

Investment in Environment and the Economic Performance of Companies Adhering to the Carbon Efficient Index – ICO²

Abstract

The contemporary society, based on greater environmental awareness, has become more demanding in the evaluation of companies and products. As a result, companies feel increasingly responsible and pressured to invest in the environment. In that sense, the goal in this research was to disclose whether a relation exists between environmental investments and economic performance, based on a sample of nine companies listed in the Carbon Efficient Index of the São Paulo Stock Exchange, between 2007 and 2011, and also whether these investments positively influence the companies' long-term performance, as highlighted by Bonifant, Arnold and Long (1995), Klassen and McLaughlin (1996) and Alberton (2003). Therefore, correlation analysis and the regression model with pooled data were used. The results indicated a positive relation between environmental investments in terms of total assets and companies' economic performance. These investments do not positively influence the companies' long-term economic performance in this period but, on the opposite, positively influence the short-term economic performance.

Key words: Environment; investments; performance; Carbon Efficient Index.

Elizio Marcos dos Reis

Master's student in Accountancy (UFMG).

Contact: Av. Presidente Antônio Carlos, 6627, Pampulha, Belo Horizonte, MG, Brazil, CEP: 32.201-970

E-mail: elizioreis@oi.com.br

Marcia Athayde Moreira

Ph.D. in Controllershship and Accounting (USP), Professor at Universidade Federal de Minas Gerais. **Contact:** Av. Presidente Antônio Carlos, 6627, Pampulha, Belo Horizonte, MG, Brazil, CEP: 32.201-970

E-mail: mathayde@face.ufmg.br

Renata Soares França

Specialist in Finance and Specialist in External Auditing (UFMG), Professor at Faculdade Novos Horizontes. **Contact:** Rua Alvarenga Peixoto, 1270, Santo Agostinho, Belo Horizonte, MG, Brazil, CEP: 30180-121

E-mail: renata.franca@unihorizontes.br

1. Introduction

In recent years, environmental issues have been a noteworthy theme in the academic and business contexts. Society, more aware of its needs, has become more demanding in terms of attitudes that contribute to sustainable development.

Maimon (1994) states that the policy of regulatory entities, local community pressure, the international insertion of the company, the origin and size of the capital and localization are factors that influence the attitudes related to the companies' environmental responsibility.

According to Ferreira (1995), concerns with the environment derive from evidences of actions by companies, governments and individuals. Thus, companies whose activities can be considered potentially polluting, whether in response to political and social pressures or due to its own growing awareness, have attempted to raise the environmental issue as an important topic for consideration in their decisions, whether related to future investments, new product launches or even the reformulation of existing products (Ferreira, 1995).

Therefore, the environmental issue is not external to organizations. Nowadays, they feel increasingly responsible and pressured to invest in the environment as a form of preventing possible additional spending, such as losses and fines due to environmental degradation, as well as to improve the quality of life, product quality, company image, to increase the productivity and profitability of the company (Beuren & Guesser, 1998).

In this context, a critical issue is highlighted, related to the development of environmentally correct means to make businesses feasible and the financial balance of these organizations, so that environmental concerns can gain materiality through actions that permit the maintenance or even the enhancement of companies' economic and financial performance. In other words, investments are due in the maintenance and prevention of environmental problems, in combination with the maintenance and/or improvement of the economic and financial performance.

In general, the financial results of the environmental cause take form in the medium and long term, as it takes time for some results to appear. Investments in prevention, however, avoid future problems and can be smaller than the costs these problems can give rise to (Alberston, 2003). In that sense, companies need to consider the environmental impacts of the products and their processes from a strategic viewpoint (Klassen & McLaughlin, 1996). Tinoco and Kraemer (2008) add that environmental management has turned into a strategic factor to analyze the top administration, which needs to formulate and implement environmental protection strategies.

According to Bonifant, Arnold and Long (1995), the new environmental competitiveness demands the exploration of new production methods that may entail costs, but these are much lower in the long term and in large-scale production, resulting in a competitive advantage. This view is supported by Tinoco and Kraemer (2008), who consider that the results of corporate engagement in the environmental cause are not immediately feasible. Instead, these actions need too mature for the company to achieve environmental excellence and gain competitive advantage.

Therefore, it seems that, in the long term, environmental investments generate improvements in the companies' economic performance. Thus, acknowledging that, for companies to perform concrete environmental protection and/or recovery actions, mainly on a long-term horizon, their environmental actions need to be conciliated with their economic result, the question guiding this research is: ***have companies with concrete environmental protection actions improved their economic performance in recent years?***

Therefore, the objective in this paper is to verify whether companies with concrete environmental protection actions, represented by the amounts invested in the environment, improved their economic performance in recent years, that is, the intent is to evidence whether a positive relation exists between the company's environmental investments and economic performance, and if these investments positively affect its economic performance in the long term, represented by the variables Return on Assets (ROA) and Return on Equity (ROE).

To develop the research, a sample of companies will be used, which are listed on the ICO², the Carbon Efficient Index, created upon the joint initiative of the São Paulo Stock Exchange and the Brazilian Economic and Social Development Bank (BNDES). This index lists companies that voluntarily disclose information about Greenhouse Gases (GHG) provoked by their activities.

