ABSTRACT

**Purpose:** Compare and analyze the profitability of sustainable electricity companies with Brazilian sustainable companies from the B3 Corporate Sustainability Index.

**Theoretical framework:** The important concept of *Triple Bottom Line* in companies and society was addressed, linked to sustainable companies in the electricity sector.

**Method/design/approach:** Descriptive and applied statistics were used with non-parametric statistical tests for a non-normal distribution for analysis of the collected data.

**Results and conclusion:** The research shows that, by all indications, there is a connection between the profitability of sustainable companies in the electricity sector and the totality of companies that make up B3’s corporate sustainability index and that, therefore, being included in the list of sustainable companies is to add value good image and sustainability for the company in the electricity sector.

**Research implications:** The research details that being sustainable is profitable for companies in the electricity sector in the long term, as their profitability can be linked to the B3 group of sustainable companies. This fact helps other companies in the electricity sector to be part of the corporate sustainability index and, therefore, have good environmental, social and economic sustainability practices.

**Originality/value:** This study is avant-garde in comparing sustainability in the electricity sector, amplifies the corporate sustainability discourse and encourages the maximum number of companies, mainly in the electricity sector, to have a sustainable culture in their business.

**Keywords:** Corporate Sustainability, Electricity Sector, *Triple Bottom Line*, Sustainable Companies.

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O COMPORTAMENTO DAS AÇÕES DAS EMPRESAS SUSTENTÁVEIS DO SETOR ELÉTRICO EM RELAÇÃO AO ÍNDICE DE SUSTENTABILIDADE EMPRESARIAL DA B3

**RESUMO**

**Objetivo:** Comparar e analisar as rentabilidades das empresas elétricas sustentáveis com as empresas sustentáveis brasileiras do Índice de Sustentabilidade Empresarial da B3.

**Referencial teórico:** Abordou-se o importante conceito de *Triple Bottom Line* nas empresas e na sociedade, atrelado às empresas sustentáveis do setor elétrico.

**Método:** Utilizou-se de estatística descritiva e aplicada com testes estatísticos não paramétricos para uma distribuição de não normalidade para análise dos dados coletados.

**Resultados e conclusão:** A pesquisa apresenta que, ao que tudo indica, há conexão entre as rentabilidades das empresas sustentáveis do setor elétrico com a totalidade de empresas que compõe o índice de sustentabilidade.
1 INTRODUCTION

In an intensely competitive financial market, more and more companies seek greater profits for their business, either on account of their own survival over time to large profits that are distributed to investors or that are invested in their own business. However (Silva Junior et al., 2018, Duda et al., 2022, Silveira et al., 2022), the impacts that companies generate to the environment can be very considerable in a negative way and therefore the theme of environmental sustainability is very relevant today.

Furthermore, global warming is a latent concern in relation to companies, since as Faria et al. (2020); Baschera & Hahn (2022) argue, climate change can considerably affect the productivity and survival of organizations, the customs and quality of life of people in the urban and rural environment and the risk and return ratio of investments made in companies that may be affected by climate change. Therefore, the authors still comment that stakeholders are increasingly interested in the subject by trying to establish what are the impacts on companies that can damage their productivity.

Allied to these dictates, as the maturity of sustainable development is increasingly latent in organizations, the concept of the Triple Bottom Line arises in the business world, in order to equalize three important pillars within a society: the environmental, social and economic factor. As demonstrated by Oliveira et al. (2021), this concept, in addition to disseminating a good image of companies for good sustainability practices, further disseminates environmental actions, without removing any connection with economic and social issues.

Adding to these factors, it can be observed that in times of global economic crisis, companies generally decrease their investments and actions in social and innovation themes that can unlock a large amount of resources to achieve long-term results, as Oliveira et al. (2019) details, including environmental sustainability and environmental preservation issues. The authors also report that the electricity sector is one of the most important for a country and that it serves as the basis for the other industries of a nation and that, for this reason, whenever possible, should have actions aimed at sustainability and innovation.

