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DO EMERGING MARKETS SUSTAINABILITY INDEXES TRANSLATE WHAT THEY ARE SUPPOSED TO?

¹Soerger Zaro, Claudio, ^{*2}Soerger Zaro, Elise and ³Gomes, Carolina Mariela

¹Universidade Estadual do Mato Grosso do Sul, Dourados, 105, 79804-970, BR

²Universidade Federal da Grande Dourados, Accounting, Dourados, Mato Grosso do Sul, 79825-070, BR

³Universidade Estadual do Mato Grosso do Sul, Dourados, 105, 79804-970, BR

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**Corresponding author:*
Soerger Zaro, Elise

ABSTRACT

This work aims to investigate the determinants of the carbon efficient index of B3. Thus, we analyzed information from 1423 firm-year observations between 2012 and 2016. The variable size has a significant and positive association as a determinant of the participation of companies in the index together with the industry in which companies operate. The result for size confirms previous national and international research analyzing the determinants of environmental management by companies. As for the significance in relation to the company's operating industry, there are significant differences in relation to the oil, gas and biofuels sector. However, the main result arises from the additional analyses: there is no significant difference between participation in the index and level of carbon emission. Such result questions the basis for the formation of that index that, perhaps, is too focused on company size and its volume of trading on the stock exchange.

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INTRODUCTION

Due to climate change, especially in the last few years, concern about the attitude of companies in relation to more sustainable practices and actions has grown. In this scenario, companies began to adopt a responsive position by developing mechanisms that contribute to the reduction of environmental impacts. However, the elaboration of such mechanisms is not the only change that has been observed. Recently, several companies have also begun to elaborate statements that contemplate their environmental performance, disseminating information related to their interaction with society and the environment. The demand for information on non-financial performance of companies has intensified due to the demand from interested parties and the pressure from non-governmental organizations (NGOs) and other related parties (stakeholders), that demand a greater transparency on the impacts of a company, and also from investors, that show concerns with sustainability (e.g., signatories to the PRI - principles for responsible investment, or CDP - carbon disclosure project).

The aforementioned actors generated strength for action on climate change issues, reporting on environmental actions mainly related to greenhouse gas (GHG) emissions (Haque & Deegan, 2010). Among this non-financial information, carbon emissions are relevant, forasmuch as emissions are identified as one of the main causes of climate change, as highlighted by the climate change report prepared by the UN Intergovernmental Panel on Climate Change (UNFCCC, 1992). Furthermore, the importance of global warming places companies at the center of discussions, since they are the main responsible for impacting the environment due to their activities (Santos, Bereun, & Rausch, 2011). In order to highlight the issue and companies that disclose carbon emissions, it has become common for stock exchanges to create ideal portfolios to present the results of companies with serious actions in terms of sustainability and carbon emissions. The index provides visibility to companies and signals to investors they are committed to reviewing their processes and reducing their environmental impact. Considering the Brazilian stock exchange, which is an important stock exchange in Latin America and in emerging countries, one of the dimensions to determine the composition of the current B3 index refers to the disclosure of carbon

emissions by the company (B3, 2017). According to B3, companies that compose the carbon efficient index are those that adopt transparency practices regarding their GHG emissions, that is, participation in the index aims to encourage companies to measure, disclose and monitor emissions (B3, 2017), and thereby improve its management. Considering that the disclosure of carbon emissions occurs in Brazil on a voluntary basis, we seek to understand the motivations for the disclosure of carbon emissions by companies, which requires observing their environmental performance more significantly. Thus, it is possible to observe their position in relation to the emission of polluting gases and the coping methods adopted. Thus, in this study, we intend to answer the following research question:

Which factors determine the participation of companies in the carbon efficient index?: Studies on disclosure point out variables that influence the quality and the reasoning for environmental disclosure (Alperstedt, Quintella, & Souza, 2010; Burgwal & Vieira, 2014; Hackston & Milne, 1996; Kolk, 2003; Kolk, Levy, & Pinkse, 2008; Silva & Silva, 2015). The results vary. It points to the existence of some factors that directly affect corporate environmental disclosure. Research on voluntary disclosure identifies that size and industry are important factors for the company to disclose social-environmental information (Burgwal & Vieira, 2014). This result is consistent with that obtained by Rover *et al.* (2012), who revealed the significant variable size in the level of environmental disclosure by potentially polluting Brazilian companies. Understanding the determinants of the participation of Brazilian companies in the carbon efficient index brings a theoretical contribution to the literature on determinants of corporate disclosures (Matsumura, Prakash, & Vera-Muñoz, 2014; Murcia, Rover, Lima, Fávero, & Lima, 2008; Santana, Góis, Luca, & Vasconcelos, 2015) in that it identifies specific factors related to the disclosure of carbon emissions in the Brazilian market considering that Brazil is a signatory to the Paris Agreement and has goals for reducing carbon emissions by 37% by 2025 compared to levels of 2005 (CEBDS, 2019). Therefore, it is relevant to understand the set of factors that influence the actions of companies, including the adoption of public policies to help achieve such goals. This study provides practical contributions for managers of organizations to position themselves in relation to other companies in the market and to identify the signaling that it is possible to give to the market with these practices; contributions to investors and other users of information are also expected so that they understand the conjuncture behind the index's participation information. On the other hand, studies on pollutant gas emissions discuss the organizations' attitudes towards the disclosure of carbon emission control management. Examining the development of mechanisms and reporting of greenhouse gases, specifically carbon disclosure, to understand the role of carbon disclosure in the emerging climate regime, Kolk *et al.* (2008) found that there was extensive information disclosed by companies about their activities related to climate change. However, the level of carbon disclosure provided is not particularly valuable to users. It results in progress in technical terms but little evolution in relation to the cognitive and value dimension.

THEORETICAL BASIS

Environmental disclosure: Corporate social responsibility reports began focused on environmental topics, which has been taking place in the 20th century and, mainly, from the 1970s. The first World Conference on Environment was held in Stockholm in 1972 with international repercussions and was a step towards the emergence of a new awareness regarding ecological problems. After that, it began to echo in society, giving rise to a concern with issues related to sustainability. It began to be observed more expressively in the corporate sphere from 1970, and France disclosed the Social Balance (*Bilan Social*) in 1977 (Gray, 2000). Despite this, only in the late 1980s the first environmental reports were published. However, after that we observed a more intense diffusion, mainly as a result of the creation of environmental standards, such as the European Eco-Management and Audit Schemes (EMAS) aimed at companies that intend to improve their environmental performance, and later the ISO

14.001, which advocates the promotion of environmental quality management (Daub, 2007). With the development of these corporate practices, the debates regarding the Triple Bottom Line (TBL) proposal intensified from 1997. This proposition is based on the perception of (Elkington, 1998), who highlighted that in order to achieve sustainable development, it is necessary to consider not only financial results, but also the social-environmental effects generated by organizations, therefore companies should seek a balance between gains and losses of all dimensions (Owen, 2013). In this regard, the performance of a company is linked to the indicators of the Triple Bottom Line; it directs its business according to indicators. It is possible that many of the main companies in the world has already adopted this approach. Kiernan (2001) warns executives of the peril of disregard such aspects. Companies are expected to plan, execute, evaluate and disclose their economic, social and environmental results. With this practice, they manage performances in the three dimensions. Although the dimensions are different, there is an influence exerted by the business model and the organization's culture on the form of value creation over time or on the use and maintenance of its resources (Owen, 2013). Vouros *et al.* (2020) highlight that the integration of GRI principles in reporting is still moderate, which indicates that the disclosure of sustainability reporting needs improvement.

Voluntary disclosure: The significant increase in social responsibility publications issued by corporations may vary in relation to level and regulation in different countries. Due to legislation and other forms of government incentives disclosures differ among countries (Kolk, 2004). There are several factors and motivations for the publication or not of a sustainability report: sometimes internal specifications of the corporation, or social aspects, such as credibility and reputation. The study carried out by Hackston and Milne (1996), which investigates the factors that determined environmental disclosure, presents findings that the variables income, size and sector explain the level of disclosure. In the Brazilian context, the study by (Rover *et al.*, 2012) sought to explain the determinants that influence voluntary disclosure by potentially polluting companies. They found that individual factors such as size, audit and sustainability influence the level of environmental disclosure. They refuted the variables profitability, indebtedness and internationalization as factors that do not explain environmental disclosure. The level of corporate governance on the stock exchange is also a significant element in determining voluntary information, such as environmental and social information (Bomfim, Teixeira, & Monte, 2015). Financial performance and share returns were also identified as significant in the choice of disclosure of non-mandatory information (Santana *et al.*, 2015).

