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Editorial

Dear readers and contributors to REPeC,

The Journal of Education and Research in Accounting (REPeC) is a three-monthly electronic periodical published by the Brazilian Academy of Accounting Sciences (Abracicon).

The current Volume 10, Issue no. 3, covering July-September 2016 contains articles involving different areas of accounting. Below is a brief description of each or these papers.

The first article in this issue, **Audit Committee: compliance with SOX, Bacen, Susep and IBGC rules**, by *Marina Schreiber de Abreu Siigor Sorrentino, Bruna Teixeira and Ernesto Fernando Rodrigues Vicente*, identify the level of compliance of companies' audit committees on the distinguished levels of BM&FBOVESPA with the SOX, Bacen, Susep and IBGC rules.

The next paper, by *Taís Duarte Silva and Gilberto José Miranda,* **Indicators of working capital management before and after the adoption of the international accounting standards in Brazil,** aimed to compare the indicators of working capital management before and after the adoption of the law, these being: Net Working Capital (NWC), Working Capital Requirement (WCR), Cash Balance (CB) and Liquidity Ratio (LR).

The third article, under the title **Determining factors for the adoption of stock option plans in brazilian publicly traded companies**, by *Geovanne Dias de Moura, Edilson Sidnei Padilha and Tarcísio Pedro da Silva*, aimed to identify the determining factors for the adoption of stock option plans in Brazilian publicly traded companies.

Structural equation models using partial least squares: an example of the application of SmartPLS® in accounting research is the fourth article in this issue, by *João Carlos Hipólito Bernardes do Nascimento and Marcelo Alvaro da Silva Macedo.* This study presenteded a literature review of accounting studies that used the PLS-SEM technique. Next, as no specific publications were observed that exemplified the application of the technique in Accounting, a PLS-SEM application is developed to encourage exploratory research by means of the software SmartPLS®.

The next to last article, under the title **Influences of academic socialization on the development of scientific publications in accounting in Brazil: an analysis of *Stricto Sensu* Graduate Programs,** by *Flaviano Costa and Gilberto de Andrade Martins*, and aim to investigate about the influence of the academic socialization promoted by *stricto sensu* graduate programs in accounting in Brazil on the development of scientific production in the area.

Finally, the article by *Raphael Vinicius Weigert Camargo, Rita de Cássia Correa Pepinelli Camargo, Dalton Francisco de Andrade and Antonio Cezar Bornia entitled* **Performance of Accounting students on the Enade/2012 test: an application of the Item-Response Theory,** concluded that the items of the Enade test were very difficulty for the group that took the test. Independently of the student characteristics analyzed, overall, the proficiency scores were very low.

Good reading to all!

Prof. Dr. Valcemiro Nossa
General Editor

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Audit Committee: compliance with SOX, Bacen, Susep and IBGC rules

Abstract

The objective in this study was to identify the level of compliance of companies' audit committees on the distinguished levels of BM&FBOVESPA with the SOX, Bacen, Susep and IBGC rules. The compliance was analyzed by means of a checklist, built based on the main standards and recommendations the Brazilian companies are subject to. The analysis departed from the following characteristics: composition, qualification, mandate, number of meetings, attributions and obligations. A predominantly quantitative and descriptive document research was undertaken. Fifty-eight companies were considered and 1,508 verifications, showing an average compliance level of 50% (13 out of 26 questions), ranging between 88% (23 questions) and 4% (1 question). The results appointed that financial institutions and social security and insurance institutions are the group that best complies with the audit committee rules, while the companies submitted to SOX and other companies show the lowest compliance rates in the sample. In addition, no relation was found between the distinguished corporate governance levels and the committees' level of compliance, that is, being classified in the new market does not guarantee good compliance with the audit committee standards.

Key words: Corporate governance. Audit committee. Rules.

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1. Introduction

As a result of the financial scandals in large companies and the economic crisis in 2008, which led to mistrust in the stock markets around the world, studies are fundamental about corporate governance structures that help to mitigate the conflicts of interest and the information asymmetry present in the relation between stockholder and manager.

In this context, an acknowledged corporate governance mechanism is the audit committee which, according to Souza (2010, p.21), is "one of the pillars in the reconstruction of investors' belief in the credibility of the financial statements and other operational performance information the publicly traded companies provide to the market".

Although the audit committee concept emerged in 1930, created by the New York Stock Exchange (NYSE), it only became compulsory in 2002 after the enactment of the Sarbanes-Oxley Act (SOX). According to Santos (2009), the creation of legal standards is linked to the need to achieve the security the citizens require, which was not being attended to through self-regulation only.

In Brazil, after the SOX, and in line with a global trend, the audit committees have increasingly turned into a legal obligation, like in the regulatory determinations of the National Monetary Council (CMN) and the National Private Insurance Council (CNSP), via Susep. In addition, there are the orientations of the Brazilian Corporate Governance Institute (IBGC) and the Brazilian Securities Commission (CVM).

These entities publish standards about the characteristics the audit committee needs, that is, aspects related to its composition, specialization, mandate and attributions that contribute to enhance its efficiency. Nevertheless, there is evidence that not all committees are complying with these requirements.

Santos (2009), for example, found that many companies do not practice the rule of independence of the audit committee members, and Chiodini (2010) found that a financial expert is lacking in most of his sample, against the IBGC recommendations. Recent studies suggest that, when the audit committee is not constituted to act independently, with access to information and professional counseling, and does not contain financially literate members, this significantly compromises its performance.

Hence, it is important for the stockholders and other users to know the structure of the audit committee in the company of interest, considering that the composition of the committee may differ from the current rules, may not comply with the expectations of what serves as an important elements to mitigate the agency problems and contributes to the reliability and safety of the information the company issues. This situation can compromise the assessment of the risk inherent in the accounting information, negatively affecting decisions on the purchase, sale or maintenance of corporate bonds, entailing financial losses.

In that sense, considering that the audit committee evidences a better corporate governance practice when it is constituted according to the rules of the regulators, it is important to know the current structure of the audit committee in Brazilian companies. Thus, the objective in this study is to identify the compliance level of the audit committees at the distinguished levels of BM&FBOVESPA with the SOX, Bacen, Susep and IBGC rules. Therefore, the following research question was formulated: **What is the level of compliance of the audit committees in companies at the distinguished corporate governance levels of BM&FBOVESPA with the SOX, Bacen, Susep and IBGC rules?**

Thus, this study is expected to serve as a guide for companies that do not have an audit committee yet and intend to comply with the best corporate governance practices; for companies that do have this committee, in order to analyze if they comply with the proposals of the rules applied to their company; for regulatory entities to compare what is recommended by the other entities; for the capital market to facilitate the users' understanding through greater information transparency; and for the academy to contribute to discussions on the theme. In addition, the research is justified because no recent study was located in Brazil that verifies the committee structure, considering all variables analyzed in this study.

2. Theoretical Framework

According to Jensen and Meckling's (1976) Agency Theory, the contractual relation, in which one or more persons (principal) transfer the decision power to another person (agent), is loaded with so-called agency problems deriving from the conflict of interest and the information asymmetry present in this relation.

In that sense, the principal (stockholder) needs to use control and monitoring mechanisms to avoid the agent's (manager) inappropriate behavior. Hence, "corporate governance can be considered as a set of mechanisms intended to increase the probability that the resource providers will guarantee the return on their investment for themselves" (Silveira, 2004, p.12).

One noteworthy mechanism in this context is the audit committee. The role of the audit committee in the governance system is to act to protect the interests of stockholders and other stakeholders in the organization. According to the IBGC (2009, p. 13) the committee "should act to operate the duties and responsibilities of the management's function in the supervision of the internal processes and guarantee the integrity and effectiveness of the internal controls for the production of financial reports". In addition, the committee intends to guarantee the integrity of the capital market (Peleias, Segreti, & Costa, 2009) and play a monitoring role to guarantee the quality of the financial statements and corporate accountability (Carcello, & Neal, 2000).

According to the audit and consulting company PricewatershouseCoopers (2007, p.30):

> The legal or regulatory requirements for an Audit Committee vary from country to country – while, in some, the committees are compulsory for publicly traded companies, in others, they represent voluntary actions. In addition, the responsibilities of each Audit Committee differ depending on the local culture, and particularly on the companies' needs.

In Brazil, the obligation to establish audit committees is limited to companies submitted to the SOX and Bacen and Susep standards, with some exceptions. After March 2003, the companies that operate in the American market, and thus, are under the regulation of SOX, can replace the Audit Committee by the Fiscal Board, provided that the latter is adapted to the functions of the audit committee (Furuta, 2010).

Concerning Bacen, the financial institutions obliged to install an audit committee are limited to the institutions that closed off the two latest financial years with an equity of one billion *reais* or higher, or administer one billion *reais* or more in resources from third parties; or when the sum of the deposits captured and the resources from third parties totals five billion *reais* or more (Banco Central do Brasil, Resolution 3.198, 2004).

And the social security and insurance institutions submitted to Susep should have closed off the two latest financial years with an Adjusted Net Equity of 500 million *reais* or higher or Technical Provisions corresponding to 700 million *reais* or more (Conselho Nacional de Seguros Privados, Resolution 118, 2004). For companies that do not fit into these groups, the Brazilian Securities Commissions (CVM) and the Brazilian Corporate Governance Institute (IBGC) recommend and advise on the constitution of the audit committee.

Hence, each entity has its set of determinants for the establishment and functioning of the audit committee. For the sake of a better understanding of the similarities and differences, Figure 1 compares the rules of SOX, Bacen, Susep and the IBGC orientations. The CVM recommendations for the audit committee are not included in Figure 1, as they involve aspects related to the composition of the members: they should include at least one representative from the minority stockholders and at least two members should possess expertise in finance.

	SOX	Bacen (*)	IBGC (**)	Susep (***)
Composition	Independent members of Board of Administrators	Independent members. Cannot include Fiscal Board members	Independent members, with at least one representative from minority stockholders	No reference
	No reference	At least three members	No reference	At least three members
Qualification	At least one member should be financial expert	At least one member should be knowledgeable in accounting and auditing	All members should have basic accounting and finance knowledge, being one with greater expertise in accounting and auditing or financial management	At least one member should be knowledgeable in accounting and auditing
Mandate	No explicit reference	Maximum mandate of five years with return after three years	Can be limited through automatic turnover	Maximum mandate of five years with return after three years
Meetings		Determines that periodical meetings should be held with auditors	Meetings with auditors	Meetings with independent auditors at least quarterly
	No reference	Meeting with auditors at least quarterly	Regular meetings with Board of Administrators, Fiscal Board (when established), CEO and other officers	Meeting with auditors at least quarterly
Attributions	Responsibility for hiring and replacing auditors	Recommend the external auditor to be hired	Recommend the hiring, remunerations, retention and replacement of the independent auditor	Recommend the hiring and replacement of the independent auditor
	All audit and non-audit services should be pre-approved by the committee	No reference	No reference	No reference
	Supervise the elaboration, disclosure and auditing of financial statements	Revise half-yearly financial statements, including notes and management reports	No reference	Revise half-yearly financial statements, including notes, management reports and independent auditor's opinion
	Determine on set of internal procedures to guarantee accounting disclosure	Responsible for revision of efficiency and efficacy of internal controls and risks	Internal control and risks	Verify compliance with legal determinations and standards, besides regulations and internal codes
	No reference	Assess compliance by institutional management with recommendations by independent or internal auditors	Monitor recommendations of external and internal auditors	Assess compliance or justification for non-compliance with recommendations of independent auditors or internal auditors
	Adoption by company of a code of ethics for managers	No reference	Watch over compliance with code of conduct	Establish and disseminate rules and internal codes
	Adopt procedures to receive and treat complaints related to accounting, internal controls and auditing	No reference	No reference	No reference
Obligations	No reference to committee report	Should elaborate audit committee report	No reference	Should elaborate audit committee report every six months
	No specific reference	Rules for own functioning should be approved by Board of Administrators	Should adopt internal rules	Rules for own functioning should be approved by Board of Administrators

(*) Based on Resolution 3.198/2004; (**) Based on Code of Best Corporate Governance Practices; (***) Based on CNSP 118/2004.

Source: adapted from Santos (2009).

Figure 1. Audit committee: Comparison between SOX and Brazilian rules

As observed, except for Susep, which makes no mention, the other entities highlight that the audit committee should fully consist of independent members. Bronson, Carcello, Hollingsworth and Neal (2009) analyzed whether the composition of the fully independent committee is relevant to obtain effective monitoring results, in order to mitigate the requirements established by the Sarbanes-Oxley (SOX) Act. The research appointed that the composition of the audit committee only has beneficial effects when the entity is totally independent. Thus, the results support that requirement.

The presence of the financial expert can positively influence the company. Felo, Krishnamurthy and Solieri (2003) concluded that a positive correlation exists between the percentage of financial experts on the audit committee and the financial disclosure quality, that is, the larger the number of financial experts on the audit committee, the better the quality of the company's financial disclosure.

Other studies that appoint the positive effect of the presence of a financial expert include Sharma, Naiker and Lee (2009) and Raghunandan and Rama (2007), who found signs that the presence of a financial expert is positively related with the meeting frequency of the audit committee, as these experts effectively monitor the financial reports.

What the temporal aspect is concerned, that is, the length of the mandate and the number of hours worked, Art. 12 of the Brazilian Central Bank, Resolution 3.198 (2004), establishes that the mandate of the Audit Committee members should be five years at most, except private companies that do not need a fixed mandate for the committee members; and that the Audit Committee members can only return to the same council at least three years after the end of their mandate.

The audit committee's attributions can vary according to the context of each company (Peleias *et al*., 2009). In general, the function of the audit committee is to hire, compensate and supervise the independent audit firm that will prepare the audit reports and related activities; the committee is also responsible for solving any conflicts about financial reports between the management and the independent auditors (Furuta, 2010; Santos, 2009).

Also concerning the attributions, Carcello, Hermanson and Neal (2002) analyzed 150 reports that describe the activities of the audit committee and found a high degree of conformity between the compulsory audit committee functions and what is disclosed in their reports, such as information related to the review and discussion of the financial statements with the management. Nevertheless, the voluntary disclosure of the audit committee's activities was more common for financial institutions, large companies, companies listed on the New York Stock Exchange (NYSE) and companies with more independent members sitting on the board.

Concerning the report elaborated by the audit committee, it is intended to determine the management's responsibility to establish and maintain these controls and identify the analysis standard this management uses to assess the effectiveness of controls. The report should contain an assessment of the efficacy of internal controls at the baseline date when the audit report was issued, and should include the report in which the independent auditor attests the management's declaration, as a part of the audit (Souza, 2010). The absence or ineffective action of the audit committee is considered a flaw that should be appointed in the independent auditor's opinion.

3. Method

This research is characterized as descriptive which, according to Gil (2002, p. 42), "is basically intended to describe the characteristics of a certain population or phenomenon, or to establish relations between variables". With regard to the procedures, the research is characterized as documentary. According to Lakatos and Marconi (2001, p. 174), "the source of data collection is restricted to written documents or not". In this study, the documentary research was based on the information published on the website of BM&FBOVESPA and on the companies' websites.

What the approach of the problem is concerned, the number of items evidenced was quantified in the data collection and in the treatment of the results, characterizing a predominantly quantitative approach (Richardson, 2008).

First, a bibliographic survey was undertaken in scientific journals, dissertation and thesis databases and accounting congresses to elaborate the theoretical framework and analyze background studies to gain knowledge on the theme. Next, a comparison was elaborated to support the understanding of the similarities and differences established by the SOX, Bacen and Susep standards and IBGC orientations. The analysis was based on the characteristics of the audit committee, which were classified in the following categories: composition, qualification, mandate, number of meetings, attributions and obligations.

Based on Figure 1, a checklist was elaborated with 26 questions. The data resulting from the application of the checklist were analyzed in two phases.

First, each company's compliance with the audit committee characteristics was verified, considering the rule the company should adopt. As some financial institutions in the sample hold ADRs, they should comply with both Bacen and SOX. Companies without the obligation to constitute the audit committee should at least comply with the IBGC recommendations. Thus, the selected companies were divided in five groups (SOX, Bacen, SOX and Bacen, Susep and IBGC), which permitted verifying the audit committee's compliance in an analysis focused on the relevant rule for each company. "Yes" was attributed in case of compliance with an item and "no" in case of non-compliance. When no evidence was found on a certain aspect in the information available on the BM&FBOVESPA or on the company website, the concept attributed was "not mentioned" (NM).

In the second phase, an index was created to identify the audit committee's level of compliance with the rules analyzed and thus answer the research question. The index was created, attributing score 1 for each "yes" on the checklist and score 0 for each "no", adding up the scores to reach the index. In addition, the governance level of each company was verified, assessing whether there is a relation with the index found through quartile analysis.

The selected population consists of the companies in the special listing segments of BM&FBOVESPA. The choice of this group is justified because the companies in these segments are subject to strict corporate governance rules (BM&FBOVESPA, 2014). As the audit committee is part of the set of best corporate governance practices, the number of companies with such committees was expected to be higher.

In the universe of 207 companies (9 Bovespa Mais, 145 New Market, 20 Level 2 and 43 Level 1), 66 had an audit committee in 2013. That year was chosen because it was the most recent year with available information on the audit committee. Among these companies, eight were excluded due to incomplete data or data related to 2014. Hence, the population resulted in 58 companies, 39 listed on the New Market, 11 on Level 1 and 8 on Level 2 of the Distinguished Corporate Governance Levels.

One limitation in this study is related to the data analysis, which was elaborated based on the information the companies had published, but does not necessarily cover all aspects related to the audit committee, but only the aspects verifiable through the analysis of the information available to the public.

4. Analysis and research results

In this topic, the analysis of the data and the research results concerning the Composition, Qualification, Mandate, Meetings, Attributions and Obligations of the Audit Committee and the level of compliance with Corporate Governance will be presented.

Table 1 presents the data on the composition of the audit committee in the 58 companies in the sample.

Table 1
Composition of Audit Committee

No.	Questions	SOX		Bacen		SOX and Bacen		Susep		IBGC		Total	
		Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No
1	Does the audit committee consist of at least 3 (three) members?	15 75%	5 25%	8 100%	0 0%	5 100%	0 0%	2 100%	0 0%	19 83%	4 17%	49 84%	9 16%
2	Are the members independent?	1 16%	19 84%	2 38%	6 62%	3 60%	2 40%	0 0%	2 100%	2 9%	21 91%	8 14%	50 86%
3	Are some members also fiscal board members?	1 5%	19 95%	0 0%	8 100%	0 0%	5 100%	0 0%	2 100%	0 0%	23 100%	1 2%	57 98%

Source: research data (2015).

As observed in question 1, in 84%, or 49 of the companies selected, the audit committee consists of at least three members, complying with the corporate governance recommendations observed in the rules by Bacen and Susep. Five companies submitted to SOX and four companies not obliged to constitute an audit committee do not comply with this prerogative. It should be highlighted that the SOX does not mention the amount of members.

In question 2, concerning the independence of the members, in 86% of 50 companies in the research population, the audit committee members are not independent. This result supports the findings by Silveira and Ito (2008) and Santos (2009), who also identified, in 2007 and 2008, respectively, that most of the audit committees have members who are not independent. As a rule, the SOX and Bacen require that the companies have independent members sitting on the audit committee. Thus, six financial institutions, 19 companies with ADRs and two financial institutions traded on the American market do not comply with the regulations. In addition, 21 other organizations differ from this rule.

What question 3 is concerned, about the existence of audit committee members who also sit on the fiscal council, 98% or 57 companies in the research population do not sit on the fiscal board. The result shows that only one company, JBS, which is subject to SOX, does not comply with this requisite. It should be highlighted that this requirement comes from Bacen.

According to the IBGC recommendation, among the independent members on the audit committee, at least one should represent the minority stockholders. None of the companies in the sample comply with the requirement or do not disclose this information.

Table 2 presents the audit committee's qualification in the 58 companies in the study population.

Table 2
Qualification of Audit Committee

No.	Questions	SOX		Bacen		SOX and Bacen		Susep		IBGC		Total	
		Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No
1	Is at least one of the members a financial expert?	14 70%	6 30%	7 88%	1 13%	5 100%	0 0%	1 50%	1 50%	16 70%	7 30%	43 74%	15 26%
2	Is at least one of the members knowledgeable in accounting and auditing?	9 45%	11 55%	7 88%	1 13%	5 100%	0 0%	2 100%	0 0%	15 65%	8 35%	38 66%	20 34%
3	Do all members have basic accounting and finance knowledge?	6 30%	14 70%	1 13%	7 88%	5 100%	0 0%	1 50%	1 50%	6 26%	17 74%	19 33%	39 67%
4	Do the committees contain at least one member with further experience in accounting and auditing or financial management?	14 70%	6 30%	8 100%	0 0%	5 100%	0 0%	2 100%	0 0%	19 83%	4 17%	48 83%	10 17%

Source: research data (2015).

As verified in question 1, 74% or 43 companies in the selected population have at least one financial expert. The result supports the evidence by Furuta (2010), which appoints that most companies that constitute Audit Committees between 2005 and 2008 contained a financial expert. In the study by Chiodini (2010), it was observed that most companies with ADRs in the American market have at least one financial expert. During the 18th Roundtable of Audit Committee professionals, KPMG (2009) verified that only 10% of the participants do not have financial experts sitting on the committees. This recommendation comes from the Sarbanes-Oxley (SOX) Act. Thus, six companies, despite being submitted to SOX, do not comply with this requirement.

About question 2 on the existence of at least one member knowledgeable in Accounting and Auditing, 66% or 38 companies present both areas of expertise, according to the data published on the websites of BMF&BOVESPA and of the companies studied. This requirement comes from Bacen and Susep. The company Banrisul, subject to Bacen, is the only company in this group that does not have at least one member with expertise in Accounting and Auditing.

Questions 3 and 4 are IBGC recommendations. In question 3, it is observed that, in 67%, or in 39 companies from the selected population, not all members have basic knowledge in Accounting and Finance. Questions 3 and 4 refer to recommendations from IBGC. In question 3, it is observed that, in 67% or 39 companies from the entire research population, not all members possess basic knowledge in Accounting and Finance. According to data published on the website of BMF&BOVESPA, the members from the companies Biosev and CCX are only knowledgeable in Finance and, in IOCHPE, members are only knowledgeable in Accounting. The companies who are not obliged to establish an audit committee and comply with the IBGC recommendations on an optional base present the highest percentage of members knowledgeable in both areas, corresponding to 74% or 17 companies from the group.

As regards question 4, about 83% or 48 companies from the research population, have at least one member experienced in Accounting and Auditing or Financial Management, that is, comply with the rules established by the IBGC.

Table 3 appoints the length of the audit committee's mandate in the 58 companies of the study population.

Table 3
Mandate of Audit Committee

Period (in years)	SOX	Bacen	SOX and Bacen	Susep	IBGC	Total
1	8 40%	4 50%	3 60%	2 100%	8 35%	25 43%
2	6 30%	2 25%	1 20%	0 0%	8 35%	17 29%
3	1 5%	1 13%	0 0%	0 0%	4 17%	6 10%
4	1 5%	0 0%	0 0%	0 0%	0 0%	1 2%
5	2 10%	1 13%	1 20%	0 0%	0 0%	4 7%
+ than 5	0 0%	0 0%	0 0%	0 0%	1 4%	1 2%
Indefinite	2 10%	0 0%	0 0%	0 0%	2 9%	4 7%

Source: research data (2015).

What the length of the audit committee's mandate is concerned, 43% or 25 companies from the study sample have a one-year mandate, and 29% or 17 companies work with a two-year mandate.

In the Internal Rules of the company Diagnósticos da América S/A (Dasa) for 2013, it is highlighted that the members' mandate is up to ten years. The companies that disseminated an indefinite mandate in their Bylaws and/or Internal Rules include Brooksfield, CTEEP, CVC and JBS.

According to Beuren, Nass, Theiss and Cunha (2013), the non-declaration of mandates may represent some flexibility for the companies. On the other hand, this can induce the companies towards the non-renewal of the committee members, which may impair the necessary impartiality in the performance of their functions, due to the bonds created over time. Setting parameters for the mandate of the audit committee is also interesting to compare their characteristics in different companies.

In line with the rules of Bacen and Susep, the maximum length of the mandate should be five years, with the possibility of return after three years, which means that, in this aspect, the companies mentioned above are non compliant. Divergent information is found on the length of the mandate the companies disseminated in the Bylaws and /or Internal Rules and the information published on the website of BM&F-BOVESPA for the companies Banco ABC, Banco Bradesco, Banco do Brasil, Banco Banrisul, BIC Banco, Banco Pan, Banco Pine, Banco Santander, Banco Sofisa and Porto Seguro.

In addition, the IBGC determines that the mandate should be limited through an automatic turnover. It was verified that 100% or 58 companies from the study population do not perform this automatic turnover, according to information published in the Bylaws and/or Internal Rules and on the BM&F-BOVESPA website.

Table 4 presents the frequency of the audit committee meetings in the 58 companies from the study population.

Table 4
Audit Committee Meetings

Period (in years)	SOX	Bacen	SOX and Bacen	Susep	IBGC	Total
Two-monthly	0 0%	0 0%	0 0%	1 50%	1 4%	2 3%
At least two-monthly	1 5%	0 0%	0 0%	0 0%	1 4%	2 3%
Quarterly	5 25%	4 50%	2 40%	1 50%	9 39%	21 36%
At least quarterly	2 10%	3 38%	2 40%	0 0%	1 4%	8 14%
At least six-monthly	0 0%	0 0%	1 20%	0 0%	0 0%	1 2%
Periodical	3 15%	1 13%	0 0%	0 0%	1 4%	5 9%
Not mentioned	9 45%	0 0%	0 0%	0 0%	10 43%	19 33%

Source: research data (2015).

A higher frequency of quarterly meetings is observed, in 36% or 21 companies. In Brazil, Silveira and Ito (2008) stated that companies subject to SOX present audit committee meetings with an average of nearly one meeting per month. This finding is not confirmed in the sample companies, which had, in most cases, quarterly meetings in the group subject to SOX. In the same study, the authors found that, for companies in the New Market, the average approaches bimonthly meetings. In this sample, however, only 3% or two companies hold bimonthly or at least bimonthly meetings.

Under the rules of Bacen, IBGC and Susep, companies should also hold meetings with the independent auditors. The analysis performed revealed that 100% of companies hold meetings with the independent auditors, according to information disclosed in the Bylaws and/or Internal Rules. Additionally, the companies Sofisa, CCR, Sabesp, IOCHPE and Light released, in the Bylaws and/or Internal Rules, that the meetings are periodic, but did not disclose the periodicity. According to findings by Segreti and Costa (2007, pp. 7-8), in the survey conducted in 2006, "72.0% or 18 respondents indicated that the audit committee and independent auditors meet at least once each quarter to review the scope of the audit work ".

Noteworthy is a considerable percentage of 33% or 19 companies from the population, which does not mention or has not published any information on the frequency of meetings in the Bylaws and/or Internal Rules.

Regarding the performance of the audit committee in the companies surveyed, Table 5 shows the attributions recommended for the audit committee.

Table 5
Attributions of Audit Committee

No.	Questions	Yes	No	NM
1	Recommends hiring of external audit?	45 78%	0 0%	13 22%
2	Are non-audit services pre-approved by the audit committee?	22 38%	12 21%	12 21%
3	Do the auditors forward the specific report to the committee?	44 76%	0 0%	14 24%
4	Are the elaboration and disclosure processes of the financial statements supervised by the audit committee?	38 66%	2 3%	18 31%
5	Are the financial statements revised each semester?	13 22%	20 34%	25 43%
6	Does the committee determine a set of internal procedures?	19 33%	17 29%	22 38%
7	Is the committee responsible for the efficacy and efficiency of internal controls?	18 31%	11 19%	29 50%
8	Does the committee verify the compliance with legal determinations, standards, regulations and internal codes?	41 71%	1 2%	16 28%
9	Does the committee verify the managers' compliance with the ethics code?	13 22%	11 18%	34 59%
10	Verifies compliance with code of conduct?	14 24%	5 8%	39 67%
11	Does the committee establish and disseminate internal regulations and codes?	24 41%	10 17%	24 41%
12	Adopts procedures to receive and treat complaints?	20 34%	9 15%	29 50%

Source: research data (2015).

All rules incorporated in the Brazilian stock market include the recommendation to hire an external audit. It is observed that 78% or 45 companies of the total population disclose that one of the audit committee's duties is to recommend the hiring of independent auditors. It is noteworthy that all companies subject to Bacen or Susep figure in this group, and that 22% or 13 companies did not disclose that information, five of which are subject to SOX and eight to the IBGC.

In question 10, 24% or 14 companies of the total population adopt a code of conduct. It is highlighted that 8% or 5 companies do not comply with the regulations of the IBGC, including B2W - Companhia Digital and Ser Educacional S.A., submitted to the IBGC; BRF S.A and Odontoprev S.A., submitted to SOX; and Itaú Unibanco Holding S.A., submitted to SOX and Bacen jointly.

In question 11, in 41% or 24 companies of the total population, the audit committee establishes and publishes internal regulations and codes.

In question 12, 34% or 20 companies of the total population adopt procedures for receiving and handling complaints. It is noteworthy that, in 50% of the sample, no evidence was found on this information. In the study by Segreti and Costa (2007, p. 8), "60.0% or 15 respondents reported the audit committee's actual participation in the stages of the process for receiving and handling complaints of irregularities related to accounting, internal and audit controls".

In relation to the audit committee's obligations, Table 6 presents the research questions recommended for the audit committee.

Table 6
Obligations of Audit Committee

No.	Questions	Yes	No	NM
1	Elaborates audit committee report?	45 78%	0 0%	13 22%
2	Elaborates audit committee report each semester?	18 31%	18 31%	22 38%
3	Has internal rules?	34 59%	1 2%	23 40%

Source: research data (2015).

It is observed in Question 1 that 78% or 45 companies of the total population disclose as one of the audit committee obligations the preparation of the audit committee report. It is noteworthy that all companies subject to Bacen and SUSEP are in this group and that, out of 13 companies or 22% of the selected population that did not disclose this information, five companies are subject to SOX and eight to IBGC. This is a requirement of Bacen and SUSEP.

In question 2, on the biannual preparation of the audit committee report, 38% or 22 selected companies do not disclose or mention this information in the Bylaws and/or Internal Rules. Among the companies that prepare the report every six months, i.e. 31% or 18 companies of the total population, two companies are subject to SOX, eight to Bacen, four to SOX and Bacen jointly, two companies to IBGC and two companies, or 100% of the group, to Susep.

In Question 3, on the existence of internal rules for the audit committee, 59% or 34 companies meet the requirement of Bacen and SUSEP. It is remarkable that JHSF Participações S.A. does not comply with this rule, as it does not have and/or does not set rules for the operation of the audit committee.

Finally, in Table 7, the compliance rates are presented for the audit committee found in each company (IA) with information of the distinguished corporate governance level of BM&FBOVESPA (DCGL) and the guiding rule.

