

The relationship between the assets intangibility index and the market value of companies

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Abstract

The purpose of this study is to evaluate the association between the assets intangibility index and the market value of companies' shares within the Brazilian capital market. The assumption is that business models based significantly on knowledge and technologies should promote competitive advantages, which should be reflected in the market value of companies. To perform the empirical tests, we considered the quarterly information, from 2008 to 2014, of the companies that compose the IBrX 100 index of BM&FBovespa. The results of the estimation of panel data regression models with sectional fixed effects and double fixed effects confirmed the positive and statistically relevant association between the assets intangibility index and the maximization of share valuation, represented by the market-to-book ratio. This shows that greater investments in intangible assets provide a greater valuation of the company's market price.

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1. INTRODUCTION

Intangible assets represent elements associated with investments, scientific and technological innovation and value creation. For this reason, it is natural to suppose that they have an importance in the formation of the companies' economic value, under a strategic resources vision. According to Technical Pronouncement CPC 04 (R1), intangible assets are identifiable non-monetary assets without physical substance, they are generally associated with the acquisition, development, maintenance, and enhancement of elements without physical substance such as scientific or technical knowledge, implementation of new processes or systems, licenses, intellectual property, market knowledge, name, reputation, image, and trademarks. The condition for the recognition as intangible assets is that such items are identifiable, controlled and generate future economic benefits.

Aligned with this precept, Kayo (2002) points out that, in the United States of America (EUA), expected economic results from assets with no physical substance demonstrate a competitive advantage that creates sustained value for the company, from rare and irreplaceable resources, which may lead to the generation of abnormal profits, evidenced by the growth of the index based on the difference between the book value and the market value of the shares.

According to Ritta and Ensslin (2010), intangible assets are the new drivers of the economic environment of companies due to the contemporary business models are heavily based on knowledge and technologies, leading companies to greater investment needs in intangible assets, aiming at maintaining their competitive advantages.

While investments in tangible assets provide a clearly identifiable return, since equipment, plants, and technologies are available and priced in the market, investments in intangible assets, due to their characteristics and peculiarities, are not always available in the market, and they are often developed by companies to meet their specific characteristics and their return is not always easy to measure.

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Intangible assets exceed tangible assets in many companies, both in value and contribution to growth, but they are often recognized as expenses in financial reporting and therefore they remain absent from corporate balance sheets (LEV, 2001). The change of focus with regard to intangible assets, from 1960, 1970 and 1980, is related to corporate value in relation to their net asset value. The average market-to-book rate of the 500 S&P companies has steadily increased since the 1980s, reaching a six-fold ratio in March 2001. Lev's (2001) interpretation is that in every six dollars of market value, one dollar is recorded as tangible assets and the remainder represents intangible assets.

Following this perspective, in Brazil, some studies associate companies' investments in intangible assets with equity and the increase in share values, by creating the expectation of future cash generation (KAYO; FAMÁ, 2010; RITTA et al., 2010; COLAUTO; NASCIMENTO; AVELINO, 2009).

Considering this context, the purpose of this study is to evaluate, in the Brazilian capital market, the association between the assets intangibility index and the valuation of companies, that is, if companies that intensify their resources in intangible assets are more well-perceived by the market in the evaluation of their shares. The research is based on the assumption that a greater share of intangible assets in the company's net worth structure is positively related to the entity's market value indicators – the ratio between market value and market-to-book value, in particular. To perform the empirical tests, the quarterly information of 2008 to 2014 of the companies listed in the BM&FBovespa that constitute the IBRX indicator 100 is considered.

The main motivation for the study arises notably for its applicability, whose conclusions will contribute to the business decision making process. Such results on intangible asset market valuation are of interest to the main users of accounting information, such as investors, administrators, creditors or legislators. The innovation of this research is in the way of calculating the dependent variable Intangible Asset Index (IIA), obtaining results that also contribute to the studies on intangible assets and their influence on the creation of corporate value. The literature on the determinants of company market value in relation to the book value has increased significantly due to the changes brought about by the modernization of the rules to follow the evolution and innovation of the business, but there are still development opportunities, especially with regard to items on which identification, recognition, and measurement discussions persist, such as intangible assets arising from systems, licenses, intellectual property, image, and trademarks by companies.

