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Full Length Research Paper

Intangible driven earnings and value creation in the electric and electronic industry in the USA

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Considering the relevance of intangible assets in a company's value and the difficulty to measure them, this study seeks to investigate the adequacy of a performance indicator based on intangibility: intangibles driven earnings (IDE) as proposed by Gu and Lev (2003) and its relation with the creation of shareholder value. Based on data in a panel of companies from 1998 to 2008, in the electrical and electronic equipment industry in the United States market, we find that the change in earnings provided by intangibility (IDE) is related to intangibility variables such as, for example, investments in research and development, and investments in information technology. In addition, with operating profits serving as a control variable, a positive linear relationship is obtained between return to shareholders and IDE, which suggests that intangibility, helps in the creation of corporate value.

Key words: Intangible assets, intangibles driven earnings, return to shareholders, operating profits, investments in research and development, investments in information technology.

INTRODUCTION

Intangible capital has become an important item in the business world, chiefly with regard to creating wealth. Lev (2001) asserts that wealth and growth are driven primarily by intangible assets, suggesting that physical and financial assets have become commodities. Similarly, highlighting the importance of intangible assets, Kalafut and Low (2001) have argued that although these have not always been recognized, they have become important drivers of corporate performance.

The search for market differentiation and innovation depends more and more on intangible aspects, given that the acquisition of tangible assets is relatively easy. Hence, according to Barney and Hesterly (2005), to obtain competitive advantage, companies have sought to explore resources, in particular intangibles that have value, are rare and difficult to reproduce. Other factors also evidence the important role of intangibles in the corporate economic scenario, such as evidence produced by Villalonga (2004) suggesting that intangible assets are a predominant factor for sustainable competitive advantage acquired by companies.

Along with the rise of this new form of economics, in which intangible assets have become more relevant, the problem of how to measure the value of certain companies arises. Accounting systems or financial models that usually address intangible assets have found difficulties to grasp a company's real value. On this problem regarding company valuation Sveiby (1997) asserts that investors are unable to appraise intangible assets that serve to create future cash flows, and that therefore they cannot base themselves on information found in the preceding year's financial reports.

As a result, the market value of companies intensive in intangible assets will tend to fluctuate exceedingly, together with the general economic cycles and atmosphere among investors (Sveiby, 1997). In accordance with these factors, Lev and Zarowin (1999) have found evidence of a weakening of the coefficient of determination between annual corporate profits and the respective return of their stocks, suggesting that wealth and the current economy's growth are driven by intangible and intellectual assets (Lev, 2001).

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Considering the relevance of intangible assets in a company's value and the difficulty to measure them, this study seeks to investigate the adequacy of a performance indicator based on intangibility intangibles driven earnings (IDE) as proposed by Gu and Lev (2003), and its relation with the creation of shareholder value. Based on data in a panel of companies from 1998 to 2008, in the electrical and electronic equipment industry in the United States market, we find that the change in earnings provided by intangibility (IDE) is related to intangibility variables such as, for example, investments in research and development, and investments in information technology. In addition, with operating profits serving as a control variable, a positive linear relationship is obtained between return to shareholders and IDE, which suggests that intangibility helps in the creation of corporate value.

THEORETICAL BACKGROUND

In accordance with international accounting norms (IAS-38, paragraph 7), published by International Accounting Standards Board (IASB), intangible assets are defined as non-monetary assets, with no physical substance, resulting from past events and that contribute to obtain future benefits. Additionally, the definition suggested by Lev (2001) determines that the terms 'intangible', 'knowledge assets', and 'intellectual capital' may be employed in an interchangeable manner, and in general they refer essentially to the entitlement to a non-physical asset to obtain future benefits. This entitlement may be under legal protection through the registration of patents and trademarks. It is important to emphasize that intangible assets are also difficult to define. Andriessen (2004), for instance, suggests that there are a number of visions on what the elements of intangible assets are, there being no consensus whatsoever regarding the accounting definition.

For Lev (2001), the base of intangible assets may be subdivided into intangibles related to innovation, structural organization, and human resources. In view of the difficulty imposed by the scope of the definition of intangible assets, Lev (2001) proposed a typology based on the following classes: (i) assets associated with product innovation, such as those that originate from a company's research and development efforts; (ii) assets associated with a company's brand, allowing it to sell its goods at a price higher than that of its competitors; and (iii) structural assets that do not represent significant innovations or inventions, but that are more efficient manners of doing business, providing the product with a differential as compared to its competitors.

