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Sustainability in the capital market: a study on the performance of the ISE and the Ibovespa in the Brazilian stock market during the period from 2006 to 2020

Sustentabilidade no mercado de capitais: um estudo sobre o desempenho do ISE e do Ibovespa no mercado acionário brasileiro durante o período de 2006 a 2020

Sostenibilidad en el mercado de capitales: un estudio sobre el desempeño del ISE y el Ibovespa en el mercado de valores brasileño durante el periodo de 2006 a 2020

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PALAVRAS-CHAVE

Mercado de Capitais. Índice de Sustentabilidade Empresarial. Risco e Retorno.

Resumo: Muito se discute a respeito dos impactos das atividades humanas no meio ambiente e sobre a importância da sustentabilidade. Hoje, a sociedade passou a cobrar a responsabilização de empresas e acionistas em relação aos impactos socioambientais e à priorização de investimentos sustentáveis. Este trabalho buscou mensurar o desempenho da carteira teórica do ISE (Índice de Sustentabilidade Empresarial) como forma de verificar se as empresas ativas em práticas sustentáveis apresentam um melhor desempenho, se comparadas às empresas pertencentes ao Ibovespa. Para este fim, foi realizado um estudo de abordagem quantitativa, sendo calculados os indicadores de desempenho das carteiras de Sharpe, Treynor e Modigliani & Modigliani para o ISE e o Ibovespa, durante um período de 15 anos (2006 a 2020). Os resultados mostraram que, no médio prazo, o desempenho do Ibovespa se sobressaiu ao do ISE, mas o mesmo não pode ser afirmado ao se comparar a performance dos índices sob a perspectiva de longo prazo, já que, além de superar o retorno acumulado do Ibovespa, o ISE apresentou menor nível de risco. Desta forma, o presente estudo contribui com a literatura de finanças e sustentabilidade ao trazer

evidências empíricas de que o investimento em ações de empresas pertencentes ao ISE pode oferecer aos investidores maiores retornos e menores riscos no longo prazo, se comparadas ao retorno do Ibovespa. Este estudo ainda mostra que é possível desenvolver estratégias de investimentos que estejam alinhadas às práticas socioambientais, mas que também forneçam uma boa expectativa de retorno aos investidores no longo prazo.

KEYWORDS

Capital market. Corporate Sustainability Index. Risk and Return.

Abstract: *Much is discussed about the impacts of human activities on the environment and the importance of sustainability. Today, society demands that companies and shareholders take responsibility for their social and environmental impacts and prioritize sustainable investments. This study aimed to measure the performance of the theoretical portfolio of the ISE (Corporate Sustainability Index) of the Brazilian stock exchange, as a way of verifying whether companies active in sustainable practices present a better performance, which would be reflected in the returns offered by variations in quotations of their shares. To this end, portfolio performance indicators of Sharpe, Treynor, and Modigliani & Modigliani were calculated using data from a period of 15 years (2006 to 2020). The results showed that in the medium term, the performance of Ibovespa outperformed that of the ISE, but the same cannot be said when comparing the performance of the indices from a long-term perspective, since in addition to surpassing the accumulated return of Ibovespa, the ISE presented a lower level of risk. In this way, the present study contributes to the finance and sustainability literature by bringing empirical evidence that investing in shares of companies belonging to the ISE can offer investors greater returns and lower risks in the long term, when compared to the return on Ibovespa. This study also shows that it is possible to develop investment strategies that are in line with socio-environmental practices, but that also provide a good return expectation for investors in the long term.*

PALABRAS CLAVE

Mercado de Capitales. Índice de Sostenibilidad Corporativa. Riesgo e Regreso.

Resumen: *Mucho se discute sobre los impactos de las actividades humanas en el medio ambiente y sobre la importancia de la sostenibilidad. Hoy, la sociedad ha comenzado a exigir la rendición de cuentas de las empresas y accionistas en relación con los impactos socioambientales y la priorización de inversiones sostenibles. Este trabajo buscó medir el desempeño de la cartera teórica del ISE (Índice de Sostenibilidad Empresarial) como una forma de verificar si las empresas activas en prácticas sostenibles presentan un mejor desempeño, en comparación con las empresas pertenecientes al Ibovespa. Para ello, se realizó un estudio de enfoque cuantitativo, calculando los indicadores de desempeño de las carteras de Sharpe, Treynor y Modigliani & Modigliani para el ISE e Ibovespa, en un período de 15 años (2006 a 2020). Los resultados mostraron que, en el mediano plazo, el desempeño del Ibovespa superó al del ISE, pero no se puede decir lo mismo al comparar el desempeño de los índices desde una perspectiva de largo plazo, ya que, además de superar la rentabilidad acumulada del Ibovespa, el ISE presentó el menor nivel de riesgo. De esta forma, el presente estudio contribuye a la literatura de finanzas y sustentabilidad al traer evidencia de que invertir en acciones de empresas pertenecientes al ISE puede ofrecer a los inversionistas mayores retornos y menores riesgos en el largo plazo, en comparación con el Ibovespa. Este estudio también muestra que es posible desarrollar estrategias de inversión que estén alineadas con las prácticas socioambientales, que también brinden una buena expectativa de retorno a los inversionistas en el largo plazo.*

Introduction

The United Nations World Commission on Environment and Development (WCED) defines sustainable development as “the ability to meet the needs of present generations without compromising those of future generations” (WCDE, 1987). The first initiatives in investments based on sustainability and social responsibility date, according to Caplan, Griswold and Jarvis (2013), from the colonial period in the United States of America (USA), when some religious groups refused to invest part of their donation in slave market activities. However, it was only in the 1960s and 1970s that environmentally and socially responsible investments began to take shape.

