Earnings Quality and Investment Efficiency: An Analysis of Electricity Companies Listed in B3

Qualidade dos Lucros e Eficiência do Investimento: Uma Análise das Empresas de Eletricidade Listadas em B3

Edgar Maria Ferreira da Costa
Graduação em Ciências Contábeis pela Universidade Federal da Grande Dourados
edgar96costa@hotmail.com
Thaynara Pietro Fernandes
Graduação em Ciências Contábeis pela Universidade Federal da Grande Dourados
thaynara.pietro85@gmail.com
Josimar Pires da Silva
Doutor em Ciências Contábeis pela Universidade de Brasília
josimarctb@gmail.com
Rafael Martins Noriller
Doutor em Ciências Contábeis pela Universidade de Brasília
rafael.mnoriller@gmail.com

Endereço: Edgar Maria Ferreira da Costa
Universidade Federal da Grande Dourados. R. João Rosa Góes, 1761 - Vila Progresso, Dourados - MS, 79825-070. Brasil.
Endereço: Thaynara Pietro Fernandes
Universidade Federal da Grande Dourados. R. João Rosa Góes, 1761 - Vila Progresso, Dourados - MS, 79825-070. Brasil.
Endereço: Josimar Pires da Silva
Universidade Federal da Grande Dourados. R. João Rosa Góes, 1761 - Vila Progresso, Dourados - MS, 79825-070. Brasil.
Endereço: Rafael Martins Noriller
Universidade Federal da Grande Dourados. R. João Rosa Góes, 1761 - Vila Progresso, Dourados - MS, 79825-070. Brasil.

ABSTRACT

The present study analyzes the relationship between earnings quality and investment efficiency of electricity companies listed in Brazil, Bolsa, Balcão [B]3. The choice of the electric sector is due to the large number of companies, the volume of resources invested in the sector, and strong regulation as a reducing factor of informational asymmetry. The data analyzed covers the period from 2010 to 2017 through a static panel, and comprises a sample of 57 companies in the electricity sector. We used information contained in the financial statements extracted from the [B]3 database on its website for disclosure purposes. Higher-quality financial reporting should increase investment efficiency. Moreover, reducing adverse selection and moral hazard increases the quality of financial reporting information and allows managers to identify better investment opportunities. With this is mind, the hypothesis of this research is that there is a significant and positive relationship between earnings quality and investment efficiency of electricity companies listed in [B]3. Results indicated a positive relationship between earnings quality and investment efficiency, especially mitigating overinvestment. These results corroborate studies conducted in developed economies. Notwithstanding, higher information quality does not mitigate underinvestment.

Keywords: Investment Efficiency. Information Quality. Electricity Sector.

RESUMO

O presente estudo analisa a relação entre a qualidade dos ganhos e a eficiência do investimento das empresas de eletricidade listadas no Brasil, Bolsa, Balcão [B] 3. A escolha do setor elétrico se deve ao grande número de empresas, ao volume de recursos investidos no setor e à forte regulamentação como fator redutor da assimetria informacional. Os dados analisados cobrem o período de 2010 a 2017 por meio de um painel estático, e abrangem uma amostra de 57 empresas do setor elétrico. Utilizamos as informações contidas nas demonstrações financeiras extraídas do banco de dados [B] 3 de seu website para fins de divulgação. Relatórios financeiros de alta qualidade devem aumentar a eficiência do investimento. Além disso, a redução da seleção adversa e do risco moral aumenta a qualidade das informações dos relatórios financeiros e permite que os gestores identifiquem melhores oportunidades de investimento. Diante disso, a hipótese desta pesquisa é que existe uma relação significativa e positiva entre a qualidade dos ganhos e a eficiência do investimento das empresas de energia elétrica listadas em [B] 3. Os resultados indicaram uma relação positiva entre a qualidade dos lucros e a eficiência do investimento, especialmente mitigando o sobreinvestimento. Esses resultados corroboram estudos realizados em economias desenvolvidas. No entanto, a maior qualidade da informação não atenua o subinvestimento.

Palavras-chave: Eficiência de Investimento. Qualidade da Informação. Setor Elétrico.

1 INTRODUCTION

Capital investment decisions are a key factor in determining the value of the company and, therefore, investor wealth. The main determinants for a company to make efficient investment decisions include specialized and dedicated management teams and sufficient capital resources. Previous literature shows that high-quality financial reporting and corporate governance mechanisms can help prevent or mitigate suboptimal investments by disciplining manager behavior and reducing the cost of capital (CHEN, XIE; ZHANG, 2017).