Andriessen (2004) detected a number of essential features in the economy based on intangibles, which differentiates them from an economy based on agriculture or manufacturing industry: (i) goods and services associated with added knowledge are in rapid expansion and (ii) knowledge has become an important product itself, changing the concept of product ownership within corporations, as tacit knowledge is now instilled into employees.

Other studies also evidence the importance of investments in intangible assets. For example, Lev and Souggiannis (1996) demonstrate the importance of investments in research and development for the return of stocks. In addition, Barth et al. (2003) evidence the strong correlation between brand value and share value, while Hall et al. (2006) have detected a positive relationship between the number of patents that a company holds and its market value.

Reilly and Schweis (1999) have drawn up a set of six attributes required to qualify an intangible asset: (i) it should be subject to specific identification, with a recognizable description; (ii) it should be subject to an existence and legal protection; (iii) it should be subject to private property rights which in turn may be legally transferable; (iv) the existence of tangible evidence or expression such as, for example, agreements, a license for use; (v) preparation at the time of or based on an identifiable event; and (vi) it should be subject to destruction or elimination at an identifiable time.

Within the scope of the relevance of intangibility, Gu and Lev (2003) proposed an IDE indicator to measure the outcome provided by intangible assets, which will be discussed. Problems arising from the deficiency in current financial and accounting information may cause losses to companies and investors, and in this regard Lev (2001) pointed out a few implications: (i) windfall gains for informed investors, contrary to even the best corporate governance practices, (ii) increased market volatility, giving rise to a lack of confidence by investors, and (iii) an increase in the cost of capital. In addition, as already discussed, current accounting methods are deficient in capturing the real value of companies, especially the value of intangible assets. In this regard, according to Lev (2001), several accounting methods allow fraudulent practices to be induced, implying tampering with the performance disclosed by companies.

Bearing in mind that financial statements may conceal the true value of intangible assets, Gu and Lev (2003) proposed a measuring mechanism with the use of past accounting information as well as projections of future results on a company's performance. In this manner, Gu and Lev (2003) combined past data with future data in order to assess the value added by intangible assets. In fact, Kalafut and Low (2001) assert that financial performance metrics simply based on retrospective data do not reflect the wealth and potential of a company to create value. For example, Daniel and Titman (2006) found no evidence of correlation between future returns and past tangible information. In this regard, it should be recalled that in finance theory, the value of any asset will depend on its future cash flows. Therefore, despite past

data allowing an assessment of the potential for a company's creation of flows, they may not cover the large number of future strategies provided chiefly by intangible assets.

Lev (2003) have devised a model for estimating the value of intangible assets based on the neo-classical theory of the productive function, whereby a company's economic performance is composed of three main kinds of assets:

$$\text{Economic Performance} = \alpha \cdot \text{Fixed Assets} + \beta \cdot \text{Financial Assets} + \gamma \cdot \text{Intangible Assets} \quad (1)$$

where α, β, and γ are the differentiated contributions by each kind of assets in the company's economic performance.

Notice that performance measurements based solely on the company's past financial results, such as profits or cash flows, do not reflect the major portion of intangible assets. According to Equation 1, the method proposed by Gu and Lev breaks down the company's performance into a number of portions, evidencing the role of intangible assets. Pursuant to the model, the value of intellectual capital is estimated by subtracting the normal returns on physical and financial assets from the portion that contains the measurement of the company's economic performance. The result of this difference represents the contribution by intangible assets to the company's performance, and is known as results driven by intangibles or as intangibles driven earnings (IDE).

$$\text{IDE} = \text{Economic Performance} - \alpha \cdot \text{Fixed Assets} - \beta \cdot \text{Financial Assets} \quad (2)$$

A number of steps should be followed to calculate IDE, based on Equation 2. To start with, a measurement of economic performance is obtained based on past results and future projections of the company's EBITDA. Gu and Lev (2003) suggested that past and future time horizons should be equal, and recommended periods from three to five years. This study uses three past years and three future years to analyze economic performance for a given period t, as seen in Figure 1.

