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EFFECTS OF INTANGIBLES ON FINANCIAL ANALYSTS' FORECAST

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ABSTRACT

The purpose of this research was to verify the influence of intangibles on the accuracy and dispersion of profit forecasts made by financial analysts. This study was motivated by observing that the literature suggests that intangibles can influence analysts' forecasts; however, the results are divergent, and there is no consensus regarding the direction of this influence in the studies found that address this theme. To achieve the research objectives, a sample of American non-financial companies with shares traded on Nasdaq from 1995 to 2016 was used from the OLS (Ordinary Least Squares) method, as adopted by most of the literature on the subject. The choice of such sample was due to the greater availability of intangible data and analysts' coverage, comparability with results of previous research in the literature and also because the respective stock exchange concentrates companies with greater degree of intangibility. The main results indicated that investments in R&D and recognized intangible assets were capable of improving analysts' forecasts. However, Goodwill was negatively correlated with analysts' forecasts by reducing accuracy and widening forecast dispersion. The evidence suggested an association between intangible and analysts' forecasts, providing evidence that the direction of this influence cannot be generalized to all intangibles, depending on the level of uncertainty and information complexity of the intangible studied.

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1 INTRODUCTION

The world economy is constantly changing, evolving, and bringing new forms of business and products. Much of the process of market evolution is driven by competition between companies, intensified by the globalization process. Jia (2017) highlights that competition has increasingly evolved around the intellectual capital of companies, becoming the most important competence. In this context, companies are looking for ways to differentiate themselves from their competitors and achieve better results by investing in research and development (R&D) and by developing innovative processes and products (McDermott, 1999).

This relationship between innovation and achieving better performance has already been addressed in the literature. Perez and Famá (2006) thus analyzed the relationship between innovation and business performance through intangible assets not recognized in the financial statements. The results observed indicate that the intangible-intensive companies present significantly superior performance. Simões and Louzada (2016), in turn, empirically demonstrated the relationship between intangible assets and competitive advantage, showing that the persistence of intangible levels has a positive impact on ROIC generation.

As knowing the importance of intangibles for business performance, financial analysts should note this in their profit forecasts. According to Cummins (2005), it is up to financial analysts to reflect the value of intangibles in their forecasts, in order to assess the potential for generating additional profits that may materially contribute to the company's bottom line. Thus, previous works point out that the increased disclosure of intangible asset information by companies helps reducing information asymmetry, increasing stock liquidity, attracting investors, increasing coverage and, consequently, contributing to forecasts' improvement (Diamond & Verrecchia, 1991; Lang & Lundholm, 1996; Srinivasan, 2007). Noteworthy is the discretion involved in the decision to recognize intangible assets, which allows managers to signal their prospects to the market (Dinh, Eierle, Schultze & Steeger, 2015; Matolcsy & Wyatt, 2006).

Other studies point out that, due to the higher degree of complexity and uncertainty of intangible assets, actions such as adequate recognition, measurement, and evaluation are difficult and, consequently, affect forecasts. Gu and Wang (2005) in this sense, present that, in the last decades, the increase on the size of intangibles, in proportion and contribution to the results, has become a "problem" for financial analysts, as it parts from intangible assets that are not recognized by accounting in the financial statements. In addition, when recognized, most investments in intangible assets are not properly identified in the financial statements due to their difficulty in separating other operating expenses (Lev, 2005). Moreover, R&D investments tend to be exclusive and private to the investing company, which limits the comparison between companies in the process of obtaining information for decision-making (Palmon & Yezegel, 2012). That is, the uncertainty of future economic benefits linked to intangible assets increases the difficulty for analysts to have a proper understanding of companies' ability to generate future cash flow, culminating in greater difficulty in long-term perception of the company.

From previous studies, we observed that, although there is recognition of the existence of relationship between intangibles and analysts' forecasts, there is still no consensus on the direction of this influence. On one hand, intangibles provide useful information about expected future profits. On the other hand, it is argued that the uncertainty and complexity of this information may make it difficult to properly assess the future cash flow expected by analysts. Thus, it is motivated to carry out a work that aims to fill the existing gap by contributing to the debate and understanding the existence of different results in search of a consensus on the subject. In view of the above, the following research problem is presented: **What is the**

relationship between financial analysts' earnings forecasts and the different types of intangibles presented in the financial statements?

In order to answer the research question, the general goal was to verify the influence of intangibles on the accuracy and dispersion of earnings forecasts made by financial analysts. Specifically, we seek to analyze whether (i) the intangibles recognized in the financial statements, (ii) investments in R&D and (iii) *Goodwill* influenced the accuracy and dispersion of analysts' forecasts.

Given the above, the development of this research is justified, due primarily to the growing importance of intangibles over the years. According to Santos, Gomes, Fernandes, Pinheiro and Schmidt (2006), the value generation of these assets has increased significantly, given the augment in the materiality of their values in the composition of the companies' total assets. Another point that highlights the growth of intangibles is the market value index relative to the book value of companies listed in the S&P 500, which rose from one in the early 1980s to six in 2001 (Lev 2001). Intangible studies have thus gained importance, given their informational and evaluation complexity (Penman, 2009). Jia (2017) highlights then two motivations for this type of study: (i) innovation, which has become a key element for the company's long-term success and growth; and (ii) the implications of intangible investments on future profits, which are complex and difficult to evaluate (Ali, Ciftci, & Cready, 2012). In addition, it is of paramount importance to understand how such a factor can influence the analyst in light of its important role that, according to Luo, Homburg and Wieseke (2010), generates value for investors in two ways: (a) analyzing publicly available information more skillfully and (ii) collecting information unavailable to the general public, which is important for the proper valuation of the company.