Previous research highlights that higher-quality financial reporting should increase investment efficiency (BUSHMAN; SMITH, 2001; HEALY; PALEPU, 2001; LAMBERT; LEUZ; VERRECCHIA, 2007), and companies can reduce information asymmetries by increasing the quality of these reports (BUSHMAN; SMITH, 2001; HEALY; PALEPU, 2001). Surveys (BIDDLE; HILARY, 2006; BIDDLE; HILARY; VERDI, 2009; CHEN et al., 2011; MCNICHOLS; STUBBEN, 2008) suggest that reducing adverse selection and moral hazard increases the quality of financial reporting information and allows managers to identify better investment opportunities.

Consistent with the argument that the reduction of adverse selection and moral hazard increases the quality of information, Biddle *et al*. (2009) and Biddle and Hilary (2006) found that firms with higher-quality financial reporting invest more efficiently, which is represented by lower investment-cash flow sensitivity. However, this sensitivity may reflect funding constraints or excess cash (FAZZARI; HUBBARD; PETERSEN, 2000; KAPLAN; ZINGALES, 2000). These results raise the additional question of whether lower quality of information relates to overinvestment, underinvestment, or both.

In practice, companies may face some funding constraints that limit the ability of managers to carry out all projects with positive NPV (e.g., Hubbard, 1998). In theory, however, companies are likely to obtain funding for all projects with positive NPV and will continue to invest until the marginal benefit of the investment equals the marginal cost (e.g., Hayashi, 1982). It is noteworthy in this context that investment opportunities are the single driver of the investment policy of a firm (MODIGLIANI; MILLER, 1958).

Previous literature has shown that friction in the capital market can distort the optimal investment of firms (CHEN; LILL; VANCE, 2014), which leads to overinvestment or underinvestment. Overinvestment occurs when managers invest ineffectively, selecting poor projects to expropriate the existing resources of companies. On the other hand, underinvestment occurs when companies facing funding constraints move away from projects

with positive NPV due to the high cost of raising capital (e.g., BIDDLE *et al.,* 2009). Both situations could relate to poor quality of information, since this is an important feature of financial reporting that affects the efficient allocation of resources (DEMERJIAN; LEV; LEWIS; MCVAY, 2013).

It is noteworthy that studies show the positive relationship between financial reporting quality and investment efficiency, above all, in developed countries, such as the USA (e.g., BIDDLE *et al*., 2009), and largely in the European Union, with little evidence in emerging countries (CHEN *et al.,* 2011). Findings are likely to differ when considering the Brazilian scenario, which has significant variation in the sizes of companies listed in B3, i.e., Blue Chips and companies less consolidated in the market and with higher risk, small-caps and mid-caps. When taking greater risks, managers may carry out projects that do not always add value to shareholders.

For the Brazilian context, previous literature shows lower Financial Reporting Quality (FRQ) in private companies, presumably due to the lower market demand for public information. The quality of this reporting is lower in countries with low investor protection, bank-oriented financial systems, and greater conformity between tax and financial reporting rules (CHEN *et al*., 2011). In emerging markets, private companies finance investments from outside sources - including bank loans, private equity issues, leasing, commercial credit, financing from special development agencies or governments, and informal financing - and from retained earnings and additional contributions from owners (BECK; DEMIRGUC-KUNT; MAKSIMOVIC, 2008).

A large body of literature documents how the availability of external or internal funds affects investment decisions (BLANCHARD; LOPEZ-DE-SILANES; SHLEIFER, 1994; MYERS; MAJLUF, 1984). These studies used samples of publicly traded companies that depend mainly on capital and debt financing. For private companies, external funding sources are generally limited and consist mainly of bank loans and commercial credit. On the other hand, the presence of regulation in some sectors, such as electricity, can mitigate risks, especially overinvestment and underinvestment. Thus, empirical evidence in developing countries still represents a gap to be filled, especially in sectors with large amounts of investments, as is the case in the electricity sector.

According to the National Electric Energy Agency (ANEEL, 2013), the electricity subsector in Brazil has a widely dispersed power generation network, with 2,661 generating projects and an installed capacity of 118,886,137 kW. These factors show the size and importance of this subsector for the country. Despite dispersion, companies operate mostly in

the form of natural monopolies. The importance of this subsector, given its prominent role in the country's economy by producing a primary input in the production chain, relates to the regulation of its accounting practices. Regulation intends to avoid surprises in the financial health of companies in the sector, and, consequently, prevent the interruption in the supply of this input.