In addition to the introduction, which contextualizes the subject and defines the purposes of the research, the work includes: the discussion of the theoretical aspects and the literature review that support the development of the study (Section 2); the definition of methodological procedures to conduct empirical tests (Section 3); presentation and discussion of results (Section 4); and the synthesis of the main conclusions and suggestions for future research (Section 5).

2. THEORETICAL BACKGROUND

2.1 Technological innovations in companies

The transition to knowledge economy verified in the last decades has made the composition of equity structure of the companies change, showing a greater concern in performing investments in technology. According to Tigre (2005), the Theory of the Firm was developed from 1920 with questions about realism and the neoclassical model. The new paradigm, instituted by technical and organizational innovations, provided a new direction for the internal organization of the firm and its interaction with the market, a fact that changed the dynamics of capital accumulation. With the increased complexity of organizations, due to technological advancement, management techniques, and the emergence of modern companies, this theory received great attention and became the focus of studies (CAMARGOS; COUTINHO, 2008).

In this context, the Theory of the Firm would be adequate to explain the insertion of technology in the reality of modern companies, a fact that contributes increased intangible assets in the economy. When there is a need for discussion about different segments of companies, it can provide bases on production organization and transaction costs inherent to the performance of any activity, leading to the emergence of new firms.

Coase's (1992) contribution was had a great relevance to developing new approaches to the Theory of the Firm by criticizing that firms have been treated by economic theory as "black boxes" because they appear in any market but without internal substance. Coase (1992) states that the resources of an economic system are employed by firms and they are used according to internal decisions, not depending directly on market operations. In such a way, he considers that the efficiency of an economic system also depends on how this firm conducts its business, especially considering the large modern companies.

Within this view, the evolution of the industrial process, the transaction costs involving certain activities and the technological changes themselves may better explain the economic changes that have arisen involving the increase of technological companies, to the detriment of industrial companies, with the consequent increase of intangible assets in their composition.

However, a group of intangible assets is not only composed of technological changes. According to CPC 04, as examples of elements composing it we have: software, patents, copyrights, film rights, client lists, mortgage rights, fishing licenses, import quotas, franchises, customer or supplier relationships, customer loyalty, market share, and marketing rights.

In addition, according to Gu and Wang (2005), most intangible assets are not recognized in the accounting statements and accounting rules valid at the time of the study did not require companies to report separate performance measures for intangible assets. The authors observed that the high complexity of knowledge about intangible assets increases the error of predicting analysts' information about firms that are intensive in such assets.

2.2 Impacts of intangible assets on corporate value

The evaluation of the companies' performance is the aim of investors and other economic agents who are users of accounting information. And in this analysis, intangible assets are resources that can improve performance because their differentiation in the process of constructing or creating value can become a competitive differential that will be translated into the performance of companies over time (CARVALHO et al. 2010).

Along the same lines, Lev (2001) had already pointed out that wealth and growth in the economy would be driven primarily by intangible assets. For the author, physical and financial assets would quickly turn into commodities that would remunerate the average investment, while those returns above normal or better competitive position could be obtained by the development of intangible assets along with other types of assets.

In the view of Teh, Kayo and Kimura (2008), intangible assets would be important to give companies a competitive advantage in order to protect them from the threats of potential competitors, as well as to maintain and expand the business market. In his studies, Lev (2001) presents the economic changes conducted since the mid-1980s and emerged with the intangible asset, innovating the unique combination of two economic forces, the first by the increased companies' competition for globalization and changes in the regulation of sectors that are relevant to economy (economic bias) and the second by information technology, driven by global e-commerce (technological bias), significantly changing the structuring of companies, leveraging intangible assets as a multiplier of corporate value.

The studies of Oliveira, Rodrigues, and Craig (2010) have found that net income, *agio*, and other intangible assets are significantly associated with the share price. When the subclasses of identifiable intangible assets were considered, the authors found evidence of an increase in the relevance of *agio*, other intangible assets, and research and development expenses.

If there is a certain consensus that intangibles provide a greater economic value to businesses, Machado and Famá (2011) emphasize that characteristics of the activity sector and strategies implemented by each company make the effects caused by the intangible asset to be differentiated.

Amaral et al. (2014), in turn, state that accounting is a reference for the manager's decision making, especially regarding the measurement of value or profits and losses that are correlated to assets that can create value and growth for the company. They are assets that present invisible information that has the ability to deliberate on the price of the company's product, that is, they are non-materialized assets that generate an appreciation of the organization's business.