When the environmental appeal is present and growing in society, this study is justified as it can arouse the desire to get involved in environmental initiatives in companies that are not committed to these actions yet. In addition, as highlighted by Cohen, Fenn and Konar (1997), no consensus exists among researchers about the relation between environmental and economic performance. Therefore, from the academic viewpoint, this study intends to contribute to a better understanding of management decisions on environmentally healthy actions and economic performance.

In the next part, the theoretical framework is presented, which will discuss management and environmental performance, environmental performance versus economic performance, besides earlier studies related to the theme. The third part discusses the methodological aspects, including data collection, analysis units, characteristics of the variables, hypotheses and regression models used. Finally, the research results are presented, followed by the final considerations.

2. Theoretical Framework

2.1 Management and Environmental Performance

According to Tinoco and Kraemer (2008), for a long time, companies were only concerned with the efficiency of productive processes but, over time, as a result of the increased complexity of business and increasingly severe environmental constraints, their way of acting strongly changed, favoring ecological awareness inside companies as well as in society and in governments, giving rise to the notion of environmental management (Tinoco & Kraemer, 2008).

Alberton and Costa Jr. (2007) highlight that a movement with environmental traits has existed for a long time, but gained strength as from the 1970's, when it got disseminated around the world. As a result of the evolution in the quality and development of Quality Management Systems, international standards and governmental standards, the evolution of the term sustainable development, environmental accidents and large conferences, in combination with pressure from NGOs (Non-Governmental Organizations) and greater environmental awareness, environmental management increased and was internalized in the organizations, with greater insertion of the environmental variable in administrative management (Alberton & Costa Jr., 2007).

Environmental management is the way the organization gets mobilized, internally and externally, to conquer the desired environmental quality, using a set of well defined and appropriately applied measures and procedures, aimed at reducing and controlling the impacts a business causes in the environment (Valle, 2000; Tinoco & Kraemer, 2008).

The efficient implementation of environmental management requires a systemic view company/environment that can lead to the creation and innovation of products and processes, which entail concerns with the environmental cause (Alberton & Costa Jr., 2007). The improvement of processes and products resulting from the integration of environmental considerations in the company's operational decisions, as well as from the consideration of groups of stakeholders, represents what is called environmental performance (Sharma & Vredenburg, 1998).

Henri and Journeault (2010, p. 65) define environmental performance as “[...] the capacity of the organization to establish harmonious relationships among various stakeholders concerned with environmental issues”. Based on this definition, it appears that environmental performance is oriented both internally, towards the view of the company's business, and externally towards society in general, which requires responsibilities from the organizations that involve protection and improvement of the environment, with

consequent investments. Both investments to implement environmental management and the costs and revenues this new process generates affect the profitability indicators (Alberton & Costa Jr., 2007).

Tinoco and Kraemer (2008) highlight that the first doubt that emerges when companies are confronted with the environmental variable in their decision processes is the view that expenses and, consequently, the costs of the production process increase. Nevertheless, “[...] experienced companies identify the economic and strategic results of organizational engagement in the environmental cause” (Tinoco & Kraemer, p. 137, 2008).

This can be attributed to the need for companies to signal an environmentally correct behavior, so as to conquer the recognition of society, being rewarded with economic benefits. Therefore, companies that adopt and signal good environmental practices need to invest, which can vary in volume, according to the size, sector and regulations of the activity performed (Alves, De Luca, Cardoso, Gallon & Cunha, 2012).

This is consistent with the view of Alberton and Costa Jr. (2007), in which environmental investments can lead to a superior environmental performance and can be directly related with the companies’ economic performance.

2.2 Environmental Performance versus Economic Performance

Cardoso, Mário and Aquino (2007) include the concept of eco-efficiency into the context, which refers to the production of useful items simultaneously with the reduction of resource consumption and of the environmental impacts. In that sense, cost reduction is achieved in two senses, by reducing waste and avoiding the payment of fines and indemnities. As a consequence of these attitudes, the company can benefit from an increased demand for its products and access to cheaper funding sources. Recognition by the employees can facilitate the retention of talents and the adoption of less degrading alternatives encourages technological innovation, creating or maintaining a competitive advantage (Cardoso, Mário & Aquino, 2007).

Reis (2002) considers that environmental performance is directly related with financial performance. This relation is due to an Environmental Management System (EMS) that verifies the environmental impacts, making room for increased expenses and decreased costs. Cost reduction is due to the elimination or minimization of waste and/or increased expenses, deriving from the improvement of the company’s image in the market and a better acceptance of its products.

Klassen and McLaughlin (1996) affirm that, from the strategic viewpoint, the literature indicates that business needs to consider the environmental impacts of products and manufacturing processes, and that companies need to undertake environmental technology and management initiatives. In addition, environmental management is a significant component of functional strategies, particularly operational ones and, as part of the corporate strategy, affects the environmental performance which, by turning into public knowledge, becomes observed and evaluated by the market. Hence, as a result of the structural and infrastructural changes deriving from environmental management, both the cost reduction and market gains affect the financial performance.

