Based on behavioral finance theory, investors' attentiveness may be a significant factor in IPO overpricing [22]

When adverse information is discovered, investors generally receive separate signals and withdraw from the offering [8]. As a result, participating in the offering provides each investor with a potentially beneficial choice. In a competitive market, the issuer captures the value of this option, resulting in overpricing to the extent that it exceeds the accompanying adverse selection cost [17].

In this sense, overpricing is a benefit of becoming public because it reflects the issuer's capacity to extract informational rents from investors. However, underpricing is a cost of going public because of adverse selection [23].

The literature on prediction errors provides many potential reasons for the reported bias in researchers' forecast errors [24]. The cognitive bias explanation suggests that irrational analysts make consistent mistakes when evaluating openly available data, including past earnings and stock price movements [20]. The strategic bias explanation takes the existence of rational forecasts produced by analysts for granted but posits that they intentionally slant their predictions to meet strategic goals like pleasing a company's management [9]. The accuracy level of the forecast is meant to motivate management to reveal more data in the future.

Analysts do not foresee news that comes after the prediction but rather include the impacts of such news in forecast revisions as the event materializes in results. According to the skewed earnings distribution bias argument, even if an analyst is honest, unbiased, and reasonable, systematic bias may still occur in skewed profits [15]. Analysts can make predictions based on the mean or median of an earnings distribution, for instance. However, the underlying loss functions affecting the prediction error are distinct depending on whether the mean or median is being predicted. Thus, researchers make early projections that are, on average, excessively optimistic because they need to consider the unequal timeliness of results concerning the recognition of good news and negative news.

The strategic bias theory proposes that researchers intentionally over-optimize their projections to increase their trading commissions and access to information [19]

Analysts utilize the volume of trade as a measure of researcher motivations to bring in extra revenue, optimistic profit estimates are issued by researchers to earn transaction fees [21]. Researchers that make optimistic predictions are compensated by better pay or incentives since they assist in bringing in and keeping underwriters. The researchers are biased toward underreacting to negative earnings changes and overreacting to favorable ones [24]. This tendency is confirmed by researchers' exaggeration of highly favorable news reflecting a tactical motivation to estimate profits optimistically in the face of high information uncertainty [25].

Based on this information, the firtst hypothesis is:

H1 – The analyst makes the forecast more optimistic than the real performance.

The pricing decision for an IPO is crucial, influenced by factors like the company's performance, prevailing market conditions, investor demand, and the scale of the offering. Analyst coverage plays a pivotal role post-IPO, influencing market perception and investor behavior significantly. Studies [26,27,28] indicate that analysts affiliated with lead underwriters tend to issue biased recommendations, skewing towards optimistic projections that may not always reflect market realities. Section 4 verifies this hypothesis empirically.

3. Methodoly

This article uses a quantitative approach to provide greater precision in results on IPO forecast performance. Cross-sectional secondary data was used, including revenue, earnings before interest, taxes, depreciation, and amortization (EBITDA), and net profit. The period analyzed was between 2004 and 2020. This period was chosen for a few key reasons: It covers a significant time span of 16 years, allowing for a robust analysis of IPO forecasting trends over an extended period rather than just a snapshot in time. The beginning of the period in 2004 coincides with an increase in IPO activity in Brazil, as the country's public capital markets began to mature relative to developed markets.

Such data is related to the financial statements of the companies analyzed and the forecasts of leading banks, both of which are provided by the London Stock Exchange's information collection platform. Specifically, we examined all IPOs that occurred in Brazil during the study period, totaling 156 primary offerings and 468 observations.

The performance forecast of the leading banks was used for the variables previously described for three years, starting from the date of the IPO. These forecasts were compared with actual performance, based on companies' accounting data for the same period. The forecast error was calculated from the mathematical difference between the predicted/expected performance and the actual performance for each year (Equation 1) and subsequently accumulated for three years (Equation 2). The average error was calculated according to Equation 3.

$$\text{Error}_{i,t} = \left[\frac{\text{Real Variable}_{i,t}}{\text{Predicted Variable}_{i,t}} - 1\right] * 100 \quad (1)$$

$$\text{Acumulated Error}_i = \sum_{t=0}^{3} \text{Error}_i \quad (2)$$

$$\text{Average Error}_{i,t} = \frac{\sum \text{Error}_{i,t}}{n_{i,t}} \quad (3)$$

Where 'i' can indicate the IPO company, the leading bank or the sector. The 't' can indicate the year or three-year period, while 'n' represents the number of observations.