Among the studies that directly analyzed publications on carbon credits, Santos, Santos *et al.* (2011) reported information on carbon projects disclosed in explanatory notes and management reports. Their findings identified that the information is limited to the form of credit generation and the cost of these investments. Companies have made no effort to publish information on accounting and tax treatment of operations with carbon credits. The study by Silva and Silva (2015) also corroborated the authors' findings. Analyzing the level of information regarding clean development mechanisms (CDM) and the carbon credits evidenced by 28 anonymous companies registered with the Securities and Exchange Commission (CVM) confirms that the companies analyzed do not use specific or detailed information in accounting for carbon credits. This was proven by Kolk *et al.* (2008). They identified that, although the number of companies providing information on the generation of carbon credits has increased, the available information is not particularly valuable to investors, non-governmental organizations or legislators. According to (Matsumura *et al.*, 2014), companies that choose to voluntarily disclose information on carbon emissions provide transparent non-financial information to investors. They inform future costs that can be imposed on companies due to their carbon emissions. However, if they do not disclose their carbon emissions, there will be an adverse outcome for them. Verrecchia (2001) advocates that disclosure of social and environmental information is expected to be beneficial to companies since, companies would not disclose if they did not

perceive that the benefits in disclosing non-mandatory information outweigh the costs of disclosing it. The act of voluntary disclosure of carbon emissions, even in the absence of mandatory behavior, can also be associated with beneficial consequences, such as market compensation Matsumura *et al.* (2014). Also according to Matsumura *et al.* (2014), the concern about the risk of climate change and the levels of carbon emissions by interested parties foresee the conduction of the value redistribution of companies that cannot successfully control their carbon emissions. Thus, companies that have the possibility to control emissions are not only demonstrating their capacity, but also constructing an image vis-a-vis other companies, that is, a positive image for possible stakeholders. Such positive visibility can even serve as a business strategy, as it becomes visible to new investors who may be interested in the company. On the other hand, the controls of these emissions can benefit society in which it operates, since a company that invests in renewable energy alternatives that reduce carbon emissions can bring economic benefits to the community in general (Matsumura *et al.*, 2014). Epstein and Wisner (2001) propose the use

Carbon credits: With a global need to reduce impacts and damage caused by global warming, the United Nations Framework Convention on Climate Change (UNFCCC, 1992) predicted the need for all countries to assume responsibility by signing a legal treaty towards the containment of polluting gases in the atmosphere. This convention was divided in two parts: on one side developed countries (Annex I) and on the other side developing countries not belonging to Annex I. They became known as Convention Parties, which should meet annually to discuss environmental issues and, above all, global warming. The third meeting of the parties was held in December 1997 in Kyoto, Japan. Among other measures, the COP 3 adopted a protocol of legal instrument containing more imposing commitments for the Parties, mainly to developed countries, for the first decades of the 20th century. The most relevant COP gave rise to the document known as the Kyoto Protocol, which would make the reduction of greenhouse gases (GHG) mandatory to all countries that adhere to the Protocol (REIS JÚNIOR, 2012). In this Protocol, it was possible to create the carbon market, which enables negotiating carbon credits. In trade, it was established that Annex I countries should pay to producing countries, those that do not belong to Annex I, values corresponding to the impact generated on developed countries (Kollmuss, Zink, & Polycarp, 2008).

CARBON EFFICIENT INDEX: The formation of environmental indexes has become frequent to promote companies with adequate environmental practices and present options of companies that can be considered to investors concerned with the theme (López, Garcia, & Rodriguez, 2007). The dimensions of analysis for the formation of such indexes are diverse but carbon emissions have been an important issue in the formation of indexes worldwide given the impacts of emissions on the environment. In particular, the carbon efficient index (ICO2) is an initiative by B3 in partnership with the BNDES aiming to encourage companies with an intense securities trading to measure, evidence and monitor pollutant gas emissions. The declared main point of evaluation is the transparent disclosure of emissions and the efficiency of these emissions (B3, 2017). Given the argument above, the intuition is that companies with a greater efficiency in managing the emission of polluting gases will be more interested in disclosing such information and obtaining the benefits of an improved image, attracting new investors.

