

**Impact of Convergence to IFRS on
the Economic and Financial Performance of
Construction and Transportation Enterprises:
A Study Conducted through Data
Envelopment Analysis**

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Abstract

The objective of this study was to verify the impact of convergence Brazilian accounting standards international accounting systems performance assessment of the economic and financial sector companies listed on the construction and transportation BM&FBovespa. Was used the model of data envelopment analysis (DEA) to evaluate financial performance. The data refer to the re-release of 55 companies in the construction and transportation in 2009, using a set of 23 indicators. The DEA model used in the evaluation of the economic and financial performance was satisfactory and earned important results for the comparison between before and after IFRS. The results were significant in the comparison between the results in IFRS and BR GAAP, which indicates and effectives the relationship between the two performances of companies. Thus we conclude that the performance was not affected with the change of accounting standards in Brazil.

Keywords: Performance Evaluation, Accounting Convergence, Data Envelopment Analysis

1 Introduction

Performance evaluation is vital for a company, and it is focused on its sustainability and its perennial activities. With a performance evaluation process aligned with the interests of users, the company is able to attract foreign investment in an applied way. According to [1], to evaluate the performance of a company is to formulate a judgment based on information that was provided to the ones who are agents of the assessment process. Based on this point of view, [2] argue that measuring performance, i.e., providing information, is the first step to present, with quality, to users the real situation of the company.

In terms of performance evaluation, [3] and [4] defend in their studies the importance of using economic and financial indicators as a tool for synthesizing the information present on the balance sheet aiming to equip the assessment of enterprises performance. On the other hand, [5] points out that the use of economic and financial indicators must be the main instrument for evaluating performance, since these are indicators where information is more readily obtained in the performance evaluation process. When dealing with the prospect of the information generated and provided to users, [6] argues that there is a need to condense the information present on the balance sheets and indicators into a single information that focuses on what is required to the user, when assessing the company's performance. This way, using multi criteria methods in assessing the economic and financial performance of enterprises is substantiated as an important research branch. Within this perspective, some papers that utilize Analysis Data Envelopment (DEA) are highlighted as a tool for assessing the economic and financial performance, such as studies of [7], [8], [9] and [10]. From this point of view, the application of the model in [11] paper is highlighted. This is the Brazilian paper with greater visibility in national accounting research on the DEA model.

Quality accounting information is generated from quality accounting policies, in this sense, and also because of the fact of the expansion of the market to global levels, since the 1970's, there have been many discussions, with greater tenacity, about the global adoption of accounting common standards. The argument presented is that with common standards of measurement and recognition of financial and economic elements of enterprises, transaction and investment costs would decrease [12]. Another argument, that has been empirically confirmed by many studies, is that international accounting standards increase the quality of accounting information provided by the companies ([13], [14], [15]). One can observe here the quality of accounting information, such as minimizing the information asymmetry between the various users (stakeholders) and company managers.

With harmonizing accounting process, accounting standards, mainly the policies regarding the measurement of enterprises' assets, were changed in order to improve the quality and reduce the information asymmetry between users [14]. These changes tend to significantly affect the results offered by the economic and financial indicators. It, in turn, proves whether these changes were significant for enterprises. It should also be considered that in some areas the impact has been more experienced than in others.

Within this configuration, there has been formulated the core research process question which was adopted for this study and elaborated as follows: What is the level of impact of the Brazilian accounting convergence to international accounting standards, in the economic and financial performance evaluation system of companies in the construction and transportation sectors listed on the BM&FBovespa? Based on this question the objective of the research question was configured as to verify the impact of the Brazilian accounting convergence to international accounting standards, in the economic and financial performance evaluation systems of companies in the construction and transportation areas listed on the BM&FBovespa.

This study focuses its contribution in the possibility of understanding the process of accounting convergence to international standards. The study presents the perceived effects on the financial statements of Brazilian companies listed on the stock market. Thus, this paper contributes to the studies of [16], [17], [18]; [19]; [20], [21]; [22]; [23]; [24]; [25]; [26], which also aimed at understanding which changes in the financial landscape, in the accounting practices, and in the proposals in IFRS were brought to enterprises.

The study is also based on the proposal of a performance evaluation system that uses the Data Envelopment Analysis, and that is capable of measuring the efficiency focusing on the economic and financial indicators. This theme is supported with studies conducted by [7], [8], [9], and [10]. In Brazil, as previously presented, the pioneer work which provided greater visibility to the DEA model as a way to evaluate the performance of companies was the doctoral thesis of [11].

Research papers as [19], [24] and [26] have to be justified for not being trivial and for standing out as important research that invested the convergence process in other countries that acceded to these policies. It also corroborates the studies of [27], and [28], [29] which discuss and defend the use of indicators as a way of analyzing performance.

