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## **Comparison of the Business Performance of Publicly Held Companies Concerning the Good Governance Practices Adopted by B3**

**PAULO HENRIQUE VIEIRA GOMES**

*Universidade de Brasília (UNB)*

**BRUNO LUIZ DA SILVA SANTOS**

*Brigham Young University, Provo (BYU)*

### **Abstract**

This article has the general objective of comparing the business performance of publicly traded companies in the electricity and in the construction and transport sectors listed on the Brazilian stock exchange, taking into account the level of adherence to good corporate governance practices adopted by the B3. The sample used in this study comprises a total of 52 companies, of which 27 of them are from the electricity sector and the remaining 25 are from the construction and transport sector. As mentioned earlier, the data used in this study are secondary, meaning that they are accounting and economic information for the years of 2016 to 2018. In addition to that, an efficiency index built on economic financial indicators submitted to Data Envelopment Analysis was used (DEA) in this study. These levels of business efficiency were introduced to the non parametric Wilcoxon test, and the normality of the sample was then verified using the Shapiro Wilk test. The results indicate that good corporate governance practices, which are represented by the requirements to adhere to the differentiated levels of B3, imply greater economic financial efficiency, with empirical evidence pointing to superior business performance for companies listed in the differentiated levels of corporate governance. However, the results tested from the sample of this research refute the hypothesis of the study, meaning that the adoption of good governance practices, measured by adherence to B3's differentiated levels of corporate governance, leads to superior business performance, which is measured by the efficiency calculated by Data Envelopment Analysis.

**Keywords:** Corporate Governance, Performance, Efficiency, Data Envelopment Analysis.

## **1 INTRODUCTION**

Based on the literature on corporate governance, it can be seen that, over the years, it has become one of the leading credentials for positive business performance. That is because corporate governance is seen as a strategic element to help increase organizations' results and development opportunities. The adoption of corporate governance practices will benefit companies by improving the alignment of interests between shareholders and other stakeholders, reducing conflicts between principal and agent. (Macedo & Corrar, 2012)

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The adoption of corporate governance mechanisms by companies has, in general, the objective of facilitating fundraising and reducing the cost of capital (Ferreira et al., 2013). Studies seek to demonstrate that governance is related to business performance (Klapper and Love, 2004; Silveira, Barros and Famá, 2006; Cicogna, Toneto Junior and Vale, 2006; Larcker, Richardson and Tuna, 2007; Rogers, Ribeiro and Securato, 2008, Peixoto *et al.*, 2011; Macedo and Corrar, 2012; Catapan, Colauto and Barros, 2013; Bansal and Sharma, 2016; Ntim, 2018). In this sense, many research studies have been developed in Brazil relating to adopting good governance practices and performance. Lins (2003) and Klapper, Love (2004) observed a relationship between these two factors, while Silveira, Barros and Famá (2003), Cicogna, Toneto Junior, Vale (2006) and others reach opposite or inconclusive results.

In the perception of Vieira et al. (2011), the corporate governance and performance binomial is inserted in the business and academic space as the basis for the formation of a set of procedures that allow shareholders to better monitor management. Furthermore, this control mechanism allows for harmony between shareholders and contractors, whose form of action is characterized by corporate governance. Thus, this study aims to answer the following question: how is corporate governance related to the technical efficiency of companies listed in the electricity distribution and construction and transport sectors of B3?

This study hypothesizes that companies that adopt good Corporate Governance practices have better technical efficiency (Silveira, Barros and Famá, 2006; Rogers, Ribeiro and Securato, 2008, Peixoto *et al.*, 2011; Macedo and Corrar, 2012; Catapan, Colauto and Barros, 2013) and that it is not possible to determine that the companies that adhere to the differentiated levels of the Bovespa have technical efficiency superior to the others (Fernandes; Dias; Cunha, 2010; Vieira et al., 2011; Ferreira et al., 2013).

This study aims to analyze comparatively the technical efficiencies of companies listed at different levels of corporate governance and others without this feature. As specific objectives, this study proposes: to build a technical efficiency index for the studied companies; analyze the technical efficiency profiles of companies at differentiated and traditional levels; verify the evolution of the technical efficiencies of the analyzed companies.

Therefore, the technical efficiencies, calculated from the Data Envelopment Analysis (DEA) technique, of companies belonging to the electricity distribution and construction and transport sectors of B3 will be analyzed. Furthermore, using the Wilcoxon test, the difference between the efficiencies of companies with good governance practices and companies without this feature will be verified. Information on inputs and outputs for calculating efficiencies will be taken from the B3 website for 2016, 2017, and 2018.

