ARTICLES

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GENDER INFLUENCE IN STOCK RECOMMENDATIONS BY EQUITY RESEARCH ANALYSTS

Influência de gênero nas recomendações de ações por analistas de Equity Research

Influencia del género en las recomendaciones de acciones de los analistas de Equity Research

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ABSTRACT

This study empirically tests the hypothesis in the literature that women, in their investment decisions, tend to show greater risk aversion and/or a lower degree of optimism than their male counterparts by analyzing investment recommendations by Equity Research analysts in Brazil. Based on a sample of 7496 recommendations for the main companies listed on the B3 between 2009-2021, a statistically significant effect was found in the opposite direction to that predicted: recommendations made by women tended to be more optimistic. We found that the difference is specific to sell recommendations, issued more frequently by men and that the effect disappears when controlling for the coverage sector and institution, which suggests that the difference is due to the fact of women, who account for only 12.8% of all recommendations, focus on covering specific sectors, such as consumption.

Keywords: gender, overconfidence, Equity Research, equities, stocks.

RESUMO

Este estudo busca testar empiricamente a hipótese, presente na literatura, de que, em suas decisões de investimento, mulheres tenderiam a apresentar maior aversão ao risco e/ou menor grau de otimismo do que seus pares homens baseado na análise das recomendações de investimento por parte de analistas de Equity Research no Brasil. Numa amostra com 7496 recomendações para as principais empresas listadas na B3 entre 2009-2021, encontrou-se um efeito estatisticamente significativo na direção oposta ao previsto: recomendações feitas por mulheres tenderam a ser mais otimistas. Verificou-se que a diferença se dá especificamente nas recomendações de venda, emitidas mais frequentemente por homens, e que o efeito desaparece ao se controlar o setor de cobertura e a instituição a que o analista pertence. Ou seja, sugere que a diferença ocorre porque mulheres, que respondem por apenas 12,8% do total de recomendações, se concentrarem na cobertura de setores específicos, como consumo.

Palavras-chave: *gênero, excesso de autoconfiança, Equity Research, renda variável, ações.*

RESUMEN

Este estudio se propone probar empíricamente la hipótesis de que las mujeres en sus decisiones de inversión tienden a mostrar una mayor aversión al riesgo y/o un menor grado de optimismo que los hombres analizando las recomendaciones de inversión realizadas por analistas de Equity Research en Brasil. A partir de una muestra de 7496 recomendaciones para empresas que cotizan en la B3 entre 2009-2021, se encontró un efecto estadísticamente significativo en sentido contrario al previsto: las recomendaciones realizadas por mujeres tendieron a ser más optimistas. Se verificó que la diferencia se da específicamente en las recomendaciones de venta, emitidas con mayor frecuencia por los hombres, y que el efecto desaparece al controlar por sector de cobertura e institución a la que pertenece el analista, lo que sugiere que la diferencia se debe a que las mujeres, que representan sólo el 12,8% de todas las recomendaciones, se centran en la cobertura de sectores como el consumo.

Palabras clave: *género, exceso de confianza, Equity Research, renta variable, acciones.*

INTRODUCTION

The issue of gender becomes relevant when we note the still timid participation of women in the Brazilian stock market. Although 47% of Brazilian investors are women (Anbima, 2020), this number drops to 25% if we only consider the stock market, in which women make up only 500 thousand of the almost 2 million CPFs registered in B3.

When considering the professional insertion of women in this market, the numbers are even more discouraging: in the Equity Research area, responsible for recommending shares to institutional investors, and the focus of this work, only 12.75% of investment recommendations published between 2010 and 2021 were given by women.

In this context, it must be understood whether gender significantly affects investment decision-making. In the last 20 years, literature has provided evidence that women are more averse to risk and less self-confident and optimistic than men in their investment decisions. Byrnes et al. (1999), Eckel and Grossman (2008), Charness and Gneezy (2012), and Brooks et al. (2019), for example, point out that men tend to be more likely to take risks in their investments than women. Bjuggren and Elert (2019), Jacobsen et al. (2008), and Barber and Odean (2001) found evidence that men are more optimistic about the future performance of the main financial indicators than women and more self-confident in their abilities.

Along these lines, this study seeks to verify whether the gender effect can also be found in the recommendations of sell-side analysts, whose function is to evaluate shares in a given sector in a fundamentalist way through financial models by establishing a target price and generating a *buy*, *sell* or *hold* recommendation for them. More specifically, the research question is: Do female analysts have a lower tendency to issue *buy* recommendations and a greater tendency to suggest holding or selling the same stock compared to the recommendations of male analysts?

As *buy*, *hold*, or *sell* recommendations depend directly on the relationship between the fair value that the analyst assigns to the company (based on a financial projection model) and the prevailing market value (which reflects market consensus expectations), a *buy* recommendation by a specific analyst implies (1) that he or she has more optimistic projections than the market average regarding the company's growth and profitability prospects and/or (2) that he or she perceives the risk of the company's investment as lower than perceived by the market, which would imply a lower discount rate and, therefore, a higher fair present value. Therefore, we consider that sell-side recommendations are a relevant sample to test whether there is a relationship between gender and the degree of optimism and/or risk aversion. Therefore, this work aims to deepen the study of women's behavior in the stock market, which is still little explored in Brazilian research.

This work will be structured into six sections: this introduction, a review of the literature, then the methodology presented, detailing the data sample used, followed by the results achieved, the analysis of the data obtained, and the final considerations.

LITERATURE REVIEW

This work is situated in the literature on the existence or absence of gender effects in investment decisions, specifically focusing on two aspects: 'risk aversion' in investment decision-making and the 'degree of optimism' of the agent in making projections about the future.

Gender behavioral differences have increasingly become the subject of study, often through laboratory experiments, questionnaire applications, or the analysis of individual investment portfolios, yet the results are not always clear. One of the earliest empirical associations identified was the relationship between gender and risk: Jianakoplos and Bernasek (1998) concluded that women were more risk-averse than men. This statement spurred numerous subsequent articles on the behavioral issue of gender in the corporate world, many of which corroborate this result (some influential reviews on the subject are Eckel & Grossman, (2008); Croson & Gneezy, (2009); Croson et al., (2012)).

Bajtelsmit and Bernasek (1996) argue that researchers in the area point to several possible explanations for gender differences in investing, which would originate from discriminatory issues that directly influence gender differences in income and employment levels. Historically, women have had a lower level of wealth than men, a fact that persists despite changes over the years. Previous studies indicate that risk propensity is related to the level of wealth. Women tend to opt for lower-risk assets as they have, on average, lower income, accumulated wealth, and job security than their male counterparts. There is also a historical, sociocultural issue of women having less control over their or their family's income, which used to be seen as the responsibility of men. Other cultural aspects may also be present. According to Bajtelsmit and Bernasek (1996), for example, women would receive more conservative investment recommendations than men because they are more risk-averse or because the investment professional believes they should be.

However, with more field studies, it becomes clear that the results diverge, not always corroborating the previously proposed relationship between risk aversion and gender. In a meta-analysis, Byrnes et al. (1999) present results that, in general, confirm the idea that male participants are more likely to take risks than female participants. However, a more detailed analysis indicates that the result may vary according to age and context. Charness and Gneezy (2007), analyzing previous studies on gender and risk, conclude that women, in fact, make fewer investments in risky assets than men. However, the researchers reinforce the need for more research that explores this issue. Eckel and Grossman (2008) point out that although women appear more risk-averse than men in most published experiments, this result is inconsistent for all experiments and emphasizes the need for more studies. Adams and Ragunathan (2015) highlight that most studies on the topic are based on samples of university students or the general population, not on senior executives, and their effects may not be replicated in samples of women who hold management positions due to a self-selection effect: it is possible that women who choose to pursue a career in management, for example, have different risk profiles than those who do not.