2 Economic and Financial Performance Evaluation

The theoretical basis of this study, which is substantiated on the performance evaluation takes into consideration the epistemological positioning of its authors, who are one group that works with evaluating financial performance and another group that works with non-financial performance evaluation. It is noteworthy that the discussion generated between these two groups regard only information used in measuring performance, given that the first group advocates using only financial information and the other group admits the use of information from other groups. For this study, which focuses on working with financial performance indicators, however, current concepts of non-financial information are corroborated.

Regarding the concept of performance evaluation, [1] p. 196 states that it is the exercise of fruiting a judgment on any information provided, which can generate a positive or negative judgment, being both of the considerations consequences of the process. The question that arises is what is the most relevant information when formulating a judgment by the information user.

Corroborating what was previously stated, [2] show that the evaluation process must be based as an evaluation system. About this statement, the authors postulate the existence of a prism that must be used when evaluating corporate performance. This prism consists of five questions that should be asked to seek a consistent system of assessing enterprise performance: (1) Who are our key stakeholders and what do they want and need? (2) What do we want and needs from the stakeholders on a reciprocal basis? (3) What strategies need to be implemented to meet the desires and needs of stakeholders, provided they meet the requirements of the company itself as well? (4) What processes must be put in place so that we can implement the strategies? (5) What is the ability necessary to put in place in order to allow the processes operation?

To [30] p. 54 within a company one can check which processes have greatest importance, checking which procedures suffer the greatest burden of performance evaluation. Still referring to the authors, one shall only measure what is important, what is not important has no need to be measured. Corroborating this statement, the authors describe some forms of performance measurement that managers can take within their companies.

Regarding the performance evaluation through indicators, [3] comments on the accounting researches that used this form of companies performance measurement. According to the author, at the beginning of the century there were already some indicators, which had limitations in operation performance evaluation. On the other hand, in the 1960s, even though there were more financial indicators, there were incipient academic researchers in this area.

Corroborating this discussion, [4] confirms that the performance evaluation with the use of accounting indicators, has become an important management tool, given that indicators bring to light information that is not evident in the balance sheets. The author was stating that the indicators somehow eliminate, in a certain way, the direct effect of enterprise size, bringing the information to terms comparable to other companies that have similar activities. [5], on the other hand, describes that speed is the main factor that favors the use of indicators in performance assessment, given that companies tend to keep their financial statements on time.

[5] Presents a model that works with predicting the solvency of enterprises, using it for a set of indicators. Meanwhile, in Brazil this line of research was also absorbed in academia. An evidence of this trend was [31] paper, who developed what was called Insolvency Thermometer for non-financial companies in Brazil. Using indicators this compact, to meet sporadic interest, must be understood as a way of satisfying the needs of a single user set. [32] describes in his paper discussions regarding the performance appraisal system used in the past by the Indian government for the State enterprises from his country. His considerations show that what suits one user may not suit the others.

Thus, the study of performance based on financial and economic indicators must take into consideration some aspects as the relevance of the use of certain indicators, as well as the way in which it presents a result in a single information. The indicators which are well used, as described above, can generate large contributions to corporate management and to mitigate risk investments. One should also consider the possibility of using mathematical methods that are more robust so that a more comprehensive and more accessible information can be taken to the decision maker.

Two questions arise. The first one relates to the importance of developing researches that deal with enterprises performance evaluation methods. The second one deals with the implications quality information generate on the process of performance evaluation. About this second aspect, accounting convergence has come to, according to the researches of [19], increase the quality of accounting information, which would lead to an improvement in the performance evaluation process.

3 Accounting Practices Harmonization

According to [33] "International accounting has emerged to alleviate the plight of those who want to invest abroad and up to today had to handle balance sheets in dozens of different accounting standards, trying to match them to compare them." According to the authors, the accounting convergence process worldwide has been being discussed since the nineteenth century, when companies were basically manufactures.

The accounting convergence process conducted in different countries started, according to [12], with the discussions and subsequent creation of IASC in 1973. Thereafter, more precisely in 2001, IASC became IASB (International Accounting

Standards Board). This institution was the main driving force in the effective implementation of the international standards in some countries around the World.

Around the 90's, in Brazil, some discussions regarding the modernization of Law 6.404/76 started to arise. This law is called Corporation Law. According to [34] p. XXII the proposed revision of the law "aimed making it responsive to the local and global information needs." Thus, in 2000, the law was presented to the Chamber of Deputies as Bill 3741, which was approved on December 28, 2007 and promulgated in the Official Journal on the same day under the name of Law 11.638/07. This law allows the CVM to formulate accounting standards for Brazilian companies in order to validate the process of harmonization with IASB standards. These new accounting rules have already entered into effect, on an optional basis in 2008, and in 2010 standards were mandatory to all companies stock trading at BM&FBovespa.