Market variables are usually used when relating corporate governance and business performance (Patel; Balic, Bwakira, 2002; Orazalin, Makarov Ospanova, 2015; Paulo, Ferola, Martins, 2020) or economic-financial indicators (Silva, 2010; Silveira, Barros and FAMÁ 2003; Macedo et al., 2009). However, in countries with a developing capital market, these



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indicators tend to have biases that might compromise their use. In this sense, the analysis of technical efficiency indices becomes an alternative for measuring business performance (Zheka, 2005; Peixoto et al., 2011).

Due to the lack of parsimony about the relationship between corporate governance and business performance, and the inappropriate treatment that is commonly given to the latter factor, this study seeks to add to the discussion on the subject by providing empirical evidence on the subject based on the methodology suggested by Peixoto et al. (2011), which uses technical efficiency as a proxy for business performance.

This research is subdivided into five sections along with this introduction. The second section presents the evolution of the discussion on Corporate Governance and its main concepts and the exposition of previous empirical work involving its relationship with the performance of companies. In the third section, the methodological procedures are pointed out. Afterward, the description and analysis of the results are shown. Finally, the conclusions, study limitations, and suggestions for future work are presented.

## 2 CORPORATIVE GOVERNANCE

Although Corporate Governance was intensely discussed in the late 20th century, with the emergence of the first governance codes and the beginning of the later century because of a series of scandals involving large corporations, its origin and development date back to the 1930s, when Berle and Means (1932) investigated the control modalities of the 200 largest North American companies in the early 1930s, these authors were pioneers in studies on the separation between ownership and control in organizations.

Also, in the 1930s, Coase (1937) developed the concept of firm from the transaction cost theory and the theory of contracts. Jensen and Meckling (1976) discussed the relationship of agency, property rights, and views of finance to establish a theoretical-methodological framework about the shareholding structure of organizations through the publication of the article "Theory of the firm: managerial behavior, costs agency and capital structure."

Williamson (1985) stood out in this scenario with studies on transaction costs, limited rationality, agents' opportunism, and asset specificity. Garvey and Swan (1994) were one of the first to define corporate governance, which in the authors' view must be understood and evaluated from a nexus of implicit and explicit contracts, which constitute the possible ways that governance has to intervene in the form of decision-makers to manage their contracts.

In the early 1990s, the Cadbury Commission created the first code of best corporate governance practices in England, which became known as the Cadbury Report. In 1995, the Brazilian Institute of Administration Counselors (IBCA) was created in Brazil, bringing together qualified professionals and promoting their training to work on boards of directors.



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That was the milestone of GC in Brazil, contributing to the development and dissemination of good corporate governance practices in Brazil. (Silva, 2010)

Shleifer and Vishny (1997) discussed the legal protection of investors and the concentration of ownership in the global scope of governance systems. Then, from the perspective of agency theory, the authors conceptualized Corporate Governance as a set of mechanisms by which capital providers seek to ensure an adequate return on their investments. That is a set of tools that minimize conflicts of interest and costs.

In 1999, the Organization for Economic Cooperation and Development (OECD), which brings together the 29 most industrialized countries, elaborated the principles of corporate governance to help member countries assess and institutionally improve good governance. That same year, the name of IBCA was changed to the Brazilian Institute of Corporate Governance (IBGC). In May of the same year, the first code of best corporate governance practices was released, provoking debate on the main governance practices and models, bringing about a considerable evolution of the institutional environment. (Silva, 2010)

Nascimento and Reginato (2013) argue that it was from 2002 onwards that the theme Corporate Governance gained prominence, motivated by the sequence of scandals that caused great changes in the North American capital market, which surreptitiously destroyed the confidence of investors in management companies, and the quality of information produced and disseminated. The response to these events was the enactment of the Sarbanes-Oxley Act in July 2002.

IBGC (2009) defines corporate governance as a system that encompasses relations among owners, boards of directors, officers, independent auditors, and the fiscal council. These instruments are fundamental for the exercise of administrative control. Good corporate governance practices aim to increase the value of society, facilitate its access to capital and contribute to its continuity.

