DO THE ESG/SRI INDICES ISE AND IGCT HAVE HIGHER RETURNS AND LOWER RISK THAN IBOVESPA AND IBRX? AN UNADJUSTED AND RISK-ADJUSTED ANALYSIS

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ABSTRACT

Socially Responsible Investments (SRI) are a part of the broader concept of Environmental, Social and Governance (ESG), a set of institutional practices that aggregate the activities of a company with the responsibility with its social and environmental surroundings. Markets and investors are increasingly interested in such good practices that stock exchanges developed indices composed of companies with differentiated initiatives of sustainability and governance (Liang & Renneboog, 2020). This paper aims to investigate whether two of the B3 ESG/SRI indices, ISE and IGCT, outperform in the mean-variance (return and risk) dimension the most famous B3 broad indices, Ibovespa and IBrX. We performed two sets of analysis, an unadjusted and a risk adjusted. The latter consists of parametric and nonparametric tests of equal mean and equal/homogeneity variances to address our research question; the former was performed by a trend model and the CAPM, which allow the examination of abnormal returns as well as the systematic risk of ESG portfolios. Results show that Brazilian ESG/SRI indices are not statistically different from broad indices in returns, i.e., they have, on average, equal means. However, there is evidence that the ESG/SRI indices have a lower idiosyncratic and systematic risk than the Ibovespa and IBrX indices.

Keywords: ESG/SRI Indices. Returns. Risk.

1   Introduction

Socially Responsible Investments (SRI) can be defined as an integrated organizational strategy that combine economic and financial interests with social and environmental issues (Gillan, Koch & Starks, 2021). It is constituted by a bunch of companies that along with their normal activities (production of goods and services), also act on improving the community where they are located (Liang & Renneboog, 2020; Widyawati, 2020). In a broader perspective, one argues that the SRIs are important to a long-lasting economic and social wellbeing, what is discussed in the so-called Sustainable Development Goals (SDG), created in 2015 by the United Nations (UN, 2023).

Public and private companies have been seeking to perform good practices due to the development of different demands from consumers and markets in the direction of a large participation in terms of an efficient use of resources and more a humanized production process (Cunha *et al.*, 2019; Durand, Paugam & Stolowy, 2019). Hence, the SRI is associated with many of the SDGs because companies can drive their social actions in numerous directions. However, it is more directly related to objectives number 8 (decent work and economic growth), 9 (industry, innovation, and infrastructure) and 12 (responsible consumption and production).

Shortly, these objectives promote technological expansion and the necessity of higher quality jobs, infrastructure, and good use of resources as a decisive condition to a Sustainable Development (UN, 2023). We can also mention other objectives, such as gender equality (5), reduced inequalities (10), and climate action (13), as important fields of action for organizations that aim to be considered socially responsible.

The concept of Socially Responsible Investment is part of a broader approach, the Environmental, Social, and Governance (ESG) investing. ESG is a series of procedures and criteria endorsed by investors to evaluate a company or a group as socially and environmentally

responsible, as well as its level of information transparency (Liang & Renneboog, 2020; Gillan, Koch & Starks, 2021; Elouidani, Outouzzalt & El Ouidani, 2022; Meng-Tao *et al.*, 2023).

As demand for this kind of investment increased around the world, financial markets have developed ways to classify companies that claim themselves as sustainable and/or socially responsible (Cunha *et al.*, 2019). Many stock exchanges around the world have created sustainability indices, which can be defined as theoretical portfolios constituted by companies that adopt high levels of transparency and governance and act protecting the environment and improving the development of local communities (Fernandes, Fonseca & Cunha, 2018; Cunha *et al.*, 2019). The pioneers were the Dow Jones Sustainability Index (DJSI) of the New York Stock Exchange (NYSE), the FTSE4Good of the London Stock Exchange, the Corporate Sustainability Index (ISE) created by B3, the Brazilian Stock Exchange, and the JSE SRI Index, created by the Johannesburg Stock Exchange.

The idea behind ESG/SRI indices is the measurement of the average performance of assets and shares of companies that make up their portfolios (Durand, Paugam & Stolowy, 2019; B3, 2023). Theoretically, theses indices should represent better long-term investments since characteristics as social and environmental protection and disclosure, transparency, and governance are associated with higher investors' confidence, higher level of liquidity, lower cost of capital and lower risk (Torres & Enciso, 2017; Ndione, 2020; Liang & Renneboog, 2020; Gillan, Koch & Starks, 2021; Meng-Tao *et al.*, 2023).

