CORPORATE SOCIAL RESPONSIBILITY AND FIRM PERFORMANCE: A CASE STUDY FROM THE BRAZILIAN ELECTRIC SECTOR

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ABSTRACT

Research on the outcomes of Corporate Social Responsibility (CSR) on firm performance has gained much interest in recent years, reflecting the investors' growing awareness of social, environmental, ethical and corporate governance issues. The literature in this field, though vast, is littered with contradictory evidence. In addition, most studies lack a coherent set of metrics to assess CSR. Using a differentiated approach, in which firms' social responsibilities are evaluated within a multidimensional framework considering information from their social annual reports, this paper extends the understanding of the relationship between CSR and firm performance by providing empirical evidence of a positive association between these variables in the Brazilian electric sector during the years of 2009 to 2012.

KEYWORDS. Brazilian Electric Market. Portfolio Formation. Portfolio Performance Analysis.

Paper topics. Financial Management

1. Introduction

Researchers have long argued that corporate responses to environmental issues should be kept at the minimum level required. However, in recent decades, this view has come under increasing criticism. Business firms, whose only concern was once considered to increase their profits, now play a greater role in many aspects of our lives. Not only have such firms incorporated a range of environmentally friendly technologies and processes, but they have also engaged in activities traditionally regarded as governmental. Corporate involvements in public health, education, social security, and the protection of human rights, as well as cooperation with non-governmental organizations (NGOs) and nonprofit organizations (NPOs), are common examples of these companies' efforts to become more socially responsible.

Society as a whole is also changing the way companies' performances are assessed. As the emphasis of Corporate Social Responsibility (CSR) becomes more widely accepted, the general public starts to make decisions based on criteria that include ethical concerns, such as environmental protection and employee wellbeing. Different stakeholders, including customers, suppliers, employees, communities, investors, and activist organizations, have all started to question companies' ethics and responsibility towards society and local communities. Governments, in turn, apart from their general competencies in setting the policy framework, are further called upon to recognize firms' positive attitudes towards the environment, either by granting tax relief or tax advantages or by backing low-interest loans or initiating public-private partnerships.

More recently, as increasing stakeholder pressure has required companies to be transparent, Corporate Social Responsibility Disclosure (hereafter CSRD) has been perceived as a tool of a firm's increasing transparency and credibility in financial markets. Even though no framework for nonfinancial reporting has risen to the level of International Financial Reporting Standards (IFRS), many publicly traded companies now voluntarily disclose relevant information on governance, environmental and social responsibility. Regarding this matter, the Global Reporting Initiative's (GRI) Framework, a reporting system that enables all companies and organizations to measure, understand and communicate Environmental, Social and Corporate Governance (ESG) information, is considered as a benchmark for CSRD. The GRI Sustainability Reporting Guidelines, currently in its fourth generation, offer reporting principles, standard disclosures and an implementation manual for the preparation of sustainability reports by organizations, regardless of their size, sector or location. Finally, the utmost reference concerning ESG disclosure is Bloomberg's ESG data system. Since 2009, Bloomberg Finance has uploaded company ESG data to its financial service platform. Corporate ESG data is typically released through annual corporate sustainability reports. Bloomberg currently provides data on more than 120 ESG key performance indicators for approximately 5,000 publicly listed companies globally, and is increasing coverage every day.

In recent years, environmental issues and CSR disclosures have also become important in emerging markets. For instance, in Brazil, most major companies now have a department of corporate social responsibility and seek to link their social and environmental responsibilities to their core business. In the readers' prize for sustainability reporting that is awarded by the Global Reporting Initiative (GRI), Brazilian companies captured eight out of 24 nominations and two of eight prizes in 2008.

Civil society and the media in Brazil also address the topics of corporate responsibility and sustainability. Public opinion surveys conducted over the past decade at the request of the Brazilian Ministry of Environment (MMA) suggest that Brazilians lead in their concern about environmental issues, with over 90% perceiving air pollution, climate change, biodiversity loss or water availability as serious problems – at least 30 percentage points more than the international average [Brazil 2012]. With regard to Brazilian financial markets, much has been achieved as well. In July 2013, the Brazilian Mercantile, Futures and Stock Exchange (BM&FBOVESPA) approved its own sustainability policy, consisting of market, environmental, social, and corporate governance initiatives. In addition, by May 2012 over 75% of the top 100 BM&FBOVESPA companies had already been publishing CSR reports on an annual basis [BM&FBOVESPA

2013]. Despite BM&FBOVESPA's efforts to foster CSRD in Brazil, problems of low comparability between reports of different companies have been observed. The Brazilian electric sector could be an exception to this issue, since the disclosure of their social reports is regulated by the Brazilian National Agency for Electricity (ANEEL), which determines the use of the Brazilian Institute of Social and Economic Analysis (Ibase) model as standard.