In this context, North (1992) indicates different economic benefits consequent to efficient environmental management. The author divides them in three topics:

- In the first topic, the cost savings are indicated as: reduced consumption of water, energy and other inputs; recycling/sale or use of residues and reduction of effluents; and reduction of fines and penalties as a result of pollution.
- In the second topic, the author highlights the economic benefits from the perspective of increased revenues, as follows: increased marginal contribution of green products, which can be sold at higher prices; increased market participation, due to the innovation of products and lesser competition; new product line for new markets and increased demand for products that contribute to decrease the pollution.

- In the third topic, the author indicates strategic benefits, such as: improved institutional image; renewal of product portfolio; increased productivity; high level of staff commitment; improvement in work relations; improvement in creativity for new challenges; improvement in relations with governmental entities, community and environmentalist groups; guaranteed access to the external market and better compliance with environmental standards.

Despite these benefits, no consensus exists yet about the relation between companies' environmental and financial performance (Cohen, Fenn & Konar, 1997). The controversy about the organizations' development of environmentally responsible actions and their acceptance by the managers is found in the theories of shareholders and stakeholders, in which each group defends a logic, denying and encouraging the environmental responsibility practices (Machado, Macedo, Machado & Siqueira, 2010).

The shareholder theory establishes that the maximum responsibility of an organization is the production of profits and wealth for its shareholders and that any different actions can put the company's survival at risk, besides the agency problem between the shareholders and managers it can give rise to (Friedman, 1970). In view of this theory, a negative relation is observed between environmental investments and companies' economic performance, suggesting that other management responsibilities, besides the commitment to income and profit, can put them at a disadvantage when compared to companies that do not engage in environmental actions.

According to the stakeholder theory, management based on this public involves the allocation of organizational resources and considers the impacts of this allocation in different stakeholder groups internal and external to the organization (Freeman, 2001). It is considered that this theory combines business and socioenvironmental objectives, as the organizations exist in a socioenvironmental context and, therefore, need to consider the problems deriving from this environment. Hence, it is difficult for an organization to be healthy when operating in an environment that is not (Drucker, 2001). Therefore, according to this theory, a positive relation exists between organizations' economic performance and environmental investments, without any deviation from the company's objective function.

In this case, although it is difficult to combine the economic and socioenvironmental results in order to measure the effects for stakeholders and shareholders, the final result of the corporate activity needs to take into account the returns that optimize not only the shareholders, but also the other stakeholders' part (Machado *et al.*, 2010).

Cohen, Fenn and Konar (1997) highlight that, historically, corporate investments in environmental protection measures tend to be considered as negative for the financial performance. Companies frequently saw environmental investments as a necessary evil to respond to social standards, control the pollution and protect public health, resulting in lower global profitability, deviating resources for a fundamentally non-productive use (Cohen, Fenn & Konar, 1997).

In recent years, however, this premise has been increasingly attacked, not only by those in favor of the environment, but also by important corporate leaders, academics and investors. An increasing number of corporate leaders have accepted the notion that the environmental performance is an important component of the competitive advantage (Cohen, Fenn & Konar, 1997). Good managers constantly look for ways to enhance the company's competitiveness and they consider the improvement of the company's environmental performance as a way to further this competitive power (Miles & Covin, 2000).

Therefore, although no consensus exists on the relation between management decisions that involve investments in development and environmental protection actions and companies' economic performance, some managers may be engaged in these actions, which according to the theory can offer economic benefits for the companies.

2.3 Earlier Studies

Focused on internal investment decisions in the environment, as a way to improve the companies' economic and financial performance, some Brazilian studies have attempted to establish this relation, such as Beuren, Theiss and Carli (2012), who developed a study to verify the influence of eco control on companies' environmental and economic performance. Questionnaires were forwarded to directors of 106 companies listed on BM&F Bovespa, and their results proved the hypotheses that eco control influences economic performance both directly and through influences from environmental performance. The control variables strengthen this evidence in companies with greater environmental exposure, public visibility, environmental concern, pressure from stakeholders and size.

Alberton and Costa Jr. (2007) investigated whether the implementation and certification of an Environmental Management System (EMS) according to NBR ISO 14001:96, in Brazilian companies traded on the São Paulo Stock Exchange between January 1993 and March 2003, positively affect their economic and financial performance. The results indicated an upward trend in the ROA, ROE and ROS (Return on Sales) indicators in the post-certification period. The indicators P/P (Price/Profit) and P/EVS (Price/Equity Value of Share) showed significant reductions in the same period.

Based on the Signaling Theory and Legitimacy Theory, Alves *et al.* (2012) investigated the relation between publicly traded companies' economic and environmental performance in Brazil and Spain in 2009 and 2010. In the research, the economic indicators representative of economic performance ROA, ROE, ROS and ROM (Return on Market) represented by Tobin's Q were used. The environmental performance of each company was represented by the indicator EN30 (general total investment on environmental spending and protection, taken from version G3 of the GRI sustainability report, divided by the Asset value. The results indicated that, in Spain, in 2009, a negative relation existed between ROA and environmental performance, equal to zero in 2010. In the Brazilian companies, in 2010, the ROA showed a positive correlation with the environmental performance (Alves *et al.*, 2012).

Jacques *et al.*, (2011) studied the 30 largest Brazilian agricultural companies in terms of gross operational revenues, and the results indicated that environmental investments are positively related to their economic performance, represented by the net profit.