2.3 Review of studies on intangible assets

In order to present previous studies on the topic of intangible assets and the results obtained so far, this section brings some of the research performed both internationally and nationally. In the international literature, several studies on intangible assets are found such as those of Choi, Kwon and Lobo (2000), Lev (2001), Sveiby (2001), Knott, Bryce and Posen (2003) and Whitwell, Lukas and Hill (2006), Jones (2011), Basso (2013) and Arif (2013).

Choi, Kwon, and Lobo (2000) analyzed the relationship between the value of intangible assets, the associated amortization expense and the market values of the companies' shares. The empirical results, based on the analysis of the portfolios, indicated that the market responds positively to items of intangible assets reported in the balance sheet, but it does not react significantly to amortization expenses, not showing a positive relationship with the return of shares. This study corroborated the considerations present in Resource-Based View (RBV)- a strategy perspective that explains the competitive advantage based on the firm's distinctive resources and competencies.

Lev (2001) mainly associated intangible assets with the current growth of the companies and the related corporate value in relation to their net asset value, using the market-to-book ratio of the 500 companies that make up the S&P index. Lev's (2001) studies are referenced in most current research on intangible assets and their relationship to firm value. Sveiby's (2001) study focused on the measurement of intangible assets using the term intellectual capital to create shareholder value, highlighting the inability of an accounting measurement system to measure social phenomena, but presenting several ways to enable the identification of intangible assets. Villalonga (2004), innovated by associating the persistence of corporate profits with a greater intangibility of resources.

Other authors that contributed to research involving the intangible asset were Knott, Bryce, and Posen (2003). They tested the contribution of the stock of intangible assets to an optimal production function and they examined the extent to which such an asset stock prevents movements of those resources to rivals in the pharmaceutical industry. The results showed that the process of accumulating intangible assets alone does not hold such mobility to rivals as asset stocks reach a steady state very quickly. Incoming companies could reach the level of intangible assets of an old operator by simply combining their investment to a steady state, but through intangible assets, they get returns that are above normal. It is concluded that the process of accumulating intangible assets by itself is not a mechanism of isolation in an advantageous position in the market.

Also in the RBV study, Whitwell, Lukas, and Hill (2006) investigated a number of antecedent factors that could affect the accuracy of analysts in the evaluation of intangible assets in the period after the crises of WorldCom, Enron and others. However, the authors have come to the conclusion that stock analysts do not fully understand the ability to generate wealth by intangible assets and, for various reasons, they eventually exclude them from their valuations or recommendations. The most immediate suggestion derived from the study is that analysts should regularly update their valuation models to capture the relationship between intangible assets and wealth generation. These results challenge analysts to combine the focus of the micro, from a specialized analysis with an appreciation of long-term trends, visualizing the driving forces of the macro business environment.

In another perspective, Jones (2011) innovated when evaluating the capitalization of intangible assets from a perspective of association with bankruptcy codes, where managers used capitalization of intangible assets to improve company performance, also noting the need to evaluate the rules used to recognize these assets.

Basso et al (2013) analyzed the contribution of intangible assets to company value, using the methodology proposed by Gu and Lev (2011), which associates the company's performance with physical assets, financial assets, and intangible assets. Their results, based on a robust econometric research with many variables related to performance and flows of the companies generated by the intangible capitals, presented a significant relation between comprehensive value and market value, concluding that the variable explains market value, presenting itself as a solution for accounting intangible assets.

Ariff (2013) investigated the voluntary disclosure of information on intangible assets in eight East Asian countries, demonstrating their relevance to results and demonstrations of companies in another region and other markets, unlike previous articles, and reaching similar results on the relevance of research on intangible assets.

In Brazil, although at a lower stage than observed in the international literature, there has been a tendency to increase research involving intangible assets, mainly after the publication of Law 11,638 of December 28th, 2007, due to the registration of the group of Intangible Assets, bringing Brazilian legislation into line with international accounting practices. Ritta et al. (2010) point out that before that period, some research in Brazil already dealt with the issue since Brazilian companies listed abroad had already been using the concept of intangible assets in their demonstrations since 2001.