For analysis purposes, the average revenue errors, EBITDA, and net profit were taken by year, period and leading bank. When the error has a positive sign, it indicates overpricing, suggesting a forecast with an overestimation bias. If the error is negative, there was an underpricing, with the forecast having an underestimation

bias. To test hypothesis 1, we utilized the difference of the average/median test, a parametric t-test, and a non-parametric Wilcoxon test. The differences between the estimate and the actual can be caused by several factors, from exogenous factors such as economic aspects, to endogenous ones such as conservatism, earnings management and excessive optimism, among others.

The authors analyzed the forecasted results of Revenues, EBITDA and Net Income, against actual results, and scrutinized the differences, to understand the impacts of such differences in value, as well as compared what would have been the underwriting value if the actual numbers were forecasted. The researcher was able to identify many factors, in different views, for both managers/ shareholders and investors, and which KPIs were overestimated, generating gaps in the perceived value of the companies and their stocks.

4. Results

The aim of this research is to determine whether there is bias in forecasts prepared by Equity Analysts, especially those related to Investment Banks in IPOs. The sample collected for the study consists of 159 Brazilian companies that conducted IPOs between 2004 and 2020. Figure 1 shows the number of IPOs in this period.

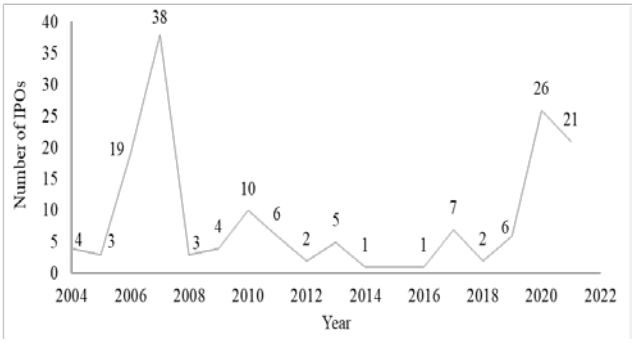

Figure 1. Number of IPOs in the period from 2004 to 2021

In 2007, there has been the major number of IPOs in the analyzed period, considering the otimism of the period and growth opportunities. From 2008 to 2019 there have been crises that discouraged IPOs, for example, the subprime crisis, the European crisis, and the political-economic-financial crisis in 2015-2016. In 2020 there has been the pandemic and the second major number of IPOs in the period. This fact can be justificative, since there has been a reduction do Special Liquidation System and Costs (SELIC) to 2%. That led to an increase the number of people that went from fixed income to B³ (variable income), facilitating that enterprises capture more resource in a more accessible way.

The three years accumulated Actual Revenues add up to BRL 729 billion, against an estimated value of BRL 724 billion, a 5 billion difference in the period, or a surplus of 0.7%. The average delta per company was BRL 32mm. As expected, the largest differences occur in the earliest IPOs, for the methodology adopted for the latest was to use the Actual value as the same as the forecasted in the absence of any estimates or actual figures. For this matter, the accumulated bias is greater in the first year, summing a deficit of BRL 10 billion. To check forecast errors, the percentage difference between the actual value and the value projected by the leading banks was used. The difference was calculated for each IPO, then descriptive statistics were performed on the sample together for net revenue, as shown in Table 1.

Table 1. Descriptive statistics net revenue forecast errors

Year	Min	1º Q	Avera	Med	3º Q	Max	St. Dev
Y0	-0,905	-0,020	-0,052	-0,006	0,037	0,157	0,210
Y1	-0,999	-0,135	-0,052	-0,005	0,059	0,723	0,280
Y2	-0,642	-0,174	-0,010	-0,031	0,113	1,532	0,330
Y3	-0,661	-0,236	-0,007	-0,037	0,238	0,658	0,310
Acu	-1,833	-0,254	-0,069	-0,013	0,075	1,868	0,540

When comparing actual values with those predicted over the years, on average, revenue forecasts were optimistic, with the actual value being lower than the projected value. The minimum values are negative (optimistic bias) and the maximum values are positive (pessimistic bias). This discrepancy highlights instability in the forecasts and is accentuated over the years, due to the increase in standard deviation until the second year. The negative accumulation of differences over the analyzed period, based on measures of central tendency, reinforces the forecasts being consistently more optimistic than the actual values.