Although debate about CSR and ESG data has continued to grow, we remain a long way from consensus about their effects on a firm's financial performance in capital markets. The literature in this field is vast but littered with contradictory evidence. In this context, and considering the important role Corporate Social Responsibility has taken in the Brazilian financial market, this paper aims to propose a coherent set of metrics to assess CSR in Brazil and to investigate whether it has established a relationship with firms' financial performance in the Brazilian electric sector in recent years.

Besides this introduction, where we stated the main reasons and objectives of this work, this paper consists of four other sections. Section 2 presents the theoretical background of the research. Section 3 discusses the methodology and the metrics we use in our experiments. Section 4 reports and discusses the results. Finally, Section 5 summarizes the results with the aim of offering conclusions and proposals for future papers.

2 Theoretical background

2.1 CSR outcomes on firm performance: opposing views

The idea of social responsibility dates back centuries. For generations, religious investors have avoided partnering or investing with those who earned their money through alcohol, tobacco, weapons or gambling. Formal or scholarly writing on this subject, however, is largely a product of the 20th century.

From the very start of the discussions, two conflicting visions have shaped thoughts about the outcomes of CSR on firm performance: [Friedman's 1970] shareholders theory, which states that a firm's only social responsibility is to increase its profits, and [Freeman's 1984] stakeholders theory, whose core idea is that organizations managing their stakeholder relationships effectively will survive longer and perform better than those organisations that do not. Friedman's argument is partially sound. Certainly, adopting CSR principles involves costs, which might be short term in nature or continuous outflows. In addition, it can be argued that when competitive corporations maximize profits, production is achieved as efficiently as possible, yielding maximum welfare for society. On the other hand, the assumptions underlying Freeman's stakeholder theory are rooted in the concepts of the "unavoidability of normative conformity with the social environment" [Palazzo & Scherer 2006]. Although this may look as bringing to surface moral factors, the key point of the underlying rationale is that CSR is indeed a necessity, not a choice. In other words, since corporations operate within the boundaries of society of which they are an integral part, it is conceptualized that they depend upon society for their continuity and growth.

At the end of the day, the fundamental distinction between the two visions is that, under the shareholder theory, nonshareholders can be viewed as "means" to the "ends" of profitability whilst under the stakeholder theory, the interests of many nonshareholders are also viewed as "ends".

As the concept of social responsibility became popular over the years and with the conflicting views of the above-mentioned theories triggering discussions about the legitimacy and value of corporate responses to CSR concerns, a wide range of studies have investigated the relationship between CSR and financial performance (FP). In this context, a specific body of literature emerged in the 1980s to shed light on the financial performance of the so-called "socially responsible portfolios," which incorporate ESG criteria into the investment process. The studies of [Anderson & Frankle 1980] and [Rudd 1981] are considered to be seminal works in this field. The former compared portfolios composed of the securities of socially disclosing firms to those of assets of non-disclosing firms, concluding that social disclosure has information content, which the market values in positive terms. The latter, on the other hand, investigated the

financial performance of several portfolios formed on the basis of screening strategies, which basically consist of excluding companies from investments because of their involvement in certain activities deemed to be negative (negative screening); or supporting companies involved in projects with a positive social or environmental impact (positive screening). [Rudd 1981] stated that those strategies bias portfolios, as they exclude securities and force concentration into other assets. Under the same reasoning, [Grossman & Sharpe 1986] added that any constraint imposed on a selection of assets would only reduce or maintain investors' maximum possible utility. However, it should be stated that the sole use of screening strategies on portfolios is not a proper way to assess the relationship between ESG and financial performance, as sustainable portfolios have a clear disadvantage in terms of asset allocation compared to other types of portfolios. Instead, comparisons should be made between portfolios of equivalent systematic risk, as outlined in [Anderson & Frankle 1980].