In the current century, with the sustainability agenda on the rise, society has started to demand more responsibility from companies in dealing with global problems, such as social inequality and climate change, in addition to demanding accountability from shareholders for the socio-environmental impacts of companies. With that, the financial sector started the debate on socially responsible investments.

Socially Responsible Investments (SRI) are, according to Fernandes and Linhares (2017), investment strategies that consider, along with economic and financial analyses, environmental, social and corporate governance performance factors. The SRI seek to build a portfolio based on the negative screening of stocks and companies, removing from the portfolio those industries and companies that do not follow the ethics that this type of investment preaches.

With the advancement of SRI, another approach has emerged: impact investing. Contreras-Pacheco, Avella and Pérez (2017) define SRI as the profitable application of financial resources in business initiatives, aimed at the sustainable development of a

society. This subsequently led to one of the most relevant styles of sustainable investing. According to Naum (2018), companies considered as examples of sustainable practices, which apply environmental, social, and governance factors (Environmental, Social and Governance - ESG) in their activities, are the best candidates to attract investments.

Paz and Kipper (2016) indicate that the first set of sustainability indicators was launched in 1999 by the New York Stock Exchange: the Dow Jones Sustainability Index – DJSI. Subsequently, other stock exchanges also mobilized and created their own sustainability indices: the London stock exchange created the FTSE4Good (Footsie for Good) in 2001; the Johannesburg Stock Exchange created the Johannesburg Stock Exchange Index (JSEI) in 2003; and in Brazil, the São Paulo Stock Exchange created the Corporate Sustainability Index (ISE) in 2005.

Finally, in 2006, the link between ESG investment and performance was formalized by the United Nations (UN), with the creation of the PRI, which stands for Principles for Responsible Investment, according to Caplan et al. (2013). The PRI's mission is to encourage organizations and managers to engage with the potential of ESG factors in investment analysis.

According to Caplan et al. (2013), most PRI signatories are in Northern Europe, but the USA leads the number of signatures and with the highest rate of growth of adhesions. The principles that the signatories have committed to follow are: (i) Incorporate ESG factors into investment analysis and decision-making processes; (ii) Be proactive and incorporate ESG issues into asset ownership policies and practices; (iii) Encourage disclosure of companies' ESG information; (iv) Promote the adoption and implementation of the principles within the investment sector; (v) Increase effectiveness in implementing the principles; and (vi) Disseminate reports on activities and progress in implementing the principles.

It is also worth mentioning that the PRI have been growing consistently since their inception. In 2020, the document reached the mark of approximately 3000 signatories and about 100 trillion dollars of assets under management (PRI, 2020). In view of this, the numbers show that the principles of sustainability and social responsibility have been consolidated in the capital market. Von Wallis and Klein (2015) argue that investment decisions were based on liquidity, risk, and return, however a growing number of investors have included, in addition to these factors, the issue of sustainability.

In the Brazilian stock market, the ISE has become, in addition to a more responsible investment portfolio, a process of education and dissemination of sustainable practices, as many companies are using the ISE questionnaire as a mechanism for monitoring progress. In addition, the index has the potential to raise foreign investor confidence in the Brazilian market.

Faced with the growth trend of ESG investments and the power of influence of the capital market in promoting sustainable development, the question that motivated this research was the following: Do companies actively involved in sustainable practices, which are concerned with ESG factors in their activities, have a better performance with regard to the growth of their value in the capital market?

Based on this, the objective of this work was to measure and evaluate the performance of the theoretical portfolio of the ISE, for a period of 15 years, regarding the return and risk offered by the shares of companies that compose it, comparing it with the performance of the market portfolio. To this end, the analysis was carried out by dividing the dates into three short periods of five years each, namely: 2006 to 2010, 2011 to 2015, and 2016 to 2020. Furthermore, in order to provide a long-term performance perspective, the ISE

was also evaluated taking into account the entire period analyzed, corresponding to the accumulated returns from 2006 to 2020.

Thus, the research, elaborated in the light of the Sharpe (1966), Treynor (1965), and Modigliani & Modigliani (1997) Ratios, evaluated whether the ISE presented a differentiated performance in the Brazilian capital market in relation to Ibovespa, from its creation until the present moment. The results showed that in general, in the medium term, the performance of Ibovespa outperformed that of the ISE in specific subperiods. However, from a long-term perspective, the ISE presented a lower level of risk and surpassed the return presented by Ibovespa in the accumulated return of the last 15 years. In addition, another result observed was the presence of a more defensive behavior by the ISE, when compared to Ibovespa during the same period.

Therefore, this research contributes to the literature in finance and sustainability by empirically demonstrating that over the last 15 years, investment in shares of companies engaged in sustainable practices and belonging to the ISE offered investors higher returns, with lower risks. Bearing in mind the importance of the theme in the current scenario and the commemoration of ISE's 15th anniversary, it is also hoped that this work may contribute to strengthening the existing relationship between financial and socio-environmental performance, as well as fostering future academic research involving sustainability in the capital market. In addition, it is expected that the results may encourage the adoption of ESG criteria by companies in investment decisions, including medium and long-term perspectives, as adopted in this work.

Theoretical elements of the research

The discussion about sustainability has gained relevance in recent decades and has raised important questions about the impacts of

human activity on the environment. According to Serra, Felsberg and Fávero (2017), the lifestyle of contemporary society can affect the functioning and maintenance of ecosystems, to the point of seriously destabilizing the ecological conditions that support life on Earth.

Due to the challenges of the 21st century, such as the increase in per capita consumption, greater social complexity, and environmental problems on a global scale, Marcondes and Bacarji (2010) state that the integration of sustainability principles in business strategies will be inevitable. For the authors, although a significant part of entrepreneurs and executives see sustainable development as a necessary evil, which entails additional costs for the company, there is a portion of the business community that sees sustainability as a new way of doing business.