Therefore, there are many aspects of investigation regarding the value of sustainable investments and its effects of financial markets and the economy as a whole. One can ask about its consequences on the value of firms, as well as the comparison of companies with good ESG practices with those with a poor ESG performance (Gillan, Koch & Starks, 2021). Another research approach is the investigation of how markets evaluate ESG/ SRI realizations by measures created to summarize them, as sustainable indices, or other potential indicators (Torres & Enciso, 2017; Fernandes, Fonseca & Cunha, 2018).

Our analysis focuses on the second type of investigation, and we try to understand how Brazilian ESG/SRI indices differ in terms of risk and return from the broad indices. In a more formal perspective, we compare them considering the mean-variance domain, which is the base for the portfolio theory, developed by Markowitz (1952), which says that a diversified investor should combine assets that minimize the risk and maximize the return of its portfolio, aiming a positive gain in the future.

In terms of the proposed analysis, one can verify how an ESG/SRI portfolio allow diversification as result of a risk-return optimization. Hence, the contribution of this paper is to assess the concrete situation of ESG/SRI investments in the Brazilian stock market, observing whether they result in better returns and lower risk to investors once they are characterized by deeper levels of disclosure, transparency, and governance.

Therefore, this paper aims to examine, using unadjusted and risk-adjusted methods, the homogeneity in terms of mean (return) and variance (risk) of the Brazilian ESG/SRI indices comparing it with broad indices. Shortly, we want to assess whether the mean and the variance of the returns of the Corporate Sustainability Index (ISE), and of the Corporate Governance Trade Index (IGCT) differ from the mean and variance of the Ibovespa Index and the Brazil Index (IBrX). The following are the hypotheses of this study: *i*) ESG/SRI indices have higher returns than the market in general; and *ii*) ESG/SRI indices have lower risk than the market in general. The following section discusses some of the literature review on ESG and firms'

performance. Then, we discuss the data and the methods adopted in this study. Next, we present our results. The last section brings the main conclusions and limitations of the study.

2   Literature Review

There is an extensive literature on sustainability and social responsibility in many areas. In what regard corporate finance, the main approach is related to the companies' ability to become more valuable while taking ESG/SRI practices such as a higher level of disclosure and acting in the development of local communities, schools, places, forests, etc. (Liang & Renneboog, 2020). Another possible perspective regards the way markets price ESG activities, a phenomenon that differs by country, production sector, ownership characteristics, and other factors (Gillan, Koch & Starks, 2021; Meng-Tao *et al.*, 2023).

The first set of approach focuses on firms' variables and its relation to a proxy for its performance, such as return, value, risk, liquidity, cost of capital, and others. The core of the second type of investigation is the aggregate affiliation of price, volatility, and performance compared to a general measure, such as non-ESG/SRI indices or to its historical realization.

The adoption of sustainability practices gives some degree of visibility to companies regarding financial and accountability transparency, what reflects in investors perceptions, since they can assess those companies as more or less risky (Marcondis & Bacarji, 2010). Moreover, Cheng, Ioannou, and Serafeim (2014) argue that sustainable firms have better performance in terms of risk than non-sustainable firms. Those practices are also related to positive responses and good reporting by the market (Aaron, Mcmillan & Cline, 2012).

Gillan, Koch, and Starks (2021) performed a bibliographic review of ESG in corporate finance. The authors report that, although there is no evidence of a concrete influence of social responsibility on a company's value, ESG disclosure is driven by some characteristics of the market and ownership and is positively associated with value and performance and negatively related to risk or cost of capital, showing that social responsibility can produce good results for a company.

An empirical exercise was performed by Meng-Tao *et al.* (2023) using data on Chinese companies. Their study tried to understand the relationship between ESG disclosure and stock liquidity. The findings also go on the direction of a positive association between good practices and stock liquidity and risk alleviation (idiosyncratic and systematic). However, it is not homogeneous, varying by sector of activity, institutional ownership, geographic location, size, return on assets, profitability, and age. The authors also find that, among the elements of the ESG acronym, governance (G) plays a more relevant role in liquidity, followed by social (S) and then environment (E) (Meng-Tao *et al.*, 2023).

Larrinaga (2023) argues that ESG reports can be just a means of disguising real social and environmental problems. Durand, Paugam, and Stolowy (2019) argues that ESG practices do not impact the price or the trading level of the stocks, but it draws the attention of individual and institutional investors who seek this kind of investment in the long run.