Corporate governance deals with the following aspects: preservation and maximization of shareholder rights, ensuring the protection of minority shareholders; establishment of relationship practices between shareholders, board, and directors, aiming to maximize the organization's performance; definition of strategies, operations, value creation and allocation of results; creation of value systems that govern companies in their internal and external relations; implementation of instruments that aim at the excellence of management and the protection of the rights of the parties interested in its results. (Andrade & Rossetti, 2012)

The governance system must have a set of procedures whose purpose is to guarantee the insertion of some benefits. Among such benefits are: optimizing the performance of companies participating in the stock exchange; ensure the increase of companies' shares through an excellent corporate image; reduce the cost of capital; to facilitate the growth in the feasibility of obtaining resources in the capital market; guaranteeing stakeholders the rights to

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the company's assets, protecting them against controlling shareholders, who have the power to influence decisions on behalf of the company, to promote the sustainable development of the stock market and build an excellent image of it before agents involved. (Fernandes; Dias & Cunha, 2010)

In the conception of Nascimento and Reginato (2013), control, which the definitions of governance address, is developed from the creation of internal and external mechanisms, which enable decisions to be taken in order to maximize investor wealth. These controls are necessary in light of agency problems, as executives make decisions intending to maximize their personal usefulness rather than shareholder wealth.

Governance mechanisms can be internal or external. They encompass the instruments available for their performance. The board of directors, management incentives, internal audit, shareholding structure, internal control systems, and the fiscal council are internal instruments. At the same time, the legal and regulatory environment, the capital market, disclosed information, accounting, finance, services independent legal, and auditing are examples of external corporate governance mechanisms. (Frezatti et al., 2009)

According to Vieira et al. (2011), the board of directors is the essential point of a governance system. The role of the board of directors in corporate governance is highlighted in the management decision-making process, in the ratification of relevant information, and in the monitoring of senior management, considered to be control decisions. The initiation and implementation steps belong to management decisions (executive board), and such separation is necessary to ensure that a given judgment is not exercised by an agent who acts, at the same time, as manager and controller (FAMA; JENSEN, 1983). In companies that have separate ownership and control, control decisions are transferred to the board of directors, which, in a way, ensures the practical survival of the corporation.

Frezatti et al. (2009) point out the capital market as an external CG instrument and that its structure is an essential element for developing good practices. Inspired by the practices of the German stock exchanges, it was implemented in Brazil through B3, differentiated ratings for companies committed to the best corporate governance practices. In 2000, levels of companies were created according to the quality of their business instruments, classifying them into level 1, level 2, and new market. Each level requires more demands and commitment to best practices than the last.

The creation of these differentiated listings aimed to strengthen the capital market and meet the investors' desire for more information about the companies. These levels also reduce investment risk, thus creating more value for the business. B3 defines them as a set of standards of conduct for companies, managers, and controllers considered essential for a good valuation of shares and other assets issued by companies. (Oliveira et al., 2013)

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Frame 1

**Comparison of requirements between different levels of CG in B3.**

Segment/Level	Level 1	Level 2	New Market
% <i>free float</i>	25%	25%	25%
Share Capital	Common and Preferred Shares	Common and Preferred Shares (with additional rights)	Only Common Shares
Board of Directors	Minimum of 3 members (according to law)	Minimum of 5 members: 20% must be independent	Minimum of 5 members: 20% must be independent
Financial statements following to international standards	Optional	US GAAP or IFRS	US GAAP or IFRS
Tag-along rights	80% for Common Shares (as per legislation)	100% for Common Shares e 80% for Preferred Shares	100% for Common Shares
Becoming a Member of the Market Arbitration Chamber	Optional	Mandatory	Mandatory

Source: NDGC of Bovespa (2021)

## 2.1 Previous Empirical Studies

In recent literature, there are several studies relating good Corporate Governance practices with the value and economic-financial performance of companies, among which we have: Fernandes, Dias and Cunha (2010); Peixoto et al. (2011); Vieira et al. (2011); Macedo and Corrar (2012); Fauzi and Locke (2012); Catapan, Colauto and Barros (2013); Bijalwan and Madan (2013).

Fernandes, Dias and Cunha (2010) used B3's differentiated corporate governance levels (N1, N2, and Novo Mercado) to measure corporate governance. The authors aimed to analyze whether there were changes in the performance of companies after adhering to B3's differentiated levels of corporate governance. To achieve it, they used a sample of 40 Brazilian companies that adhered to governance levels in 2007 and compared with the years immediately before (2006) and after (2008) to find significant signs of changes in profitability and value of the firm after accession. Profitability was measured by the accounting indicators Return on Assets (ROA) and Return on Equity (ROE); both were divided according to the percentage in low, average, good, and excellent profitability. To measure the firm's value, Tobin's Q was used, which being less than one indicates value destruction and greater than one wealth creation. Finally, although companies show variation in the performance indexes analyzed in the period after adhesion, statistically, it cannot be inferred that there were changes in their performance after joining the differentiated levels of corporate governance at B3.