That said, this research intends to contribute to the discussion by, unlike previous studies - in addition to using proxies already used to investigate intangible assets such as R&D investment and intangible assets recognized in the financial statements −, filling a gap in the discussion, by adding *Goodwill*'s intangible. In addition, we sought to separately analyze the influence on financial analysts' forecasts (i) of intangible assets recognized in the financial statements, (ii) investments in R&D and (iii) *Goodwill*, as it may be distinguished between the types of intangibles due to the degree of complexity and uncertainty of each one, and may help to understand the existence of different results so far.

2 THEORETICAL FRAMEWORK

2.1 Assets and intangible assets

The two main attributes of an asset, according to Santos *et al*. (2006), are the control of resources and the ability to provide future economic benefits. The asset is an entity-controlled resource, over which future economic benefits are expected. If there is not such expectation, directly or indirectly, there is no asset. According to Lev (2005), intangible assets, like any assets, are also a source of future benefits, but have no physical incarnation. Lev (2001) defines an intangible asset as a right to future benefits that has no physical or financial body. However, in Accounting, Economics, and Management, intangible assets are given different names, such as *intangible assets, knowledge capital, and intellectual capital*. According to Zanoteli (2015, p. 143), the meaning, in essence, is the same: “non-physical right to future benefits.”

Lev (2005) categorizes intangible assets as follows: (i) Products/Services: via the knowledge gained from future R&D investment, trademarks and/or patents that enable companies to offer new products or services to their customers; (ii) Relationship with customers: is associated with their loyalty, which allows for higher prices or guarantees a large market share; (iii) Human resources: configured unique practices adopted by the company, which considerably increase labor productivity; (iv) Organizational capital: arises through unique

projects and business processes that enable companies to outperform competitors by generating higher revenues or reducing production costs.

According to Lev (2001), investment in R&D is the focus of researchers as it is disclosed in income statements separately from other intangibles. In contrast, from Damodaran's (2007) perspective, *Goodwill* is the most recognized intangible asset in the financial statements. *Goodwill* represents the portion of the amount paid referring to the expected future profitability of an intangible asset, also composed of market value and book value (Martins, Diniz & Miranda, 2012). As for Iudicibus (2010), *Goodwill* is constituted by the excess cost of acquiring a company, due to its expected future profitability over its assumed assets and liabilities.

However, the recognition, measurement and, consequently, the valuation of intangibles are complex and a source of wide discussion by Accounting Science for several factors, including: (I) for the segregation between operating expenses and investments in intangibles, many subjective judgments would be required; (II) not all intangible investments generate future returns; (III) it is difficult to measure them (Kanodia, Sapra & Venugopalan, 2004). That occurs, according to Scott (2012), because most intangible assets are generated internally with their costs being diluted over the years.

Thus, the fact that not all intangible assets are reported in the financial statements becomes the biggest obstacle in the study of the relationship between intangibles and company performance (Lev, 2001). That is, only part of intangibles, whose measurement and recognition may be properly performed, can be recognized as intangible assets in the balance sheet, making intangible assets recognized in the balance sheet as the least uncertain type of intangible assets. R&D, while providing important information about the entity's future, present greater uncertainty about the future benefits that may be generated, and *Goodwill* represents a portion of a paid amount that is difficult to measure for external users for proper review by Financial analysts.

2.2 Analyst accuracy and intangible assets

Intangibles are considered as unique characteristics of companies, which allow them to differ themselves from their competitors. Investments in intangible assets, such as R&D (Research and Development), are essential to gaining competitive advantage and, consequently, increasing corporate profitability (McDermott, 1999; Perez & Famá, 2006). Proof of that, Currim, Lim and Zhang (2018) showed that, even in times of pressure, companies that were able to maintain their R&D investments have been rewarded with better long-term performance.

Aware of this, Cummins (2005) points out that analysts should reflect the value of intangible assets in their forecasts if they presume they can generate additional profits and materially contribute to the company's bottom line over a five-year period. Analyzing this, Abeysekera (2016), from experiments with analysts, suggests that both internally developed brands and purchased brands are considered by analysts and treated equally for the purpose of earnings forecasts in annual reports. In this process, analysts play an important role in mitigating information asymmetry, bringing information to investors, analyzing public information more skillfully and collecting information not available to the general public, thereby assisting in decision making (Abhayawansa & Guthrie, 2016; Luo *et al*., 2010).

Given this, Kwon (2002) showed that companies that use more technology in their processes − that is, companies with a higher degree of intangibility − attract greater coverage from financial analysts due to higher growth expectations. The author explains that, the greater the number of analysts following a given company, the greater the accessibility of information, which in turn would lead to better predictions. Analyzing such a relationship, Bae, Hur, Lee, and Goh (2017) analyze the influence of patent citations on financial analysts' predictions, so that their findings indicate that analysts are more likely to make long-term forecasts for companies with higher citations of patents. In other words, companies with a higher degree of intangibility attract more analysts because of their higher earning potential, generating an increase in

information analyzed with greater ability by analysts, allowing for a better evaluation and prediction of these. It is also noteworthy that the discretion involved in the decision to recognize intangible assets allows managers to signal their prospects to the market, and the greater the amount of signaling, the greater the amount of information available to analysts (Dinh *et al*., 2015).