The National Association of Energy Consumers (ANACE, 2018) considers that the electricity subsector in Brazil is largely institutionalized through several bodies, namely: National Energy Policy Council (CNPE), Ministry of Mines and Energy (MME), Electricity Sector Monitoring Committee (CMSE), Energy Research Company (EPE), ANEEL, National System Operator (ONS), Electric Energy Trading Chamber (CCEE), and Eletrobras (which acts as a holding of state-owned companies). The creation of Law No. 12,783/2013 is also worthy of attention. This law provides that energy generation and transmission companies would renew their concession contracts in advance, which allows ANEEL to regulate the prices charged. This context corroborates the conception that regulation in the referred sector is active and ongoing (Silva, Borges, Gonçalves & Nascimento, 2017).

Based on the previously highlighted context and on the reasons listed, the research problem resumes in the following question: **what is the relationship between earnings quality and investment efficiency of publicly traded Brazilian companies in the electricity subsector?** To answer the research problem, this investigation analyzes the relationship between these variables in electricity companies listed in Brazil, Bolsa, Balcão [B][3].

The first motivation of this study is the absence of empirical studies on the efficiency of investments in emerging economies, particularly in the Brazilian context, in which companies vary largely in size. Research on investment efficiency mostly address developed countries. Few studies have focused on emerging markets, which have a weaker control and monitoring system. This weaker control allows greater expropriation by the manager, especially regarding minority shareholders. Understanding this relationship is even more essential from the point of view of investors, who have financial reports as their main source of information and use accounting numbers in resource allocation decisions.

Moreover, the studies analyzed did not address the relationship between earnings quality and investment efficiency in specific sectors, especially in regulated environments. This research analyzes manager behavior in terms of investment efficiency and earnings quality in the Brazilian electricity sector. Considering the importance of this sector, especially regarding the amount of funds raised in the market, the present research highlights the

relationship between these factors, and can be useful to investors and other researchers.

2 LITERATURE REVIEW AND HYPOTHESIS DEVELOPMENT

Dechow, Ge and Schrand (2010) define earnings quality based on SFAC No. 1, paragraph 42, which states that financial reports must provide information about the financial performance of a company over a given period. Thus, "high-quality earnings provide more information about financial performance characteristics of a firm, which are important for a decision maker to make a specific decision".

One of the purposes of financial reporting is to facilitate efficient capital allocation. An important aspect of this role is improving investment decisions (CHEN *et al.*, 2011). Specifically, the theory suggests that improving financial transparency alleviates underinvestment and overinvestment problems. Recent studies support this prediction (BIDDLE; HILARY, 2006; BIDDLE; HILARY; VERDI, 2009; CHEN et al., 2011; HOPE; THOMAS, 2008; MCNICHOLS; STUBBEN, 2008).

A large part of the relevant literature associates earnings quality (EQ) with investment efficiency (BENLEMLIH; BITAR, 2018; BIDDLE; HILARY, 2006; BIDDLE; HILARY; VERDI, 2009; BUSHMAN; SMITH, 2001; CHEN et al., 2011; ELAOUD; JARBOUI, 2017; GOMARIZ; BALLESTA, 2013; HABIB; HASAN, 2017; HEALY; PALEPU, 2001; LAMBERT; LEUZ; VERRECCHIA, 2007; MANUEL et al., 2016). In this regard, studies have shown that higher-quality financial reporting could increase investment efficiency (BIDDLE; HILARY, 2006; BUSHMAN; SMITH, 2001; HEALY; PALEPU, 2001; LAMBERT; LEUZ; VERRECCHIA, 2007), leading to lower investment-cash flow sensitivity (BIDDLE; HILARY, 2006; BIDDLE; HILARY; VERDI, 2009).

These surveys highlight that higher earnings quality (EQ) makes managers more responsible, allowing better monitoring, reducing adverse selection and moral hazard, and hence reducing information asymmetries, which can mitigate underinvestment and overinvestment problems (ELAOUD; JARBOUI, 2017; GOMARIZ; BALLESTA, 2013). In addition, EQ could improve investment efficiency, allowing managers to make better decisions through better identification of the most accurate projects and accounting profits for internal decision makers (BUSHMAN; SMITH, 2001; GOMARIZ; BALLESTA, 2013; MCNICHOLS; STUBBEN, 2008). Moreover, it could highlight the ability of managers to use the resources entrusted to them (FRANCIS; HUANG; ZANG, 2008; HABIB; HASAN, 2017).

From an efficient contracting perspective, more able managers would invest more efficiently compared to their less able peers. More able managers are more efficient in evaluating the timing and economic returns on investment, as well as in synthesizing information in reliable estimates of the risks and returns associated with corporate investment (DEMERJIAN; LEWIS; MCVAY, 2013; HABIB; HASAN, 2017). As such, they are more likely to signal positively about the firm's value compared to their less able counterparts through forecast disclosures. In contrast, the prospect of income extraction shows that the most able managers overvalue their personal improvement in their careers and, in doing so, take actions that can worsen the firm's costs. For example, more able managers can be overconfident and thus overestimate the returns on corporate investment (HABIB; HASAN, 2017). Empirical evidence reveals that excessive managerial confidence can distort corporate investment decisions (HUANG *et al*., 2011) and lead to value-destroying mergers (MALMENDIER; TATE, 2008). In this case, higher EQ would mitigate the effects of debt extraction, especially by providing investors with more relevant and reliable information.