Vieira et al. (2011) highlights the importance of corporate governance in recent years after numerous scandals and financial fraud in large companies. Good corporate governance

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practices started to be seen to ensure transparency in the disclosure of information, protect shareholders' rights and guarantee equal treatment between controlling and minority shareholders. The author created a corporate governance index through an instrument with 24 binary questions divided into four dimensions (disclosure, composition and functioning of the board, ethics and conflicts of interest, and shareholder rights). This instrument was used to measure the governance of the 142 companies analyzed from 2002 to 2008. The ROA and share return were the performance measures used. The results indicated that positive (negative) variations in governance are associated with positive (negative) variations in the operational performance of companies (ROE). However, there is no evidence that variations in the quality of governance have an impact on share returns.

Peixoto et al. (2011) argue that different corporate governance mechanisms are suggested to minimize agency conflicts between managers and shareholders and minority and majority shareholders. Thus, the objective was to analyze whether the adoption of these mechanisms results in greater efficiency for Brazilian companies in the electricity sector listed on Bovespa from 2007 to 2009. Of the 33 companies analyzed, 14 were classified in one of the three different levels of governance of the B3, and the others were listed on the traditional market. To measure the efficiency of the companies, the technique of Data Envelopment Analysis (DEA) was used. The governance variables used in this study were control rights, cash flow rights, and the degree of independence of the board of directors. In 2007 and 2008, the average efficiency of companies listed in one of the three levels was higher than the total sample average. In 2009 the opposite happened. Through the regression analysis of panel data, it was found that the concentration of the right to cash flow is positively related to efficiency, and that it also increases the firm's value, as measured by Tobin's Q. Finally, the authors used company size, represented by the log of total assets, as a control variable and showed that size negatively influences efficiency, that is, smaller companies are more efficient in the sample of this study.

Vieira et al. (2011) advocate that corporate governance is related to the management of organizations. Therefore, from the moment that their practices contribute to resolving conflicts between agents and principals, it becomes a target of interest for entrepreneurs. Aiming to assess whether the adoption of corporate governance practices changes the capital structure and performance of companies, the authors evaluated 84 companies with shares traded on Bovespa. They listed them in one of the three levels of governance. The independent variables are given by the governance index, the percentage of common shares of the largest shareholder, the percentage of common shares of the controlling shareholder, the independence of the board, and the percentage of common shares of the five largest shareholders. The result indicates that it cannot be inferred that the corporate governance practices adopted by the companies listed in the differentiated levels of governance did not contribute to variations in the performance or the capital structure of the companies studied.

Fauzi and Locke (2012) investigated the relationship between corporate governance (structure of the board of directors and ownership structure) and the performance of 79 publicly traded New Zealand companies in 2007-2011. Regarding the board structure, the



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authors used the variables: the size of the board, the proportion of independent members, the presence of women, and the existence of advisory committees. To represent the ownership structure, managerial and concentrated properties were used as variables. The results showed that the proportion of independent directors, women on the board, and focused ownership negatively affected performance (Tobin's Q and ROA). Conversely, the number of board members, managerial ownership, and the existence of advisory committees were positively affected related to the performance of companies.

Macedo and Corrar (2012) comparatively analyzed the accounting-financial performance of 26 companies in the electricity distribution sector in Brazil with good corporate governance practices and others without this characteristic from 2005 to 2007. In the authors' view, The company had good corporate governance practices if it was listed in the New Market segment on 1/31/2007 and had been listed before 12/31/2005; otherwise, it did not have good practices. As a result, the 26 companies were divided into two groups, eight with good practices and eighteen without this feature. To calculate the accounting-financial performance of the companies studied, the Data Envelopment Analysis (DEA) technique was used, which calculates an efficiency index for each company through inputs and outputs. The authors concluded that for the year 2005 and the average of the three years studied, the performance of the two groups was statistically different at the 5% level; that is, the group with good practices had a higher efficiency rate than that which did not feature. As for the years 2006 and 2007, the performance of both groups is statistically equal at the 5% significance level.

Catapan, Colauto, and Barros (2013) verified the effect of Corporate Governance on performance variables, both accounting and market, in 111 publicly traded non-financial Brazilian companies listed on B3 in 2008, 2009, and 2010. To measure the level of corporate governance of companies, the authors used the instrument proposed by Silva and Leal (2005). This index comprises fourteen dichotomous questions, which refer to the presence or absence of specific governance attributes, divided into four categories (transparency, control and conduct, composition and functioning of the board, and shareholder rights). The authors concluded that the corporate governance index was positively and significantly related only to the market variable (Tobin's Q). On the other hand, the IGC was positively associated with the two accounting variables (ROA and EBITDA) but without statistical significance.