The three years accumulated Actual EBITDA add up to BRL 132.1 billion, against an estimated value of BRL 132.4 billion, a slight BRL 224mm negative difference in the period. The average delta per company was BRL 1mm. The largest difference occurs in the earliest IPOs, for the methodology adopted for the latest was to use the Actual value as the same as the forecasted in the absence of any estimates or actual figures. For this matter, the accumulated bias is greater in the first year, summing a surplus of BRL 2,1 billion. Descriptive statistics for percentage differences can be seen in Table 2.

Table 2. Descriptive statistics of EBITDA forecast errors

Year	Min	1º Q	Avera	Med	3º Q	Max	St. Dev
Y0	-1,052	-0,267	-0,029	-0,023	0,121	1,761	0,490
Y1	-5,370	-0,515	0,042	-0,042	0,259	6,238	1,430
Y2	-2,115	-0,533	-0,193	-0,151	0,143	2,616	0,740
Y3	-2,368	-0,464	-0,094	-0,199	0,108	3,359	0,830
Acu	-5,865	-0,853	-0,134	-0,074	0,366	9,055	1,720

Measures of central tendency are negative, except for the year 1 average, signaling an optimistic bias in EBITDA forecasts. In other words, the real values were lower than predicted, especially in the last two years after the IPO. For year 2, the mean and median have opposite signs, reinforcing the presence of extreme values (outliers). The year's standard deviation was the largest in the analyzed period, as well as the largest difference between

minimum and maximum, signaling high variability in forecasts. Over the period, both the average and the median were negative, confirming the optimistic bias.

The three years accumulated Actual Net Income add up to BRL 56.6 billion, against an estimated value of BRL 68.7 billion, a BRL 12 billion negative difference in the period. The average delta per company was BRL 77mm. As of the previous KPIs, the largest difference occurs in the earliest IPOs, for the methodology adopted for the latest was to use the Actual value as the same as the forecasted in the absence of any estimates or actual figures. Descriptive statistics for differences in EBITDA can be viewed in Table 3.

In the same form as the net revenues and EBITDA, the measurement central tendency for the net profit is negative, showing an optimism bias of forecast. Based on average and median, the forecast errors are major on year 1 and 2. The 3º quartile enhance this affirmation, considering the negative value for the same period, showing that the sample part (75%) has your forecast net profit the otimism mode. The difference between the the minimum values and values maximus are smaller, considering the last analysis, but the standard deviation is major for year 1.

Table 3. Descriptive statistics of net profit forecast errors

Year	Min	1º Q	Avera	Med	3º Q	Max	St. Dev
Y0	-6,400	-0,385	-0,234	-0,049	0,111	3,013	1,384
Y1	-4,737	-0,792	-0,472	-0,395	-0,052	1,984	0,920
Y2	-3,664	-0,754	-0,537	-0,379	-0,029	0,737	0,858
Y3	-3,065	-0,554	-0,302	-0,340	0,116	0,981	0,647
Acu	-6,400	-1,400	-0,804	-0,357	0,016	3,013	1,726

Table 4 compares the performance of leading investment banks. The most relevant players in Brazil since 2004 were Itaú-BBA (a Brazilian publicly listed bank), BTG (also a Brazilian publicly listed bank), Credit Suisse (an international bank), and Bank of America – Merrill Lynch (an international bank). These 4 represent 72% of the offered volume (BRL 130 billion out of BRL 182 billion) and 76% of the companies listed (118 out of the 156). When it comes to the average size of the offer, UBS-BB (a JV of a Brazilian Bank and UBS) has performed the largest size deals, whilst Citi has only done one relatively small IPO.