2.2 CSR and Financial Performance: The Brazilian Case

Much of the empirical work concerning socially responsible investments and financial market behavior in Brazil has focused on the Brazilian Corporate Sustainability Index (ISE). Based on best practices of corporate governance, economic efficiency, social justice and environmental equilibrium, the ISE was launched in December 2005, being the fourth index of this kind in the world, following the Dow Jones Sustainability Index (DJSI), the FTSE4Good and the Johannesburg Sustainability Index (JSE). The ISE reflects the return of a portfolio composed of stocks of a maximum of 40 companies selected on the basis of sustainability guidelines. Major recent contributions regarding the ISE performance can be found in the works of [Vives & Wadha 2012], [Ortas et al. 2012] and [Cunha & Samanez 2013]. [Vives & Wadha 2012] analyzed the conditions that make for effective sustainability indices in promoting capital market development and responsible practices, concluding that the ISE plays a major role in the development of sustainability in Brazil, not only by enhancing the interest of asset managers in sustainable investments, but also by serving as a reference guide for the initiation and development of sustainability practices. [Ortas et al. 2012] analyzed the ISE financial performance comparing it to the Bovespa Index (IBOVESPA), inferring that investing in the ISE does not result in a risk or return disadvantage in bullish market periods. However, during the last financial crisis, the index became riskier than its official benchmark, given that the former includes companies affected to a large extent by fluctuations, whereas the latter includes more stocks in other "sin" sectors that are not affected to the same extent. [Cunha & Samanez 2013] assessed the ISE performance during the period from December 2005 to December 2010, comparing it to the IBOVESPA and to other BM&FBOVESPA sectoral indices, suggesting that although sustainable investments have presented some interesting characteristics, such as increasing liquidity and low diversifiable risk, they did not achieve satisfactory financial performance in the analysis period.

In this work, the relationship between socially responsible investing and financial performance is re-examined using a different approach in the Brazilian electric sector, in which firm's social responsibilities are evaluated within a multidimensional framework considering information from their social annual reports. We expect that our findings will contribute to a better understanding of these issues in contemporary Brazil.

3 Methodology

3.1 Data Envelopment Analysis

The first step of this work consists of selecting, among all Brazilian publicly traded electric companies, those with the best ESG practices. Moreover, we also consider different groups of companies, ranked according to their performances in terms of CSR. To do so, we make use of a multidimensional approach, commonly referred to as Data Envelopment Analysis (DEA), in which different ESG criteria serve as the bases of comparison. Since its genesis until today, DEA has been markedly developed in both theoretical innovation and practical applications. Nevertheless, the conventional Constant Returns to Scale (CRS) and Variable

Returns to Scale (VRS) models are the two prevailing assumptions in the literature. They are briefly described in the following lines.

The first model was introduced by [Charnes et al. 1978] and marked the birth of DEA. The model, also known by the authors' initials – CCR - considers constant returns to scale (CRS), whereby an increase in inputs results in a proportionate increase in output levels. However, depending on the problem specification, one can expect that an increase in inputs may not result in a proportional change in outputs. To circumvent this problem, [Banker et al. 1984] proposed the BCC/VRS model under the assumption of variable returns to scale. The BCC model was originally developed by adding a convexity restriction to the CCR formulation, thus generating a variable returns to scale (VRS) frontier. To do so, a new variable is added to the objective function: u_o, if input-oriented, or v_o, if output-oriented. Three ranges can be distinguished within the efficient frontier: increasing ($u_o < 0$), constant ($u_o = 0$) and decreasing ($u_o > 0$) returns to scale. With increasing (decreasing) returns to scale, an increase in input levels leads to a higher (lower) increase in output levels. The multiplier form of the BCC/VRS model can be written as below:

$$\begin{aligned}
&\text{Max } E_o = \left(\sum_{j=1}^{s} \mu_j y_{jo}\right) + u_o \\
&\text{s.t.} \\
&\sum_{i=1}^{m} v_i x_{io} = 1 \\
&\sum_{j=1}^{s} (\mu_j y_{jk} + u_o) - \sum_{i=1}^{m} v_i x_{ik} \leq 0, \\
&k = 1, 2, \ldots, o, \ldots n \\
&\mu_j, v_i \geq 0, \quad \forall\ i, j \\
&u_o \text{ unconstrained in sign}
\end{aligned}$$

(input-oriented)

$$\begin{aligned}
&\text{Min } \left(\sum_{i=1}^{m} v_i x_{io}\right) + v_o \\
&\text{s.t.} \\
&\sum_{i=1}^{m} \mu_j y_{jo} = 1 \\
&\sum_{i=1}^{m} (v_i x_{ik} + v_o) - \sum_{j=1}^{s} \mu_j y_{jk} \leq 0, \\
&k = 1, 2, \ldots, o, \ldots n \\
&\mu_j, v_i \geq 0, \quad \forall\ i, j \\
&v_o \text{ unconstrained in sign}
\end{aligned} \qquad (1)$$

(output-oriented)

In this study, we opt for the output-oriented version of the BCC/VRS model to represent our ESG performance ranking problem. This is mainly justified by the input and output variables selected in the analysis, as section 4.2 shows.