Bijalwan and Madan (2013) sought to investigate the influence of corporate governance, measured by the size and composition of the board of directors and the shareholding structure of companies, on company performance. The country's institutional environment is an external governance mechanism, and the results may vary according to the country in which the studied companies are located. The authors investigated 121 Indian companies listed on the Bombay Stock Exchange in 2010 and 2011. Companies with more than ten board members had a higher average return on capital employed (ROCE) than fewer than ten advisers. However, as for the return on equity (ROE), return on assets (ROA), and profit after tax (PAT) indicators, the opposite happened. Companies with less than ten board members had higher averages than those with more than ten board members. Regarding the



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shareholding structure, companies with block holding property, that is, those in which more than one shareholder holds 25% to 50% of the shares, had higher averages for all indicators studied (ROCE, ROA, ROE, and PAT) of them than those with a concentrated ownership structure (when more than 50% of the shares are held by only one shareholder or family/group) and diversified (when none of the shareholders holds more than 25% of the shares).

Recent literature relating good corporate governance practices with the performance of organizations still shows inconclusive results. Some studies showed positive results, others mixed, and some could not even find a significant relationship between corporate governance and the performance of organizations. Frame 2 presents a summary of the studies explored in this section on corporate governance in recent years.

Frame 2

**Studies on Corporate Governance and Company Performance**

Authors and years	Independent variable	Dependent Variable	Outcomes
Fernandes, Dias e Cunha (2010)	Corporate Governance different Segments	ROA, ROE, and Tobin's Q	Neutral
Peixoto <i>et al.</i> (2011)	Board of Directors and Shareholder Right	DEA ( <i>inputs</i> : Operarional Revenue, total liability, capital; <i>outputs</i> : ROA, Operational Profit, and Tobin's Q)	Mixed
Vieira <i>et al.</i> (2011)	Board of Directors and Shareholder Structure and Governance segment	ROE, Annual profit per stock e total debt	Neutral
Fauzi e Locke (2012)	Board of Directors and Shareholder Structure	ROA and Tobin's Q	Mixed
Macedo e Corrar (2012)	Corporate Governance different Segments	DEA ( <i>inputs</i> : Long-Term Debt, Fixed Assets; <i>outputs</i> : VA/TA, RC/Sells, VA/Adjusted Equity, Asset Turnover, CL.)	Positive
Bijalwan e Madan (2013)	Board of Directors and Shareholder Structure	ROA, ROE, ROCE, and NOPAT	Mixed
Catapan, Colauto e Barros (2013)	Corporate Governance Segment	ROA, EBITDA, and Tobin's Q	Positive

Source: Authors based on the literature review (2021)

### 3 METHODOLOGY

This research can be characterized, according to Collis and Hussey (2005), as being descriptive. Concerning its objectives and quantitative regarding the procedures, as it seeks, through the application of Data Envelopment Analysis (DEA) to information from publicly traded companies listed on B3, expose and compare characteristics of their financial performance.

The sectors used in this study were Electric Energy and Construction and Transport, as classified by B3. The first sector of the study was included, primarily due to its relevance to

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the country's economy and infrastructure, as highlighted by Peixoto et al. (2011), and, according to Silva and Leal (2005), for being a promising and stable sector of the economy, which arouses the interest of researchers and investors. Another reason for its inclusion in this study was its presence in previous studies. The Construction and Transport sector was included in the sample to meet the suggestion given by Peixoto et al. (2011) in their work, which consists of the simultaneous analysis of more than one industrial sector to test the adequacy of the DEA. Furthermore, the choice of this sector was specifically based on its relevance to Brazil's economy, since in 2010, the GDP of this sector registered an increase of 11.6%. Along with that, according to Albuja et al. (2011), attracting many investors, which arouses research interests.

Given the restriction of the population universe imposed by choice of the two sectors to be studied, the sampling process adopted was non-probabilistic, as it was based on the criterion of data availability, meaning that all companies that presented all the information necessary throughout the analysis were part of the sample, which for this study covers the years 2016 to 2018. Therefore, based on this criterion, the final sample contains 52 companies, of which 27 are from the electricity sector and 25 from the construction and transport sector.

The data used in the study are secondary, being accounting and economic information from 2016 to 2018, collected on the B3 website on 03/20/2020. The data collected was from the Balance Sheet and the Income Statement for the Year (DRE). Based on these data, seven variables were calculated, shown in Frame 3.