The convergence process can be summarized into two periods, utilizing as a historical milestone its adoption by the European Union, approved in 2002, and to be obligatorily applied in 2005. After this large economical block's final adoption – which was very influential on the world market - countries in all continents followed the same path, which was then characterized as the period after the European Union. The power of this decision made by the European Union can be perceived when compared with the descriptions made by [16]. In this paper, the authors state that Australia was one of the first countries to adopt the accounting standards presented by the, previously called, IASC. The authors stressed that it was a risky decision made by the government, since no other country in the world was applying these standards, and that it would generate a very strong capital cost, what might isolate the rest of the Australian economy from the world.

However the convergence process was not a consensus for European countries. [35] reported that the main fear among managers of the enterprises from that country was to predict what effects would be observed in the enterprises after this adoption. [36] describes that no European company gained with the convergence process, they only had adjustment costs. Moreover, [37] defended the convergence process and described that the great virtue was not the convergence itself, but the homogenization of the enterprises' accounting disclosures.

When it comes to the comparison between enterprises performance in accordance to the accounting policy adopted by its country of origin, [22] studied the relationship between the U.S. accounting standards, U.S. GAAP and the international accounting standards described in IFRS. The results point at the existence of information asymmetry between these two sets of standards, which would imply that the adoption in Brazil a significant impact on enterprises performance.

Regarding the impact, the studies of [15] and [26] have reported that in Greek companies the major effects were experienced as being a stronger volatility in the demonstrations of the leading companies in the country. Miranda in 2008, on the other hand, has studied the impact on the enterprises performance in France, England and Spain. The results of the studies have exposed that the most affected country by the convergence was England, which is actually the one country that had

its GAAP as a common-law, even when adopted by IFRS. According to the author the impact on code-law countries, Spain and France, were not significant.

Researchers studying the impact promoted by the accounting convergence in Brazil in the enterprises performance are still incipient. However, some studies can be highlighted, such as: [20], [23], [38], [39], [40], [41], [42]. These studies highlight only the existence of the trend impact, given that the convergence process during the elaboration of the papers had not occurred completely. [20] Has studied the relationship between the companies listed on the Brazilian Stock Exchange and the ADRs, comparing them with enterprises with ADRs and with stocks traded in London. The results have pointed at the existence of information asymmetry between BR GAAP and IFRS, which would motivate a strong impact on the performance of Brazilian enterprises.

The research results that have been presented highlight, especially, the expectation that there is an impact on enterprises performance. However, it is unclear how the impact will be. On the other hand, empirical studies that have been conducted so far, highlight that the impact has already occurred, but its effect was reduced, which corroborates with Miranda's (2008) study, taking in consideration that in Brazil GAAPs are in code-law format. This way, the process of building a model of performance analysis will continue, presenting the model of Data Envelopment Analysis.

4 Data Envelopment Analysis

The study of [43] was considered by academia to be the pioneer in the application of models of efficiency analysis for m input variables with n output variables. This study was the result of the doctoral thesis of E. Rhodes, who sought to evaluate the performance of the education system in American schools. In this study, Rhodes took into account a set of input variables of the production system, including, for example, teachers' workload, and number of hours students were reading. As outcome variables or model outputs, some variables were taken in consideration, such as: psychomotor skills, grades in Mathematics and Logic, among others. To come to a solution, Rhodes, together with Charnes and Cooper, developed a Mathematical Optimization model that allowed to measure students performance by comparing them. This was the first model of Data Envelopment Analysis (DEA) that admitted the use of n analysis variables, given that the first model developed by [44] deals with a limited number of variables.

The model developed by [43] was baptized, by later researchers, as the CCR model of Data Envelopment Analysis (CCR as a tribute to C - Charnes, C - Cooper and R - Rhodes), or CCR DEA, or even DEA CRS (*Constant Return Scales*). This model is defined by a fractional programming problem (PF_o) which corresponds to the model below:

$$\text{Objective function: } \quad \text{Max}_{v,u} \theta = \frac{u_1 y_{10} + u_2 y_{20} + \dots + u_s y_{s0}}{v_1 x_{10} + v_2 x_{20} + \dots + v_m x_{m0}}$$

$$\begin{aligned} \text{Subject to:} \quad & \frac{u_1 y_{1j} + u_2 y_{2j} + \dots + u_s y_{sj}}{v_1 x_{1j} + v_2 x_{2j} + \dots + v_m x_{mj}} \leq 1 \quad (j \\ & \quad \quad \quad = 1, 2, \dots, n) \\ & v_1, v_2, \dots, v_m \geq 0 \\ & u_1, u_2, \dots, u_s \geq 0 \end{aligned}$$

The consideration that is made on the CCR model assumes that the returns will always be constant or proportional. That is, if an *A* producing unit has twice the number of employees than a *B* producing unit, by the CCR – Efficient model, so that *A* can be efficient, this production unit must produce twice as *B* too. [45] have reconsidered this conjecture and have realized that, if an enterprise set is analyzed, the largest ones tend to have lower performance, i.e., if the number of employees in unit *A* is twice the number of employees in unit *B*, the result of *A* may not be up to twice that of *B*. Assuming that *B* is an efficient unit.