In other words, in order to estimate economic performance in *t*, the past EBITDAs should be considered for the periods *t-3, t-2 and t-1*, as well as future EBITDAs projections for the periods $t+1$, $t+2$, $t+3$, according to the following equation.

$$\text{Economic Performance} = \sum_{i=1}^{6} \delta_i \cdot EBITDA_i \quad (3)$$

Owing to the complexity of assessing intangibles, Gu and (i) physical assets, (ii) financial assets, and (iii) intangible assets. Equation 1 reflects the starting point in the model by Gu and Lev (2003).

where δ_i are weights attributed to each EBITDA.

In Equation 3, Gu and Lev (2003) were not explicit on the weights to be adopted, but did consider that future data should have a greater weight. The weights employed in this study comply with the behavior given by Equation 4.

$$\delta_i = \frac{i}{\sum_{j=1}^{6} j} \quad (4)$$

In the work by Gu and Lev (2003), the gains estimate, in this case EBITDAs, should be calculated in two manners: (i) first, by means of the assumption that the detected trends will continue, and then, (ii) second, with the use of growth forecasts by analysts. However, in this paper EBITDA's real value for each company was employed, in the respective year. Hence, the purpose was to test the model itself and not its predictive power. In order to use the future periods' real data instead of projections by analysts, the study was able to focus with greater accuracy on the association by IDE with investments in intangible assets.

An advantage of the proposed methodology, however, has to do with a decline in the disparity of information contained in the accounting report, as it considers the company's future performance and attributes less weight to past data that are likely not to entirely explain the potential for the company's creation of value in the subsequent periods. This disparity in information was defined by Hendriksen and Van Breda (1992) as arising from the market's impossibility in knowing all of the corporate conditions and alternatives involved in an *a* priori analysis.

The second step to calculate IDE in Equation 2 involves an estimate of results arising from other assets that make up the company: physical assets and financial assets. Physical assets are properties, plant, and equipment, and financial assets are funds owned by the company, in addition to investment in securities (Gu and Lev, 2003). Owing to the availability of data, this study employed as financial assets only the items stated as cash in the database.

Factors α and β in equation 2 were defined respectively at 7% a year for the return on physical assets, based on average the return on shareholders' equity, and at 4.5% year for the return on financial assets, which represents average returns on ten-year US treasury bills, according to Juergen (2001). Although these values are discretionary, as they are constant,

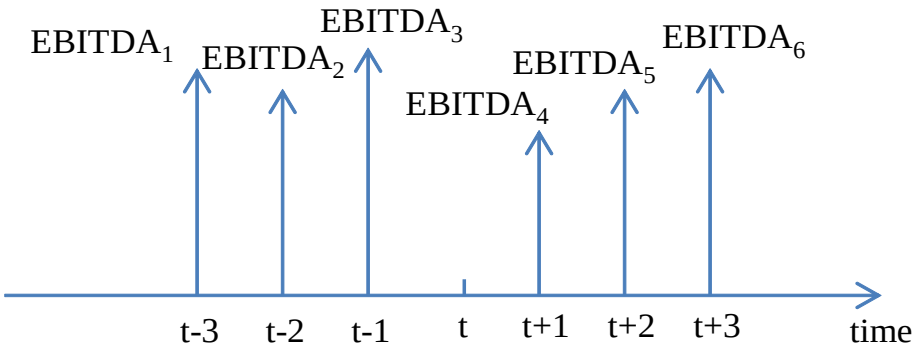

Figure 1. Variables employed to calculate economic performance.

their influence in regression analyses may be reduced. However, it is suggested that future studies should run a sensitivity analysis of regression models to parameters α and β.

Based on an economic performance calculation with the use of past and future EDITDAs and an estimate of the earnings provided by physical assets and financial assets, IDE values may be obtained for each company. Hence, by means of the proposed approach, Gu and Lev (2003) have established a new manner for analyzing the company's performance, breaking it down into components and further, isolating the contribution of intangible assets by means of IDE.

The originality of the model by Gu and Levi (2003) is due to the fact that the value created by intangibles is calculated based on financial variables, in a manner independent from the variables usually associated with intangibility, such as for example investments in research and development, capital expenditures, brand value, or expenditures with information technology. Based on an IDE indicator of earnings provided by intangibles, its connection with the creation of value may be assessed, measured by the return on shares. This will avoid a problem of circularity in the study of the relationship between intangible assets and the creation of value. The study's key variables associated with the IDE analysis are pointed out in Table 1.