Through a case study in Fiat, Reis (2002) evidenced the financial benefits resulting from the minimization of negative environmental impacts. Thus, there is evidence that the environmental performance explains the company's financial performance, an important reason to encourage other companies that intend to reduce negative environmental impacts, not only to comply with the environmental legislation, but also proactively to guarantee competitiveness (REIS, 2002).

Although most of the studies presented above indicate that a positive relation exists between economic performance and environmental performance, no consensus exists yet about the true relation between these variables. No studies were found that verify the long-term relation between environmental investments and economic performance, as proposed in this research.

3. Method

Vergara (2003) classifies research in terms of means and ends. What the end of this article is concerned, it is classified as exploratory and descriptive. Exploratory because it contributes to research in the area, as it analyzes the environmental and economic relation from a long-term perspective. According to Gil (1996, p. 25), exploratory studies "[...] are aimed at enhancing the familiarity with the problem, with a view to making it more explicit or constructing hypotheses". Descriptive, because it presents and analyzes the relations between companies' environmental investments and economic performance. Martins (2007) mentions that descriptive research is aimed at describing the characteristics of a certain population or phenomenon, as well as at relating variables and facts.

As regards the means, this is a documentary study. Documentary research uses documents elaborated by public or private entities of any kind, or by individuals (Vergara, 2003). Martins and Theóphilo (2009) add that the documentary research strategy is characterized as studies that use a wide range of documents as a source of data, information and evidences: diaries, documents files in public or private entities, etc.

In this study, the documents used to obtain the necessary information were the financial statements of the companies available in Economática®, the Sustainability Report and the Social Balance Sheet. A quantitative design will be used, in which the concepts will be tested and investigated through the definition of variables that will be observed with the help of statistic procedures, such as descriptive data analysis, correlation analysis and the use of regression models to analyze the influence of environmental investments on the companies' economic performance. Richardson (2012) says that, in principle, the use of the quantitative research method represents the intent to guarantee the precision of results, avoid distorted analyses and interpretations, with a security margin regarding inferences. It is applied in studies that aim to discover and classify the relation among the variables.

The study involved companies listed on the Carbon Efficient Index – ICO² of the São Paulo Stock Exchange (BM&F Bovespa), which includes companies that voluntarily disclose information about the Greenhouse Gases – GHG provoked by the development of their activities, between 2007 and 2011. The use of a sample from the ICO² instead of the Corporate Sustainability Index – ISE was due to the fact that the Carbon Efficient Index is new in the capital market, considering that the disclosure of these initiatives contributes to academic discussions and to the companies.

According to the BM&F Bovespa, the main aim of the ICO² is to encourage the companies that issue the most traded stocks to verify, disseminate and monitor their GHG emissions, so as to prepare them for an economy called low carbon. Therefore, one of the objectives of this index is to encourage companies to disclose information about the environmental impact, suggesting that these companies are stimulated to constantly invest in technologies and procedures to reduce these environmental impacts.

To define the study sample, the companies listed on the ICO² index in April 2012 were surveyed, as highlighted in Figure 1:

Sample definition criteria	Quantity
Companies listed on the ICO ² in April 2012	29
(-) Financial companies excluded from the sample	6
(-) Companies excluded due to lack of data	14
Total companies used in this study	09

Figure 1. Definition of the Sample

Source: Elaborated by the authors

In view of the exclusions distinguished in the above figure, the companies that will be used to develop the empirical research proposed in this paper are listed in Figure 2:

1	BRASKEN	4	ELETROBRAS	7	PÃO DE AÇÚCAR
2	BRF FOODS	5	ELETROPULO	8	TIM PARTICIPAÇÃO
3	CEMIG	6	NATURA	9	VALE

Figure 2. Companies Included in the Sample

Source: Elaborated by the authors

The dependent variables chosen to conduct this study, which represent the companies' economic performance, are:

- Return on Assets (ROA): according to Cohen, Fenn and Konar (1997), this measure is widely used by market analysts as a corporate performance measure, as it measures the assets' efficiency in the production of profits. It is obtained by dividing Net Profits by Total Assets.
- Return on Equity (ROE): according to Cohen, Fenn and Konar (1997), it is a corporate performance measure related to shareholder investments. It is obtained by dividing the Net Profits by the Equity.

Other authors, such as Freedman and Jaggi (1982), Alberton (2003), Alberton and Costa Júnior (2007) and Alves *et al.* (2012) used the variables ROA and ROE to measure companies' economic performance.

The independent variables to conduct the study are:

- INV: Investment in Environment divided by Total Assets
- INV t-1: Investment in Environment divided by Total Assets, lagged by one period.
- INV t-2: Investment in Environment divided by Total Assets, lagged by two periods.
- LNAT: Natural Logarithm of Total Assets
- LNLO: Natural Logarithm of Operational Income

The variables LNAT and LNLO represent control variables that are normally used to indicate the company size, as larger companies have better market conditions, scale gains, among others, which can influence their economic income. The natural logarithm is used to mitigate the heteroscedasticity, an inherent problem in estimations that use pooled data, due to the different sizes of the companies in the sample (Gujarati, 2006).