METHODOLOGY

As the objective of the work is to identify the determinants to participate in the index based on the disclosure of carbon emissions, publicly traded companies with shares traded on B3 were selected. The data collection procedure was performed in the Economatica database. To this end, information was collected from 371 companies from 2012 to 2016. This generated 1,779 observations. The determinants were extracted from published financial statements. Size was controlled by the logarithmical

transformation of total asset. Return on assets served to control the company's financial performance. Return on shares was used to determine market performance. Binary variables were also included to identify the industry in which companies operate. To achieve the scope of this study, an analysis was carried out regarding the determinants of disclosure through logistic regression. As mentioned, companies that disclose carbon credit information (ICO2) are the study's dependent variable, and the variables described above are independent. Controls were used for a greater robustness. The estimated models follow the general formula:

$$ICO2 = \beta_0 + \beta_1 \text{ size} + \beta_2 \text{ accounting performance} + \beta_3 \text{ market performance} + \beta_4 \text{ indebtedness} + \beta_5 \text{ profitability} + \beta_6 \text{ industries.}$$

The dependent variable of this study is the disclosure of carbon emission information. The technique used to measure this variable was the composition of the portfolio of the carbon efficient index (ICO2) of B3 in 2017. The binary variable one was applied for companies that belonged to the theoretical portfolio, and null for other companies. The analysis of the efficiency of carbon management was performed through multiple regression using panel data to control the specific effects of each company. B3 only informs the current composition of the carbon portfolio. Therefore, the dependent variable indicates for five years the companies currently listed in the index, but that may have changed. The size of a company is the significant variable in explaining environmental disclosure, as large companies exert a greater effect on the community and a greater visibility, and obtain a greater attention from the government and the market Rover *et al.* (2012). The variable size can be measured in different ways. The most used techniques are number of employees, total assets and sales volume (Burgwal & Vieira, 2014; Hackston & Milne, 1996). In this study, the total assets indicator was used. The variable accounting performance was selected because it is considered a relevant point for the explanation of voluntary disclosure in the existing literature, for it has a positive relation with environmental disclosure. More profitable companies tend to disclose more information (Hackston & Milne, 1996). The profitability variable was also used in the study conducted by Rover *et al.* (2012) to study explanations for voluntary environmental disclosure in Brazil using panel regression analysis, also reporting a positive relation with environmental disclosure. The use of the profitability variable was measured by the return on assets of companies (ROA).

For the use of market performance, there was a return on the companies' shares. Its value is obtained by subtracting the logarithm of the initial share price from the logarithm of the final share price. In the sample, there was no collection among 319 observations for this variable due to the lack of stock price quotation. Indebtedness has already been used in several studies that had the determinants of environmental disclosure as a scope. Rover *et al.* (2012) worked with the hypothesis according to which companies with higher indebtedness disclose more environmental information than companies with less indebtedness. The authors verified a relation with the practice of disclosure. The measurement of this variable was given by the ratio between the divided payable liability and the assets of companies. Profitability can be measured using multiple indicators. The studies by (Hackston and Milne (1996) calculated it based on averages of several years, that is, over an extended period. However, a more reliable method for measuring profitability is the return on equity (Burgwal & Vieira, 2014). Therefore, in this study, the measurement of the variable profitability was carried out by means of return on equity (ROE). Binary variables were also included to identify the industry in which companies operate. Code 1 means oil, gas and biofuels; code 2 means consumption; code 3 means financial; code 4 means others; and code 5 means public utility. To avoid effects caused by extreme observations and because it is a multivariate analysis, the Mahalanobis distance was calculated by dividing the distance by five, which is the number of variables used for the calculation. The observations that exceeded the critical value in table T of Student at 0.01 (5.893) were considered as outliers. The number of outliers excluded from the sample was 37.