The BCC model is composed in the same way that the CCR model, by a Fractional Programming problem (PF_o). However, the differential of the model is the addition of u_0 , which is a free variable, which depicts the slack factor or the harmonization factor of the enterprises performance. The model proposed as (PF_o) was presented as follows by [45]:

$$\begin{aligned} \text{Objective} \quad & \text{Max } v, u, u_0 \theta \\ \text{function:} \quad & = \frac{u_1 y_{10} + u_2 y_{20} + \dots + u_s y_{s0} + u_0}{v_1 x_{10} + v_2 x_{20} + \dots + v_m x_{m0}} \\ \text{Subject to:} \quad & \frac{u_1 y_{1j} + u_2 y_{2j} + \dots + u_s y_{sj} + u_0}{v_1 x_{1j} + v_2 x_{2j} + \dots + v_m x_{mj}} \leq 1 \quad (j \\ & \quad \quad \quad = 1, 2, \dots, n) \\ & v_1, v_2, \dots, v_m \geq 0 \\ & u_1, u_2, \dots, u_s \geq 0 \end{aligned}$$

For this efficiency coefficient generated by the BBC model, both [43], and [45] have demonstrate that $Ef_{BCC} \geq Ef_{CCR}$. This statement is justified by the fact that this model allows that the returns are not constant, i.e, that there is some difference between the results of DMUs with no impact on efficiency. Therefore this model is also called Variable Return Scale - VRS.

According to [45], some second order models have been developed, which seek to analyze the performance by taking certain precautions regarding the applicability of the model. Among these models, the Additive model or ADD is the best known for allowing the evaluation of performance, without requiring the use of orientation to the model. However, this model does not perform the calculation of the efficiency ratio. For this reason, in the present paper, the model described by Zhenhua and Gang in 2010 has been utilized. In this model, the calculation of the efficiency is possible, also admitting the measurement of slacks and excesses of the production system. This way, the model is described as:

Objective function:
Subject to:

$$\begin{aligned} \min &= \frac{1 - w^l \alpha}{1 - w^o \beta} \\ \sum_{j=1}^n \lambda_j x_{ij} + s_i^- &= (1 - \alpha)x_{ik} \quad \text{se } w^l > 0 \\ \sum_{j=1}^n \lambda_j x_{ij} + s_i^- &= x_{ik} \quad \text{se } w^l = 0 \\ \sum_{j=1}^n \lambda_j y_{rj} + s_r^+ &= (1 - \beta)y_{rk} \quad \text{se } w^o > 0 \\ \sum_{j=1}^n \lambda_j y_{rj} + s_r^+ &= y_{rk} \quad \text{se } w^o = 0 \\ \sum_{j=1}^n \lambda_j &= 1 \quad (VRS) \\ \lambda_j \geq 0; s_j^- \geq 0; s_r^+ &\geq 0 \\ j = 1, 2, \dots, n; i = 1, 2, \dots, m; r = &1, 2, \dots, p \end{aligned}$$

In this PPF w^l and w^o are non-negative numbers and at least one of the two must be non-zero. The efficiency of the model is defined by $(1 - \alpha)/(1 + \beta)$.

On the other hand, w^l and w^o are used as coefficients to signal the orientation model. For the *input* orientation, it must be admitted that $w^l = 1$ and $w^o = 0$. For the *output* orientation, the model admits that $w^l = 0$ and $w^o = 1$. Finally, and assuming the case of this dissertation, for a model that does not take in consideration any orientation, it must be admitted that $w^l = 1$ and $w^o = 1$, what generates a fractional programming problem which is solved as follows:

Assuming a *t* scalar which is non-zero and non-negative, it is presented $t = 1/(1 + w^o \beta)$, in this way, the model PPL is, as follows:

Objective function:
Subject to:

$$\begin{aligned} \min & t - w^l t \alpha \\ t + w^o t \beta &= 1 \\ \sum_{j=1}^n \lambda_j x_{ij} + S_i^- &= (t - A)x_{ik} \quad \text{se } w^l > 0 \\ \sum_{j=1}^n \lambda_j x_{ij} + S_i^- &= x_{ik} t \quad \text{se } w^l = 0 \\ \sum_{j=1}^n \lambda_j y_{rj} + S_r^+ &= (t - B)y_{rk} \quad \text{se } w^o > 0 \\ &> 0 \\ \sum_{j=1}^n \lambda_j y_{rj} + S_r^+ &= y_{rk} t \quad \text{se } w^o = 0 \\ \sum_{j=1}^n \lambda_j &= t \quad (VRS) \\ t > 0; \lambda_j \geq 0; S_j^- \geq 0; S_r^+ &\geq 0 \\ j = 1, 2, \dots, n; i = 1, 2, \dots, m; r = &1, 2, \dots, p \end{aligned}$$

Since t is a positive scalar, a transformation is reversible, and the optimal solution is: $\alpha^* = A^*/t$; $\beta^* = B^*/t$; $\lambda^* = \Lambda^*/t$; $s^{-*} = S^{-*}/t$, $s^{+*} = S^{+*}/t$. Thus this was the model used to calculate the efficiency of the enterprises listed on the BM&FBovespa. It was chosen because it is a more robust model than the one presented by [43] to address the slacks and excesses of analyzed DMUs.