However, ESG or sustainability reporting can generate some advantages for Brazilian companies. Ching and Gerab (2017) argue that the higher the quality of ESG disclosure by a firm, the higher its legitimacy from the investor's perspective. This mechanism occurs through the lens of signaling and stakeholder theories, which reduces the level of information asymmetry.

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In a similar investigation, Crisóstomo, Freire, and Freitas (2020) debate the increasing attention paid to corporate sustainability. They find that ESG performance in Brazil is leading by firms that operate in industries of higher environmental risk. The authors argue that this can be the result of the Brazilian legislation that forces some sectors to compensate for the impacts caused by their activities.

Regarding the examination of market indices, Fernandes, Fonseca, and Cunha (2018) examine the presence of short- or long-term memory in the series of ESG/SRI indices in four countries (Brazil, South Africa, USA, and England). The authors show that sustainability indices around the world do not follow a random walk, i.e., they have some memory, which implies that current prices are influenced by past prices. However, ESG/SRI indices can present a lower variance when compared to broad indices.

Cunha *et al.* (2019) show similar results, indicating heterogeneities in SRI performances in different countries, but offering good risk-adjusting opportunities to investors. Torres and Enciso (2017) find that for the Mexican financial market, the ESG/SRI indices outperform the broad market portfolio in the mean-variance dimension using unadjusted and risk-adjusted measures.

Zou *et al.* (2019) investigate the financial market responsiveness to SRI indices created in Brazil, China, and South Africa. The results of that paper show that companies that are part of an SRI index display positive abnormal returns, but in a heterogeneous manner: the higher performance is more pronounced among firms with higher investments in R&D.

3   Methods

3.1   Data and unadjusted methods

Our data consists of indices' daily prices collected from B3 (Brasil, Bolsa, Balcão), the Brazilian stock exchange. We selected two ESG/SRI indices, the Corporate Sustainability Index (ISE), and the Corporate Governance Trade Index (IGCT), and two broad indices, that represent the financial market, Ibovespa Index, and the Brazil Index (IBrX).

For Ibovespa and IBrX data ranges from January 1998 to December 2022. For ISE, it ranges from November 2005 to December 2022. For IGCT data begins in December 2005. The period coverage is full of macroeconomic occurrences that caused some impact on the financial market, such as the subprime crisis in 2008 and the Covid-19 pandemic in 2020-21 (Figure 2).

Our main variable is the daily return of the price of the index. We calculated the returns by taking the natural logarithm of prices as displayed in equation 1. This represents the rate of change in a continuous basis which we chose due to the considerable number of observations we have.

$$R_t = ln\left(P_t/P_{t-1}\right) \tag{1}$$

Where: R_t is the return in day t; P_t the price of the index in day t; and P_{t-1} is the price of the index in day t-1.

The analysis consists of testing whether the mean and the variance of the ESG/SRI indices (ISE and IGCT) statistically differ from the mean and the variance of the broad indices. We do such procedure under the hypothesis that ESG/SRI indices offer higher levels of return (mean) and a lower level of risk (variance).

After analyzing the normality of the returns (Jarque-Bera test), we used a parametric *t-Student* test and a non-parametric Wilcoxon test for equal means (μ) under the following test of hypothesis. We compared each ESG/SRI index with each broad index at a time.

$$H_0: \mu_{ESG} = \mu_{Mkt}$$

$$H_1: \mu_{ESG} \neq \mu_{Mkt}$$

As we did for the mean, we performed a parametric F test and a non-parametric homogeneity Levene test for the variance of the returns to understand whether there is a difference between the degree of risk of a sustainable portfolio and a non-sustainable portfolio. Both tests consider the ratio of the variances and verify if it is statistically equal to one. We reproduce the test of the hypothesis as follows.

$$H_0: \sigma^2_{ESG} = \sigma^2_{Mkt}$$

$$H_1: \sigma^2_{ESG} \neq \sigma^2_{Mkt}$$

3.2 Regression analysis and risk adjusted methods

To investigate the growth behavior of the prices of the indices, we performed a trend analysis as the one represented in Equation (2). This would allow us to examine how their prices change over time. We used the natural logarithm of the price to rescale it and better compare the results for each index.

$$\ln (P_{i,t}) = b_{0,i} + b_{1,i}t + \varepsilon_i \tag{2}$$

Where: $P_{i,t}$ stands for the price of index i in day t; $\beta_{0,i}$ is the intercept; $\beta_{1,i}$ is the trend coefficient; t is trend variable (days); and ε_i is the residual term.