According to PwC (2020), as the scale of investment necessary for the transition to a sustainable economy is beyond the capacity of the public sector alone, it is necessary to reposition organizations in this paradigm shift. To do this, managers must carefully consider the role they would like to play and make a clear strategy on how deeply they would like to embed ESG factors in the organization.

Sustainable and responsible investing is a process that combines the investor's financial objectives and concerns with environmental, social, and corporate governance (ESG) factors, whether in investment analysis, asset selection, or shareholding activities. The ESG concept is defined by Liang and Renneboog (2020) as the incorporation of environmental (Environment), social (Social) and governance (Governance) factors in administrative management and investment portfolio decisions. The environmental dimension ("E") measures the impact of the organization's activities on the natural ecosystem and encompasses greenhouse gas emissions, use of

natural resources in the production chain, waste, and pollution. Social issues ("S") refer to the relationships between the organization and its employees, customers, and society. Finally, the authors include in the governance dimension ("G") the rights of shareholders, the functionality of the board of directors, remuneration policies, practices that curb fraud and bribery, in addition to encompassing issues of diversity and social inclusion in the organizations.

The motivations behind incorporating ESG into investment analyzes are influenced at first by more financial than ethical issues, however for Amel-Zadeh and Serafeim (2018), there is considerable variation on this aspect. The motivations are associated with the increased perception by company managers and investors, that the performance of ESG factors can affect the costs and availability of capital. In addition, according to these authors, it can minimize the risks to externalities caused by the companies that most impact the environment.

According to Umlas (2008), investors who incorporate ESG factors into investment decisions tend to be "patient capital", that is, they focus their strategies on the long term. The author also emphasizes the importance of these investments, mainly for emerging countries, which can encourage the creation of non-exploitative jobs, share their benefits with neighboring communities, productive activity that is not environmentally destructive, and so on.

Fernandes and Linhares (2017) also highlight the benefits of investing in ESG companies in emerging countries, due to lower market efficiency in these countries and the importance that ESG companies represent for the economy of these countries. As the governments of these countries do not have sufficient capacity to consistently provide

infrastructure, health, education, among others, companies considered ESG in a way assume the role that the State should play in emerging countries.

B3, the Brazilian stock exchange, currently offers several stock indices, which are classified as: broad, Governance, Segments and Sectors, Sustainability, and in partnership with S&P Dow Jones. According to B3, the main indicator of the Brazilian stock exchange is Ibovespa, which gathers the most liquid companies in the Brazilian capital market, composed of shares and units of shares of companies listed on the stock exchange.

The Corporate Sustainability Index constitutes a tool for comparative analysis of the performance of companies listed on B3, considering criteria of economic efficiency, environmental balance, social justice, and corporate governance. More than its role as a stock exchange index, the creation of the ISE could also mean positive effects on the Brazilian market, as an inducer of sustainability, as pointed out by Marcondes and Bacarji (2010).

Beato, Souza and Parisotto (2009) verified that the ISE was more profitable than Ibovespa in the period from 2006 to 2008. In 2006 the profitability of the ISE ended the year with an increase of 37.82 %, against 32.93 % of Ibovespa. In 2007, Ibovespa showed greater profitability, closing the year with an increase of 43.65 %, against 40.35 % of the ISE. With the 2008 crisis, as expected, the authors found that the indices had negative variations, with the ISE accumulating a drop of 41.09 % and Ibovespa, a drop of 41.22 %. However, even in the face of the international market crises in 2007 and the financial crisis of 2008, the ISE presented a variation of 13.95 % in its profitability, while Ibovespa reached a variation of 12.24 %.

Milani, Righi, Ceretta and Dias (2012)

analyzed the series of daily returns of the Ibovespa, IGC (Índice de Governança Corporativa), IGCT (Índice de Governança Corporativa Trade), ISE and ITAG (Índice de Ações com Tag Along Diferenciado) indices with the aim of comparing the performance of the best practice indices with Ibovespa. The conditional volatility of the differentiated practices indices was significantly lower than the volatility of the Ibovespa index, despite the high correlation of returns. In addition, the Sharpe Ratio demonstrated that the return per unit of risk was superior to the best practice ratios. With this, the authors verified that investments in companies with better practices are less risky and more profitable for the investor.

Cunha and Samanez (2014) considered investments arising from the ESG Incorporation strategy, comparing the performance of the ISE index to the Ibovespa index and the other sectors of the Brazilian stock exchange. To do so, they used liquidity indicators, in addition to the Sharpe, Treynor, Jensen, Sortino, Modigliani & Modigliani and Omega performance Ratios. The authors found that the ISE performed very similarly to that of Ibovespa, but after the 2008 financial crisis, the index showed a slower recovery.

Friede, Busch and Bassen (2015) aggregated evidence from more than 2000 empirical studies in order to analyze the relationship between financial performance and ESG investments. The study found that more than 90 % of the studies analyzed did not find negative results between ESG and financial performance. The most important thing is that of these, the vast majority point to a positive relationship. The authors also reinforce that the long-term responsible investment orientation should be important for all investors, in order to fulfill their fiduciary duties and be aligned with the broader goals of

society.

For Von Wallis and Klein (2015), when analyzing the academic literature on socially responsible investments, there is disagreement regarding the profitability of these investments. The reasons for this disagreement are linked to the different comparison methods, in addition to the choice of performance indicators and benchmarks used for the calculations. However, the authors note that the vast majority of studies indicate a similar performance between socially responsible investments and conventional investments.

Fernandes and Linhares (2017) verified whether investments in shares of companies classified as ESG present superior financial performance than the others. Based on the risk and return ratio of the portfolios, using Jensen's Alpha and the Capital Asset Pricing Model (CAPM), the authors analyzed the portfolios of developed countries and emerging countries. In both groups, the ESG portfolios outperformed the others over the long term. However, the risk-adjusted return was higher only for emerging countries.