METHODOLOGY

This descriptive and exploratory study is intended to investigate the potential connections between variables related to intangibility and to financial performance in American companies. The study's variables were devised based on secondary data for the period from 1998 to 2008, taken from the Thomson-Reuters Datastream database. US companies with shares traded in stock markets in the electrical and electronic equipment industry were analyzed. The choice of this specific segment and market was based on the larger amount of data available, on greater liquidity and on a broader disclosure of information associated with intangibles. In addition, it should be noted that by virtue of its strong reliance on research and development and brand strengthening, the electrical and electronic equipment business is composed of companies in which intangibility is relevant.

In order to analyze using panel data methods, variables were considered for the years from 2001 to 2005, that is, a five-year period, as data from 1998 to 2000 and from 2006 to 2008 were employed to find the IDE variable, in accordance with the procedure detailed below. Roughly 700 companies were considered every year in a non-balanced panel, based on the absence of data on several companies for some of the years. In spite of the large number of observations, the nature of the sampling, with a focus on one sole industry and on companies traded in stock markets, does not allow results to be generalized. Nonetheless, the results may serve to stress theoretical arguments relating intangibility to performance.

Building assumptions takes place by means of theoretical references, in which an analysis is performed on the relation between corporate performance and intangibility. Specifically, the following alternative assumptions are investigated based on the study by Gu and Lev (2003).

H_1: The degree of the companies' intangibility measured by means of IDE, is positively related to investments in research and development, in software, and in capital expenditures.

H_2: The degree of the companies' intangibility is positively related to the company's brand value, considering investments in research and development as a control variable.

H_3: Return to shareholders is positively influenced by the degree of intangibility, considering the company's operating performance as a control variable.

H_4: Return to shareholders is positively influenced by the degree of intangibility, considering the company's cash flow generation as a control variable.

Hence, assumptions 1 and 2 consider whether the building blocks of IDE intangibility, as suggested by Gu and Levi (2003) and obtained as a by-product of economic performance subtracted from returns on financial assets and tangible assets, have a relation with variables typically associated with intangibles such as investments in research and development (RD) and investments in information technology, measured in this study based on expenditures with computer software (IS) and brand value (Brand). Assumptions 3 and 4 consider whether the building blocks of intangibility (IDE) are capable of explaining the creation of value measured by return to shareholders, using as control variables the company's operating

Table 1. Key variables in the model by Gu and Lev (2003).

Variable	Description	Data stream codes
Cash	Cash	WC02003
PPE	Property, plant, and equipment	WC02501
IS	Investments in software	WC18229
RD	Investments in research and development	WC01201
EBITDA	Earnings before interest, taxes, depreciation, and amortization	DWED
Capex	Capital expenditures	K1FD12
Brand	Value of the company's brands and patents	WC02507
CF	Flow of entries and exits of company funds	WC08311

Table 2. Descriptive statistics of the study's variables.

Variable	Average	Median	Minimum	Maximum	Standard deviation	Asymmetry	Kurtosis
IDE	3103	227	-506322	179404	37772	-7.0	90.6
∆IDE	-715	32	-430022	179258	27641	-7.6	134.5
IS	9303	153	0	157000	28896	4.3	18.2
RD	16381	1518	0	1332000	76937	11.5	155.4
Capex	13499	611	-5626	1238320	62401	11.2	161.7
Brand	8736	908	0	136387	20432	3.7	15.0
SR (%)	-0.33	0.00	-12.04	7.17	1.52	-1.7	9.8
EBITDA	30824	140	-2467000	4144000	190302	7.3	125.7
∆EBITDA	1079	0	-2785800	2622000	138008	-1.4	207.9
CF	3233	99	-99157	265500	15794	8.3	105.2
∆CF	156	28	-364711	184411	13467	-13.5	463.4

performance and cash flow generation, respectively.