3.2 Portfolio Formation

After assessing companies' ESG performances based on their DEA efficiency values, three distinct groups are formed in each year of the analysis period: a first group comprising firms with the best ESG practices, i.e. with the highest DEA efficiencies (mostly above 90%); a second group including companies with the lowest efficiency values; and a last group which encompasses all firms that did not produce any social reports during the years of the analysis. Upon completion of this process, we proceed to portfolio formation. At this stage, four different portfolios are formed for each group, which makes a total of 12 portfolios per year of the analysis. In the first class of portfolios (Portfolios A), the weights of each firm are proportional to their DEA efficiencies within each group, except for the third group, where all firms participate with the same weights on the portfolio formation. In the second case (Portfolios B), all firms within each group receive the same weights, i. e. the process is identical to the third group formation in the first case. Portfolios C, in turn, are minimum-variance portfolios, which aim to find the asset combination offering the lowest possible risk levels within each group and Portfolios D are maximum Sharpe portfolios, whose objective is to find optimal weights that maximize the Sharpe ratio — a performance index proposed by [Sharpe 1966] measuring the risk-adjusted excess return of an asset or a portfolio over its benchmark. Additionally, for the last two cases (Portfolios C and D), we also impose a special restriction in which all firms are forced to participate with a minimum percentage of 2,5% on each group portfolio formation. This not

only contributes to the reduction of the portfolio's diversifiable risk, but also allows for a better understanding of the relationship between ESG factors and portfolio financial performance, as restricted portfolios better represent their group overall performance.

In this work, the standard deviation based on historical stock returns is used to gauge the risk of individual assets and portfolios. The expected return of a portfolio *p* of *N* assets can be computed as follows:

$$\mathrm{E}(R_p) = \overline{R_p} = \mathrm{E}\left(\sum_{i=1}^{N} W_i \times R_i\right) = \sum_{i=1}^{N} W_i \times \mathrm{E}(R_i) = \sum_{i=1}^{N} W_i \times \bar{R}_i \,. \qquad (2)$$

where W_i and R_i correspond respectively to the weights and returns of individual assets within the portfolio. Hence, the variance of a portfolio can be stated as follows:

$$\sigma_p^2 = \mathrm{E}\left(R_p - \overline{R_p}\right)^2 = \mathrm{E}\left(\sum_{i=1}^{N} W_i \times R_i - \sum_{i=1}^{N} W_i \times \bar{R}_i\right)^2 . \qquad (3)$$

For a portfolio of *N* assets, it can be shown that:

$$\sigma_p^2 = \sum_{i=1}^{N} W_i^2 \sigma_i^2 + \sum_{i=1}^{N} \sum_{\substack{j=1 \\ j \neq i}}^{N} W_i W_j \rho_{i,j} \sigma_i \sigma_j \,, \qquad (4)$$

where $\rho_{i,j}$ denotes the correlation between assets *i* and *j* while σ_i and σ_j represent their standard deviations, respectively. In matrix form, equation (4) can be written as below:

$$\sigma_p^2 = \boldsymbol{W}' \boldsymbol{\sigma}_{i,j} \boldsymbol{W} \,, \qquad (5)$$

where $\boldsymbol{W}$ is the vector of assets' weights within the portfolio, $\boldsymbol{W}'$ is the transposed form of $\boldsymbol{W}$ and $\boldsymbol{\sigma}_{i,j}$ corresponds to the portfolio's variance-covariance matrix.