More recently, new issues have been incorporated into the gender literature, such as the effect of emotions on the decision-making process. Ricciardi (2011), for example, compiles various articles that address behavioral differences in finance according to gender, highlighting that the hypothesis that women exhibit higher levels of concern than men during the decision-making process related to financial services or products should be investigated. The role of negative feelings such as worry, anxiety, stress, and others may affect the investor's risk propensity and remains an underexplored topic.

Another line of research on the gender effect focuses on the theme of self-confidence and over-optimism, with various studies indicating that men tend to be more confident and optimistic than women. Aristei and Gallo (2022) found this effect in a recent study using data from 14 countries. Bhandari and Deaves (2006) suggest that overly confident behavior can manifest as a high level of certainty displayed by the individual or by a lack of knowledge about the subject, which they do not perceive. In terms of gender, even though women do not show lower levels of knowledge, their degree of self-confidence appears to be lower. On the other hand, studies indicate that the issue of confidence depends on the subject matter. In one of the first studies on the topic, Lundeberg et al. (1994) showed that in some fields of knowledge, such as mathematics, men exhibit overconfidence more intensely than women, but no significant differences were observed in other subjects, like memory and learning issues. These authors mentioned other studies that classify the issue of confidence and gender as content-specific, that is, specific to the subject matter. Women also seem to be better at calibrating their confidence, as they demonstrate greater awareness that their answers could be wrong when, in fact, they were, unlike men, who show excessive confidence, especially when they are not sure.

Self-confidence can also manifest as overly optimistic behavior. Bjuggren and Elert (2019), Jacobsen et al. (2008), and Barber and Odean (2001), for example, found evidence that men are more optimistic about the future performance of major financial indicators than women and more confident in their abilities to achieve positive outcomes.

In the Brazilian context, Carneiro (2023), through a comparative study of the investment behavior of women and men using questionnaires, finds that Brazilian women have a lower risk tolerance, lower confidence level, lower investment literacy, and a higher propensity to be influenced by social factors compared to men.

Finally, the issue of altruism may also be related to gender. For instance, Póvoa et al. (2017) demonstrate that women behave more generously and less focused on their outcomes than men in an experiment known as the Ultimatum Game, which involves the division of a sum of money among participants.

Although the topic has gained relevance over the years, there is a near absence of in-depth studies exploring gender issues, specifically in the Equity Research area, which has attracted much attention in the Brazilian market due to increased stock market activity and a rise in Initial Public Offerings (IPOs) by firms. In one of the few international studies found on this subject, male and female analysts are compared in terms of performance—measured by

their alpha (excess return) on recommendations; risk-taking; bias—through the percentage of sell recommendations and career outcomes; and likelihood of appearing in the Institutional Investor ranking. In this study, Li et al. (2013) conclude that recommendations from female analysts in the American market generate similar returns but with lower risk, and that they are less likely to issue sell recommendations, contrary to the notion that women are less optimistic than men.

Understanding the behavioral differences between men and women in the financial market and companies, in general, is extremely relevant for market participants, especially when it comes to an opinion-forming area that influences the capital market so much as stock recommendations. This issue is underscored by the realization that not all studies conducted so far present consistent conclusions on the issue of risk and gender, with gaps to be explored in search of more assertive results. Additionally, studies specifically for the Brazilian market are even rarer, generally exploratory, based on qualitative surveys through questionnaires with relatively small samples or laboratory experiments simulating financial decisions in artificially designed environments, often involving undergraduate or graduate students, raising questions about the external validity of the findings.

Thus, this paper seeks to fill an important gap in the Brazilian literature on quantitative research on gender issues. The uniqueness of this work lies in analyzing 7496 investment recommendations actually made by market agents over eleven years, providing a more comprehensive and concrete view of the issue. More specifically, it aims to empirically test the hypothesis present in the literature that women, in their investment decisions, tend to show greater risk aversion and/or a lower degree of optimism than their male counterparts.

METHODOLOGY

Justification and sample

The field of Equity Research, which is dedicated to analyzing publicly traded companies listed on the stock exchange, was specifically chosen to test the hypothesis in question. Known as sell-side, it operates alongside banks' brokerage firms and is responsible for establishing the target price of stocks and making investment recommendations, which are divided into three types: *buy*, *hold*, and *sell*. A *buy* recommendation indicates that the analyst is optimistic about a particular stock and expects potential gains above the market average. *Hold* recommendations suggest that the stock price is expected to align with the rest of the market. Finally, a *sell* recommendation points to a pessimistic view regarding the future performance of that security. Such assumptions are based on detailed studies of each company and its sector, analyzing its financial statements, strategy, management, and competitors, among others, and developing sophisticated models to project key financial variables like revenue, profit, cash flow, etc.

Thus, a recommendation should essentially reflect these aspects, focusing on the company's performance compared to the market. Typically, Equity Research departments are divided into teams that cover specific market sectors, such as retail, oil and gas, electric energy, transportation, education, and others. In addition to building financial models, sell-side analysts also write detailed reports on the sectors and companies studied, in which they discuss macroeconomic and sectoral outlooks and the companies' financial results, as well as make their projections on future profitability perspectives.

This is an area where activity can be influenced by the characteristics of the team's lead analyst, as the commonly used evaluation methods—such as discounted cash flow analysis or multiple comparisons—, although quantitative, depend on many subjective assumptions that the director's vision can influence. Furthermore, Research teams tend to be small, composed of only a few people in each team, making the direction and vision of the lead analyst even more relevant. Given this, it is interesting to understand if there are empirical differences in the recommendations made by male and female lead analysts to objectively measure whether gender is a relevant factor in such decisions.

Data collection and preparation

All recommendations made by all sell-side analysts listed for the 70 highest market value companies on the Brazilian Stock Exchange (B3) over the last eleven years were compiled to construct the database for analysis. The Bloomberg platform was used, which allows viewing, for each company/stock, the respective recommendations from analysts covering it. These data are displayed according to the chosen date and show the institution the analyst belongs to, their name—which allowed for gender identification—the recommendation given, and the target price set for the stock. To ensure the quality of the obtained data, another platform, Capital IQ, was used for comparison, which also provides Equity Research analysts' recommendations, as well as the sectors they cover and the institutions they work for.

For data collection, an eleven-year period from 2010 to 2021 (with data from the end of 2009) was established to obtain an extensive analysis period, during which information was collected year by year, allowing enough time for possible changes in analysts' recommendations. Regarding the stocks analyzed, companies with the highest market capitalization on the exchange (value obtained by multiplying the number of shares in circulation by the price per share) were selected, given their relevance and consequent coverage by a larger number of analysts. Seventy companies from eleven different sectors were selected.

The selection considered the average market value of each company over the last twelve months, based on November 12, 2020. The main companies for each sector were analyzed, whose names are specified in Table 1.