A large body of literature shows that companies can improve the quality of accounting information. According to neoclassical theory, companies invest until the marginal benefit is equal to the marginal cost of that investment so as to maximize values (HAYASHI, 1982; YOSHIKAWA, 1980). In the Keynesian framework, the preference for growth or financial security is what determines investment (CROTTY, 1992; GORDON, 1992). In the agency framework, which considers information asymmetry problems, firms may deviate from their optimal investment levels (CHEN *et al*., 2011) and therefore suffer from overinvestment or underinvestment. In agency theory, however, several control mechanisms mitigate information asymmetries and information risk. These mechanisms also allow better supervision of management activity, mitigating the opportunistic behavior of managers, especially with regard to earnings management, thus improving earnings quality (ELAOUD; JARBOUI, 2017; GOMARIZ; BALLESTA, 2013; HEALY; PALEPU, 2001; HOPE; THOMAS, 2008; MARTÍNEZ-FERRERO; GARCIA-SANCHEZ; CUADRADO-BALLESTEROS, 2015).

Hirshleifer, Hou, Teoh and Zhang (2004), Biddle *et al*. (2009), and Chen *et al*. (2011) examine the effect of information quality on two inefficient scenarios, overinvestment and underinvestment. These authors reported that higher information quality helps underinvestment companies to make investments, and overinvestment companies to decrease their investment level. In line with the evidence that earnings management leads to overinvestment because it distorts the information used by managers (MCNICHOLS;

STUBBEN, 2008), higher-quality information mitigates overinvestment and, consequently, earnings management. In turn, conservatism reduces both overinvestment and underinvestment, because it reduces investment-cash flow sensitivity in overinvestment firms and facilitates access to external financing in underinvestment firms (ELAOUD; JARBOUI, 2017; GOMARIZ; BALLESTA, 2013). Furthermore, conservatism reduces agency problems related to management decisions, mitigating managerial opportunism and allowing good debt agreements in an asymmetric information environment (AHMED; DUELLMAN, 2007; BALL; SHIVAKUMAR, 2005; GARCÍA LARA; GARCIA OSMA; PENALVA, 2009; GARCIA-MECA; GARCIA-SANCHEZ, 2018; LEVENTIS; DIMITROPOULOS; OWUSU-ANSAH, 2013).

Previous literature also shows that private companies have lower Financial Reporting Quality (FRQ), presumably due to the lower market demand for public information. The FRQ is lower in countries with low investor protection, bank-oriented financial systems, and greater conformity between tax and financial reporting rules (CHEN *et al.*, 2011). These characteristics are common in civil law countries, especially Brazil. Research points to a greater tendency to earnings management in these countries compared with countries characterized by common law, capital market-based financing, strong accounting profession, high level of development, and adequate accounting education (ALI; HWANG, 2000; BALL; KOTHARI; ROBIN, 2000).

In emerging markets, private companies finance investments from outside sources - including bank loans, private equity issues, leasing, commercial credit, financing from special development agencies or governments, and informal financing (financing from loan sharks, family, and friends) - and from retained earnings and additional contributions from owners (BECK; DEMIRGUC-KUNT; MAKSIMOVIC, 2008). A large body of literature documents how the availability of external or internal funds affects investment decisions (BLANCHARD; LOPEZ-DE-SILANES; SHLEIFER, 1994; MYERS; MAJLUF, 1984). These studies used samples of publicly traded companies that depend mainly on capital and debt financing. For private companies, external funding sources are generally limited and consist mainly of bank loans and commercial credit. Without attractive domestic investment opportunities, managers of these companies choose to keep unexpected cash inside the company, rather than distributing it to investors in the form of dividends, share repurchases, or debt reduction.

Chen *et al*. (2011) also argue that the funding source will affect the relationship between FRQ and investment efficiency. Bank loans are the most common source of external

capital for private companies in developing countries (BECK; DEMIRGUC-KUNT; MAKSIMOVIC, 2008). This is due to financial difficulties, reallocation of resources, and acceptance or rejection of investments. Banks can access information other than financial statements, potentially reducing the importance of the accounting information disclosed in financial reports. However, in addition to the large body of research documenting the role of accounting information for lending decisions in the US and other developed countries, there is also evidence that banks rely on borrowers' financial reports in credit decisions in emerging markets (as is the case in Brazil) and for small firms (BERRY; GRANT, 2004; BERRY; FAULKNER, 1993; DANOS; HOLT; IMHOFF JR, 1989). In comparison with other external capital providers that rely more on mutual trust and private communication, banks are likely to examine the financial statements of corporate clients more carefully.