Kayo (2002) examined the differences in capital and risk structure between tangible and intangible-intensive firms. The research results showed that the capital structure seems to be the most important factor in the differentiation between the two types of companies, showing that firms that are intensive in intangible capital present significant differences from the financial point of view in relation to firms that are capital intensive. The research of Kayo (2002) used the studies of Lev (2001), among others, creating his own methodology, using some of the variables used in this research. In another article of this research on the capital structure of companies, Kayo and Famá (2004) examined the financial characteristics of companies that are intensive in tangible assets and those that are intensive in intangible assets, using as an indicator the intangibility index, measured by the ratio between corporate value divided by the book equity. The results of the research showed that companies that are intensive in intangible assets had, on average, a lower degree of indebtedness, but these companies tended to present a higher weighted average cost of capital.

Ritta et al. (2010) investigated the relationship between intangible assets and financial variables in Brazilian companies belonging to the Ibovespa Index in the years of 2007 and 2008 using two variables: investment index in intangible assets, obtained by total intangible assets in relation to equity, and the intangibility index, obtained by the relation between market value and equity. The results found a positive correlation between the investments made in intangible assets and the corporate intangibility index, and the regression analyzes were significant and showed a positive relationship between intangible assets and the financial variables proposed: net income, equity, and market value. From the analysis of the studies by Kayo (2002) and Ritta et al. (2010), the innovative way of calculating the dependent variable IIA, calculated by dividing the number of intangible assets by total assets, emerged.

Nascimento et al. (2012) studied the correlation between the impact of the intangibility index (II), calculated by the difference between book value and market value, and performance indicators, including Return on Equity (ROE) and Return on Assets (ROA), of information technology and telecommunications companies, concluding that there were no differences between the analyzed segments and that ROA did not present a significant correlation.

Zago, Mello, and Rojo (2013), for example, sought to assess the influence of intangible assets on the performance of companies listed on the Bovespa Index in 2011 and 2012. They verified the relationship between the intangibility index (II) and the degree of average intangibility (DAI) and performance indicators such as return on assets (ROA), return on equity (ROE), and return on investment (ROI). The results identified by the authors showed that the degree of intangibility did not have a significant influence on the performance of companies.

The study conducted by Leite and Santos (2013) focused on the valuation of intangible assets of the five largest companies in the basic materials industry (BMI) in Brazil from 2005 to 2010, and in the analysis of their influence on the market value of companies. The descriptive results of the research were not convergent despite the valuation of the firms' intangibles during the analyzed period. However, it was observed that the excess return on assets was significant and with estimates higher than the tangible assets, but with greater volatility.

Perez and Famá (2015) presented the strategic characteristics of the intangible assets in the current society, concluding that these assets are relevant to generate value by promoting a higher economic performance in the companies that allocate a greater portion of resources to investments in intangible assets, demonstrating their strategic importance to increase the wealth of the business. In summary, from the studies carried out, there is a theoretical gap in the national literature to be filled on the impact of the presence of intangible assets on the market value of companies, controlling their explanatory capacity through other financial and market variables. In empirical terms, such effects are not yet consolidated.

Considering the above, especially regarding the perspective that intangible assets add abnormal value and results, as well as in the results of studies such as the ones of Lev (2001), Ritta et al. (2010) and Zago et al. (2013) and Perez and Famá (2015), among others, it is possible to infer that companies that intensify their resources on intangible assets are better evaluated by the market, considering their share prices. The assumption is that business models based significantly on knowledge and technologies should promote competitive advantages, which should be reflected in the market value of companies. In this sense, the following research hypothesis is formulated, so it can be tested empirically:

H₁: Within the Brazilian capital market, the companies that make up IBrX have a positive relationship between the assets intangibility index and market-to-book.

3. METHODOLOGICAL PROCEDURES

As previously pointed out, the purpose of the present study is to evaluate, within the Brazilian capital market, the association between the market value of the companies and the assets intangibility index. To test empirically the H_1 hypothesis, it is important to define, objectively, the econometric model and the sample to perform the tests.