The next equation shows the linear programming problem to be solved to compute the optimal weights of Portfolios C (minimum-variance portfolios), according to [Markowitz's 1952] portfolio theory:

$$\begin{aligned} &\text{Min } \sigma_p^2 = \boldsymbol{W}' \boldsymbol{\sigma}_{i,j} \boldsymbol{W} \\ &\text{s.t. } \textstyle\sum_{i=1}^{n} W_i = 1 \\ &W_i \geq 0{,}025, \quad \forall\, i = 1, \ldots, n \end{aligned} \qquad (6)$$

As already mentioned, the above formulations aim to minimize the total dispersion of returns, gauged here by the standard deviation. Equation (7) below, on the other hand, shows the formulation of the maximum Sharpe ratio portfolios (Portfolios D), whose goal is to maximize their risk-adjusted excess return over their benchmark [Sharpe 1966], here represented by the risk-free rate:

$$\begin{aligned} &\text{Max IS} = \frac{\mathrm{R_p} - \mathrm{R_f}}{\sigma_p} \\ &\text{s.t. } \textstyle\sum_{i=1}^{n} W_i = 1 \\ &W_i \geq 0{,}025, \quad \forall\, i = 1, \ldots, n \end{aligned} \qquad (7)$$

where $\mathrm{R_p}$ is the return of the portfolio and $\mathrm{R_f}$ corresponds to the risk-free rate.

After having obtained the optimal weights of each portfolio, the returns and standard deviations can be computed using equations (1) and (5), respectively. With these values, we can calculate the Sharpe ratio of all portfolios in each ESG performance group, for further comparative purposes. Finally, we also compute the beta of each portfolio, a measure of its overall market risk. Basically, the higher the portfolio's beta, the more exposed it is to market changes. The beta of a portfolio is calculated as follows:

$$\beta_p = \boldsymbol{W}\boldsymbol{\beta} = \sum W_i \, \beta_i \,, \qquad (8)$$

where β_i is the individual beta of the i[th] asset of the portfolio which, in turn, is defined as below:

$$\beta_i = \frac{\text{cov}(R_i, R_m)}{\text{var}(R_m)} = \frac{\sigma_{i,m}}{\sigma_m^2}, \quad (9)$$

where *m* refers to the market portfolio, gauged here by its proxy, the IBOVESPA index. In this work, however, assets' betas are estimated by the values of the slope coefficients of their daily returns ($R_{i,t}$) on the market portfolio returns ($R_{m,t}$), according to the following equation:

$$R_{i,t} = \alpha_i + \beta_i R_{m,t} + \epsilon_{i,t}. \quad (10)$$

3.3 Portfolio Assessment

In this last stage, comparisons among different group portfolios and between portfolios and the IBOVESPA, ISE and IEE indices are made on the basis of five different criteria: the Sharpe ratio, the Treynor's measure, the Jensen's measure, the Sortino's ratio and the Omega ratio. These measures are briefly described below.

3.3.1 Sharpe Ratio (ShR)

As already mentioned, the Sharpe ratio [Sharpe 1966] represents the differential return of a portfolio by unit of total risk, as shown in Eq. (11):

$$ShR_{(p)} = \frac{R_p - R_f}{\sigma_p}, \quad (11)$$

where R_p is the portfolio's return; R_f is the risk-free return; and σ_p is the standard deviation of the portfolio's returns.

3.3.2 Treynor Ratio (TrR)

The Treynor ratio [Treynor 1965] represents the differential return of a portfolio by unit of systematic risk, i.e. its beta (β_p):

$$TrR_{(p)} = \frac{R_p - R_f}{\beta_p}. \quad (12)$$

3.3.3 Jensen Ratio (JnR)

The Jensen's measure [Jensen 1968], sometimes referred to as "Jensen's alpha", in its turn, represents the average return on a portfolio over and above that predicted by the capital asset pricing model (CAPM), given the portfolio's beta and the average market return, according to the following equation:

$$JnR_{(p)} = R_p - [R_f + \beta_p(R_m - R_f)], \quad (13)$$

where R_m represents the market portfolio.

3.3.4 Sortino Ratio (SoR)

The Sortino's measure [Sortino & Price 1994] is similar to the Sharpe and Treynor ratios, in the sense that it calculates the premium ($R_p - R_f$) per unit of risk. Conversely, instead of using the portfolios's standard deviation (σ_p) or its beta (β_p), the Sortino ratio is computed using the downside risk (σ_{DR_i}), which only considers the portfolio's probability of incurring a return inferior to that acceptable by the investor (R_{min}). Thus, the ratio is computed as follows:

$$SoR_{(p)}(R_{min}) = \frac{R_p - R_f}{\sigma_{DR_i}}. \quad (14)$$

3.3.5 Omega Ratio (Ω)

The Omega measure [Keating & Shadwick 2002] is a function of the portfolio's return, and is calculated by dividing the probability of obtaining a return superior to a minimum expected return (R_{min}) by the probability of obtaining a return inferior to the same R_{min}, as shown in Eq. (15):

$$\Omega_{(p)}(R_{min}) = \frac{\int_{R_{min}}^{b} [1 - F(x)]\, dx}{\int_{a}^{R_{min}} F(x)\, dx}, \qquad (15)$$

where $F(x)$ is the cumulative distribution function of the portfolio's returns defined by the interval [a,b].