The relationship between earnings quality and investment efficiency in emerging countries (especially Brazil) shows that higher EQ makes managers more responsible, allowing better monitoring, reducing adverse selection and moral hazard, and hence reducing information asymmetries. In other words, higher EQ could improve investment efficiency (ELAOUD; JARBOUI, 2017; GOMARIZ; BALLESTA, 2013; BUSHMAN; SMITH, 2001; MCNICHOLS; STUBBEN, 2008). With this in mind and considering the particularities of these emerging markets and their main sources of financing, we elaborated the following hypothesis:

H_1= there is a significant and positive relationship between earnings quality and investment efficiency of electricity companies listed in B3.

Considering that reducing information asymmetries can mitigate underinvestment and overinvestment problems (ELAOUD; JARBOUI, 2017; GOMARIZ; BALLESTA, 2013), we elaborated the following hypotheses:

H_{1b}= there is a significant and positive relationship between earnings quality and investment efficiency in a scenario of overinvestment in electricity companies listed in B3.

H_{1c}= there is a significant and positive relationship between earnings quality and investment efficiency in a scenario of underinvestment in electricity companies listed in B3.

3 METHODOLOGY

This research used data from the financial statements published and made available on the website of Brasil, Bolsa, Balcão [B]³. The sample initially comprised 57 companies in the

electricity sector. The data analyzed covers the period from 2010 to 2017. The final sample consisted of 57 companies, therefore without exclusion.

3.1 Investment Efficiency

Conceptually, investment efficiency means undertaking all projects with a positive NPV. Biddle, Hilary and Verdi (2009) and Gomariz and Ballesta (2013), among others, use a model that considers investment in terms of growth opportunities. Specifically, investment efficiency will exist when there is no deviation from the expected level of investment. However, there are firms that invest above the ideal value (positive deviations from the expected investment), while there is a lack of investment for those that do not carry out all profitable projects (negative deviations from the expected investment).

To estimate the expected level of investment for firm i in year t, we specify a model that predicts the level of investment based on growth opportunities (as measured by sales growth). Deviations from the model, reflected in the error term of the investment model, represent investment inefficiency (BIDDLE; HILARY; VERDI, 2009; GOMARIZ; BALLESTA, 2013). The basis for measuring profit is net profit (NP). The metric used - measurement of time series -, Persistence (EQ1) (or absence of it), is equal to the residuals of the following regression:

$$Investments_{i,t} = \alpha + \beta CV_{i,t-1} + \varepsilon_{i,t} \qquad (1)$$

Where $Investments_{i,t}$ is the total investment of firm i in year t, defined as the net increase in tangible and intangible assets, and scaled by the lagged total assets. $CV_{i,t-1}$ is the rate of change in sales of firm i from *t-2* to *t-1*.

The residuals of the regression model reflect the deviation from the expected investment level. We use these residuals as a firm-specific proxy for investment inefficiency. A positive residual means that the firm is making investments at a higher rate than expected according to sales growth, leading to overinvestment. In contrast, a negative residual means that the actual investment is lower than expected, corresponding to a scenario of underinvestment according to Gomariz and Ballesta (2013).

The dependent variable will be the absolute value of the residuals, considering three senarios: a) the absolute value of the residuals in module, a lower value means greater

efficiency ($InvEff_{i,t}$); b) the absolute value of positive residuals, considered as overinvestment, a higher value means greater inefficiency through overinvestment; c) the absolute value of negative residuals, considered as underinvestment, multiplied by minus one (-1), a higher value means greater inefficiency through underinvestment.

3.2 Earnings Quality

For earnings quality proxy, this research considers the studies of Dechow and Schrand (2004); Dechow, Ge and Schrand (2010), and Perotti and Wagenhofer (2014). We also used the earnings persistence model, often addressed in the literature. The basis for measuring profit is net profit (NL). The metric used - measurement of time series -, Persistence (EQ1) (or absence of it), is equal to the residuals of the following regression:

$$NP_{i,t} = \alpha + \beta NP_{i,t-1} + \varepsilon_{i,t} \tag{2}$$

Where:

NP is the net profit, divided by total assets at the beginning of period *t*.

The use of residuals is justified since the results of Dechow and Dichev (2002) show a negative relationship between the standard deviation of the residual and persistence, and between the level of accruals and persistence.