Table 1. Sample sectors and companies

Financials	Materials	Consumer Staples	Consumer Discretionary	Energy	Industrials
Itaú Unibanco	Vale	Ambev	Magazine Luiza	Petrobras	Weg
Itausa	Suzano	JBS	B2W	Cosan	Localiza
Sul America	CSN	Carrefour Brasil	Lojas Renner	Ultrapar	Gol
B3	Gerdau	Minerva	Lojas Americanas	Petrorio	Embraer
Banco do Brasil	Klabin	Marfrig	Via Varejo		CCR
	Baskem	BRF	Cogna		Rumo
	Usiminas				Azul

Utilities	Health Care	Communication Services	Real Estate	Information Technology
Eletrobras	Hapvida	Telefônica	BR Malls	TOTVS
Engie Brasil	Notre Dame	TIM	Iguatemi	Cielo
CPFL Energia	Hypera		JHSF	
Eneva	Pharma		Multiplan	
Energisa	Qualicorp		Cyrela	
Equatorial Energia				
Sanepar	Fleury			
EDP Energia				

The database with all the recommendations from all years, sectors, and companies was later filtered, excluding recommendations that did not present the name of the analyst generating the recommendation (for which, consequently, gender could not be defined), as well as those indicating that the financial institution is legally prevented from issuing recommendations on that stock (e.g., 'restricted' or 'not rated'). Finally, the recommendations had to be standardized to the three existing types of recommendation (*buy*, *hold*, and *sell*), as there are various nomenclatures used in the market to denote these three types.

Thus, the following recommendations were considered and replaced by *buy*: *accumulate*, *buy*, *buy/attractive*, *buy/cautious*, *buy/neutral*, *long-term buy*, *market outperform*, *outperform*, *overweight*, *overwt/attractive*, *overwt/in-line*, *overwt/neutral*, *overwt/positive*, *sector outperform*, and *strong buy*, considering all demonstrate a positive view for the stock, and predict it will perform above the market and its price will rise, being advantageous to take a buying position. For *hold*, the following recommendations were considered: *equalweight*, *equalwt/attractive*, *equalwt/cautious*, *equalwt/in-line*, *equalwt/neutral*, *equalwt/positive*, *fairly valued*, *hold*, *maintain*, *market perform*, *neutral*, *neutral/attractive*, *neutral/cautious*, *neutral/neutral*, *sector perform*, as all indicate the same view that the stock will remain at the same level or perform in line with the market, without expectations of significant highs or lows in its price. For the *sell* recommendation, the following designations were considered: *market underperform*, *reduce*, *sector underperform*, *sell*, *sell/attractive*, *sell/cautious*, *sell/neutral*, *strong sell*, *underperform*, *underweight*, *underwt/attractive*, *underwt/cautious*, *underwt/in-line*, *underwt/*

neutral, and *underwt/positive*, all indicative that the stock should reduce its price or perform below the market, thus, it is advised to sell the stock. Additionally, for recommendations that have different views together, for example, "*sell/attractive*" or "*neutral/attractive*", the first word of the recommendation was considered, i.e., recommendations with "*sell/attractive*", were treated as *sell* recommendations. Research and consultations with Research market professionals were conducted to define the replacements.

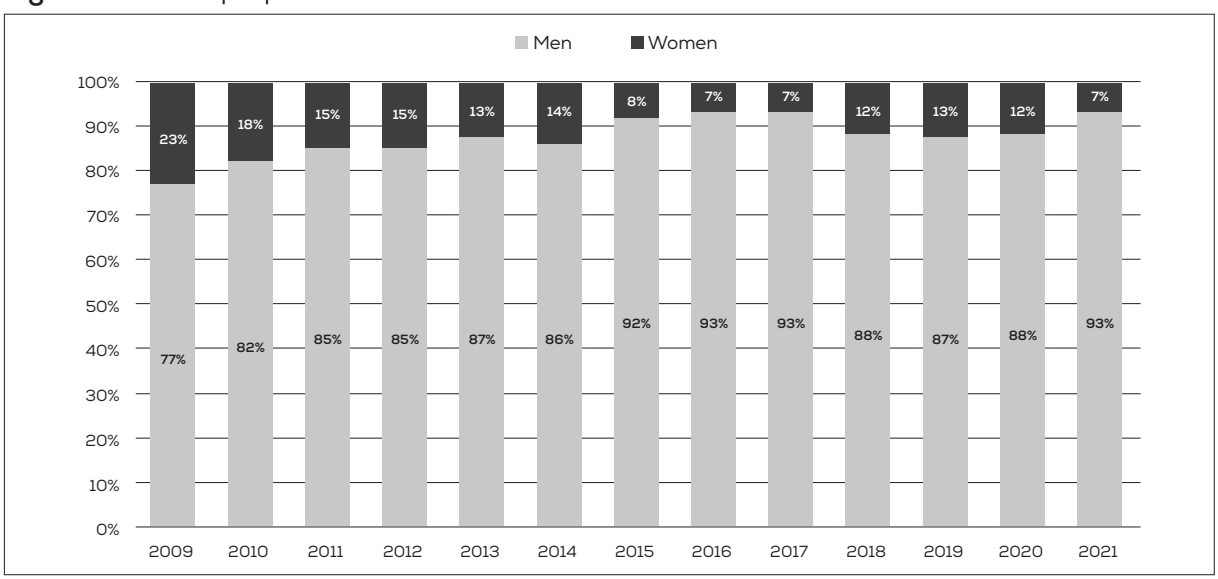
Stylized facts

After organizing and filtering the relevant data, the collected database comprised 7496 analyst recommendations. (The spreadsheet with the data used can be accessed here). Below, we present the main stylized facts from the sample.

Regarding gender, it is noticeable that the proportion of men in the sample is significantly higher than that of women. Out of 7496 data points, 87.25% represent recommendations from male analysts, while only 12.75% represent recommendations from women. This reinforces the perception that few women are still working in the financial market, specifically in Equity Research.

When comparing the proportion of male and female analysts over the years of analysis, it is noticeable that the proportion of women in the industry has been decreasing over the years, as shown in Figure 1, in 2009 and 2010, the female gender represented 23% and 18% of the total recommendations, respectively, and in 2019 and 2020, only 13%. In 2021, this percentage was even lower, at 7%, however, since the number of recommendations collected that year is lower than in previous years, the year may present a biased result (the same can be said for 2009). It was expected that the proportion of women would increase over the years, due to their greater inclusion in the workforce, however, the sample identified the opposite movement, a decrease in the representation of women among the total analysts.