Table 4. Summary of Offerings by Leading Underwriter

Leading Bank	Total Offered	% Share	# Offerings	% Share	Average Size	% Average
Itaú-BBA	44,506	24,5%	38	24,4%	1,171	0,4%
BTG	44,144	24,3%	45	28,8%	981	-15,9%
Credit Suisse	22,121	12,2%	26	16,7%	851	-27,1%
BoFa Merrill Lynch	19,907	10,9%	9	5,8%	2,212	89,6%
UBS BB	14,134	7,8%	3	1,9%	4,711	303,8%
Bradesco	11,550	6,3%	7	4,5%	1,650	41,4%
XP Investiment	7,627	4,2%	6	3,8%	1,271	8,9%
JP Morgan	6,762	3,7%	6	3,8%	1,127	-3,4%
Morgan Stanley	5,446	3,0%	7	4,5%	778	-33,3%
Santander	3,398	1,9%	5	3,2%	680	-41,8%
Pactual	1,820	1,0%	3	1,9%	607	-48,0%
Citi	609	0,3%	1	0,6%	609	-47,8%
Total	182,025	100%	156	100%	1,167	

Table 5 compares Accumulated Actual Revenues with Accumulated Estimated Revenues where author demonstrates a relevant discrepancy amongst the leading banks. Itaú BBA and BTG have the same relevance but the first seems to have IPOs with more biased estimates from Equity Researchers. BTG´s IPOs revealed to have accurate (even underestimated projections) by 1% and Itaú an overestimate of 4%, thus actuals lower than forecasted. The same applies to the third and fourth places on the league table. Credit Suisse and Bank of America – Merrill Lynch have almost the same relevance but the first seems to have IPOs with more biased estimates from Equity Researchers. Credit Suisse ´s IPOs revealed to have accurate an overestimate of 5%, thus actuals lower than forecasted, and BoFa Merrill Lynch underestimated projections by 5%. The other banks rang from overestimations (6%), underestimations (4%), to almost zero bias (XP Investimentos, due to recent and fewer IPOS), and Pactual and Citi underestimating revenues by more than 10%.

Table 6 compares Accumulated Actual EBITDA with Accumulated Estimated EBITDA, in which author demonstrates a relevant discrepancy among the leading banks. The Equity Researchers that forecasted the EBITDA results for Itaú BBA, BTG, Credit Suisse, Bradesco, Pactual, and Santander have overpromised (bias) from 2% to 11%. This bias adds up to BRL 6.2 billion. Depending on the trading EBITDA multiple, this bias can reach from BRL 48 billion to more than BRL 100 billion in Enterprise Values. The greater discrepancy here is the IPOs offered by JP Morgan, with 38% overpromising bias from Research Houses. On the other hand, BofA Merrill Lynch, UBS-BB, XP, Morgan Stanley, and Citi have IPOs with underpromising expectations from Equity Researchers, by BRL 8,0 billion, with a highlight on the UBS-BB's 21% bias.

In Table 7 the author compares Accumulated Actual Net Income with Accumulated Estimated Net Income, demonstrating relevant discrepancy among the leading banks. The Equity Researchers that forecasted the Net Income results for Itaú BBA and Morgan Stanley were the only ones that underpromise results (4% and 7%, respectively), summing BRL 773mm in actual net Income higher than expected. All other leading banks had Equity

Researchers overpromising the Net Income, as shown in the table below, with the IPOs from JP Morgan presenting the largest bias. Together they presented a BRL 12.8 billion in Net Income overestimated during the first three years of the IPO. This amount represents billions of reais to investors, both in dividends and with reflection on the market value of the shares.

Table 5. Summary of Revenues Forecast vs. Actuals by Leading Underwriter

Leading Bank	Act. vs. Est. Delta Accm.				% of Bias Accum (Estimated/ Actual)			
	FY0	FY1	FY2	FY3	FY0	FY1	FY2	FY3
Itaú-BBA	-2957,32	-3057,89	-3474,59	-3500,00	-5,74%	-5,22%	-5,15%	-4,49%
BTG	987,35	1508,55	1238,39	1177,29	1,34%	1,51%	0,94%	0,70%
Credit Suisse	-287,35	-689,03	-1107,35	-4416,51	-1,21%	-1,63%	-1,62%	-4,51%
BoFa Merrill Lynch	-419,17	-1080,09	-651,62	3782,13	-1,75%	-3,02%	-1,26%	5,10%
UBS BB	13,38	2492,38	5235,32	5235,32	0,08%	4,61%	5,55%	3,93%
Bradesco	-3,35	-70,18	-110,18	83,00	-0,05%	-0,80%	-1,01%	0,61%
XP Investimentos	-21,48	-21,48	-21,48	-21,48	-0,18%	-0,18%	-0,18%	-0,18%
JP Morgan	40,69	-8756,30	-2913,60	2953,73	0,57%	-39,54%	-5,41%	3,33%
Morgan Stanley	-73,90	-599,84	-1199,50	-1479,14	-0,51%	-3,16%	-4,60%	-4,38%
Santander	-7,65	-267,26	-524,95	-750,17	-0,26%	-4,92%	-6,12%	-6,02%
Pactual	125,69	76,32	578,59	1057,25	8,27%	2,34%	9,58%	10,99%
Citi	0,00	50,65	7,42	925,41	0,00%	2,33%	5,00%	13,35%
Total	-2603,12	-10414,16	-2943,55	5046,83				