RESULTS ANALYSIS

Descriptive statistics

Descriptive statistics for the study's key variables are presented, with data for all the periods covered in the sampling. Table 2 reflects the great degree of variable dispersion, not only for those variables associated with intangibles as well as those associated with financial or operating performance. Monetary variables are shown in millions of US dollars, while the variable on the return on shares appears as a per annum percentage. Bearing in mind asymmetry and kurtosis statistics, it can be assumed that the variables do not have a normal distribution. Hence, statistically significant results in the regression analyses should be looked with caution, as occasional error distribution may not comply with the assumptions of statistical models.

Tables 3, 4, 5, and 6 reflect the correlations between the variables for each model under study, considering all the available values regardless of the year. In spite of not evidencing the longitudinal behavior of data, this analysis by means of a pooled model allows the detection of potential relations likely to arise when analyzing panel data. It is important to stress that the correlation indicates a linear relationship, and hence the study is restricted to first degree functions among the variables. Occasionally there may be non-linear relations not detected in the analysis.

Table 3 suggests that the intangibility (IDE) variable specified by Gu and Lev (2003) has a relevant linear relation (0.708) with investments in information technology, in particular in computer software (IS), which in turn has a reasonable correlation (0.503) with expenditures in research and development (RD).

On analyzing model 2, Table 4 reflects a low correlation between IDE and the company's brand value (brand), which suggests that intangibility may have only a slight linear relation with the brand.

Table 5 provides a preview of the model 3 results in the panel analysis, describing the linear relations among the variables and simultaneously considering the data for all of the years. Two relevant results are shown: (i) the high positive correlation (0.849) between operating profits measured by means of EBITDA and the change in the intangibility rate (∆IDE), and (ii) the high positive correlation (0.643) between the change (∆EBITDA) and the change in the IDE intangibility rate. Hence, the

Table 3. Correlation matrix of the model 1 variables.

Variable	IDE	IS	RD	Capex
IDE	1.000	0.708	0.356	0.141
IS		1.000	0.503	0.195
RD			1.000	0.372
Capex				1.000

Table 4. Correlation matrix of the model II variables.

Variable	IDE	RD	Brand
IDE	1.000	0.356	0.289
RD		1.000	0.402
Brand			1.000

Table 5. Correlation matrix of the model 3 variables.

Variable	SR	EBITDA	∆EBITDA	IDE	∆IDE
SR	1.000	0.032	-0.010	0.062	0.033
EBITDA		1.000	0.363	0.022	0.849
∆EBITDA			1.000	-0.448	0.643
IDE				1.000	-0.087
∆IDE					1.000

explanatory variables in Model 3 may reflect multicollinearity, reducing the results' significance.

Table 6 reflects a low relation among the model 4 variables. The existence of a reasonable correlation (0.462) between CF and ∆CF suggests that cash flow generation may be dependent through time. This dependence, however, does not seem to affect the creation of shareholder value.

Panel data analysis

When considering all of the data regardless of the period, it is possible to run preliminary analyses on the assumptions to be investigated. Nonetheless, an analysis of panel data leads to a better understanding of this process by absorbing cross-section assessments jointly with longitudinal analyses, in the course of the five years under study.

Tables 7 and 8 demonstrate the results of the regressions associated with assumptions H_1 and H_2 in this study. The results described refer to the model of fixed effects or random effects considered to be the most adequate based on the sample data. In accordance with Hsiao (2003), when the inferences are restricted to the model's effects, it will be more appropriate to consider them fixed, and when the inferences are run on the population of effects and the data originate from a random sample, then random effects should be considered.

The key difference between fixed or random effects is related to the fact that unseen individual effects may or may not consider elements correlated with regressors (Greene, 2008). In general, fixed effect models are structured to study the causes and changes in an entity (Kohler and Kreuter, 2005), while random effect models are appropriate for marginal or unconditional inferences over the entire population the effects (Hsiao, 2003).

In spite of the existence of general rules, when the number of periods is finite and the number of observations in each period is large, the question of treating the effects as fixed or random is not easy to answer (Hsiao, 2003). In this study the choice of a model takes place by means of the Hausman test, in which based on a comparison of the efficiency and consistency of estimators, the null hypothesis with regard to the preference for the random effects model is compared to the alternative assumption with regard to the preference for the random effects model (Greene, 2008).

It is important to highlight that the test results will point to the random effects model in three of the four models analyzed. Hence this kind of effect induced by the tests is in a way in line with Hsiao's (2003) suggestion that when the number of entities is large, a structure based on

Table 5. Correlation matrix of the model 4 variables.