Table 7
Compliance Index of Audit Committee with Corporate Governance

DCGL	Standard	Company	IA	DCGL	Standard	Company	IA	DCGL	Standard	Company	IA
N1	Bacen e SOX	Itau	23	NM	Bacen e SOX	Cielo	16	N1	IBGC	Magazine Luiza	12
NM	SOX e Bacen	Parana Banco	23	NM	IBGC	EDP	16	NM	SOX	JBS	11
NM	Susep	Sul America	23	NM	IBGC	Petrorio	16	N2	IBGC	B2W	10
NM	Bacen	Banco Pan	22	N2	Ssusep	Porto Seguro	16	NM	SOX	GOL	10
NM	Bacen	ABC Banco	21	N1	SOX	TIM	16	NM	SOX	Suzano	10
NM	Bacen e SOX	Santander	20	N1	IBGC	TOTVS	16	NM	SOX	Eneva	9
N1	IBGC	Cetip	20	N1	IBGC	CCX	15	N1	IBGC	Alupar	7
NM	SOX	OdontoPrev	20	NM	SOX	Gafisa	15	N1	IBGC	Tupy	7
NM	Bacen	BB	19	NM	IBGC	Rodobens	15	N2	IBGC	CCR	6
NM	Bacen	BICBanco	19	N2	IBGC	Usiminas	15	NM	IBGC	Ecorodovias	6
NM	Bacen	Banco Pine	19	NM	SOX	BRF	14	NM	IBGC	Kroton	6
NM	Bacen	Bovespa	19	NM	IBGC	Dasa	14	N2	IBGC	Tarpon	6
N2	SOX	Sabesp	18	N1	IBGC	Paranapanema	14	NM	SOX	Brookfield	5
N1	IBGC	Lojas Renner	18	N2	IBGC	Ser Educacional	14	NM	SOX	MMX	5
NM	Bacen e SOX	Bradesco	17	NM	SOX	Cosan	13	NM	IBGC	CVC	4
NM	Bacen	Banrisul	17	NM	SOX	Pão de Açúcar	12	N2	SOX	Equatorial	4
NM	SOX	Fibria e Celulose	17	N2	SOX	IOCHPE	12	NM	SOX	Marfrig	4
N2	Bacen	Banco Sofisa	16	N1	IBGC	JHSF	12	NM	SOX	Celesc	3
NM	IBGC	Biosev	16	NM	SOX	Light	12	NM	IBGC	Cteep	1
N1	SOX	Copel	16	–	–	–	–	–	–	–	–

Source: research data (2015).

Based on the arithmetic mean, the average level of compliance in the selected companies corresponded to 50%, or 13 points out of 26. By means of the quartile analysis, the relationship between the indices found and the rules and DCGL are verified.

It is observed that companies that scored between 26-17 (upper quartile) showed the highest level of compliance. Thus, financial institutions, subject to Bacen, and social security and insurance institutions subject to Susep, constitute the group that best complies with the set of rules concerning the audit committee.

Companies that scored between 17.25 and 9.76 (second quartile) had a median compliance, and companies that scored between 9.75 and 0 (first quartile), a group formed by companies subject to SOX and the IBGC, represents the lowest levels of compliance in the selected population.

The results show that companies subject to a regulatory agent tend to be more concerned about compliance with the corporate governance rules. Antunes, Honorato and Antunes (2007, p. 3) argue "that the best governance practices migrate from the aspiration of investors to legal obligation." What is understood is that the legal regulations entail an advance in the compliance with corporate governance.

The relationship between the index obtained and the corporate governance levels is weak and, therefore, no relationship can be found between different levels of governance and the compliance ratio, that is, being rated in the new market does not guarantee good compliance with the rules for the audit committee.

5. Conclusion

The study aimed to identify the level of compliance of audit committees of companies from the distinguished levels of BM&FBOVESPA with the rules of SOX, Bacen, Susep and IBGC. To achieve this goal, an index was built through the application of a checklist based on the rules that affect Brazilian companies.

The average level of compliance in the companies in the sample was 50% (13 of 26 questions), with a maximum of 88% (23 questions) and a minimum of 4% (1 question). The companies subject to the rules of Bacen and SUSEP constitute the group with the highest compliance, while companies subject to SOX and those that are not bound to establish an audit committee presented the lowest rates in the sample.

It can be inferred, based on the findings, that companies subject to a regulatory agent tend to be more concerned about corporate governance. In addition, it is inferred that belonging to the highest levels of corporate governance on BM&FBOVESPA is no prerogative to better adapt to the governance practices related to the audit committee.

A prominent fact is that some companies, despite being required to comply with certain rules, do not. This is the case of the independence of the members, an aspect that, although the entire population has to comply, 86% of the committees are composed of members who are not independent. As regards the qualifications of members, six companies, despite being subject to SOX, have no financial expert, and one company subject to Bacen does not have at least one member knowledgeable in Accounting and Auditing, as required by the respective entities.

It is noteworthy that, during the data collection, divergent information was found regarding the mandate of the committees the companies reported in the Bylaws and/or Internal Rules and information available on the BM&FBOVESPA website, that is, internal rules may not have been complied with in some cases.

Regarding the attributions and duties of the audit committee, the difficulty to find available data is noteworthy. This information is usually disclosed in the Committee Report or Bylaws and/or the Internal Rules and, in 22% and 40% of the companies, these documents, respectively, were not available. This situation violates one of the principles of corporate governance, which is transparency, and impedes the stakeholders' monitoring of the audit committee functions.

Thus, the study made it possible to demonstrate how the current structure of audit committees in companies at different levels of corporate governance on BMF&BOVESPA, contributing to the discussion and dissemination of the topic in the academic community and among the stock market agents seeking mechanisms to provide security and credibility to stakeholders.

Considering the limitations of the research, a larger number of companies should be included, with other companies on BM&FBOVESPA that have an audit committee; the study should be conducted in companies that are not publicly traded in order to verify the compliance with the corporate governance practices; and in publicly traded companies that do not have an audit committee, in order to discover the reasons for the absence of such a committee and/or its features.

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Indicators of Working Capital Management before and after the adoption of the International Accounting Standards in Brazil

Abstract

The issues concerning the adoption of the international standards in Accounting have been frequently discussed, seeking to understand the possible impacts perceived in companies after the enactment of Law No. 11.638 / 2007. In this context, although appropriate working capital management is crucial to the life of organizations, few studies have been conducted. Thus, this study aimed to compare the indicators of working capital management before and after the adoption of the law, these being: Net Working Capital (NWC), Working Capital Requirement (WCR), Cash Balance (CB) and Liquidity Ratio (LR). Therefore, a descriptive study was conducted using document analysis of financial statements with a quantitative approach. The study sample consisted of 35 economic sectors, calculating the indicators of all companies in these sectors for the period from 2004 till 2013, which permitted the comparison of a four-year period before and four years after the adoption of the international standards. In order to identify significant changes in the indicators, we used the nonparametric Mann-Whitney test. The results showed significant changes in the indicators NWC, CB and LR, without significant change in the WCR, which suggests that the financial assets and liabilities have undergone more changes than the operating assets and liabilities.

Key words: Law No. 11.638/07, Working Capital Need, Cash Balance, Liquidity, IFRS.

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1. Introduction

The enactment of Law No. 11.638/2007 in Brazil entailed several changes in the elaboration process of the financial statements, including the recognition, measuring and registering of equity elements. Thus, the adoption of the *International Financial Reporting Standards (*IFRS) caused changes in accounting practice and potentially in financial statements analysis.

Considering the internationalization process, Silva, Mamede, Nogueira and Tavares (2011) affirm that the IFRS standard is being rapidly accepted in different developed markets and that, therefore, it can turn into the only existing accounting language. The authors highlight that, despite the difficulties and the long term, accounting convergence is the way to achieve harmonization towards a global standard.

Accounting harmonization is essential in the financial analysis of companies, as clearer and more understandable information reduces the information asymmetry and contributes to the decision process. It should be highlighted, however, that if the changes are not clear to their users, they can cause difficulties in the interpretation of the financial analysis (Barbosa, Dias & Pinheiro, 2009).

Antunes, Grecco, Formigoni and Mendonça (2012) affirm that the adoption of the international standards entails different reflexes for the accounting practices, affecting the financial information and its analysis. According to the authors, these standards affect the accounting process, and can therefore influence the economic-financial indicators deriving from the financial statements. Therefore, it is fundamental to investigate the consequences for the comparability of the financial statements, with a view to an appropriate interpretation and analysis of the financial statements (Barbosa *et al.,* 2009).

When discussing the issue of the changes that can affect the analysis process of a company's financial statements, the analysis of the financial situation stands out. In that sense, some authors affirm that the finance literature is focused on studies about long-term financial decisions. Nevertheless, they highlight that the short-term elements are relevant with regard to the total assets and need to be analyzed, as they can even affect the profitability of the business (Garcia-Teruel & Martinez-Solano, 2007; Nazir & Afza, 2009; Kasiran, Mohamed & Chin, 2016).

In view of these observations, in this context of convergence, it is relevant to assess the analysis process of the companies' economic and financial situation, with a view to verifying possible changes in the levels of the indicators. Therefore, the managers need to focus on the management of the working capital as, in the search to maximize its profits, the company can end up facing liquidity problems, which can lead to its bankruptcy (Raheman & Nasr, 2007).

In the management of the working capital, the Fleuriet model stands out, proposing a classification for the current asset and liability accounts, according to their financial or operating characteristics. This segregation is fundamental to assess the working capital requirements and the management of short-term resources (Nascimento, Espejo, Voese & Pfitscher, 2012).

In view of the above, the following question is raised: **did indicators of working capital management undergo significant changes after the adoption of the international accounting standards in Brazil?**

Hence, the general objective in this study is to compare the indicators Working Capital Requirement (WCR), Cash Balance (CB), Net Working Capital (NWC) and the Liquidity Ratio (LR_{WCR}) before and after the adoption of the international accounting standards. Therefore, initially, the changes deriving from Law 11.638/2007 were identified, as well as the possible impacts in the indicators of working capital management. Then, the financial statements were analyzed, calculating the indicators for the purpose of comparing the four-year period before and after the publication of that law.

The adoption of the international accounting standards entailed challenges, resulting in a search for greater quality in the financial information. Thus, the research is justified because it identifies the impacts in the companies' working capital management, which can currently be considered fundamental in the economic-financial analysis of enterprises.

Costa, Macedo, Câmara and Batista (2013) affirm that working capital management is evidenced as a means to achieve financial balance, essential for good business performance. Hence, it can be considered a tool that supports the short-term resource management and can favor the profitability of the business (Fonseca & Ceretta, 2012). In the same sense, Vieira (2008) affirms that working capital management is intended to maintain the financial balance of a company. Hence, it is considered that the changes in the investigated indicators can cause financial and economic influences in the business environment.

2. Theoretical Framework

2.1. Working Capital Management

Financial statement analysis permits knowing about the economic and financial situation of a company. Specifically regarding its financial situation, it is emphasized that this should be based on the study of indicators that reflect the decisions related to the working capital and its financial equilibrium (Assaf, 2010).

Hence, the objective of analyzing the financial statements would be to collect information on the economic and financial reality of a company to support decision making. It should be noted that the need and the type of information will vary according to the interests of each user (Martins, Miranda & Diniz, 2014).

Rogers, Rezende, Lemes, Melo and Almeida (2006) argue that the analysis of financial reporting is crucial to collectinformation on the performance and economic-financial situation of the company. However, the authors point out that the results of the companies may differ greatly according to the rules. Thus, the use of some indicators supports the analysis process.

In this sense, the indicators are relevant in the analysis of financial statements, since they contribute to understand the financial health of the entity. In addition, they can be considered as a numerical relationship between accounts, which allows us to understand the relationship between certain elements in the statements, clarifying their analysis (Martins et al., 2014).

Silva, Santos, Hein and Lyra (2012) point out that companies can use two ways to analyze the financial statements in order to evaluate liquidity and working capital. These forms are recognized as traditional analysis and dynamic analysis of working capital. Braga (1991) points out that the working capital management is dynamic and states that the traditional instruments for the analysis of the financial statements provide a static view and, thus, studies emerged with alternative approaches, especially Fleuriet.

The dynamic or advanced analysis of working capital, also known as the Fleuriet Model, aims to consider the dynamism of the business environment, since it presents the reclassification of balance sheet accounts according to the cycle, being cyclic and non-cyclic, or operational and financial (Silva et al., 2012)

For Martins et al. (2014), the net working capital, the working capital requirement and the cash balance indicators are relevant to maintain the balance in the financial situation of the company. Vieira (2008) states that there is yet another indicator (LRWCR) obtained by the ratio between CB and the module of WCR, also relevant for the financial analysis. The formulas to calculate these indicators are displayed in Picture 1.

Index	Formula
Net Working Capital (NWC)	(Net Assets – Net Liabilities)
Working Capital Requirements (WCR)	(Net Operating Assets – Net Operating Liabilities)
Cash Balance (CB)	(Net Financial Assets – Net Financial Liabilities)
Liquidity Ratio (LR_{WCR})	(Cash Balance / |WCR|)

Source: elaborated by the authors based on Martins *et al.* (2014) and Vieira (2008).

Picture 1. Indicators of working capital management

Martins *et al.* (2014) affirm that, if the NWC is positive, there are more applications in the company than funding sources. In the analysis of the NWC, Marques and Braga (1995) affirm that, when this indicator is positive, this means that the long-term origins supplanted the needs for long-term investments and were applied in the company's current assets.

Concerning the Working Capital Requirements, Martins *et al. (*2014) affirm that this indicator demonstrates the part of the operating assets that is not funded by operating liabilities. According to Matarazzo (1997), the WCR is essential not only for the sake of financial analysis, but also to analyze the treasury and funding, growth and profitability strategies. This reveals its importance in the economic-financial analyses of a company.

According to Assaf (2010), the operational deadlines and production and sales levels directly influence the WCR, that is, these variables can modify the investment in working capital. Thus, the WCR can be limited. Therefore, the author affirms that this indicator can be calculated in days of sales, making it less sensitive to changes in the company's activities. Therefore, it is sufficient to calculate the WCR as established in Picture 1, dividing it by the annual net revenues.

The Cash Balance, according to Marques and Braga (1995), can indicate the suitability of the financial policy the administration uses. When this balance is positive, it indicates that there are more resources than short-term debts and, when negative, it can demonstrate difficulties in the organization's financial situation.

Finally, there is the LR_{WCR}. According to Vieira (2008), the more negative this ratio is, the worse the company's financial situation will be. In other words, this ratio indicates the extent to which the CB is sufficient to cover the WCR.

According to Machado, Machado and Callado (2006), the question regarding the financing of working capital has gained ground and is often discussed. The authors state that the management of working capital is relevant and, at the same time, it is a challenge for managers. In accordance with this understanding, Silva et al. (2012) emphasize that the analysis of the company's financial statements, especially concerning working capital management, can support the users' decisions.

For Gill, Biger and Mathur (2010), the management of working capital should be carried out more efficiently, because it can improve the profitability of a company. In the same way, the studies by Garcia-Teruel and Martinez-Solano (2007) and Nazir and Afza (2009) also point to the existence of the relationship between the management of working capital and profitability.

The analysis of the relevance of working capital indicators reveals that changes in these indicators can influence the financial analysis of the company. Thus, in the next topic, it is discussed how the adoption of international standards may have affected the indicators mentioned above and the analysis process of the financial statements.

2.2. The Management of Working Capital and the Changes Resulting from the Adoption of the International Accounting Standards

Based on the current context, in view of the changes after the enactment of Law 11.638/2007, it is relevant to understand what affects the analysis process of the companies' financial statements. In that sense, some studies are presented in which this aspect is discussed (Miranda, 2008; Barbosa *et al.,* 2009; Martins & Paulo, 2010; Silva *et al.,* 2011, Braga, Araújo, Macedo & Corrar, 2011; Cunha, Santos, Hein & Lyra, 2013; Ribeiro, Carlesso, Lemes & Tavares, 2013; Silva, 2014).

Miranda (2008) investigated the possible impacts the use of the international standards causes in the economic-financial indicators of banks from countries in the European Union. The study calculated the indices before and after the adoption of the IFRS for the sake of comparison. Next, the quantitative analysis was elaborated, which appointed that the international standards influence the indicators. The authors affirm that the results demonstrate that the international standards can significantly change the banks' economic-financial indicators.

In the Brazilian context, Barbosa *et al.* (2009) investigated six companies, classified under the corporate governance level of the São Paulo Stock Exchange, which had published their financial statements for 2008 under the Brazilian standards and the IFRS standards. These were: Eternit, Gol, Lupatech, Renar, São Carlos and UOL. The authors found no significant changes in the economic-financial indicators after the adoption of the IFRS, which according to them demonstrates that no information asymmetry exists in those companies.

Also seeking to identify the impact the adoption of the IFRS causes in the performance indicators, Martins and Paul (2010) analyzed 13 companies listed on BM & FBOVESPA, which published their statements between 2007 and 2009, according to the Brazilian standards and also in accordance with IFRS, which are: Ambev, Eternit, Goal Lupatech, Mangels, Positivo, Renner, Romi, Santander, São Carlos, Souza Cruz, TAM and UOL. The authors concluded that the adoption of IFRS has been reflected in the performance analysis of companies through positive changes in indicators of financial dependence, indebtedness, return on assets and return on equity, and negative variations in immobilisation indicators of permanent resources, general liquidity and current liquidity. The results show, however, that these differences between the two standards (BR GAAP and IFRS) have decreased, especially as a result of Brazil's increased convergence with the international standards.

Analyzing the main financial indicators, Silva et al. (2011) sought to identify possible variations caused by the adoption of international standards. The authors investigated 54 companies on BM & FBOVESPA, listed on the Ibovespa index in the first quarter of 2011. The authors found a significant difference only in the debt composition index, and the change resulting from the adoption of the IFRS was positive.

The study by Braga et al. (2011) in 75 companies listed on Bovespa, which republished their statements for 2007, pointed out that some economic and financial indicators, the fixed assets and net income results were similar, except for the debt ratio, which showed a significant change (increase).

Cunha et al. (2013), under the new law, researched on the reflections of the financial indicators, which are: Return on Equity, Return on Assets, Sales Growth, Current Liquidity, Debt Composition, Net Margin and Asset Turnover. These authors analyzed 16 companies in the consumer staples sector, textiles subsector, which had all the statements for the period 2000 to 2008 and concluded that there were no significant changes, i.e. Law 11638 / 2007 did not change these indicators.

Regarding the financial situation of the companies, as a result of the enactment of Law 11638 / 2007, Silva (2014) identified, based on a study in thirty-five economic sectors, an upward trend in current and dry liquidity indicators. The results show that international standards have led to the increase of these indicators.

For Tonetto and Fregonesi (2010), the use of international accounting standards involves significant changes in the recognition and measuring of assets and liabilities. These authors also emphasize that these recognition and measuring changes may change the capital structure of companies.

Considering the studies cited, one can see that the adoption of international standards has led to changes in the indicators used in the analysis process of the financial statements. In this sense, as the relevance of working capital management in this analysis is clearly shown, it is important to pay attention to the aspects that have caused changes that may interfere in the users' decision.

Analyzing the changes introduced by Law 11638 / 2007, Silva (2014) identified the changes that affected the current assets and liabilities accounts, classifying them into three types: changes in the classification of accounts, changes in the criteria for evaluating accounts and changes in the recognition or derecognition of accounts. The author subsequently sought to demonstrate the consequences of these changes in liquidity ratios.

Next, it is demonstrated how the changes introduced by Law 11638 / 07 influenced the indicators of working capital management, considering NWC, WCR and CB. Picture 2 shows these changes.

As noticed, Picture 2 shows the abovementioned changes in the classification of accounts. In addition, the accounts that underwent changes are described, showing the possible impacts on working capital indicators. Therefore, the signals are used "+", "-" and "n / a" are used, which indicate, respectively, that the account can change in a positive or negative sense or not undergo any changes.

Changes	Account	Up to 2007	After adoption of CPCs	NWC	WCR	CB
Account Classifications	Quick assets	1) Bank accounts with negative balance should be classified under current liabilities.	An exception was made for overdraft banking or guaranteed current accounts.	n/a	n/a	n/a
		2) Applications with maturity under 90 days were classified as immediate liquidity.	Items subject to significant value changes (e.g.: foreign currency or commodities) are not classified as quick assets.	n/a	n/a	n/a
	Accounts payable	3) The account "discounted bills", registered as a credit account, reducing the account of receivables.	The account discounted bills is registered under current liabilities.	n/a	n/a	n/a
	Special Assets and Anticipated Expenses	4) Long-term assets kept for sales or related to discontinued operations were not reclassified.	Non-current assets for sales or from discontinued operations are classified as circulating assets.	+/-	n/a	+/–
	Suppliers, tax obligations and other liabilities	5) Dividends payable classified under other liabilities and dividends proposed classified under provisions. These amounts had already been approved in the shareholders' assembly.	Dividends classified under Compulsory Dividends Payable. Only minimum compulsory dividend recognized in bylaws is disclosed. Additional amounts proposed should be registered in specific equity account.	+	n/a	+
	Loans and Funding, Debentures and Other Debt Securities	6) The financial charges account only consisted of interests from loans.	The composition of the financial charges include interests and all additional expenses (and revenues), such as fees, commissions, premiums, etc.).	_	n/a	_
		7) Non compliance with contractual clauses could cause reclassification of all debt to short term, except when agreed with funder.	Non compliance of contractual clauses obliges company to reclassify all debt to current assets. Exception only if agreed with creditor before balance sheet date.	–	n/a	–
		8) Spending on marketing of debentures or promissory notes was registered as anticipated expenses.	The spending on the marketing of debentures or promissory notes are part of effective funding costs and should be registered under financial charges.	+	n/a	+
		9) The premiums for the issuing of debentures or promissory notes were accounted for directly under equity, as a capital reserve.	Premiums for the issuing of debentures or promissory notes are registered as a liability account.	–	n/a	–
	Income Tax and Social Contribution Payable	10) Deferred taxes could be classified as current or long term, for assets as well as liabilities.	Deferred taxes can only be classified under liabilities or non-working assets.	+/–	+/–	n/a

Legend: "+" positive impact; "–" negative impact; "n/a" does not affect the indicator; "+ /–" impact can be positive or negative.

Source: adapted from Silva (2014).

Figure 2. Changes in account classifications and possible impacts on working capital management indicators

Based on Picture 2, one can identify changes in assets and liabilities that can change the working capital indicators, thus highlighting how the international convergence process has affected the analysis process in companies. It is noticed that the changes in the accounts "Cash" and "Accounts Receivable" cannot cause any impact in working capital indicators, as the changes were only reallocations within the same balance sheet groups.

In the other accounts, it should be noted that the adoption of the international standards affected most financial assets and liabilities, therefore changing the NWC and ST. These changes were related to the term, increasing or decreasing the current assets or liabilities, and also related to the reclassification. In the accounts "Special Assets and Prepaid Expenses", Silva (2014) uses the case of non-current assets held for sale, because this is the account that is closest to the group in question. The author adds that the reclassification causes an increase in current assets and liabilities. It is understood, therefore, that the changes may affect the NWC and WCR positively or negatively.

In the group "Suppliers, tax obligations and other liabilities", as defined by the standard, additional dividends are now classified under equity, leading to a reduction in current liabilities, which will positively affect the NWC and CB.

The account "Loans and Funding, Debentures and Other Debt Securities" shows the largest number of changes. Other items are included in the financial charges account, which leads to increased financial liabilities, while the NWC and CB will be affected negatively. In relation to non-compliance with non-contractual terms, there was an increase in current assets, which also influences the NWC and CB indicators negatively. There is still the issue of debentures, which causes a reduction in liabilities positively affecting the NWC and CB indicators. Finally, the debenture premiums cause an increase in current liabilities, negatively influencing the NWC and CB.

Picture 3 shows the changes brought about by the convergence process with international standards in terms of valuation criteria. It can be noticed that significant changes occurred in the evaluation of some accounts, both under assets and liabilities, which, in turn, can affect the working capital indicators and company valuation itself.

Changes	Account	Up to 2007	After adoption of CPCs	NWC	WCR	CB
Evaluation criteria	Accounts receivable	1) Net realizable value.	Valued at net realizable value, but adjusted at present value.	–	–	n/a
		2) Provision for doubtful receivables.	Estimated losses in doubtful receivables.	+	+	n/a
	Financial instruments	3) Valued at purchasing cost or market value, the lowest of both.	Valued at fair value.	+/–	n/a	+/–
	Suppliers, tax obligations and other liabilities	4) Accounts valued at cost.	The balance should be adjusted to present value.	+	+	n/a
	Loans and Funding, Debentures and Other Debt Securities	5) Liabilities registered at value updated to balance sheet date.	Besides the registration at the updated value, the company should adjust the account balance at present value.	+	n/a	+

Legend: "+" positive impact; "-" negative impact; "n/a" does not affect the indicator; "+ /-" impact can be positive or negative.

Source: adapted from Silva (2014).

Picture 3. Changes in valuation criteria and possible impacts in working capital management indicators

The valuation changes resulted in the compulsory use of adjustment to present value, which affects accounting. In the group "accounts receivable", it is necessary to debit the account adjustment to present value, reducing the assets and crediting a financial income account (Iudícibus, Martins, Gelbcke & Santos, 2013). Therefore, this change may adversely affect the CCL and WCR indicators, as there will be a reduction of the asset.

Also in the "Accounts Receivable", in item 2, the international standards show that the account "provision" should no longer be used, adopting the account "estimated loss on doubtful receivables". As stated by Silva (2014), this change means that there is an increase in the account balance, positively affecting the NWC and WCR indicators.

Other changes resulting from the use of adjustments to present value occurred in the accounts "Suppliers, Tax Obligations and Other Liabilities" and "Loans and Funding, Debentures and Other Debt Securities", resulting in a reduction in liability accounts. Thus, in both cases, changes to the NWC, as well as the WCR group "Suppliers" and the CB of the group "Loans".

Also regarding valuation changes, there is the requirement to use fair value, which occurs in the account "Financial Instruments", which can change the NWC and CB both positively and negatively. Thus, as shown in Pictures 2 and 3, there were changes in the classification and valuation of accounts that can affect working capital indicators. It is emphasized that, according to Smith (2014), there were no changes in the (de)recognition of accounts.

According to Gilio (2011), convergence to the accounting standards in Brazil, through the IFRS, caused significant changes in financial accounting, as it presented a conceptual framework that raises the question of the essence over form for the recognition, measuring and disclosure of accounting. It is understood, therefore, that these changes may contribute to the approximation between financial and management accounting.

From the interpretation of Pictures 2 and 3, it is clear that the changes resulting from the adoption of international standards can affect the financial indicators of a company. It is clear, too, that most of the changes show an increase in asset accounts and a reduction in liability accounts, which leads to the inference that, in this aspect, the standards caused a reduction with regard to conservatism in accounting (Silva, 2014).

As shown in the literature, international standards have resulted in significant changes in financial accounting. Therefore, it is understood that these changes will also influence management accounting. The analysis of the financial statements, essential to understand the financial position of an entity, should recognize the consequences of these changes.

3. Methodological Aspects

As to the objectives, the research is classified as descriptive, since sectorial information of Brazilian companies is raised for analysis. The approach is classified as quantitative, which is defined by the use of statistical tools in the process of collecting and analyzing data (Gil, 2006).

Regarding data collection, the financial statements of companies were consulted, classified by sectors available on the website of the Instituto Assaf. The Institute's database consists of Brazilian publicly traded companies whose financial statements are published by the Brazilian Securities Commission (CVM). Document analysis was used for the collection and organization of data. Thus, the research sample was composed of the 35 economic sectors available on the website of the Instituto Assaf, totaling more than 500 companies, covering the period 2004-2013, as described in Picture 4.

Steel	Leisure, Culture and Entertainment
Water and Sewage	Machinery
Food and Beverages	Metals
Car parts	Mining
Shoes	Paper and Pulp
Cement and Aggregates	Perfumery and Cosmetics
General Trade	Basic Chemistry
Transportation Operators	Diversified Chemistry
Civil Construction	Health Services
Natural Crops	Transportation Services
Natural Gas Distributors	Diverse Services
Appliances	Educational Services
Electronics	Telecommunication Services
Electric Energy	Software e-commerce
Oil Extraction	Special Retailing
Railways	Road and Airway Vehicles
Hotel Business	Clothing
Diverse Material Industry	

Source: elaborated by the authors.

Picture 4. Investigated sectors

For the sake of analysis, the sample was divided in two parts: the first refers to a four-year period before the adoption of the international standards, from 2004 till 2007; and the second to four years after the adoption from 2010 till 2013. As observed, the years 2008 and 2009 were not investigated, as that was the transition period, when the international standards were partially adopted.

After collecting the material, the indicators NWC, WCR, CB and LR_{WCR} were calculated, based on the formulae demonstrated in Picture 1 and converted into billing days. Next, these indicators were analyzed, comparing both periods to check for significant differences of means.

Therefore, the *Kolmogorov-Smirnov* test was used to identify the data distribution. The test results demonstrated that the distribution is not normal. Thus, next, Mann-Whitney's non-parametric test was used.

The Mann-Whitney test is a non-parametric test to identify if two independent samples present equal means at a certain level of significance. Thus, posts are attributed to the observations as if they were part of a single sample (Chan, Silva & Martins, 2007). The results are presented in the next topic.

4. Analysis of Results

The study sample consists of 35 economic sectors, as indicated earlier. The indicators NWC, WCR, CB and LR_{WCR} were calculated separately for each sector and each year of study, and their values were displayed in days. To apply the Mann-Whitney test, however, the sample was separated per period, analyzing all sectors as the whole, in the period before and after the adoption of the international standards.

Table 1 displays the means and sum of the indicators in both periods analyzed, according to the Mann-Whitney test, to show some changes.

Table 1

Comparison of means and sum of both periods

Indicators	Period	Mean	Sum
NWC_{days}	before	125.82	17237.00
	after	151.90	21266.00
WCR_{days}	before	146.65	20091.50
	after	131.51	18411.50
CB_{days}	before	113.91	15606.00
	after	163.55	22897.00
$LR_{WCR\ days}$	before	118.04	16172.00
	after	159.51	22331.00

Source: research data.

The analysis of Table 1 reveals that the indicators NWC, CB and LR_{WCR} showed higher means and sum of posts when comparing the period before and after the adoption of the standards. It is highlighted that the WCR was the only indicator that dropped between the periods.

In Table 2, the differences of means are demonstrated according to the Mann-Whitney test, comparing the periods before and after the adoption of Law 11.638/07, based on a significance level of 0.05. This shows a significant variation in three out of four indicators.

Table 2

Difference of indicators before and after the adoption of the Law

Items	NWC_{days}	WCR_{days}	CB_{days}	$LR_{WCR\ days}$
Mann-Whitney U	7784.000	8541.500	6153.000	6719.000
Wilcoxon W	17237.000	18411.500	15606.000	16172.000
Z	-2.709	-1.573	-5.156	-4.307
Sig. (p-value)	.007	.116	.000	.000

Source: research data.

As can be seen in Table 2, the results of the non-parametric test indicate that the indicators NWC, CB and LR_{WCR} presented significant differences between the period before and after the enactment of Law 11.638 / 2007; while the WCR presented no statistically significant difference. These results are similar to Silva (2014), who investigated the same sectors, finding significant differences in current liquidity indicators and dry liquidity. It is inferred that the changes perceived in these indicators may derive from the same factors that caused the changes in working capital indicators, as both indicators use elements of current assets and liabilities.

When analyzing the differences in the indicators, it appears that the changes in the NWC and CB indicators may be due to changes introduced by Law 11638 / 2007, as presented in the theoretical framework in Pictures 2 and 3, as these could cause an increase or decrease of assets and liabilities and consequently alter those indicators. The existence of positive or negative change in financial indicators was also perceived by Barbosa et al. (2009), in a study of some publicly traded companies.

The WCR indicator, however, showed different behavior. The analysis of Table 1 shows a negative variation in this indicator, but this variation was not significant in statistical terms. This suggests that Law 11.638 / 07 affected the financial assets and liabilities more strongly than the operating assets and liabilities, confirming the data presented in Figures 2 and 3.

The LR_{WCR} is an indicator that can be used to complement the analysis of the company's financial situation. Calculated based on the CB and WCR, the indicator changes significantly, accompanying the behavior of the balance in treasury and corroborating the findings of Silva (2014) with regard to liquidity.

In summary, the results indicate that the economic and financial indicators, in this case working capital indicators, have undergone significant changes after the adoption of Law 11638 / 2007. Similar studies with other indicators also found differences, such as Miranda (2008), Ribeiro et al. (2013) and Silva (2014). However, when adopting the Fleuriet model, this study shows that the detailed analysis of current asset and liability elements can generate more accurate information, since it not only confirms significant changes in terms of business liquidity, but also shows that the change mainly occurred in the financial elements.

5. Final considerations

The analysis process of financial statements is an important activity that supports decision making by users, notably creditors and investors. Thus, changes in accounting procedures deserve attention because they can affect the indices used in the decisions of internal and external users to the company. The adoption of international standards was undoubtedly one of the biggest changes in Brazilian accounting since the enactment of Law 6404 in 1976.