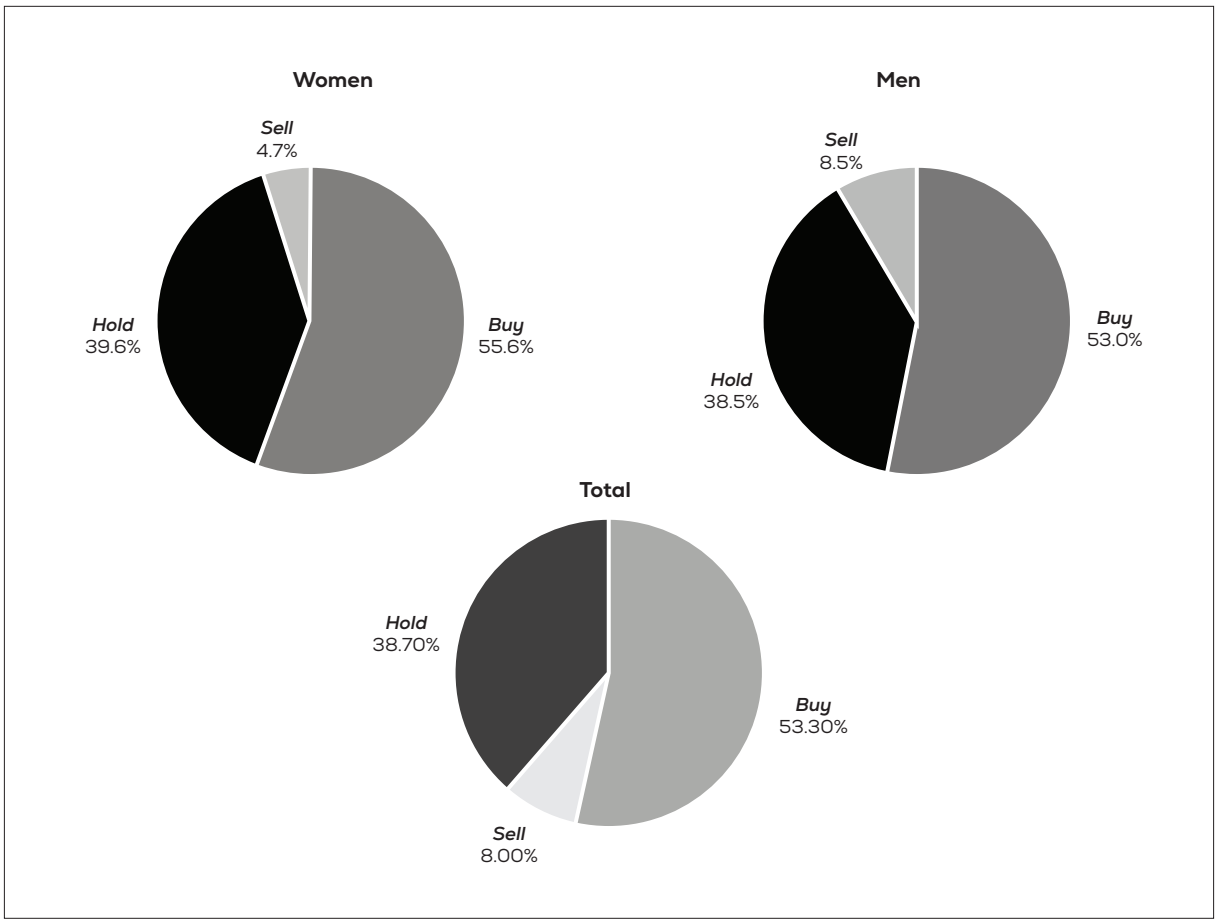
Figure 1. Gender proportion in recommendations between 2009 and 2021



Source: Based on the sample results.

Considering the three types of recommendations in the sample, it is observed in Figure 2 that more than half of the recommendations given are buy, representing 53.3% of the total, while hold represents 38.7% of the total, and *sell*, the smallest portion, 8.0%. This proportion reinforces the assumption that Equity Research teams hesitate to recommend *sell* for the stocks they cover, as this stance may alienate the analyst from the company, especially if it is a client of the bank or financial institution. Thus, analysts end up giving more *buy* recommendations if they are positive about the company's results or, in a pessimistic scenario, assign more *hold* than *sell*. Not only that, but the buy recommendation represents more than 50% of the total recommendations, possibly suggesting an overconfidence on the part of Equity Research analysts in the form of an excessive optimism bias when assigning recommendations for a company's stock.

Figure 2. Proportion by type of recommendation

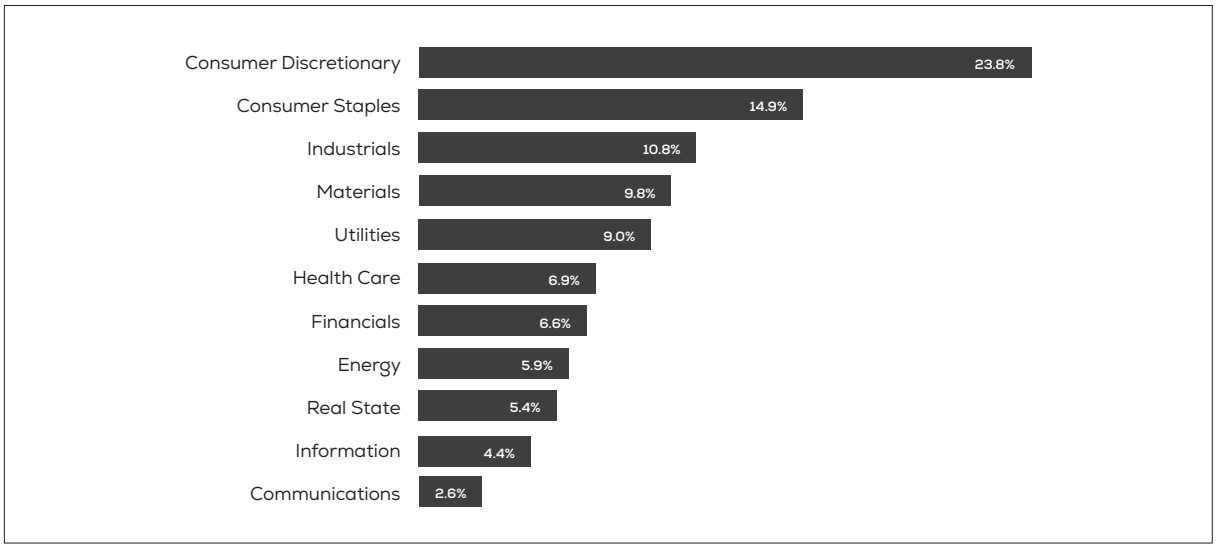


Source: Based on the sample results.

To better understand the gender distribution in the selected sectors of the sample, two figures were elaborated (Figure 3 and Figure 4), one for the female and one for the male. There is a clear concentration of women in specific sectors, such as Consumer Discretionary, with 23.8% of analysts being women, followed by Consumer Staples, 14.9%, and Industrials, 10.8%. Thus, it can be concluded that women are more present in retail sectors and less in sectors such as

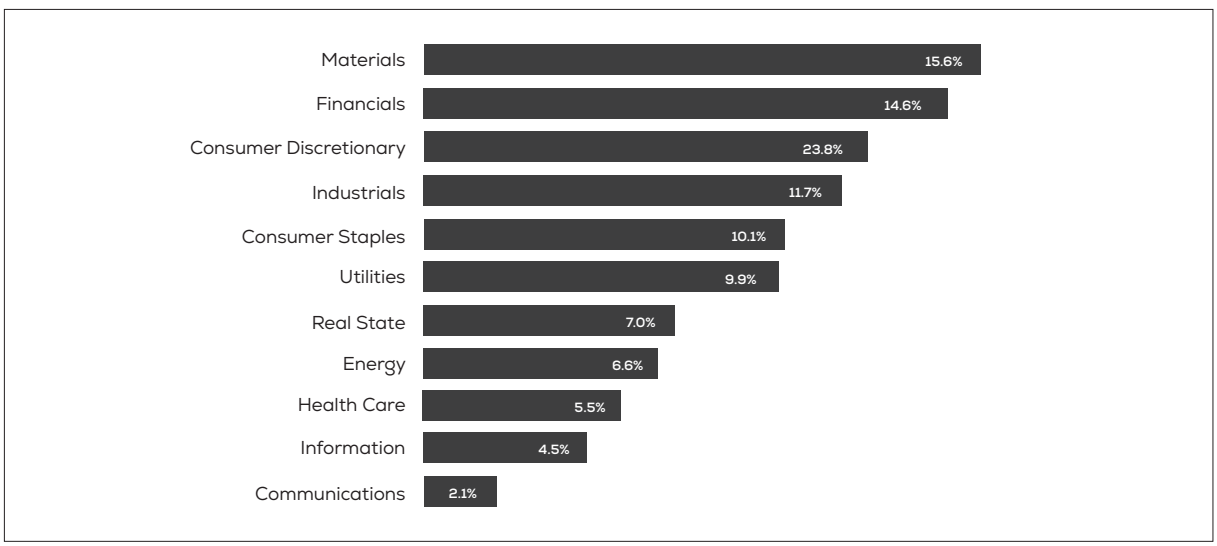
Financials, Energy, and Real Estate. Regarding the distribution of the male gender, it is observed that men are more present in sectors such as Materials and Financials, representing 15.6% and 14.6%, respectively. It is worth noting that, for both male and female genders, Information and Communication appear as sectors with a lower proportion, however, this fact can be explained by being sectors with a smaller number of companies analyzed and, consequently, with fewer recommendations in the sample.