Therefore, we assumed three premises, as follows:

1.   The higher the magnitude of accruals (in this case the residuals of Equation 1), the lower the earnings quality (Dechow & Dichev, 2002);

2.   The lower the magnitude of accruals (in this case the residuals of Equation 1), the higher the persistence (Dechow & Dichev, 2002);

3.   Negative relationship between the standard deviation of the residuals and persistence (Dechow & Dichev, 2002).

Therefore, greater volatility of the residuals in Equation (2) can correspond to lower earnings quality. We used regression residuals (2) in this study as a proxy for earnings quality in relation to persistence, and as an independent variable in the OLS regression - Equation (3) - to test the association between earnings quality and investment efficiency, according to model 3.

3.3 Model Specification

According to panel data, the proposed model to test the effect of earnings quality on investment efficiency is as follows:

$$InvEff_{i,t} = \beta_0 + \beta_1 PER_{i,t} + \beta_2 EC_{i,t} + \beta_3 TAM + \beta_4 VPL_{i,t} + u_{i,t} \qquad (3)$$

Where:

$InvEff$ = Residuals of Equation (1), $Investments_{i,t} = \alpha + \beta CV_{i,t-1} + \varepsilon_{i,t}$;

PER = Residuals of Equation (2), $NP_{i,t} = \alpha + \beta NP_{i,t-1} + \varepsilon_{i,t}$;

EC = Capital Structure, measured by the ratio of liabilities scaled by the total assets;

TAM = Firm's Size, measured by the log of revenues;

VPL = Change in Shareholders' Equity.

We inserted control variables in the model for greater robustness of results. Chart 1 summarizes and justifies the variables and their measurements.

Chart 1 – Summary of variables

Variable	Expected Signal	Justification
Explanatory Variable		
Persistence (PER)	Positive	Increased profit quality results in greater investment efficiency (Healy and Palepu, 2001; Lambert and Leuz and Verrecchia, 2007).
Control Variable		
Capital Structure (EC)	Positive	Debt maturity reduces excessive investment (Mello and Miranda, 2010) However, the role of debt maturity under informational asymmetry has shown that the use of short-term debt is a mechanism that can mitigate informational asymmetries and agency costs between shareholders, creditors and administrators (Gomariz and Ballesta, 2013)
Firm´s Size (TAM)	Positive	The size of the company has a positive relationship with investment efficiency, as evidenced in Lee's (2009) work with US publicly traded companies.
Change in Shareholders' Equity (VPL)	Positive	The increase in shareholders' equity may result in greater efficiency in the allocation of investments (Petria, Capraru and Ihnatov, 2015; Menguc, Auh and Ozanne, 2010)

Source: Prepared by the authors.

4 ANALYSIS OF RESULTS

Table 1 shows the descriptive statistics of the variables adopted in the research, in which: a) invEff had a mean and median greater than zero, thus showing a situation of overinvestment greater than that of underinvestment. This result differs from the work by Gomariz and Ballesta (2013), which presented a mean and median lower than zero, therefore, prevalence of underinvestment; b) EC has an average of 0.74%, demonstrating the prevalence of third party capital in relation to equity, increasing the risk of investments in projects of these companies; d) NPV with an average of 0.003% and a high coefficient of variation (i.e. greater than 20%), possibly demonstrating the low reinvestment of reported profits, mainly due to the possibility of distributing constant dividends; e) TAM has an average of more than R $ 10 million, showing the existence of companies, mostly consolidated in the market, such as Blue Chips and Mid Caps. However, there was a high coefficient of variation, also demonstrating the existence of Small Caps.

Table 1 – Descriptive statistics

VARIABLE	Average	Median	Maximum	Minimum	Standard Deviation
InvEff	2.95e-18	0.03255	0.47150	-3.31611	-8.91636
PER	0.00000	0.00435	0.92139	-1.88652	0.14053
EC	0.74103	0.75471	0.97772	0.03111	0.13056
TAM	10.297.425	4,750,491	1.73e+08	0.00000	20,919,668
VPL	0.06357	0.02546	3.89663	-6.49484	0.62672

Source: Prepared by the authors.

Through the Variation Inflation Factor (VIF), there was an evident absence of multicollinearity of the variables adopted in the research, therefore, not compromising the estimation of the research equations. In turn, the other tests were performed, i.e., normality of residues, homoscedasticity and autocorrelation. As for normality, the Jarque-Bera test indicated that the residues do not follow a normal distribution. Still, the normality of the residues was not verified. However, the Central Limit Theorem (e.g. GUJARATI; PORTER, 2011) was used, in which for samples larger than 100 observations the normal distribution is assumed.