Table 6. Summary of EBITDA Forecast vs. Actuals by Leading Underwriter

Leading Bank	Act. vs. Est. Delta Accm.				% of Bias Accum (Estimated/ Actual)			
	FY0	FY1	FY2	FY3	FY0	FY1	FY2	FY3
Itaú-BBA	-322,23	-252,59	-561,86	-977,69	-2,92%	-1,81%	-3,22%	-4,67%
BTG	-283,70	-1034,88	-2111,24	-3165,70	-1,95%	-5,50%	-9,04%	-11,04%
Credit Suisse	-102,32	11,51	-1124,58	-1960,89	-1,93%	0,11%	-6,68%	-8,33%
BoFa Merrill Lynch	236,32	849,87	769,63	1855,10	5,81%	11,99%	7,47%	12,40%
UBS BB	846,61	2725,20	3905,14	3905,14	25,26%	32,70%	28,46%	20,94%
Bradesco	-80,45	-97,49	-167,10	-245,92	-8,38%	-6,84%	-8,39%	-8,95%
XP Investimentos	97,48	97,48	97,48	97,48	3,55%	3,55%	3,55%	3,55%
JP Morgan	-80,37	-746,57	-935,66	-1557,55	-12,46%	-67,61%	-37,06%	-38,31%
Morgan Stanley	-13,91	380,24	852,70	1909,15	-0,43%	9,29%	13,65%	20,85%
Santander	26,67	-19,91	-145,53	-265,84	3,91%	-1,56%	-7,35%	-9,28%
Pactual	70,91	-136,73	-124,03	-34,53	22,75%	-28,29%	-11,90%	-2,11%
Citi	0,00	393,45	303,17	217,57	0,00%	36,16%	19,24%	9,88%
Total	395,02	2169,57	758,11	-223,68				

Table 7. Summary of Net Income Forecast vs. Actuals by Leading Underwriter

Leading Bank	Act. vs. Est. Delta Accm.				% of Bias Accum (Estimated/ Actual)			
	FY0	FY1	FY2	FY3	FY0	FY1	FY2	FY3
Itaú-BBA	547,15	497,17	418,59	446,67	15,21%	9,30%	5,47%	4,38%
BTG	-908,28	-1691,73	-3742,95	-4490,40	-28,77%	-54,21%	-90,28%	-52,98%
Credit Suisse	-146,76	-666,22	-1786,89	-2825,04	-5,52%	-12,09%	-16,91%	-15,96%
BoFa Merrill Lynch	-186,41	-356,63	-134,83	-158,22	-14,28%	-14,99%	-3,39%	-2,50%
UBS BB	-365,50	-1858,30	-2187,26	-2187,26	-87,26%	803,33%	-267,84%	-84,89%
Bradesco	-80,66	15,80	-7,45	-77,41	-19,20%	1,90%	-0,62%	-4,53%
XP Investimentos	-41,29	-41,29	-41,29	-41,29	-3,89%	-3,89%	-3,89%	-3,89%
JP Morgan	-40,70	-488,89	-1103,86	-1828,84	-24,60%	-1290,90%	-530,60%	-341,09%
Morgan Stanley	-25,37	17,84	82,27	326,47	-1,15%	0,67%	2,21%	6,51%
Santander	1,39	-68,34	-170,13	-252,09	0,38%	-8,10%	-11,59%	-11,26%
Pactual	-89,94	-242,07	-269,41	-173,97	-113,21%	-509,56%	-28,24%	-45,21%
Citi	0,00	-470,88	-470,88	-796,98	0,00%	315,93%	-329,14%	-196,80%
Total	-1336,37	-5353,55	-9414,10	-12058,36				