Figure 3. Proportion of total women by sector



Source: Based on the sample results.

Figure 4. Proportion of total men by sector

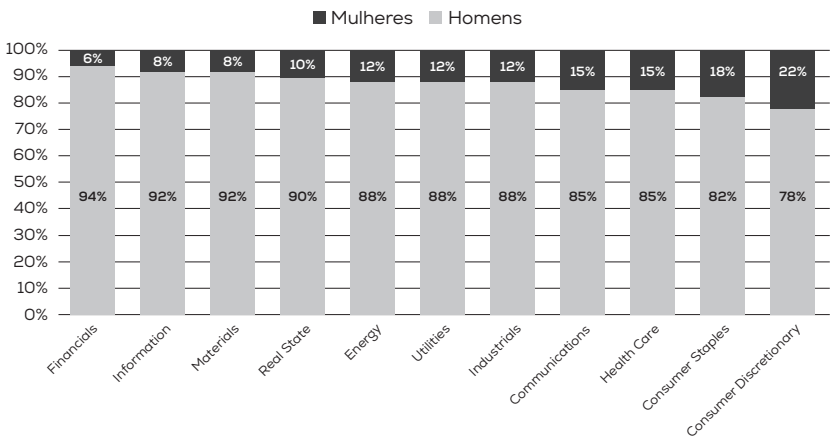


Source: Based on the sample results.

Regarding the distribution of gender across sectors, it is observed in Figure 5 that in all sectors, the proportion of men is significantly higher than that of women. Even in the sector with the highest

presence of women, Consumer Discretionary, it is observed that only 22% of the recommendations are from women, while in the sector with the lowest presence of the female gender, Financials, this proportion drops to just 6%. The low number of women leading teams analyzing financial institutions may be related to the low proportion of women working in this sector in general.

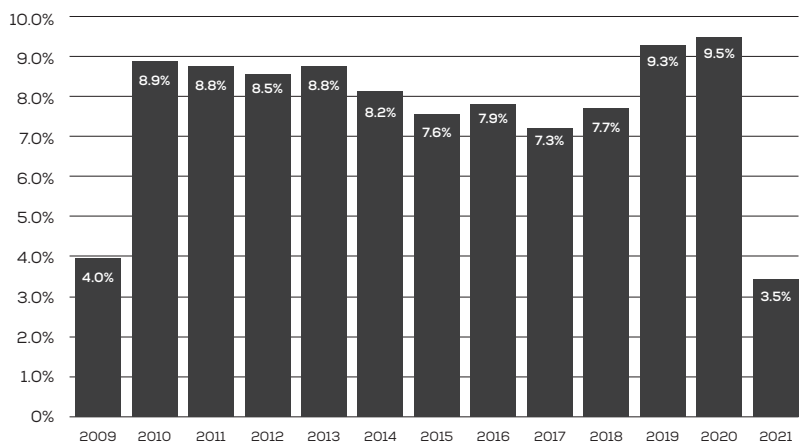
Figure 5. Proportion of men and women leading teams by sector



Source: Based on the sample results.

Regarding the distribution of recommendations over the sample years, it is observed that they are evenly distributed between the years 2010 to 2020. It is noteworthy that 2009 and 2021 recorded a smaller number of recommendations because the entire year is not considered in the sample.

Figure 6. Number of recommendations per year



Source: Based on the sample results.

QUANTITATIVE ANALYSIS

Based on the collected sample, the study aimed to test whether there is a significant influence of the gender factor on recommendations. Specifically, the literature suggests that men are more likely to take risks and are more self-confident and optimistic than women. In this case, they would be expected to assign a higher proportion of *buys* over *holds* and *sells* to the stocks under their coverage. As the recommendations of *buy*, *hold*, or *sell* directly depend on the relationship between the fair value that the analyst assigns to the company from their financial projection model and the prevailing market value, which reflects the consensus expectations of the market, a *buy* recommendation by a specific analyst would imply (1) that they have more optimistic projections than the market average regarding the growth and profitability prospects of the company and/or (2) that they perceive the investment risk of the company as lower than perceived by the market, which would imply a lower discount rate and, therefore, a higher present fair value.

There are two ways to interpret the investment recommendations to be analyzed: (1) as gradations within an ordering that reflects the analyst's positioning relative to the market (e.g., a *buy* recommendation that reflects a maximum degree of optimism or minimum perception of risk), followed by *hold* and finally *sell*, in which case we could transform the recommendations into quantitative variables and analyze them using multiple linear regression, or (2) as discrete, qualitatively distinct categories, in which case we would have to use logistic regression methodology. We chose to develop both models in this study in order to be able to interpret the level of optimism within a continuous range (through naked multiple linear regression) *and* to identify variables that may classify analysts into statistically separate groups (through logistic regression).

Regression models (linear and logistic) were used because the study aims to analyze the effect of four input variables (sector, institution, gender, and date) on the output variable (recommendation). The output variable has three distinct possible categories (*buy*, *hold*, and *sell*). Therefore, an ANOVA-type analysis must be conducted in pairs and at multiple levels. This would make the analysis of results difficult to interpret in an integrated manner. As the model was developed, all input variables could be analyzed at once, and their effects were interpreted in a unified way.

Multiple linear regression

The first quantitative analysis performed was a multiple linear regression, with the independent variables being the analyst's gender and the year of the recommendation and the dependent variable, the generated recommendation. The goal is to create a model that calculates the analyst's recommendation based on their gender and the year the recommendation was made. The expression describing the model is: $\text{RECOMMENDATION} = b_0 + b_1.\,\text{GENDER} + b_2.\,\text{YEAR}$, where b_0, b_1, and b_2 are the linear regression coefficients to be calculated, which indicate the individual effect of each input variable of the model on the output variable.

The three types of recommendations were transformed into quantitative variables, considering 2 for *buy* recommendations, 1 for *hold*, and 0 for *sell*. Therefore, the independent variable can be understood as a proxy for the analyst's degree of optimism about the stock (i.e., the higher the recommendation, the more optimistic the analyst, or alternatively, the less risk-averse).