In this context, the objective of this study was to determine whether, after the adoption of international standards, significant changes occurred in working capital indicators, known as the Fleuriet model, i.e. NWC, WCR, LR_{WCR} and CB. Therefore, initially, the main changes introduced by Law 11638 / 2007 were presented that could impact these indicators, followed by an analysis in 35 economic sectors, during the four years before and four years after the changes. It is noteworthy that the study period covers the years 2004-2013, but the years of 2008 and 2009 were not considered as they were considered a transition period.

Consistent with the changes in the accounts that make up the current assets and liabilities, the study results indicate that the indicators NWC, CB and LR_{WCR} showed significant variation between the periods analyzed, being higher after the adoption of the international standards. The WCR indicator did not change significantly. In other words, the detailed analysis of asset elements and liabilities confirms the significant changes in terms of liquidity and also shows that the change occurred mainly in the financial elements.

These findings attest the relevance of detailed analysis of working capital in operational and financial data to show that the changes brought about by the adoption of international accounting standards most strongly influenced the financial items. Thus, by using the statements for decision making, external users should be aware of the changes that have affected the financial elements of current, since such fluctuations can change the indicators, thus affecting the decision-making process.

In general, it appears that the changes resulting from the adoption of international standards may have contributed to the occurrence of these variations. It should be noted, however, that there are also other factors that can contribute to these changes, such as aspects related to the economy or to internal factors of companies.

Thus, this study intended to promote reflection on the impacts of Law 11.638 / 2007 in the management of working capital, given its importance in the analysis of the financial situation of companies. Also noteworthy are the limitations of the study, since the analysis was carried out in the sectors as a whole. Thus, for future studies, the analysis could show differences in each sector separately, since the activities of each company or segment can influence the results of the indicators.

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Determining Factors for the Adoption of Stock Option Plans in Brazilian Publicly Traded Companies

Abstract

The objective was to identify the determining factors for the adoption of stock option plans in Brazilian publicly traded companies. Therefore, a descriptive research was developed by means of document analysis and a quantitative approach, using logistic regression. The sample consists of 158 companies, using data for the period from 2009 till 2012. The results evidenced an increase in the number of companies with stock option plans during the period. Among the factors company size, liquidity constraint, stock concentration, horizon problem, stockholder participation of CEO, dual function of CEO and chairman of the board, described in the literature as influences for the use of stock option plans, three were confirmed in the sample analyzed. The factors "current liquidity" between 2010 and 2012; "horizon problem" between 2009 and 2012; and "stockholder participation" in 2012, further evidence positive relations in the Brazilian context.

Key words: Determinants; Adoption of stock option plan; Brazilian publicly traded companies.

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1. Introduction

Among the existing remuneration plans, stock option plans are one of the most used forms of long-term incentive in the United States and Europe. This remuneration alternative is little by little disseminated in Brazil as well, mainly under the argument that managers' stockholder participation is a direct and efficient method to align interests between the owner and the manager (Wood & Picarelli, 2004; Galdi & Carvalho, 2006; Dias, Cunha & Mário, 2009; Cesari & Ozkan, 2015).

The conflicts caused by the separation between ownership and management are discussed in the Agency theory, whose precursors were Jensen and Meckling (1976), in a study in which they mention that the Agency theory examines the relations between principals and agents. Although, in principle, the agent (manager) works for the principal (stockholder), he ends up creating his personal motivations and objectives of maximizing satisfaction, which are not always aligned with those of the principal.

In that sense, Galdi and Carvalho (2006) mention that the adoption of stock plans theoretically reduces agency conflicts, as the employee's target is to maximize the company value in order to increase his remuneration as well. In countless studies related to stock option plans, such as Ding e Sun (2001), Uchida (2006), Tzioumis (2008), Dias (2010), Perobelli, Lopes e Silveira (2012), Quin (2012) and Cesari and Ozkan (2015), the agency problems caused by the separation between property and control in large corporations are emphasized.

In addition, researchers (Bryan, Hwang & Lilien, 2000; Uchida, 2006; Tzioumis, 2008; Dias, 2010; Qin, 2012) also appoint that the growing use of stock option plans can be associated with different factors. In Brazil, however, where the interest in research on this theme is growing, the investigation of the determinants still represents a relevant research gap, as most studies were concentrated on relevant issues related to the disclosure of information about stock option plans. As examples, the studies by Nunes (2008), Dias *et al.* (2009), Perobelli *et al.* (2012), Miranda, Tomé and Gallon (2011), Niyama, Campos, Gonçalves and Campos (2012), Tannuri, Farias, Vicente, Bellen and Alberton (2012) and Larini, Schäfer, Rosa and Ferreira (2015) can be mentioned.

In the literature, among the determinants for the adoption of stock options, the company size (Ding & Sun, 2001; Kato, Lemmon, Luo & Schallheim, 2005; Uchida, 2006; Chourou, Abaoub & Saadi, 2008; Tzioumis, 2008; Dias, 2010); liquidity constraints (Yermack, 1995; Bryan *et al.*, 2000; Ding & Sun, 2001; Uchida, 2006; Tzioumis, 2008; Dias, 2010); stockholder concentration (Nagaoka, 2005; Banghoj, Gabrielsen, Petersen & Plenborg, 2010; Dias, 2010); horizon problem (Bryan *et al.*, 2000; Tzioumis, 2008); dual functions of CEO and chairman of the board (Tzioumis, 2008; Qin, 2012); and stockholder participation of CEO (Kato *et al.*, 2005; Uchida, 2006; Chourou *et al.*, 2008; Tzioumis, 2008; Qin, 2012) is highlighted.

Based on the above, the following research question was elaborated to guide this study: **What are the determinants of the adoption of stock option plans in Brazilian publicly traded companies?** Thus, the objective of this study is to identify the determinant factors for the adoption of stock option plans in Brazilian publicly traded companies.

The study is justified by the importance of the theme in view of the agency problem in companies and due to divergences in earlier research results (Bryan *et al.*, 2000; Ding & Sun, 2001; Kato *et al.*, 2005; Uchida, 2006; Tzioumis, 2008; Dias, 2010; Qin, 2012) that are a source of concern. It is highlighted that the results are inconclusive concerning the effects of each variable as, in most cases, the results of the variables diverge among the studies (Dias, 2010).

In addition, due to the small number of studies in the context of the Brazilian market, it should again be highlighted that the investigation of the determinants for the use of this form of variable remuneration still represents a relevant research gap in the Brazilian stock market, considering that, in Brazil, mainly issues relate to information disclosure on the stock option plans have been analyzed. Thus, the intent is to contribute to enhance the discussion on the theme.

The study is also relevant because it relates the adoption of stock option plans with factors Brazilian researchers have hardly explored. Hence, the study is justified as it contributes to strengthen the understanding on the theme in the Brazilian context and extends the discussion to factors that can influence the adoption of stock option plans.

The study is structured in seven parts, starting with this introduction. Next, the theoretical framework is presented, which discusses contents on the agency theory, stock option plans and determinants for the adoption of stock option plans. Then, the methodological aspects used to develop the research are described. Then, the analysis of the results is presented, followed by the final considerations.

2. Agency Theory

The Agency theory was introduced in the economy in the 1970's, due to the sharing of risks between principals and agents as, often, directs and agents work together but with different objectives (Jensen & Meckling, 1976). The stakeholders treated the risk differently. Thus, the Agency theory broadened studies on the theme risks, including the so-called agency problem, which occurs when the cooperators have different objectives and a different division of work (Ross, 1973; Jensen & Meckling, 1976).

In the agency relations, two problems can emerge: the principal's objectives conflict with the agent's and it is costly for the principal to verify what the agent is actually doing; and the sharing of risk, which comes up when the principal and agent have different attitudes towards the risk (Jensen & Meckling, 1976).

When the principal is aware of the agent's activities, a remuneration system based on behavior can be effective. When the director does not know what the agent is doing, conflict can occur. In Agency theory, the conflicts between principal and agent are known as moral risk and adverse selection (Fama & Jensen, 1983). The moral risk problem can be understood as actions that are hidden to the owners or are costly to observe. The adverse selection problem can be considered as hidden information – in this case, the agent has information the owners cannot observe (Arrow, 1985).

When the principal's work is delegated to the agent, the agency relation develops. The agent's mission is the perfect accomplishment of the principal's interests. The principal faces the risk of the agent's failure, but the agent's execution of the mission can also influence the payment agreed upon with the agent. Thus, the agent's level of reward generally depends on the director's interest in the accomplishment of the mission. The advantage for the agent, in the form of a reward, represents a cost for the principal, while the agent's efforts offer benefits to the principal and, at the same time, cost for the agent (Eisenhardt, 1989).

Agency theory develops risk monitoring and sharing factors, affecting a remuneration system based on the agent's performance. Monitoring factors include work programming, investment in selection systems, monitoring of performance by the principal and the relational proximity between the principal and the agent. These risk factors are the principals and agents' attitudes towards the risk, the size of the purchase and uncertainty in the performance result (Eisenhardt, 1989; Bergen, Dutta & Walker, 1992).

Agency theory is used to analyze the conflict of interests among the main stakeholders and develop conflict solving mechanisms (Tipuric, 2008). The agents are motivated by self-interest and are rational actors. Thus, the directors can motivate the agents, controlling their incentives. The information systems prohibit the agent's opportunism, as they inform the director about what the agent can do. When the company has information to verify the agent's behavior, the agent is more prone to behaving in favor of the principal's interest (Eisenhardt, 1989).

According to Siffert (1996), the bilateral relations between principal and agent have three characteristics in common: (a) the agent has different actions at his disposal and can employ the company's resources in distinct manners, including the misappropriation of part of this amount, or simply not make efforts to maximize the partners' profit; (b) the agents' behavior affects not only their own well-being, but also that of the principal, whether due to the increase or decrease of the financial resources available, af-

fecting the organization's performance; and (c) there exists information asymmetry among the stakeholders. The principal cannot monitor all of the agent's steps, nor identify his degree of commitment to work in order to maximize the principal's wellbeing.

The ideal contract between principal and agent is part of the discussions held in Agency theory, in which the agent (manager or employee) tries to satisfactorily maximize personal gains through the principal's economic objectives, and the agent's level of commitment is a function of the value of the reward received for the objectives achieved (Podrug, Filipovic & Milic, 2010).

3. Stock Option Plans

Options have been used since the Greek and Roman civilizations, and the current model was developed in the United States, after the crisis of 1929 (Nunes, 2008). The oldest register is found in the Chrysler Corporation, where the Board of Administrators approved the first option plans in 1952 (Smith & Wallace, 1997). In Brazil, the first records of incentive plans through stock options date back to the 1970's, used by North American companies established in the country (Nunes, 2008).

According to Nunes (2008), the use of stock options as a form of remuneration is to grant, at a specific data, options to purchase batches of company stock in the future, at a fixed price, which may be equal or not to the market price at the moment the option is granted. The author also mentions that the use of this type of remuneration enhances the employees' motivation to improve their performance, which will consequently result in the increased value of the stock, surpassing the exercise price and leading to further gains.

Stock option plans, increasingly important in companies' financial structure, are relevant options for the employees, which comply with some requisites: they grant the employees the right to purchase a determined or determinable number of stocks and receive a certain amount that varies according to the price of the stock or the value of the dividends. Thus, the stock options are considered as a form of retribution of the company to the employees (Tiscini & Raoli, 2013).

Companies do not only issue stock options to adjust the managers and stockholders' interests, but are also used to remunerate the employees, attracting and retaining them, and also to obtain shareholder revenues (Uchida, 2006; Cesari & Ozkan, 2015). The attraction and retention of the employees occurs because, if they resign from the organization before owning the stock options, the employees lose their rights. In addition, when they accept the options, the employees become stockholders of the company they work for (Tzioumis, 2008; Cesari & Ozkan, 2015).

The regulatory framework for the theme in the Brazilian market was set in 2008, when the Accounting Pronouncements Committee (CPC) approved Technical Pronouncement CPC 10 – Stock based payment (Dias, 2010; Larini *et al.*, 2015).

4. Determinants For The Adoption Of Stock Option Plans And Research Hypotheses

Different factors are appointed in the literature as determinants for the adoption of stock option plans, such as the company size (Ding & Sun, 2001; Kato *et al.*, 2005; Uchida, 2006; Chourou *et al.*, 2008; Tzioumis, 2008; Dias, 2010); liquidity constraints (Yermack, 1995; Bryan *et al.*, 2000; Ding & Sun, 2001; Uchida, 2006; Tzioumis, 2008; Dias, 2010); stockholder concentration (Nagaoka, 2005; Banghoj *et al.*, 2010; Dias, 2010) horizon problem (Bryan *et al.*, 2000; Tzioumis, 2008; Dias, 2010); dual function of CEO and chairman of the board of administrators (Tzioumis, 2008; Qin, 2012); and stockholder participation of the CEO (Kato *et al.*, 2005; Uchida, 2006; Chourou *et al.*, 2008; Tzioumis, 2008; Qin, 2012). Next, each of them is described along with the respective research hypotheses.

4.1 Company size

In larger companies, according to Ding and Sun (2001), controlling the agent's actions is more difficult when compared to smaller companies. Therefore, the incentives to adopt stock option plans to minimize potential agency problems are stronger in larger companies. Uchida (2006) presents similar arguments as, according to him, managers of large companies should allocate more complex resources, turning the monitoring more difficult for the stockholders. Thus, the use of stock option plans can contribute to further alignment between principal and agent.

In addition, large companies tend to perform more complex operations, as they do business in different countries with different types of companies, located in several geographical regions. Therefore, it is plausible to consider that, besides attracting more influential and trained professionals, these companies offer better remunerations to their executives, including the use of stock option plans (Kato *et al.*, 2005; Chourou *et al.*, 2008; Tzioumis, 2008). Tzioumis (2008), like Dias (2010), mentions that the financial capacity of big companies is larger, granting them greater possibilities to remunerate their executives with stock option plans. Thus, the first research hypothesis is:

H_1: The company size is a determinant for the adoption of stock option plans. Bigger companies are expected to possess better conditions and incentives to adopt stock option plans.

4.2 Liquidity constraints

Another motive that can contribute to the adoption of stock option plans to remunerate managers, in accordance with Tzioumis (2008), is the presence of constraints in the company's liquidity, as the stock options do not require the disbursement of cash. The author also mentions that the stock options can serve as an incentive for the manager to try and revert the situation.

According to Ding and Sun (2001), the stock option plans are a form of remuneration "without money" for the executives, from the stockholders' viewpoint. The authors also highlight that the executives will inject money in the company if they decide to exercise their options. Therefore, they observe that companies who face liquidity constraints will be more prone to adopting the stock option plans as a way to remunerate their executives.

Other authors defend the same thought, such as Yermack (1995), Bryan *et al.* (2000), Uchida (2006) and Dias (2010). Thus, the second hypothesis was established:

H_2: Liquidity constraints are a determinant for the adoption of stock option plans. In that sense, companies with liquidity constraints are expected to be more prone to the adoption of stock option plans.

4.3 Stockholder concentration

In some companies, the controlling stockholder holds a high percentage of stockholder participation. In these cases, the concentration reduces the managers' discretionary behavior, as large investors aim for the maximization of company income and greater control on company assets so as to have their rights respected (Nagaoka, 2005; Dias, 2010).

Differently from various dispersed stockholders, large controlling stockholders have greater access to the executives' actions, as their economic incentives to monitor the managers are larger. According to Banghoj *et al.* (2010), these factors reduce the need to pay variable remuneration, mainly when based on performance, which is the case of stock option plans.

According to the line of reasoning that greater capital concentration contributes to further alignment between the principal and the agent's interests, the third research hypothesis is established:

H_3: The stockholder concentration is a determinant for the adoption of stock option plans. Following the line of reasoning that greater capital concentration contributes to further alignment between the principal and the agent's interests, companies with greater stockholder concentration are expected to use less stock option plans.

4.4 Horizon problem

The horizon problem, according to Tzioumis (2008), emerges when the CEOs get close to retirement. That happens, according to the author, because in most cases, the manager starts to overvalue projects that only offer short-term results, instead of investments that can increase the company's efficiency in the long term, such as investments in research and development for example.

Hence, the stock option plans could alter the short-term focus of managers close to retirement and encourage the search for projects and investments that favor the stockholders' long-term interests (Bryan *et al.*, 2000; Tzioumis, 2008; Dias, 2010).

Thus, in view of the possible existence of the horizon problem, the fourth research hypothesis was established:

H_4: The CEO's age is a determinant for the adoption of stock option plans. The CEO's higher age is expected to influence the companies' proneness to the adoption of stock option plans.

4.5 Dual functions (CEO and chairman of the board)

The duality analyzed in this study occurs when an individual serves as the CEO and chairman of the board of directors, that is, two top functions. From the agency theory approach, the separation between the functions of chairman and CEO would be expected to contribute to a reduction in the agency conflicts (Qin, 2012). The non-duality, as Qin (2012) describes, allows the board of administrators, representing the shareholders, to monitor and control more effectively the actions of executives serving as directors.

In addition, when comparing a CEO who does not accumulate the functions of CEO and chairman of the board with a CEO who possesses this dual responsibility, Tzioumis (2008) calls attention to the fact that, when these dual functions exist, the CEO faces more complex tasks. In addition, the author observes that greater responsibility and skill is required. Therefore, better remuneration would be necessary for the manager.

In these cases, one alternative is to increase the performance-based remuneration, including stock option plans in the remuneration package. Thus, the fifth research hypothesis was established:

H_5: The dual function of CEO and chairman of the board is a determinant for the adoption of stock option plans. Companies in which the same individual serves as CEO and chairman of the board are expected to be more prone to the adoption of stock option plans.

4.6 Stockholder participation of CEO

When the managers possess stock of the company they work for, they will pay for part of the costs and will be less prone to wasting company wealth (Morck, Shleifer & Vishny, 1988). Hence, the adoption of stock option plans can be an alternative to align the CEO's interest with that of the other stockholders, thus minimizing potential agency problems (Kato *et al.*, 2005; Uchida, 2006; Chourou *et al.*, 2008; Qin, 2012).

Tzioumis (2008) clarifies that the CEO's stockholder participation in the company he works for refers to the percentage of stock he holds in relation to the total circulating stocks, and also presents arguments similar to Kato *et al.* (2005) and Chourou *et al.* (2008), arguing that the stock option plans represent additional incentives for the CEO to try and maximize the company value and, consequently, maximize the stockholders' wealth. Thus, the sixth research hypothesis is established:

H_6: The stockholder participation of the CEO is a determinant for the adoption of stock option plans. In this sense, companies with stockholder participations of the CEO are expected to be more prone to the adoption of stock option plans, as this action will lead to more aligned interests.

5. Methodological Procedures

This research, characterized as descriptive, was developed through document analysis and a quantitative approach of the data. The study population consists of the companies listed on the São Paulo Stock Exchange (BM&FBOVESPA) on October 16th 2013. The research sample includes the publicly traded companies participating in Level 1, Level 2 and the New Market of BM&FBOVESPA, except for companies from the financial sector and others excluded due to the peculiarities of the sector. Companies without data for all variables in all years analyzed were also excluded, thus totaling 158 companies, 24 of which were listed at Level 1, 14 at Level 2 and 120 on the New Market.

The choice of these companies is justified by their representative role in their respective sectors. In addition, as they participate in the distinguished corporate governance levels, these organizations are subject to a set of practices intended at expanding the stockholders' rights, transmitting greater safety and improving the quality of information provided to the public.

Initially, the reference forms of each of the 158 companies were analyzed to identify companies with stock option plans. Next, data were collected about the factors appointed in the literature as determinants for the use of these plans, as highlighted in the research construct presented in Figure 2.

	Variables	Description How to calculate	Data source	Authors
Dependente	Stock option plan	Company has one: Não = 0 / Sim = 1	Reference form: Section 13 – Remuneration of managers	Ding e Sun (2001), Uchida (2006), Dias (2010)
Independente	Size	Napier's logarithm of total assets	Economática database	Ding e Sun (2001), Uchida (2006), Tzioumis (2008)
	Current liquidity	Current assets / Current liabilities	Economática database	Ding e Sun (2001), Tzioumis (2008)
	Stockholder concentration	% ordinary stock held by main shareholder	Economática database	Nagaoka (2005), Banghoj *et al*. (2010), Dias (2010)
	Horizon problem	Age of CEO	Reference form: Section 12 – Assembly and management	Bryan *et al*. (2000), Tzioumis (2008), Dias (2010)
	Dual functions	Duality: Não = 0 / Sim = 1	Reference form: Section 12 – Assembly and management	Tzioumis (2008), Chen e Lee (2010)
	Stockholder participation of CEO	Present: Não = 0 / Sim = 1	Reference form: Section 13 – Remuneration of managers; Section 15 – Control	Kato *et al*. (2005), Chourou et al. (2008)

Source: elaborated by the authors.

Figure 1. Dependent and independent variables

As observed in Figure 2, the data related to size, current liquidity and stockholder concentration were collected in the database Economática. The data on the horizon problem, dual functions and stockholder participation of the CEO were manually collected from the Reference Forms of each of the 158 companies. The data collection and analysis period ranged from 2009 to 2012.

Next, the statistical procedures of multivariate data analysis were applied by means of logistic regression. Logistic regression, according to Hair, Anderson, Tatham and Black (2009, p. 34) - "[...] is the appropriate multivariate technique when the sole dependent variable is dichotomous", which is the case in this study, in which the adoption or not of stock option plans is the dependent variable, corresponding to "0" for companies without such plans and "1" for companies that do have these plans. Thus, the goal was to verify the association between the dependent/binary variable, the adoption of stock option plans, and the different independent variables presented. Therefore, the logistic regression was defined as the appropriate statistical technique.

6. Data Description And Analysis

This part contains the description and analysis of the collected data. First, the number of companies with stock option plans between 2009 and 2012 is described. Next, the logistic regression results are demonstrated that permitted reaching the research objective.

First, in Table 1, the total number of companies with stock option plans among the 158 companies in the sample is shown.

Table 1

Companies with stock option plans between 2009 and 2012

Stock option plans	2009		2010		2011		2012	
	Nº	%	Nº	%	Nº	%	Nº	%
Use	77	49	89	56	105	66	112	71
Do not use	81	51	69	44	53	34	46	29
Total companies	**158**	**100**	**158**	**100**	**158**	**100**	**158**	**100**

Source: research data.

The analysis of data in Table 1 shows that the stock option plans still did not receive due important in the business context in 2009. That is due to the number of companies that possessed these plans (49), corresponding to only 49%. Nevertheless, an increase is noticed in the number of companies that adopted these plans, reaching 71% in 2012.

Next, logistic regression was applied to identify the determinants for the adoption of stock option plans in the sample companies. The first step is to demonstrate, through Table 2, how the companies would be classified if the model were only guided by the frameworks observed.

Table 2

Classification before logistic regression analysis

Classification Table (a,b)					
Observed			Predicted		
			Stock Option Plans		Percentage Correct
			No	Yes	
Painel A – 2009					
Step 0	Stock Option Plans	No	81	0	0
		Yes	77	0	100
	Overall Percentage				51,30
Painel B – 2010					
Step 0	Stock Option Plans	No	0	69	0
		Yes	0	89	100
	Overall Percentage				56,30
Painel C – 2011					
Step 0	Stock Option Plans	No	0	53	0
		Yes	0	105	100
	Overall Percentage				66,50
Painel D – 2012					
Step 0	Stock Option Plans	No	0	46	0
		Yes	0	112	100
	Overall Percentage				70,90

Source: research data.

As observed in Table 2, according to the results produced in the statistical software SPSS, in the pre-classification, all companies in the sample of 158 companies would be classified as having stock option plans in all years analyzed. According to Dias and Corrar (2009), this means that the model will correctly classify companies with stock option plans, but will incorrectly classify companies without these plans.

In this research, the overall percentage of correct classifications corresponds to 51.30% in 2009, 56.30% in 2010, 66.50% in 2011 and 70.90% in 2012. This analysis is important, in accordance with Dias and Corrar (2009), as it serves as a reference to assess the efficacy of the model when it starts to operate with the independent variables.

Thus, these percentages are expected to increase after the inclusion of the independent variables. In Table 3, the respective variables are evidenced with the respective scores and significance levels in the periods analyzed.

Table 3
Independent variables of logistic regression between 2009 and 2012

Variables	2009		2010		2011		2012	
	Wald	Sig.	Wald	Sig.	Wald	Sig.	Wald	Sig.
Size (Total Assets)	0.3050	0.581	0.4220	0.516	0.1260	0.723	0.8070	0.369
Current Liquidity	0.4060	0.524	6.5780	**0.010***	0.7650	**0.082***	3.3780	**0.066***
Stockholder concentration	0.7950	0.389	0.8015	0.305	0.7265	0.346	0.7569	0.398
Horizon problem	2.8390	**0.092***	3.8230	**0.051***	6.3670	**0.010***	17.0910	**0.000****
Dual functions	0.0880	0.767	0.0250	0.875	0.2270	0.634	0.0030	0.958
Stockholder participation of CEO	0.4470	0.504	2.1910	0.139	2.4640	0.116	4.0220	**0.045****

**Statistically significant at 0.05.
*Statistically significant at 0.10.

Source: research data.

In Table 3, it is observed that the variable "size" is not statistically significant at 10% in the period analyzed. Therefore, hypothesis H_1 is rejected, as the result demonstrates that the size cannot be considered a determinant factor for the adoption of stock option plans in the sample analyzed. Thus, the report by Ding and Sun (2001), Kato *et al.* (2005), Uchida (2006), Chourou *et al.* (2008), Tzioumis (2008) and Dias (2010) was not confirmed.

It is also observed in Table 3 that the variable "current liquidity" was statistically significant at 0.10 for the years 2010, 2011 and 2012. Hence, hypothesis H_2 could not be rejected, as the result indicates that companies with current liquidity constraints had more stock option plans. This result is in accordance with the literature (Yermack, 1995; Bryan *et al.*, 2000; Ding & Sun, 2001; Uchida, 2006; Tzioumis, 2008; Dias, 2010), in that companies with liquidity constraints are more prone to the adoption of stock option plans as a way to remunerate their executives.

Like the variable "size", "stockholder concentration" was not statistically significant either in any of the years analyzed. Therefore, hypothesis H_3 was rejected, that is, for the research sample, the argument by Nagaoka (2005), Banghoj *et al.* (2010) and Dias (2010) that stockholder concentration can influence the adoption of stock option plans was not confirmed.

It is also observed that the variable "horizon problem" was statistically significant at 10% in all years analyzed. Thus, hypothesis H_4 is not rejected, as the result evidences that, among the companies in the sample, the CEO's age is associated with the adoption of stock option plans, in accordance with Bryan *et al.* (2000), Tzioumis (2008) and Dias (2010).

Another variable with statistical significance at the level of 10% was "stockholder participation of the CEO", but only for 2012. Therefore, hypothesis H_6 could not be rejected for that year. Like in the studies by Kato *et al.* (2005), Uchida (2006), Chourou *et al.* (2008) and Tzioumis (2008), that result indicates that, in 2012, the CEO's stockholder participation was a determinant for the adoption of stock option plans.

It is also verified in Table 3 that the variable "dual functions" was not statistically significant either. Therefore, hypothesis H_5 was rejected for the companies analyzed, that is, for the research sample, the report by Tzioumis (2008) about the role of double responsibility as a determinant for the adoption of stock option plans was not confirmed.

In short, three variables showed statistical significant in at least one of the years. Hence, "current liquidity" between 2010 and 2012, "horizon problem" between 2009 and 2012 and "stockholder participation" in 2012 can be considered determinants for the adoption of stock option plans among the publicly traded companies in the research sample.

Next, in Table 4, the Step, Block and Model, Hosmer & Lemeshow tests and the indicators -2LL, Cox-Snell R^2 and Nagelkerke are presented, so as to analyze, after the inclusion of the independent variables, whether the models can be considered capable of performing the predictions as accurately as desired level.

Table 4
Validation tests of logistic regression model between 2009 and 2012

	2009		2010		2011		2012	
Painel A – Omnibus Tests of Model Coefficients								
	Chi-square	**Sig.**	**Chi-square**	**Sig.**	**Chi-square**	**Sig.**	**Chi-square**	**Sig.**
Step	3.981	0.552	15.472	0.009	11.322	0.045	30.143	0.000
Block	3.981	0.552	15.472	0.009	11.322	0.045	30.143	0.000
Model	3.981	0.552	15.472	0.009	11.322	0.045	30.143	0.000
Painel B – Model Summary								
-2 Log likelihood	214.9520		201.0250		190.2760		160.4580	
Cox & Snell R Square	0.025		0.093		0.069		0.274	
Nagelkerke R Square	0.033		0.125		0.096		0.348	
Painel C – Hosmer and Lemeshow Test								
Step	**Chi-square**	**Sig.**	**Chi-square**	**Sig.**	**Chi-square**	**Sig.**	**Chi-square**	**Sig.**
1	11.628	0.169	10.317	0.243	13.558	0.194	11.902	0.156

*Statistically significant at 0.010.

Source: research data.

The Step, Block and Model tests are intended to demonstrate the predictive capacity of the model. The results, described in Panel A of Table 4, corresponded to 3.981 for 2009; 15.472 for 2010; 11.322 for 2011 and 30.143 for 2012. It should be highlighted that, in 2009, the Step, Block and Model coefficients are not statistically significant at 5%, that is, in that year, there was no significant improvement in the quality of the predictions after the inclusion of the independent variables. This result is mainly due to the fact that, in 2009 (Table 3), only one of the six variables was significant.

In addition, in Panel B of Table 4, a -2Log likelihood coefficient of 214.952 is found in 2009; 201.025 in 2010; 190.276 in 2011 and 160.458 in 2012, that is, decreasing. These results indicate that the explanatory power of the model increases over the years as, according to Dias and Corrar (2009), the lower the indicator, the greater the predictive power of the model will be.

The Cox & Snell and Nagelkerke tests are considered pseudo-R^2 and similar to the determination coefficient R^2, used in the linear model, in accordance with Dias and Corrar (2009). Therefore, the two indicators in this research reflect that the set of independent variables (determinants of stock option plans) cannot satisfactorily explain the variations in the log of the dependent variable index (adoption of stock option plans). It is highlighted that 2012 displays the best results for these indicators mainly because, in that year (Table 3), three out of six variables analyzed were significant.

Finally, the Hosmer and Lemeshow test, also according to Dias and Corrar (2009), tests the hypothesis that there are no significant differences between the model predictions and observations, resulting in values without statistical significance for all years. In this case, this result indicates that the predicted values did not significantly differ from the observations. Therefore, the Hosmer and Lemeshow test demonstrates that the models are suitable to verify whether the factors analyzed play a determinant role in the adoption of stock option plans.

In Table 5, the hit percentage of the classifications after the inclusion of the independent variables is demonstrated.

Table 5

Final classification of logistic regression analysis for the period from 2009 till 2012

Classification Table (a,b)					
Observed			*Predicted*		
			Planos de Opções de Ações		*Percentage Correct*
			Não possui	Possui	
Painel A – 2009					
Step 0	Stock Option Plans	No	55	26	67.90
		Yes	40	37	48.10
	Overall Percentage				58.20
Painel B – 2010					
Step 0	Stock Option Plans	No	30	39	43.50
		Yes	24	65	73.00
	Overall Percentage				60.10
Painel C – 2011					
Step 0	Stock Option Plans	No	12	41	22.60
		Yes	5	100	95.20
	Overall Percentage				70.90
Painel D – 2012					
Step 0	Stock Option Plans	No	17	29	37.00
		Yes	8	104	92.90
	Overall Percentage				76.60

Source: research data.

It can be perceived in Table 5 that, after the inclusion of the independent variables, the hit percentage of the model, which corresponded to 51.33% in 2009; 56.30% in 2010; 66.50% in 2011 and 70.90% in 2012 (results displayed in Table 2), increased to 58.20%, 60.10%, 70.90% and 76.60%, respectively, as shown in panels A, B, C and D of Table 5.