Table 8. Results of t test and Wilcoxon test

Period	T Test			Wilcoxon Test		
	Estimate Average	Real Average	p-value	Estimate Average	Real Average	p-value
Y0 - Revenue	1.935.27	1.887.70	0.0314 **	915.41	759.89	0.0067**
Y1 - Revenue	3222.32	2130.27	0.0260 **	898.96	800.35	0.0230**
Y2 - Revenue	2744.83	2594.44	0.0271 **	1072.31	967.00	0.0401**
Y3 - Revenue	1072.31	967.00	0.0304 **	1599.39	1503.62	0.0459**
Period	T Test			Wilcoxon Test		
	Estimate Average	Real Average	p-value	Estimate Average	Real Average	p-value
Y0 - EBITDA	372.3959	336.7798	0.0403**	184.0342	153.6140	0.0351**
Y1 - EBITDA	575.4401	380.8533	0.0411**	170.1720	123.2460	0.0435**
Y2 - EBITDA	491.9405	461.2566	0.03906**	239.7023	177.9045	0.0193**
Y3 - EBITDA	552.8561	507.0194	0.0213**	320.2700	262.8255	0.0380**
Period	T Test			Wilcoxon Test		
	Estimate Average	Real Average	p-value	Estimate Average	Real Average	p-value
Y0 – Net Income	122.1722	99.6077	0.0147***	60.4483	45.9240	0.0060***
Y1 - Net Income	195.8259	132.3691	0.0090***	107.6589	47.0320	0.0001***
Y2 - Net Income	280.8016	192.5288	0.0023***	167.0685	103.5590	0.0000***
Y3 - Net Income	304.9817	238.8752	0.0046***	209.0865	155.6205	0.0000***

4.1. Hypothesis Test

Since the descriptive analysis showed forecast errors (negative average and median), based on the mathematical difference between the estimated values and the real values for revenue, EBITDA and net income, we proceeded to a statistical perspective (Table 8).

The results show a statistical difference between estimated values and real values at a level of 5% for revenue and EBITDA and 1% for net income, both in t test t (average difference), and Wincoxon test (median difference). Based on this, the hypothesis that the analyst makes the forecast more optimistic than the real performance can't be rejected.

5. Discussions

High-end organizations such as multinational investment banks risk their credibility in a sizable market segment to pursue opportunities in a more niche market as equity research [22].

The banks do not profit from the research itself, but with the benefits of the biased research, prepared by "independent" forecasts, intended to price the offered shares in a way that benefits the underwriter, being this benefit a higher variable fee, a more significant upside for the IB's clients, thus bringing more clients, a perception that the deals these banks conduct are profitable, or even the reduction of lawsuits [8].

These interests influence either way; the technical and independent valuation (and pricing) and forecasts are wrong [16]. Forecast estimates influence investors' projections regarding a company, leading them to do uncertain valuations based on those projections rather than incorrect pricing. Indeed, biases occur specially when investment banks consolidate their many divisions under one administration, seeking synergies [23].

While handling an IPO, an underwriter will service the company and its potential new shareholders, creating a chronic biased disease.

As stated before, the professionals who make the forecasts and work as Equity Researchers, most of them related to an investment bank and lead bookrunner of IPO processes. Such banks, also as mentioned here, make money through the sale of financial products to companies (including IPO fees) [21]. In the process of retaining clients, banks estimate the pre-money valuation of the client's companies, even before having access to complete due diligence and extensive valuation. The promises must become a reality as the banks have to maintain their reputation, keep the clients satisfied, and profiting out of it. This would be acceptable should the forecasts be performed according to reality, which was not observed in some of the IPOs that took place in Brazil in the last 20 years.

The results are near those in the literature [10,16,17,23].

On average, the Revenues and EBITDA presented relatively low biases. However, EBITDA and Net Income revealed biases that could represent billions of dollars regarding enterprise value, market cap, and dividends for investors. Moreover, the researcher proved that some lead book runners have their IPOs forecasts prepared by Equity Researchers that are, on average, more wrong than others, meaning that, on average, the bias of Revenues and EBITDA do not present relevant bias. However, when analyzing this factor by company or bank, the discrepancies increase significantly, revealing that Equity Researchers make incorrect forecasts.