A gender dummy was created (with 1 indicating male gender), as well as dummies for each of the years from 2009 to 2021. Considering that the timing of the recommendation can influence the attractiveness of a stock, such dummies were created to control this effect in the sample, as there are moments considered more optimistic (bullish), in which there will be a greater number of *buy* recommendations in the sample, or more pessimistic (bearish), with more *sell* recommendations. Thus, as the market is cyclical and presents such influences depending on the economic moment, the year was used as a control variable so that the year factor does not distort the sample and data analysis. The model presents the following expression:

$$\text{RECOMMENDATION} = b_0 + b_1.\,\text{GENDER\_MALE} + b_2.\,\text{YEAR2010} + b_3.\,\text{YEAR2011} + \ldots + b_{13}.\text{YEAR2021}.$$

The results obtained are shown below.

Table 2. Multiple regression results and coefficients

	Valores
R Multiple	0.102366
R-Squared	0.0104788
Adjusted R-Squared	0.0087595
Standard Error	0.6355266

Variable	**Coefficient**	**t Stat**	**P-value**
(Intercept)	1.546	38.595	0.000***
Gender	-0.055	-2.496	0.013**
2010	-0.043	-0.979	0.327
2011	0.004	0.088	0.930
2012	-0.074	-1.670	0.095*
2013	-0.060	-1.364	0.172
2014	-0.089	-1.997	0.046**
2015	-0.117	-2.607	0.009***
2016	-0.161	-3.587	0.000***
2017	-0.089	-1.964	0.050**
2018	-0.037	-0.823	0.411
2019	0.030	0.693	0.489
2020	0.051	1.777	0.239
2021	0.046	0.853	0.394

Note: Significant at * 10%, ** 5% and *** 1%. Source: Based on Excel results.

In the model, the R-squared and Multiple R found are low, at 0.0104788 and 0.102366, respectively, which is expected, given that the variables determining the fundamental value of the stock, such as the company's cash generation, are specific to each company or sector and were not included in the model. The regression equation estimated by the model is:

$$Y = 1.546 - \mathbf{0.055GEN} - 0.043x_{2010} + 0.004x_{2011} - 0.074x_{2012} - 0.060x_{2013} - 0.089x_{2014} - 0.117x_{2015} - 0.161x_{2016} - 0.089x_{2017} - 0.037x_{2018} + 0.030x_{2019} + 0.051x_{2020} + 0.046x_{2021}$$

Here, GEN is the gender dummy (0 = female, 1 = male), and xn is the dummy for each of the n years between 2010 and 2021.

The gender variable showed a significant P-value at 5% (0.013), however, the coefficient (-0.055) showed a sign opposite from what was expected: when a male analyst generates the recommendation, the degree of optimism of the recommendation tends to be lower. Some years also showed significant P-value, which is to be expected, since, as mentioned earlier, the recommendations should respond to more bullish or bearish market moments.

The result obtained – those recommendations by male analysts tended to be *less* optimistic than those of female analysts – refutes the original hypothesis of the work of greater risk aversion and lower degree of optimism in women. The result, however, is in line with Li et al. (2013) conclusions for the American Equity Research market.

Logistic binomial regressions

Taking the second form of interpreting the recommendations, namely, as discrete and qualitatively diverse categories, we need a distinct analytical tool. For this purpose, logistic regression was chosen.

Firstly, the analysis was individualized for each possible recommendation (*buy*, *hold*, and *sell*) to directly estimate how much the gender factor increases (or not) the probability of the analyst assigning each of the three recommendations through binomial logistic regressions for each recommendation. Unlike multiple linear regression, which treats recommendations as a continuous quantitative variable and thus assumes that the three recommendations are equidistant from each other (i.e., that moving from buy to hold or from hold to sell results in the same marginal impact on the dependent variable – of 1 unit, in this case), logistic regression directly estimates the probability of generating a recommendation, given the independent variables. It was estimated:

$$P(Y=1) = \frac{1}{1+e^{-g(x)}}$$

being $g(x) = \beta_0 + \beta_1 GEN + \beta_2 x_{2010} + \ldots + \beta_{13} x_{2021}$, where β_1 represents the effect of gender for each recommendation.

A binomial logistic regression was chosen for each recommendation to highlight potential gender-specific effects for each type of recommendation. The multinomial logistic regression with three categories (presented in the next section) is technically (like all multinomial logistic regressions) a 'combination' of the three binomial ones. The summary of the results obtained for each of the three models is in Table 3:

Table 3. Summary of logistic regression models

Model	β_1 (gender coefficient)	Equation g(x) estimated for the model $P(Y=1)=\frac{1}{1+e^{-g(x)}}$
Buy	-0.0936	$0.2678 - 0.\mathbf{0936GEN} - 0.0626x_{2010} + 0.0250x_{2011} - 0.2292x_{2012} - 0.0897x_{2013} - 0.1521x_{2014} - 0.2586x_{2015} - 0.3372x_{2016} - 0.1113x_{2017} - 0.0472x_{2018} + 0.2061x_{2019} + 0.2350x_{2020} + 0.2664x_{2021}$
Hold	-0.0388	$- 0.3512 - 0.\mathbf{0388GEN} - 0.0452x_{2010} - 0.0354x_{2011} + 0.1660x_{2012} - 0.0636x_{2013} - 0.0536x_{2014} + 0.0481x_{2015} + 0.0310x_{2016} - 0.1423x_{2017} - 0.0561x_{2018} - 0.3039x_{2019} - 0.2722x_{2020} - 0.3645x_{2021}$
Sell	0.5562**	$- 3.4969 + \mathbf{0.5562GEN} + 0.4943x_{2010} + 0.0686x_{2011} + 0.3351x_{2012} + 0.6383x_{2013} + 0.7970x_{2014} + 0.8136x_{2015} + 1.0466x_{2016} + 0.9029x_{2017} + 0.4696x_{2018} + 0.3948x_{2019} + 0.1527x_{2020} + 0.3790x_{2021}$

Note: Significant at * 10%, ** 5% and *** 1%. GEN represents the gender dummy (0 = female, 1 = male), and xn is the dummy for each of the n years between 2010 and 2021. Source: Based on R Studio results.

No statistically significant gender effects were found for *buy* or *hold* recommendations (the p-values were 0.1834 and 0.58739, respectively). Only the *sell* recommendation model showed a significant p-value at 5% for the gender variable (0.000514).

In logistic regression, the coefficient represents the change in the log-odds ratio, g(x), for each unit change in the predictor variable. In this case, a positive coefficient of 0.5562 was found, indicating that male analysts are more likely to generate *sell* recommendations than female analysts (in line with the conclusion obtained by the linear regression model, as expected).