Coupled with these debates, for some decades electricity companies have been arguing about the transition to clean electricity generation by organizations in this sector. According to Brose (2022), the international discussion to draw up a strategy for a process of transition from...
clean energy is very fair and, in a way, inclusive, mainly, for places that still depend on more polluting ways to obtain electricity and difficult access to distribution. Castro & Silva (2022) further broaden the discussion by suggesting that the impacts of climate change not only have an economic hold, but also influence human, social and environmental conditions.

To cite as an example, wind power generation is one of the cleanest forms of energy source and the gains are significant, as described by Saidi & Omri (2020), as they preserve the environment by contributing to the reduction of carbon emissions because they are more harmful to the environment. Another relevant example is the generation of electricity through the solar photovoltaic system. However, as Silveira et al. (2019) explains, the viability of this type of energy generation is still far away for most people in the world because it has a high technology cost.

As well as for households, the cost of switching from more polluting to clean power generation is significant for electricity companies, because, as explained by Silva et al. (2020), the values are significant for making this change, but the gains can be observed in the medium and long term, since Brazil has committed to increase its clean energy generation in the face of environmental degradation scenarios. However, whether it is more advantageous or not, for families it is still an unknown as Gheiner et al. (2020) reports.

However, from the perspective of the corporate image, it is possible that the companies in the electricity sector have a recognition for their good actions of corporate sustainability when they submit to the dictates of the Business Sustainability Index (ISE) of B3, since as Costa Lucas et al. (2022) reports, the companies that are part of the ISE aim to act with good practices of corporate sustainability and be disseminators of these actions so that other companies can follow the same examples, besides, be a reference for responsible new investments to be made for long-term results.

The ISE, which was created in 2005 by B3, the São Paulo Stock Exchange, is a theoretical portfolio made to reflect the average return on shares of the public limited companies listed on the B3 list selected through a methodology that encompasses the best practices of the theme of environmental sustainability. Therefore, as reported by Koch et al. (2022), to be part of this select group of companies it is necessary to demonstrate the adoption of best practices related to environmental, social and corporate governance issues.

The electric energy index (EEI) resulted from a theoretical portfolio that indicates the average performance of the quotes of the largest shares listed in the most representative B3 of the electric power sector, according to B3 (2023). According to the methodology used, the IEE represents the best companies in the Brazilian electricity sector in terms of marketability and presence throughout the national territory.

However, it can be seen that some companies in the EEI electricity sector have not been part of the ESI over the years and have therefore not taken into account the requirements of the methodology of that index to be part of the theoretical portfolio of companies adopting the best business sustainability practices. By not investing in environmental issues, the companies in the electricity sector that are outside the ISE, in a way, stop giving the impression of good sustainability practices by "saving" resources for this business focus.

Therefore, the question arises: Who has a greater visibility before society among the companies in the electricity sector: those that are not included in the ISE or those that save resources and do not meet the dictates of the ISE? In other words, the objective of the research is to compare the performance of the actions of the most sustainable companies in the electricity sector and, to mark out this measurement, the premise was that being included in the ISE is a fact that the company is concerned with environmental, economic and social sustainability and, therefore, have greater values of corporate sustainability.

By taking as a basis that the companies inserted in the ISE have the best practices of corporate sustainability, the study aims to analyze the performance of the companies that are in
the ISE and those that are outside the ISE of the electric sector in terms of valuing their shares listed on the São Paulo Stock Exchange - B3.

The research aims to verify whether the profitability of the companies in the electricity sector, which are in the index of corporate sustainability, follow the profitability of the group of companies in the ISE. Therefore, the work is justified, since there are still companies in the electricity sector that are not part of the ISE.

Thus, the research has the scope of encouraging all the more companies in the electricity sector to comply with the dictates and precepts of sustainability of B3’s methodology and to be part of the theoretical portfolio of the ISE and, in a practical manner, to contribute to the sustainable development of the country's business with increasingly sustainable attitudes and to be able to increase its market value with the good sustainable image of its organization.

Thus, it fosters debate around the image transmitted by sustainable companies in the electricity sector to their customers and society and assists in decision making so that other organizations can adopt sustainable practices in their companies. This is work of great importance in the electricity sector, since these companies serve as the basis for the other companies of Brazilian industry and are very contributory to the country's performance.