Frame 3  
**Variables used to calculate efficiency**

Variable	Description	Theoretical fundamentals	Group
Third-party capital	Resources from financing and loans	Peixoto <i>et al.</i> (2011)	Inputs
Equity	It is the capital invested by the partners of a company	Huang, Hsiao and Lai (2007), Peixoto <i>et al.</i> (2011)	
Financial Expenses	These are the remuneration of third-party capital.	Iudícibus and Marion, (2011)	
Return on Assets (ROA)	Demonstrates the company's ability to generate profit concerning what is invested in it	Peixoto <i>et al.</i> (2011), Ferreira <i>et al.</i> (2013)	Outputs
Current Liquidity	Shows a company's ability to pay off short-term debt	Macedo and Corrar (2012)	
Asset turnover	This shows when a company recovers the value of its assets in one year, through sales	Macedo and Corrar (2012)	
Return on Equity (ROE)	Demonstrates the company's ability to remunerate the capital that the partners invested	Martins, Diniz and Miranda (2018)	

Source: Authors (2021)

The collected data were analyzed in three steps:

1. Elaboration of descriptive statistics
2. Construction of an efficiency index using the DEA



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### 3. Application of a test of means

The first stage of the analysis used frequency tables, measures of central tendency and variability, of companies as a whole and segregated by governance levels (NM, N1, and N2 versus Traditional Market).

The second step consists of applying the nonparametric technique of Data Envelopment Analysis (DEA). According to Banker, Charnes, and Cooper (1984 apud Kassai, 2002), this method uses mathematical programming to obtain ex post facto evaluations of the relative efficiency of the results obtained by a decision-making unity (DMU). The DEA contemplates a series of strategies for measuring efficiency based on the consumption of inputs to produce outputs. Two of the best known are the CRS, from the constant English return to scale, and the VRS, variable returns to scale. The first of these strategies consider that the consumption or increment of inputs and outputs occurs proportionally. In contrast, the second strategy does not have this limitation, which allows its adoption with a greater degree of reliability (FERREIRA et al., 2013).

Another characteristic that must be observed when applying a DEA is the input or output orientation. The first type keeps the number of outputs constant and analyzes how much inputs must be minimized for a DMU to maximize efficiency. In the second type of orientation, the inputs are kept constant, while the output levels are elevated until the DMU reaches maximum efficiency. The DEA model adopted in this study was the VRS due to its lesser limitation, input-oriented, the most commonly observed in previous studies.

It is noteworthy that the use of DEA is advocated by Zheka (2005) and Peixoto et al. (2011) in countries with developing capital markets, such as Brazil, since economic-financial and market indicators normally, used directly in these types of studies, can present biases, which would end up hindering a more accurate analysis. The DEA can be understood, in this sense, as a mitigation of these biases since it builds a single index based on multiple inputs and outputs.

Finally, in possession of the efficiency indices built for the companies, an average test was applied so that the performance of those at different levels of corporate governance could be compared against those that make up the traditional B3 segment. To choose between the Wilcoxon parametric T test and the nonparametric Wilcoxon test, the normality of the sample was verified using the Shapiro-Wilk test. The null hypothesis of this test is that the sample follows a normal distribution; thus, if it is rejected, nonparametric techniques must be used.

The software used for data analysis was Microsoft Excel and R: A language and environment for statistical computing. All results obtained are presented in the following section.

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#### 4 RESULTS AND ANALISYS

Initially, the frequencies of companies by segment of B3 are presented in Table 1. Of the 52 companies, 32 are listed at different levels of corporate governance, which represents 61.54% of the total sample. Companies listed at traditional levels are 20 in number, which represents 38.46% of the total.

Within the differentiated levels, 25 companies belong to the Novo Mercado, representing 48.08%, evidencing a trend that companies that adhere to the NDGC opt, in most cases, for the Novo Mercado, as can be seen in Rodarte and Camargo (2013).

Table 1  
**Companies by B3 segment**

Segment	NDGC			Tradicional	Total
	New Market	Level 1	Level 2		
Quantity %	25 48,08%	2 3,85%	5 9,62%	20 38,46%	52 100,00%

Source: Authors (2021)

Then, efficiencies were calculated based on the DEA strategy with input-oriented VRS. Table 2 presents descriptive statistics for efficiencies considering the sample as a whole and segregated by NDGC and traditional market.