According to the findings of this research, there are a few primary reasons why analysts have a tendency to create inaccurately optimistic projections for IPO of companies in comparison to their actual future performance

Investors and analysts have a conflict of interest since they have an incentive to make optimistic projections in order to assist in the acquisition of IPO underwriting mandates and to have positive connections with business management. When positive estimates are issued, it can result in increased trading commissions as well as increased access to information for analysts.

Analysts may purposefully manipulate their projections in an upward direction in order to win the favor of management and encourage them to supply additional information in the future. This is known as strategic bias. The existence of this strategic bias results in estimates that are constantly optimistic.

Even logical analysts are capable of making systematic errors when interpreting public data such as historical earnings and stock prices. These errors might result in unduly optimistic forecasts owing to cognitive biases.

Analysts frequently base their estimates on the mean or median of an earnings distribution; however, the underlying loss functions are asymmetric for good news compared to negative news. This indicates that the earnings distribution is skewed. Due to this, analysts are compelled to produce preliminary estimates that are, on average, excessively optimistic.

Analysts have a tendency to underreact to negative earnings changes and overreact to favorable ones, which again leads to an overall optimistic bias in estimates. This is a factor that contributes to the overall optimistic bias.

Due to a number of important considerations, analysts frequently make projections for IPO companies that are overly optimistic in comparison to the actual future success of those company.

When investment banks and analysts are compelled to produce favorable projections in order to win IPO underwriting mandates and maintain strong connections with firm management, a conflict of interest is created. In the event that positive forecasts are made, it is possible that trading fees will increase and analysts will acquire access to confidential information.

Analysts may purposefully demonstrate a bias toward optimistic estimates in order to garner favor with management and to incentivize them to give more information in the future. This is referred to as strategic bias. As a consequence of this strategic orientation, optimistic forecasts are consistently generated.

When it comes to evaluating public data, such as historical earnings and stock prices, cognitive bias is the tendency of even intelligent analysts to make consistent errors. This tendency is referred to as the cognitive bias. Because of cognitive biases, these errors could lead to forecasts that are overly optimistic.

When making projections, analysts usually count on the mean or median of an earnings distribution as their primary data point. The loss functions that are associated with both positive and negative news are, however, asymmetric. This is a crucial point to keep in mind. The result of this is that experts produce forecasts that are early and, on average, tend to be overly optimistic rather than realistic.

As a result of analysts' inclination to respond insufficiently to negative changes in earnings and excessively to positive ones, their estimates tend to be overall optimistic. This is because analysts tend to respond inadequately to negative changes.

Overall, the presence of conflicts of interest, strategic incentives, cognitive biases, and asymmetric loss functions collectively enable analysts to repeatedly generate excessively positive earnings predictions for IPO enterprises, which do not correlate with the actual performance of these businesses. This discrimination appears to be acknowledged by the market, which also functions to somewhat repair it.

6. Conclusion

We objective is analyze the discrepancies between the projected numbers obtained during the analysis performed by various Equity Research Companies during the IPO process and the actual numbers performed by the companies in different time-lapses. The results show that the forecast is fragile, being influenced by behaviour the analysts and forecast optimists. The cognitive bias explanation suggests that irrational analysts would make consistent mistakes when evaluating openly available data. Other times, they intentionally slant their predictions to meet strategic goals, like pleasing a company's management.

The present study has a single country and a short analysis period, which don't allow for generalizations. Due to the lack of more complex and robust statistical procedures, the results are fragile. Another problem is that only forecasts from leading banks and real results over a short and medium horizon were analyzed, ignoring exogenous effects that cannot be predicted in their entirety, such as, for example, financial crises.

These results indicate a need for greater rigor in the analysis of financial reports, reinforcing the importance of independent due diligence. For managers, planning requires more open communication with investors to maintain their credibility. Investors should adopt an analytical approach and diversify their sources of information to avoid making decisions based on biased forecasts. The findings also highlight the need to further study biases and conflicts of interest in financial analyses, encouraging the creation of more realistic models and mitigating behavioral biases that may be present in the financial market.

The next step in this study is to dive deep into each and every equity research house in Brasil and detail all their projections, at the time of the IPO, with the actual results, obtaining a guide of which house presents more deviations and in which sectors. It would also be good to have a broad study of the main reasons why some of the leading banks are associated with Equity Researches more wrong than others.

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