2 THEORETICAL FRAME

In order to support the understanding of the issues addressed and intertwine them, a conceptual and applied perspective of sustainability, on the economic, social and environmental aspects, will be presented. In addition, the Brazilian electricity sector and relevant factors on sustainability in the sector will be presented, besides highlighting the ISE and the IEE for a better understanding of the comparison of the companies that are in the ISE and IEE, concomitantly and the companies in the electricity sector that are outside B3’s business sustainability index.

2.1 Sustainability and the Triple Bottom Line Concept

One can refer the origin of the term sustainability to the study of the relationships of living beings between themselves and between them and the environment, known as ecology, as Pacobello et al. (2022) shows, and nowadays it is difficult to dissociate sustainability and the concept of Triple Bottom Line. Around 1990, discussions on sustainability evolved by giving the same concern to the environment as to the economic and social dimensions, as demonstrated by Silva et al. (2022) when he said that the negotiating environment should follow and cherish the economic success of organizations, with an environmental quality and a sense of social justice.

At the same time, it is noticeable that discussions about sustainability in Brazilian companies began to be implemented in the 1990s, as Teixeira & Bessa (2009) explains. The authors also explain that the subject is sensitive and that cultural and political changes are necessary for the dictates of sustainability to be put into practice. Agustina et al. (2023) explores that there is currently an emphasis on income through the extensive exploitation of natural resources without limit, without highlighting the environmental sustainability, culture and quality of life of individuals.

The concept of sustainability, according to Afonso (2006) can be verified by the conservation of the quantity and quality of the resources of the environment in which one lives, by using all natural resources in a satisfactory manner without harming current generations and preserving in the same quantity and quality for future generations so that they are enjoyed in the best possible way.
Furthermore, the term sustainability came about from the discussions surrounding sustainable development, in which the best use of natural resources was discussed. According to Gonçalves-Dias et al. (2007), as well as today, there were preservationists, who defend the preservation of natural resources and developmentalists, who prioritize the economic factor for the progress and development of a society at the expense of the environment. In addition, according to Ahmad & Sulaiman (2023), the definition of sustainable development at business level has developed rapidly in methods and techniques for cost management in the environmental, economic, social and political branches.

Therefore, according to Silva et al. (2014) there are three major pillars that are considered fundamental and guide strategic, tactical and operational decision making in organizations, which characterizes the Triple Bottom Line: environmental sustainability, which is related to the diversity of existing ecosystems, economic sustainability, which guides profitable decisions and for the very existence of the company and social sustainability, which stimulates culture, social well-being and sense of justice.

For Ferreira et al. (2004), a new entrepreneurial philosophy emerges with a socially, economically and environmentally responsible management by redeeming moral and ethical principles and focusing them on strategic business decisions in order to preserve the 3 dimensions of the Triple Bottom Line. Thus, among other actions, companies are motivated to publish their social balance sheets so that they present their actions responsible for their business to society.

Figure 1 presents the list of factors that characterize the Triple Bottom Line in its 3 dimensions.

![Figure 1: The Three Dimensions of the Triple Bottom Line](image)

Source: Ferreira, Pucci and Lopes (2004, p.363)

For Mota (2022), discussions on the theme of corporate sustainability have gained perenniality due to concerns about the scarcity of natural resources and their use in a sustainable and controlled way and that, as a result, over the years, become more relevant, mainly because of the impacts on the environment in the actions and omissions of companies, as Kolk & Mauser (2002) details. Therefore, according to the authors, these discussions are present both in the academic milieu and in the practical milieu of the organizations.

In addition, companies are increasingly identifying strategic forms of positive relationships with stakeholders to contribute to society and the environment without putting so
much emphasis on profits, and thus the concept of corporate sustainability emerges, as Tandoh et al. (2022) details.

Most of the discussions on sustainability revolve around the feeling of the proper use of natural resources, both by companies and by living beings, as Souza et al. (2017). Therefore, as human development has been perceived naturally with new technologies and new forms of coexistence, the development of the theme of corporate sustainability has also been growing from the new interactions of organizations with the means in which they operate, as Strandhagen et al. (2017) explains.