From the same perspective, Matolcsy and Wyatt (2006) found evidence that, on average, recognizing intangibles in the financial statements is associated with more predictable earnings and is able to provide more insight into the company's future performance, and thus assist in predicting future profits. Thus, greater disclosure of information related to the future benefits generated by intangible assets would reduce information asymmetry, increase stock liquidity, attract investors, increase coverage and, consequently, improve analysts' forecasts (Diamond & Verrecchia, 1991; Lang & Lundholm, 1996; Srinivasan, 2007). In another paper, Maaloul, Ben Amar and Zeghal (2016) present the relationship between voluntary disclosure of intangibles and earnings forecasts of financial analysts. In their findings, the evidence indicates that increased disclosure of intangibles affects the accuracy and dispersion of analysts' earnings forecasts, in addition to their favorable consensus recommendations.

However, other aspects inherent in intangible assets make it difficult to measure the expectation of future economic benefits and may turn it difficult to predict the profitability of companies with a higher degree of intangibility. As already discussed in the previous section, as for Scott (2012), intangible assets are generated internally and their costs are diluted over the years, making their proper measurement and recognition more complex. In addition, we highlight the subjectivity linked to the segregation between operating expenses and investments in intangibles and the uncertainty linked to the measurement of future economic benefits (Kanodia *et al.*, 2004). Given this, the complexity and uncertainty of intangibles may negatively affect the predictability of future profits. According to Barron, Byard, Kile and Riedl (2002), Gu and Wang (2005) and Dinh *et al*. (2015), the difficulty in evaluating them tends to reduce the quality of the forecasts.

Given the above, it is believed that the complexity of intangibles is associated with the accuracy of analyst forecasts, increasing or reducing the accuracy of earnings forecasts made by financial analysts depending on the level of complexity of each intangible studied, generating the first hypothesis of search.

H1 – The accuracy of financial analysts' forecasts will be higher when associated with intangibles of less uncertainty and complexity.

2.3 Scattering of analyst forecasts and intangible assets

In line with other studies (Dinh *et al*., 2015; Jia, 2017; Kwon, 2002; Matolcsy & Wyatt, 2006; Srinivasan, 2007), the influence of intangibles on the dispersion of analysts' forecasts will also be investigated. Kwon (2002) and Matolcsy and Wyatt (2006) found less dispersion in companies with more intangibles, while Dinh *et al*. (2015) and Jia (2017) used dispersion in their work and concluded that investment in intangibles is significantly associated with higher levels of dispersion of the forecasts. Srinivasan (2007) explains that such a metric is of great interest to internal and external users of companies participating in the stock market because it reflects the *ex-ante* variability of company performance.

Regarding its relationship with intangibles, the dispersion of the forecast is capable of reflecting the uncertainty generated by the intangibles about the company's future profits quality of information, and may also be interpreted as an alternative measure of information asymmetry in the capital market. (Barron *et al.*, 1998; Chakravarty & Grewal, 2016). Following the same perspective approach for constructing the first hypothesis, companies with a higher degree of intangibility attract greater coverage and thus increase the accessibility of information (Kwon, 2002). As for Barth *et al.* (2001), companies with a higher level of intangibles provide greater incentives to analysts by allowing greater chances of earnings. That is, companies with more

intangibles generate greater availability of information for all users, reducing the informational asymmetry, making forecasts less dispersed.

As an example, Matolcsy and Wyatt (2006), when checking Australian companies from 1990 to 1997, found evidence that capitalization of intangibles is associated with greater accuracy of forecasts and lower degree of dispersion. As another example, one can cite Kwon (2002), who segregated his sample into two groups: (i) *high-tech* and (ii) *low-tech* and thus examined the differences in accuracy and dispersion in between the groups. The results indicated greater accuracy and less dispersion for companies belonging to the *high-tech* group compared to *low-tech* companies.

In contrast to these works, other authors argue that intangible information is considered to be uncertain future economic benefits that may also reflect the dispersion of forecasts (Amir, Lev & Sougiannis, 2007; Dinh *et al*., 2015; Gu & Wang, 2005). Chakravarty and Grewal (2016) explain that, as information quality decreases, it becomes more difficult to predict growth prospects and, therefore, valuation models cannot adequately predict future profits.

According to Dinh *et al.* (2015), there are two levels of uncertainty related to intangibles. Firstly, the uncertainty of the environment in which the company operates, where it is not possible to predict the actions of customers, suppliers and competitors, which may affect production, sales and performance. Secondly, the uncertainty related to future economic benefits should be cited, since the success of an intangible can be hardly predicted (Amir, Lev & Sougiannis, 2007; Dinh *et al*., 2015; Gu & Wang, 2005). Dinh *et al.* (2015), with data from the 150 largest companies on the German stock exchange, show that capitalization of research and development (R&D) costs are significantly associated with the forecasting errors of top analysts and the dispersion of such forecasts.

Based on these arguments, it is believed that intangible uncertainty is associated with dispersions of analysts' forecasts, increasing or reducing the dispersion of earnings forecasts made by financial analysts as a function of the uncertainty level of each studied intangible, which culminates in a second research hypothesis.

H2 – The dispersion of financial analysts' forecasts will be smaller when associated with intangibles with less uncertainty and complexity.