In 2009 (Panel A), analyzing 81 companies without stock option plans, 67.90% would be classified correctly. Concerning the 77 companies with the plans, the percentage of hits after the inclusion of the independent variables is equivalent to 48.10%.

In 2010 (Panel B), out of 69 companies without stock option plans, 43.50% would be classified correctly. As regards the 89 companies with plans, the hit percentage after the inclusion of the independent variables would increase to 73%.

In 2011 (Panel C), among the 53 companies without stock option plans, only 22.60% would be classified correctly. On the other hand, out of 105 companies with stock option plans, the percentage of hits after the inclusion of the independent variables corresponds to 95.20%.

Finally, in 2012 (Panel D), out of 46 companies without stock option plans, 37% would be classified correctly. As regards the 112 companies with stock option plans, the percentage of hits after the inclusion of the independent variables corresponds to 92.90%.

Therefore, when considering these results, it can be statistically affirmed that the factors "current liquidity" between 2010 and 2012, "horizon problem" between 2009 and 2012 and "stockholder participation" in 2012 can be considered determinants for the adoption of stock option plans among Brazilian publicly traded companies listed on the distinguished corporate governance levels of BM&FBOVESPA in the research sample.

7. Final Considerations

The objective in this study was to identify the determinant factors for the adoption of stock option plans in Brazilian publicly traded companies. Therefore, a descriptive research was conducted through document analysis and a quantitative approach, using logistic regression. The sample consisted of 158 companies with data for the period from 2009 till 2012, obtained from the Reference Forms and the database Economática.

The results evidenced that the stock option plans do not receive due importance in the corporate context. Nevertheless, an increase was observed in the number of companies that adopted such plans between 2009 and 2012. In that period, the year 2012 stood out with the largest number of companies with such plans, i.e. 112 (71%) among the 158 companies analyzed. In the negative sense, 2009 stood out, when only 77 companies (49%) had stock option plans.

The logistic regression revealed that the variable "current liquidity" was statistically significant for the years 2010, 2011 and 2012. Thus, hypothesis H_2 could not be rejected, as the result indicated that companies with current liquidity constraints had more stock option plans. This result is in accordance with the literature (Yermack, 1995; Bryan *et al.*, 2000; Ding & Sun, 2001; Uchida, 2006; Tzioumis, 2008; Dias, 2010), in that companies with liquidity constraints are more prone to the adoption of stock option plans to remunerate their executives.

It was also verified that the variable "horizon problem" was statistically significant in all years analyzed. Thus, hypothesis H_4 was not rejected, as the result evidenced that, among the companies in the sample, the CEO's age is associated with the adoption of stock option plans, in accordance with Bryan *et al.* (2000), Tzioumis (2008) and Dias (2010).

Another statistically significant variable was "stockholder participation of CEO", but only for the year 2012. In this case, hypothesis H_6 could not be rejected for that year. This result indicated, like in the studies by Kato *et al.* (2005), Uchida (2006), Chourou *et al.* (2008) and Tzioumis (2008) that, in 2012, the stockholder participation of the CEO was one of the determinants for the adoption of stock option plans.

Therefore, it is concluded that the factors "current liquidity" between 2010 and 2012, "horizon problem " between 2009 and 2012, and "stockholder participation" in 2012 can be considered determinants for the adoption of stock option plans among the publicly traded companies in the research sample.

These discoveries provided further evidence, for the Brazilian context, of positive relations between: "current liquidity" and the adoption of stock option plans (Yermack, 1995; Bryan *et al.*, 2000; Ding & Sun, 2001; Uchida, 2006; Tzioumis, 2008; Dias, 2010); "horizon problem" and the adoption of stock option plans (Bryan *et al.*, 2000; Tzioumis, 2008; Dias, 2010); and "stockholder participation" and the adoption of stock option plans (Kato *et al.*, 2005; Uchida, 2006; Chourou *et al.*, 2008; Tzioumis, 2008; Qin, 2012).

On the opposite, the variable "size" was not statistically significant and, therefore, hypothesis H_1 was rejected. Hence, the report by Ding and Sun (2001), Kato *et al.* (2005), Uchida (2006), Chourou *et al.* (2008), Tzioumis (2008) and Dias (2010) was not confirmed. One possible justification is that larger companies are more able to introduce other governance devices, also capable of minimizing potential agency problems.

The variable "stockholder concentration" did not demonstrate statistical significance either in any of the years analyzed. Thus, hypothesis H_3 was rejected, that is, for the research sample, the argument by Nagaoka (2005), Banghoj *et al.* (2010) and Dias (2010) was not confirmed. One justification for this result is the fact that, in Brazil, concentrated ownership is the predominant structure in most companies and, therefore, does not influence the adoption of stock option plans.

In addition, the variable "dual functions" was not statistically significant. Therefore, hypothesis H_5 was rejected for the companies analyzed. Thus, the report by Tzioumis (2008) that this dual responsibility is a determinant for the adoption of stock option plans was not confirmed. One justification for this result is that the companies do not consider the stock option plans as a way to monitor managers with dual functions.

It is highlighted that the theme is extremely important and that the discussion in the academic context is increasing; and that the results found provoked interest in future research. Hence, the use of stock option plans should be monitored not only in the companies listed on the distinguished corporate governance levels, but also in companies from the traditional market. It would also be interesting to verify whether the activity sector interferes in the results found, besides other periods and other factors not used in this study.

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Structural Equation Models using Partial Least Squares: an Example of the Application of SmartPLS® in Accounting Research

Abstract

In view of the Accounting academy's increasing in the investigation of latent phenomena, researchers have used robust multivariate techniques. Although Structural Equation Models are frequently used in the international literature, however, the Accounting academy has made little use of the variant based on Partial Least Squares (PLS-SEM), mostly due to lack of knowledge on the applicability and benefits of its use for Accounting research. Even if the PLS-SEM approach is regularly used in surveys, this method is appropriate to model complex relations with multiple relationships of dependence and independence between latent variables. In that sense, it is very useful for application in experiments and file data. In that sense, a literature review is presented of Accounting studies that used the PLS-SEM technique. Next, as no specific publications were observed that exemplified the application of the technique in Accounting, a PLS-SEM application is developed to encourage exploratory research by means of the software SmartPLS®, being particularly useful to graduate students. Therefore, the main contribution of this article is methodological, given its objective to clearly identify the guidelines for the appropriate use of PLS. By presenting an example of how to conduct an exploratory research using PLS-SEM, the intention is to contribute to researchers' enhanced understanding of how to use and report on the technique in their research.

Key words: Structural Equation Models; Minimal Least Squares; SmartPLS®.

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1. Introduction

The literature in the fields of marketing (e.g., Howell, 1987; Bagozzi & Yi, 2012), information systems (e.g., Hardin, Chang, & Fuller, 2008), strategy (e.g., Sarkar, Echambadi, &Harrison, 2001; Agarwal, Sarkar, Echambadi, 2002), organizational behavior (e.g., Edwards, 2001), management (e.g., Shields, 1997; Shields & Shields, 1998; Franke, Kristopher & Edward, 2008; Richardson & Vandenberg, 2005), consumer behavior and psychology (e.g., Bollen & Bauldry, 2011) have customarily used Structural Equation Models - SEM) to investigate different latent phenomena.

Specifically in Accounting, the academy's interest in understanding latent phenomena, such as perceptions, judgments, attitudes, organizational knowledge and cultures, and mainly in measuring its influence on different measures, such as learning, satisfaction and even corporate performance, such as stock prices, has significantly increased in recent decades (Smith & Langfield-Smith, 2004; Bisbe, Batista-Fogueta, & Chenhall, 2007; Henri, 2007), particularly in Behavioral Accounting Research – BAR (Mason & Levy, 2001).

The SEM technique has been used in Accounting research due to the need to overcome some of the limitations of first-generation multivariate techniques, including regressions in Ordinary Least Squares (OLS), predominantly in empirical Accounting literature, being particularly useful for research designs in which a dependent variables turns into an independent variable in subsequent relations (Hair Jr., Black, Babin, Anderson, & Tatham, 2009). In these cases, the relations are traditionally investigated using simultaneous equations (including the two-stage least squares method - 2SLS), which can lead to inconsistencies in the estimators if one or more explanatory variables are correlated with the error term of the equation, known as "simultaneous equation bias" (Gujarati & Porter, 2011).

In addition, in comparison with the OLS regression, the SEM offers a range of advantages, such as: more flexible premises; ability to analyze multiple relationships simultaneously; working with latent variables; analyzing time series data; ability to test non-normal data; test models with many equations as a whole, obtaining global adjustment measures; ability to model the mediating and moderating variables; ability to model error terms; etc. (Xiao, 2013).

In that perspective, for example, the study by Nicolaou, Sedatole and Lankton (2011) can be mentioned, which through the incorporation of moderating effects in the structural model found results that suggest that the background literature, operated through first-generation multivariate techniques, mainly OLS regression, provided an incomplete explanation on how the integration of information systems affects the confidence in interorganizational alliances. Nevertheless, although SEM is frequently used in the international literature, Accounting research have hardly used the variant based on Partial Least Squares - PLS-SEM, largely due to a lack of knowledge on the benefits its use offers (Lee, Peter, Fayard, & Robinson, 2011). Although the PLS-SEM approach is frequently used in survey-based research, this method is the most suitable to model complex relations with multiple relationships of dependence and independence among latent variables (Nitzl, 2014). In that sense, it is very useful for applications in experiments and file data (Lee *et al.*, 2011).

This low use of the PLS-SEM approach is even more surprising in view of the Accounting researchers' increasing emphasis, mainly in Management Accounting, on the need to use the technique, as it permits the development of more holistic models (Hughes & Kwon, 1990; Shields, 1997; Shields & Shields, 1998; Chenhall, 2003).

When compared to the multivariate technique, which is more frequent in Accounting research, OLS regression, which restricts the analysis of the relation between a single dependent variable and a range of explanatory variables in a one-way causal sense, consequently demanding the estimation of separate equations to analyze each hypothetic relation, the PLS-SEM permits estimating equations for the simultaneous analysis of the relation among multiple dependent variables (Lee *et al.*, 2011; Smith, 2014).

In that aspect, departing from the insights by Lee, Peter, Fayard, & Robinson (2011) and Nitzl (2014), who encourage studies focused on the elimination of barriers and, consequently, on encouraging the use of PLS-SEM in Accounting, this study intended to exemplify the use of PLS-SEM in exploratory Accounting studies, using the software SmartPLS®.

Like with any statistical tool, PLS-SEM requires that researchers have considerable knowledge on the method applied, as PLS-SEM comes with several details that, if not treated correctly, can lead to incorrect conclusion, which can obviously cause severe problems for the future development of the theory (Nitzl, 2014). Hence, the main contribution of this study is methodological, given its objective to clearly identify the guidelines for the appropriate use of PLS. By explaining the development of an exploratory research using PLS-SEM, the intention is to contribute to the researchers' enhanced understanding of how to use and report on the technique in their studies.

Besides this Introduction, this study is divided in four topics. Initially, in the Theoretical Background, a short general context of the PLS-SEM approach is presented, together with a literature review of Accounting studies that used the technique for data analysis. Next, in the third topic, the methodological aspects are discussed. In the fourth topic, an example is presented of the application of a reflexive measuring scale. Finally, in the last topic, the final considerations are presented, evidencing the research limitations and indicating opportunities for future research.

2. Theoretical Background

2.1 General context of PLS-SEM approach

The SEM is a set of multivariate statistical technique that permit the simultaneous investigation of a set of theoretical relations among one or more independent variables, with continuous or discrete variables, and one or more dependent variables, also continuous or discrete (Tabachnick & Fidell, 1996). Combining aspects of factorial analysis with multiple regression, the SEM enables the researcher to simultaneously investigate multiple relations of dependence and independence among latent variables, by means of observed variables, as one of the most recent multivariate techniques used in the Social Sciences (Hair Jr, Hult, Ringle, & Sarstedt, 2014).

In Table 1, an overview is presented of the general particularities among Covariance-based SEM - CB-SEM), PLS-SEM and Ordinary Least Squares Regression (OLS):

Table 1

Aspects of CB-SEM, PLS-SEM and OLS Regression techniques

Criteria	CB-SEM	PLS-SEM	OLS Regression
Main software used	LISREL, EQS, AMOS, Stata and MPLUS.	SmartPLS, PLSGraph, NEUSREL and WarpPLS.	SPSS, SAS, Excel, Stata and Minitab.
Objective of general analysis	Assess whether the null hypothesis of the proposed model is plausible, rejecting null hypotheses of specific paths without effect.	Reject the null hypothesis of a set of specific paths.	Reject the null hypothesis of a set of specified relationships.
Objective of variance analysis	Global adjustment model according to the data, represented by several adjustment indices.	Explained variance (e.g. high R^2).	Explained variance (e.g. high R^2).
Estimation technique	Maximum likelihood (ML) is the most used.	Ordinary Least Squares.	Ordinary Least Squares.
Type of maximization	Maximizes the reproduction of the covariance among the variables.	Maximizes the prediction of original gross scores.	Maximizes the prediction of original gross scores.
Specification of construct	Supports the use of reflexive and formative measures for the constructs.	Supports the use of reflexive and formative measures for the constructs.	The measures are combined using a scale, index or other weighting schemes.
Dependent variables	Supports multiple dependent variables.	Supports multiple dependent variables.	A single dependent variable can be assessed.
Mediation test	Mediating variables are tested as part of the comprehensive model.	Mediating variables are tested as part of the comprehensive model.	Separate multistep model to test mediating variables (e.g., Baron & Kenny, 1986).
Premises	Multivariate normal distribution and independent observations (parametric).	Non-parametric.	Multivariate normal distribution and independent observations (parametric).
Data source	Primary data.	Primary and secondary data.	Primary and secondary data.
Sample size	Small samples may not converge, but large samples can introduce bias in the goodness-of-fit statistics.	Large samples do not entail bias in the statistics.	Large samples do not entail bias in the statistics.

Source: adapted from Chin & Newsted, 1999, Gefen, Straub, & Boudreau, 2000; Lee *et al.*, 2011.

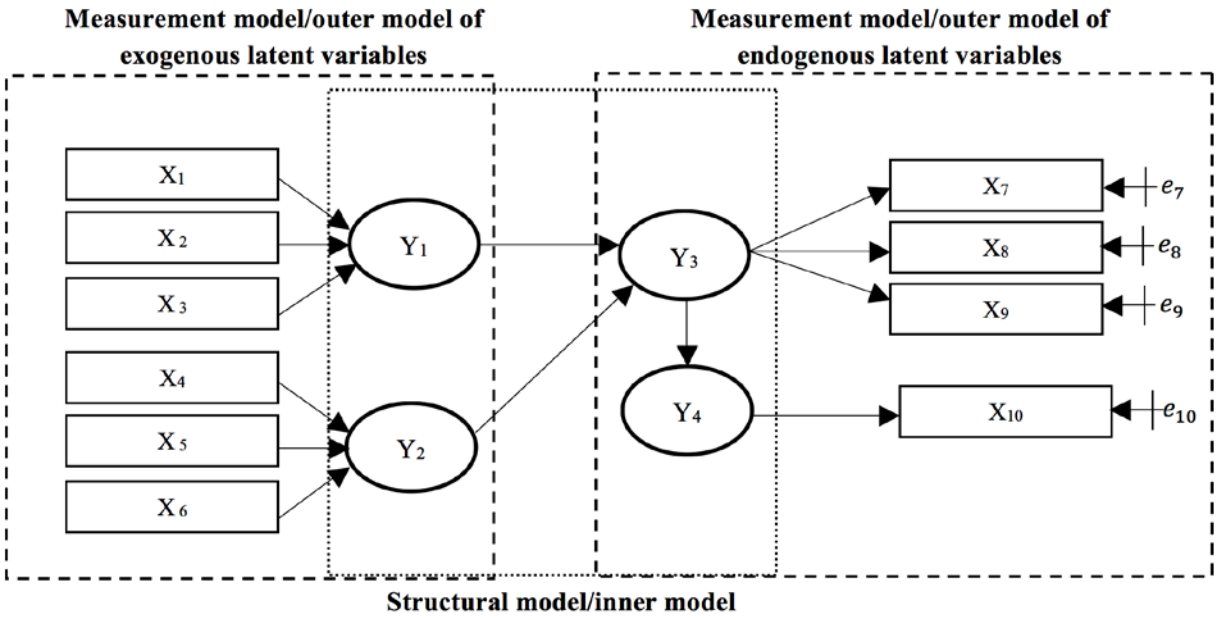
It can be noted that, in some aspects, the PLS-SEM approach converges with the OLS regression (e.g. in the objective of the variance analysis, estimation technique, maximization type, data source and sample size). Nevertheless, the CB-SEM is invariably closer to OLS Regression than to PLS-SEM (e.g. with regard to the premises). Although the method based on the Covariance Matrix (CM) is the most disseminated to conduct the SEM, the PLS-SEM has shown to be a frequently used alternative, mainly because it is more flexible with regard to the dimensioning of the sample and because of the lack of suppositions on the data distribution (therefore, it is known as soft modeling) (Nitzl, 2014). The philosophical distinction between CB-SEM and PLS-SEM is relatively simple. If the objective of the research is to test the theory, that is, its confirmation, the appropriate method is CB-SEM. In contrast, if the objective is theoretical development, PLS-SEM is the appropriate choice (Hair, Ringle, & Sarstedt, 2011). Conceptually, PLS-SEM is similar to the use of multiple regression analysis. Its main objective is to maximize the explained variance in the dependent construct and to assess the quality of the data based on the characteristics of the measuring model (Hair Jr. *et al.*, 2014).

The PLS-SEM is called "Partial Least Squares" because the parameters are estimated by means of a series of least squares, while the term "partial" derives from the iterative estimation procedure of the parameters in blocks (per latent variable), to the detriment of the entire model, simultaneously (Lee *et al.*, 2011).

In SEM, the measuring of the phenomenon, not directly observable as a rule (latent construct), occurs through indicators that serve as proxies of the latent variable of interest. Thus, through the combination of several items in a scale, the abstract concept of interest can be measured indirectly (Hair Jr. *et al.*, 2009).

In the path models, diagrams are used to visually exhibit the hypotheses and theoretical relations among variables. In Figure 1, the latent constructs are represented by circles or ellipses (Y1 till Y4), the indicators (observed or manifest variables) are represented by rectangles (x1 till x10). The relations among the constructs and between indicators and constructs are represented as arrows. In PLS-SEM, the arrows always point in a single direction, representing a directional relationship. Arrows pointing in a single direction are considered a predictive relation and, in case of a strong theoretical foundation, they can be interpreted as causal relationships. Finally, the error terms (*e.g.*, e_7 or e_8), reflexively linked to the endogenous construct, represent the non-explained variance when the path models are estimated (Hair Jr. *et al.*, 2014).

Also according to Figure 1, a PLS path model consists of two elements: structural model (also called inner model in the context of PLS-SEM), which evidences the relations (paths) between the constructs; and the measuring models (also referred to as outer models in PLS-SEM), which refers to the relations between the constructs and the indicating variables (rectangles) (Hair Jr. *et al.*, 2014).



Source: adapted from Hair Jr. *et al.*, 2014.

Figure 1. An example of a path model

The Measuring theory specifies how the latent variables (constructs) are measured. Two types of measuring scales exist in SEM: reflexive or formative. The reflexive indicators, typical of psychometric models, such as the Classical Test Theory (CTT) and the Item Response Theory (IRT), are the most used in the literature. In this type of approach, the sense of "causality" goes from the latent variable to the indicators, that is, the latent construct "causes" the observable items (Hair Jr. *et al.*, 2014). In Accounting research, these indicators would capture perceptions, learning and judgments for example, which are latent construct, normally considered as causes of manifested behavior or of performance scores measured in simulated decision tasks (Rodgers & Guiral, 2011).

In the formative scales, the latent variables are considered "effects" to the detriment of "causes". In this approach, the non-observable construct results from the occurrence of several items that represent a better and more complete image (Rodgers, 1999). To give an example, "liquidity" is a theoretical construct consisting of observable variables, such as the Current Liquidity Index (CLI), Immediate Liquidity Index (ILI), General Liquidity Index (GLI), among others (Rodgers & Guiral, 2011). Studies that require the use of file data (such as management accounting, capital market and management research) demand the use of formative factors (Rodgers & Guiral, 2011).

A path model of PLS consists of two elements. Initially, there is a structural model, also called inner model, in which the relations (paths) between the constructs are exhibited. The second element, the measuring model, also known as outer model, exhibits the relations between constructs and indicators (rectangles) (Hair Jr. *et al*., 2011). The estimation of the model offers empirical measures of the relations between the constructs (structural model) and between the indicators and constructs (measuring models). The empirical measures permit comparing the structural models with the theoretically established reality. Hence, the fitness of the theory to the data can be determined. Differently from the CB-SEM approach, there is no single goodness-of-fit criterion for the PLS-SEM. Hence, it is important to acknowledge that the quality of the fitness presents distinct meanings in contexts of CB-SEM and PLS-SEM (Hair Jr. *et al.*, 2014).

The fitness statistics in CB-SEM derive from the discrepancy between the empirical and theoretical covariance matrix (Hair Jr. *et al.*, 2009), while the PLS-SEM departs from the discrepancy between the observed (in case of manifest variables) or approximate values (in case of latent variables) of the dependent variables and the values forecasted by the model in question (Hair Jr.*et al.*, 2011). Consequently, using PLS-SEM, the researchers depend on measures that indicate the predictive capacity of the model to judge its quality. More precisely, the assessment of the resulting structural and measuring models in PLS-SEM rests on a set of non-parametric assessment criteria, using procedures like bootstrapping and blindfolding (Hair Jr. *et al.*, 2014).

In this respect, the assessment of Measuring models (relations between the indicators and constructs) involves: composite reliability; variance extracted; indicator reliability; and discriminant validity in case of reflexive models; and variance extracted; collinearity between indicators; and the importance and relevance of external weights in formative models. The assessment of the structural model (relations between constructs), on the other hand, considers: the determination coefficients (R^2); predictive relevance (Q^2), size and significance of path coefficients, effect sizes (f^2) and (q^2)(Hair Jr. *et al.*, 2014).

The composite reliability is used to assess whether the sample is truly free from bias or if the responses – on the whole – are reliable. Composite reliability coefficients between 0.60 and 0.70 are considered appropriate in exploratory studies, while coefficients of 0.70 and 0.90 are considered satisfactory for the other types of research (Hair Jr. *et al*., 2014). The variance extracted is the extent to which a measure is positively correlated with alternative measures of the same construct. To establish the variance extracted, the researcher considers the external loadings of the indicators and the Average Variance Extracted - AVE. The AVE is the part of the data of the variables explained by each of the respective latent constructs or, in other words, the average extent to which the variables are positively correlated with their respective constructs (Ringle, Silva, & Bido, 2014). Thus, when the AVE is superior to 0.50, it is admitted that the model converges to a satisfactory result (Fornell & Larcker, 1981).

High external loadings in the same construct indicate that the associated indicators have a lot in common with the phenomenon the latent construct captures. This characteristic is known as indicator reliability. The external loadings of all indicators should be statistically significant. Therefore, standardized values with external loadings superior to 0.708 are expected. Indicators with external loadings between 0.40 and 0.70 should only be eliminated if the procedure entails increased reliability and the composite reliability superior to the suggested minimum value (Hair Jr. *et al*., 2011).

The discriminant validity measures that a construct is truly distinct from the others through empirical standards. Hence, the establishment of discriminant validity implies that the construct is unique and captures phenomena the other constructs in the proposed model do not understand. The main form of assessing the discriminant validity is by confronting the square roots of the AVE coefficients of each construct with the (Pearson) correlations between the other latent constructs (Fornell and Larcker criterion). Discriminant validity will exist if the correlations between the latent variables are inferior to the square root of the AVE (the indicators have a stronger relation with their VL than with other VL (Hair Jr. *et al.*, 2014). Finally, the determination coefficient (R^2), predictive relevance (Q^2) and effect sizes (f^2) and (q^2), criteria to assess the structural model in PLS-SEM (Hair Jr. *et al.*, 2014), will be discussed further on in topic four.

2.2 Short review of Accounting studies that used PLS-SEM

In the past 21 years, some studies have been developed in which the PLS-SEM approach was used as the data analysis technique. Concerning the journals that most publish studies using this type of approach, relevant Accounting journals are observed in the international context, such as Accounting, Organizations and Society (AOS), Management Accounting Research (MAR), The Accounting Review (TAR) and International Journal of Accounting Information Systems (IJAIS), in which 8, 4, 3 and 3 articles were published, respectively.

Studies related to the following subareas are emphasized: performance and remuneration; Cost/Management Accounting; leadership and behavioral aspects; and Management Information Systems. Finally, samples of different dimensions are highlighted, ranging from 569 observations (Dowling, 2009) to extremely small samples of 18 observations (Anderson, Hesford, & Young, 2002). In Table 2, some Accounting studies are listed that used PLS-SEM as the data analysis technique.

Table 2
Accounting studies that used PLS-SEM as the data analysis technique

Study	Journal	Research objective	Sample size
Cohen, Pant, & Sharp (1994)	Behavioral Research in Accounting (Bria)	Investigate the behavioral determinants of auditors' aggressiveness in relations with clients.	62
Ittner, Larckert & Rajan (1997)	The Accounting Review (TAR)	Examine the effect of financial and non-financial performance measures on annual bonus contracts of CEO's.	317
Rodgers (1999)	Journal of Economic Psychology (JEP)	Assess the influence of perceived economic and management risk on judgment and decision making.	268
Vandenbosch (1999)	Accounting, Organizations and Society (AOS)	Investigate the use and perceived importance of management support information systems for organizational competitiveness.	344
Anderson, Hesford, & Young (2002)	Accounting, Organizations and Society (AOS)	Examine the determinant factors (external environment, processes and team dynamics) of the successful implementation of Activity Based Costing - ABC.	18
Chenhall (2004)	Behavioral Research in Accounting (Bria)	Analyze the role of behavioral conflicts in the implementation of ABC Costing.	56
Hartmann (2005)	Abacus (ABA)	Assess the relation between task uncertainty, environmental uncertainty and tolerance of bias in accounting performance measures.	250
Chenhall (2005)	Accounting, Organizations and Society (AOS)	Examine how the informational dimensions underlying strategic performance measuring systems (SPMS), such as the Balanced Scorecard, influence the desired organizational results.	80
Pennington, Kelton, & DeVries (2006)	Journal of Information Systems (JIS)	Analyze the effect of stress on intentions to use Audit Command Language – ACL technology.	43
Bouwens & van Lent (2006)	Journal of Management Accounting Research (JMAR)	Relation between performance measures and cash bonuses.	151
Mahama (2006)	Management Accounting Research (MAR)	Investigate the relations between the two control management systems (performance measuring systems and socialization processes) and cooperation and how this relationship turns into performance in strategic relations with suppliers.	73
Naranjo-Gil & Hartmann (2006)	Journal of Management Accounting Research (JMAR)	Analyze the relation between management team characteristics and management accounting systems.	99
Naranjo-Gil & Hartmann (2007)	Accounting, Organizations and Society (AOS)	Investigate how the heterogeneity of the management team directly and indirectly affects strategic change through the conception and use of the management accounting system.	103

Study	Journal	Research objective	Sample size
Hall (2008)	Accounting, Organizations and Society (AOS)	Analyze how the comprehensive performance measuring systems (PMS) affect management performance.	83
Elbashir, Collier, & Davern (2008)	International Journal of Accounting Information Systems (Ijais)	Investigate the relation between corporate intelligence systems and organizational performance.	347
Homburg & Stebel (2009)	Management Accounting Research (MAR)	Analyze the determinants of contract clauses between accounting service companies and their clients.	76
Chapman & Kihn (2009)	Accounting, Organizations and Society (AOS)	Analyze the associations between the integration of information systems, budgetary use (control), perceived success of the system and business unit performance.	169
Hall & Smith (2009)	Accounting, Organizations and Society (AOS)	Investigate the relation between mentioning and turnover intentions in public accounting companies.	107
Hartmann & Slapničar (2009)	Accounting, Organizations and Society (AOS)	Assess the relation between the subordinate's trust in superiors and the formality of the performance assessment process.	160
Dowling (2009)	The Accounting Review (TAR)	Analyze the factors that influence the appropriate use of audit support systems by auditors.	569
Abernethy, Bouwens, & Van Lent (2010)	Management Accounting Research (MAR)	Investigate the effects of the leadership style on three elements of the corporate management control system (delegation choice, planning and control systems and the performance measuring system).	128
Diaz & Loraas (2010)	International Journal of Accounting Information Systems (Ijais)	Assess, in the post-adoption period of a technology, the relation between expected learning efforts and the intention to use the technology.	69
Elbashir, Collier, & Sutton (2011)	The Accounting Review (TAR)	Analyze the influence of organizational control related to knowledge management and resource development in the assimilation (strategic integration and use) of business intelligence systems (BI).	347
Nicolaou, Sedatole, & Lankton (2011)	Contemporary Accounting Research (CAR)	Examine if and how the integration of information systems (IIS) affects the trust in inter-organizational alliances.	116
Kallunki, Laitinen, & Silvola (2011)	International Journal of Accounting Information Systems (Ijais)	Assess the effects of the adoption of corporate resource planning systems on the management and financial and non-financial performance control systems of a company.	70
Chong & Mahama (2014)	Management Accounting Research (MAR)	The impact of the budget use style on the team level motivation and team efficacy.	186
Lau & Roopnarain (2014)	The British Accounting Review (BAR)	The effects of non-financial and financial measures on employees' motivation to participate in the definition of objectives.	149

Source: survey by the authors.

Hence, the PLS-SEM approach not only offers a range of advantages in comparison with the first-generation multivariate techniques, being very flexible in terms of the premises and sample dimensioning; but also presents some similarities with OLS Regressions. Accounting researchers have recently used it, with publications in relevant journals.

In addition, it is once again highlighted, as briefly discussed in the Introduction, that the occasional ignore of the relations of dependence and independence between the variables of the model under analysis in the OLS models, the non-control of the direct and indirect effects in the relations of dependence/independence and the non-incorporation of moderating or mediating effects in the structural model potentially makes it more difficult to fully understand the phenomenon of interest.

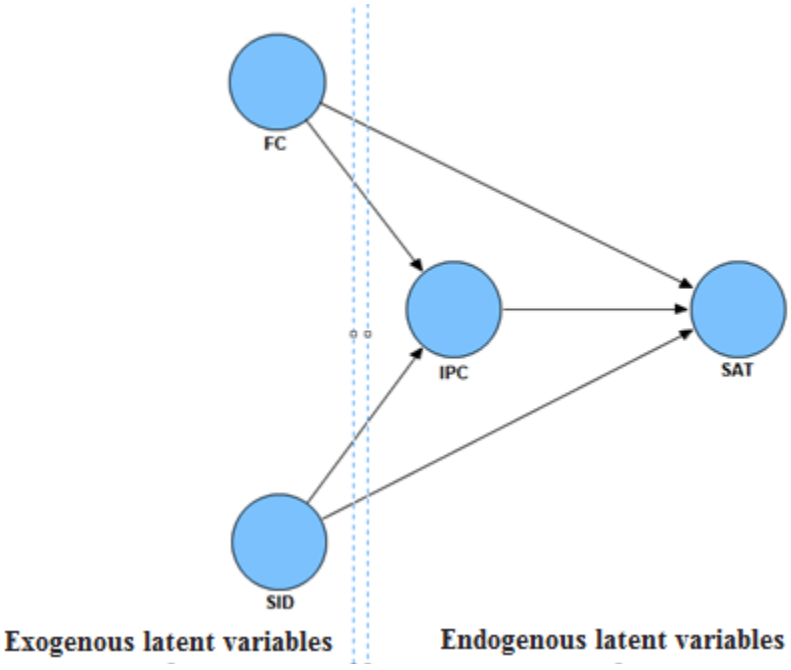
Hall and Smith (2009), for example, modeled indirect effects in the relation between mentoring and turnover intentions in public accounting companies, observing that the "contradictory" effects related to mentoring (which could serve to increase or reduce the turnover) derived from the fact that they were almost exclusively examined through direct effect models, providing inconsistent results. Nicolaou, Sedatole and Lankton (2011), then, incorporated moderating effects in the structural model and found distinct results from what had been reported in the literature thus far.