Garcia (2017) also analyzed companies from developed and emerging countries, with the aim of measuring the relationship between socio-environmental performance and its relationship with the financial performance of these companies, investigating the circumstances in which it pays to be green. In addition, the author also investigated whether belonging to a stock exchange sustainability index results in better financial and socio-environmental performance. The results indicated that the association is positive only in developed countries; in emerging countries, the relationship is negative between socio-environmental and financial performance in companies. In addition, a company being listed in sustainability indexes does not reflect on its financial performance, although it generates

better socio-environmental performance.

Serra et al. (2017) analyzed the return and risk of the ISE in relation to Ibovespa, taking into account the period from November 30, 2005 to November 30, 2015. The authors concluded that between 2005 and 2010, the indices showed similar return behaviors. As of 2011, when the ISE began to be rebalanced every four months, the average and standard deviation of the ISE were better than Ibovespa. The index also presented lower risks in relation to Ibovespa, throughout the period analyzed in the study.

Vasconcelos, Santos, Marion and Bergmann (2019) analyzed whether Stock Investment Funds and Sustainable Companies provided positive returns in relation to Ibovespa and the ISE, in the period from 2010 to 2016. The authors found that sustainable investments showed defensive characteristics, with returns above the market in times of crisis and below the market in times of economic growth. However, the weight of management fees significantly destroyed the profitability of these investments.

Regarding financial and ESG performance in companies from developed and emerging countries, Garcia and Orsato (2020) found evidence that the institutional environment interferes in ESG performance. In developed markets, the authors observed that there was a positive and significant relationship between financial and ESG performance, as expected by the literature. On the other hand, when analyzing companies from emerging countries, the result was the opposite: the relationship between financial performance and ESG was statistically negative. The authors explain this relationship based on the strength that the institutional environment exerts on company strategies, including in the socio-environmental sphere (Garcia & Orsato, 2020).

More recently, Lucas, Yoshikuni and Di

Agustini (2022) found evidence of the existence of a bidirectional causality between the ISE and Ibovespa indices, suggesting that there is a feedback relationship between these indices, which can assist investors in anticipating events that may impact both, with knowledge of only one. This characteristic can be very useful for risk and loss management in the capital market (Lucas et al., 2022).

In summary, most works (as highlighted by Friede et al. (2015)) point to a non-negative relationship between socio-environmental performance and the performance of the shares of companies active in sustainable practices on the stock exchange. However, it was possible to observe that the divergences regarding the theme in the academic literature are mainly influenced by the comparison methods, such as the analysis performed by Garcia (2017), which examined emerging and developed markets. It should be noted, however, that most studies (Milani et al. (2012), Cunha and Samanez (2014)) took into account the Sharpe Ratio, in addition to taking into account shorter periods of comparison.

Another issue raised by the works is related to risk. Most works point out that investments linked to companies active in sustainable practices are less risky than conventional ones, although there are some variations regarding the results depending on the country analyzed. In addition, the ISE showed a defensive behavior, with a less expressive drop in periods of crisis, despite not reaching the same degree of recovery as Ibovespa in times of economic recovery.

Methodological elements of the research

The objective of this study was to measure and evaluate the performance of the theoretical portfolio of the ISE, over 15 years, in terms of the return and risk offered by the shares of the

companies that make it up, comparing it with the performance of the market portfolio (Ibovespa). To this end, the Interbank Deposit Certificate (Certificado de Depósito Interbancário - CDI) interest rate, which is one of the main benchmarks in the Brazilian financial market, was adopted as the risk-free rate. To measure the performance of the ISE's theoretical portfolio, the Sharpe (1966), Treynor (1965) and Modigliani & Modigliani (1997) Ratios were used. Ibovespa was established as a comparison parameter because it is the main index of shares traded on B3, in addition to corresponding to approximately 80 % of the number of trades and financial volume of the entire Brazilian stock exchange.

Regarding the time considered, firstly analyzes were made from the subdivision into three periods of five years each, namely: 2006 to 2010; 2011 to 2015; 2016 to 2020. The calculations were based on the accumulated ISE and Ibovespa in each of these three subperiods, in addition to the consolidated for the entire accumulated period, in order to provide an analysis from a long-term perspective.

In addition, the monthly return rates were subjected to statistical analysis of dispersion, in order to obtain the standard deviation of the data, used as a measure of risk in the Sharpe and Modigliani & Modigliani Ratios. In order to calculate the beta of the Treynor Ratio, statistical analyzes of the variance of the monthly returns of Ibovespa and the covariance of the monthly returns of the ISE were also necessary.

With regard to the risk-free rate, all the historical series of the CDI were extracted from the electronic portal of B3, with statistical data provided by CETIP (Central de Custódia e de Liquidação Financeira de Títulos Privados). The other indicators were calculated based on adjusted closing data from Ibovespa and ISE,

whose data was collected through the electronic portal of B3.

As for the risk of the portfolios, based on the monthly returns, the annual standard deviations and the respective accumulated returns were obtained. The standard deviation is the risk measure used in the Sharpe and Modigliani & Modigliani Ratios. In order to calculate the risk of the portfolios in the Treynor Ratio, it was necessary to obtain the beta index.

Table 1 summarizes the variables used in the formulas that will be presented next, as well as the necessary calculations to obtain each one and their respective data collection sources.