3 METHODOLOGY

3.1 Data collecting and sampling

The survey sample is made up of all US non-financial NASDAQ-listed companies all the way from 1995 to 2016 and made available through the Thomson Reuters database. The sample period was chosen by the period with the largest number of analysts providing forecasts. The choice of the respective stock exchange was primarily due to the greater availability of data on the intangibles studied and the greater analyst coverage, to the comparability with other findings in the literature, and the fact that, according to Burgman and Roos (2004), NASDAQ concentrates companies of the new economy with a greater degree of intangibility, focus of this paper. The relation number of companies/year after the sample delimitation is presented in Table 1, as follows:

Table 1
Number of companies/year

Year	Companies	%	Year	Companies	%	Year	Companies	%	Year	Companies	%
1995	1583	2,80%	2001	2615	4,63%	2007	3461	6,13%	2013	3929	6,96%
1996	2125	3,76%	2002	2664	4,72%	2008	3560	6,31%	2014	3902	6,91%
1997	2314	4,10%	2003	2733	4,84%	2009	3634	6,44%	2015	3723	6,59%

1998	2447	4,33%	2004	2366	4,19%	2010	3723	6,59%	2016	3531	6,25%
1999	2547	4,51%	2005	3019	5,35%	2011	3851	6,82%			
2000	2598	4,60%	2006	3214	5,69%	2012	3938	6,97%	**Total**	**56.461**	**100%**

Source: Prepared by the authors.

To delimit and exclude very small companies from the base, presented in Table 1, those with less than US $ 1 million in sales and total assets were excluded. (Barth, Kasznik, & McNichols, 2001; Palmon & Yezegel, 2012). We observe that there was an increase in the number of companies fitted in such boundaries until the year 2012: start counting from 1583 companies in 1995 and reaching a total of 3938 companies in 2012. Subsequently, there has been a reduction in the number of companies over the years, reaching 3531 in 2016.

3.2 Variables used

From the observation of studies that relate analysts' forecasts to intangibles, the dependent, independent and control variables have been identified, as well as their measurement methods. Due to the wide variety of methods for measuring variables, it is noteworthy that, for choosing the variables and the measurement method used, the most commonly used proxies for measuring the forecasts of financial analysts and intangible assets have been observed. Table 2 presents a summary of the variables.

Table 2
Variable definition

Variable	Abbreviation	Definition/Calculation Method	Literature
Dependent variables			
Accuracy of analyst forecast	APN	Negative of the absolute value of analysts' forecast errors deflated by stock price.	Almeida and Dalmácio, 2015; Dalmácio, 2009; Gu and Wang, 2005; Jia, 2017; Lang and Lundholm, 1996.
Analyst forecast scattering	DP	Standard deviation of forecast estimates for company i over period t, scaled by the share price of company i over period t.	Almeida and Dalmácio, 2015; Dinh *et al*., 2015; Jia, 2017; Lang e Lundholm, 1996; Srinivasan, 2007.
Dependent variables			
Goodwill	GW	Net goodwill divided by the total assets of company i over t.	-
R&D	IPD	Total investment in R&D divided by total sales of company i over period t.	Dinh *et al*., 2015; Gentry and Shen, 2013; Palmon and Yezegel, 2012; Srinivasan, 2007.
Intangible assets	IA	Intangible Assets/Market Value Added of company i over period t (MVAD)	Matolcsy and Wyatt, 2006
Control variables			
Size	TAM	Natural logarithm of the market value of the company i in the period t..	Amir *et al.*, 2003; Dinh *et al*., 2015; Gu and Wang, 2005; Matolcsy and Wyatt, 2006.
Sector	D_SET	Company activity sector (1 = companies in a given sector and 0 = companies in other sectors)	Jia, 2017
Dummy negative net income	D_NNI	1 = companies with negative net income and 0 = other companies	Amir *et al.*, 2003; Gu and Wang, 2005
Analyst coverage	CA	Number of analysts who made earnings forecasts for company i over period t.	Almeida and Dalmácio, 2005; Dinh *et al*., 2015; Jia, 2017; Lang and Lundholm, 2012; Srinivasan, 2007.

Year dummy	YEAR	Dummy year sample that assumes a value of one for a given year and zero for others	Jia, 2017
Sales growth	GROW	Revenue growth	Barth *et al.*, 2001; Jia, 2017.
Return on assets	ROA	Return on total assets	Jia, 2017

Source: Original of this research.

Highlighting the measurement of the variables of analysts' forecasts, the accuracy of prediction (AP) is measured as the negative value of the absolute difference between the median of analysts' prediction (absolute difference between the consensus prediction of analysts and the profit by the company's annual actual action over the period), deflated by the stock price on the last business day. (Almeida & Dalmácio, 2015; Lang & Lundholm, 1996). According to Matolcsy and Wyatt (2006), the variable is deflated to facilitate comparisons between companies. Forecast dispersion (FD) is calculated as the standard deviation of forecast estimates for company i over period t, scaled by the share price of company i over period t (Almeida & Dalmácio, 2015; Jia, 2017; Kwon, 2002). In both variables, the literature also points to other divisor options, such as Matolcsy and Wyatt (2006), which use total assets, and Kwon (2002), which uses the average of analysts' forecasts. However, there is a greater use of year-end share price as a divisor (Almeida & Dalmácio, 2015; Dinh *et al*. 2015; Jia, 2017; Lang & Lundholm, 1996; Srinivasan, 2007).