5 Research Method

This research aims at verifying the impact of the convergence to international accounting standards of the enterprises listed in the construction and transportation sectors of BM&FBovespa. It is highlighted, regarding its methodological lineation, as a deductive study, and according to its goals, as a descriptive research, with documentary procedures and a quantitative approach. This classification was obtained based on the classification described by [47] and [48].

Fifty-five companies were studied in this paper, since this was the sector presented by BM&FBovespa as being the largest sector. The information collected on the field of the stock market correspond to the re-dissemination of 2009, since all the companies that have disseminated for the first time in 2010, were obliged to disclose information from the prior period. This sector has been determined, since it is assumed that it is one of the sectors affected, taking in consideration instruments as CPC 17, which describes new rules for the recognition and measurement of revenue by construction companies. Thus, Table 1 shows the description of the companies based on the activity segments. It was verified that the research sample represents approximately 67% of the total population.

Table 1: Companies listed on the BM&FBovespa Construction and Transportation Sector.

Sector	Subsector	Segment	Listen enterprises	Analyzed enterprises	
Construction and Transportation	Engineering and construction	Civil Construction	22	21	
		Heavy Construction	5	3	
		Consulting Engineering	2	1	
		Real State Intermediation	2	2	
		Construction Material	5	4	
		General Services	6	2	
	Transportation	Road Operations	15	7	
		Store Support Services	15	9	
		Hydro-way Transportation	2	1	
		Road Transportation	2	2	
	Total			76	51

Source: Adapted from BM&FBovespa.

For the analysis of enterprises efficiency, a set of 23 economic and financial performance indicators was used. These indicators were extracted from the studies of [49], [50], as well as some studies conducted by Brazilian authors, such as, [51], [52] and [53]. This distinction was made because Brazilian researchers defend four analysis categories: Liquidity, Debt, Profitability and Activity. On the other hand, international authors argue that there is another set of indicators of market indexes. Thus, Table 2 describes the indicators used in the data analysis.

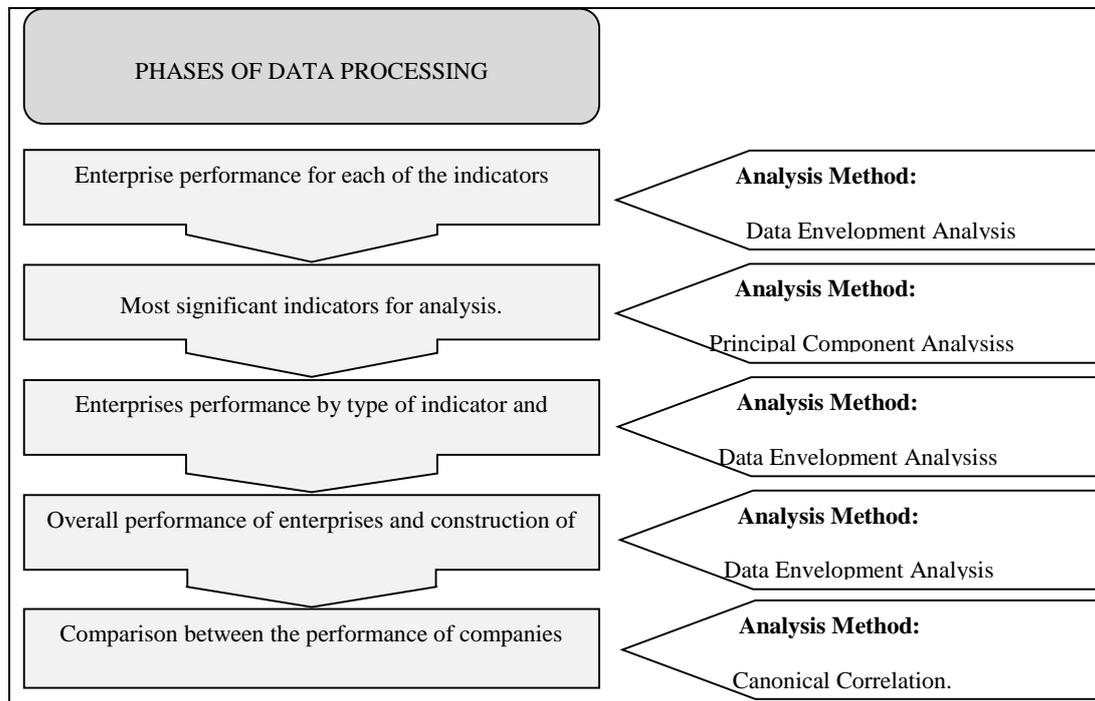
Table 2: Indicators Used.