Variable	SR	CF	∆CF	IDE	∆IDE
SR	1.000	0.022	-0.011	0.062	0.033
CF		1.000	0.462	-0.143	0.018
∆CF			1.000	-0.288	-0.101
IDE				1.000	-0.087
∆IDE					1.000

Table 7. Regression results of IDE building blocks and intangibility variables.

Variable	Model I - Random effects			Model II - Random effects		
	Coefficient		Standard error	Coefficient		Standard error
Const	2952		4915	-2427.17		4011
IS	0.516	***	0.180			
RD	0.289	*	0.158	0.431	***	0.135
Capex	-0.088		0.140			
Brand				0.217		0.149
Akaike criterion			964.3			2525.1
Schwarz criterion			971.2			2533.2
Hannan-Quinn criterion			966.8			2528.4
Adjusted R2			0.280			0.188

*,**,*** Significant at 10, 5 and 1%, respectively.

random effects would be more appropriate, as the study's focus would be on the general nature of the population and not on each company's specific effects.

The outcome of the analysis of the relation among the IDE building blocks and the variables typically associated with intangibility are shown in Table 7. As already mentioned, model I seeks to confirm whether the IDE intangibility building blocks devised by Gu and Lev (2003) are related with investments in software (IS), with expenditures in research and development (RD), and with capital expenditures (Capex). A panel analysis shows that at a 1% significance level, investments in information technology have a linear relation with IDE. The relation between RD and IDE is also relevant, but with a 10% significance level. On the other hand, capital expenditures have no linear significance with IDE.

The panel data analysis in model II suggests that brand value measured by means of the brand variable is not related to IDE. Therefore, the results demonstrate that the null hypothesis cannot be rejected, which is opposed to alternative hypothesis H_2, showing that brand value does not result in profits driven by intangibility. Alternative assumption H_1 is partly confirmed. The IDE intangibility indicator has a statistically significant relation with RD and IS.

However, from the viewpoint of the proposition by Gu and Lev (2003), for the electrical and electronic equipment industry in the United States market, IDE is associated with intangibility variables, chiefly with investments in research and development, and in information technology. Yet, brand value does not explain IDE, that is, the value created by intangibles. Results of choice criteria based on the adequacy of models, are also demonstrated in Table 7. According to Orea and Kumbhakar (2004), the best models involve lower values for the Akaike information criterion (Akaike, 1969) or greater values for the Schwarz (1978) criterion.

Once it was studied whether IDE really reflects intangibility variables, an assessment was performed of its relation with value creation. The SR variable associated with value creation reflects the return on shares, measured in annual periods by comparing share prices at the end of each period and adjusting them for dividends and other earnings. Table 8 demonstrates the outcome of models III and IV, which employ as control variables respectively, operating profits measured by EBITDA and the generated cash flow, expressed through the variable CF. In order to show any likely effects of long-term variations, the differences between variables in consecutive periods of time are also employed.

Analysis of model 3 supports alternative hypothesis H_3, suggesting that stock profitability may be explained by the IDE intangibility ratio (Gu and Lev, 2003), considering as control variable the operating profits measured by EBITDA. In other words, creating shareholder value is based not only on operating performance but also on

Table 8. Regression results of stock profitability and IDE.

Variable	Model III - Fixed effects			Model IV - Random effects	
	Coefficient		Standard error	Coefficient	Standard error
Const	0.112	***	0.017	0.021	0.040
EBITDA	-5.26E-06	***	1.57E-07		
∆EBITDA	2.35E-06	***	5.25E-07		
IDE	1.36E-05	***	3.49E-06	8.61E-07	9.97E-07
∆IDE	1.74E-05	***	4.40E-06	8.21E-07	1.03E-06
CF				-4.07E-09	4.33E-09
∆CF				6.18E-10	4.52E-09
Akaike criterion			940.5		781.0
Schwarz criterion			1597.3		801.3
Hannan-Quinn criterion			1199.4		789.0
Adjusted R2			0.100		0.001

*,**,*** Significant at 10, 5 and 1%, respectively.

company-owned intangibles. Despite the negative EBITDA coefficient, it is worthy of note that the high correlations between EBITDA and ∆EBITDA with ∆IDE, as seen in Table 6, may induce multicollinearity that may distort coefficient results. Nonetheless, a positive relation between intangibility and value creation may be seen in this study's context.