3.3 Models

In order to facilitate understanding, two general models have been developed to investigate the relationship between intangible assets and the analysts' forecasts. In model 1, the chosen dependent variable was the "accuracy of analysts' forecasts" and the independent variables represent intangibles, as presented in Table 2 (R&D, Intangible Assets and *Goodwill*), in different regressions. Model 2, on the other hand, utilized the "dispersion of analysts' forecasts" as the model-dependent variable and, again, as independent variables, the "R&D", "Intangible assets" and "*Goodwill*" have been used.

$$AP_{it} = \beta_0 + \beta_1 Intangível_{it} + \beta_2 Control_{it} + e_{it} \qquad \text{Equation (1)}$$

Where, AP_{it}: accuracy of analysts' forecasts by consensus (average and median) of analysts of firm i over t; $Intangível_{it}$= intangible variable of company i over t; $Control_{it}$= control variables of company i over t; e_{it}= random error for company i over t.

$$DP_{it} = \beta_0 + \beta_1 Intangível_{it} + \beta_2 Control_{it} + e_{it} \qquad \text{Equation (2)}$$

Where, DP_{it}= dispersion of analysts' forecasts of company i over t; $Intangível_{it}$= intangible variable of company i over t; $Control_{it}$= control variables of company i over t; e_{it}= random error for company i over t.

That is, in the first econometric regression, the intangible active impact as an independent variable on the accuracy of analysts' forecasts has been investigated. In the second regression, the impact of R&D as an independent variable on the accuracy of analysts' forecasts has been investigated. Finally, the impact of "*Goodwill*" as an independent variable on the accuracy of analysts' forecasts has been investigated. Thus, such models originate six distinct models from the alternation of the studied variables.

4 RESULTS ANALYSIS

4.1 Analysis of Descriptive Statistics and Correlations

In this section, the descriptive statistics of the sample variables of this research will be presented. It is noteworthy that, due to the high dispersion of the variables, the *winsorization* process has been used, which limits the effects of *outliers* without removing them (Fusai & Roncoroni, 2007). Table 3 presents the descriptive statistics of the *winsorized* variables, considering that, when observing the independent variables of intangible assets "*Goodwill*", "R&D" and "intangible assets", there are companies with little investment in R&D.

Table 3
Descriptive Statistics

Variables	Number of observations	Average	Standard Diversion	Minimum	Maximum
AP	34.167	-1,936	24.79	-399.2	0
DP	34.314	0,131	1,929	0	33.33
GW	35.638	0,192	0,248	0	1,731
IA	36.841	0,117	0,576	-2,634	3,063
IPD	25.142	0,533	2,655	0	117.1
TAM	60.183	19.20	3,318	6,076	23.93
GROW	64.652	0,398	1,776	-1	17.01
D_PREJ	67.977	0,342	0,474	0	1
ROA	67.910	-0.0790	0,593	-36.68	0,495
CA	38.144	1,707	0,984	0	4,025

Notes. AP = analyst forecast accuracy as measured by the average of analysts for firm i over t; AP_MEDIAN = accuracy of analyst forecasts predicted by the median of analysts of firm i over t; DP = standard deviation of forecast estimates for company i over period t, scaled by the share price of company i over period t; GW = net *Goodwill* value divided by the total assets of company i over t; IPD = total investment in R&D divided by total sales of company i over period t; AI = recognized intangible assets measured by intangible assets divided by MVAD (Added market value of company i over t); TAM = natural logarithm of the company's market value; D_PREJ = *dummy* for companies with losses where 1 = companies with negative net income and 0 = other companies; CA = natural logarithm of the number of analysts who issued earnings predictions for company i over the period t; GROW = company revenue growth i over t with relation to t-1; ROA = return on total assets of firm i over t; Ctrl. sector = Company activity sector (1 = companies in a given sector and 0 = companies in other sectors); Ctrl. year = *dummy* sample year that assumes value equal to one for a given year and zero for other years.

From the data presented in Table 3, we note the occurrence of companies with very little investment in R&D (RDI). Also noteworthy is the fact that the dependent variables (AP and DP) possess different interpretations. The accuracy of the predictions has its maximum zero, demonstrating that the higher and closer to zero, the more accurate the prediction. As for the dispersion, it has its minimum value zero, indicating that the smaller and closer to zero, the smaller the dispersion between forecasts. An additional care that must be taken, besides observing the descriptive statistics, before the tests, is the correlation analysis. According to Dalmácio (2009), from this verification, it is possible to perform a preliminary analysis of the relationships between the variables. Thus, Table 4 shows the correlation matrix between all the variables in order to observe the degree of association between them.

Table 4
Variable correlation matrix

	AP	DP	IPD	IA	TAM	GROW	D_PREJ	ROA	CA	GW
AP	1									
DP	-.655***	1								
IPD	-.005	004	1							
IA	.060***	-.035**	002	1						
TAM	.263***	-.238***	-.048***	-.0176	1					
GROW	-.020	.024*	.071***	-.0012	-.075***	1				
D_PREJ	-.074***	.072***	.138***	.038***	-.429***	.064***	1			
ROA	.239***	-.121***	-.165***	-.021	.365***	-.100***	-.511***	1		
CA	.058***	-.023*	-.007	-.0413***	.571***	-.0535***	-.207***	.189***	1	
GW	009	-.007	-.034**	.104***	.066***	.086***	006	.027*	.127***	1

Notes. Asterisks indicate significance: *** (1%), ** (5%) and * (10%). AP = accuracy of analyst forecasts as measured by the median of analysts of firm i over t; SD = standard deviation of forecast estimates for company i over period t, scaled by the share price of company i over period t; RDI = total investment in R&D divided by total sales of company i over period t; IA = recognized intangible assets measured by intangible assets divided by MVAD (added market value of company i at t); TAM = natural logarithm of the company's market value; D_PREJ = *dummy* for companies with losses where 1 = companies with negative net income and 0 = other companies; CA = natural logarithm of the number of analysts who issued earnings forecasts for firm i over period t; GROW = company i's revenue growth over t with relation to t-1; ROA = return on total assets of company i over t; Ctrl. sector = Company activity sector (1 = companies in a given sector and 0 = companies in other sectors); Ctrl. year = *dummy* sample year assuming a value of 1 (one) for a given year and 0 (zero) for other years and GW = net *Goodwill* value divided by the total assets of company i over t.