With the model represented in Equation 2 we can test the hypothesis of equal values for $b_{1,i}$ comparing the ESG indices with the broad indices, i.e., H$_0$: $b_{1,ESG} = b_{1,Mkt}$. It allows the examination of how equally or differently indices' prices increase over time, which is also a crude way to perceive ESG performance in a mean-variance perspective.

In general, financial decisions are based on risk-adjusted measures, which means the level of return an asset or a portfolio can provide related to its level of risk. One of the ways to do such an analysis is considering a pricing model. As Torres and Enciso (2017), we run a regression based on the Capital Asset Pricing Model (CAPM) that associates the excess of returns of a portfolio to its risk premium.

Equation 3 shows the model considered. Arbitrarily, we used the return of the savings rate, the simplest investment in Brazil, as a proxy for the risk-free asset. In general terms, it provides a remuneration of 0,5% per month. The model consists of a directly confrontation between the ESG indices and the broad indices, and the analysis resides on the investigation of a statistically significant alpha, indicating the existence of potential abnormal returns on ESG, and also whether the beta (systematic risk) is equal or different from 1, i.e., if the ESG index level of risk differs from the market as whole (H$_0$: $\beta = 1$).

$$R_{ESG} - R_f = \alpha + \beta(R_{Mkt} - R_f) + \varepsilon \tag{3}$$

Where: R_{ESG} is the returns of the ESG index; R_f is the return of the risk-free asset; R_{Mkt} is the return of the broad index; α is the intercept, which in financial terms configures a performance measure called Jensen's alpha; β is the systematic risk; and ε are the residuals.

4 Results

4.1 Descriptive statistics

Figure 1 displays the series of prices of the investigated indices. It shows the daily evolution of Ibovespa and IBrX from 1998 to 2022. Data for ISE and IGCT starts in 2005. Due to many factors such as amount of negotiation, number of assets in the theoretical portfolio, existence, popularity, etc., Ibovespa shows a higher-level price performance.

Visually, it also seems to have a greater level of variance compared to the other indices. IBrX has some price evolution characteristics with Ibovespa, since it is a broad index, composed of the 100 most valued companies. For this reason, it appears to respond with less intensity to economic crises such as the 2008-2009 subprime and the Covid-19 pandemic in 2020-21.

Due to differences in the scales (levels of prices) and the fact that they are more recent indices, one barely sees oscillations in the evolution of ISE and IGCT in Figure 1. We perform the analysis of the returns bellow; however, it is worth noting that the ESR/SRI indices are also impacted by externalities. The remaining question is whether these economic effects on intensity differ from the effects on the broad indices.