In that respect, in view of the Accounting academy's increasing interest in understanding latent phenomena, and mainly in measuring their influence on different measures, such as learning, satisfaction, efficiency and efficacy of corporate performance information systems, the PLS-SEM approach has revealed to be a suitable and extremely relevant data analysis technique for the current Accounting research agenda.

3. Method

To encourage the development of exploratory studies using SEM, the investigation of graduating students' satisfaction will be simulated, as an example of a latent variable, by means of a study using SmartPLS®. In this fictitious example, the construct Satisfaction (SAT), a dependent variable, is explained by the constructs proposed by Nascimento, Bernardes, Sousa and Lourenço (2015), that is, "Initiatives to Promote Quality" (IPQ), "Scientific Education" (SE) and "Information Support for Students" (ISS). For the four constructs, seven-point Likert scales indicating increasing levels of agreement are used, with score 1 corresponding to I completely disagree and score 7 to I completely agree, while the remaining scores indicate intermediary levels of agreement.

All constructs were measured by means of five items, according to the orientations of Bido, Silva, Souza, & Godoy (2009) which, based on simulations, recommend the use of at least five indicators per latent variable. Another important observation is related to the minimum number of observations per indicator. According to Bentler & Chou (1987), at least five cases should be used per estimated parameter. The conceptual model (structural model) is displayed in Figure 2.



Source: developed by the authors.

Figure 2. Structural model proposed

In this structural model, IPQ simultaneously serves as a dependent (endogenous) and independent (exogenous) variable, as it is explained (arrows pointing towards it) by other latent constructs "Scientific Education" (SE) and "Information Support to Students" (ISS) – and also explains the SAT construct, which is placed in the middle of the model in this case (the exogenous variables only originate arrows, that is, they are not "constituted" inside the model, like the SE and ISS constructs).

Although the PLS approach is acknowledged for its ability to deal with small samples, that does not mean that this is not a relevant concern. The literature suggests that samples of less than 100 observations should be avoided, setting 200 observations as a good starting point (Hoyle, 1995). In this sense, as the base used in this study consists of 440 observations, that is a sufficient number to develop the study. The SEM analysis via PLS does not accept missing values. Therefore, treatment is needed, like adjustments by the average for example. Another important aspect is the analysis of multivariate outliers, which should be properly verified.

The choice of the SmartPLS software is justified because it is the most frequently used nowadays, and mainly because it is available free of charge to students and researchers. Despite this common use, the amount of didactical material available on the software remains limited, mainly because it is relatively recent (developed in 2005) (Wong, 2013). To obtain an academic license, a registration should be completed on the developer's website (www.smartpls.de). In this study, version 2.0 was used.

As presented earlier, in view of the objective to encourage the use of PLS-SEM in Accounting research, next, a reflexive measuring scale will be applied, which is the most recurrent in the literature and the most similar to multiple regression, a multivariate technique commonly used in accounting literature (Lee *et al.*, 2011), by means of SmartPLS®.

4. Data Analysis

4.1 Exploratory Factor Analysis

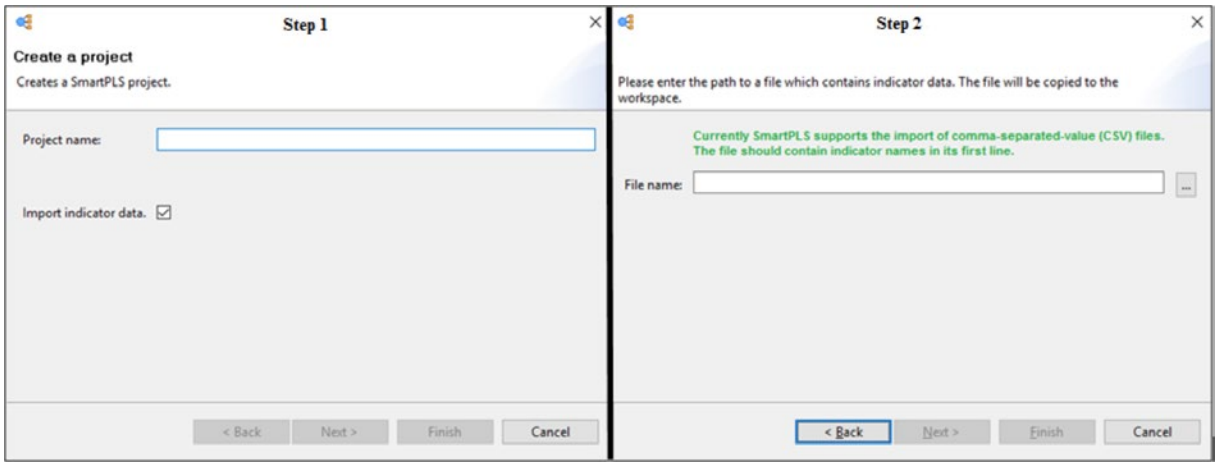
Before performing the SEM procedure, it is important to assess the measures of the constructs, especially the one-dimensionality of the scale - if the items converge to a single construct (Andrade, Tavares, & Valle, 2000). To this end, Exploratory Factor Analysis (EFA) was used separately for each reflexive construct (the use of EFA is valid exclusively for reflexive measuring models, i.e. it does not apply to formative measuring scales), given the interest in evaluating the relationship of each variable with its specific factor. The principal components method was used, adopting the eigenvalue criterion equal to one (1) to extract the factors used. As the existence of correlation between the constructs was expected, we opted for the use of oblique rotations (oblimin direct), which extracts factors considering the covariance between the constructs (Field, 2009).

In the IPQ construct, the Kaiser-Meyer-Olkim (KMO) coefficient of 0.814, superior to the floor of 0.50, and the value of the Chi Square test statistic of Bartlett's test corresponding to 967.991, significant at 0.000, indicates the existence of good fit of the EFA. Relating to commonalities, i.e. the common variance ratio of each item explained by the factor, the items had a mean of 0.63 with a minimum value of 0.57, superior to the floor of 0.50. The solution with extraction of one (1) factor showed an explained variance of 63.04%, also higher than the minimum value reported in the literature, that is, 60% (Hair et al., 2009).The value of 0.853 for Cronbach's Alpha concluded the satisfactory level of internal consistency of the scale (Field, 2009), while the average correlation of 0.58, statistically significant at 0.01, indicated the existence of intermediate colinearity between the indicators of the construct.

The constructs SE (KMO 0.771, 965.124 significant at 0.000, average communality of 0.6052, explained variance of 63.93 with extraction of one factor, Cronbach's alpha of 0.822 and 0.604 average correlations significant at 0.01), ISS (KMO 0.833, 1020.083 significant at 0.000, average communality of 0.6292, explained variance of 60.05 with extraction of one factor, Cronbach's alpha of 0.855 and average correlations of 0.64 significant at 0.01) and SAT (KMO 0.785, 1067.116 significant at 0.000, average communality of 0.6293, explained variance of 60.05 with extraction of aonefactor, Cronbach's alpha of 0.844 and 0.6467 average correlations significant at 0.01) also presented values superior to those recommended in the literature. Thus, it is concluded that the scales are suitable to apply the SEM procedure.

4.2 SEM via Smart PLS

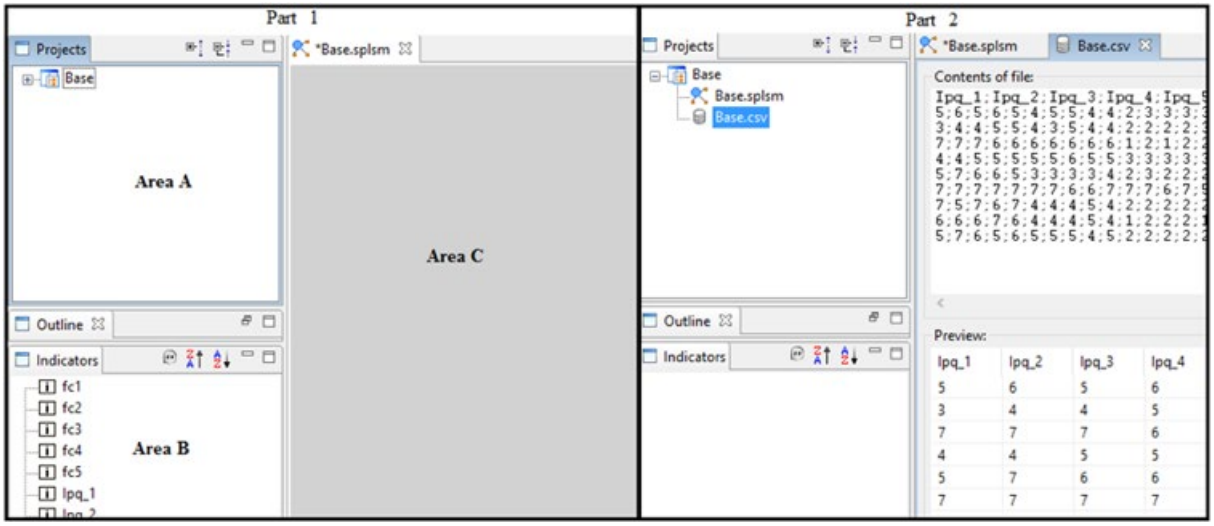
To create a new project, access File, New, and then Create New Project. On the screen open, include the name of the project, called Base here (Step 1) (do not deselect the option import indicator data), click on Next and select the file in its location of origin, clicking on the asterisk (Step 2). It should be highlighted that SmartPLS only supports text files with figures separated by commas (.csv). Finally, after selecting the file (.cvs), click on Finish.



Source: outputs of SmartPLS® v. 2.0.

Figure 3. Steps to create a project and import the database

After concluding the importation of the database, the software presents a screen with three areas. The first marks the project (A), the second the indicators imported (B); and, finally, the model window, where the structural model can be "drawn" (C), as presented in Figure 4 (Part 1). Before starting the process, it is important to verify whether the base has been validated. Therefore, in the Project area, click on the + sign (next to the project name) and then double click the csv file, according to Figure 4 (Part 2):

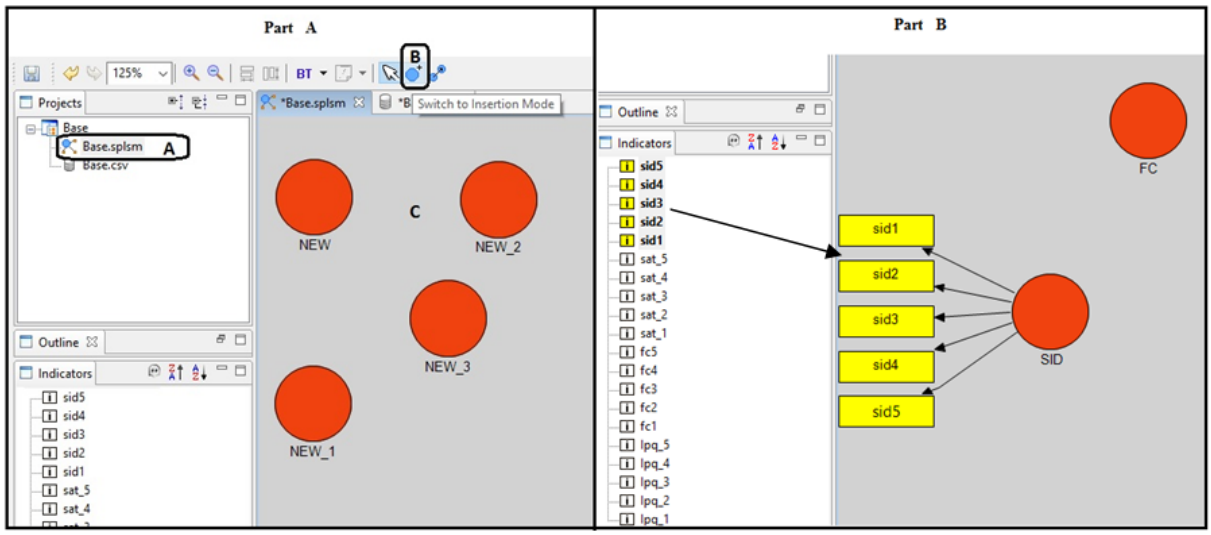


Source: outputs of SmartPLS® v. 2.0.

Figure 4. SmartPLS interface and database validation screen

In the right corner, in "choose delimiter", click on "Semicolon" and then "validate". If there are no problems with the database, the program will issue a message "The data file is valid!". Once the validation of the database has been concluded, the structural model is designed. Therefore, click in the window Base. splsm (mark A), then the button "switch to insertion mode" (mark B) and, finally, click in the design area.

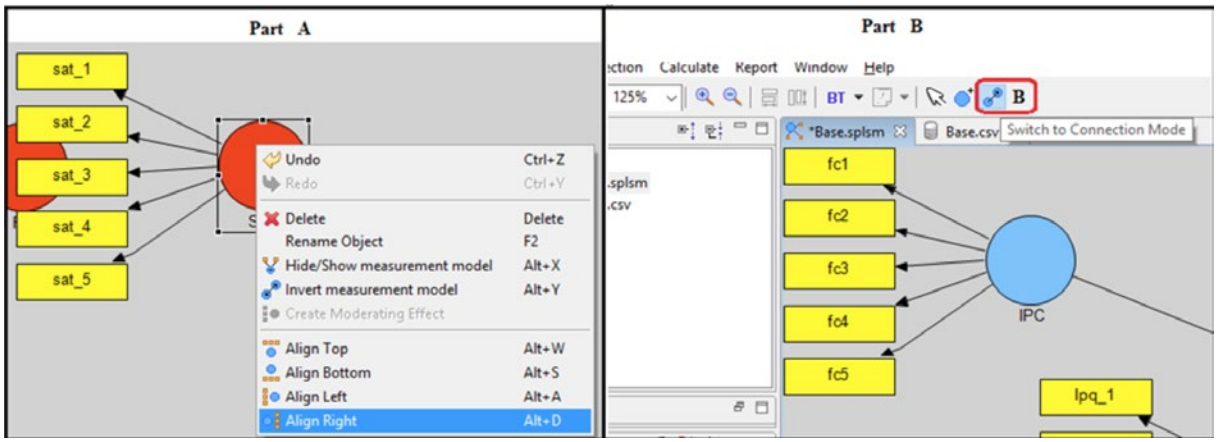
It is important to highlight that each click inserts a latent construct. Hence, working with four latent constructs, four clicks are needed (mark C), as evidenced in Figure 5 (Part A). The next step is to name each construct, clicking on each of the circles and then pressing F2. Then, the indicators should be linked to their respective latent constructs. Thus, press the key Shift, click on the first indicator, then on the next and draw the selection to the respective latent construct. To give an example, the item interval sid1-sid5 is part of the latent construct ISS, as shown in Figure 5 (Part B):



Source: outputs of SmartPLS® v. 2.0.

Figure 5. Insertion of latent construct and indexation of indicators to the constructs

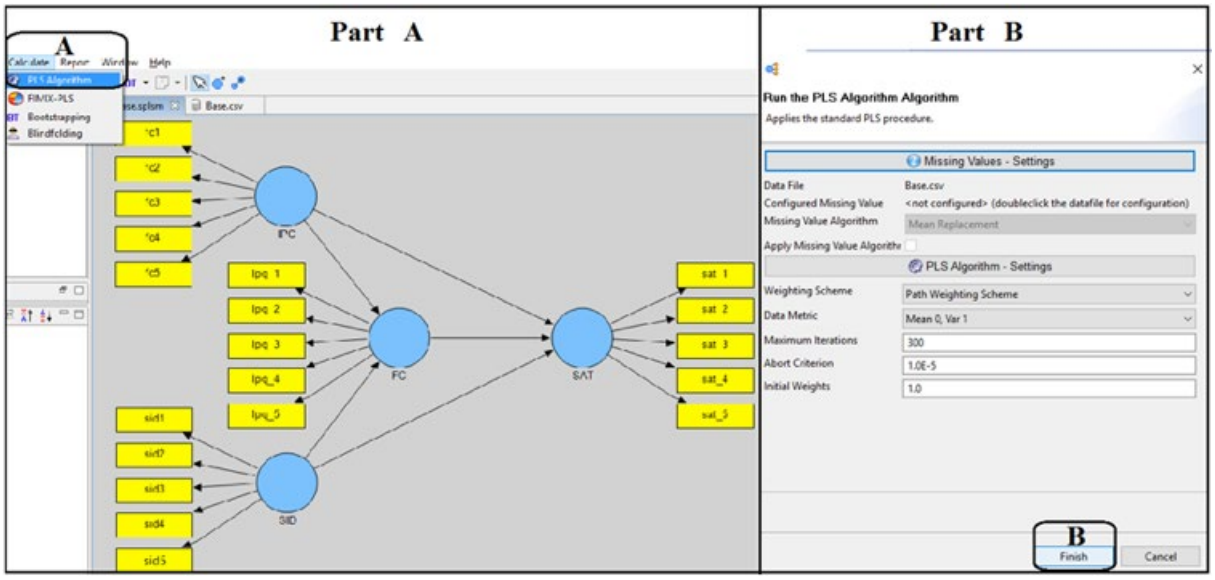
The indicators already linked to some construct are marked in yellow, while the remainder stays white. After linking all indicators with their respective latent constructs, it is important to organize the data visually. To give an example, press the right mouse button on the latent construct to alter on which side the items are presented, as shown in Figure 6 (Part A). Next, click on the button "switch to connection mode" (mark B) (procedure shown in Figure 6 – Part B) and link the circles, thus establishing the relations between the latent constructs.



Source: outputs of SmartPLS® v. 2.0.

Figure 6. Change of item positions and establishment of relations between constructs

After concluding the connection process between the latent construct, Path-Modeling estimation is applied, accessing the option 'Calculate' followed by 'PLS Algorithm', according to Figure 7, (Part A). The traditional analysis configuration is the standard in SmartPLS®. Thus, it is sufficient to press "Finish" (Figure 6, Part B).



Source: outputs of SmartPLS® v. 2.0.

Figure 7. Path-Modeling Estimation using PLS Algorithm

After exemplifying how to create and estimate a PLS path model, we will now focus on assessing the quality of the results. As presented earlier, this process is divided in two phases: assessment of measuring model and structural model. Initially, the model assessment focuses on the measuring model. As the example used involves a reflexive measuring scale, the composite reliability, variance extracted, indicator reliability and discriminant validity will be assessed. In SEM, the composite reliability is used to replace Cronbach's Alpha (Bagozzi & Yi, 1988). To obtain the composite reliability, access: PLS =>Calculation Results =>Quality Criteria =>Overview. As the coefficients (0.8828, 0.8941, 0.8937 and 0.8970 for SE, IPQ, SAT and ISS, respectively), are much higher than the minimum of 0.6, it can be concluded that high levels of internal consistency exist in the latent variables. If the measuring model were formative, this indicator would not be reported.

To calculate the indicator reliability, the loadings need to be squared (available in: PLS =>Calculation Results=>Outer Loadings). Therefore, an electronic worksheet should be used (to transport the data between the applications, select the values in SmartPLS® and paste them in the worksheet). In Table 3, the loadings and respective reliability coefficients are indicated. To give an example, item IPQ_1 presented a factor loading of 0.8451. The squaring of this coefficient (0.84451^2) results in a reliability indicator of 0.73119.

Table 3
Reliability indicator

Construct	Itens	Loadings	Reliability	Construct	Itens	Loadings	Reliability
IPQ	IPQ_1	0.8551	0.73119601	SE	FC1	0.8877	0.78801129
	IPQ_2	0.7918	0.62694724		FC2	0.7708	0.59413264
	IPQ_3	0.8176	0.66846976		FC3	0.7084	0.50183056
	IPQ_4	0.7632	0.58247424		FC4	0.7648	0.58491904
	IPQ_5	0.7311	0.53450721		FC5	0.7372	0.54346384
SAT	SAT_1	0.9163	0.83960569	ISS	SID1	0.8956	0.80209936
	SAT_2	0.7671	0.58844241		SID2	0.796	0.633616
	SAT_3	0.7445	0.55428025		SID3	0.7478	0.55920484
	SAT_4	0.7822	0.61183684		SID4	0.7281	0.53012961
	SAT_5	0.7412	0.54937744		SID5	0.8108	0.65739664

Source: developed by the authors using data from SmartPLS® v. 2.0.

The analysis of Table 3 shows that all indicators present individual reliability coefficients superior to the minimum acceptable level of 0.4 for exploratory studies and close to 0.7 for confirmatory studies (Hulland, 1999). As the objective of the eventual study in theory would be to empirically test the constructs proposed by Nascimento, Bernardes, Sousa and Lourenço (2014), it can be concluded that reliable indicators exist. To verify the convergent validity, the average variance extracted (AVE) of each latent variable is verified. Therefore, access: PLS =>Calculation Results =>Quality Criteria =>Overview. As all AVE coefficients (0.6025, 0.6287, 0.6287 and 0.6365 for SE, IPQ, SAT and ISS, respectively), are superior to the acceptable limit of 0.5 (Bagozzi & Yi, 1988), it is concluded that convergent validity exists.

The square root of the AVE of each latent variable is used to determine the discriminant validity. As presented earlier, it is concluded that discriminant validity exists when this coefficient (square root of AVE) is higher than the correlation coefficient between the latent variables (Fornell & Larcker, 1981). For this assessment, a table needs to be created with the correlations between the latent variables (obtained based on the section "Latent Variable Correlation", PLS=>Quality Criteria=>Latent Variable Correlations) and the square root of AVE, which is calculated manually and reported in bold in the diagonal of the table. Table 4 presents the square AVE coefficients of each construct and the correlations between the latent variables:

Table 4
Discriminant validity

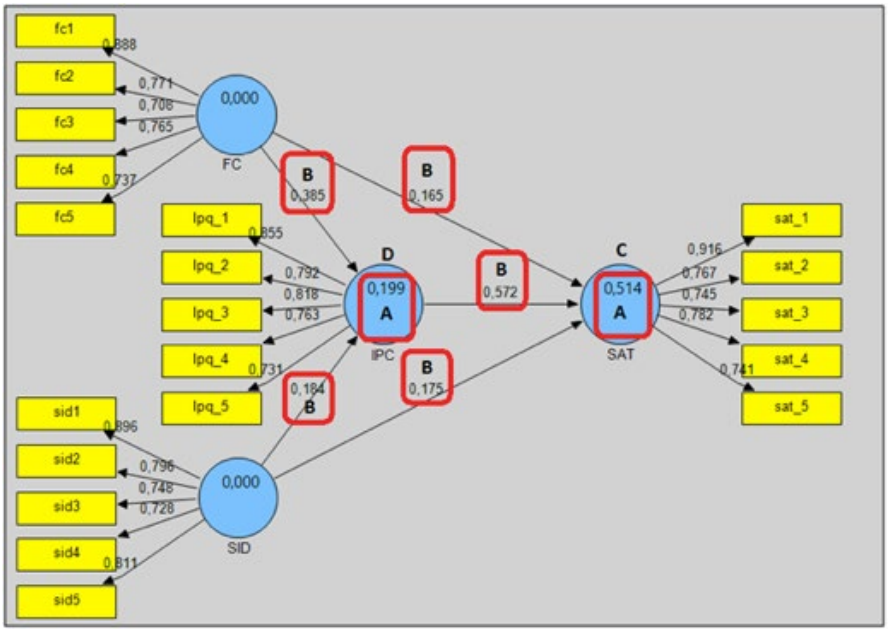
	SE	IPQ	SAT	ISS
SE	**0.776209**			
IPQ	0.4028	**0.792906**		
SAT	0.4180	0.6788	**0.792906**	
ISS	0.1193	0.2300	0.3260	**0.79781**

Source: developed by the authors using data obtained using SmartPLS® v. 2.0.

The AVE of the latent variable SE found corresponded to 0.6025. Thus, the square root obtained equals 0.776, approximately. As the square AVE's of all latent constructs are superior to the correlation coefficients, it can be concluded that discriminant validity exists.

After concluding the assessment of the measuring model, the next step is to assess the structural model. In this aspect, it is important to report and discuss the determination coefficients (R^2), predictive relevance (Q^2), size and significance of the path coefficients, effect sizes (f^2) and (q^2) (Hair Jr. *et al.*, 2014). In Figure 8, the values inside the circles (mark A) evidence the extent to which the latent variable is explained by the other latent variables in the structural model, while the values on the arrows, called path coefficients (mark B) explain the strength of one construct's effect on the others.

When assessing the degree of explanation of the variance in the endogenous target variable, in this case SAT, the (R^2) corresponded to 0.514 (mark A), which permits concluding that the three latent variables tested (ISS, IPQ and SE) moderately explain 51.4% of the variance in SAT. In combination, the variables SE and ISS explain about 20% of the IPQ variance (mark D). Concerning the sizes and significance of the path coefficients of the inner model, the model suggests that SE presents a stronger inner effect on SAT (0.572), followed by ISS (0.175) and IPQ (0.165). The theoretical relation (path) forecasted between all constructs is statistically significant (standardized path coefficients superior to 0.1).



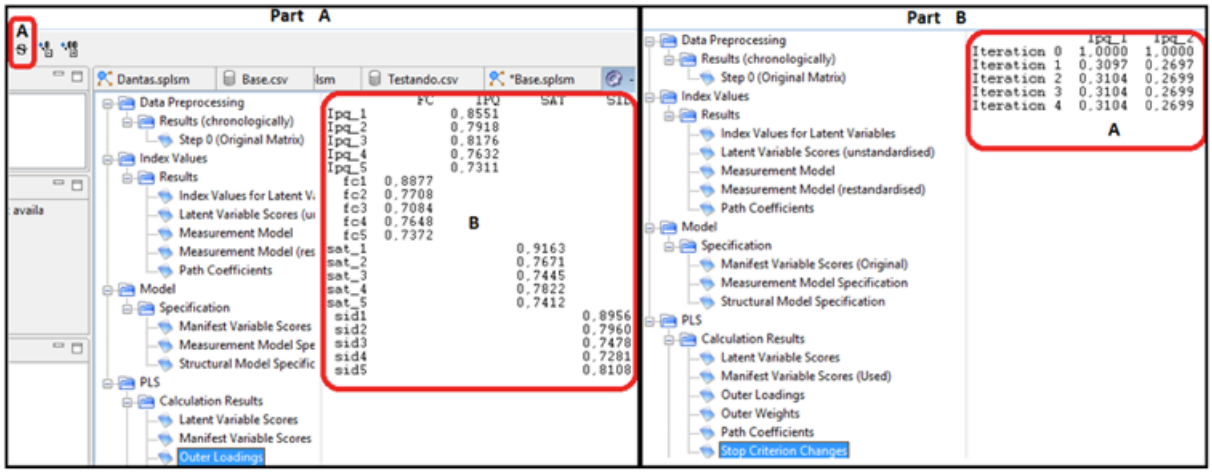
Source: output of SmartPLS® v. 2.0.

Figure 8. Assessment of internal models

Besides reporting the path estimates in the modeling window, SmartPLS® also presents a report based on accessible text through the "Report" menu, and then "Default report". To access the correlations between the latent variable and its respective indicators, as a reflexive model is adopted in this example, the values reported in the "Outer Loadings" (PLS =>Calculation Results =>Outer Loadings) window are analyzed.

For the sake of easier access, press the icon "Toggle Zero Values" (mark A, part A in Figure 9) to remove the extra zeros in the table, thus making it easier to see the path coefficients. If the measuring model were formative, the option "Outer Weights" should be selected. In mark B, part A, Figure 9, the path coefficients estimated in the outer model are reported (the same values reported in Figure 8) for each construct, as presented earlier. According to Hair Jr. *et al.* (2014), the standardized outer loadings should be superior to 0.70. hence, it can be concluded that the loadings and significance of the outer model are superior to the floor reported in the literature.

According to Wong (2013), SmartPLS® concludes the estimation when (whichever happens first): (i) the criterion to interrupt the algorithm is reached; or – (ii) the maximum number of iterations is reached. As the intention is to obtain a stable estimate, the algorithm should conclude the estimation before reaching the maximum number of iterations. To verify whether that is the case, access "Stop Criterion Changes" to determine how many iterations were necessary. The ideal scenario is the conclusion of the estimation before reaching the maximum number of iterations (in this example, the algorithm converged only after four iterations to the detriment of 300, concluding that the estimate is very good, as presented in mark A, in part B of Figure 9).

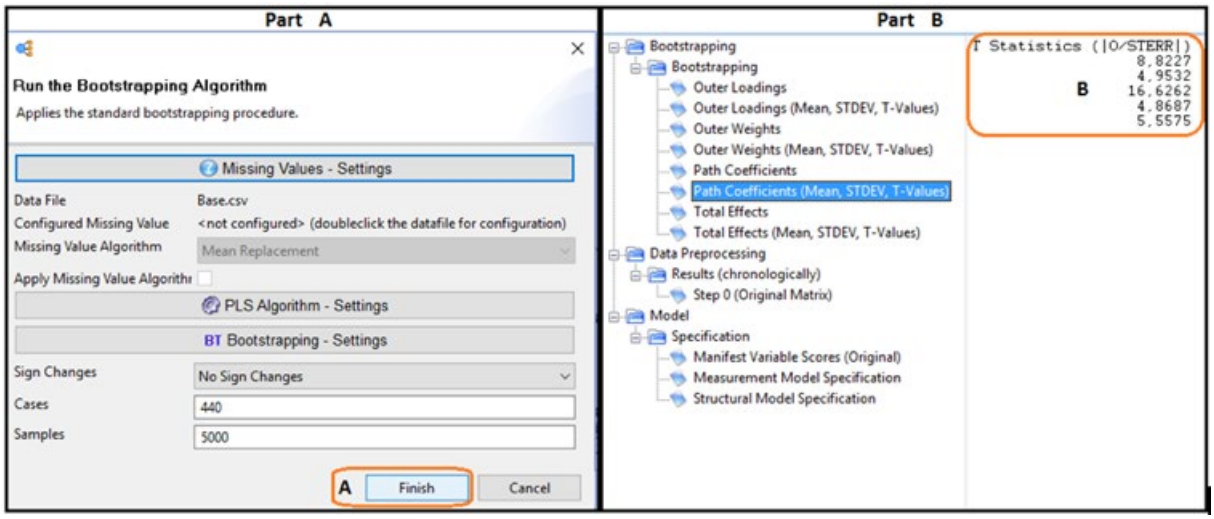


Source: outputs of SmartPLS® v. 2.0.

Figure 9. Path coefficients of outer model and maximum number of iterations of the algorithm

SmartPLS provides "t" statistics to test the significance of the inner and outer models, using a procedure called bootstrapping. In this process, a large number of subsamples (e.g. 5,000) are produced based on the original sample, with replacement, to obtain the standard bootstrap errors, which in turn permit the approximate estimation of "t" values for significance tests of the structural paths (Wong, 2013). For this procedure, access the option "Calculate" and then "Bootstrapping". In SmartPLS, the sample size is known as cases, and the number of subsamples as samples. Thus, as there are 440 valid observations in the database, the number of cases in the Bootstrapping procedure should be increased to 440. After this adjustment, press Finish (mark A, Figure 10, part A).

After concluding the estimation process in the path modeling, the "t" statistics are reported. Thus, coefficients at least higher to 1.96 are expected (5% significance). As many indicators and latent constructs are invariably used in the studies, the display of "t" statistics directly in the modeling window can be impaired. Therefore, SmartPLS publishes a report under Default Report =>Path Coefficients (Mean, STDEV, T-Values). Scroll horizontally until the end, as shown in mark B of Figure 10, part B.



Source: outputs of SmartPLS® v. 2.0.

Figure 10. How to run the bootstrapping and how to obtain the "t" statistics of the constructs

As observed, the values in the column "T-statistics" are superior to 2.57 (significance level = 0.01). The same analysis should be applied to the outer model. Therefore, the values in the window "Outer Loadings (Means, STDEV, T-Values)" should be verified. As all "t" statistics are superior to 2.57, it can be concluded that the loadings of the external model are also highly significant. The next step in the assessment of the structural model is to examine the forecasting skills of the model and the relations between the constructs (Hair Jr. *et al.*, 2014).