Table 4. Results for the sell model

Variable	Coefficient	Z Value	p-Value
(Intercept)	-3.4969	-11.438	<2e-16***
GEN	**0.5562**	**3.474**	**0.000514*** **
2010	0.4943	1.587	0.6410
2011	0.0686	0.210	0.8569
2012	0.3351	1.054	0.1003
2013	0.6383	2.079	0.5174
2014	0.7970	2.610	0.2779
2015	0.8136	2.652	0.0691*
2016	1.0466	3.479	0.0173**
2017	0.9029	2.950	0.4377
2018	0.4696	1.483	0.7393
2019	0.3948	1.265	0.1362
2020	0.1527	0.477	0.0887*
2021	0.3790	1.032	0.1206

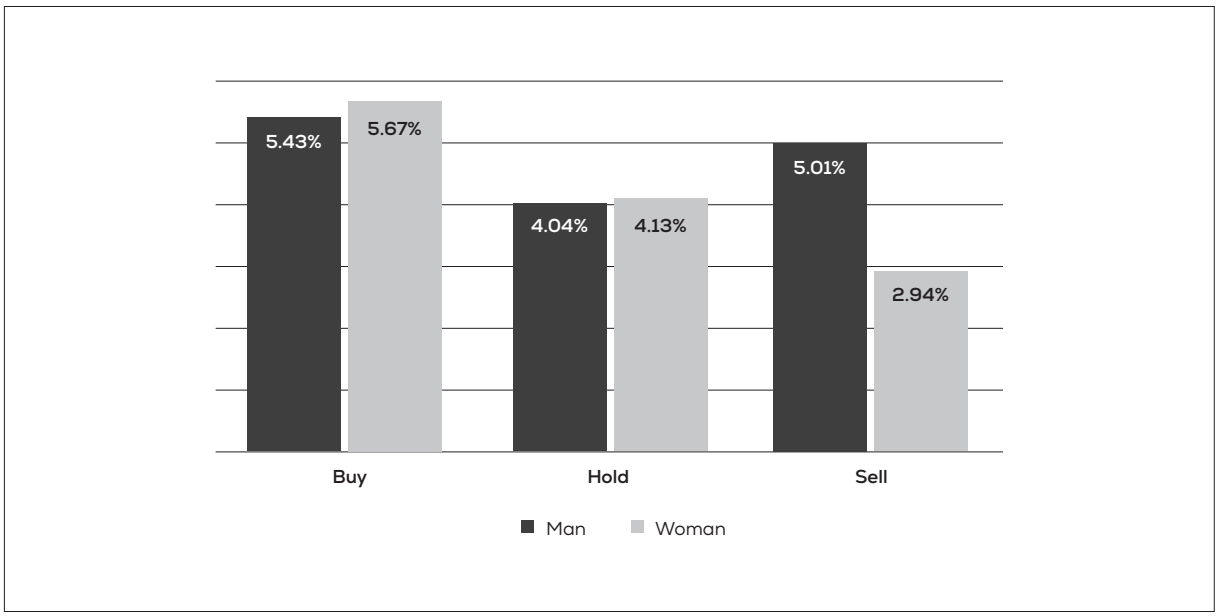
Note: Significant at * 10%, ** 5% and *** 1%. GEN represents the gender dummy (0 = female, 1 = male), and xn is the dummy for each of the n years between 2010 and 2021. Source: Based on R Studio results.

To interpret the result, we can calculate the probability of each gender generating a type of recommendation using the value of the intercept generated in the model, added to the product of the coefficient β_1 of the gender dummy variable by its own value (0 or 1). Applying this result as g(x) in the logistic regression probability formula of the sell model above, for example:

$$\frac{1}{1 + e^{(-3.4969 + 0.5562 * 0)}}$$

We find that all else being constant, if gender=0 (female), the probability of generating a *sell* recommendation is 2.94%. If gender=1 (male), such probability increases to 5.01%. This result demonstrates a notable difference between genders in generating this specific recommendation, which is not seen for the other two recommendations. For *buy* recommendations, the probability of generation by a female analyst was 5.67%, and by a male analyst, 5.43%. For *hold* recommendations, the probability of being generated by female analysts was 4.13%, while for male analysts, it was 4.04%. These results indicate a similarity in the behavior of both genders in generating such recommendations. The proportions are displayed in Figure 7.

Figure 7. Probability of generating each type of recommendation by gender



Source: Based on the sample results.

The effects obtained go, again, in the opposite direction to the original hypothesis of the work, with male analysts being more likely to issue a *sell* recommendation.

The generation of a recommendation for a stock, from the perspective of the behavioral factors that influenced it, can have various interpretations. *Sell* recommendations could be more associated with higher levels of pessimism and concern among men. However, the literature suggests otherwise, so it would be surprising if this were the explanation for the difference found

in recommendations. Moreover, if that were the case, it would be expected that this divergence would be reflected in a lower probability of assigning optimistic *buy* recommendations, which was not confirmed by the data.

Another possible interpretation relates to the meaning of the recommendations for the companies followed. Among the types of possible recommendations in Research, *sell* is the least common, being only 8% of the 7496 recommendations in the sample, because such a recommendation can alienate the analyst generating it from the analyzed company. Thus, generating this recommendation could be interpreted as more aggressive or assertive, requiring a high level of confidence on the part of the generating analyst. From this perspective, the evidence could align with the results previously found in the literature. When studying price settings by various service professionals, Graham et al. (2007), for example, found that women are more concerned about relationships with their clients and associates than men and charge lower prices for their work or adjust the prices they practice for certain clients. This behavior was also seen in the Ultimatum Game experiment, where women were consistently found to be more generous in their offers. Testing such a hypothesis would require research addressing more qualitative aspects of decisions, for example, through questionnaires and interviews, which is outside the scope of this work.

Furthermore, two alternative explanations for the results found can be identified. First is the influence of the self-selection factor, assuming that the woman who reaches the lead analyst position does not reflect the average of women in the general workforce, which diverges from the standard gender behavior seen. For example, Nekby et al. (2008) found that in some predominantly male environments with higher levels of competition, such as the financial market, the selected women tend to be as competitive and confident as their male counterparts. Similarly, Adams and Funk (2012) found that certain gender differences disappear as one moves up the hierarchical ladder and that female directors, in certain situations, might even be more prone to risk than their male peers. Such an effect could apply to female Equity Research directors.

The second explanation relates to the uneven distribution of women and men across different sectors. As previously seen, there is a relatively higher presence of women in sectors such as Consumer (22%) and a lower presence in others like Financials (7%) and Materials (8%). It is possible that part of any divergence in investment recommendations between genders could stem exclusively from more or less optimistic perspectives on each sector.

Multinomial logistic regression

To test the last explanation, a multinomial logistic regression model was elaborated, suitable for cases where the response variable is a nominal qualitative with three categories, as is the case here (*buy/hold/sell*), controlling for the sector, the analyst covers as well as the institution they belong to. This allows predicting the probabilities of different outcomes for the recommendation, given the independent variable of interest: gender.

The recommendation now becomes a three-level qualitative variable, *buy*, *hold*, and *sell*, and is the output variable of the model. Our variable of interest, the gender of the lead analyst (GENDER), was transformed into a two-level qualitative variable, M (male) and F (female).

To control the effect of the sector, a variable representing the percentage of sell recommendations in each sector (named PSETSELL) and an equivalent variable for the percentage of hold recommendations given to each sector (named PSETHOLD) were created. As the reference category of the model will be the proportion of *buy* recommendations, it was not necessary to create a control variable for this recommendation. Thus, the model tests how much a specific recommendation diverges from the average recommendations for the same sector, avoiding the creation of a large number of dummy variables, as eleven different sectors were analyzed.

A similar adjustment was made to control for the different institutions the analyst works for. Since Equity Research analysts use macroeconomic assumptions (GDP growth, inflation, interest rates, etc.) provided by the economic area of each institution, we chose to control these effects so that the remaining effect best reflected the degree of optimism or pessimism of the analyst individually (and not of the company they work for). Therefore, equivalent variables were created for the proportion of sell and hold given by the institutions (named PINSTSELL and PINSTHOLD).

Finally, equivalent variables for each month the recommendation occurs (PMESSELL and PMESHOLD) were created to eliminate the effect of economic cycles or any seasonality in the recommendations.