RESULTS

Initially, we present the descriptive statistics of the sample companies. Mean, standard deviation, minimum and maximum of the quantitative variables of the study are presented. In all variables, a great variability stands out, a fact verified by the high standard deviation. This evidences the adequacy of the use of regression for data analysis.

Table 1. Descriptive statistics

Variable	Mean	Standard deviation	Minimum	Maximum
ICO2	0.065442	0.247375	-	1.000000
(log) Active	14.024650	2.924101	2.302585	21.086160
ROA	(0.128382)	0.866044	(10.848480)	4.527918
Return on shares	(0.069241)	0.525759	(3.204633)	1.909543
Indebtedness	0.752600	1.120576	-	14.851790
ROE	0.035564	3.925839	(63.574210)	86.700000

The dependent variable ICO2 has an average of 0.065, which indicates that a very low percentage of publicly traded companies participate in this index. This is expected because it should value efficiency in pollutant gas emissions. As highlighted on the website, it "takes into account, for the weighting of shares of component companies, the degree of efficiency in GHG emissions, in addition to the free float (total shares outstanding) of each of them." Given the compatibility of the use of logistic regression, the analysis was carried out using panel data considering the dependent variable ICO2, operated by a dummy equal to one if the company is part of the index and null if it is not.

Table 2. Logistic regression panel analysis of the determinants of participation in the ICO2 index

Variables	Coefficients	Stand. Dev.	Significance	Conf. Interval (95%)	
(log)Assets	16,57528000	1,26136700	0,00000000	14,10305000	19,04751000
ROA	5,60561500	3,70469900	0,13000000	(1,65546000)	12,86669000
Stock Return	2,21827300	2,75478500	0,42100000	(3,18100700)	7,61755300
Debt	(10,47771000)	7,88180800	0,18400000	(25,92577000)	4,97034800
ROE	(0,58414410)	0,52294900	0,26400000	(1,60910500)	0,44081720
Industry	Baseline - GasandBiofuel				
Trande	27,72422000	4,71900900	0,00000000	18,47514000	36,97331000
Financial	17,40720000	6,15031900	0,00500000	5,35279200	29,46160000
Utilities	(3,19509200)	4,90266900	0,51500000	(12,80415000)	6,41396100
Other	23,93166000	5,88252100	0,00000000	12,40213000	35,46119000
Constant	(329,46500000)	24,12881000	0,00000000	(376,75660000)	(282,17340000)
Numberofobservations	1.423				
Numberofgroups	311				
Prob> Chi2 =	0,0000				

Table 3. Regression of the determinants of participation in ICO₂ controlled by emission of CO₂

VARIABLES	COEFFICIENT	STD DEVIATION	SIGNIFICANCE	CONFIDENCE INTERVAL (95%)	
SIZE	.1241384	.0380059	0.001	.049084	.1991927
ROA	.00246	.1783059	0.989	-.34966	.3545799
RETURN SHARES	.260597	.0742713	0.001	.1139255	.4072685
INDEBTEDNESS	.2710126	.1865118	0.148	-.0973124	.6393377
ROE	.0004906	.0260131	0.985	-.0508804	.0518615
EMISSION (LOG)	-.0182104	.014863	0.222	-.047562	.0111411
SECTORS	BASELINE - OIL, GAS AND BIOFUELS				
CONSUMPTION	.0037275	.1582115	0.981	-.3087098	.3161648
FINANCIAL	.4401803	.1919979	0.023	.0610213	.8193393
OTHER	-.0635369	.1763852	0.719	-.4118638	.2847899
PUBLIC UTILITY	-.1145701	.1615649	0.479	-.4336299	.2044896
CONSTANT	-1,671,135	.58061	0.005	-2,817,728	-.5245419
NUMBER OF OBSERVATIONS	172				
PROB > F =	0.000				

The results are shown in Table 2. First, the Chi² probability is evaluated as it identifies whether the regression is significant as a whole. The value of Chi² probability was equal to 0.0000, lower than the limit of 0.05, which indicates that the logistic regression is strongly significant.