Figure 1: Evolution of the prices of B3 broad indices, Ibovespa and IBrX, and the ESG / SRI indices, ISE and IGCT, from 1998 to 2022
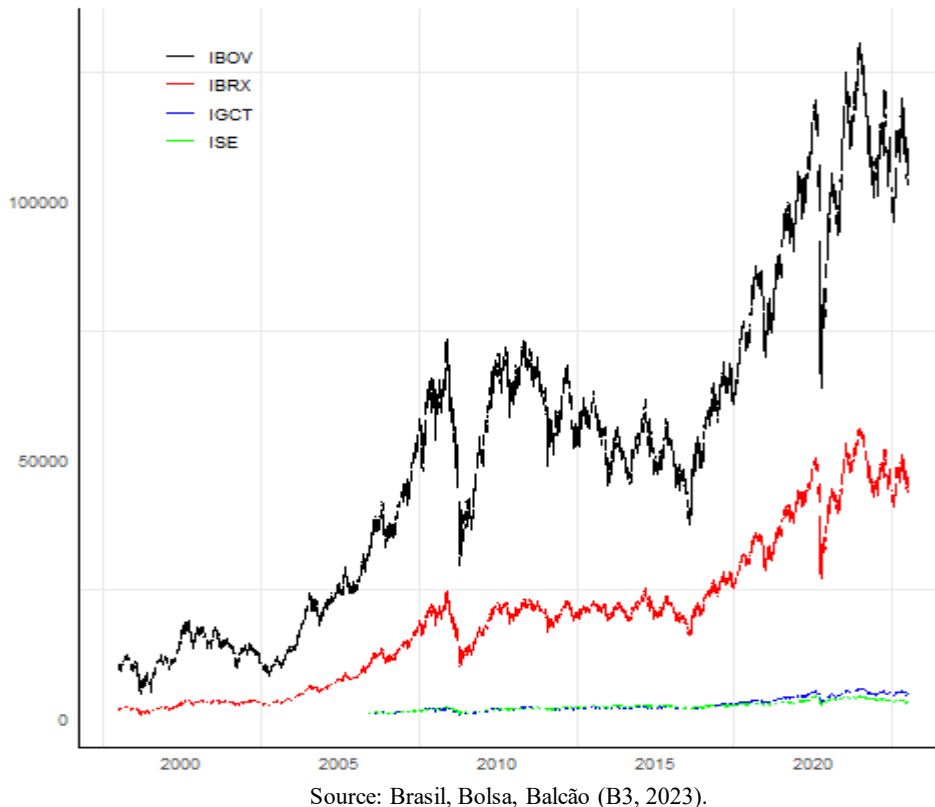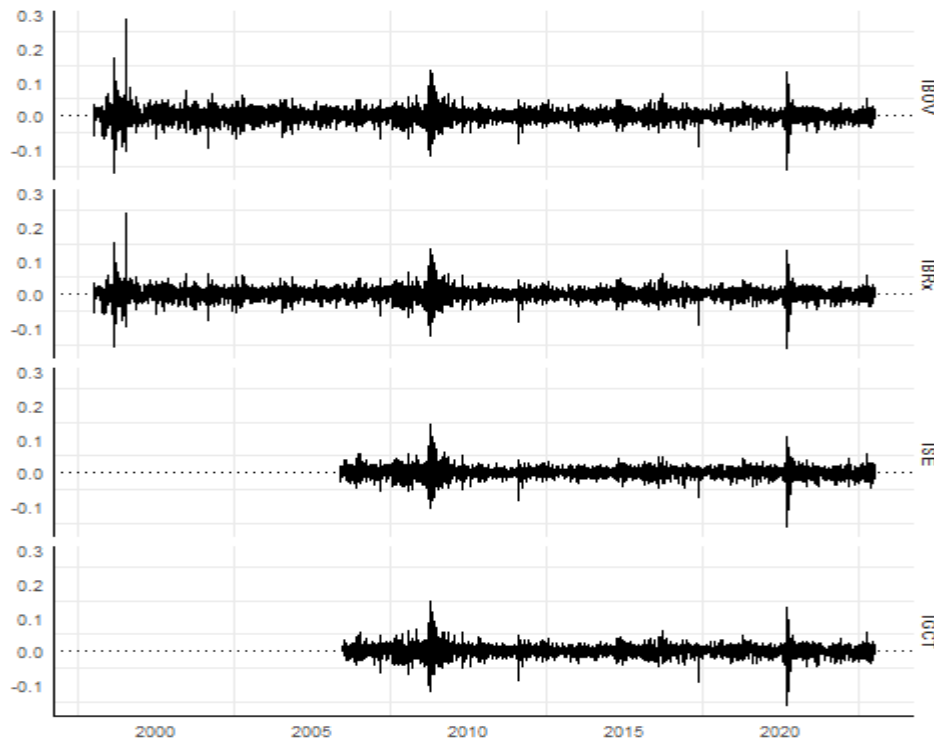

Source: Brasil, Bolsa, Balcão (B3, 2023).

Figure 2 shows the daily returns of the indices, calculated from their prices according to equation 1. From this perspective, we can observe that all for indices have in common time behavior, which would be something like a random walk, except for the fact that they are clearly affected by period of crisis.

Figure 2: The evolution of returns of broad indices, Ibovespa and IBrX, and ESG/SRI indices, ISE and IGCT, from 1998 to 2022

Source: Brasil, Bolsa, Balcão (B3, 2023).

However, their variances seem to be constant in the long term. Again, it remains to be seen whether their variances differ from each other. Before addressing that, we discuss some other data characteristics. Table 1 displays descriptive statistics of prices (panel A) and returns (panel B) of the indices investigated. The table corroborates the differences in scale among the index's prices: while Ibovespa has average price higher than 50.000 points, IBrX does not reaches 20.000 points. ISE and IGCT have average values at the level of 2.500.