Table 1
Variables used in the study

Variables	Calculation	Source
R _{fi}	Monthly average returns of the CDI	B3- CETIP
R _{mi}	Monthly average returns of the portfolios: Ibovespa and ISE	B3- Eletronic portal
σ _{pi}	Monthly standard deviation of the returns of the portfolios: Ibovespa and ISE	B3- Eletronic portal
σ _M	Monthly standard deviation of the returns of the Ibovespa portfolio	B3- Eletronic portal
β _i	Covariance of ISE in relation to the Ibovespa portfolio: (ISE; Ibovespa)/ (Variance (Ibovespa))	B3- Eletronic portal

Source: Developed by the authors.

The Sharpe (1966) index was calculated according to Equation 1:

$$IS_i = \frac{(R_i - R_f)}{\sigma_i} \quad \text{[Equation 1]}$$

Where:

IS_i is the Sharpe Ratio of portfolio i ;

R_i is the average return of portfolio i ;

R_f is the return on the risk-free asset;

σ_i is the sample standard deviation of the returns of portfolio i .

The index measures the excess return of the portfolio in relation to the risk-free rate, adjusting it to the total risk of the portfolio. The higher the result, the better the portfolio performance.

The Treynor Ratio is similar to the Sharpe Ratio, but relates the premium solely to the systematic risk measure. While the Sharpe Ratio uses total risk, the Treynor Ratio proposes the risk inherent in assets and influenced by market fluctuations. The calculation of the Treynor (1965) ratio is given by Equation 2.

$$IT_i = \frac{(R_i - R_f)}{\beta_i} \quad \text{[Equation 2]}$$

Where:

IT_i is the Treynor Ratio;

R_i is the return on portfolio i ;

R_f is the return on the risk-free asset;

β_i is the systematic risk of portfolio i .

As with the Sharpe Ratio, the higher the result of the equation, the better the portfolio's performance.

Prior to the calculation, it was necessary to obtain the ISE beta value. For that, the monthly returns of both indices were submitted to statistical analyzes of variance and covariance. Subsequently, the relationship between the covariance of ISE returns and the variance of Ibovespa returns was calculated to obtain the ISE beta value, as shown in Equation 3.

$$\beta = (\text{covar (ISE; Ibovespa)}) / (\text{var(Ibovespa)}) \quad \text{[Equation 3]}$$

Where:

β : the beta of the ISE portfolio;

covar (ISE; Ibovespa): the covariance between the returns of the ISE and Ibovespa portfolios;

var (Ibovespa): the variance of the returns of the Ibovespa portfolio.

The Modigliani & Modigliani (1997) ratio equation, used to measure the performance of the ISE, is presented in Equation 4.

$$IM_i^2 = \frac{\sigma_M}{\sigma_p} (R_i - R_f) + R_f \quad \text{[Equation 4]}$$

Where:

IM_i^2 is the Modigliani & Modigliani Ratio of portfolio i;

R_i is the return on portfolio i;

R_f is the return on the risk-free asset;

σ_M is the sample standard deviation of market portfolio returns;

σ_p is the standard deviation of portfolio returns.

One of the factors that influenced the choice of this index is that, as the Sharpe Ratio is a pure number and the Modigliani & Modigliani measurement unit is a percentage, the M2 analysis is more intuitive. Another factor is the fact that the M2 adjusts the portfolio return with the risk of the most appropriate market segment, which makes the performance comparison between the ISE and Ibovespa more assertive.

Results and discussion

The results section begins with the results obtained for risk and return, which were the basis for calculating the Sharpe, Treynor and Modigliani & Modigliani Ratios. Next, the results obtained for the Sharpe, Treynor, and Modigliani & Modigliani Ratios are presented

and analyzed.

Table 2 displays the annual cumulative return values for Ibovespa and the ISE, based on the cumulative return calculation. It is possible to observe that in the years 2008, 2011, 2014 and 2015, both the ISE and Ibovespa indexes presented negative returns. In 2013, however, Ibovespa presented a negative return of 15.5 %, while the ISE obtained a positive return of 1.94 %.

Table 2
Ibovespa and ISE annual return and risk.

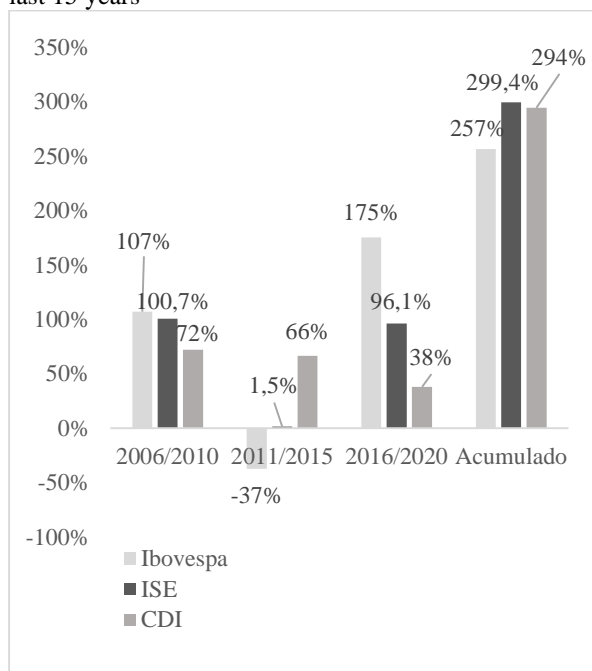
Year	Ibovespa	
	Return	Risk
2006	32,93%	5,92%
2007	43,65%	4,15%
2008	-41,22%	9,47%
2009	82,66%	5,55%
2010	1,05%	5,23%
2011	-18,11%	4,68%
2012	7,40%	5,59%
2013	-15,50%	4,23%
2014	-2,91%	6,18%
2015	-13,31%	5,64%
2016	38,93%	7,85%
2017	26,86%	3,94%
2018	15,03%	6,20%
2019	31,58%	3,40%
2020	3,17%	11,76%

Year	ISE	
	Return	Risk
2006	37,83%	6,43%
2007	40,35%	4,24%
2008	-41,09%	9,97%
2009	66,39%	6,28%
2010	5,84%	4,11%
2011	-3,28%	3,43%
2012	20,49%	3,81%
2013	1,94%	2,91%
2014	-1,94%	4,38%
2015	-12,90%	4,47%
2016	13,79%	5,60%
2017	17,40%	3,38%
2018	9,87%	4,75%
2019	33,19%	4,19%
2020	0,32%	11,29%

Source: Developed by the authors.