3.1 Definition of the model

To test the determinant effects of the predicted relation in the research hypothesis H_1 , we specify the model (3.1), which will be the basis of the empirical tests, with the use of panel data, which according to Marques (2000), provides a greater amount of information, greater variability of data, lower collinearity between variables, higher number of degrees of freedom and greater efficiency in the estimation.

$$MTB_{it} = \beta_0 + \beta_1 IIA_{it} + \beta_2 ROE_{it} + \beta_3 IFIN_{it} + \beta_4 EBITDA_{it} + \beta_5 TAM_{it} + \beta_6 IBOV_t + \varepsilon_{it} \quad (3.1)$$

Where:

MTB_{it} : it is the ratio between market value and book value (equity value) – market-to-book - where the market value is obtained by multiplying the share price by the number of shares of the company i in period t ;

IIA_{it} : it corresponds to the asset intangibility index, calculated by dividing the number of intangible assets by the total assets of company i , at time t ;

ROE_{it} : it measures the return on equity from company i at time t ; calculated by the division between net income (after taxes) and equity, expressing the capacity of adding value to the shareholder;

$IFIN_{it}$: it is the financing structure of company i at time t , calculated by the ratio between the total amount of financial debts and the total value of assets representing the participation of short and long-term debts in the company's equity structure;

$EBITDA_{it}$: it corresponds to income before interest, income tax, depreciation/depletion and amortization, divided by the total assets, of company i , at time t ;

TAM_{it} : it is a size measure, calculated as a function of the natural logarithm of the total assets of company i at time t ;

$IBOV_t$: it is the natural logarithm of the Ibovespa index, at time t .

For the test of hypothesis H_1 , the variable of interest is IIA , which represents the assets intangibility index. The research hypothesis is corroborated if this variable presents a positive and statistically relevant relationship with the dependent variable (MTB). In this case, the positive relationship between the assets intangibility index and the market value of the company, relative to the book value, would be confirmed. In addition to the variable of interest, control variables were incorporated into the estimation model: ROE , $IFIN$, $EBITDA$, TAM , and $IBOV$. The consideration of these variables acts as an element of robustness of the potential findings, insofar as the effects of return on invested capital, the degree of financial leverage, the size of the entity and the behavior of capital market in defining the value of the entity are controlled.

ROE is a financial indicator that reflects the company's ability to add value to itself, using its own resources. It is expected, therefore, that higher rates of return on equity are positively reflected in market value. On the other hand, $IFIN$ represents the degree of financial leverage of companies and it translates into the ability of, from the use of third-party resources, to add value to the company. In this sense, based on the premise of risk and return, a positive relationship between the degree of indebtedness and the market value is expected. $EBITDA$ is used essentially to analyze the performance of organizations, as it reflects a proxy of the operating cash generation capacity, and it should be priced positively by the market.

The variable TAM was incorporated in the model with the purpose of capturing the effects of the variable size of the company on the market value of the companies. Finally, IBOV represents the market index of which the variables are part, and a positive relationship with the dependent variable (MTB) is expected, considering that the market value of the companies would be influenced by the average performance of quoted shares traded.

These variables, used together to test the effects of IIA on MTB, are an innovation proposed by the model in relation to previous studies. Cunha, Campos and Longhi (2015) studied whether the stock price can be explained by the variables Net Income (LL), Equity (PL), Size (TAM), Indebtedness (END), Market-to-book (MTB) and Free float (FREEFLOAT) for companies that are part of the Corporate Sustainability Index (CSI) portfolio. Only PL, LL and FREEFLOAT were statistically significant.

Gilio (2010) related MTB to IIA (added of *agio* and *deferred*) finding a non-significant negative relation. Camargos, Camargos, and Rachumi (2009) made a comparative study of the explanatory stock power, to identify if the variables of the Traditional Financial Analysis (TFA) and Dynamic Analysis explain the stock return, concluding that the first one has a greater power of explanation. The study used, among others, the variables, ROE, TAM and EBITDA represented by factors.

3.2 Sample data

For the empirical tests, the quarterly information, from 2008 to 2014, collected in the software of Thomson Reuters, referring to the companies that make up the IBrX 100 index of BM&FBovespa were considered. The use of the IBrX - Brazil Index reference is justified because it is a price index that measures the return of the theoretical portfolio composed of 100 stocks selected among the most traded on BM&FBovespa in terms of number of trades and financial volume. These shares are weighted in the index portfolio by their respective number of shares available for trading in the market. In this sense, the choice derives from the relevance of the companies that compose the portfolio since the index is composed of open companies that are among the 100 best classified as to their marketability index, verified in the twelve months prior to the revaluation, and cumulatively, which were traded in at least 70% of the trading sessions in the twelve months prior to the formation of the portfolio.