The company data related to ROA, ROE, AT and LO were extracted from the financial statements, obtained from the database Economática[®]. The environmental investment values were obtained from the Sustainability Reports EN30 (general total investments in environmental spending and protection) and from the environmental indicators (total investments in environment) of the sample companies published in the Social Balance Sheets.

3.1 Hypotheses

According to Reis (2002), Alberton (2003), Alberton and Costa Júnior (2007) and Beuren, Theiss and Carli (2012), the environmental performance is positively related with the companies' economic performance. For these companies to have a satisfactory environmental performance, the environmental impacts of the products and manufacturing processes need to be considered in the business, and the companies need to undertake environmental technology and management initiatives (Klassen & McLaughlin, 1996). Thus, the following hypothesis is raised:

- **H1:** environmental investment is positively related with the companies' economic performance.

To verify the hypothesis (H1), a correlation analysis will be developed for the entire study period, that is, from 2007 till 2011, between the variable INV, which represents the values invested in the environment weighted by the Total Assets, and the companies' economic performance, represented by the variables ROA and ROE.

As highlighted earlier by Klassen and McLaughlin (1996), companies need to take into account the environmental impacts of the products and their processes from a long-term strategic perspective. Alberton (2003) adds that the financial results of the environmental cause need to take form in the medium and long term. In that sense, a new hypothesis is highlighted:

- **H2:** environmental investments have a positively influence on companies' economic performance in the long term.

To verify the hypothesis (H2), the following regression models with pooled data will be used:

$$ROA_{it} = \beta_0 + \beta_1 INV_{it} + \beta_2 INV_{it-1} + \beta_3 INV_{it-2} + \beta_4 LNAT_{it} + \varepsilon_{it} \quad \text{Equation (1)}$$

$$ROE_{it} = \beta_0 + \beta_1 INV_{it} + \beta_2 INV_{it-1} + \beta_3 INV_{it-2} + \beta_4 LNLO_{it} + \varepsilon_{it} \quad \text{Equation (2)}$$

Where:

ROA = Return on Assets

ROE = Return on Equity

INV = Environmental investments weighted by total assets

INV t-1 = Environmental investments weighted by total assets, lagged by 01 period.

INV t-2 = Environmental investments weighted by total assets, lagged by 02 periods.

LNAT = Natural Logarithm of Total Assets

LNLO = Natural Logarithm of Operational Income

$\beta_0, \beta_1, \beta_2, \beta_3, \beta_4$ = Estimated Coefficients of the Model

ε_{it} = error terms of the model

i = each company

t = time (annual)

With the help of these models, the intent is to verify the influence of environmental investments on the dependent variables ROA and ROE. Therefore, the independent variables will be the environmental investments divided by the total assets for the current year (β_1), for the previous year (β_2) and lagged by two periods (β_3). This means that, when the ROA represents 2007, for example, β_1, β_2 and β_3 will represent the years 2007, 2006 and 2005, respectively. It is highlighted that, to pursue this study, short term is considered as the current period, medium term as a one-year period and long-term as two years. To clarify the correct interpretation of the results of Equations 1 and 2, Figure 3 presents the expected signs of the coefficients.

Coefficients	Expected Sign
β_0	+/-
β_1	-
β_2	+/-
β_3	+
β_4	+

Figure 3. Expected Signs of the Coefficients

Source: Elaborated by the authors

As the data will be regressed through pooled data, some classical premises of a multiple regression model need to be adopted.

As regards the multicollinearity, a situation in which an exact or approximately exact linear correlation exists between the independent variables, the Variance Inflation Factor Test - VIF was applied, followed by the Breusch-Pagan Test to verify the homoscedasticity of the error terms of the model, that is, whether a constant variance exists in the error terms. The Ramsey Test verifies whether the model is correctly specified or whether variables have been omitted. In addition, the Jarque-Bera test was applied to verify the normality of the residues and the F Test to verify the validity of the regression coefficients.

To apply the statistical tests, mainly the one that verifies the correct specification and absence of variables in the model (Ramsey Test), in Equation 1 and Equation 2, which adopt ROA and ROE as de-

pendent variables, the LNAT and LNLO were used as control variables, respectively. The test results are shown in Tables 3 and 4 of the results section.

4. Presentation and Analysis of the Results

Initially, the characteristics of the companies used in this study are displayed with a view to better understanding the behavior of the variables in the data under analysis. Table 1 summarizes the descriptive statistics of the sample companies' data.

Table 1
Descriptive statistics of the variables between 2007 and 2011

Variables	Mean	SD	Minimum	Median	Maximum
INV (%)	0.257	0.215	0.001	0.221	0.767
ROA (%)	7.067	7.691	-11.000	5.500	24.900
ROE (%)	19.722	23.652	-0.062	-52.800	75.300
Operational Income (R\$ thousand)	4,394,365	8,787,196	-516,839	1,287,529	37,400,224
Total Assets (R\$ thousand)	51,379,891	64,791,150	1,962,611	23,438,221	241,783,112

Source: Elaborated by the authors

The analysis of Table 1 shows that, on average, the companies in the sample invest 0.257% of their total assets in the environment, varying by 0.215% as shown by the standard deviation. The analysis of the minimum and maximum for this variable shows, however, that some companies invest hardly anything in the environment, showing 0.001% in total assets, while others by far exceed the mean environmental investments with 0.767% of the total company assets.