Before describing these analyses however, as the estimate of the path coefficients in structural models is based on Ordinary Least Squares (OLS) regressions, as well as on a regular multiple regression, the path coefficients can be biased. Hence, it is important to examine whether collinearity problems exist in the structural model. To develop this assessment in the inner model, the scores of the latent variables (PLS => Calculation Results => Latent Variable Scores) should be used one by one as inputs of a multiple regression (e.g. the score of the SE variable is inserted as dependent and the IPQ, SAT and ISS scores as independent, and so forth). As SmartPLS does not offer this procedure, another statistical package needs to be used. In this example, no multicollinearity problems were observed (minimum 1.057 and maximum 1.966 for VIF).

As presented earlier, concerning the investigation of the structural model, it is important to understand that the PLS-SEM adjusts the model to the empirical data, in the attempt to obtain the best estimates of the parameters by maximizing the explained variance of the latent endogenous variable, thus, to the detriment of applying goodness-of-fit measures, the structural model in PLS-SEM is assessed based on heuristic criteria that are determined by the predictive power of the model (Hair Jr. *et al.*, 2014). In this aspect, it is assumed that the model is specified correctly, as it predicts the endogenous constructs (Rigdon, 2012). Hence, besides assessing the significance of the path coefficients and the level of the R^2 coefficients, it is also important to report and discuss the size of the (f^2) and (q^2) effects and the predictive relevance (Q^2).

Besides assessing the R^2 coefficients of all endogenous constructs, the change in R^2 when an exogenous construct is omitted from the model can be used to assess if the omitted construct substantially affects the endogenous construct of interest (Hair Jr. *et al.*, 2014). That measure is known as the size of the effect (f^2). Chin, Marcolin and Newsted (1996) affirm that the researchers should not only indicate if the relation between the variables is significant, but also report the effect size between these variables, given that it helps the researchers to assess the global contribution of the research. Calculated manually, the f^2 of an endogenous latent variable is obtained by confronting the R^2 included with the R^2 excluded. The R^2 included is the value available in the global model estimate and the R^2 excluded is obtained based on the re-estimation of the model after the exclusion of a specific predecessor (a latent construct) of the proposed model. f^2 is calculated as follows (Hair Jr. *et al.,* 2014):

$$f^2 = \frac{R^2\text{included} - R^2\text{excluded}}{1 - R^2\text{included}}$$

In the path model (Figure 8), SAT presents an R^2 of 0.514, but the $R^2_{\text{excludedSE}}$ corresponds to 0.492, the $R^2_{\text{excludedIPQ}}$ to 0.251 and the $R^2_{\text{excludedISS}}$ to 0.485. Hence, the f^2 calculated equals 0.045, 0.541 and 0.060, for SE, IPQ and ISS, respectively. Hence, considering that f^2 coefficients of 0.02, 0.15 and 0.35 indicate small, small and large effects, respectively (Hair Jr. *et al.,* 2014), it is concluded that the effect of the SE construct is medium, of the IPQ large and of the ISS small.

Besides assessing the magnitude of the R^2 coefficients as a predictive precision criterion, the researchers should also examine Stone-Geisser's Q^2 (validated redundancy measures). More specifically, the procedure predicts the point indicators in the endogenous reflexive measuring models and constructs of a single item (the procedure does not apply to endogenous formative constructs).

The Q^2 coefficients can be calculated by means of the Blindfolding procedure in Calculate=>Blindfolding. In the Blindfolding configuration window, an Omission Distance – OD between 5 and 10 is suggested for most studies (Hair Jr. *et al.*, 2012). However, as the division of the number of observations used in the model by the distance chosen may not result in a whole number (Wong, 2013) and as there are 440 observations in the database used, an OD of 8 can be chosen (resulting in a product of 55). Only the endogenous constructs of the model are selected to execute the blindfolding algorithm. Therefore, only IPQ and SAT are selected.

The first part of the default report (Default Report=>Blindfolding=>Results=>Construct Crossvalidated Redundancy) presents the summary of the total results of the blindfolding procedure (first three lines), followed by the results of each of the eight blindfolding rounds. Chin (1998) suggests that a good model demonstrates relevance when Q^2 is higher than zero. Hence, as all Q^2 coefficients are considerable higher than zero (values reported in column 1-SSE/SSO), it is concluded that predictive relevance of the model exists in relation to the endogenous latent variables.

The Q^2 coefficients estimated by the blindfolding procedure represent a measure of how well the path model can predict the initially observed values. Similar to the approach of the f^2 effect to assess R^2 coefficients, the relative impact of the predictive relevance (q^2) can be obtained by means of a procedure analogue to the calculation of f^2 (Hair Jr. *et al.,* 2014):

$$q^2 = \frac{Q^2\text{included} - Q^2\text{excluded}}{1 - Q^2\text{included}}$$

In Table 5, the Q^2 coefficients included and excluded for each construct and the respective size of the predictive relevance are reported.

Table 5
Assessment of size of predictive relevance

	Q^2 included	Q^2 excluded	q^2 Effect Size	Size
SE	0,3186	0,2931	0,037422953	Small
IPC	0,3186	0,1576	0,236278251	Medium
ISS	0,3186	0,3008	0,026122689	Small

Source: developed by the authors based on data obtained from SmartPLS® v. 2.0.

Thus, based on the reported Q^2 coefficients of each construct, it is concluded that SE, IPC and ISS present small, medium and small effects, respectively (Hair Jr. *et al.*, 2014).

5. Final Considerations

The SEM is described as the second generation of multivariate analysis, offering substantial advantages over the first-generation techniques, such as the principal components analysis, factor analysis, discriminant analysis or multiple regression, due to the researcher's greater flexibility to assess the interaction between theory and data (Chin, 1998). SEM is a fusion of two powerful approaches – factorial analysis and path analysis – which allow the researchers to simultaneously assess the measuring model (traditionally using factor analysis) and the structural model (traditionally using path analysis) (Lee, Peter, Fayard, & Robinson, 2011).

Despite the relevance and mainly the potentials of the SEM technique, the variant based on PLS-SEM has been hardly used in Accounting literature, mainly due to the lack of knowledge on the benefits its use offers. In this sense, departing from the insights by Lee *et al.* (2011) and Nitzl, (2014), this study presented an overview of the PLS-SEM technique, a review of the recent accounting literature that used PLS as a data analysis technique and, finally, exemplified the use of PLS-SEM to conduct exploratory studies by means of SmartPLS®.

Although some important topics could not be elaborated in further depth, the study achieved its objective and, in that sense, represents an important tool for further research, mainly at the graduate level. Despite the potentials of using PLS-SEM for Accounting research, the amount of didactic material available on PLS-SEM, and mainly specific material on SmartPLS is still very incipient (Wong, 2013). This study is relevant by minimizing this gap and encouraging the development of exploratory studies using SmartPLS®, being particularly useful for graduate students.

Therefore, this study is expected to contribute to the researchers' understanding on PLS-SEM and, as such, the technique can be incorporated into the routine of Accounting research. Future studies can be developed to exemplify the use of formative models, second-rank constructs, multilevel analyses, longitudinal frameworks and mainly data without normal distribution, such as dichotomous data. Future studies can also discuss the benefits of using PLS-SEM to replace or complement the first-generation multivariate techniques employed in accounting research.

This study is limited by the fact that it merely exemplifies the application of a reflexive measuring scale, and mainly because it does not address SEM modeling based on covariance.

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Influences of academic socialization on the development of scientific publications in accounting in Brazil: an analysis of *Stricto Sensu* Graduate Programs

Abstract

This research was intended to answer the following research question: **What is the influence of the academic socialization promoted by *stricto sensu* graduate programs in accounting in Brazil on the development of scientific production in the area?** Therefore, interviews were held with nine accounting professors, including eight Ph.D.'s and one post-Ph.D. in Accounting from different Brazilian regions, affiliated with different graduate programs, between 2014 and 2015. To treat the data, the interviews were submitted to content analysis. In view of this problem, the interviewees argued that most graduate programs use the publication of a manuscript or article as an assessment criterion in the subjects, with the participation of a faculty member, at least as a co-author, considering that this is one of the evaluation criteria for the graduate programs to remain accredited and recommended by the Coordination for the Improvement of Higher Education Personnel (Capes). It was also evidenced that the student is prepared to comply with formal requirements in the publications, leaving the political quality to the background, in which scientific arguments are used to criticize, debate and oppose themes already consecrated as almost unquestionable truths in accounting.

Key Words: Accounting – Teaching and Research. Scientific Production. Academic Socialization.

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1. Introduction

Many Brazilian and international studies and publications in different areas have investigated the epistemological profile and quality of scientific publications in their activity fields (Samuelson, 1994; Camí, 1997; Chow & Harrison, 1998; Theóphilo, 2000; Chow & Harrison, 2002; Lowe, 2003; Broome, 2004; Theóphilo, 2004; Harzing, 2005; McKneally, 2006; Martins, 2007; Castiel & Sanz-Valero, 2007; Baggs, 2008; Moizer, 2009; Andrade, 2011; Alcadipani, 2011; Zago, 2011; Thomaz & Muramoto, 2012; Yamamoto, Tourinho, Bastos & Menandro, 2012; Wreszinski, 2012, Righetti, 2013; Reinach, 2013; Schekman, 2013; Wood Jr., 2014; Domingues, 2014; Bianchi, 2014; Costa, 2016; Wood Jr., 2016, among others). Most of these studies are focused on the increased number of manuscripts and articles, but also discuss the qualitative problems found in many of these studies; others discuss ethical conducts in research processes, such as micro and self-plagiarism and protocol and outcome management (distortions caused in the study to reach a desired response).

In that context, Castiel and Sanz-Valero (2007) and Wreszinsky (2012) guarantee that, in the contemporary context, the scientific production process can entail some problems for the knowledge areas, such as: [1] *citationism* or the strategy of praiseful citations, which corrupts the idea of the impact factor; [2] lack of deviations from established theories, that is, the studies almost always discuss the same theme, without great modifications that can lead to the evolution of the field; [3] *salami science*, in which a study is separated in several smaller studies for publication in countless scientific communication media; [4] increased number of authors per articles (authorial barter) for everyone to score; and [5] ethical problems such as plagiarism, self-plagiarism and protocol management.

Nevertheless, it should be highlighted that this scientific production process is strongly influenced by an academic socialization the researchers in the area go through when they take Master's and Ph.D. programs. Besides the objective structures present in the field, which set the rules of the scientific game, there is the agents' *habitus*, which can be molded by the socializations the researchers in the area go through in the course of their academic trajectories. Nevertheless, the game of the *habitus* only starts with the cards distributed by the field, and the agents' actions result from the interactions between the *habitus* and the field (Souza, 2007). In that sense, it should be considered that the *stricto sensu* graduate programs play a seminal role in the structuring of the scientific field, as they should provide the researchers with support for the production and dissemination of knowledge that contributes to the growth of the field as a whole. Each agent will internalize that content according to his/her ontological view of reality though, entailing the possibility of different academic behaviors.

In a reflection on the *stricto sensu* graduate programs in general, Bertero, Caldas and Wood Jr. (1999, p. 153) consider that the Brazilian official discourse presents that, within a short space of time, the graduate programs went through considerable growth for an emerging country. Nevertheless, the authors raise the problem of quality, that is, "[...] if the programs consolidate very quickly, there is still the fact that they remain second-class programs in terms of the quality of scientific production and the training level of the graduates". Although their study goes back almost 15 years, it is clearly timeless in view of the presentations joined thus far and the inquiries the scientific production as a whole is confronted with.

Therefore, it is important to study the academic socialization offered by the *stricto sensu* graduate programs in accounting in Brazil because, in recent years, these programs increased considerably and, consequently, the number of journals, congresses and scientific publications in accounting also grew in that period. Thus, this perspective on the graduate programs is important, as the objective of their existence is to support the entire academic socialization process, transforming the agents that enter the research area and faculty working to maintain and improve the scientific accounting field.

In view of the above, this research is focused on answering the following research question: **What is the influence of the academic socialization promoted by *stricto sensu* graduate programs in accounting in Brazil on the development of the scientific production in the area?** Thus, the objective underlying this study is to analyze how the academic socialization influences the production process of scientific knowledge in Accounting in Brazil. Therefore, the article is divided in four additional sections, as follows: [1] theoretical framework to support the research findings; [2] methodological procedures used; [3] presentation and analysis of results and; [4] final considerations and implications of the study.

2. Academic Socialization: The Social Construction of the Scientific Reality

One of the themes and concerns much debated in the scientific-technological world is the training of scientists, who go through all educational levels, from basic training to the highest levels of academic degrees. Therefore, the training of scientists necessarily involves worldviews and conceptions of science which, in turn, should not overlook the historical context in which they operate, as well as political elements. In this context, Trigueiro (2001) argues that the solution to enhance the training of scientists is not simple and requires a considerable effort of graduate programs to:

> [...] Create mechanisms that favor, in the curriculum and academic practices, an ethos much friendlier to exchange, to experience exchange, even involving public beyond research institutions or universities, stimulating 'listening' to society, through seminars and thematic discussions [...]. Another aspect that seems crucial in the formation of the scientists is to stimulate creativity. This, an important value in the academic world, has not always received due attention, either by the graduate programs or by senior management of universities or research institutes [...]. The academy, with all its rituals, traditions and succession practices, tends to prevent or restrict the creativity and dull critical thinking, even if that is precisely the reason for its constitution (p. 66-68).

Trigueiro (2001, p. 65-66) concludes his presentation by pointing out that "the main need for the formation of contemporary scientists is the considerable expansion of communicability, in its different forms, levels and processes to the daily life of these professionals." Accordingly, in order to achieve these attributes, scientists need to undergo a secondary socialization, called academic socialization.

2.1 Socialization Processes

The real understanding of everyday life is a complex process. Although language permits the transmission of knowledge and communication among agents, it should be considered that everything that is transmitted or played goes through the receiver. This reveals the effects of subjectivity inherent in the interpretive process of any human being, as the world around you can be differently perceived by others who are around you. This social process of apprehension of the subjective reality is closely connected with the sociology of knowledge, because "[...] the sociology of knowledge concerns the analysis of the social construction of reality" (Berger & Luckmann, 2008, p. 14).

Regarding the internalization of reality, Berger and Luckmann (2008) highlight the importance of individual perception of the process of integration into society. Although all human beings integrate that objectively accessible society, characterized by the repetition of habits, among other routines, these individuals were not born directly as members of this social world, but rather became part of it. Thus, the assumption process of the existing world as the world one is part of is configured as an interpretive process of that which the individual is confronted with. This process of internalization of the perceived reality is transmitted through a socialization.

In this context, socialization is defined as an "[...] ontogenetic process through which internalization takes place, which is the broad and consistent introduction of an individual in the objective world of a company or sector [...]" (Berger & Luckmann, 2008, p. 175). The socialization process distinguishes two moments - a so-called primary socialization and another secondary socialization. The construction of the first world for each individual takes place in the primary socialization - it is a process influenced by emotional issues. Characterized, among other things, by formalism and anonymity, the secondary socialization refers to a process of internalization of more objective issues or based on institutions of the social world. Thus, in both the primary and secondary socialization, social issues are internalized, but the primary socialization demands identification, whose condition is dispensable for the secondary socialization.

As the identity is not a condition for the secondary socialization, its precepts are not deeply rooted in the consciousness of individuals, making this socialization more vulnerable to changes. On the other hand, the transformation of aspects constructed during the primary socialization process is more complex, but does not extinguish the possibility of their modification. It is highlighted that such changes require processes called resocialization (a procedure similar to primary socialization, but demanding a whole social framework to promote this transformation). Thus, the past appears as a driver of secondary socialization, whereas this is the baseline reality of the resocialization. In the same sense, Duarte Jr. (2008, p. 81) states that "[...] as the knowledge assimilated in the secondary socialization is less affectively marked, it can more easily be placed in brackets, that is, forgotten or left aside".

Therefore, the secondary socialization "[...] is any subsequent process that introduces an individual already socialized into new sectors of the objective world of his society", i.e., it is the internalization of institutional underworlds or based on institutions (Berger & Luckmann, 2008, p. 175). In this context, one can conclude that the academic socialization is a kind of secondary socialization, which inserts the agent in the scientific world, providing him/her with the status of scientist through teachings and guidance on the rules of the scientific game, defined by the institutions and agents in the field.

2.2 Graduate Programs in Brazil

By June 2016, 28 *stricto sensu* graduate programs in accounting are functioning in Brazil, some offering academic Master's and Ph.D. programs, while others only offer a professional or academic Master's program. Most of these programs are Young and increased the volume of scientific publications in accounting, due to the theses and dissertations developed and defended in these programs. Nevertheless, the quality does not follow the volume of these scientific communications, which tend to prioritize the aspects of quantitative productivity. In Figure 1, the *stricto sensu* graduate programs in accounting in Brazil recognized by the Coordination for the Improvement of Higher Education Personnel (capes) are listed (until June 2016).

Program	Higher Education Institution	PM	AM	D
Administration and Controllership	Universidade Federal do Ceará		X	
Accounting	Universidade de Brasília		X	X
Accounting	Universidade Federal do Espírito Santo		X	
Accounting	Fundação Instituto Capixaba de Pesquisas em Contabilidade, Economia e Finanças	X	X	X
Accounting	Universidade Federal de Goiás		X	
Accounting	Universidade Federal de Minas Gerais		X	
Accounting	Universidade Federal de Uberlândia		X	X
Accounting	Universidade Federal da Paraíba		X	X
Accounting	Universidade Federal de Pernambuco		X	X
Accounting	Universidade Estadual de Maringá		X	
Accounting	Universidade Federal do Rio de Janeiro		X	X
Accounting	Universidade do Vale do Rio dos Sinos		X	X
Accounting	Universidade Federal do Rio Grande do Norte		X	
Accounting	Universidade Regional de Blumenau		X	X
Accounting	Universidade Presbiteriana Mackenzie	X		
Accounting	Centro Universitário Fecap		X	
Accounting and Administration	Universidade Comunitária da Região Chapecó		X	
Accounting and Actuarial Sciences	Pontifícia Universidade Católica de São Paulo		X	
Accounting	Universidade Federal da Bahia		X	
Accounting	Universidade Federal do Paraná		X	X
Accounting	Universidade Estadual do Oeste do Paraná		X	
Accounting	Universidade Federal de Santa Catarina		X	X
Accounting UNB – UFPB - UFRN	Universidade de Brasília		X	X
Controllership	Universidade Federal Rural de Pernambuco		X	
Controllership and Accounting	Universidade Federal do Rio Grande do Sul		X	
Controllership and Accounting	Universidade de São Paulo		X	X
Controllership and Accounting	Universidade de São Paulo - Ribeirão Preto		X	X

Source: Capes (2016).

Figure 1. *Stricto sensu* graduate programs in Accounting in Brazil

In all missions of academic Master's and Ph.D. programs, the concern with the scientific training and teaching of graduates appears through a secondary socialization, to convey to the student the status quo of scientific and accounting thinking and the rules of the scientific game imposed by institutions that structure the field. This concern is in line with the Law of University Reform 5.540 / 1968, which set the goals of graduate programs: [1] train teachers for higher education; [2] prepare highly qualified personnel for public and private companies; and [3] encourage studies and scientific research through training of researchers, to serve the development of the country.

In this context, it can be observed that Accounting as a scientific object is still incipient, since most stricto sensu graduate programs in accounting emerged less than ten years ago. The implementation of the first stricto sensus graduate program in Accounting in Brazil happened in 1970, at the School of Business Administration, Economics and Accounting of the University of São Paulo (FEA / USP). Also in the 1970s, the Master's Program in Accounting was created at the Getúlio Vargas Foundation, which, due to restructuring, moved to the State University of Rio de Janeiro in 1991. In 1978, the Doctoral Program was implemented at FEA / USP, which until a few years ago was the only one in Brazil (Peleias, Silva, Segreti & Chirotto, 2007).

In addition, the authors mention that, throughout the 1980s, no new graduate programs emerged, which again occurred as fromfrom the 1990s, due to the following: [1] requirements of Law 9394/1996 that at least one third of professional higher education teachers in universities and colleges hold at least a Master's degree and that there are teachers dedicated to teaching and research full-time; [2] increase of higher education courses in accounting in Brazil; and [3] increase in the number of teachers in Accounting in Brazil holding a Ph.D.. With this growth of graduate programs, there was a numerical increase in research and new conferences, meetings and journals in accounting emerged. In this analysis perspective, the Coordinatino for the Improvement of Higher Education Personnel [Capes] also emerges to guide and set guidelines for graduate programs, establishing standards to measure the quality of these programs.

2.3 Capes: The Rules of the Brazilian Scientific Game

Capes has performed triennial evaluations of graduate programs, since its implementation in 1976. In this sense, it plays an important role in the Brazilian scientific and technological development context, whose main functions are to: [1] drive the evolution of graduate programs, putting forward goals and challenges that signal the advancement of science and technology today and the increase of national competence in this field; [2] improve graduate programs, guaranteeing a judicious opinion on the strengths and weaknesses of their design and performance and a reference for the program's stage of development; [3] provide the country with an efficient database on the situation and evolution of graduate education; [4] establish the quality standard required for this level of education and identify programs that meet this standard; [5] support, under the legislation in force, the opinions of the National Education Council on the authorization, recognition and renewal of recognition of Brazilian Master's and Ph.D. programs; [6] contribute to increase the efficiency of programs in meeting national and regional needs of high-level human resource training; and [7] offer support for the definition of the development policy of graduate education and the reasons for decisions on development actions by government agencies on research and graduate education (Cunha, 2007; Capes, 2015).

In Brazil, graduate programs are evaluated according to Capes Decree 68/2004. A common point between the assessment of graduate programs and teachers who can be part of these programs is their scientific output. In this context, Capes conducts triennial reviews of the journals in the areas of knowledge by means of Qualis, which can be considered as a set of tools used to measure the quality of the graduate programs' intellectual production. This Qualis system assigns a stratum to each journal, according to the quality, measured by the sum of points obtained by each article published, starting at A1 (highest stratum), A2, B1, B2, B3, B4, B5 and C, with zero weight (CAPES, 2016). According to Martins and Lucena (2014), this evaluation system provided both an advance to Brazilian graduate education and consequences for superficial and hardly relevant research, due to the pressure for publications to obtain the score required for a good evaluation.

Thus, joining both ends: academic socialization and evaluation of Master's and Ph.D. programs, an even greater problem appears, because the graduate programs are under pressure to maintain a minimum grade and continue working. Therefore, they end up transferring this productive view to their students by making them produce in mass, often without due time of maturation on the research theme. That is the reason for the presence of superficial texts, replicated research and ethical problems of plagiarism and self-plagiarism in scientific texts. That brings us to the research problem of surveying this scientific development scenario, in relation to the evidence obtained in the analyses carried out on academic socialization, in order to better understand the conditions of scientific accounting research today.

3. Methodological Procedures

The methodological procedures are fundamental for scientific research as, according to Demo (1995), research is the founding reason of academic life and needs methods to be operated. In that sense, the goal in this part is to describe the main research construct, the research sample used, the data and evidence collection technique and the treatment of the information collected in the study.

3.1 Construct and Operational Definition of the Research

The main construct of the research is academic socialization which, for this research, represents the process the agents involved in the scientific field go through. That is a kind of secondary socialization, fundamentally intended to encourage the knowledge production through the teaching and research techniques and to prepare teachers who comply with the qualification requirements of higher education courses (Bourdieu, 2004; Berger & Luckmann, 2008), in this case for the accounting area.

In this study, academic socialization is used as a fundamental premise to understand the scientific field of accounting, because it is supposed to be the primary element that influences and legitimizes the knowledge construction process and, in that sense, it directly influences the way the agents tend to act in the field. Therefore, the "academic socialization" construct is operated through interviews, with a view to surveying the agents' perception on how the graduate programs in Accounting transmit the rules of the scientific games and the characteristics of the social structures present in the field to their students.

3.2 Population and Sample

The research population consists of accounting researchers who went through an academic socialization at the Master's and Ph.D. or post-doctoral level in Accounting, in order to understand the academic socialization construct. Nevertheless, studying the entire population is unfeasible. Therefore and because the research privileges in-depth instead of comprehensive data, nine accounting researchers were interviewed in depth, including eight Ph.D.'s and one person holding a post-doctoral degree in Accounting, from different regions of Brazil and affiliated with different Higher Education Institutions (HEI). Intentional sampling was used, as the criterion to choose the agents was their availability to answer the interview. In Figure 2, the respondents' profile is detailed, maintaining their anonymity.

Respondent	Detailed Description of academic activities
Interviewee 1	**Education:** Ph.D. in Controllership and Accounting. **Year of graduation:** 2007. **Activity region:** Southeast. **Activities:** [1] participates or participated as a member of the American Accounting Association; [2] participates or participated as a leading member of the National Association of Graduate Programs in Accounting (ANPCONT); [3] participates or participated as a member of the Scientific Committee of the National Association of Graduate Education and Research in Business Administration (Anpad); [4] member of editorial boards and reviewer of Brazilian and international journals; [5] extensive bibliographic production in Accounting and Finance (more than 50 articles published in Brazilian and international congresses and journals). **Research areas:** Accounting and Finance; Capital Market; Corporate Governance: Financial Market and Disclosure. **Educational experience:** [1] Accounting professor at undergraduate, Master's and Ph.D. level; [2] advisor of countless monographs, six Master's theses and eight doctoral dissertations, besides scientific initiation projects.
Interviewee 2	**Education:** Ph.D. in Controllership and Accounting. **Year of graduation:** 2009. **Activity region:** Southeast. **Activities:** [1] editorial board member and reviewer for Brazilian journals; [2] extensive bibliographic production in Accounting and Finance (more than 60 articles published in congresses and Brazilian and international journals). **Research areas:** Accounting and Finance; Capital Market; Private Law. **Educational experience:** [1] Accounting professor at undergraduate, Master's and Ph.D. level; [2] advisor of countless monographs, two Master's theses and four doctoral dissertations.
Interviewee 3	**Education:** Post-Doctoral degree in Controllership and Accounting. **Year of graduation:** 2013. **Activity region:** South. **Activities:** [1] current or past institutional evaluator for Brazilian Institute of Educational Studies and Research Anísio Teixeira (Inep); [2] participates or participated as a member of the Coordination Committee of the National Student Performance Examination (Enade) in Accounting; [3] member of editorial boards and reviewer for Brazilian journals; [4] participates or participated as a member of the Scientific Committee of Anpad and the USP Controllership and Accounting Congress; [5] extensive bibliographic production in Accounting (more than 150 articles publishes in congresses and Brazilian and international journals); [6] current or past activity as *ad hoc* consultant in analysis and judgment processes of merit and technical-scientific validity of research projects for the Brazilian Scientific and Technological Development Council (CNPq). **Research areas:** Accounting and Finance; Accounting and Finance Teaching. **Educational experience:** [1] Accounting professor at undergraduate, Master's and Ph.D. level; [2] CNPq Research Productivity grantee – Level 2; [3] advisor of countless monographs, 16 Master's theses and two doctoral dissertations.
Interviewee 4	**Education:** Ph.D. in Controllership and Accounting. **Year of graduation:** 1996. **Activity region:** Southeast. **Activities:** [1] participates or participated as a leading member of ANPCONT; [2] member of editorial boards and reviewer for Brazilian and international journals; [3] current or past activity as a member of Capes evaluation committees in Business Administration, Accounting and Tourism; [4] member of CNPq Advisory Committee in Business Administration and Accounting [5] current or past editor-in-chief of Revista Contabilidade & Finanças at University of São Paulo; [6] guest co-editor of Esmerald for the development of special issues in international journals [7] participates or participated as a member of the European Accounting Association (EAA); [8] extensive bibliographic production in Accounting (more than 150 articles published in Brazilian and international congresses and journals). **Research areas:** Management Control, Management Accounting and Controllership. **Educational experience:** [1] Accounting professor at undergraduate, Master's and Ph.D. level; [2] CNPq Research Productivity grantee – Level 1A; [3] advisor of countless monographs, 22 Master's theses and 17 doctoral dissertations.

Respondent	Detailed Description of academic activities
Interviewee 5	**Education:** Ph.D. in Controllership and Accounting. **Year of graduation:** 2002. **Activity region:** South. **Activities:** [1] member of editorial boards and reviewer for Brazilian journals [2] current or past editor-in-chief for Brazilian scientific journals; [3] extensive bibliographic production in accounting (more than 150 articles published in Brazilian and international congresses and journals). **Research areas:** Management Control, Management Accounting and Controllership. **Educational experience:** [1] Accounting professor at undergraduate, Master's and Ph.D. level; [2] advisor of countless monographs, 20 Master's theses and four doctoral dissertations.
Interviewee 6	**Education:** Ph.D. in Controllership and Accounting. **Year of graduation:** 2007. **Activity region:** Southeast. **Activities:** [1] member of editorial boards and reviewer for Brazilian journals [2] current or past editor-in-chief for Brazilian scientific journals; [3] member of CNPq Advisory Committee in Administration and Accounting; [4] extensive bibliographic production in accounting (more than 120 articles published in Brazilian and international congresses and journals). **Research areas:** Accounting Teaching and Research; Sustainability and Environmental Accounting. **Educational experience:** [1] Accounting professor at undergraduate, Master's and Ph.D. level; [2] CNPq Research Productivity grantee – Level 2; [3] advisor of countless monographs and 12 Master's theses.
Interviewee 7	**Education:** Ph.D. in Controllership and Accounting. **Year of graduation:** 2009. **Activity region:** Southeast. **Activities:** [1] member of editorial boards and reviewer for Brazilian and international journals [2] current or past visiting professor at international universities; [3] current or past representative in internationalization project of graduate program in Controllership and Accounting at FEA/USP (STAR Commission); [4] extensive bibliographic production in accounting (more than 110 articles published in Brazilian and international congresses and journals). **Research areas:** Management Control, Management Accounting and Controllership. **Educational experience:** [1] Accounting professor at undergraduate, Master's and Ph.D. level; [2] advisor of countless monographs, two Master's theses and three Doctoral dissertations.
Interviewee 8	**Education:** Ph.D. in Controllership and Accounting. **Year of graduation:** 2008. **Activity region:** Central-West. **Activities:** [1] member of editorial boards and reviewer for Brazilian journals [2] current or past institutional evaluator for Inep; [3] current or past *ad hoc* consultant in the evaluation of research projects for the Araucária Scientific and Technological Support and Development Foundation; [4] extensive bibliographic production in accounting (more than 180 articles published in Brazilian and international congresses and journals). **Research areas:** Accounting Teaching and Research; Management Control: Controllership and Management Accounting. **Educational experience:** [1] Accounting professor at undergraduate, Master's and Ph.D. level; [2] CNPq Research Productivity grantee – Level 2; [3] advisor of countless monographs and 22 Master's theses.
Interviewee 9	**Education:** Ph.D. in Controllership and Accounting. **Year of graduation:** 1997. **Activity region:** Northeast. **Activities:** [1] member of editorial boards and reviewer for Brazilian and international journals [2] current or past coordinator of Capes evaluation committees in Business Administration, Accounting and Tourism; [3] current or past institutional evaluator for Inep; [4] participates or participated as a member of the Coordination Committee of Enade in Accounting; [5] extensive bibliographic production in accounting (more than 200 articles published in Brazilian and international congresses and journals). **Research areas:** Accounting Teaching and Research; Value Added Statement and Socio-environmental Accounting. **Educational experience:** [1] Accounting professor at undergraduate, Master's and Ph.D. level; [2] CNPq Research Productivity grantee – Level 2; [3] advisor of countless monographs, 36 Master's theses and one Doctoral dissertation.

Source: elaborated by the authors.

Figure 2. Educational Background and Institutional Affiliation of Respondents

The above reveals that the respondents were heterogeneous in terms of institutional affiliations, academic activities, research areas, educational experience and geographical origin. It is important to highlight that the sample contains few interviewees because an in-depth analysis was privileged, without any claim on generalizing the research results, which does not in any way detract from the validity of the research evidence.