Regarding the period, the choice to consider data as of 2008 is justified by the beginning of Law 11,638/07 and CPC 04, which defined the accounting treatment of intangible assets that were not specifically covered in other pronouncements, promoting uniformity in terms of recognition, measurement, and disclosure in companies that are subject to these regulations, which represent the majority of the capital market in the period considered. Despite the existence of previous regulations, such as CVM Deliberation 488 of October 3rd, 2005, which guided the inclusion of the intangible asset group in the presentation of the financial statements, the specific guidelines on recognition and measurement were only presented in Law 11,638/07 and CPC 04.

4. ANALYSIS OF THE RESULTS

Considering the purposes of the study, the analysis of results is presented in two stages: the analysis of descriptive statistics and the regression analysis, through panel data. Raised the variables that make up the model (3.1), the first step of the analysis process was the verification of descriptive statistics, summarized in Table 1, showing that the variables IBOV, TAM, IFIN, and EBITDA show very close measures of central tendency values (mean, median). With respect to the measure of variability, represented by the standard deviation, they show small values if presented with sharper curves, by interpreting the kurtosis indicator, with the exception of the IFIN variable that is closer to a flattened (platykurtic) curve. For the other variables MTB, IIA and ROE, the inverse analysis is verified with respect to central measures and variability, but concordant with respect to kurtosis.

Table 1. Descriptive statistics of the model variables (3.1)

Statistics	MTB	ROE	IIA	IFIN	EBITDA	TAM	IBOV
Mean	3.1014	0.1861	0.1589	0.3104	0.1396	16.2968	10.9456
Median	1.8000	0.1529	0.0682	0.3188	0.1258	16.2989	10.9465
Maximum	52.0100	1.7933	0.8795	0.6986	0.8386	21.0862	11.1615
Minimum	0.1000	-0.7455	0.0000	0.0000	-0.1595	11.6543	10.5334
Standard deviation	4.3946	0.2302	0.2089	0.1642	0.0941	1.8242	0.1522
Asymmetry	4.6612	2.7718	1.6535	-0.0789	1.6249	0.4325	-0.6265
Kurtosis	32.5780	17.8399	4.9362	2.4752	10.1653	3.5231	3.2123

Note: MTB - ratio between market value and net book value - market-to-book; IIA assets intangibility index; ROE measures the return on equity; IFIN - financing structure; EBITDA - profit before interest, income tax, depreciation/depletion and amortization, divided by total assets; TAM - size measurement; IBOV - natural logarithm of the Ibovespa index.

Preliminarily to the estimation of the model (3.1), procedures were adopted in order to verify the fulfillment of the conditions to assure the robustness of the findings. Confirming the normality condition, as highlighted in Table 1, the risks of multicollinearity and autocorrelation and of heteroscedasticity in the residues were evaluated and treated.

For the diagnosis of the risk of multicollinearity, the variance inflation test among the independent variables was performed, as suggested by Kennedy (1998) and Gujarati (2006). The Variance Inflation Factor (VIF) calculated from the auxiliary regressions between each independent variable (j-th) and the other remaining regressors of the model are shown in Table 2.

Table 2. Results of variance inflation tests between the independent variables

j-th variable	R2 auxiliary regression	VIFj	j-th variable	R2 auxiliary regression	VIFj
IIA	0.0095	1.0096	EBITDA	0.1887	1.2298
ROE	0.1182	1.1341	TAM	0.1050	1.1173
FIN	0.0647	1.0692	IBOV	-48.6126	0.0202

Note: IIA assets intangibility index; ROE measures the return on equity; IFIN - financing structure; EBITDA - profit before interest, income tax, depreciation/depletion and amortization, divided by total assets; TAM - size measurement; IBOV - natural logarithm of the Ibovespa index.

Considering the objective rule suggested by Kennedy (1998) and Gujarati (2006) that there are serious problems of multicollinearity if any of the VIF is greater than 10, the results highlighted in Table 2 demonstrate that this is not the case in the present study.

In the estimation of the model (3.1) with the use of panel data and the ordinary least squares method, evidence of autocorrelation in the residues was identified. In order to deal with this problem and to avoid the risk of heteroscedasticity, OLS estimations were discarded, using robust parameters using the SUR (PCSE) method. In this case, robust parameters are generated, even in the presence of autocorrelation and heteroscedasticity in the residues. In addition, due to the extreme values observed in the descriptive statistics, additional tests were performed excluding the observations that distanced by more or less five standard deviations from the mean.