With the addition of these six control variables, a multinomial regression was performed, with a three-level output (*sell*, *hold*, and *buy*) with the reference category buy. The result of the model (coefficients and standard deviations) can be seen Table 5.

Table 5. Multinomial regression results

Coefficients:								
	(Intercept)	GENERON	PMESSELL	PMESHOLD	PINSTSELL	PINSTHOLD	PSETSELL	PSETHOLD
HOLD	-6.188	-0.079	2.150	4.758	1.877	4.907	2.606	4.269
SELL	-8.567	0.147	9.837	2.258	9.320	4.699	17.269	1.446
Standard errors								
	(Intercept)	GENERON	PMESSELL	PMESHOLD	PINSTSELL	PINSTHOLD	PSETSELL	PSETHOLD
HOLD	0.269	0.076	0.559	0.334	0.362	0.324	1.083	0.409
SELL	0.506	0.169	0.823	0.582	0.466	0.581	2.058	0.779

Note: GENERON = gender dummy (0 = female, 1 = male); PMESSEL = proportion of sell each month; PMESHOLD = proportion held each month; PINSTSELL = proportion of sell per institution; PINSTHOLD = proportion of holding per institution; PSETSELL = percentage of sell in each sector; PSETHOLD = holding percentage in each sector. The first line (HOLD) decomposes the propensity to change from buy to hold, and the second line (SELL) decomposes the propensity to change from buy to sell.
Source: Based on the results of R Studio.

The first line of each table (titled HOLD) breaks down the propensity to change a recommendation from *buy* to *hold* (since *buy* is the reference category of the model). Thus, the coefficient of -0.0788 for the male gender variable (GENERON) indicates that men are less likely to move from *buy* to *hold* than women.

The second line of the tables (titled SELL) captures the propensity to change a recommendation from *buy* to *sell*. The coefficient of +0.1467 for the same male gender variable (GENERON) for *sell* indicates that men are more likely to move from *buy* to *sell* than women.

Therefore, the direction of the effect is ambiguous (men are less likely to move from *buy* to *hold* but more likely to move to sell) and does not clearly identify a greater optimism on the part of male analysts in their recommendations. Moreover, the effects found are not statistically significant, unlike the effects of sector, institution, and date of recommendation, all significant at 1% (except PSETHOLD for *sell*). Table 6 shows the p-values of the model variables.

Table 6. P-values

	(Intercept)	GENERON	PMESSELL	PMESHOLD	PINSTSELL	PINSTHOLD	PSETSELL	PSETHOLD
HOLD	-	**0,2998**	0,0001	0,0000	0,0000	0,0000	0,0160	0,0000
SELL	-	**0,3842**	0,0000	0,0001	0,0000	0,0000	0,0000	0,0635

Note: GENERON = gender dummy (0 = female, 1 = male); PMESSEL = proportion of sell each month; PMESHOLD = proportion held each month; PINSTSELL = proportion of sell per institution; PINSTHOLD = proportion of holding per institution; PSETSELL = percentage of sell in each sector; PSETHOLD = holding percentage in each sector. The first line (HOLD) decomposes the propensity to change from buy to hold, and the second line (SELL) decomposes the propensity to change from buy to sell.
Source: Based on the results of R Studio.

CONCLUSION

This study aimed to empirically test the hypothesis, observed in literature, that in their investment decisions, women tend to exhibit greater risk aversion and/or a lower degree of optimism than their male counterparts, using the analysis of investment recommendations by Equity Research analysts in Brazil. Its major contribution lies in the fact that, unlike most of the existing literature based on exploratory surveys with qualitative questionnaires or laboratory experiments simulating financial decisions, with relatively small samples, we analyzed a broad sample of 7496 investment recommendations made by market agents over eleven years. Therefore, the results are relevant both for the academic literature interested in the study of gender and for market participants who offer or receive investment recommendations.

For the analyzed sample, we can conclude that the data do not support the hypothesis that the analyst's gender significantly affects their recommendations. In the first analysis, using multiple regression, a statistically significant gender effect was identified in the opposite direction than expected: recommendations by male analysts tended to be more conservative than those issued by female analysts. In the analysis of logistic regressions individualized by recommendation, it was identified that the gender disparity occurs specifically for *sell* recommendations, which male analysts disproportionately generate. The multinomial logistic regression showed that this

effect disappears when controlling for the coverage sector, the institution the analyst belongs to, and the date of the recommendation.

The findings contradict those more commonly found in literature, suggesting a higher level of confidence and optimism on the part of men, as well as a greater risk tolerance, which would make them more likely to issue *buy* recommendations, suggesting that such effects may be specific to certain contexts. However, some caveats regarding the study's limitations are in order. For the analysis, we sought a broad database, collecting data year by year from 2009 to 2021 from companies with the largest market capitalization on the Brazilian stock exchange and considering all financial institutions with recommendations for these companies on the Bloomberg platform. However, as indicated in the Stylized Facts section, *sell* recommendations correspond to a small part of the total (8%), which could also distort the results. Additionally, the sample contains a much larger number of recommendations generated by male analysts compared to those generated by female analysts, 6540 and 956, respectively, out of a total of 7496 recommendations, which may impact the analysis since smaller samples are more likely to present some bias.

The discrepancy is due to the much larger number of men active in the financial market in general and in the Equity Research area. This disparity is accentuated in leadership positions such as director, as is the case here. Therefore, a potential effect of self-selection, as described by Nekby et al. (2008) and Adams and Funk (2012), cannot be discarded, where in some predominantly male environments with higher levels of competition, women who reach high hierarchical levels tend to be as competitive and confident as their male peers. A recommendation for subsequent work would, therefore, be the conduct of qualitative studies on the profile of women in the position of lead analysts, useful to test this hypothesis, which would allow determining whether the absence of gender effect on stock recommendations found in the present study can be generalized to women as a whole, or if it is particular to the group of women who reach higher hierarchical levels, such as the lead analysts of this study.

Finally, the analysis is based on investment *recommendations* made by sell-side analysts to their clients and not on investments *actually made* by them. The literature raises some situations where analysts would have incentives to recommend buying a stock they would not buy. Malmendier and Shanthikumar (2014), for example, cite strategic (pleasing management) and non-strategic (excessive optimism) reasons for this. Hovakimian and Saenyasiri (2010) find evidence of conflicts of interest by analysts who would issue excessively optimistic recommendations in an attempt to please the managers of the companies they follow to obtain privileged access to information in the future (Lim, 2001) and because their compensation was linked to the profits generated by investment banking and brokerage activities (Lin & McNichols, 1998). From the perspective of this work, the topic would be relevant if a distinct reaction by male and female analysts to the misalignment of incentives were evidenced. A suggestion, therefore, for a sequel to this study would be to test whether there are gender differences in the behavior of sell-side analysts in situations of this type of conflict of interest.

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CONFLICTS OF INTEREST

The authors have no conflicts of interest to declare.

AUTHORS' CONTRIBUTION

Amanda Martinez El Ghossain: Conceptualization; Data curation; Formal analysis, Investigation; Writing – proofreading and editing.

Anna De Abreu Sampaio Navarro Vieira: Conceptualization, Data curation; Formal analysis; Investigation; Writing – original draft.

Alexandra Strommer Godoi: Conceptualization; Methodology; Project administration; Supervision; Visualization; Writing – original draft; Writing – proofreading, and editing.

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