As for the autocorrelation of residues, its absence was verified through the Durbin-Watson test. For heteroscedasticity, the estimation was performed with White correction. In addition, stationarity tests were performed, (a) ADF - Fisher and (b) PP - Fisher, indicating stationarity at the level of the research variables, I (0). In time, the Breusch-Pagan test and the

F (Chow) test were performed to detect the best model and the results showed the Cross-section Fixed (A) as highlighted in Table 2. In time, considering the segregation to highlight the relationship between quality of profit and efficiency of investments in a scenario of superinvestments and subinvestments, it was necessary to adopt B and C estimation, Cross-section Fixed.

Table 2 - Regression Analysis of the Profit Quality and Investment Efficiency variables

VARIABLE	A (Total)	B (Overinvestiment)	C(Underinvestiment)
	Cross-section Fixed *t-value* (sig)	*Cross-section Fixed* *t-value* (sig)	*Cross-section Fixed* *t-value* (sig)
INTERCEPT	0,3161	1,2675	-0,4391
	0,7521	0,2061	0,6609
PER	3,2013	1,9990	1,0191
	0,0015	0,0466	0,3091
EC	-0.6891	2,3842	-1,1488
	0,4913	0,0178	0,2517
TAM	2,1414	0,0147	1,0428
	0,0332	0,9883	0,2980
VPL	1,2636	-2,6279	0,8039
	0,2075	0,0091	0,4221
R²	**0,6802**	**0,9433**	**0,2756**
R² adjusted	**0,6106**	**0,9310**	**0,1181**
F	**9,7778**	**76,53**	**1,7495**
(sig)	**0,0000**	**0,0000**	**0,0018**

Source: Prepared by the authors.

In "A" estimation, the positive and significant 1% relationship between PER and InvEff was evident. confirming the first hypothesis of the research, in convergence with the works of Biddle, Hilary and Verdi (2009), Gomariz and Ballesta (2013), Healy and Palepu (2001), Lambert, Leuz and Verrecchia (2007), so that one can infer that the increase in the quality of information, measured by the persistence of profits, can mitigate the inefficiency of investments. This fact may be related to the possibility of better monitoring, which would be reducing adverse selection and moral hazard, resulting in a reduction in information asymmetry.

Regarding the control variables, the result of the estimation showed an inverse relationship between the size of the company and the efficiency of investments, at the level of 5%. This factor may have been caused by the significant variation between the sizes of the

companies listed in B3, i.e., the significant presence of Small Caps and Mid Caps, companies less consolidated in the market and of greater risk, when compared with Blue Chips. Thus, the larger the company, measured by the volume of revenues, the lower the efficiency of investments. For the other control variables, EC and NPV, the coefficients and statistics were not statistically significant, thus not allowing greater inferences.

Considering only the scenario of overinvestment, estimation "B", the estimation results showed a positive and significant relationship at 5% of PER with InvEff. confirming the second hypothesis of the research, in convergence with the works of Biddle, Hilary and Verdi (2009) and Gomariz and Ballesta (2013), so that it can be inferred that the increase in the quality of information, measured by the persistence of profits, can mitigate the inefficiency of investments related to overinvestment. Otherwise, companies that show higher quality of information, through persistence, enable managers to better base their investment decisions, allowing them to reduce excessive investments, towards the optimal investment. Another possible inference is that companies that show greater profit persistence have more efficient managers in the allocation of resources, in order to reduce excessive investments.

Regarding the control variables, an inverse relationship was found between capital structure and investment efficiency, so that the greater the use of third party capital, the lower the investment efficiency, at the level of 5%. This divergence evidenced may be related to the concentration of ownership in emerging countries, especially in Brazilian companies, since a greater concentration of ownership would be used as a corporate governance mechanism to mitigate information asymmetry. Otherwise, the increase in the use of third party capital would increase the risk of companies, which may incur in the execution of inefficient projects.

As for the NPV variable, higher equity values represent greater investment efficiency. The companies that present the greatest variation in shareholders' equity are generally growing companies, which are aligned with the realization of value-generating projects. Otherwise, the managers of these companies are more aligned with the allocation of resources in projects that create value for shareholders. The TAM variable did not present statistical significance.

Subsequently, considering the underinvestment scenario, no statistical significance was found between the reduction in InvEff and PER. Thus, it is not possible to infer that the quality of profit, as measured by persistence, mitigates underinvestment. For this scenario, the control variables were not statistically significant.