A more critical analysis of the means for the variables INV, ROA and ROE reveals that the environmental investments remain far below the company profitability. While the mean ROA and ROE correspond to 7.067% and 19.722%, respectively, the environmental investments represent only 0.257% in terms of the total assets. The variables Operational Income (LO) and Total Assets (AT) display great dispersion around the average, characterizing the differences in the sample companies' sizes.

Although an analysis based on the means and standard deviation of a variable is simple, it can also be considered that the companies in this study are inclined to attend to the shareholders' aspirations, as the mean environmental investments are much lower than the economic indicators.

To present a solution for hypothesis (H1), in Table 2, the correlation matrix of the variables studied between 2007 and 2011 is displayed.

Table 2
Correlation among variables between 2007 and 2011

Variables	INV	ROA	ROE	LO	AT
INV	1				
ROA	0.319	1			
ROE	0.264	0.969	1		
LO	0.495	0.273	0.136	1	
AT	0.350	-0.008	-0.127	0.803	1

INV = Environmental Investment/Total Assets, ROA = NI/TA, ROE = NI/NE, LO = Operational Income, AT = Total Assets

Source: Elaborated by the authors

The analysis of the correlations in Table 2 shows a positive relation between environmental investments in terms of total assets and economic performance represented by ROA and ROE, with correlation coefficients corresponding to 0.3193 and 0.2641, respectively. According to Gujarati (2006), the correlation coefficient is a measure of the association between two variables, varying between -1 and +1, indicating a perfect negative and positive association, respectively. According to Dancey and Reidy (2006), this association is considered strong when the coefficient is superior to 0.70.

Therefore, it can be inferred that, although weak, a positive relation exists between environmental investments in terms of total assets and the companies' economic performance in the period from 2007 till 2011, that is, the more the companies invest in the environment, the better their economic performance, which suggests the non-rejection of the hypothesis H1 in this paper. This positive relation is consistent with the idea of the stakeholder theory, in which the company can obtain results without losing the environment it is inserted in out of sight.

In addition, a positive correlation is verified between operational income and total assets on the one hand and environmental investments on the other, with 0.494 and 0.350, respectively. This suggests that the companies with higher income or higher assets have more resources to invest in the environmental cause.

To support the initial analyses and answer the research question and hypothesis H2, the data were regressed through regression analysis with pooled data, as shown in Table 3.

Table 3

Regression with pooled data - ROA (Equation 1)

Variables	Coefficient	Standard Error	T statistics	Probability
Intercept	72.818	18.383	3.96	0.000
INV _{it}	20.257	6.809	2.98	0.005
INV _{it-1}	2.320	7.373	0.31	0.755
INV _{it-2}	-12.801	6.205	-2.06	0.046
LNAT _{it}	-2.867	0.776	-3.69	0.001
VIF Test			2.08	-
Breusch and Pagan Test			7.69	0.1083
Ramsey Test			1.58	0.2107
R ²			0.399	-
Adjusted R ²			0.339	-
F test			6.64	0.0003

Source: Elaborated by the authors

To undertake the validity tests described in the method and estimate the regression coefficients, the software STATA was used. As regards multicollinearity, the VIF test was applied. According to Gujarati (2006), as a result of the presence of this problem in the regression models, the results of this test is higher than 10. As the result of the VIF test was 2.08 in the present model, it was concluded that multicollinearity was absent in this model.

Next, the Breusch-Pagan test was applied, which verifies the constant variance of the error terms. The null hypothesis of this test assumes a constant variance. As the probability coefficient of this test corresponded to 0.1083, superior to the 5% significance level adopted in this paper, the null hypothesis should not be rejected, assuming the constant variance of the residues of this model.

The Ramsey test verifies whether the model has been correctly specified or if variables have been omitted. As the probability of the test statistics was superior to the significance level, 0.2107, the model has no specification problems or omitted variables. In addition, the residues of the model have a normal distribution and the F Test confirms that the coefficients of this equation are significantly different from zero.

After verifying the validity of the model, next, the coefficients β_1 , β_2 and β_3 of the regression model will be analyzed, with ROA as the dependent variable. β_1 represents that the environmental investments in terms of total current assets has a positive and significant impact on the companies' current Return on Assets. This may mean that the companies' environmental investments revert in benefits in the short term. β_2 represents the environmental investments in terms of total assets lagged by a current period and was not significant, that is, it does not influence the dependent variable. β_3 represents the environmental investments in terms of total assets lagged by two periods and has a negative and significant influence on the companies' Return on Assets.

Thus, the results of the coefficients presented above go against the suggestions by Klassen and McLaughlin (1996) and Alberton (2003), as a negative β_1 was expected, showing that the environmental investments are not rapidly reverted in the short term, and a positive β_3 , suggesting that environmental investments made two years earlier were positively reverting in benefits, influencing the Return on Assets.

With a view to a more consistent analysis in terms of economic impacts, a second regression was developed, now using the Return on Equity as the dependent variable, whose results are displayed in Table 4.