On the other hand, model 4 results do not confirm alternative hypothesis H_4. When the analysis is controlled by the company's cash generation, the results do not reflect a significant relation among intangibility variables IDE and ∆IDE with share profitability. Hence, creating shareholder value is more related to operating performance than to cash generation. This outcome suggests that value creation measured by share appreciation does not depend simply on generating flows, but on greater operating efficiency.

Conclusion

The increasing relevance of intangible assets in the corporate environment creates the need to devise mechanisms that detect and measure them adequately. Increased competitiveness based on assets that are not tangible leads to challenges, for academia as well as for practioners, in search of the relations between intangible capital and value creation. Owing to the nature of intangible assets, their assessment as well as measurement is difficult.

In this regard, the key motivation for this research is to investigate the relation among corporate intangible capital and some of its potential components, using the methodology proposed by Lev (1999) and by Gu and Lev (2003), which establishes an intangibility metric known as IDE. Possible explanations on the return to shareholders are also investigated, that is, the appreciation of share prices based on intangible capital.

Four assumptions were tested within this study's scope. The first two were intended to demonstrate that the IDE monetary ratio created by Gu and Lev (2003) to measure intangible assets are related to the variables usually associated with intangibility: investments in research and development (RD), investments in software (IS), and the company's brand value (brand). The results of models 1 and 2 suggest that IDE is statistically related to RD and IS.

The relation of the proposed ratio with return to shareholders was also investigated, based on the hypothesis of the association between IDE and several intangibility variables. In this sense, the study aimed to assess the hypothesis that investments in intangible assets create shareholder value. The results of the regression analysis in model 3 confirmed the hypothesis of a positive relation between return to shareholders and the variable proposed for intangibility (IDE). Control variables established in this model are operating profits (EBITDA) and the change in operating profits for two consecutive periods (∆EBITDA). However, when cash flow generation (CF) control variables and cash flow generation changes for subsequent periods (∆CF) are employed in model 4, no evidence is found to support the relation between value creation and the earning driven by intangibles assets.

The results of models 3 and 4, apparently in contradiction when assessing the relation between value creating and intangibility, may arise from the choice of the effects model employed in the panel data analysis. Statistical tests gave preference to the fixed effects model to study assumption H_3 and to the random effects model to study assumption H_4. Hence, as a suggestion for future studies, it is proposed to perform a more detailed analysis of the kind of effect to consider in the analysis. As established by Hsiao (2003), treatment by means of fixed effects or by random effects is usually an item difficult to assess.

Nonetheless, in summary, the research results point out that (i) the building blocks of the IDE proposed by Gu and Lev (2003) has a relation with variables typically employed as intangibility proxies and that (ii) considering operating profits as control variables, IDE has a positive linear relation with stock price appreciation. However, it is important to highlight that that a number of limitations in the study may weaken potential generalizations.

The study used a non-random sample, restricted to companies in one sole industry in the same stock market. Justification of the sample's selection involves the market's high liquidity and the greater disclosure level of information on intangibility. Yet, other sectors and markets should be studied in order to improve the external validity of the intangibility building blocks proposed by Gu and Lev (2003).

Another limitation of the study refers to the high variability and the asymmetric behavior of several of the variables employed in the study. These features in the variables may adversely affect the statistical tests and may in particular jeopardize the results regarding statistical significance. Furthermore, the IDE creation mechanisms may be better investigated. The arbitrariness in the model by Gu and Lev (2003) associated with (i) the choice of time spans prior to and following the reference date and (ii) the weighting of the EBITDAs to calculate the IDEs provided by Equations 3 and 4 may also reduce the representativeness of results. Future studies may include a sensitivity test in order to detect whether changes in time spans and in the weighted EBITDAs would lead to IDEs more closely associated with intangibility variables.

Despite the study's limitations, it should be emphasized that the model proposed by Gu and Lev (2003) has strong theoretical background, which in practice can be tested. By analyzing the electrical and electronic equipment industry in the United States the study found that IDE (i) is linearly related with typical intangibility variables and (ii) is significant in explaining value creation.

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