Considering the particularities of the Electric Sector in Brazil, especially the strong regulation, managers are encouraged to reduce excessive investment or to invest in projects that create value. In other words, the regulation of the sector can influence the quality of the information evidenced in the financial reports and, at the same time, allow the managers of these companies essential information to reduce overinvestment. On the other hand, these factors do not mitigate underinvestment. In this way, the regulation of the Brazilian electricity sector, the measure that confers greater quality of information through persistence, mitigates overinvestment and does not impact on underinvestment.

In short, the first and second hypotheses of the research were confirmed, ie, there is a positive and significant relationship between the efficiency of the investment and the quality of the profit, measured by the persistence, of the companies of the electric energy sub-sector of Brasil, Bolsa, Balcão [B] 3 and there is a positive and significant relationship between the efficiency of the investment, in a scenario of overinvestment, with the quality of profit, measured by the persistence, of the companies in the sub-sector

5 FINAL CONSIDERATIONS

The present study highlights the relationship between the efficiency of investments and the profit quality of companies in the Brazilian electricity sub-sector, Bolsa, Balcão [B] 3, considering as a hypothesis, the existence of a positive relationship between profit quality and investment efficiency. The main hypothesis was broken down, distinguishing two different scenarios: a) overinvestment; and, b) underinvestment. The research assumes a positive relationship between investment quality and efficiency, in both scenarios, so that the increase in the quality of profit mitigates both overinvestment and underinvestment.

The results indicate a positive and significant 1% relationship between the efficiency of the investments and the quality of the profit, confirming the first hypothesis of the research, converging with the previous surveys, carried out in the European Union and in the USA. Thus, even in emerging economies, as is the case in Brazil, the quality of information can allow better decisions to be made by managers, as highlighted by Bushman and Smith (2001) and Gomariz and Ballesta (2013). In addition, another factor that may have influenced the results is the better monitoring related to the high quality of profit, which mitigates adverse selection and moral hazard. Thus, the three types of regulation practiced by ANEEL (i - the technical regulation of service standards, such as generation, transmission, distribution and

commercialization; ii - the economic regulation, in relation to tariffs and the market; and, iii - of research and development projects and energy efficiency) by reducing adverse selection and moral hazard, it raises the quality of the information shown in the financial reports and allows managers to identify better investment opportunities.

It could be highlighted, the relationship between the sources of financing, in emerging markets, in parts directed to the banking sector, in line with Chen *et al*. (2011) as it would affect the relationship between FRQ and investment efficiency. However, even though bank loans are the most common source of foreign capital for private companies in developing countries, banks' access to additional information, in addition to financial statements, has not potentially reduced the importance of the accounting information disclosed in financial reports, for electric power companies listed in Brazil, Bolsa, Balcão [B] 3. Economic regulation and research and development projects would tend to reject projects with a higher cost of capital, especially those arising from bank loans. In non-regulated sectors, there may be greater discretion in the use of third party and own capital, allowing the manager to take greater risks in search of greater value for shareholders, resulting in the execution of projects financed with third party resources.

The second hypothesis of the research was also confirmed, since, from the results, it can be inferred that the increase in the quality of information reduces overinvestment, converging with Hirshleifer, Hou, Teoh and Zhang (2004), Biddle *et al*. (2009) and Chen *et al*. (2011) who reported that higher quality of information helps to encourage companies of excessive investment to decrease their level of investment. However, the third hypothesis cannot be confirmed; it cannot be inferred that the increase in the quality of profit mitigates underinvestment, diverging from Hirshleifer, Hou, Teoh and Zhang (2004), Biddle *et al*. (2009) and Chen *et al*. (2011), in which higher quality of information helps to encourage low investment companies to make investments. Conservatism, associated with regulation, even facilitating access to external financing in relation to sub-investing companies, could mitigate the increase in investments, towards the optimal level of investments. In this case, these peculiar aspects of emerging markets would be negatively influencing the relationship between quality of profit and reduction of underinvestment.

The results highlighted in the survey cannot be generalized to other sectors in Brazil, Bolsa, Balcão [B] 3 and also to electric energy companies not listed. Another important point, the research cannot be generalized to the period prior to the process of convergence to IFRS, i.e., prior to the calendar year 2010.

For new research, it is suggested to verify (i) the relationship of investment efficiency with other proxies of profit quality, (ii) test of the research hypothesis considering the totality of companies in Brasil, Bolsa, Balcão [B] 3 and (iii) consider in the sample several countries, whether developed or developing.

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Contribuição dos Autores	E. M. F. Costa	T. P. Fernandes	J. P. Silva	R. M. Noriller
1) concepção e planejamento.	X	X	X	X
2) análise e interpretação dos dados.	X	X	X	X
3) elaboração do rascunho ou na revisão crítica do conteúdo.	X	X	X	X
4) participação na aprovação da versão final do manuscrito.	X	X	X	X