Mahdi & Abass (2022) report that making sustainability accounting reports in economic departments attracts investors and stakeholders by integrating sustainability into economic reports.

Some authors also put business ethics guidelines on the use of natural resources, thus being another subject to be inserted in the context of corporate sustainability, as detailed Madruga & Estivalete (2011). Corporate responsibility is taken into account by authors by integrating ethics into business relationships from the making of products and services to their use by society and people's discussions about the misuse of natural resources.

Following this line, it is relevant that the various discussions on sustainability and sustainable environmental, economic and social development are put into practice, because if they are not applied, they will be mere words of no practical value, as Martins et al. (2022) explains. Therefore, if business decisions are only based on the economic factor aiming at profit, leaving aside the environmental and social factors, they can jeopardize the balanced environment and/or jeopardize some social fact.

### 2.2 Sustainability in the Electricity Sector

As electric companies are the basis for the other industrial sectors, as Silva & Araújo (2022) reports, there are concerns about the reduction of pollutant emissions and a decrease in environmental impacts. Thus, the production of solar energy becomes more viable because of maintenance costs, is not polluting to the environment and is compact, revealing the relevance of obtaining and using energy derived from photovoltaic plates.

They corroborate this thinking Goldenberg & Lucon (2007), when citing that the oil reserves have already been used for half of the world's energy, and the same scarcity can be observed for natural gas, which already has a consumption of at least 60% on the planet. As non-renewable energy sources, clean energy production alternatives are needed.

It is worth highlighting the concept of energy sustainability determined by Fapesp (2007) when determining that it is necessary to offer electricity in an adequate manner and capable of attending to all individuals, provided that the theme of sustainable development is respected and that there is no aggression against the environment. Furthermore, as far as possible, it should avoid natural disasters and should not jeopardize people's safety in relation to geopolitical conflicts that may exist with energy competition between countries.

It should also be noted that, as reported by Navarro & Fernandes (2015), the use of renewable sources opens the door for households that do not have access to electricity to enjoy energy, as well as being an increasingly technological way of obtaining electricity. Tolmasquim (2011) goes beyond this understanding and finds that individuals who were distant from the distribution of electric energy now have the possibility of having electric energy in their homes, corroborating with the social thinking of the Triple Bottom Line.

In addition, it is worth noting that Brazil is very dependent on the system of electric power generation by hydroelectric power plants, as Castro et al., (2010) reports. However, this precarious dependence can be harmful if we take into account the possible abrupt climate
changes and long periods without rain, as Aquila et al. (2017) discovers, and therefore presenting a risk to the supply of electricity.

In the same vein, Almeida et al. (2022) explains that the lengthy approval of projects to open new hydroelectric power plants may be an obstacle to the redistribution of electricity in a satisfactory manner in Brazil. On the other hand, a less liberal and preservationist view follows a model that the delay in the release and maintenance of constant sustainable development studies helps to maintain a balanced ecosystem, according to Lozornio et al. (2017).

As Borges & Zouain (2010) teaches, a diversification of the form of electricity generation is needed, because a society often maintains a higher standard of living with higher production with an energy matrix that emits gases but destroys the ozone layer. Therefore, as Borges et al. (2014), it is clear that new, more sustainable forms of electric power generation are needed and are in evidence, as new generations of electric power rely on more advanced technology today.

It is worth highlighting that the electric sector has extreme relevance in the current economic scenario of the country, as Rodrigues et al. (2021) highlights, since they are mostly large and medium-sized organizations in financial resources, besides generation in large quantity of jobs and serve as the basis for a large part of the companies in Brazil. Therefore, making energy companies sustainable is moving large amounts of resources towards the sustainable development of the country.

Moreover, with a more sustainable way of functioning by companies of the Electric Energy Index, as reported by Simas & Pacca (2013), it is easier for them to participate in the Brazilian Business Sustainability Index, Stock Exchange, Balcão (B3) and, consequently, increase the consumption of goods, food and services by the population that believes in a more sustainable way of life. However, there are still companies from the IEE that do not part of the ISE because they do not take into account the corporate sustainability requirements of the methodology created by B3. Therefore, the study is relevant to verify the following hypothetical proposal:

**H1.** Organizations in the electrical sector with a philosophy of corporate sustainability, according to B3's precepts, are closer to ISE performance than electrical companies that are outside the ISE.