Table 2  
**Descriptive statistics of efficiencies for full sample and B3 segments**

Segment	Year	Mean	Deviation	Minumun	Median	Maximun
General Sample	2016	0,3980	0,3321	0,0353	0,3194	1,000
	2017	0,3550	0,3467	0,0242	0,1890	1,000
	2018	0,3359	0,3312	0,0188	0,1964	1,000
Tradicional	2016	0,3909	0,3037	0,0353	0,2924	1,000
	2017	0,2293	0,2124	0,0293	0,1676	1,000
	2018	0,2301	0,2115	0,0302	0,1823	1,000
NDGC	2016	0,4024	0,3534	0,0563	0,3360	1,000
	2017	0,4336	0,3918	0,0242	0,2455	1,000
	2018	0,4021	0,3758	0,0188	0,2257	1,000

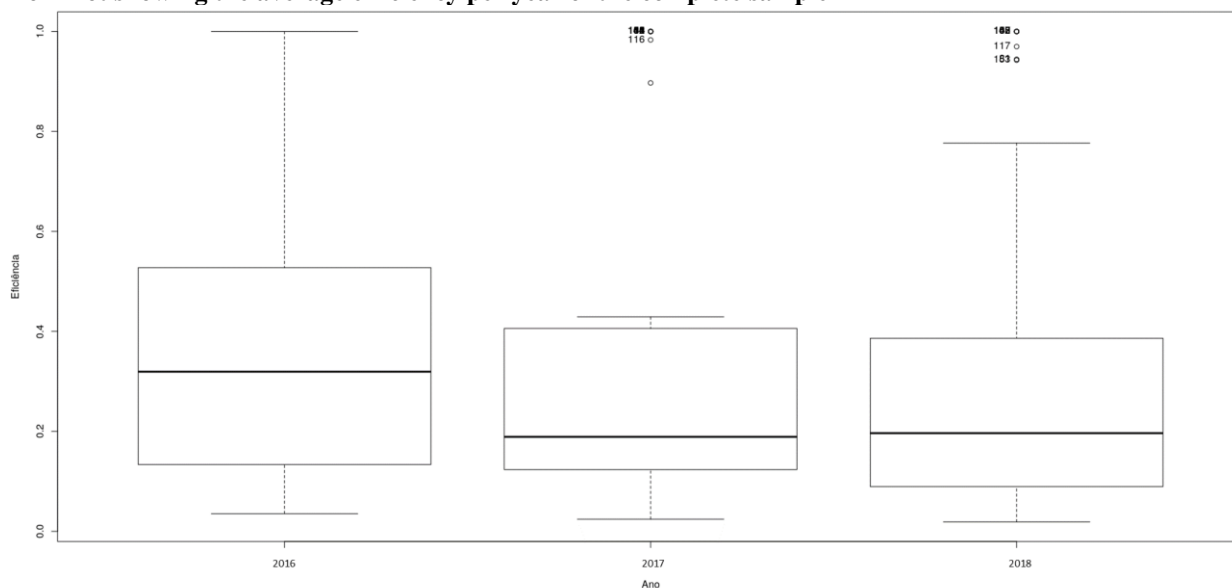
Source: Authors (2021)

It is noticed that the average of the companies in the NDGC had an average efficiency higher than the companies in the Traditional Market in all three years. From the standard deviation, it is possible to notice a high variability of efficiencies in both segments.

Of the 52 companies, 10 showed maximum efficiency in 2016, 9 in 2017, and 6 in 2018. 3 from the traditional market and 7 from differentiated levels of governance in 2018, 1 from the traditional market and 8 from the NDGC in 2017, and 1 from the traditional market, and 5 of the differentiated levels of governance in 2018. The influence of the crisis on the efficiency of these economic segments is also noticeable, where there is a drop in 2017 and 2018 compared to 2016, as shown in Figure 1.

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Figure 1  
Box Blot showing the average efficiency per year of the complete sample



Source: Authors (2021)

To increase the analysis of the companies' efficiency, it used a procedure developed by Silva et al. (2012) and adopted by Ferreira et al. (2013), whose objective is to classify them into three levels: high, medium, and weak. For this purpose, the mean and standard deviation are used as parameters. Companies with an efficiency score below the absolute difference between these two measures were classified as having weak efficiency. Those above this value, but below the sum of the average and the deviation, were classified as having average efficiency. For those with scores above the sum between deviation and mean, these were considered highly efficient companies. The results are shown in Table 3.