4 Results and discussion

4.1 Sample

Originally, all Brazilian publicly traded electric companies were included in the analysis, i.e. those listed on the Brazilian stock exchange. No distinction was made regarding companies' specific functions, such as generation, transmission or distribution. An extensive list of those companies can be found at the BM&FBovespa portal (http://www.bmfbovespa.com.br/). The initial sample comprised 67 firms. However, since some of these companies were only traded on the over the counter market (OTC) during the years of portfolio formation (2009–2012), the sample size was reduced to a total of 36 firms, with 21 of them releasing annual reports on a regular basis.

4.2 ESG Performance

For each year of the portfolio formation period, specific data about the companies were collected to calculate the desired ESG performance indicators, which later served as the basis of comparison in the DEA models, i.e. the input and output variables. They are as follows:

- Inputs: Ratio between net annual revenue and total expenditure in environmental activities (NAR/Totex) - *Input* 01.
- Outputs: Environmental Disclosure Score (EDS) - *output* 01; Social Disclosure Score (SDS) - *output* 02; and Corporate Governance Disclosure Score (CGDS) - *output* 03.

The ESG composite disclosure scores, calculated by Bloomberg ESG, are principally based on GRI standards and reflect companies' efforts to become more socially responsible and to disseminate their outcomes to the general public. The scoring methodology is completely transparent on the system, and the disclosure of all data fields would give a company a perfect score of 100. It is also worth noting that data points are weighted differently by sector and decimal numbers may be used. Despite disclosure and consistency challenges, ESG performance has become so sufficiently widespread that its analysis is valuable to long-term investors across all sectors, giving companies a compelling reason to increase their ESG data collection and reporting efforts. Even so, since ESG disclosure scores are more concerned with capturing the breadth of reporting rather than the quality of reported information, we also include the total expenditure in environmental activities (Totex) as an important factor to measure companies' efforts to become more socially responsible. In addition, since inputs in DEA models follow "the less the better rule" when assessing companies' performances, Totex is used as the denominator of the NAR/Totex ratio, the only input in this work. In other words, should concerns towards the environment be embedded in a company's culture, its NAR/Totex ratio is expected to be lower than the average for its competitors.

In this work, it is assumed that producing more outputs, i.e. having higher ESG disclosure scores, is more essential than reducing the input variable. There are several reasons that support this argument: first, there is only one input in the model and it only addresses one specific point of the ESG factors, while ESG disclosure scores encompass almost all companies' efforts to become more socially responsible; secondly, there is a certain limit to which a company can reduce its NAR/Totex ratio, while ESG disclosure scores may vary greatly throughout the years depending on a company's budget; and finally, emphasizing on ESG performance

indicators allows firms to separate assignments strategies more effectively rather than by focusing on reducing the NAR/Totex ratio. On these grounds, an output-oriented version is preferred. With regard to the returns to scale, according to [Hollingsworth & Smith 2003], to ensure that comparisons among DMUs are made by interpolation only, ruling out unfeasible extrapolations, the BCC specification is required whenever data are in the form of ratios rather than absolute numbers, as in this case (NAR/Totex ratio). In addition, it can be argued that items on corporate social reports may be fairly heterogeneous and sometimes weakly related and, for this reason, that some requirements are easier to meet than others. Finally, difficulties in increasing ESG perfomance may vary greatly across firms, depending on their activities. For these reasons, a BCC/VRS model was used to measure the productive efficiency of DMUS.

Although the initial sample comprised 21 firms releasing annual reports on a regular basis, some of them did not disclose all the required information to obtain the input and output variables in all years of the analysis period. Therefore, the final sample encompassed 20 firms for the year of 2009, 21 for 2010, 18 for 2011 and 12 for 2012. All calculations were made using the 3.0 version of the ISYDS® (Integrated System for Decision Support) software package [Meza et al. 2005]. The entire sample as well as the DEA efficiency results for the years of 2009 to 2012 are presented in Table 1, as follows.