### 3 METHOD

The method used is a descriptive analysis of the data collected from tests carried out for the distribution of the collected data. Tests for non-normal distribution of data were applied through non-parametric testing.

The database used for this study and for the tests carried out were extracted from Economatica (2023), from the following dimensions: the last day price of all the shares that make up ISE and IEE was extracted from January 2013 until December 2022 for a 10-year analysis. Quotations are made up of the first day of the month and the last working day of the month, and thus the stock change for that month and year was calculated with the following Excel formula:

\[
\text{Asset (x)}\% = (\text{End Quote}/\text{Start Quote}) - 1
\]

Where:

- \(\text{Asset (x)}\%\) = Variation of the quotation of the company in B3.
- \(\text{End Quote}\) = Last quotation value of the day of the action
- \(\text{Start Quotation}\) = First quotation of the day of action
3.1 The Selection of Groups to Explore

Ownership of the percentage changes of assets in each month and in each year between January 2013 and December 2022, 4 groups were divided for comparisons. Therefore, the variables formed were as follows:

<table>
<thead>
<tr>
<th>Nome da variável</th>
<th>Descrição</th>
</tr>
</thead>
<tbody>
<tr>
<td>IEE s ISE</td>
<td>Composta pelas 11 empresas que estão no IEE e no ISE</td>
</tr>
<tr>
<td>IEE n ISE</td>
<td>Composta pelas empresas que estão no IEE, mas não estão no ISE</td>
</tr>
<tr>
<td>ISE</td>
<td>Composta pelas 70 ações das empresas do ISE</td>
</tr>
<tr>
<td>IEE</td>
<td>Composta por todas as ações do IEE</td>
</tr>
</tbody>
</table>

The purpose of making groupings is to make various comparisons, such as the behavior of the set of shares of the electricity companies compared to the total shares of the ISE. The objective is the inductive use of comparison to know if this set of actions of the electric sector that is in the ISE has the same direction and behavior of all the actions of the companies that make up the ISE to determine if the factor of corporate sustainability for the shares of the companies of the electric sector is relevant in their performances in the B3.

The business sustainability factor adopted for the research was considered for all companies that are part of the ISE in its composition for the mandate from January to April 2023, since it is the companies that, according to the model adopted in the research, have released values to fit into the ISE methodology during previous years and, therefore, adopt a sustainable culture during the period in which the research data was collected.

3.2 Testing of Variables

A preliminary analysis was done to determine whether the extracted and pooled samples have a normal distribution or a non-normal distribution to determine the appropriate inductive statistical line, as Signorelli et al. (2022) and Meireles (2022) exemplify.

Holding a total of 9,250 data extracted from Economatica's website (2023) for each first and last working day of each month, Student and Shapiro-Wilk's t-tests according to Bussab & Morretin (2004) and Casella & Berger (2010) were done for the independent groups in the profitability of all the companies of the groups included in the years 2013 and 2022 for each group, to determine whether the data follows a normal or non-normal distribution and then use typologies appropriate statistics.

<table>
<thead>
<tr>
<th>Testes com as variáveis IEE s ISE e ISE</th>
<th>Tipo de Teste</th>
<th>Estatística</th>
<th>p</th>
<th>gl</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ano 2013</td>
<td>Shapiro-Wilk</td>
<td>0,876</td>
<td>&lt;0,001</td>
<td></td>
</tr>
<tr>
<td>Ano 2017</td>
<td>Shapiro-Wilk</td>
<td>0,553</td>
<td>&lt;0,001</td>
<td></td>
</tr>
<tr>
<td>Ano 2018</td>
<td>Shapiro-Wilk</td>
<td>0,933</td>
<td>&lt;0,001</td>
<td></td>
</tr>
<tr>
<td>Ano 2022</td>
<td>Shapiro-Wilk</td>
<td>0,952</td>
<td>0,004</td>
<td></td>
</tr>
<tr>
<td>Ano 2013</td>
<td>t de Student</td>
<td>-0,601</td>
<td>0,549</td>
<td>79,00</td>
</tr>
<tr>
<td>Ano 2017</td>
<td>t de Student</td>
<td>-1,777</td>
<td>0,079</td>
<td>79,00</td>
</tr>
<tr>
<td>Ano 2018</td>
<td>t de Student</td>
<td>1,199</td>
<td>0,234</td>
<td>79,00</td>
</tr>
<tr>
<td>Ano 2022</td>
<td>t de Student</td>
<td>1,274</td>
<td>0,207</td>
<td>79,00</td>
</tr>
</tbody>
</table>