Table 4
Regression with pooled data - ROE (Equation 2)

Variables	Coefficient	Standard Error	T statistics	Probability
Intercept	17.531	60.176	0.29	0.772
INV _{it}	48.909	24.22	2.02	0.050
INV _{it-1}	48.408	25.436	0.72	0.474
INV _{it-2}	-62.992	21.364	-2.95	0.005
LNAT _{it}	-0.016	2.913	-0.01	0.996
VIF test			2.15	-
Breusch and Pagan test			0.18	0.6722
Ramsey test			0.78	0.5108
R ²			0.243	-
Adjusted R ²			0.166	-
F test			3.14	0.025

Source: Elaborated by the authors

Following the some procedures adopted for Equation 1, the validity tests of the model were applied, without multicollinearity or heteroscedasticity problems, showing that the model is correctly specified or that no variable has been omitted. In addition, the distribution of the model residues is normal and the F test confirms that the coefficients of this equation are significantly different from zero.

With regard to the coefficients of Equation 2, β_1 , which represents the environmental investments in terms of total current assets, a positive and significant impact on the companies' current return on equity was observed. This may mean that the companies' environmental investments revert in benefits in the short term. β_2 , which represents the environmental investments in terms of total assets lagged by one period, were not significant, that is, they did not influence the dependent variable.

β_3 , which represents the environmental investments in terms of total assets lagged by two periods, which had a negative and significant impact on the companies' current Return on Equity.

Similarly to the results found when the dependent variable was the ROA, the results of the coefficients in Table 3 go against the suggestions by Klassen and McLaughlin (1996) and Alberton (2003), as a negative β_1 was expected, showing that the environmental investments are not rapidly reverted in the short term, and a positive β_3 , suggesting that environmental investments made two years earlier were positively reverting in benefits, influencing the Return on Equity.

The above results suggest the rejection of the second hypothesis H2, as the coefficients of the equations used in this study go against the expectations and recommendations in the literature. The environmental investments lagged by two years were expected to positively influence the current ROA and ROE, but the sign of the coefficient related to this variable was negative. Similarly, the current environmental investments were expected to negatively influence the current ROA and ROE, but the sign of the coefficient related to this variable was positive.

In short, the environmental investments in terms of total assets are positively related with the companies' economic performance, but it could not be proven in this paper that the economic benefits of these investments take form in the long term, as recommended in the literature. This supports the idea, however, that the environmental investments can be considered an important component of competitive advantage, in view of the positive short-term relation with the economic performance.

5. Final Considerations

The objective in this research was to verify whether a positive relation exists between the environmental investments in terms of total assets (INV) and the companies' economic performance, as well as whether these investments positively influence these companies' economic performance in the long term. The economic performance was represented by the variables Return on Assets (ROA) and Return on Equity (ROE).

Based on the correlation matrix, the results found in this study showed that, although weak, a positive relation exists between the environmental investments in terms of total assets and the companies' economic performance for the period from 2007 till 2011, that is, the more the companies invest in the environment, the better their economic performance.

This positive relation between environmental investments and the companies' economic performance may derive from the companies' strategic view, investing in the environment as a way to cut down on their product costs, gaining market recognition and increasing the search for their products and the access to cheaper funding sources, creating or maintaining a competitive advantage, in accordance with Cardoso, Mário and Aquino (2007). The positive relation found in this study supports the positions of Bonifant, Arnold and Long (1995), Klassen and McLaughlin (1996), Reis (2002), Alberton (2003) and Alberton and Costa Jr. (2007), who defend that good environmental management, which requires investments, may be related with the companies' economic and financial performance.

In the regressions, however, the coefficients found in this research indicated an opposite direction to the expectations and the literature recommendations. It was expected that the environmental investments lagged by two periods would positively affect the current ROA and ROE, but the sign of the coefficient related to this variable was negative. Similarly, it was expected that the current environmental investments would negatively affect the current ROA and ROE, but the sign of the coefficient related to this variable was positive.

These results differ from the perspectives of Bonifant, Arnold and Long (1995), Klassen and McLaughlin (1996) and Alberton (2003), which consider that, at first, the environmental investments may represent high costs but that, in the long term, these costs revert in an economic advantage for the companies, which could not be concluded in this research.

Although contradictory, the results presented in this paper suggest that the companies' environmental investments rapidly revert in economic benefits, encouraging the managers to make permanent investments in the environment. This fact strengthens the idea that the companies should consider the environment they are inserted in, combining the corporate and socioenvironmental objectives, and that the environmental investments can be considered a form of enhancing the competitive power of the business.

As a limitation, the period chosen for this research can be highlighted, as well as the small number of companies used in this study and the variables chosen to represent the economic performance, which impede the generalization of the conclusions presented here and are sources of new studies, with a view to rejecting or supporting the present findings.

Despite the limitations, however, it is concluded that this study contributes to understand how the companies' environmental investments are related with their economic performance, contributing to new discussions and future research.