Prices also have a different spectrum of ranges. Ibovespa is much more volatile than the others, which can be interpreted as a first indication that ESG/SRI indices are less risky than market values. However, we must perform a further analysis to confirm this. The other values presented in panel A of Table 1 allow us to argue that prices are not normally distributed, since, all indices, they are slightly asymmetric to the right (skewness > 0,03) and platykurtic (kurtosis < 0).

Most analysis in finance use returns as the main variable. Panel B of Table 1 shows that the returns of the indices do not differ much in absolute values. However, again Ibovespa has a higher standard deviation, while ISE and IGCT seem to vary in a lesser extent.

Since we aim to compare the mean and variance of the returns, we tested whether they are normally distributed because parametric equal mean and variance tests assume normality. According to the p-values of the Jarque-Bera test, we must reject the null hypothesis that the returns of the indices follow a normal distribution. For this reason, we also run the Wilcoxon nonparametric test for equal mean and the nonparametric Levene variance normality test. We discuss the results in the next section.

Table 1: Descriptive statistics of prices and returns of Brazilian broad indices, Ibovespa and IBrX, and ESG/SRI indices, ISE and IGCT, 1998-2022

	Ibovespa	IBrX	ISE	IGCT
Panel A: Prices				
n	6,187	6,187	4,226	4,205
Mean	51,954.45	19,523.89	2,463.06	2,697.07
Standard Deviation	31,898.96	14,315.62	810.47	1,291.64
Median	52,806.22	19,858.69	2,371.22	2,139.94
1st quartile	21,531.47	5,872.37	1,923.51	1,870.94
3rd quartile	67,729.41	24,535.19	2,960.09	3,546.61
Skewness	0.4436	0.6485	0.4126	0.8801
Kurtosis	-0.6314	-0.4154	-0.5150	-0.5022
Maximum	130,776.27	56,006.73	4,399.74	5,910.71
Minimum	4,760.58	923.41	974.44	846.42
Panel B: Returns				
Mean	0.0004	0.0005	0.0003	0.0004
Standard Deviation	0.0195	0.0179	0.0160	0.0168
Median	0.0008	0.0008	0.0005	0.0007
1st quartile	-0.0095	-0.0083	-0.0076	-0.0078
3rd quartile	0.0109	0.0100	0.0086	0.0092
Skewness	0.2315	0.0067	-0.4580	-0.4478
Kurtosis	14.7390	13.5216	10.8113	10.9617
Maximum	0.2882	0.2412	0.1449	0.1496
Minimum	-0.1723	-0.1612	-0.1587	-0.1618
Jarque-Bera (p-value)	0.0000	0.0000	0.0000	0.0000

Source: Brasil, Bolsa, Balcão (B3, 2023).

4.2 Mean and variance differences in ESG/SRI indices

Although we have evidence that the returns are not normally distributed, we chose to perform and show the results of parametric tests of equal mean and variance. Table 2 shows the results for the mean. We took each ESR/SRI index and compared it with each of the broad indices (Ibovespa and IBrX) under the null hypothesis of equal mean.

Panel A of Table 2 displays the results of the parametric *t-Student* test. For all comparisons there is no evidence that the mean returns of ESG/SRI indices are statistically different from the returns of broad indices. The same conclusion is taken when analyzing the results of the Wilcoxon test, we do not reject the null hypothesis of equal mean. It has some implications for the examination of the performance of ESG/SRI portfolios: some evidence suggests that there is a positive effect on the value of the firms that take ESG actions, others say the contrary (Gillan, Koch & Starks, 2021).

This result indicates that ESG/SRI practices do not influence the returns of Brazilian firms and, further, that they are like those of the market as a whole. Since, sustainability and governance imply disclosure, transparency, and other good practices that are values by investors, one would expect higher levels of returns of the so-called green investments (Gillan, Koch & Starks, 2021).

Now we discuss whether the risk of ESG/SRI indices is equal to the ones of the market. Table 3 shows the results of the F-test for equal (panel A) and greater (panel B) variance, and the non-parametric Levene' test (panel C). Observing the column of the ratio, we see that the returns of the broad indices have higher variance (> 1) than the ESG / SRI indices in all comparisons. In the first panel we reject the null hypothesis of equal variance.