Source: Prepared by the author (2023)
The Behavior of the Stocks of Sustainable Companies in the Electric Sector in Relation to B3’s Corporate Sustainability Index

Figure 2: Charts showing comparative profitability for each group

Source: Prepared by the author (2023)

Table 3 - Tests with variables - H0 μ IEE n ISE ≠ ISE

<table>
<thead>
<tr>
<th>Ano</th>
<th>Tipo de Teste</th>
<th>Estatística</th>
<th>p</th>
<th>gl</th>
</tr>
</thead>
<tbody>
<tr>
<td>2013</td>
<td>Shapiro-Wilk</td>
<td>0,871</td>
<td>&lt;0,001</td>
<td></td>
</tr>
<tr>
<td>2017</td>
<td>Shapiro-Wilk</td>
<td>0,557</td>
<td>&lt;0,001</td>
<td></td>
</tr>
<tr>
<td>2018</td>
<td>Shapiro-Wilk</td>
<td>0,930</td>
<td>&lt;0,001</td>
<td></td>
</tr>
<tr>
<td>2022</td>
<td>Shapiro-Wilk</td>
<td>0,947</td>
<td>0,003</td>
<td></td>
</tr>
<tr>
<td>2013</td>
<td>t de Student</td>
<td>0,2994</td>
<td>0,765</td>
<td>75,00</td>
</tr>
<tr>
<td>2017</td>
<td>t de Student</td>
<td>-0,8214</td>
<td>0,414</td>
<td>75,00</td>
</tr>
<tr>
<td>2018</td>
<td>t de Student</td>
<td>0,0380</td>
<td>0,970</td>
<td>75,00</td>
</tr>
<tr>
<td>2022</td>
<td>t de Student</td>
<td>0,7705</td>
<td>0,443</td>
<td>75,00</td>
</tr>
</tbody>
</table>

Source: Prepared by the author (2023)
**Graph 3:** Charts showing comparative profitability for each group

![Graphs showing comparative profitability](image)

**Source:** Prepared by the author (2023)

Assuming that the samples have 11 companies that are in the IEE and are in the ISE (IEE s ISE) and 7 companies that are in the IEE, but are not in the ISE and the ISE has 70 samples, the tendency is that we do not have the normal distribution curve of the elements in the research. As the p-value in all cases of the *Student's* t-test is greater than 0.05 (5%), there was no statistically significant difference between the ISE's EEI groups and the ISE and the ISE's EEI and the ISE, so if we state that the groups are different, the probability of error will be greater than 5% in each of the *Student's* t-tests presented.

From the analysis of the graphs of the distribution of the profitability between the groups, it is noted that the histogram graph is more similar when confronting the EEI groups and SEI groups than the EEI groups in the SEI and SEI. In addition, it is well known that this is a distribution of non-normality of the data, since it is verified that the tails are very heavy and there are deformations in the graphs in relation to what is presented in graphs with normal distribution of values.

As some samples have data with less than 50 companies, the statistical test indicated is *Shapiro-Wilk* to determine whether the distribution is normal or if the distribution is not normal, according to Neves (2019). After the *Shapiro-Wilk* tests, a small p-value was suggested, lower than 0.05 and thus violates the assumption that there is normality in the distribution of data, according to Aslam (2019).