3.3 Collection of Data, Information and Evidences

To collect the data on the academic socialization of agents belonging to the scientific-accounting field, the interview was used. According to Martins and Theóphilo (2009, p. 88), the purpose of the interview is "[...] to grasp and understand the meaning respondents attribute to issues and situations in contexts that were not previously structured, based on the researchers' assumptions. The interview was in-depth and semi-structured because it was conducted by a script, but with freedom to add new questions that may come up during the interviews. With the prior consent of the respondents, the whole process was recorded and later transcribed for the sake of the analyses needed.

The interviews were scheduled in advance and carried out from November 2014 to May 2015. Only nine respondents in the sample were interested in participating in the research, out of 36 individuals who were asked to respond to the interview questions. The time to answer the interviews was long due to the delay or lack of response to emails sent to the persons invited to participate in the study; or due to the sometimes lengthy period it took for the participants to schedule the interviews, who on many occasions had no free space in their agenda.

Another important factor is that all documentation followed strict criteria of ethics in research. Before the interview, respondents signed a consent form for the audio recording of the interview. These precautions were relevant for the investigation to provide transparent results and to ensure the anonymity of the agents, who in this study were assigned in numerical order, i.e. Interviewee 1 Interviewee 2, and so on.

Finally, before applying the interview to the respondents, a pretest was held with four doctoral students, interviewed at the School of Economics, Business Administration and Accounting of the University of São Paulo, who pointed out inconsistencies and difficulties to answer the questions. Two of these four agents assessed the face validity or apparent validity - which signals that the instrument measures what it purports to measure - but, as this process is subjective, simple and sometimes unsatisfactory (Martins & Theóphilo, 2009), the other two agents were also asked to validate the content each question intended to measure and answered the content validation form to guarantee the validation of the interview script.

3.4 Data Treatment and Analysis

To answer the research question proposed, the content analysis technique was applied to the interviews. This technique intends to reliably understand the content of oral and/or written discourse, consisting of data and information from a certain context, pronounced by agents from a given field or activity area (Martins & Theóphilo, 2009; Bardin, 2009). In this article, the content analysis was intended to understand and explain the attitudes, values and perceptions of the agents involved in the scientific field of Accounting, through the investigation of the interviews with the respondents.

4. Presentation and Analysis of the Results

The concern was to verify how the academic socialization influences the way the agents consider the production and scientific publication activities. Thus, it was presented to the nine respondents in the sample that researchers who have taken a Master's or Ph.D. program in Accounting experienced an academic socialization, and that many of these programs strongly encourage the publication of papers during the student's affiliation with the institution. Therefore, they were asked how this socialization influences the quality and development of scientific publications in accounting.

In view of this challenge, Interviewee 2 asserted that academic socialization can influence, both positively and negatively, the quality of scientific papers in accounting. In this sense, the respondent began stating that the new graduate programs need to consolidate the academic market and that, therefore, there is great pressure on teachers and, consequently, on the students linked to these programs, to publish many manuscripts and articles in conferences and journals positively evaluated in the Qualis Capes system, in order to add a sufficient score to maintain or raise the score in the three-year period that is being evaluated. In this scenario, Interviewee 2 raised the positive aspect of academic socialization, remembering the time of his Master's program, and affirmed:

> *So, what was positive in my opinion was: it [academic socialization] offered me and the people together with me a research training [...] in my case and in the case of most people who were there, who were coming from the undergraduate program without ever having to open a paper in life, without ever knowing what a research was, it was training from scratch. So in my case I had not written a monograph, I had never read a scientific article. In this case, we started from scratch and learned how to write a paper, a dissertation at the end of this process, shall we say, reasonable. So all these articles that we made amidst the disciplines, the positive aspect for the quality was, I think, the fact that we trained a lot.*

However, this process of academic socialization, along with the publication urge some graduate programs in Accounting promoted, also entails negative aspects in the respondent's point of view, because, according to him, "[...] the negative point is that much garbage is produced throughout this process, people end up making many articles and, of course, when you do too much, you do not do anything well, you don't have the maturity yet to produce something very decent [...] "(Interviewee 2) . Finalizing their perceptions about the negative aspects of the duality academic socialization x quality of scientific communication in accounting, Interviewee 2 warned that:

> *So, ultimately, it impairs the quality of work, in general, because it kind of generalizes research, generalizes the aspect of publication, because the researcher starts to publish that much that it kind of turns into a publishing industry and end up losing relevance. People end up getting lost in the process and the result is what we know, a lot of articles that serve no purpose, no one reads [...]. Perhaps a compromise would be to go through the training, perhaps with the same article or with one or two items that you were working on ina working paper and the same work was evolving, which would obviously be a dissertation or parts of the dissertation or something correlated, and then the work itself would evolve and, in the end, you would have one or two publications throughout this process, but of good quality.*

In these terms, it is healthy to note that the scientific writing habit is relevant to the growth of science, and that the respondent's criticism is related to the quality of what is being written. Contributing to this understanding, Respondent 7 argued that the Master's and doctoral courses need to exercise "doing research", but disagreed that this training needs to reach the point of publication, in the belief that the time is very short, so there is a need for maturing in order to be able to minimally prepare a high-quality research. Thus, Interviewee 6 said that "[...] nothing that is done without pleasure and a bit of maturity is produced with good quality and generates additional stress in the student."

In this same line of reasoning, Interviewee 5 considered that you cannot elaborate high-quality publications in the duration of a course (usually four to five months) because, for a manuscript or article to be robust and suitable for disclosure, time is needed to choose the research problem, formulate hypotheses, select the most appropriate method to answer the question posed and collect, process and interpret the data, information and evidence from the research as well as in the conclusions. Similarly, Respondent 4, based on his way of acting as a teacher, guaranteed that:

> *[...] Just so you understand, the students that I advise, in terms of dissertation and thesis, I make it clear to them that I would like to publish with them but, if they do not want to, that is their problem. And if they want to leave my name out, I am there to discuss everything because paper is one thing and thesis is another. Thesis is logical, has content, has an extension, and communication of an article is much more restricted, abridged, it is the filet and you even have a chance to learn things that you did not learn during the assembly of the thesis. That's the great thing about the process and should be preserved. And then I too argue against the programs in which the student, when he delivers the work, must also deliver an article, along with the Professor [...] I mean, the guy has to do article and furthermore has to deliver thesis and dissertation, that is very complicated, because the quality of the work will be bad and it will generate the urge to produce.*

Contributing to this understanding, Respondent 3 believes that you cannot even call this compulsory process, linking the academic production of students and teachers through the urge to produce academic socialization. For the respondent, there is only one game of interests, in which the student produces an article in a reasonably short time period. This is awarded a concept or a score for the student to complete the course credits. This whole procedure entails a low quality of these scientific papers, as there are time and even knowledge constraints so that you can write one paper with the quality and depth necessary for the scientific growth of the area. Thus, Respondent 3 asserted that:

> *This socialization occurs when we establish, for example, research networks or investigations in groups. In this context, there is socialization and then discipline helps. Now, if the teacher sets the preparation of an article according to the congress standards as an approval measure, for example, ANPCONT, which is our area, or the USP Congress, and lets the Congress correct the student's article to score the discpline, there is no socialization. Then there is a promotion of scientific production in a way that I even consider incoherent.*

In these terms, Interviewee 8 claimed that, if the research activity is systematic and structured, so that the student researcher is affiliated with research laboratories and projects, it will promote the quality because, in that case, there is an exchange of experiences among researchers, teachers and students that promotes the scientific advancement of the field. However, for the respondent, if the concern is co-authorship as a formality or to meet the rules of Capes for scoring graduate programs, then scientific papers are made only for barter and lose the relevance and quality of research as a whole.

In view of this whole context, Respondent 5 also argued that the excessive number of disciplines is a reality to be reconsidered in graduate programs in Accounting, as students are usually required to take seven or eight disciplines to meet the minimum program credits, with up to four mandatory disciplines. In addition, the respondent raised the importance of graduate programs publishing learning content to promote research training for students, on a mandatory basis, since most graduate programs care only about the technical part and neglect subjects like "Methodology of Scientific Research", "Thesis Seminars", "Epistemology of Science", among others.

Another relevant factor raised by Respondent 5 is the linking of Master's and doctoral courses with undergraduate education. For this respondent, the institutions that have graduate programs do not notice an improvement in the quality of undergraduate education, and it is not common for Master's or doctoral students to engage with B.Sc. students in scientific initiation to promote a research network at all accounting knowledge levels. In addition, the respondent further advocated that most teachers who teach both

undergraduate and Master's and doctoral programs tend to prioritize research with graduate students to obtain the required Capes score and neglect teaching and community service.

In short, the respondents' perception on the question of academic socialization in its pure form free from bias is that this process is very important for the education of an accounting scientist, since it trains the student to work as a researcher. But all agreed that, in the current accounting research scenario, the practice of academic socialization is not performed free from publication interests, and the biggest concern is not with formal, political and ethical training in the scientific environment, but with the number articles that the student can produce within the period of his affiliation with the graduate program, no matter how poor the quality of this work or the inability of such publications to cause surprise, being repeated replications of the same study.

It is important to point out that most graduate programs are concerned with training, partially and sometimes precariously, the students in the formal qualities, without taking care to enable them for the political and ethical qualities related to research. In this sense, Demo (1995) asserts the need to acknowledge that only formal quality with methodological and theoretical mastery is insufficient for an individual to become a social scientist. The agent also needs to be present as a citizen and political actor to investigate problems involving the company, under penalty of becoming a "specialized idiot" (p. 25). In addition, the author argues that, for most scholars:

> [...] The quality of the scientist is to be formally competent: the mastery of methodological tools; capacity to treat and collect the data; theoretical versatility, proven in the knowledge of the matter of the discussions in vogue, the classics; logical, mathematical reasoning; rigor and discipline towards the object that needs to be dissected, analyzed, broken down; formal overcoming of stages in the education, according to the usual rites of the academy; and so on (p. 23).

Demo (1995) argues that the quality policy does not replace nor goes beyond the formal quality, yet it is essential for the education of a social scientist; and it cannot ignore that accounting is an applied social science. Therefore, the author adds that the quality policy covers "[...] all human dimensions that are not reducible to material expressions, such as culture, education, the symbolic world, art, ideology, but has the more specific content participatory phenomenon [...] "(p. 25), ie, is the attribute that gives the scientist the ability to comment critically, sometimes even forcefully, against the political and ethical problems it finds in your searches, even that such thinking is contrary to mainstream this in the field.

Thus, the respondents' discourse revealed that scientific accounting research, still incipient, transmits to the graduate students the ideas of formal competence, leaving the political and ethical quality of the research to the background. Therefore, the academic socialization in accounting science is not complete and leaves some gaps in this process. This consideration can be confirmed by some features the respondents mentioned, including:

[1] most of the subjects taken in Master's and doctoral programs favor the format of lectures by teachers or seminars by students, which do not foster debate and discussions about the themes treated, thus hindering the critical evaluation and the active participation of students. For the respondents, the best class format is one in which scientific studies of the area are discussed and criticized, combined with actual problems of society, because only then are insights for future research generated that are unique, important and feasible;

[2] the production requirements of scientific papers for publication in disciplines is also a reality and this causes an environment that urges towards publication and is focused on formal qualities only as, in this case, the important thing is to present a logical and well systematized communication in terms of theoretical and methodological tools, no matter if research results have a social character and are able to cause surprise and change the status quo in the area. Some respondents mentioned knowing teachers, in graduate programs in the accounting area, which link the concept A or B of the subject to the publication of an article in a journal positively assessed in the program Qualis Capes;

[3] in scientific publications of accounting, generally, there is a clear separation between theory and practice, which should not happen. This fact can be confirmed by reading the articles that, with rare exceptions, have no theoretical basis, but only concepts used in practice and replicated from previous studies; or theoretical studies that have no connection with practice. In both cases, we perceive the existing gap between what is written and the interest of what is being written for the society as a whole. In this context, Demo (1995) argues that:

> [...] To many social scientists, practice appears as spurious, as less active, as uncomfortable; restricted to the 'theoretical practice', either as escape from commitments that entail risks or to avoid having to correct the theory under the impact of practice, or to conceal conservative practices under the guise of supposedly advanced theories, to raise the image of impartial, above suspicion, which makes room for 'objective' manipulation (p. 34);

[4] according to the respondents, some teachers affiliated with graduate programs in Accounting still kind of fear or face difficulty to get out of their comfort zone and act critically, through political competency, challenging the structures in the field that cause scientific stagnation, hiding behind the so-called scientific neutrality. In this case, this kind of impartial and conservative attitude is passed on to students, and so is the phenomenon of social reproduction, which is consolidated and constitutes a habits that is legitimate and difficult to be modified;

[5] in the accounting field, there is an ever-present intersubjectivity process, i.e. researchers who have greater symbolic capital in the field determine the direction of scientific research. In this context, Interviewee 8 asserted that "[...] Accounting has a focus, a great emphasis on the positivist approach so, if the group believes that this approach is the way to do research, it is difficult for those who are not, or who do not carry out a study in this approach be able to publish in the area [...] ", i.e. the academic socialization in accounting is also influenced by what the dominant researchers in the field refer to as the most "correct" way to obtain the "scientific truth".

Thus, it was observed that the issues highlighted in the habitus of the scientific-accounting agents also derive from the educational attributes of researchers in accounting the graduate courses in the area offer. However, it is important to emphasize that the academic socialization process is not the only variable that affects the quality of scientific publications in accounting.

5. Final Considerations and Implications of the Study

The aim of this research was to identify the influences of academic socialization promoted by the stricto sensu graduate programs in accounting on the development of scientific production in the field in Brazil. Thus, we verified that the regulators of Brazilian research also put pressure on the stricto sensu graduate programs, transmitting this need to publish to continue existing to the teachers and students.

In view of this problem, the respondents argued that most graduate programs use the publication of a manuscript or article as an assessment criterion in the subjects, with the participation of a faculty member, at least as a co-author, considering that this is one of the evaluation criteria for the graduate programs to remain accredited and recommended by the Coordination for the Improvement of Higher Education Personnel (Capes). It was also evidenced that the student is prepared to comply with formal requirements in the publications, leaving the political quality to the background, in which scientific arguments are used to criticize, debate and oppose themes already consecrated as almost unquestionable truths in accounting.

Therefore, the main contribution of this paper is to bring to the surface elements hardly discussed in the academic field with respect to the dissemination process of academic publications, which prioritizes the numerical count of these studies in reputable journals and conferences in the area, to the detriment

of the quality of these publications, which are the basis for the development and consolidation of scientific accounting research, using as a primary element the academic socialization process offered by stricto sensu graduate programs in Accounting.

However, any research also comes with some restrictions in its results. For this research, the limitations were: [1] being a predominantly qualitative and in-depth research, samples of respondents (nine) do not permit a broader and more widespread analysis of the theme treated in the article; and [2] interviews presuppose a certain subjectivity in the interpretation by the researcher; in addition, the interviewee can hide truths in order to remain in a comfort zone, thus avoiding opinions on causes of controversy or that require critical assessment. Finally, further research on the subject is suggested, so that we can advance in the understanding of other conditioning factors of the social context of Accounting research in Brazil.

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Performance of Accounting students on the Enade/2012 test: an application of the Item-Response Theory

Abstract

The objective in this study was to measure Accounting students' performance (proficiency) on the Enade test using the Item Response Theory (IRT). The students' performance was measured using the three parameter logistic model (3PL), based on data related to the Enade test/2012, taken from the website of the National Institute for Educational Studies and Research Anísio Teixeira (Inep), concerning 47,098 students. Through the scale, three levels of student performance could be distinguished. Level 1 students master the reading and interpretation of texts and quantitative reasoning. In addition, Level 2 students should present logical reasoning and systemic and holistic perspective. Furthermore, at Level 3, students should present interdisciplinary knowledge, covering accounting contents, critical-analytic skills and practical application of the content mastered. The results also appointed that the items of the Enade test were very difficulty for the group that took the test. Independently of the student characteristics analyzed, overall, the proficiency scores were very low. This result suggests that the HEI need to take actions and that public policies are needed that can contribute to improve the students' performance.

Key words: Student performance; Proficiency; Enade; Item Response Theory.

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1. Introduction

Education can be understood as a scarce economic good, which depends on choices and renunciations of individual or collective resources (Waltenberg, 2006). According to Cunha, Cornachione Junior and Martins (2010), empirical studies show that the importance of education and its effects are higher in developing countries compared with developed countries. The establishment and maintenance of public policies related to financial education systems, educational accountability and educational integration depend mainly on monitoring the situation the education is offered in, usually performed through assessments (Hanushek, 1979).

According to Hanushek (1979), educational knowledge assessment tests are used as a means to measure the output of the educational production process. For Primi, Hutz and Silva (2011, p. 271), "in democratic societies, such assessments serve as accountability tools, used to determine whether the organizations, to whom some roles are attributed, have fulfilled their obligations".

As a scarce economic good, a parameter for measuring its current stage is the quality of education, a parameter that supports the evaluation of the effectiveness of teaching. In Brazil, higher education is evaluated periodically by education monitoring entities subordinated to the Ministry of Education (MEC). In the case of undergraduate education, this monitoring is carried out by the National System of Higher Education Assessment (Sinaes), which adopts the National Examination of Student Performance (Enade), established in 2004 as a tool for evaluating student performance in higher education courses in relation to the program contents and skills (Inep, 2014). In addition, "the guidelines for the preparation of the Accounting test are defined in Inep Ordinance 202 of June 22, 2012" (Inep, 2014, p. 6). It should be noted that, in addition to the objective set by Sinaes to evaluate the students' performance, the Enade test is also adopted to evaluate the performance of educational institutions in imparting knowledge for students' education in relation to compliance with the curriculum components of courses based on a National Curriculum Guideline.

This test has been used, in addition to the purposes set by Sinaes, as a measure of higher education students' performance in scientific research. These surveys, usually carried out within specific areas of expertise, such as Psychology, Pedagogy, Administration, among other areas, investigate the situation of teaching in those respective areas. These evaluations, based on performance measures, are elaborated with a view to actions to improve education and the understanding of (determining) factors related to higher (or lower) academic performance, measured based on the tests.

In the scientific literature, which shows measures of higher education students' academic performance, one can see the predominance of studies using the classical test theory (CTT) to measure the students' knowledge. Based on these measures, the needs to improve the education offered are evaluated, suggestions are elaborated to improve the teaching and the factors are understood the factors that help to explain the reasons why the performance tends to be higher or lower. However, through the classical analysis, this survey may not express the reality of academic performance, as it does not consider the specifics of each item in the evaluation.

In the fields of psychology and pedagogy, respectively, studies by Primi et al. (2011) and Lopes and Vendramini (2015) used the Item Response Theory (IRT) as an alternative to measure students' performance (proficiency) on the Enade tests. It is observed in these studies that the assessment based on IRT presents more detailed results on the proficiency of the individuals assessed, also offering information about which knowledge they specifically mastered, in which both the item and the respondent are placed on the same measuring scale. Thus, among other possible observations, one can mention the comparison of the difficulty of proof regarding the knowledge (proficiency) of the student group.

Unlike TCT, IRT permits measuring students' knowledge (proficiency) according to the complexity of the content that makes up each exam question. Based on this measure, the proficiency the student effectively demonstrated can be identified, since it not only considers the number of items answered correctly. From this perspective, it is possible to distinguish between individuals, so that different students who have correctly answered the same number of questions (items), with different degrees of difficulty, have different proficiency measures.

This study seeks to contribute to Accounting teaching in Brazil by presenting an alternative measure of students' performance in the area through IRT. Thus, this study aims to measure the Accounting students' performance (proficiency) on the Enade by means of IRT.

Through this study, the intent is to model the probability of correctly answering the questions (items) that make up the test, considering the student's proficiency based on the difficulty and distinctive capacity of the items and the likelihood of a casual hit. As it permits assessing the knowledge the student effectively masters in each item, this initiative enables interventions and timely corrective actions in the teaching-learning process in order to identify gaps that comprise possible learning disabilities.

Considering education as a scarce resource, its importance in developing countries and the search to develop public policies related to education, the problem of this study rests on the Economic Theory of Education. This study aims to assess the situation of higher education in the field of Accounting through the students' performance, which corresponds to one of the end products of education, as graduates. It is necessary to evaluate and understand if the "education" resource is managed to provide private and social benefits.

Thus, the intention is to contribute to the field of education in Accounting by seeking alternative tools to measure the current situation of higher education in Accounting in Brazil, based on the evaluation of students' academic performance (proficiency), in order to assess the situation found in each type of knowledge that integrates the curriculum components of higher education courses in Accounting in detail.

The article is divided into five sections. The next section presents the theoretical framework, which includes the Economic Theory of Education, item response theory and previous studies related to the topic of the article; the third section presents the methodological procedures used in the research; the fourth section presents the results of the study, considering the estimation of the parameters of the model adopted, to measure the proficiency of students and the proficiency scale built. In the last section, the conclusions are exposed and suggestions are provided for future studies.

2. Theoretical Framework

2.1 Economic Theory of Education – Human Capital

Blaug (1992) classifies research based on Economic Theory of Education in two major fields. The first is related to the analysis of the economic value of education and the second investigates the economic aspects of education systems. Studies in the first field have concluded that the economic growth of a country or region is closely linked to people's level of education (Waltenberg, 2006). The theoretical aspects of human capital are part of this first field of the Economic Theory of Education.

The Human Capital Theory essentially seeks to understand and explain the consequences of education for the value of people's human capital. In this current, the gain of knowledge and skills causes an increase in the value of individuals' human capital, reflected in employment, productivity and potential income (Cunha et al., 2010). From this perspective, education can be considered an economic good, with problems of scarcity and dependent on choices and sacrifices in terms of individual and collective resources (Waltenberg, 2006).

This idea derives from the views of Schultz (1960), considered one of the forerunners of the Human Capital Theory. For the author, education can be treated as a form of investment in human beings and will add value to the individual who receives it. In this conception, yield and productivity increases are the result of increased human capital. Human capital, while investment in the human being is composed of two types of resources. The first relates to the resources invested by educational institutions, and the second to investments made by individuals in the form of gains waived as students. This last feature has been observed empirically by Schultz (1960) as the most significant part of the costs incurred in student education.

Later, Becker (1962) has contributed to the expansion of the Human Capital Theory, through empirical studies of the consequences of that capital gain on issues like welfare and wealth. According to Waltenberg (2006), the results found in studies conducted in this area still lack a direct quantitative relationship between economic growth and education. The definition of an optimal level of education in a country does not exist. There is no consensus on a minimum level of education that makes a country reach a condition of rapid growth, nor are the maturity and depreciation periods of human capital known. Rasera (1999) points out that education has a problem related to its form of measuring, which makes it difficult to measure a reasonable relationship between economic growth and investment in human capital. Thus, one of the few possible conclusions is that education fosters the growth of a country, but without the degree of relationship between these two variables.

The measuring and understanding of the determinants of educational performance are important for the development of policies such as educational accountability, financial education systems and educational integration. Most studies in this area used standardized outputs obtained from test marks as a performance measure (Hanushek, 1979). What is perceived in such studies, however, is the predominance of educational performance measures based on the classical test theory (CTT). This form of measuring has some weaknesses, especially with regard to performance evaluation depending on the particularities of each item in the assessment tool, specifically the tests carried out by students.

Studies like Primi et al. (2011) and Lopes and Vendramini (2015) employed the Item Response Theory (IRT) as an alternative to measure students' performance (proficiency) on Enade tests. Using the Item Response Theory (IRT), presented in further detail in subsequent sections of this study, a measure can be obtained to assess the students' performance, measuring and distinguishing the knowledge the student presented in the test. In this sense, the IRT can contribute to the human capital current in the development of the Economic Theory of Education.

These studies contribute by providing feedback on the quality of education offered to the population. This is because there is a need for greater effectiveness in teaching, mainly due to its effects in different sectors and strata of the socio-political and economic organization of a country (Lopes & Vendramini, 2015).

2.2 Item Response Theory (IRT)

The IRT includes a set of modeling techniques that, through the analysis of specific items, permit measuring certain characteristics of the individuals (Edelen & Reeve, 2007). Through these techniques, in accordance with Andrade, Tavares and Valle (2000), the relationship between an individual's latent trait(s) can be represented and the likelihood that (s)he will answer this particular item correctly. Latent trait is considered to be the characteristics of an individual that cannot be directly observed, such as proficiency in English or consumer satisfaction. An item can be represented by a matter of proof, or even by a question related to the satisfaction of the individual with a particular product or service. In the case studied in this article, latent trait refers to performance (proficiency), expressing accounting knowledge, measured by the number of items (questions) in the Enade test / 2012.

In recent decades, there has been an increase in the application of techniques derived from IRT, mainly in educational assessment (Andrade et al., 2000). The first works related to this theory emerged in the 1950's, with Lord (1952). Next came the work of Rasch (1960), Birnbaum (1968), Wright (1968) and Samejima (1969), the latter with the proposal of a gradual response model, as previous models were only applied to dichotomous responses. Nowadays, IRT models are widely applied around the world, and more information about the origin of this theory can be found in the works of Andrade et al. (2000), Bock (1997), Boomsma, Van Duijn and Snijders (2000), Van Der Linden and Hambleton (1997) and Moreira (2010).

The resulting IRT models are able to meet some limitations of the Classical Test Theory (CTT) or Classical Measurement Theory (CMT), which is commonly used in the evaluation and selection of individuals. In CTT, evaluation is based on raw and standardized scores. The score of an individual depends

primarily on the number of hits achieved, regardless of whether these correct answers are related to easy or difficult questions (Andrade et al., 2000).

One of the differences that can be identified between the CTT and the IRT is in how the models deriving from IRT treat the test. Taking the field of educational assessment as an example, in IRT, the evaluation of the test items, i.e. the test is considered on the whole, while items are considered individually in CTT, so that the score achieved on an item is independent of the score achieved on other items. The benefits IRT provides in this case is that it can capture subjects who respond to questions more consistently, that is, hitting easier instead of difficult questions, which values their scores. On the other hand, it punishes the score of individuals who hit more difficult than easy questions, since the logic is that those who get the most difficult questions right should also master the easier questions, which may be related to the random hit (Moreira, 2010).

Andrade et al. (2000) emphasize that the greatest advances of IRT are related to the creation of interpretable scales; with the possibility of comparison between individuals who have made different tests, but with items belonging to the same scale; and the comparison between individuals of different populations, who conducted tests with some items in common.

In Brazil, in addition to the wide application of IRT models in the educational assessment area, the theory has been used in several other areas, such as the degree of consumer satisfaction, valuation of companies' intangible assets, organizational management, evaluation of quality of life, psychological assessments, among others, which can be found in Moreira's work (2010). According to the author, studies have used various one-dimensional IRT models, especially the three parameter logistic model (3PL). In this study, the 3PL is used. This model considers item discrimination, item difficulty and probability of casual hit parameters, unlike the Rasch model, which only takes into account the difficulty. In the next section, some examples are discussed of studies that used the IRT to analyze the Enade test, as well as Accounting studies related to Enade.

2.3 Empirical studies

Internationally, Bartlett, Peel and Pendlebury (1993) found that the performance of students in the third year of Accounting at the University of Wales College of Cardiff was more related to the performance in the first year than other characteristics, such as demographic, financial or investments features. Byrne and Flood (2008) observed the overall performance increase in Financial and Management Accounting among students from Dublin City University with background knowledge in accounting. Both studies used the classical theory for performance measurement, based on the average students achieved in the subjects Financial and Management Accounting.

Davidson (2003), in an analysis of Canadian students, noted that superior performance in Accounting on exams that include complex issues is related to a more in-depth study approach and not just superficial memorization techniques. Factors such as previous academic performance, motivation to accomplish the course and intention to work in accounting also help to explain performance on assessment tests. Unlike the present study, student performance was measured based on an application of Classical theory (classical analysis), weighted by the relative level of difficulty involved in each question. Although this is one way to minimize the distortions arising from the use of basic Classical theory, in which all questions have the same weight in the evaluation, this level of difficulty does not fit the specific characteristics of the group of students who performed the test.

Clinton and Kohlmeyer (2005) evaluated US students and found that, although there was no significant difference between the performance of individuals submitted to an educational process based on quizzes and processes based on conventional methods, there was a significant difference in the learning perception and motivation to study in the group of students undergoing the quizz-based method. Like Davidson (2003) and unlike the present study, they used the Classical theory to measure student performance. One caveat about Clinton and Kohlmeyer's approach (2005) is that the lack of significance in the

difference between the teaching approaches can derive from distortions due to the use of Classical theory. The possibility to reassess the effectiveness of quizz-based study is the measuring of the dependent variable (student performance) based on proficiency estimated by the IRT.

In Brazil, some studies used the Enade test as the base to measure the performance of Accounting students. Souza (2008) reviewed the performance determinants of students on the Enade test / 2006. He found that variables such as the students' background knowledge prior to his admission to the course, the father's education, personal effort and family income influence the performance of the evaluated students. Santos (2012) extended the study by Souza (2008) and analyzed the effect of individual and institutional variables on student performance and data from the National Survey of courses from 2002 and 2003 and Enade / 2006, noting that variables such as gender, hours devoted to study, family income and attendance of public high school interfere positively in student performance. In addition, institutions whose teaching staff held Master's and Ph.D. degrees and worked on a full-time contract also contribute to higher student achievement.

Miranda (2011) investigated the relationship between the performance of students and the training of teachers in Accounting courses. The author used the results of Enade / 2009 as the base to measure student performance results. The results show that the academic qualification of teachers at the Higher Education Institutions (HEIs) investigated can influence the performance of students on the Enade test. Similarly, Santos, Cunha and Cornachione Junior (2009) observed that the concept of Accounting courses partially reflects the teachers' degree. The authors used a nominal five-category variable to evaluate the course performance. It should be noted that prior to the conversion to nominal, the measuring form used comes from Classical theory. Cruz, Nossa, Balassiano and Teixeira (2013) found no relationship confirming that the didactic and pedagogical structure of curricula influences the performance of students on the Enade / 2009. It was only confirmed that the geographical region of the course influences the performance.

Although there are studies related to the ENADE test in the Brazilian accounting literature, no studies were identified that investigate the relationships between the test items and student proficiency (performance) based on the IRT. In the studies reviewed, only student performance measures based on Classical theory were found, which, as appointed in the previous section, presents a number of disadvantages compared to IRT.

Some studies in other knowledge areas analyzed the Enade with the application of item response theory (IRT). Examples include Management (Scher, Moreira, Correa, Schuch, Andrade & Bortolotti, 2014), Statistics (Coelho, Ribeiro Junior & Bonat, 2014), Psychology (Primi et al., 2011) and Education (Lopes & Vendramini, 2015).

Scher et al. (2014) analyzed the Enade / 2009 taken by Management students, using the 3PL. The results showed the feasibility of using the IRT for the Enade items evaluated and also noted the increased proficiency between freshmen and seniors. Coelho et al. (2014) applied the IRT to students who took the Enade / 2009 in Statistics and found that few students showed high proficiency on the test, concentrating most respondents at an average proficiency level. Primi et al. (2011) analyzed the Enade / 2006 taken by new students and graduates in Psychology, using factor analysis and Rasch' model; they presented the construction of four performance ranges, describing, based on the test items, what knowledge, skills and expertise were needed for the student to demonstrate proficiency in each range; and observed a concentration of graduating students in higher proficiency ranges and that, in courses with higher Enade scores, the difference in performance between new and graduating students is smaller. Lopes and Vendramini (2015) analyzed the Enade test / 2005 taken by Pedagogy students. Similarly to the study by Primi et al. (2011), they also used the Rasch model and found that the test includes questions of median difficulty, similar to students' average and therefore appropriate proficiency.

It is observed among studies in other areas that used the IRT that the assessment made contains more detailed ways of measuring students' proficiency, in which both the test items and the respondents are placed on the same measuring scale, so that the knowledge the students specifically master can be indicated, The application of IRT to the Enade test of Accounting students can also contribute to understand the knowledge and skills the investigated students master, according to their level of proficiency.