Thus, via the correlation matrix, it was possible to observe that the dependent variables AP and DP, as expected, presented negative correlation with statistical significance, which may indicate that better profit forecasts lead to greater precision and less dispersion between the forecasts of the analysts. The correlation between independent and control variables with dependent variables present statistical significance, except between RDI, GROW and GWNET and the dependent variable AP_MEDIAN. However, regarding the dependent variable SD, only the RDI and GWNET variables do not present statistical significance in the correlation. It is also observed that the independent variables do not have a high correlation related to each other, which could be an indication of endogeneity problems.

4.2 Test analysis

To assess the relationship between intangible assets and financial analyst forecasts, the models cited have been applied, so that forecasts are represented by the variables dependent on forecast accuracy (FA) and forecast dispersion (FD). The *proxies* for intangible assets are represented by investments in R&D (RDI), intangible assets recognized in the financial statements (AI) and *Goodwill* (GW). Table 5 shows the results of econometric analyzes panel data using the Ordinary Least Squares (OLS) method, as adopted by most international literature on the subject (Amir *et al.*, 2003; Jia, 2017; Matolcsy; & Wyatt, 2006). In the regressions performed, the robust standard error has been used, since, according to Fávero and Belfiore (2014, p. 159), it is thus possible to obtain biased estimators.

Table 5
Results

Model	(1)	(2)	(3)	(4)	(5)	(6)
Variables	AP	DP	AP	DP	AP	DP
IPD	0,119***	-0.00352				
	(2,787)	(-0,677)				
IA			0,750*	-0.0574*		
			(1,658)	(-1,773)		
GW					-3,481***	0,158**
					(-2,935)	(2,336)
TAM	4,003***	-0,375***	3,337***	-0,235***	4,035***	-0,258***
	(8,204)	(-7,846)	(8,975)	(-7,610)	(9,321)	(-7,402)
D_PREJ	4,199***	-0,345***	3,057***	-0,226***	3,667***	-0,184***
	(5,689)	(-5,919)	(4,532)	(-3,207)	(4,946)	(-3,942)
GROW	0,200	0.00325	-0,123	-0.00425	-0.0522	0.0105
	(1,175)	(0,211)	(-0,450)	(-0,223)	(-0,161)	(0,452)
ROA	2,974	-0.0178	6,131**	-0,623**	6,576**	-0,276
	(1,538)	(-0,161)	(2,192)	(-2,029)	(1,993)	(-1,382)
CA	-4,116***	0,482***	-2,878***	0,263***	-3,379***	0,276***
	(-7,518)	(7,722)	(-8,221)	(7,680)	(-8,501)	(7,288)
Constant	-144.7***	10.66***	-122.1***	7,530***	-93.00***	6,109***
	(-4,137)	(3,845)	(-4,474)	(3,451)	(-4,231)	(2,879)
Crtl. Year	Yes	Yes	Yes	Yes	Yes	Yes
Crtl Sestor	Yes	Yes	Yes	Yes	Yes	Yes
Notes	13.378	13.418	23.704	23.768	23.375	23.436
R2 Ajust.	0,142	0,132	0,126	0.0965	0,134	0.0916
F	1,739	1,456	2,014	1,436	2,143	1,355

Notes. Asterisks indicate significance: *** (1%), ** (5%) and * (10%). The values in parentheses are the t-statistics of the estimated coefficients. FA = accuracy of analysts' forecasts as measured by the median of analysts of firm i over t; SD = standard deviation of forecast estimates for company i over period t, scaled by the share price of company i over period t; RDI = total investment in R&D divided by total sales of company i over period t; IA = recognized intangible assets measured by intangible asset divided by MVAD (added market value of company i over t); GW = net *Goodwill* value divided by the total assets of company i over t; TAM = natural logarithm of the company's market value; D_PREJ = *dummy* for companies with losses where 1 = companies with negative net income and 0 = other companies; CA = natural logarithm of the number of analysts who issued earnings forecasts for firm i over period t; GROW = company i's revenue growth over t related to t-1; ROA = return on total assets of firm i over t; Ctrl. sector = Company activity sector (1 = companies in a given sector and 0 = companies in other sectors); Ctrl. year = *dummy* sample year that assumes value equal to one for a given year and zero for other years.

In regressions 1 and 2, which aimed to specifically analyze the influence of the R&D investment intangible on analysts' forecasts, represented by the variables FA and FD, it was found that the RDI variable had a positive impact (0.119) and statistical significance (1%) on the FA variable, but did not present statistical significance in relation to the dispersion of analysts' forecasts (FD). Thus, the evidence suggests that investments in R&D have a positive influence on the accuracy of forecasts.

Regressions 3 and 4 have been performed to investigate the influence of intangible assets recognized in the financial statements (AI) on analysts' forecasts (FA and FD). The results showed a positive impact (0.750) and statistical significance (10%) on the FA variable, suggesting that intangible assets recognized in the financial statements also have a positive influence on the accuracy of forecasts. In turn, the AI variable presented a negative (-0.0566) and statistically significant (10%) value on the dispersion of analysts' forecasts (FD), suggesting that an increase in intangible assets recognized in the statements (AI) reduces the dispersion of analysts' accuracy (FD). Therefore, the findings suggest that intangible assets recognized in the statements positively influence analysts' forecasts, reducing the dispersion of forecasts.