Table 2: Parametric and non-parametric tests for equal mean (returns) between Brazilian broad indices, Ibovespa and IBrX, and ESG/SRI indices, 1998-2022

	Broad index mean	ESG/SRI index mean	Statistic	P-value	95% inf. CI	95% sup. CI
Panel A: *t-Student* test						
Ibovespa *VS* ISE	0.0004	0.0003	0.3078	0.7582	-0.0006	0.0008
IBrX *VS* ISE	0.0005	0.0003	0.6828	0.4948	-0.0004	0.0009
Ibovespa *VS* IGCT	0.0004	0.0004	0.0048	0.9962	-0.0007	0.0007
IBrX *VS* IGCT	0.0005	0.0004	0.3569	0.7212	-0.0006	0.0008
Panel B: Wilcoxon test						
Ibovespa *VS* ISE	-	-	13,156,458	0.5566	-	-
IBrX *VS* ISE	-	-	13,232,522	0.2744	-	-
Ibovespa *VS* IGCT	-	-	13,014,958	0.9363	-	-
IBrX *VS* IGCT	-	-	13,082,478	0.5962	-	-

Source: Brasil, Bolsa, Balcão (B3, 2023).

Panel B corroborates the finding that ESG/SRI practices result in a lower variance of the returns, i.e., lower risk levels. Levene's nonparametric test indicates the same thing, rejecting the hypothesis of homogeneous variances (just marginally in the comparison between IBrX and IGCT).

This result also has implications for the analysis of socially responsible investments, since its assumed higher level of disclosure and transparency is directly related to a higher level of certainty in what is expected of these firms. It follows international evidence that ESG/SRI practices reduce the risk and firm's cost of capital which increases investor's confidence as discussed by Gillan, Koch and Starks (2021).

Table 3: Parametric and non-parametric tests for comparison of variances (risk) of Brazilian broad indices, Ibovespa and IBrX, and ESG/SRI indices, ISE and IGCT, 1998-2022

	Ratio	Value	P-value	95% inf. CI	95% sup. CI
Panel A: F-test for equal variance					
Ibovespa *VS* ISE	1.4753	1.4753	0.0000	1.3957	1.5590
IBrX *VS* ISE	1.2417	1.2417	0.0000	1.1747	1.3121
Ibovespa *VS* IGCT	1.3394	1.3394	0.0000	1.2670	1.4155
IBrX *VS* IGCT	1.1273	1.1273	0.0000	1.0663	1.1913
Panel B: F-test for higher variance					
Ibovespa *VS* ISE	1.4753	1.4753	0.0000	1.4082	-
IBrX *VS* ISE	1.2417	1.2417	0.0000	1.1852	-
Ibovespa *VS* IGCT	1.3394	1.3394	0.0000	1.2784	-
IBrX *VS* IGCT	1.1273	1.1273	0.0000	1.0759	-
Panel C: Levene's test for homogeneity of variance					
Ibovespa *VS* ISE	-	94.1060	0.0000	-	-
IBrX *VS* ISE	-	57.0140	0.0000	-	-
Ibovespa *VS* IGCT	-	27.9780	0.0000	-	-
IBrX *VS* IGCT	-	9.6621	0.0019	-	-

Source: Brasil, Bolsa, Balcão (B3, 2023).

4.3 Risk adjusted results

Table 4 shows the results of the regression models for the trend of the logarithm of the prices of the indices. Panel A shows that the four indices have a statistically significant positive trend coefficient (b), which means that, although at low values, the prices of the four indices present a long-term growth trend.

Table 4: Model for the trend of the natural logarithm of the Brazilian broad and ESG/SRI indices' prices, 1998-2022

	Ibovespa	IBrX	ISE	IGCT
Panel A: Trend **model**				
Intercept	6.6121	4.1475	4.8963	3.9496
	(0.0226)	(0.0244)	(0.0182)	(0.0235)
Trend (b)	0.0003	0.0004	0.0002	0.0002
	(0.0000)	(0.0000)	(0.0000)	(0.0000)
Panel B: Test of equal trend coefficients (H_0: $b_{ESG} = b_{Mkt}$)				
F (Mkt = Ibovespa)			7,184.02	546.72
P-value			0.0000	0.0000
F (Mkt = IBrX)			27,742.56	7,493.73
P-value			0.0000	0.0000

Standard errors in parenthesis.
Source: Brasil, Bolsa, Balcão (B3, 2023).

Even though all indices exhibit an increasing behavior over time, there is evidence that the ESG/SRI indices do not follow the same rhythm as observed in Ibovespa and IBrX. Panel B of Table 4 shows that we reject the null hypothesis of equal coefficients for ISE as well as IGCT using Ibovespa or IBrX as the market reference. This result implies, by the value of the estimated parameter (b_{ESG}) that the ESG/SRI indices have a lower long-term trending characteristic compared to the broad indices.