Therefore, the discussions of the tests and the results will be carried out starting from the premise that one has an unnormal distribution of the data, through non-parametric distribution tests and, therefore, a correlation matrix will be made. Afterwards, a description and analysis of the results will be made, and some conclusions will be addressed at the end of the research.
4 RESULTS AND DISCUSSIONS

In view of the analysis of the scenario of the non-normal distribution of the data of the samples, the research used non-parametric tests to describe and compare the data of the companies that are in the EEI and ISE concomitantly and the companies that are in the EEI, but are not included in the sustainability index of B3, the ISE.

Table 4 - Spearman Correlation Matrix - IEE s ISE and ISE - Year 2012 month to month

<table>
<thead>
<tr>
<th>Meses de 2022</th>
<th>01/22</th>
<th>02/22</th>
<th>03/22</th>
<th>04/22</th>
<th>05/22</th>
<th>06/22</th>
<th>07/22</th>
<th>08/22</th>
<th>09/22</th>
<th>10/22</th>
<th>11/22</th>
<th>12/22</th>
</tr>
</thead>
<tbody>
<tr>
<td>01/22</td>
<td>-</td>
<td>0.086</td>
<td>-</td>
<td>0.089</td>
<td>0.070</td>
<td>0.063</td>
<td>0.445</td>
<td>0.143</td>
<td>0.205</td>
<td>0.172</td>
<td>0.034</td>
<td>0.063</td>
</tr>
<tr>
<td>02/22</td>
<td>0.086</td>
<td>-</td>
<td>0.044</td>
<td>0.280 *</td>
<td>0.114</td>
<td></td>
<td>0.211</td>
<td></td>
<td>0.176</td>
<td>0.102</td>
<td></td>
<td></td>
</tr>
<tr>
<td>03/22</td>
<td>0.089</td>
<td>0.044</td>
<td>-</td>
<td></td>
<td></td>
<td>0.330 ***</td>
<td>0.371 ***</td>
<td></td>
<td>0.176</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>04/22</td>
<td>0.070</td>
<td>0.280 *</td>
<td>0.114</td>
<td>-</td>
<td>0.063</td>
<td>0.098</td>
<td>0.371 ***</td>
<td>0.176</td>
<td></td>
<td>0.100</td>
<td></td>
<td></td>
</tr>
<tr>
<td>05/22</td>
<td>0.063</td>
<td>0.098</td>
<td>0.330 ***</td>
<td>0.275 *</td>
<td>-</td>
<td></td>
<td>0.393 ***</td>
<td>0.176</td>
<td></td>
<td>0.100</td>
<td></td>
<td></td>
</tr>
<tr>
<td>06/22</td>
<td>0.445 ***</td>
<td></td>
<td>0.211</td>
<td>0.393 ***</td>
<td>-</td>
<td></td>
<td></td>
<td>0.143</td>
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<td></td>
<td>0.176</td>
<td>0.255 *</td>
<td>0.093</td>
<td>0.199</td>
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<td>0.205</td>
<td>0.100</td>
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<td>0.100</td>
<td>0.193</td>
<td>0.042</td>
<td>0.018</td>
<td>0.330 **</td>
<td>0.164</td>
<td></td>
<td>0.172</td>
<td>0.112</td>
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<tr>
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<td>0.112</td>
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<td>10/22</td>
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<td>0.242 *</td>
<td>0.871</td>
<td>0.234 *</td>
<td></td>
<td>0.192</td>
<td>0.157</td>
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<tr>
<td>11/22</td>
<td>0.079</td>
<td>0.299 **</td>
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<td>0.347 **</td>
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<td>0.498 ***</td>
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<td>0.265 *</td>
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Note: * p < .05, ** p < .01, *** p < .001
Source: Prepared by the author (2023)

The first test to try to determine if there is a correlation between the profitability of the companies of IEE s ISE with ISE and of IEE n ISE with ISE was the Spearman correlation, appropriate for research in which the data presents non-normal distribution, as Relaiza et al. (2023). Therefore, through the correlation matrix, one tries to accept the hypothesis of the research objective H1= Sustainable electricity companies have profitability that agree with the ISE companies. Therefore, we did a data bottleneck to know if the profitability of the set of companies of the IEE s ISE are in agreement with the companies of the ISE.