It is noted that the results of the R&D investment intangibles and intangible assets recognized in the financial statements point to a significant improvement in analysts' forecasts, although R&D investments are considered "more uncertain" intangibles due to the difficulty of

predicting or controlling their success. (Amir *et al*., 2003; Dinh *et al.*, 2015; Gu & Wang, 2005). According to Diamond and Verrechia (1991), Lang and Lundholm (1996) and Srinivasan (2007), the greater amount of information about future cash flow generated by the recognition of investments in R&D tends to improve analysts' forecasts.

As for the results regarding the dispersion of analysts' forecasts (FD), although investments in R&D are not statistically significant, intangible assets recognized in the statements (AI) have been associated with the reduction of uncertainty generated by intangibles, since the dispersion, according to Barron *et al.* (1998), is capable of reflecting such uncertainty. This result is in line with the theory, when it indicates that only the intangibles that are closer to the tangible are recognized by accounting as intangible assets (Zanoteli, 2015).

In order to contribute not only with the variables identified in the existing literature, which relates intangibles to analysts' forecasts, we sought to add another variable to the study: *Goodwill* (GW). In the result of the econometric regressions 5 and 6, presented in Table 5, it was found that the GW has shown to be statistically significant in the model related to the accuracy of the analysts' forecast (FA) and the forecast dispersion model (FD), respectively, of 1% and 5%. However, unlike the other variables studied, the GW presented negative value (-3.481) when related to FA and positive value (0.158) when related to forecast dispersion (FD).

Thus, evidence suggests that *Goodwill* tends to negatively influence analysts' forecasts, decreasing accuracy and increasing dispersion. This finding suggests that *Goodwill* is information with greater complexity and uncertainty, and may negatively affect the predictability of future profits, which corroborates the researches by Barron *et al.* (2002), Gu and Wang (2005) and Dinh *et al.* (2015), who suggest the difficulty of evaluating intangibles as a major factor in reducing the quality of analysts' forecasts.

4.3 Expected results vs. Findings

Importantly, the expected coefficient signal may differ according to the uncertainty, complexity and amount of information of the studied intangible asset. Zanoteli (2015) points out that the assumptions for accounting recognition are aligned with the concept of tangible assets, suggesting a misalignment within the definition of intangible assets. That is, it is expected that only the intangibles that get closer to the tangible (less uncertain) will be recognized by Accounting. That way, intangible assets are recognized as intangible assets with a lower degree of uncertainty. On the other hand, R&D activities are more uncertain and complex than recognized intangible assets, given that the success of an R&D activity is difficult to control and predict (Amir *et al*., 2003; Dinh *et al*., 2015 Gu & Wang, 2005). Dinh *et al.* (2015) explain, therefore, that R&D investments are associated with increased information asymmetry due to the uncertainty of future economic benefits and the volatility of subsequent profits.

Investments in R&D have been expected to be associated with reduced earnings predictability (reduced accuracy and increased dispersion), while intangible assets got recognized with increased predictability and consequently improved forecasts (increased accuracy and reduced dispersion), due to the already greater uncertainty inherent of investments in R&D. However, the non-confirmation of the expected signals does not make it impossible to confirm or reject the research hypotheses. As already presented, greater disclosure of information related to future benefits generated by intangible assets may be able to improve analysts' forecasts (Diamond & Verrecchia, 1991; Lang & Lundholm, 1996; Srinivasan, 2007). In other words, greater disclosure of investments in R&D may result in offsetting uncertainty via information volume. Table 6 below summarizes the expected results found in the tests performed at in this study:

Table 6
Expected results vs. Found

Hypothesis	Model	Dependent variable	Independent variable	Expected coefficient	Approach	Coefficient found
H1	1	Accuracy (AP)	IPD	(-)	OLS	(+)
H2	2	Dispersion (DP)	IPD	(+)	OLS	Non-significant
H1	3	Accuracy (AP)	IA	(+)	OLS	(+)
H2	4	Dispersion (DP)	IA	(-)	OLS	(-)
H1	5	Accuracy (AP)	GW	(-)	OLS	(-)
H2	6	Dispersion (DP)	GW	(+)	OLS	(+)

Source: Prepared by the authors.

When comparing the expected coefficients with the found ones, we observed that the investment in R&D (RDI) was statistically significant in model 1. However, unexpectedly, the variable was positively related to the accuracy of the forecasts. In turn, the recognized intangible asset (IA), was significant in both analyzed models (models 3 and 4) and, as expected, the variable was positively related to the accuracy of financial analysts' forecasts (FA) and showed a negative association with the dispersion of analysts' forecasts (FD). Thus, the results between intangibles and the accuracy of analysts' earnings forecasts show a significant improvement in forecasts, by both RDI and IA variables, indicating that investments in R&D may also contribute to the predictability of future profits. Regarding the results between intangibles and forecast dispersion, the IA variable was associated with a reduction in the uncertainty generated by intangibles, since dispersion, according to Barron *et al.* (1998), is capable of reflecting such uncertainty.