Table 5 displays the results of the regressions that represent the CAPM model, which associates the risk premium of an asset or portfolio with the market risk premium. Here, we evaluate the premiums of the ESG/SRI indices against Ibovespa's (Panel A) and IBrX's (Panel B) risk premiums, investigating the level of the systematic risk and the potential existence of abnormal returns. We considered a risk-free rate of 0,5% per month (0,017% per day).

Table 5: CAPM regression model for Brazilian ESG/SRI indices, 2005-2022.

	ISE	IGCT
Panel A: Ibovespa as market portfolio		
Intercept	0.0000	0.0001
	(0.0001)	(0.0001)
Beta	0.8674	0.9467
	(0.0047)	(0.0028)
F (H_0: Beta = 1)	781.83	351.50
P-value	0.0000	0.0000
Panel B: IBrX as market portfolio		
Intercept	-0.0001	0.0000
	(0.0001)	(0.0000)
Beta	0.9040	0.9823
	(0.0045)	(0.0025)
F (H_0: Beta = 1)	451.74	49.28
P-value	0.0000	0.0000

Standard errors in parenthesis.
Source: Brasil, Bolsa, Balcão (B3, 2023).

In both cases, ISE and IGCT, we cannot observe a significant intercept (Jensen's alpha), which implies that ESG/SRI indices do not show persistent abnormal returns with Ibovespa or IBrX as the market portfolio. However, there is evidence of significant betas, i.e., the systematic risks are statistically different from zero. They are different from 1, which means that the ESG/SRI indices are less risky than market portfolios.

This analysis corroborates the unadjusted one, reinforcing that sustainable investments do not outperform general investments in term of returns, but they are better in terms of risk measures, i.e., they can offer less uncertainty to investors. When we compare ISE and IGCT levels of systematic risk (Table 5), we see that ISE seems to be less volatile than IGCT and both of than have risks closer to IBrX than to Ibovespa.

5 Conclusions

Environment issues, social responsibility, and corporate governance are subjects that are increasingly taking the attention of companies, governments, and individuals due to the necessity of an efficient and respectful use of natural and social resources (UN, 2023). Therefore, terms such as sustainability and Socially Responsible Investments (SRI) are gaining some space in economic and financial discussions (Liang & Renneboog, 2020; Ndione, 2020; Widyawati, 2020).

Stock exchanges have developed measures to publicize companies' good practices and to incorporate them into the day by day of negotiations. Investors, in their turn, price those practices in the long term (Durand, Paugam & Stolowy, 2019). The most common market indicator for environmental, social, and governance (ESG) and SRI practices are the indices, such as the Corporate Sustainability Index (ISE) created by B3 in Brazil or the Dow Jones Sustainability Index (DJSI) of the New York Stock Exchange (NYSE).

This paper aimed to evaluate the performance of two Brazilian ESG/SRI indices, ISE (sustainability) and IGCT (governance) compared to the two main broad indices, Ibovespa and IBrX, in the mean-variance domain. We used a risk-unadjusted procedure testing the hypothesis that the ESG/SRI indices have the same mean (returns) and the same variance (risk) as the market as a whole. We also performed a risk-adjusted method, running regression models for price trending and for the observation of abnormal returns and the level of systematic risk in ESG/SRI portfolios. This analysis implies a deep understanding of how the market value all the criteria (disclosure, governance, etc.) imposed upon the so-called green companies.

Our results show that ESG/SRI indices do not have statistically different returns from the broad indices, which could imply that those good practices do not produce higher values for firms or portfolios that is composed by such firms, as discussed by Fernandes, Fonseca, and Cunha (2018) and Gillan, Koch, and Starks (2021). However, ESG/SRI returns have lower variance and lower systematic risks that is, they have low levels of risk, perhaps due to the higher degree of transparency. There is no evidence of abnormal returns.

One of the main implications of this result is the possible mismatch between the expenses taken by firms to frame on ESG/SRI requirements and the lack of result on its value or on the returns to its shareholders. It raises the following questions: *i*) Are ESG/SRI investments a real thing or just an empty label? and *ii*) How serious and consistent are the criteria that companies are subject to constitute ESG/SRI indices in the Brazilian stock exchange? Further investigation should address these issues to provide a better understanding of the role of sustainability and governance indices in financial markets.

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