Variable	Subvariable	Variable	Subvariable
Liquidity	General Liquidity	Rentability	Return on Equity
	Current Liquidity		Return on Investment
	Immediate Liquidity		Return on Total Asset
	Quick Ratio		Gross Profit Margin
Debt	General Debt		Operating Profit Margin
	Net Equity Immobilization		Net Profit Margin
	Operating Own Resources Index		EBITDA Margin
	Caption Index		Profit per Share
	Interest Coverage	Activity	Asset Turnover
Market	Share Price per Profit		Storage Turnover
	Share Price per Sale		Receiving Average Period
			Payment Average Period

Source: Prepared by the author.

Thus the modeling process was comprised of five stages, the first applies the DEA model to assess the indicators individually. The second analysis process has to do with the selection of variables in which the efficiency coefficient has stood out the most within a set of variables. The third one works with the efficiency measurement process given the set of indicators selected by the previous step. The fourth step highlights the process of measuring results through the general set of indicators selected. Finally, the last step is notable for being the step that determines whether or not there was an impact on performance, regarding the analyzed performance.

The process of data analysis is presented in Figure 1, this picture shows the methods used in the analysis of the research results.



Source: elaborated by the author.

Figure 1 - Process of data analysis

The indicators efficiency analysis was performed assuming that, since the indicator is a ratio mathematical expression, it was used, as an output of the DEA model, the numerator of the indicator, and as an input of the model, the denominator. For example, the Current Liquidity indicator, expressed by Current Assets/Liabilities, the model output is the Current Assets, and the model input is the Current Liabilities. Once the companies were selected, the numerators set of the selected indicators composed the outputs group, as well as the set of inputs composed the denominators group.

In the variables selection process the Main Component Analysis was used as a method for analyzing the results. According to [54] this model is similar to the Factor Analysis method, however this model is concerned with the analysis of the first factor as being the most significant one. What [55] applies to his work was used as a criterion. The cutting line of the model was in the indicators that obtained a higher than 0.5 absolute score.

The last method used to analyze indicators was the Canonical Correlation method which, according to [54], uses two sets of variables, one is a set of X independent variables, and the other one is a set of Y dependent variables. This method was used to determine the occurrence or not of impact in the Brazilian enterprises performance. We compared the enterprises performance before IFRS and after.

6 Research Results

This session aims at presenting the results obtained by empirical research, considering the whole developing process of the performance evaluation model, as well as the comparison of the results. On the other hand, the first research results are related to the analysis of the efficiency indicators calculated by the DEA model. The results have been calculated for the disclosure period in 2009, and for the disclosure in IFRS through the full IFRS. The results are shown in Table 3.

Table 3 - Performance of enterprises by Indicator

		Members the Frontier	Mean of Efficiency	Median	Standard Deviation
General Liquidity	BR GAAP	16	0,89139	0,89591	0,10245
	IFRS	19	0,89631	0,90710	0,10055
Current Liquidity	BR GAAP	4	0,70721	0,69578	0,19887
	IFRS	4	0,70372	0,69849	0,20589
Immediate Liquidity	BR GAAP	4	0,73964	0,73766	0,20529
	IFRS	3	0,60091	0,57357	0,22844
Quick Ratio	BR GAAP	8	0,78220	0,80688	0,18276
	IFRS	8	0,79254	0,84440	0,19000
General Debt	BR GAAP	4	0,66215	0,63461	0,14483
	IFRS	4	0,69951	0,68578	0,13910
Net Equity Immobilization	BR GAAP	5	0,41580	0,28553	0,31813
	IFRS	5	0,43425	0,36424	0,29445
Operating Own Resources Index	BR GAAP	14	0,83487	0,90759	0,18009
	IFRS	14	0,81617	0,85297	0,18485
Captation index	BR GAAP	4	0,41252	0,34320	0,20030
	IFRS	4	0,38246	0,30053	0,20969
Interest Coverage	BR GAAP	1	0,06381	0,04447	0,13293
	IFRS	1	0,12234	0,10410	0,12722
Return on Equity	BR GAAP	2	0,64651	0,66734	0,21920
	IFRS	2	0,63245	0,64843	0,22158
Return on Investments	BR GAAP	1	0,35700	0,42862	0,20984
	IFRS	1	0,36755	0,45085	0,22017
Return on Total Asset	BR GAAP	5	0,66477	0,66439	0,25492
	IFRS	4	0,67117	0,67705	0,25572