6. References

- Alberton, A. (2003). *Meio ambiente e desempenho econômico-financeiro: o impacto da ISO 14001 nas empresas brasileiras*, 2003. 307 f. Tese (Doutorado em Engenharia de Produção) – Programa de Pós-Graduação em Engenharia de Produção, Universidade Federal de Santa Catarina, Florianópolis.
- Alberton, A., Costa Jr., N. C. A. (2007). Meio Ambiente e Desempenho Econômico-Financeiro: Benefícios dos Sistemas de Gestão Ambiental (SGAs) e o Impacto da ISO 14001 nas Empresas Brasileiras. *RAC-Eletrônica*, 1(2), pp. 153-171.
- Alves, J. F. V., De Luca, M. M. M., Cardoso, V. I. C., Gallon, A. V., Cunha, J. V. A. (2012). Relação entre Desempenho Ambiental e Desempenho Econômico de Empresas no Brasil e na Espanha. *Anais do Congresso Nacional de Administração e Ciências Contábeis - AdCont*, Rio de Janeiro, RJ, Brasil, 3.
- Beuren, I. M., Theiss, V., Carli, S. B. (2012). Influência do Eco-Control do Desempenho Ambiental e Econômico de Empresas. *Anais do Congresso USP de Controladoria e Contabilidade*, São Paulo. SP, Brasil, 12.
- Bonifant, B. C., Arnold, M. B., Long, F. J. (1995). Gaining competitive advantage through environmental investments. *Business Horizons*, 38(4), pp. 37-47.
- Cardoso, R. L., Mário, P. C., Aquino, A. C. (2007). *Contabilidade Gerencial – Mensuração, Monitoramento e Incentivos*. São Paulo: Altas.
- Cohen, M. A., Fenn, S. A., Konar, S. (1997). Environmental and financial performance: are they related? [Working paper]. Vanderbilt University, Vanderbilt Center for Environmental Management Studies (VCEMS), Nashville, TN.
- Dancey, C. P., Reidy, J. (2006). *Estatística sem matemática para psicologia*. (3. ed.) Porto Alegre: Artmed.
- Drucker, P. (2001). *A Administração*. São Paulo: Nobel.
- Ferreira, A. C. S. (1995). Contabilidade de custos para gestão do meio ambiente. *Caderno de Estudos FIPE-CAFI*, 12, pp. 14-22.
- Freedman, M., Jaggi, B. (1982). Pollution disclosures, pollution performance and economic performance. *Omega The International Journal of Management Science*, 10 (2), pp. 167-176.
- Freeman, R. E., Mcvea, J. (2001). A stakeholder approach to strategic management. [Working paper]. The Darden School, University of Virginia, Virginia – EUA.
- Friedman, M. (1970). The social responsibility of business is increase its profits. *The New York Times Magazine*, 33, p. 122-126.
- Gil, A. C. (1996). *Como elaborar projetos de pesquisa*. (3ª Ed.) São Paulo: Atlas.
- Guesser, J. M., Beuren, I. M. (1998). Caracterização e mensuração dos custos ambientais. *Contabilidade Vista & Revista*, 9 (3), p. 25-31.
- Gujarati, D. (2006). *Econometria Básica*. (4ª ed.) Rio de Janeiro: Elsevier.
- Henri, J, Journeault, M. (2010). Eco-control: the influence of management control systems on environmental and economic performance. *Accounting, Organizations and Society*, 35(1), p. 63-80.
- Jacques, F. V. S., Rasia, K. A., Pires, V. M., Ott, E. (2012). Influência dos investimentos e gastos ambientais no desempenho econômico das maiores empresas brasileiras do agronegócio. *Revista Espacios Digital*, Caracas, Venezuela, 33(3), p. 18.

- Klassen, R. D., Mclaughlin, C. P. (1996). The impact of environmental management on firm performance. *Management Science*, 42(8), pp. 1199-1214.
- Machado, M. A. V., Macedo, M. A. S., Machado, M. R., Siqueira, J. R. M. (2010). Análise da relação entre investimentos socioambientais e a inclusão de empresas no Índice de Sustentabilidade Empresarial - (ISE) da BM&F Bovespa. *Anais do Congresso USP de Controladoria e Contabilidade*, São Paulo. SP, Brasil, 10.
- Maimon, D. (1994). Eco-estratégia nas empresas brasileiras: realidade ou discurso? *Revista de Administração de Empresas – São Paulo*, 34(4), pp. 119-130.
- Miles, M. P., Covin, J. G. (2000). Environmental Marketing: A Source of Reputational, Competitive and Financial Advantage. *Journal of Business Ethics* 23(3), pp. 299-311.
- North, K. (1992) *Environmental business management: an introduction*. Geneva: International Labor Office (ILO).
- Sharma, S., Vredenburg, H. (1998). Proactive corporate environmental strategy and the development of competitively valuable organizational capabilities. *Strategic Management Journal* 19(8), p. 729-753.
- Reis, H. L. (2002) Os Impactos de um sistema de gerenciamento ambiental no desempenho financeiro das empresas: um estudo de caso. *Anais do Enanpad*, Salvador, BA, Brasil, 26.
- Tinoco, J. E. P., Kraemer, M. E. P. (2008). *Contabilidade e Gestão Ambiental*. (2ª ed.) São Paulo: Atlas.
- Valle, C. E. (2000). *Como se preparar para as Normas ISO 14000: qualidade ambiental: o desafio de ser competitivo protegendo o meio ambiente*. (3ª ed.) São Paulo: Pioneira.