Spearman's correlation matrix points out that, in several months of the year 2012, mainly, the correlation of the profitability of companies that are in the IEE and ISE and of companies that are in the ISE is very strong, therefore, it signals that they are moving in the same direction, in line with the research of Cahan et al. (2015) in which investments in sustainability issues have a direct relationship with the concern that the company has with its business and society and therefore highlights the market harmony between companies in the sustainable electricity sector with the ISE.
Finally, the Friedman test is used to compare the medians of the data collected in the 2013, 2018 and 2022 IEE s ISE, IEE n ISE and ISE groups to determine which medians are closest to each other, through the non-parametric ANOVA (Variance Analysis) test of repeated measurements.

After running the Friedman tests for each predefined group, it is noticeable that the medians of the ISE and IEE s ISE groups approach more closely than the medians of the ISE and IEE n ISE. Therefore, one can accept the hypothesis that sustainable electricity companies have profitability closer to the ISE than companies that are outside the ISE, in line with the results obtained by Duda et al. (2022), Wang & Sarkis (2017), and therefore increases the good image that society has of the company, mainly referring to the electricity sector that serves as the basis for all other companies of Brazilian industry, according to Fatemi et al. (2015).

5 FINAL CONSIDERATIONS

The central objective of the research was to verify whether the set of profitability of the companies in the electricity sector that are in the electric power index of B3 - the IEE - and at the same time in the ISE are converging with the profitability of the whole set of profitability...
of the companies of the ISE and this proof was present when analyzing the medians of the profitability of the groups of companies' shares during the period from 2013 to 2022 to the detriment of the medians of the shares of the electric companies that are not in the ISE.

Furthermore, the profitability of the companies that are in the IEE, but are not in the ISE has moved away from the median of the companies that make up the ISE. Therefore, being in the index that proposes that companies should follow a methodology of corporate sustainability is beneficial in order to follow such profitability and obtain a good image for society.

The research has relevance for the electricity sector, since it links the companies that have the philosophy of sustainability of a sector that is of paramount importance for Brazil and for the world to the sustainability index of B3 and it supports the other companies that are in the same sector to be part of the same index so that they follow the same lines of thinking to obtain the same benefits.

Therefore, the work has a great importance in the sense that new research can be done in the same way, but in other sectors, such as consumption, finance, real estate etc. These sectors also have their indices in B3 and have companies that are in the index corresponding to their sector and are also in ISE. Therefore, new research can be done in order to verify if such companies have profitability that approximates to all companies of the B3's business sustainability index.

Another prominent importance in the research is the fact that the work can serve as a basis for the companies in the electricity sector that are not part of the ISE to be able to attend to the peculiarities of the methodology of the sustainability index of B3 and, thus, to be able to adopt more and more sustainable postures in their business and to integrate into the ISE. It is known that adopting a sustainable culture for companies requires new investments in a series of attitudes and values to be fulfilled and this affects the profits and returns of companies in the short term, but research shows that the fruits are harvested in the long term and adds value to the company in terms of visibility and good image.

However, it can be seen as limitations of this study that the historical series harvested reflect the electricity sector companies that are in the EEI and/or EEI in the mandate from January 2023 to April 2023. Perhaps a new research would be interesting to obtain the profitability of the companies that have passed through the IEE and/or ISE in the years included in the research and to carry out the tests again in order to confirm and/or refine the results of the hypothesis raised.

Another relevant limitation to highlight is that the period during which the pandemic occurred was also taken into account in the calculations of the medians of the groups. It is known that the financial market, including the stock market, exhibited higher volatility in the period of the COVID-19 crisis, and therefore it may be that some profitability may have impaired the more reliable analysis of the data, but this period of crisis was maintained for reasons of profitability variability in a generic way and thus could better represent reality. It is an opportunity for new research to explore the profitability of these groups only in the period in which the pandemic peaked or to remove from the database the profitability of the period in which there was an exacerbated volatility of B3 shares in the period from 2020 to 2021.

However, it would be appropriate to conduct new research on the same lines with no relevant impact on profitability as in a crisis such as the pandemic to determine whether the profitability of the electricity companies in the ISE really follows closely the profitability of the sustainable companies in the group of sustainable companies.

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