Table 1 Initial sample and DEA results

CSS*	2009	2010	2011	2012	CSS	2009	2010	2011	2012
CEEB3	1.000	1.000	1.000	1.000	ELET3	0.825	0.819	0.863	1.000
CELP3	0.745	0.681	0.715	-	ELPL3	0.872	0.932	0.962	0.936
CEPE3	1.000	1.000	1.000	1.000	ENBR3	1.000	1.000	1.000	1.000
CESP3	0.779	0.860	0.985	0.945	ENGI3	0.600	0.574	0.650	-
CLSC3	0.961	1.000	0.940	1.000	EQTL3	-	0.923	0.660	0.788
CMGR3	0.700	0.725	0.744	-	GETI3	0.723	0.760	0.834	0.936
CMIG3	0.890	0.913	0.934	0.913	GPAR3	0.825	0.692	-	-
COCE3	0.810	1.000	-	-	LIGT3	0.925	0.830	0.908	-
CPFE3	0.984	0.908	0.908	0.957	REDE3	0.781	0.761	-	-
CPLE3	1.000	0.846	1.000	1.000	TBLE3	1.000	1.000	1.000	1.000
EKTR3	0.976	0.961	1.000	-					

*CSS denotes the common stock symbol of the company. AELP3, AFLT3, AFLU3, CBEE3, CEBR3, CEED3, CSRN3, EEEL3, EMAE3, ENEV3, ENMA3B, GEPA3, LIPR3, RDTR3, TRPL3 did not present any social reports during the analysis period. Source: Made by the authors.

4.3 Data Handling and Portfolio Performance

In addition to the information gathered from the selected firms' annual social reports, daily closing quotations of firms' stock prices for the years of 2009 to 2012 were also collected from the BM&FBOVESPA website. In total, 51 stocks, comprising common and different classes of preferred stocks, as well as units, were used in portfolio formation. The prices were adjusted for splits, reverse splits, dividends, mergers and other corporate events in accordance to the standards of the Center for Research in Security Prices (CRSP). In order to save space, formulas and methodologies used to derive the adjusted prices are not explained here. Finally, the price returns time series were generated from the adjusted prices by making use of a differentiation mechanism.

After the data handling, a total of 12 portfolios were formed per year of the analysis - four for each ESG performance group. Portfolios classes and groups are explained in details in section 3.2. The performance results of each group portfolio in terms of Sharpe, Treynor and Jensen's measures are illustrated in Table 2. For robustness check, three different cases were proposed for the Sharpe and Treynor ratios: first, calculations were made using the market

portfolio itself as a benchmark. Then, the risk-free rate was represented by either the annual savings rate (ASR) or the interbank deposit rate (CDI).

Irrespective of scenario, the best results were achieved in the first group portfolios, followed by those from the second group. With regard to the Jensen ratio, the same pattern could be observed for portfolios A to C, with the first group offering higher excess returns, followed by the second group.

Table 2 Sharpe, Treynor and Jensen's measures (whole period)

	ShR			TrR			JnR	
	IBOV-based	ASR-based*	CDI-based*	IBOV-based	ASR-based	CDI-based	ASR-based	CDI-based
IBOV	0.000	0.215	0.098	0.000	0.054	0.025	0.000	0.000
IEE	0.251	0.605	0.413	0.099	0.239	0.163	0.071	0.053
ISE	0.338	0.589	0.453	0.091	0.158	0.122	0.083	0.077
Portfolios A								
1st group	-0.084	0.240	0.064	-0.072	0.206	0.055	0.029	0.006
2nd group	-0.187	0.133	-0.041	-0.118	0.084	-0.026	0.008	-0.013
3rd group	-0.199	-0.104	-0.155	-2.708	-1.415	-2.117	-0.061	-0.089
Portfolios B								
1st group	-0.146	0.176	0.001	-0.128	0.154	0.001	0.019	-0.004
2nd group	-0.160	0.149	-0.019	-0.107	0.100	-0.013	0.012	-0.010
3rd group	-0.199	-0.104	-0.155	-2.708	-1.415	-2.117	-0.061	-0.089
Portfolios C								
1st group	-0.051	0.441	0.174	-0.040	0.352	0.139	0.041	0.016
2nd group	-0.151	0.267	0.040	-0.098	0.172	0.026	0.024	0.000
3rd group	-0.387	-0.073	-0.243	-0.794	-0.149	-0.499	-0.017	-0.044
Portfolios D								
1st group	0.836	1.191	0.998	0.709	1.010	0.847	0.170	0.146
2nd group	0.655	0.953	0.791	0.486	0.708	0.588	0.158	0.136
3rd group	0.321	0.457	0.383	2.980	4.235	3.554	0.179	0.151

*ASR: Annual Savings Rate; CDI: Interbank Deposit Rate. Source: Made by the authors.