Table 3 (Continued): - Performance of enterprises by Indicator

Brut Margin	BR GAAP	4	0,76378	0,75428	0,16813
	IFRS	6	0,77190	0,76877	0,17039
Operating Profit Margin	BR GAAP	6	0,76872	0,78146	0,19821
	IFRS	3	0,69182	0,68102	0,18570
Net Profit Margin	BR GAAP	5	0,75642	0,75220	0,19282
	IFRS	4	0,70668	0,68816	0,18884
EBITDA Margin	BR GAAP	6	0,75357	0,74962	0,19614
	IFRS	4	0,70478	0,69738	0,17598
Profit per Share	BR GAAP	2	0,55547	0,55540	0,25131
	IFRS	2	0,57128	0,55866	0,25002
Asset Turnover	BR GAAP	5	0,51189	0,42977	0,24879
	IFRS	4	0,50651	0,43335	0,23906
Storage Turnover	BR GAAP	2	0,26955	0,21192	0,18559
	IFRS	2	0,26756	0,19675	0,19085
Receiving Average Period	BR GAAP	3	0,23303	0,16357	0,24469
	IFRS	2	0,12266	0,03522	0,25916
Payment Average Period	BR GAAP	3	0,51005	0,49064	0,24754
	IFRS	2	0,12266	0,03522	0,25916
Share Price per Profit	BR GAAP	2	0,43070	0,39916	0,20136
	IFRS	2	0,43791	0,41664	0,20165
Share Price per Sale	BR GAAP	3	0,39130	0,34712	0,20002
	IFRS	3	0,38652	0,34166	0,20521

Source: search results.

The results in Table 3 highlight that the indicator which has the largest number of members of the efficiency border was the operating own resources index. It is also important to notice the tendency of happening significant impacts along the efficiency border, considering that in all indicators the standard for both disclosures remained. The more affected averages were the Activity indicators. It is important to highlight that the other indicators were also stable when it comes to the averages analysis.

Once the scores of corporate performance were calculated for each indicator, as the statistical description of the results is shown, the second research procedure shall be proceeded. This procedure allows a variable selection process, made in two stages. The first one considers the set of indicators by class, and in the second one, a selection considering the full set of indicators was applied. The review process was conducted by Main Component Analysis, and as the cut line the value of 0.5 was used for the first component, assuming what was described by [55].

Table 4 - Selected Indicators

	Selection by Indicator		General Selection	
	BR GAAP	IFRS	BR GAAP	IFRS
General Liquidity	X	X		
Current Liquidity	X	X		
Immediate Liquidity	X	X	X	X
Quick Ratio	X	X		
General debt	X	X		
Net Equity Immobilization	X	X		
Operating Own Resources Index	X	X		
Captation Index	X	X		
Interest Coverage			X	X
PL Profitability	X	X	X	X
Return on Investments				
Return on Assets	X	X	X	X
Gross Margin	X	X	X	X
Operating Margin	X	X	X	X
Net Profit Margin	X	X	X	X
EBITDA Margin	X	X	X	X
Profit per Share			X	X
Asset Turnover			X	X
Storage Turnover				
Receiving Average Period	X	X		
Payment Average Period	X	X		
Share Price per Profit	X	X		
Share Price per Sale	X	X		

Source: Research results.

According to the results from the variable selection conducted through the Main Component Analysis, in Table 4, it was found that no changes occurred in all of the selected indicators set. It must be highlighted that the impact was measured by the performance analysis through indicators, however this impact did not affect the analysis of indicators.

Based on the results of the selected indicators, the enterprises performance was calculated in general, i.e., the performance was measured by analyzing all the selected indicators through the DEA model, considering the groups of indicators, Liquidity, Debt, Profitability, Activity and Market, as well as the general set of selected indicators. Table 5 presents descriptive statistics of the efficiency scores obtained by the companies.

Table 5 – Descrição dos resultados da análise de eficiência por grupos

		Members the Frontier	Mean	Median	Standard Deviation
Liquidity	BR GAAP	26	0,9530	0,9978	0,0625
	IFRS	24	0,9518	0,9820	0,0624
Debt	BR GAAP	24	0,9173	0,9744	0,1114

Table 5 (Continued): – Descrição dos resultados da análise de eficiência por grupos

	IFRS	29	0,9214	1,0000	0,1107
Profitability	BR GAAP	16	0,8916	0,9633	0,1481
	IFRS	23	0,8920	0,9660	0,1490
Activity	BR GAAP	3	0,5315	0,5091	0,2328
	IFRS	3	0,5038	0,4839	0,2496
Market	BR GAAP	3	0,4614	0,4143	0,2072
	IFRS	3	0,4676	0,4227	0,2059
General	BR GAAP	33	0,9694	1,0000	0,1059
	IFRS	30	0,9650	1,0000	0,0580

Source: Research results.