From the previous values, the accumulated returns corresponding to the three subperiods, as well as the total period, were obtained. The cumulative return for each of the indices is indicated above the data bars in the three subperiods and in the total period, indicated as “Cumulative” in the figure below (Figure 1). In addition to the results regarding the ISE and Ibovespa, Figure 1 also shows the cumulative values of the ISE, preliminarily highlighting a superior performance of the ISE, as previously reported by Beato et al. (2009) and Milani et al. (2012).

Figure 1
Cumulative return of Ibovespa, ISE and CDI over the last 15 years



Source: Developed by the authors.

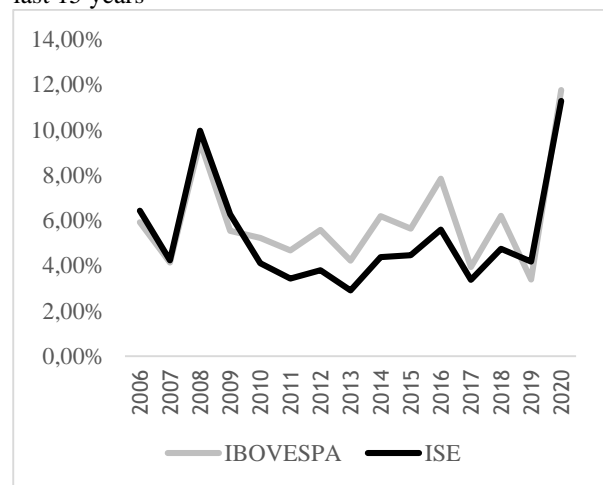
In the first period (2006 to 2010), it is noted that the accumulated return of the ISE was relatively close to that of Ibovespa, both being higher than the ISE. The second period (2011 to 2015) was not satisfactory for Ibovespa, contrary to the ISE, which reached a high of 1.47 %, being however, a much lower

return than the CDI in this period. One explanation for this result is that the analyzed period encompasses years of crisis in Brazil, which significantly negatively affected the Stock Exchange. Finally, the third period (2016 to 2020) is a highlight for Ibovespa, which surpassed the return of the ISE and the CDI.

However, although it did not present a relevant difference in return in the subperiods, in the analysis of the accumulated return, the ISE surpassed the Ibovespa and CDI rates in the last 15 years. This result suggests that in the long term, the ISE portfolio proved to be more interesting, in terms of risk and return, than Ibovespa.

With regard to the risks associated with the indices, to better visualize this information, Figure 2 illustrates the behavior of the standard deviation of the Ibovespa and ISE over the entire period (15 years).

Figure 2
Risk (standard deviation) of Ibovespa and ISE over the last 15 years

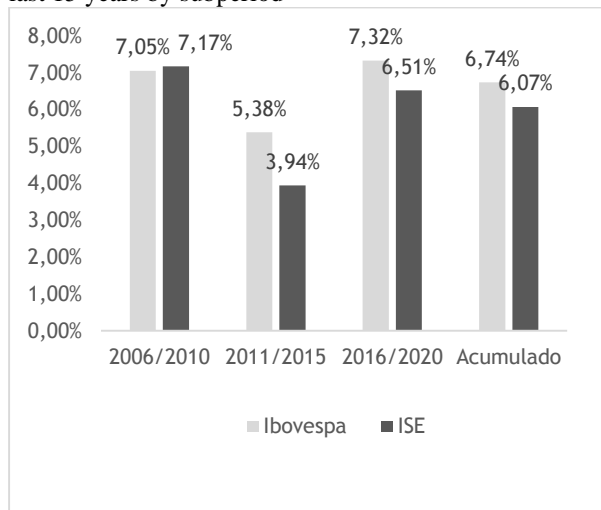


Source: Developed by the authors.

It is possible to observe that the ISE was riskier than Ibovespa in the four years following its launch (2006 to 2009). After this period, the ISE presented a lower level of risk, returning to being a riskier portfolio only in

2019. As shown in the figure below (Figure 3), the same can be observed taking into account the analysis of the accumulated returns of the three subperiods.

Figure 3
Level of risk accumulated by Ibovespa and ISE over the last 15 years by subperiod



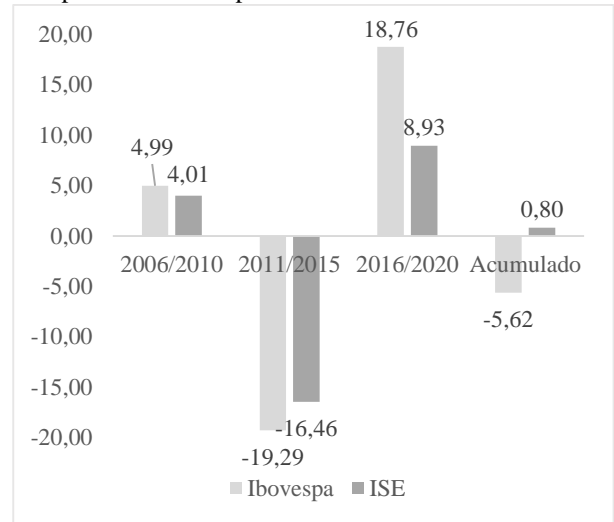
Source: Developed by the authors.