Table 3  
Efficiency Level Classification

Sample	Efficiency Score	Efficiency Level	Absolute Frequency	Relative Frequency
General Sample	$E \leq 5,32\%$	Weak	3	5,77%
	$5,32\% < E < 67,28\%$	Average	39	75,00%
	$E \geq 67,28\%$	High	10	19,23%
NDGC	$E \leq 6,57\%$	Weak	3	9,38%
	$6,57\% < E < 75,98\%$	Average	20	62,50%
	$E \geq 75,98\%$	High	9	28,13%
Tradicional	$E \leq 6,49\%$	Weak	2	10,00%
	$6,49\% < E < 50,20\%$	Average	16	80,00%
	$E \geq 50,20\%$	High	2	10,00%

Source: Authors (2021)

Observing the efficiency rating percentages in each segment, one can see a concentration of companies in the average efficiency level, both in the traditional market and in the NDGC. However, when observing the high-efficiency level, there is 28.13% of the companies in the NDGC, while there is only 10% in the traditional market. Therefore, this type of analysis only reforms the results obtained previously.

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The next step of the methodology was applying the Shapiro-Wilk test to verify the hypothesis of normality of the sample. Table 4 presents the results obtained.

Table 4  
**Shapiro-Wilk test results**

Year	W	p-value
2016	0,8211	0,0000
2017	0,7391	0,0000
2018	0,7621	0,0000

Source: Authors (2021)

The null hypothesis was rejected at the significance level of 1% for all years. This implies the inadequacy of the T-test for means, as it is parametric. Thus, we chose to use the Wilcoxon test. The results are shown in Table 5.

Table 5  
**Wilcoxon test results**

Year	W	p-value
2016	341,50	0,6918
2017	249,00	0,1837
2018	265,50	0,3094

Source: Authors (2021)

Based on p values, it is impossible to reject the null hypothesis of equality of efficiencies of the two groups for all years. Therefore, despite the average and median of the companies that are part of the NDGC, it is not possible that they are different from those observed for the companies in the traditional group.

Although there are already some articles in the Brazilian literature that use DEA in conjunction with an average test to verify a possible relationship between governance and efficiency, only the work of Macedo and Corrar (2012) observes the need to use a technique non-parametric for analysis, since, as this is a type of study in which a database is used that usually has few observations, the hypothesis of normality is necessary for the use of parametric techniques, as is the case with the test T, is hardly answered. Nevertheless, this fact does not make the research already carried out unfeasible. However, the comparison with the results obtained through non-parametric techniques loses a little meaning.

Thus, only the results obtained by Macedo and Corrar (2012) are considered for comparative purposes. According to the authors, such effects, despite indicating that companies that adopt better governance practices have superior performance, are not conclusive.

This research refutes the hypothesis that the adoption of good governance practices, measured by adherence to B3's differentiated levels of corporate governance, leads to superior business performance, measured by efficiency, which Data Envelopment Analysis calculated.

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## 5 CONCLUSION

As stated in the introduction, the purpose of this article was to verify whether the adoption of good governance practices would lead to superior business performance by comparing companies listed in different levels of corporate governance and those in the traditional market. To achieve these goals, an efficiency index was initially built based on Data Envelopment Analysis. Then, the results obtained in the first stage were analyzed using descriptive statistics to draw a profile of the companies that make up the two interest groups of the study. In addition to enabling the analysis of the behavioral trend of these groups, which were, in the last moment, submitted to a Wilcoxon test, whose objective was to verify if the means of the two groups are distinct.

The descriptive analysis allowed us to observe that the companies that are part of the traditional segment of B3 have efficiency, in general, inferior to those that integrate the different levels of governance. Also, in the descriptive analysis, a scale was built, based on Silva et al. (2011) and Ferreira et al. (2013), which showed that both companies with different levels of governance and those in the traditional market have a greater concentration in the medium efficiency range.

Finally, the results obtained with the Wilcoxon test do not allow us to state that the performance of companies listed in different governance levels is generally superior compared to those of the traditional market. However, despite not corroborating the research hypothesis, this result is supported in the literature on the subject that involves governance and performance since the articles on the subject still present very varied and inconclusive results.

This article sought to contribute to research relating to business performance and good governance practices, initially by providing more empirical evidence for the discussion of the subject. A still little explored methodology was also used, especially in Brazil, which uses the DEA to prepare an efficiency index that is used as a proxy of business performance, which, as mentioned earlier, becomes very relevant in countries with capital markets not so developed.

As a limitation of this research, it can be mentioned; first, the application of DEA, in general, reduces the generalizing power of a study since the efficiencies calculated by this method will only be valid for the sample that is used. Second, another limitation was the use of only two industrial sectors for the analysis, which, despite their economic importance, also hindered any attempts at generalization. Thus, it is suggested for future research to use more sectors of the economy, preferably industrial. In addition, other variables can also be chosen as inputs/outputs, even in a larger quantity than that used in this study. Finally, we suggest comparing several possible strategies to be adopted when applying a DEA to point, with empirical evidence, the best approach for this type of study.



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