Considering the impact of adopting IFRS on the performance of the Construction and Transportation sector, Table 5 shows that the performance was more affected in the set of Profitability indicators of the enterprises, noting that the number of members of the efficiency border has increased from 16 to 23. However, the same impact was not experienced on the average, which remained stable. Once the performance based on different indicators categories was analyzed it can be considered that there was no direct impact on the performance of this sector, which corroborates with the variables selection.

Based on the overall performance of the companies, considering the indicators both by their group and in a general way, it was verified if there actually happened or not an impact on the performance of companies in the sector being analyzed. This confirmation was performed by the method of canonical correlation and is presented in Table 6.

Table 6 – Result of the impact test of the IFRS

Equation	Eigenvalue	Canonical Correlation	Lambda	Chi-Squared	D.F.	P-Value
1	0,99792	0,99896	0,00000	654,02100	36	0,0000
2	0,96557	0,98263	0,00020	379,27000	25	0,0000
3	0,87246	0,93406	0,00578	229,35900	16	0,0000
4	0,84934	0,92160	0,04528	137,71900	9	0,0000
5	0,67477	0,82144	0,30057	53,49230	4	0,0000
6	0,07584	0,27538	0,92417	3,50950	1	0,0610

Source: research results.

Table 6 presents results that confirm the existence of a difference in performance after the application of IFRS. It is necessary to consider that the lack of impact on business performance is obtained by a correlation coefficient equal to 1, based on [55]. However, the results point to a relationship too strong being approximately 1. Thus it is possible to admit a strong symmetry between the performance achieved by disclosures under IFRS for the results in BR GAAP. This consideration is to compare the results of this survey with those obtained through the study of [22] who found influence and information asymmetry between BR GAAP and IFRS. Thus it was found that in the construction and transportation impact

of convergence in performance occurred, but its intensity was very small and hardly noticeable.

The results presented in this study corroborate the research results from [23] and [38] who presented their results for the impact as significant, though how much impact the value experienced was minimal. This fact may have occurred because, according to [33], both normative effects increased the value of some accounts, as well as reduced the result of some accounts that were observed.

Regarding [39] paper the two approaches are not congruent, given that the authors worked with a temporal series and the present paper showed the re-dissemination of 2009. Yet, it is agreed with the authors' consideration that the impact was not broad as to happened with [41], since this effect was provoked by the 2008 financial crisis. The results obtained by [20] are, somewhat, aligned with the study conducted by [40], because it works much more with the expectation of the accounting convergence process in Brazil. Both papers, in spite of the fact that they had distinct samples and objectives, verified and mapped that Brazil should go through the convergence process. Comparing [20] assumption that between BR GAAP and IFRS there is information asymmetry and therefore impact on performance really occurs, this fact was not confirmed in this paper's results, which points at a mild impact on performance.

In research conducted by Miranda, the main finding that was obtained was that, in countries with accounting standards that are based on principles, such as the case of the UK, the effects of IFRS, which is also centered on principles, was more evident than in countries which had GAAP centered in rules. Thus, the results of the research point to the real existence of impact on company performance. However, this impact was not significant, as predicted by surveys conducted before the full convergence in Brazil.

7 Conclusions

This study was conducted in the perspective of assessing the impacts of the implementation of international accounting standards, regarding economic and financial performance of enterprises. Thus, this research aimed at verifying the impact of the Brazilian accounting convergence to the international accounting standards, in the economic and financial performance evaluation systems of companies in the construction and transportation sectors listed on the BM&FBovespa. The study utilized a mathematical modeling procedure to infer a new performance evaluation model which uses Data Envelopment Analysis as the main tool applied in the analysis. The collected data regards the re-dissemination of enterprises in 2009. Thus, this study used a set of 23 indicators, divided into five classification groups, Liquidity, Debt, Profitability, Activity and Market. Initially, the efficiency scores were calculated for each of the selected indicators, and using the Main Component Analysis, these indicators were reduced. Based on the most significant indicators, the overall efficiency was calculated, as it was calculated by groups of indicators, and with this information, using the method of canonical correlation it was possible to obtain a research result.

The results obtained significance in the comparison between the results in IFRS and BR GAAP, which indicates and effectives the relationship between the two performances of the companies. The canonical correlation coefficient obtained a value which was very close to 1, indicating the existence of similarity between the performance of companies. Regarding the Main Component Analysis test, the results for both policies were the same.

Thus, it can be concluded that, based on the literature, the performance was not affected by the change of standards of the Brazilian accounting. This corroborates previous studies in Brazil that the impact was not experienced. This research corroborates mainly to Miranda's (2008) studies, where the results showed that in countries where GAAP were code-law, the impact was smaller than in countries where GAAP is common-law.

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