According to Figure 3, the risk level of the ISE was higher than that of Ibovespa only between 2006 and 2010, proving to be a less risky theoretical portfolio than Ibovespa in the rest of the analyzed periods. Under the long-term perspective, represented by the accumulated returns from 2006 to 2020, it is noted that the ISE also presented a lower risk level than Ibovespa, proving to be a less volatile index than the market over the last 15 years.

From the values of accumulated return and standard deviation, the Sharpe, Treynor and Modigliani & Modigliani Ratios were calculated. It is noteworthy that the standard deviation was the risk measure used to calculate the Sharpe and Modigliani & Modigliani Ratios. Therefore, for the Treynor Ratio, in addition to the accumulated returns already presented in this section, it was

necessary to obtain the beta of the ISE portfolio. The results obtained are summarized in Figure 4, in order to facilitate visualization and comparison between them.

Figure 4
Sharpe Ratio- Ibovespa and ISE



Source: Developed by the authors.

In the period 2006/2010, the performance of the ISE accompanied the main stock exchange index, but was moderately lower than Ibovespa. As shown in Table 2, both the ISE and Ibovespa closed 2008 with a drop of around 40 %. In the following year, 2009, Ibovespa achieved a good recovery, reaching an accumulated return of around 83 %. The ISE did not achieve the same recovery as Ibovespa, but closed the year up 66 %.

In the period from 2011 to 2015, marked by the economic and political instabilities of the Lava Jato Federal Police investigation, both indices did not show satisfactory performances. Despite presenting an accumulated increase in this subperiod, the return on the ISE was below the risk-free rate, which explains the negative result for the Sharpe Ratio.

Finally, the last period (2016/2020) was a highlight for Ibovespa, indicating that the

recovery after periods of crisis was slower for the ISE. However, when analyzing the performance of indexes in the long term, represented by the “Accumulated”, the ISE portfolio becomes a more satisfactory option. As the accumulated return of Ibovespa did not exceed the risk-free rate, its negative Sharpe Ratio values indicate that the return was not compensated for the risk assumed by its investors.

Based on one of the assumptions of the Markowitz Theory, that investors will make their investment decisions solely based on risk and return, the performance of the ISE is not as satisfactory as that of Ibovespa, if we consider periods of five years. However, if the investor takes into account the long-term perspective for resource allocation, then in this case, the ISE portfolio becomes a positive differential for the investor, in terms of risk and return.

Subsequently, based on the accumulated beta values, it was possible to calculate the Treynor Ratio. The parameters used were the Ibovespa, ISE and CDI return over the five years of the subperiods analyzed. The results obtained are shown in Figure 5.

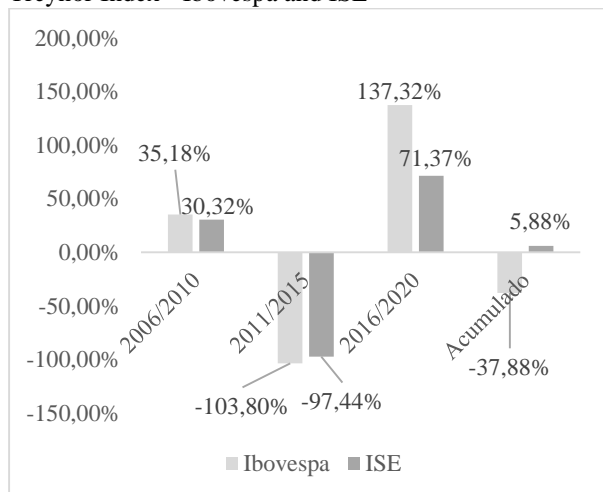
It is possible to observe that the ISE, despite showing a lower performance, was relatively close to Ibovespa in the first subperiod (2006/2010). Between 2011 and 2015, it is noted that the performance of both indexes of the Brazilian stock exchange was not satisfactory, since both presented negative returns. In the last period (2016/2020), there is a significant superior performance of Ibovespa, which reached a Treynor Ratio of 137.32% against 71.37% of the ISE.

Regarding the accumulated period, the ISE portfolio becomes a more advantageous investment option, compared to Ibovespa, as it presented a better performance in the long term. When analyzing indices from a long-term perspective, Ibovespa did not adequately compensate its investors for the level of risk they assumed. What explains this result is the fact that Ibovespa has not surpassed the accumulated return of the CDI in the long term, as shown in Figure 1.

The concept of risk considered in the M^2 index is the standard deviation, however it was necessary to adjust the portfolio risk to the market risk. To this end, the relationship between the risks of the Ibovespa and ISE was calculated, considering the first as market risk, since it is the benchmark of the Brazilian stock exchange. The values obtained are presented in Table 3.

Based on the values of portfolio risk adjusted to market risk, the M^2 index for the ISE was calculated. As Ibovespa is considered the benchmark of the Brazilian stock exchange, for the purposes of comparing the performance of the ISE, the values considered for Ibovespa were its own accumulated returns.

Figure 5
Treynor Index - Ibovespa and ISE



Source: Developed by the authors.