Considering these definitions, four estimates of the model (3.1) were promoted, with panel data and SUR (PCSE) method, combining the use of complete bases and without outliers with the use of sectional fixed effects and fixed double effects - which control, respectively, the heterogeneity between companies and between companies and periods, concomitantly. The purpose of using this combination of estimation techniques is justified by the convenience of checking if the results are resilient to different forms of estimation, which represents a kind of sensitivity analysis. The results are summarized in Table 3.

Table 3. Estimation of the model (3.1) with panel data and sectional fixed effects and double fixed effects

	Complete base		Base without outliers	
	Sectional FE	Double FE	Sectional FE	Double FE
Const	-1.5748 (0.7803)	7.7824 (0.0000)***	-0.8738 (0.8528)	7.4219 (0.0000)***
I/A	0.8701 (0.0077)***	1.0282 (0.0027)***	0.9288 (0.0023)***	0.8711 (0.0031)***
ROE	0.5768 (0.0000)***	0.5885 (0.0000)***	1.8331 (0.0044)***	2.2323 (0.0005)***
IFIN	6.7571 (0.0000)***	6.2981 (0.0000)***	5.3960 (0.0000)***	5.2608 (0.0000)***
EBITDA	13.6124 (0.0000)***	14.0179 (0.0000)***	7.6780 (0.0000)***	7.2462 (0.0000)***
TAM	-0.4079 (0.0092)***	-0.5498 (0.0000)***	-0.2458 (0.0644)*	-0.4809 (0.0000)***
IBOV	0.6383 (0.1901)		0.4039 (0.2933)	
No. Entities	86	86	86	86
Period	28 quarters	28 quarters	28 quarters	28 quarters
No. observations	2,158	2,158	2,133	2,133
R ²	0.7820	0.7915	0.8219	0.8323
Adjusted R ²	0.7724	0.7796	0.8139	0.8225
F Statistic	81.4428	66.2015	103.5161	85.4829
F (p-value)	0.0000	0.0000	0.0000	0.0000

Note: MTB - ratio between market value and net book value - market-to-book; I/A assets intangibility index; ROE measures the return on equity; IFIN - financing structure; EBITDA - profit before interest, income tax, depreciation/depletion and amortization, divided by total assets; TAM - size measurement; IBOV - natural logarithm of the Ibovespa index.

Level of Significance: *** 1%; ** 5%; * 10%. P-values in parentheses.

The results of the tests demonstrated in Table 3 show, in the four tests performed - with sectional fixed effects or double fixed effects, using robust parameters estimation SUR (PCSE), and with complete base and without base outliers - the positive and statistically significant association between the MTB dependent variable and the I/A interest variable. These results confirm the expectations that the market prices positively the assets intangibility index, that is, that the shares of the companies that are intensive in intangible assets have a better market-to-book ratio than the others. It is corroborated, therefore, the research hypothesis H_1 .

These results confirm evidence reported by Ritta et al. (2010) regarding the positive relation between investments in intangible assets, intangibility index, and financial variables. They also corroborate Lev's (2001) study, which showed that investments in intangible assets impact the market value of companies, since the disclosure of investments in intangible assets is captured by the market that prices this valuation.

The empirical evidence from the present study also reinforces the findings of Choi et al. (2000), Kayo (2002), and Teh et al. (2008) regarding the demonstration of the relevance of intangible assets in the improvement of the competitive position and its influence on the performance of the companies, represented by market value. Finally, they also corroborate the statement of Carvalho et al. (2007), in the sense that the effects of intangibility should be treated in a complementary way with other factors, with the use of control variables.

The findings of this research allow advancing in the theory of market value acquired with the presence of intangible assets through this new model that uses an explanatory variable represented by intangible assets relativized by the total assets of the companies and controlled with financial and market variables already used in previous studies.

Regarding the first of the control variables, the results show, also in the four estimates, that there is a positive association between market-to-book (MTB) and return on equity (ROE). Considering that ROE is a measure of the company's performance, it shows that the entity is generating profitability for shareholders. In this sense, the positive association evidenced empirically is intuitive and compatible with what would be expected of the behavior of the investors.

Regarding the variable representative of the degree of financial leverage (IFIN) of the companies, the results also showed a positive relationship with the dependent variable, MTB, in the four estimates performed. Given the nature of financial leverage, which is to obtain resources from third parties to invest or perform operations, enhancing shareholder returns, the positive relationship found can be defined as natural. In summary, the market prices positively the shares of leveraged companies, considering the perspective of improving the return of owners. It is evident that the benefit of indebtedness has limits since from a certain level the credit risk perception of the company can impact the cost of capital.