Table 3, in turn, shows the results for each group portfolio in terms of Sortino and Omega ratios. Concerning the first measure, the results clearly indicate higher premiums per unit of downside risk for the first and second group portfolios when the threshold is 0% or less, suggesting that these groups present lower probabilities of large losses. Conversely, should the minimum acceptable rate of return be 2%, the situation is reversed, although there is very little significant difference among groups at this threshold. With regards to the Omega ratio, the best results for thresholds lower than 0% were achieved in the second group portfolios for cases A and B and in the first group portfolios for cases C and D. Once again, third group portfolios present a small advantage if one considers the probability of obtaining a return superior to 2%, which is quite uncommon in practice.

Overall, it can be stated that the best results in Tables 2 and 3 were achieved in the first group portfolios, followed by those from the second group. In other words, socially responsible portfolios in the Brazilian electric sector not only offered higher excess returns per unit of risk but also presented lower probabilities of large losses during the analysis period.

Table 3 Sortino and Omega ratios (whole period)

	SoR (R_{min})			Ω (R_{min})		
	R_{min} (-2.0%)	R_{min} (0%)	R_{min} (+2.0%)	R_{min} (-2.0%)	R_{min} (0%)	R_{min} (+2.0%)
IBOV	4.992	0.045	-1.197	10.904	1.020	0.089
IEE	7.974	0.093	-1.362	64.867	1.129	0.011
ISE	6.021	0.079	-1.258	16.643	1.084	0.060
Portfolios A						
1st group	4.890	0.056	-1.336	40.167	0.941	0.023
2nd group	5.157	0.047	-1.336	43.909	1.004	0.016
3rd group	0.873	0.002	-0.874	16.333	0.937	0.050
Portfolios B						
1st group	4.859	0.050	-1.335	40.167	0.949	0.023
2nd group	4.870	0.048	-1.330	46.048	0.972	0.021
3rd group	0.873	0.002	-0.874	16.333	0.937	0.050
Portfolios C						
1st group	24.922	0.100	-1.427	122.500	0.956	0.007
2nd group	11.558	0.071	-1.397	64.867	1.050	0.009
3rd group	4.004	0.030	-1.357	69.571	0.896	0.013
Portfolios D						
1st group	11.281	0.157	-1.367	57.118	1.129	0.027
2nd group	8.597	0.127	-1.321	25.000	1.098	0.036
3rd group	1.563	0.061	-1.067	25.000	0.882	0.046

Source: Made by the authors.

5. Conclusions and final remarks

Although there is a growing view among investment professionals that Corporate Social Responsibility (CSR) issues can affect firm performance, one of the main criticisms addressed to emerging markets has been the lack of a coherent set of metrics to assess CSR. In this regard, the paper is innovative since it analyzes hitherto unexplored areas of CSR reporting, such as information from firms' social reports, and proposes a multidimensional framework to evaluate companies' efforts to become more socially responsible and to disseminate their outcomes to the general public.

The results clearly indicate that the involvement of Brazilian electric companies in CSR practices and their financial outcomes possibly match with what [Freeman's 1984] stakeholder theory claims, where firms fulfilling their fiduciary duty to society and disseminating their social outcomes to the general public typically performs better than those that do not invest in sustainable practices nor produce social reports. Portfolios comprising only assets from firms with the best Environmental, Social and Corporate Governance (ESG) practices not only offered higher excess returns per unit of risk but also presented lower probabilities of large losses during the analysis period. In addition, electric firms that presented lower ESG performances but also released social annual reports during the years of 2009 to 2012 performed significantly better in the Brazilian financial market than firms that did not disclose any social information within this time span.

Even though one cannot readily extrapolate findings from this study to other sectors of the economy, we expect that the applied methodology can find widespread application to other Brazilian industry sectors in the mid-term, provided that more firms adhere to social reporting

practices in the near future. It is also worth noting that other methods may be proposed to investigate the relationship between CSR and financial performances, and that the selection of performance indicators is linked to a wide variety of criteria.

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