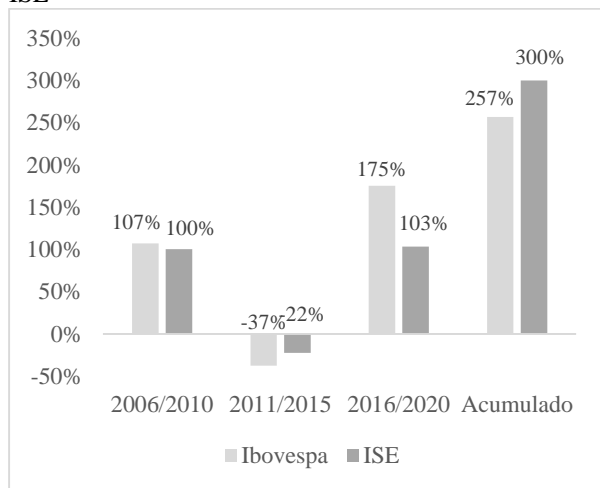
Table 3
Risk measure (M2 Index)

Year	Risk Ibovespa (σ_m)	Risk ISE (σ_p)	σ_m/σ_p
2006	5,92%	6,43%	0,92
2007	4,15%	4,24%	0,98
2008	9,47%	9,97%	0,95
2009	5,55%	6,28%	0,88
2010	5,23%	4,11%	1,27
2011	4,68%	3,43%	1,36
2012	5,59%	3,81%	1,47
2013	4,23%	2,91%	1,46
2014	6,18%	4,38%	1,41
2015	5,64%	4,47%	1,26
2016	7,85%	5,60%	1,40
2017	3,94%	3,38%	1,16
2018	6,20%	4,75%	1,31
2019	3,40%	4,19%	0,81
2020	11,76%	11,29%	1,04

Source: Developed by the authors.

Figure 6 summarizes the values obtained in the analyzed subperiods, as well as the total period.

Figure 6
Modigliani & Modigliani Ratio (M2) - Ibovespa and ISE



Source: Developed by the authors.

From the comparison between the results obtained, it is noted that the index showed the same performance trends verified in the Sharpe and Treynor Ratios. From 2006 to 2010, despite the performance of the ISE being lower

than Ibovespa, the values were relatively close to each other, as highlighted by Cunha and Samanez (2014). The second sub-period (2011/2015) was not satisfactory for both indices, which again presented a negative performance, although the performance of the Ibovespa was even worse, results aligned with Vasconcelos et al. (2019). Finally, the superior performance of the Ibovespa in the last sub-period (2016/2020) could be observed, corroborating what was highlighted by Beato et al. (2009) and Milani et al. (2012), for example.

In general, when analyzing the subperiods, the ISE portfolio does not appear to be a more favorable investment option compared to Ibovespa, according to the Modigliani & Modigliani model. However, the total accumulated results allow us to visualize another perspective. The comparison between the indices shows that the ISE performed better than Ibovespa, when the objective is a long-term strategy analysis. However, additional tests of difference between medians (Wilcoxon sums) were performed comparing the Sharpe, Treynor and Modigliani Ratios of the ISE and Ibovespa and no statistically significant differences were found between the medians, and this can be explained by the number of years analyzed ($n = 15$).

Thus, the results of this research may justify the statement by Umlas (2008) about the fact that investment decisions in companies that present sustainable practices are taken with a focus on long-term returns, from the perspective of investors. Along the same lines, the results also complement the findings of Fernandes and Linhares (2017) and Milani et al. (2012) by presenting empirical evidence that the ISE, in practice, proved to be more profitable and less risky than Ibovespa in the long term, even when analyzing a broader and more diversified historical period than that used in previous research.

Final Considerations

In this work, the performance of the theoretical portfolio of the ISE was measured and evaluated, over the past 15 years (since its creation), in relation to Ibovespa, using the Sharpe, Treynor and Modigliani & Modigliani Ratios. Taking into account the division of time into sub-periods of five years, as well as the consolidation of the entire period, it was possible to compare the performance of the indices from a medium and long-term perspective.

From the results obtained, the same tendency of results between the ISE and Ibovespa was verified in all the approaches used, in the medium and long term. When analyzing the results of the three subperiods, the performance of Ibovespa was more satisfactory than that of the ISE, despite the latter having a lower risk level than the benchmark in two of the three subperiods.

In the 2008 financial crisis, the ISE did not fall with the same intensity as Ibovespa, but in the post-crisis period, the sustainability index presented a slower recovery. The same could be observed during the troubled second period (2011 to 2015), marked by the political and economic instabilities that the country went through. Thus, the results demonstrate a more defensive behavior of the ISE.

However, if in the medium term the performance of Ibovespa outperformed the ISE, the same cannot be said when comparing the performance of the indices from a long-term perspective. In addition to surpassing the accumulated return of Ibovespa, the ISE presented a lower level of risk. With regard to the results obtained in Sharpe, Treynor and Modigliani & Modigliani, the ISE achieved a differential performance when compared with Ibovespa. Based on the long-term analysis, it was possible to conclude that investing in

shares of companies active in sustainable practices offered the investor higher returns, with lower risks.

Even if past results do not guarantee the same future performance, factors related to society, sustainability, and corporate governance have a direct impact on business, especially when poorly managed. Therefore, both organizations and investors can benefit from choosing strategies and investments that take ESG issues into account. The inclusion and good management of these factors reflect on the continuity and security of businesses and investments, which are essential for everyone to obtain good results in the long term, especially in the face of a scenario of social and environmental challenges that society may face in the future.

Finally, the present work presents some limitations and opportunities for future research. Firstly, it should be noted that the results obtained are limited to the Brazilian context and to the period in which the tests were conducted. Therefore, given that the sustainability index analyzed in this work, the ISE, is linked to the Brazilian capital market, the sample used does not allow the results found to be necessarily extended to markets in other countries. Brazil is an emerging country, which has shown a lot of economic volatility in recent decades and which has a capital market that is still quite incipient. Thus, it is not possible to differentiate through the methodology used, other determinants, in addition to the presence of better-defined socio-environmental practices in companies belonging to the ISE, which may also have affected the return of companies in this period. However, as it was not the scope of this research to expand the analysis to other markets, it is suggested that future research compare the performance of companies that are involved in socio-environmental practices, or

linked to some sustainability index, with that of other companies in different countries and economic scenarios.

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