This result goes against other empirical evidence on the subject and also the theory, when it indicates that only those intangibles that are closer to tangible will be recognized by accounting as intangible assets (Zanoteli, 2015). Previously, Matolcsy and Wyatt (2006) have shown that greater recognition of intangibles (IA variable in this paper) is associated with more predictable profits, leading to increased accuracy and reduced forecast dispersion, while Snirivasan (2007) has shown that R&D has a positive effect on forecasts. In contrast, other studies indicate that companies with greater innovation activity are more difficult to evaluate, and intangibles are negatively associated with forecasts, indicating higher errors (lower accuracy) and greater dispersion of forecasts. (Chalmers *et al.* 2012; Dinh *et al*. 2015; Jia, 2017)

Goodwill, on the other hand, had, as expected, a negative association with forecast accuracy (FA) and a positive association with financial analysts' forecast dispersion (FD). Thus, *Goodwill* is considered more complex and uncertain information, since greater complexity and uncertainty of intangibles may negatively affect the predictability of future profits. Other works suggest that the difficulty in assessing intangibles ultimately reduces the quality of forecasts (Barron *et al.*, 2002; Dinh *et al.*, 2015; Gu & Wang, 2005). This fact may be justified by the discretionary value attributed to the acquisition cost of another company.

Although no studies addressing *Goodwill* have been found in this context of relation to analysts' forecasts, such results, even being contrary to those found in relation to the IA and RDI variables previously analyzed, are compatible with Jia's findings (2017), Chalmers *et al.* (2012) and Dinh *et al*. (2015), indicating that intangible assets are negatively associated with forecasts and showing lower accuracy and greater dispersion of forecasts. But, in general, the results of the work presented the existence of distinct effects among the studied intangibles, so that the resolutions were closer to the findings of Maaloul *et al.* (2016) who, despite evidencing that the increase in the disclosure of intangibles positively impact analysts' forecasts, pointed out that this effect may vary according to the type of intangible, as it was observed in this research.

5 CONCLUSION

This paper aimed at investigating the relationship between intangibles and forecasts of financial analysts, considering that the expectation of future performance of intangibles should be incorporated by financial analysts. Specifically, we sought to analyze whether intangibles, measured by investment in R&D, intangible assets recognized in the financial statements, and *Goodwill* influence the accuracy of financial analysts' forecasts, as well as the dispersion of these forecasts. In order to achieve the overall and specific objectives, the following analyst forecast *proxies* have been used: financial analysts' forecast accuracy, calculated by the forecast median (FA), and analyst forecast dispersion (FD). The intangible assets have been measured by investments in R&D (RDI), and intangible assets recognized in the financial statements (IA) and *Goodwill* (GW). Thus, by alternating the two dependent variables for financial analysts' forecasts and the three independent variables for intangible assets (R&D investments, intangible assets recognized in the financial statements and *Goodwill*) over the specified models, the results of six econometric regressions have been investigated.

Given the results obtained, the informational contribution of R&D investments and intangible assets, recognized in the financial statements for the predictability of future profits by analysts has been evidenced, increasing the accuracy and reducing the dispersion of financial forecasts. The findings indicate that such intangibles provide information that may contribute to making future profits less uncertain and more predictable. Deepening the results, it was noted that *Goodwill* contributes to the reduction of earnings predictability, which can be explained by the existing discretionary in the acquisition process of other companies, which is not always widely disclosed.

In general, it has been possible to respond to the research problem by showing that intangibles are associated with financial analysts' earnings forecasts. The evidence found suggests that intangibles are associated with the accuracy of forecasts, confirming the research hypothesis H1 and, with the dispersion of forecasts, confirming the research hypothesis H2. These results are related to intangible assets (IA) and R&D (RDI) and are compatible with the findings of Matolcsy and Wyatt (2006) and Snirivasan (2007), corroborating the existing evidence that, on average, the recognition of intangible assets is associated with more predictable profits. However, the results are contrary to those observed by Dinh *et al.* (2015), Jia (2017) and Chalmers *et al.* (2012), who pointed out that the capitalization of development costs is significantly associated with both analysts' forecasting errors and forecasting dispersion. A significant statistical relationship between intangibles and forecasts of financial analysts has been observed.

However, the results are significant and contrary when we analyze *Goodwill*'s intangible, showing that such relationship may be positive or negative, depending on the complexity and uncertainty associated with the assessment of the intangible in question, pointing to an improvement in the accuracy of forecasts when analyzing R&D investments and intangible assets recognized in the financial statements, but worsens when *Goodwill*'s intangibles get analyzed. The findings of this research suggest that the impact of intangibles on the forecast of financial analysts cannot be generalized, as the impact occurs differently according to the intangible analyzed. In addition, just as observed in Maaloul *et al.* (2016), it should be emphasized that the sign of this association may vary depending on the type of intangible studied and its degree of complexity and uncertainty.

This paper contributes by filling a gap in the discussion about the effects of intangibles on financial analysts' forecasts by, besides investigating the effects on variables already discussed in the literature, such as investment in R&D and the intangible asset recognized in the financial statements, and adding to *Goodwill*'s report on the accuracy and dispersion of financial analysts' forecasts. Moreover, because it shows distinct results among intangibles, indicating the complexity and uncertainty of intangibles as a possible cause for distinct results found in the literature.

However, some limitations of this research should be considered. Firstly, the sample consists of companies listed in the United States, thus it is not possible to generalize the results obtained. Regarding the models used, it should be noted that those do not consider the influence of other factors on the forecasts of financial analysts. For future research, it is suggested to use other intangible *proxies* in order to verify the behavior of analysts' forecasts, segregation of companies by degree of intangibility and the investigation of this relationship in different contexts, which may influence the levels of uncertainty of intangibles, such as different countries and economic sectors.

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