As a R2-like metric is not available for a logit panel, the rating table is analyzed, which indicates 91.15% of correct rating. Therefore, the analysis of coefficients and the statistical significance of explanatory variables is allowed. The main premise of the work is that there are characteristics that differentiate companies that were selected to compose the index from the others. This is because they provided information on CO₂ emissions in addition to meeting the methodology established by B3 to participate in the index. Therefore, this hypothesis is tested by evaluating significant factors for the classification of companies that compose the index and the others that do not. Failure to observe significance would mean that there are no relevant differences between the variables chosen to define which company will participate in the index. Starting the analysis, it appears that the relation between company size and the company's participation in the index is significant because the significance is 0.0000, i.e., below 0.05. As the coefficient is positive, the interpretation is that the likelihood that the company will be included in the carbon efficient index increases the greater its size. This result is in line with the findings of the study by Burgwal and Vieira (2014), proving a positive association between size as a determinant of environmental management. As the asset was the object of logarithmic transformation, the interpretation is presented in percentage, that is, for a 1% increase in company size, the likelihood of the company being part of the efficient carbon index increases by 16%. Although the estimator seems high, it must be opposed to constant, which is strongly negative. Return on assets, our measure of profitability, shows a positive sign, which is consistent with the literature but without a significant effect. Therefore, it is not possible to advocate the effects of this variable on the participation of companies in the carbon efficient index.

A similar effect is that of return on shares, in which a positive sign is identified, which is consistent with the previous literature but not significant. Also, for indebtedness, we observed a signal compatible with the literature, that is, more indebted companies are less likely to be included in an index based on voluntary disclosure, but the effect

Table 4. Regression of determinants of the composition of the ICO2 Index - cluster per company

VARIABLES	COEFFICIENT	STD DEVIATION	SIGNIFICANCE	CONFIDENCE INTERVAL (95%)	
SIZE	.1233364	.056851	0.034	.0098614	.2368115
ROA	.0025036	.2127966	0.991	-.4222401	.4272474
RETURN SHARES	.2761064	.0756839	0.001	.1250408	.4271721
INDEBTEDNESS	.2837898	.2540934	0.268	-.2233828	.7909624
ROE	.0004939	.0314374	0.988	-.0622555	.0632434
EMISSION (LOG)	-.0185139	.0197833	0.353	-.0580015	.0209736
SECTORS	BASELINE - OIL, GAS AND BIOFUELS				
CONSUMPTION	.0056739	.3460874	0.987	-.6851195	.6964673
FINANCIAL	.4407696	.39644	0.270	-.3505279	1.232067
OTHER	-.065675	.3657561	0.858	-.7957272	.6643772
PUBLIC UTILITY	-.1088913	.348074	0.755	-.80365	.5858674
CONSTANT	-1,697,948	.8866806	0.060	-3,467,769	.0718744
NUMBER OF OBSERVATIONS	172				
NUMBER OF GROUPS	68				
PROB > F =	0.0002				

Table 1. Regression to explain the level of carbon emissions

VARIABLES	COEFFICIENT	STD DEVIATION	SIGNIFICANCE	CONFIDENCE INTERVAL (95%)	
SIZE	1543566	.2695549	0.000	1005532	20816
ROA	.3673502	129134	0.777	-.2210175	2944875
RETURN SHARES	-.1519501	.5413885	0.780	-1232566	.9286658
INDEBTEDNESS	1031663	2037075	0.614	-.3034355	5097681
ROE	-.0416754	.188532	0.826	-.4179867	.334636
ICO2	-.5170859	.5253064	0.328	-1565602	.53143
SECTORS	BASELINE - OIL, GAS AND BIOFUELS				
CONSUMPTION	-1317766	.7649636	0.090	-284464	.2091074
FINANCIAL	-.3332823	1042144	0.002	-.5412953	-1252694
OTHER	-1059	.9351606	0.261	-.2925588	.8075885
PUBLIC UTILITY	-.7450117	.7255901	0.308	-2193296	.7032722
CONSTANT	-1,297,549	4545139	0.006	-2,204,763	-3903355
NUMBER OF OBSERVATIONS	172				
NUMBER OF GROUPS	68				
PROB > F =	0.0000				