For the variable EBITDA, representing the operating cash generation capacity, the results shown in Table 3 also showed a positive association with the MTB dependent variable. This demonstrates that investors value companies that can generate operating cash, which is justifiable since it translates the company's ability to honor its contractual obligations, generate results and distribute dividends.

The impact of company size (TAM) on the market-to-book ratio was also evaluated as a control element for the tests of the hypothesis H_1 . In this case, the results showed that there is a negative association between the variables MTB and TAM, that is, the larger the company, the lower the market-to-book ratio. One of the possibilities for this result can be deduced from the statement by Nunes (2010), in the sense that large companies are pressured by various stakeholders in their activities, with higher political costs and possibly using techniques to distract that may affect their results. This can affect the market-to-book ratio of these entities.

Also, as an element of control, the possible effects of Ibovespa's behavior on the market-to-book ratio of the companies that make up the IBrX 100. This variable was only considered in the estimations with sectional fixed effects, considering that the temporal effect, inherent to the variable IBOV, is already captured in the estimates with double fixed effects. Contrary to the initial prediction of a positive association between variables, test results showed no statistically significant relationship between them. Among the elements that may justify these counter-intuitive results may be the possible characteristics of the companies that compose the IBrX 100.

Finally, it should be emphasized that the four estimates of the model (3.1) showed coherence in relation to the signs and statistical relevance of the variables. Still on the estimates, the determination coefficients (R²) of the regressions show that the models explain between 78.20% and 83.23% of MTB behavior, which is validated by F statistics, which confirm the joint significance of the parameters of the independent variables in relation to the dependent variable with p -minimum values (0.0000).

5. FINAL CONSIDERATIONS

The main aim of this study was to evaluate whether there is an association between the assets intangibility index and the valuation of companies within the Brazilian capital market, specifically in order to highlight whether companies, by intensifying their resources in intangible assets, are most valued by the market valuation of their shares.

The research hypothesis that led to the realization of the empirical tests is based on the assumption that companies with business models based on knowledge and technologies must ensure competitive advantages that are perceived by the market and translated into the valuation of the shares of these companies.

The empirical tests, which were based on the quarterly information from 2008 to 2014 of the companies that make up the IBrX 100 index of BM&FBovespa, confirmed the positive and statistically significant association between the market-to-book and the assets intangibility index, corroborating the research hypothesis and reinforcing theoretical formulations and empirical evidence from previous studies.

Overall, test results demonstrate the relevance of investments in intangible assets over the companies' market value, reinforcing the perception that the economic environment of companies with characteristics based on knowledge and technologies, maintaining their competitive advantages, and increasing the share values.

The premise is that the greater share of intangible assets in the equity structure increases the prospect of generating abnormal profits. What supports this argument is that while tangible assets, for your availability on the market, produce the return by the average, it is upon to the intangibles an above-average return, improving the company's position in the market, being this characteristic perceived by shareholders when the correlation of the variables was confirmed.

In addition to the evidence related to the variable of interest, the estimates also included examining the relationship between the dependent variable MTB and control variables. In this particular case, it was verified that MTB has a positive relationship with the return on equity, the degree of financial leverage, and the capacity to generate operating cash; and negative with the size of companies.

The study contributes to the advancement of the literature on the determinants of the market value of companies in relation to book value, which has significantly increased over time but still presents development opportunities, such as impacts of intangible assets. It corroborates other academic papers on the subject, extending the sample period and using all available information from the companies that make up the IBRX index since the introduction of the accounting group representing the intangible assets in the structure of financial statements of Brazilian open companies - Law 11,638/2007. It advances through the results obtained on the relevance of the intangible assets to the market value of the companies using an innovative model with control variables to test the effects of IIA in MTB.

If the sample period from 2008 to 2014 was highlighted as a factor of the relevance of the study, due to extending the scope of previous studies, it can also be understood as a limitation since the history of information on intangible assets is relatively short to establish definitive conclusions about the relationship studied. It is also possible to highlight the limitation regarding the comparison with studies carried out at an international level, given the structural differences regarding liquidity and consolidation of capital markets in more developed economies when compared to the Brazilian reality.

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