is not significant. Therefore, it is not possible to perform any analysis on this information. On the other hand, profitability, represented by return on equity, shows a sign opposite to what was expected but also with a non-significant effect, and it is not possible to evaluate such variable. Industry, on the other hand, was strongly significant, evidencing that it is an important control of regression. In some aspect, it may also explain the lack of significance of some determinants, since, as there are few participating companies, it may be that some sectorial characteristics differentiate them sufficiently for analysis. There is a significant difference more likely to be included in the index for the consumer, financial and other sectors in relation to the oil and gas sector, which is potentially polluting. In addition, the oil and gas are sectors of predominantly public investment, while the other sectors are mainly influenced by market factors. Hackston and Milne (1996) corroborate this result by demonstrating that companies belonging to high environmental impact sectors are a determining factor in the practice of environmental disclosure as they operate in environmentally sensitive sectors. Yet, these companies strictly comply with environmental rules due to the likelihood of being seen as having relevant environmental concerns. In addition, the constant is strongly significant and has an extremely high negative value. This reflects the small number of companies in the sample that make up the index. As a result, the initial probability of composing it is very low, growing with the increase in the size of the companies and depending on the sector in which the company operates. In order to clarify the results, we carried out tests controlling the information on carbon emissions. This information was not used for the main test due to the significant reduction of the sample. Interestingly, the value of the log of carbon emission is not significant to explain the composition of the index. Although this presents a contradiction between composing the index and the level of emission, such result may come from a selection bias. It is likely that only companies with a lower level of emission are willing to make this information public, which reduces the capacity of differentiating companies.

However, the variable size is significant. It may indicate that the size and level of trading of shares greatly influence the choice of index participants. The result does not change when controlling per cluster, as seen in table 4. In an additional analysis, carbon emission was used as a dependent variable. The result, consistent with the analyses based on the ICO2, shows company size as significant, indicating that the larger the company, the higher the level of emission, which is intuitive. However, no other variable showed significance probably due to the selection bias mentioned above, which makes it difficult to identify differences between companies since they probably only disclose emissions information, i.e., companies that have better results in relation to their peers.

FINAL CONSIDERATION

In this study, the objective was to identify the factors that determine the participation of companies in the carbon efficient index. This indicator considers a transparent practice regarding emissions of greenhouse gases (GHG) as a characteristic of the participants. It considers the disclosure of the management of carbon credits. To this end, information from 371 publicly traded companies between 2012 and 2016 was analyzed. Regarding the five years analyzed, the variable size is significant as a determinant of the participation of companies in the index. Another variable that is also strongly significant for the regression is the industry in which companies operate because companies that operate in less sensitive industries are more likely to participate in the index than companies in sectors that are classified as potentially more polluting. On the other hand, the variables performance, profitability and indebtedness are irrelevant. This can be explained by the fact that a low number of companies make up the index and because smaller companies have limitations regarding the structuring and modifications for measuring pollutant gas emissions compared to larger companies. Therefore, the determinants of the composition of the index in this study depend on the size and the sector in which the companies operate.

Despite the highlighted, the additional analyses show a worrying panorama. The findings of these analyses do not indicate that the levels of carbon emissions disclosed by companies are decisive in determining whether the company is part of the index. These results have their limitations, but they may indicate that the selection of companies for the index is predominantly driven by the size and liquidity of shares and deviate from the objective of encouraging disclosure and signaling companies with a better management of emissions of such gases. As a recommendation for future studies, it is possible to compare companies of a same size and a same industry. Thus, identifying possible specific characteristics can explain the composition of companies in the carbon efficient index. Another relevant point would be the analysis of a same number of companies. In this way, future studies on environmental management determinants can incorporate more individual variables of companies for the composition of other indicators that enable the efficiency and transparent management of polluting gases. Other studies could also assess whether the size of modifications necessary for a good management of emissions, or perhaps the measurement of emissions themselves, becomes prohibitive for smaller companies, as performance, profitability and indebtedness become irrelevant given the incapacity of smaller companies of investing in or accessing technologies that allow the measurement and management of pollutant gas emissions. In addition, future research could investigate other emerging countries in order to identify whether other countries have shown a greater care in the composition of the indexes focusing on controlling pollutant gas emissions.

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