3. Methodological Procedures

To measure the accounting students' performance (proficiency) on Enade/2012, the 3PL of IRT was used. The analyses were developed based on the estimation by means of BILOG-MG® software and the graphs produced in R software (R Development Core Team, 2012).

3.1 Population and sample

The study population consists of senior students of Accounting courses in Brazil. In total, 57,248 students enrolled to take Enade/2012 (INEP, 2014). Initially, 47,124 students with valid data were identified, regularly enrolled in Accounting courses in Brazil, convened by the Ministry of Education (MEC) and who attended the examination. Students were selected the students who took all objective tests, both General and Specific Knowledge; and noted 26 students who attended but handed back the test unsolved, i.e. they did not answer the questions. Thus, the final sample consists of 47,098 students who took the Enade / 2012. Data were extracted from the website of the National Institute of Educational Studies and Research Anísio Teixeira (INEP) on October 26th, 2015.

The age of the students ranged from 19 to 79 years, with an average of 29 years. The largest share of students was between 21 and 25 years old (19,756 people - 42%); 12,556 (27%) of the students were between 26 and 30 years; 7,135 (15%) were between 31 and 35 years; and 7,534 (16%) over 35 years. Only 177 students were up to 20 years old. Most students (94%) studied at night. There was predominance of female students (59%) and from the Southeast (39%) and South (24%). The North region concentrated the lowest number of students (6%), followed by the Central-West (13%) and Northeast (18%). Of the students in the sample, 16% came from public and 84% from private Higher Education Institutions (HEIs).

3.2 Measuring of student performance (proficiency)

3.2.1 Enade test

The Enade test / 2012 consists of discursive and objective questions (both general knowledge and specific knowledge). On the whole, there are forty (40) questions, divided into ten (10) general education questions (two discursive and eight multiple choice) and thirty (30) specialized questions (three discursive and twenty-seven multiple choice).

The general education questions involve knowledge of art and culture, technological advances, democracy, ethics and citizenship, ecology and biodiversity policies, labor relations, social responsibility, among others. The purpose of this group of questions is to assess characteristics related to an ethical, competent professional who is committed to the society he lives in (INEP, 2014).

The specific knowledge component involves questions from Accounting Theory, Professional Ethics, Financial Accounting, Cost Accounting and Analysis, Management Accounting and Controllership, among others. The purpose of these questions is to assess the skills of students in using Accounting terminologies and language, present systemic and interdisciplinary perspectives, mastery of the identification, recognition, measurement and disclosure phases, critical and analytical skills, production of information for decision making, interpretation and application of accounting standards, among other competences (INEP, 2014).

For the study, exclusively the objective questions were considered, i.e. 35 (thirty five) questions (eight general education and twenty-seven specialized), which were treated as dichotomized items and evaluated using the Three Parameter Logistic Model of the IRT (3PL), presented in further detail in section 3.2.2.

3.2.2 IRT Measuring Model

The performance measure was developed by means of IRT, in which a scale was built to evaluate the students' proficiency levels in Enade / 2012. In this form of measuring, all items that make up the assessment tool (test) are placed on the same proficiency measuring scale. Through this step, all test items could be placed on "anchor" levels to interpret the required test performance.

According to Andrade et al. (2000), the models proposed in the literature, originating in IRT, are based on three factors, namely: (i) the nature of the item, which can be dichotomous or not dichotomous; (Ii) number of people involved, represented by one or more than one; and (iii) measured amount of latent features, which can be one or more (one-dimensional or multidimensional).

In this study, we used a one-dimensional model, represented by the latent trait "knowledge in accounting", a single population is considered, i.e. Accounting students who took the Enade test / 2012; and dichotomized items are used.

The 3PL is applicable when the items are dichotomous or polytomous (items with two or more categories) with a single correct answer option. In the latter case, the polytomous items should be adjusted (dichotomized) into two categories, that is, right and wrong. This model is applicable in case you want to evaluate the item difficulty, discrimination and the probability of individuals with low skills levels giving a correct answer (Andrade et al., 2000).

The 3PL is displayed in Figure 1:

$$P(U_{ij} = 1|\theta_j) = c_i + (1 - c_i)\frac{1}{1 + e^{-a_i(\theta_j - b_i)}}$$

with $i = 1, 2, 3, \ldots, I$, and $j = 1, 2, 3, \ldots, n$,

In which:

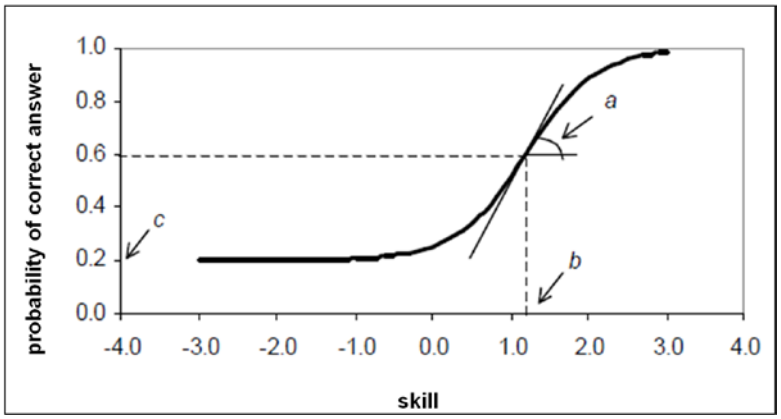
U_{ij}: dichotomous variable equal to 1 (one) when individual j gives a correct answer to item i, or 0 (zero) in the opposite case;
θ_j: Represents the skill (latent trait) of the j-eth individual investigated;
$P(U_{ij} = 1|\theta_j)$: Is the probability that individual j with skill θ_j will answer item i correctly and is called Item Response Function (IRF);
a_i: Represents the discrimination parameter of item i. The value of the parameter is proportional to the inclination of the Item Characteristic Curve – (ICC) in point b_i.
b_i: represents the difficulty parameter of item i, measured on the same scale of skills;
c_i: is the item parameter that represents the probability that individuals with low skills will correctly answer item i, that is, it represents the probability of a random hit.

Source: adapted from Andrade *et al.* (2000, pp. 9-10).

Figure 1. One-dimensional Three Parameter Logistic Model (3PL)

To estimate the model parameters based on IRT, generally, the Marginal Maximum Likelihood Method is applied, jointly applying an iterative process like the Newton-Raphson or Fisher Scoring algorithm, or Bayesian procedures, in accordance with Andrade *et al.* (2000).

In Figure 2, the Item Characteristic Curve (ICC) is displayed.



Source: Andrade *et al.* (2000, p. 11).

Figure 2. Item Characteristic Curve (ICC)

The ICC represents the existing relation between the probability of an individual, given his/her skill to correctly answer a certain item ($P(U_{ij}=1|\theta_j)$) and the parameters of the 3PL a_i, b_i and c_i, which represent, respectively, the inclination of the curve (discrimination), the position of the item in the scale (difficulty) and the possibility of a random hit for individuals with low skills. Axis Y represents the probability of an individual's correct answer, while axis X demonstrates the skill related to the latent trait assessed.

In IRT, according to Andrade *et al.* (2000), the individual proficiency (skill) measured can correspond to a real value between -∞ and +∞. In this case, an origin and a measuring unit need to be established for the scale that will be constructed for the latent trait assessed. The standard scale generally used in software that estimates the IRT models is represented by the mean 0 and standard deviation 1, that is, scale (0,1). This scale can be modified, provided that the existing relations between the model parameters are maintained. Information on the transformation of scales can be consulted in Andrade *et al.* (2000). In this study, the scale (0,1) was adopted to analyze the Accounting students' performance on Enade/2012.

In 3PL, the parameter a_i represents the discrimination of the item assessed. Items with excessively low coefficients on this parameter indicate a low discrimination power, that is, the probability that individuals with low proficiency will correctly answer the item is the same as for individuals with high proficiency. In general, according to the scale used (0,1), for an item to possess good discrimination power, the parameter a_i should be superior to 1 (Andrade *et al.*, 2000), although items with parameters superior to 0.7 are also acceptable (Scher *et al.*, 2014). That is so because the parameter a_i is proportional to the derivative of the tangent of the logistic function curve in the inflection point. Hence, steeper curves (with high coefficients for this parameter) basically distinguish individuals in two groups: individuals who master the knowledge of the item and individuals who do not. On the other hand, lower coefficients for this parameter indicate the item's low discrimination power, in which students with different skills have practically the same probability to correctly answer the item (Andrade *et al.*, 2000).

b_i is the parameter of the item's difficulty – the higher, the more difficult to item is and vice-versa. This means that, for individuals with a higher proficiency level, the probability of a correct answer is higher. It is also known as the location parameter, as it helps to verify the position of the item on the proficiency scale (Scher *et al.*, 2014). For scale (0,1), which considers an average of zero and standard deviation of one, the item coefficients for the parameter are expected to range between -2 and +2 (Andrade *et al.*, 2000).

The parameter c_i represents the probability that a low-skilled individual will correctly answer a given item. Its coefficient represents the number of alternatives in the item. Hence, for an item consisting of five alternatives, the theoretical probability that an individual will correctly mark any of the alternatives equals 0.2, a margin of tolerance can be established (superior and inferior to 0.2), in which the student's answer can be considered a mere casual hit, instead of the mastery of knowledge on the item. Thus, the expected coefficient for the parameter ranges between 0.1 and 0.3 (Scher *et al.*, 2014).

After measuring the students' proficiency and analyzing the parameters resulting from the estimated model, the next step was to analyze the students' performance in the research population. Therefore, in the next topic, the interpretation of the scale is discussed.

3.3 Analysis of student performance (proficiency)

Based on the measure of the students' performance, all questions were placed on the same scale, ranked according to the parameter of item difficulty (b_i). Items that simultaneously complied with the criteria displayed in Figure 3 were considered as anchor items.

$$
\begin{aligned}
&1.\ P(U = 1 \mid \theta = Z) > 0.65; \\
&2.\ P(U = 1 \mid \theta = Y) < 0.50;\ and \\
&3.\ P(U = 1 \mid \theta = Z) - P(U = 1 \mid \theta = Y) > 0.30.
\end{aligned}
$$

Source: Andrade *et al.* (2000, p. 110).

Figure 3. Criteria to define "anchor" levels

Thus, for an item to be considered an "anchor", most individuals (65%) need to answer it correctly, with the proficiency indicated by the level of the scale, and by a lesser proportion of individuals, i.e. maximum 50%, of individuals with a lower proficiency level. In addition, a 30% difference needs to exist between individuals with different skill levels who correctly answered the item (Andrade *et al.*, 2000). Due to the difficulty to simultaneously comply with the three criteria, however, items that complied with at least two of the criteria mentioned were also considered as "almost anchor" items.

The items identified as "anchor" or "almost anchor" items, previously defined according to Figure 3, were then analyzed and related to the objectives of the question, to the required competences and to the knowledge objects involved, as established by Inep in the Assessment Matrix of the Enade test / 2012 in Accounting, displayed in Table 1. This analysis was developed in that manner because, statistically, the IRT can distinguish among the proficiency levels and, pedagogically, the knowledge and competences the test requires in each proficiency level can be appointed.

Table 1

Assessment matrix of Enade test/2012 in Accounting

Classificação	Componente de Formação Geral	Componente Específico
Objetivos	Investigate the education of an ethical, competent professional committed to the society he lives in.	I – assess the level of understanding of scientific, technical, social, economic and financial aspects; II – assess the degree of mastery of logical reasoning in the solution of questions in different contexts; III – verify critical-analytical skills; IV – assess the level of quantitative reasoning; V – verify ability to adopt systematic and holistic perspectives; VI – analyze communication and interaction skills; VII – verify the understanding of technological innovations applied; VIII – assess the perception of ethical conduct.
Competences and Skills Assessed	Skills: read and interpret texts; analyze and criticize information; draw conclusions by induction and/or deduction; establish relations, comparisons and contrasts in different situations; detect contradictions; make valuation choices, assessing consequences; question the reality; and argue coherently. Competences: project intervention actions; propose solutions to problem situations; construct integrative perspectives; elaborate syntheses; administer conflicts and act according to ethical principles.	I – use Accounting terminologies and language; II – practice accounting with a systemic and interdisciplinary view; III – master the identification, recognition, measuring and disclosure process; IV – demonstrate critical-analytic skills, involving verifications, auditing, expertise, arbitrage and quantifications of financial, equity and governmental information; V – demonstrate skills to identify and produce information for the decision process; VI – interpret and apply accounting standards; VII – possess skills to identify users' information need to support the development of information systems; VIII – understand ethical conduct in the practice of accounting activities.
Knowledge Object	Art and culture; technological advances; science, technology and innovation; democracy, ethics and citizenship; ecology and biodiversity; globalization and geopolitics; public policies: education, housing, sanitation, health, transportation, safety, defense, sustainable development; work relations; social accountability: public, private, service sector; sociodiversity: multiculturalism, tolerance, inclusion/ exclusion, gender relations; information and communication technologies; urban and rural life; and violence.	I – Accounting Theory; II – Professional Ethics; III – Financial Accounting; IV – Financial Statement Analysis; V- Cost Accounting and Analysis; VI – Management Accounting and Controllership; VII – Financial Management; VIII – Accounting Applied to the Public Sector; IX – Auditing and Expertise; X – Financial, corporate, occupational and tax legislation; XI – Quantitative methods applied to Accounting; XII – Information systems and technologies.

Source: elaborated by the authors based on Inep (2014).

In this phase, the intent was to identify the reasons for placing the items in each point of the scale, in function of the questions' level of difficulty. In this analysis, the complexity of the objectives, the competences and the knowledge objects was taken into account, including aspects of interdisciplinarity involved in the content of the question. This analysis, together with the creation of the measuring scale and the identification of the "anchor" levels, is presented in the next topic.

4. Analysis of Results

Next, the results of the application of IRT to measure the Accounting students' proficiency (performance) on the Enade test/2012 are presented. It should be highlighted that, out of 35 questions analyzed, eight were excluded due to the very low biserial correlation coefficients, which are inappropriate to estimate the model and can cause distortions in the estimations. The following questions were excluded: 05 and 08, belonging to the general knowledge group; and 10, 19, 21, 28, 29 and 32, belonging to the specific knowledge group. This exclusion is due to the fact that the problems identified in the items appointed did not permit convergence in the estimation of the model using the marginal maximum likelihood method. In other words, the problems the items presented are that big that they make it impossible to calibrate IRT parameters. As the items possess low biserial correlation coefficients, the questions are inefficient to explain the students' performance, as the possibilities of individuals with high or low proficiency levels to answer the item correctly are similar and, therefore, the items do not help to estimate and distinguish the students' performance.

4.1 Estimation of Parameters

Table 2 presents the discrimination (a_i), difficulty (b_i) and casual hit (c_i) parameters of the items assessed, with their respective standard errors (SE). These parameters were estimated in the software BILOG-MG®, using scale 0,1.

As shown in Table 2, the parameters a_i of the items assessed are generally superior to 0.7. Parameter a_i indicates the discrimination of each item – the higher the value of this parameter, the higher its discrimination power. In other words, it indicates the extent to which each item is able to distinguish those individuals who possess the knowledge under evaluation from those who do not. The items with greater discrimination power were items 34, 14 and 11. As shown in Figure 4, these items possess the most inclined item characteristic curves.

Table 2

Estimations of 3PL Item Parameters

Items	*a*	SE	*b*	SE	*c*	SE
1	0.8271	0.0602	0.4967	0.1252	0.2787	0.0322
2	0.5854	0.0314	0.8857	0.1042	0.0929	0.0257
3	0.4705	0.0517	2.0241	0.1600	0.1592	0.0363
4	0.4435	0.0217	0.5318	0.1430	0.0893	0.0271
6	0.4496	0.0397	0.9140	0.2540	0.1740	0.0456
7	0.9238	0.0527	0.6838	0.0732	0.1814	0.0232
11	2.0006	0.0998	1.4364	0.0196	0.2222	0.0051
12	1.6104	0.0707	0.7517	0.0265	0.2123	0.0105
13	1.3361	0.0963	2.3545	0.0571	0.1704	0.0054
14	2.0909	0.2160	2.7792	0.0841	0.1400	0.0025
15	0.9278	0.0791	1.9782	0.0507	0.2586	0.0131
16	0.8736	0.0190	0.3576	0.0241	0.0238	0.0074
17	1.3547	0.1602	3.1178	0.1465	0.1816	0.0043
18	1.4574	0.1153	2.5441	0.0692	0.1679	0.0044
20	0.4851	0.0478	2.2916	0.1151	0.1195	0.0290
22	0.4242	0.0791	4.3488	0.2956	0.1510	0.0275
23	1.3846	0.0663	0.6966	0.0373	0.2553	0.0133
24	0.8050	0.0372	1.3116	0.0429	0.0596	0.0144
25	0.9345	0.0366	-0.2786	0.0876	0.1214	0.0306
26	0.6932	0.0192	0.7049	0.0381	0.0330	0.0101
27	1.2058	0.0566	1.2264	0.0274	0.1281	0.0106
30	1.9193	0.1551	2.5244	0.0613	0.1313	0.0029
31	0.8399	0.1058	3.3597	0.1826	0.1572	0.0094
33	0.5174	0.0838	4.7095	0.3753	0.0834	0.0151
34	2.1004	0.1432	1.9395	0.0321	0.2558	0.0039
35	0.7550	0.0443	1.1123	0.0703	0.1110	0.0219

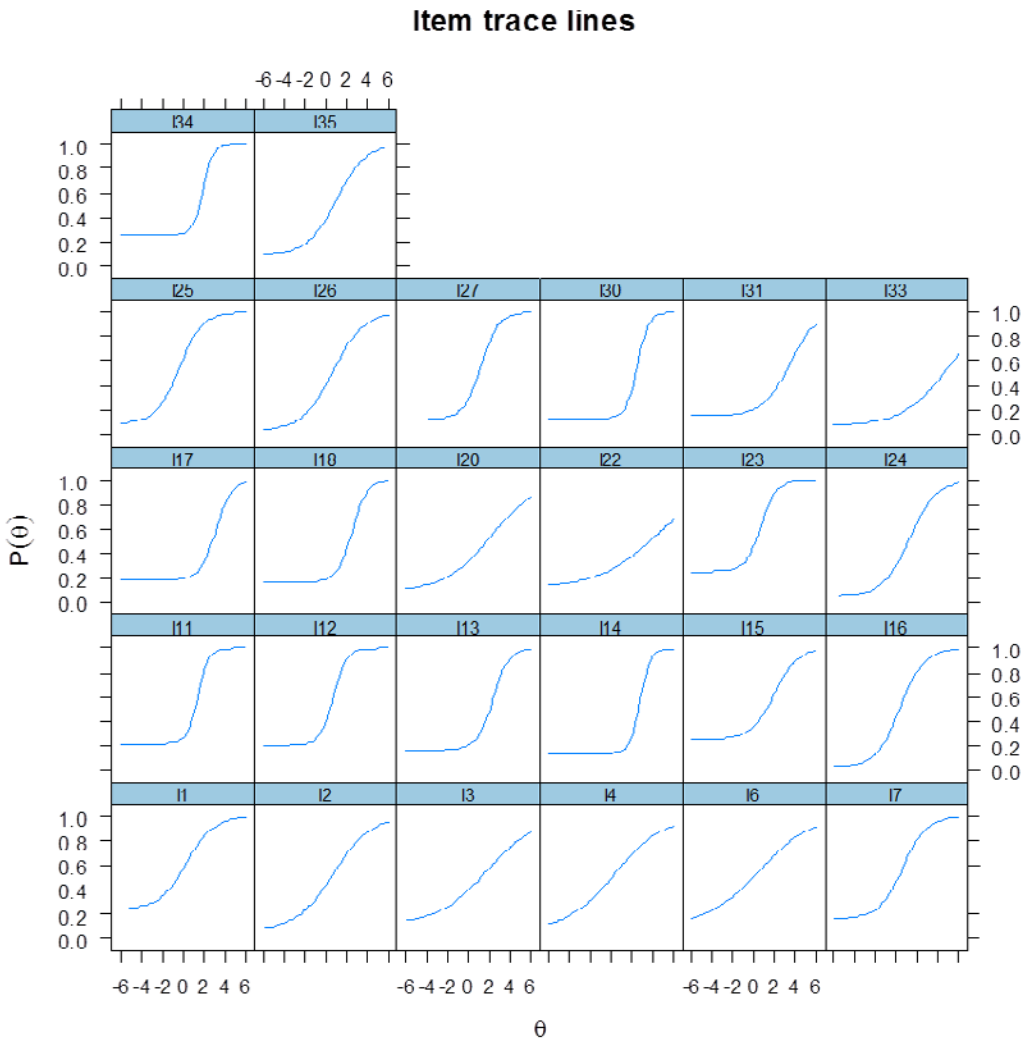
Legend: a = discrimination parameter of IRT; b = difficulty parameter of IRT; c = probability of casual hit according to IRT; SE = Standard Error.
Obs.: The parameters a, b and c presented in the table refer to the grouped item parameters.

Source: elaborated by the authors.

Parameter b_i represents the difficulty of each item – the higher its coefficient, the greater the proficiency the students need to answer the question. According to Table 2, the items with the highest degree of difficulty for the students assessed were 33, 22 and 31. These questions demand students' interdisciplinary knowledge related to Financial Accounting, Accounting Theory, Auditing, Information Systems and Financial and Tax Legislation. The analysis of the questions reveals that the student needs mastery of accounting terminology, critical-analytical skills, a systemic and holistic perspective to interpret and apply the theory and standards inherent in Accounting. On the other hand, the items the students found easier were 25, 16 and 1, which require but basic knowledge on accounting and auditing standards. Item 1 refers to a general knowledge question and demands text reading and interpretation skills. In general, questions 25 and 16, which require specific knowledge, require but the understanding of the text of the professional standard, without demanding critical-analytic skills from the student.

It should be observed that, according to Andrade *et al.* (2000), due to the mathematical definition inherent in the model used, the items are expected to present parameters b_i between -2 and +2 when the scale 0,1 is adopted. Nevertheless, as observed, the items assessed on Enade/2012 present a high degree of difficulty for the students assessed, that is, the test questions greatly exceed the proficiency of the group analyzed.

Figure 4 presents the graphs with the item characteristic curves (ICC). Axis X represents the student's proficiency and axis Y the probability of a correct answer.

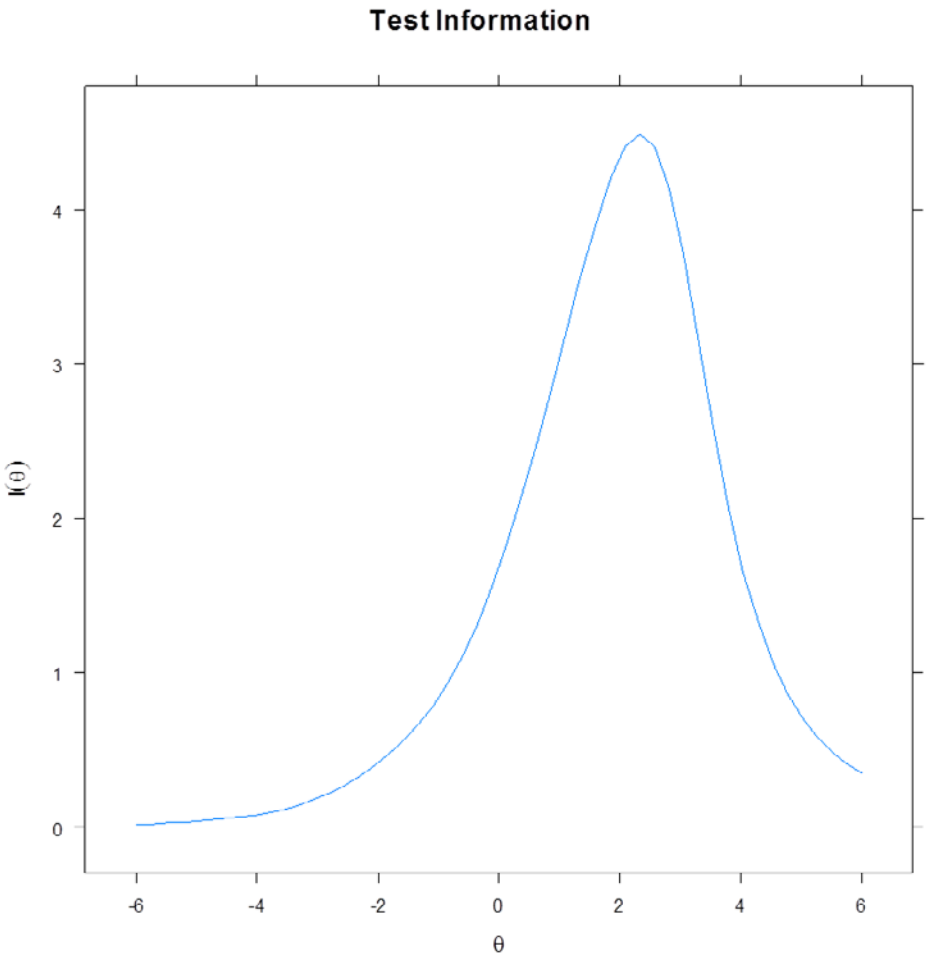


Source: elaborated by the authors.

Figure 4. Item Characteristic Curve (ICC)

Figure 4 displays the variation in the inclination of the item curves. This inclination is related to parameter a_i, that is, the discrimination of the items assessed. As explained in section 3.2.2, these curves express the items' power to discriminate individuals who master the knowledge from those who do not. As it represents the derivative of the inflection point of the curve (ICC), Figure 4 should be considered more in function of the item characteristic curve than in function of the values of θ and P(θ). In other words, items with less steep curves (ICC) or curves closer to straight lines have lesser discrimination power. As a complement to Table 1, items with lower present a less steep ICC, like in the case of items 22, 4, 6, 3, 20 and 33. Oppositely, items with higher a_i parameters, like items 34, 14, 11, 30, 12 and 18, present a steeper ICC.

Figure 5 exhibits the Test Information Function (TIF). This measures consists of the sum of the information functions of all items.

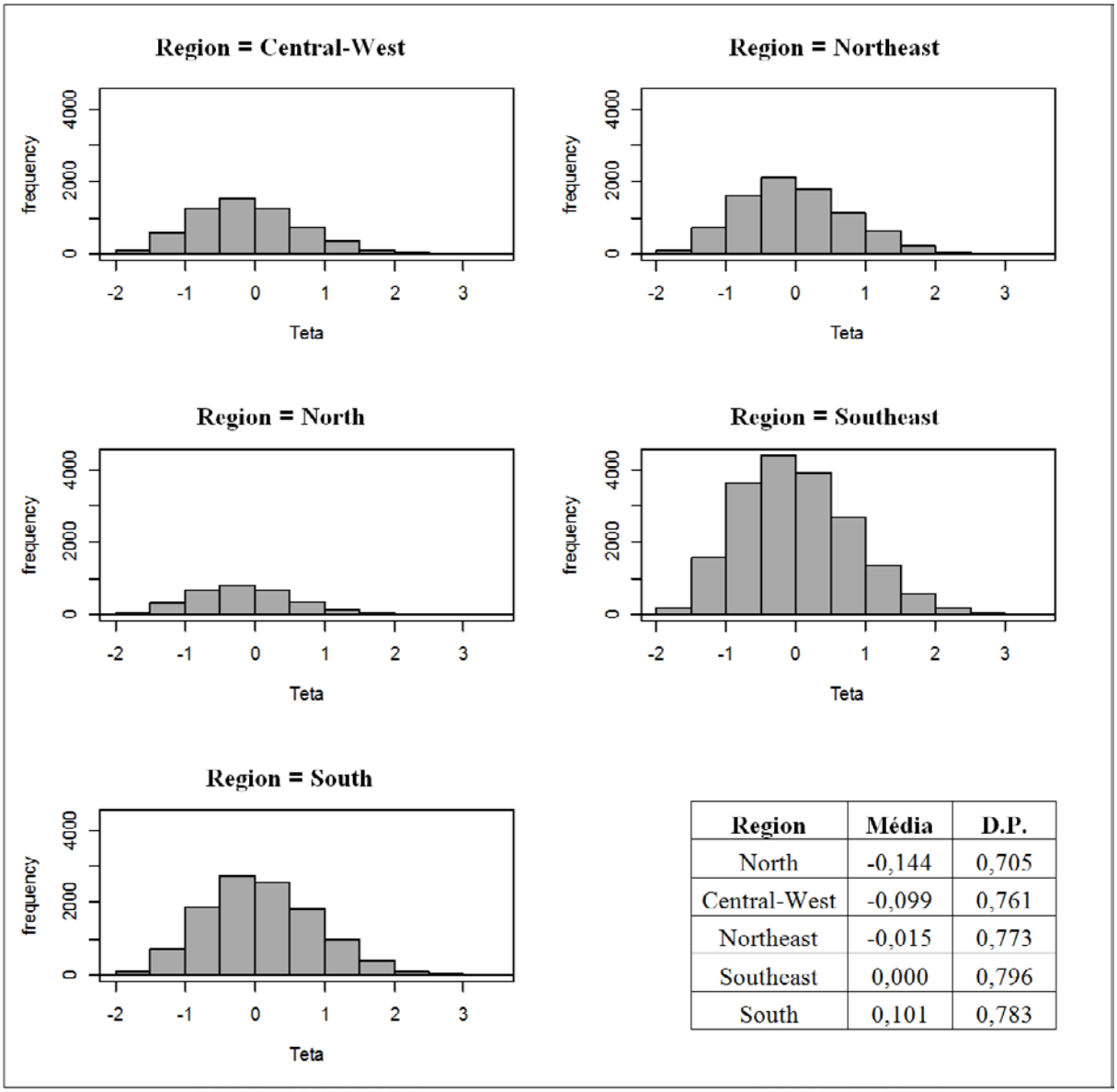


Source: elaborated by the authors.

Figure 5. Test Information Function

As shown in Figure 5, the TIF contain a larger amount of information in the scale interval from 0 to 4. That represents that the Enade/2012 applied to Accounting students represents a high degree of difficulty for the students investigated. It can be observed that only individuals with proficiency scores of two or higher have a high probability of performing well. Thus, it is a more suitable assessment tool to measure the latent trait of students whose proficiency level is close to two.

In Figure 6, the distribution of the students' proficiency level among the regions of the country is displayed. The division per region was adopted in function of the results of Cruz *et al.* (2013), who found significant performance differences among students from different regions on the Enade/2009.



Region	Média	D.P.
North	-0,144	0,705
Central-West	-0,099	0,761
Northeast	-0,015	0,773
Southeast	0,000	0,796
South	0,101	0,783

Source: elaborated by the authors.

Figure 6. Distribution of Proficiency (D.P.) per Region of the Country.

It can be observed in Figure 6 that, independently of the region of Brazil the student belongs to, his/her proficiency tends to score inferior to 0. As observed earlier, the Enade test demonstrated a high degree of difficulty for the group that took the test.

In a complementary analysis of each student group's mean score per region, it is observed that the students from the South show an average proficiency (0.101) slightly higher than in the other regions. The opposite is observed for the North, where the students' average proficiency (-0.144) is slightly lower. These results support the findings by Cruz *et al.* (2013), as the students from the Northeast, North and Central-West present lower performances. In Table 3, the mean proficiency levels of the students are presented, estimated using the 3PL of IRT, in accordance with some characteristics.

Table 3

Proficiency of students per characteristics

Characteristic		n	Mean	SD
Secondary School	Public School	13,371	0.042	0.824
	Private School	33,727	-0.017	0.764
Mother's Education	Higher Education	6,474	0.054	0.855
	Other	40,624	-0.009	0.769
Father's Education	Higher Education	5,666	0.092	0.866
	Other	41,432	-0.013	0.769
Hours of Study Outside Class	More than 3h	15,439	0.096	0.809
	Less than 3h	31,659	-0.047	0.764
Higher Education Institution	Public	7,610	0.184	0.846
		39,488	0.035	0.764

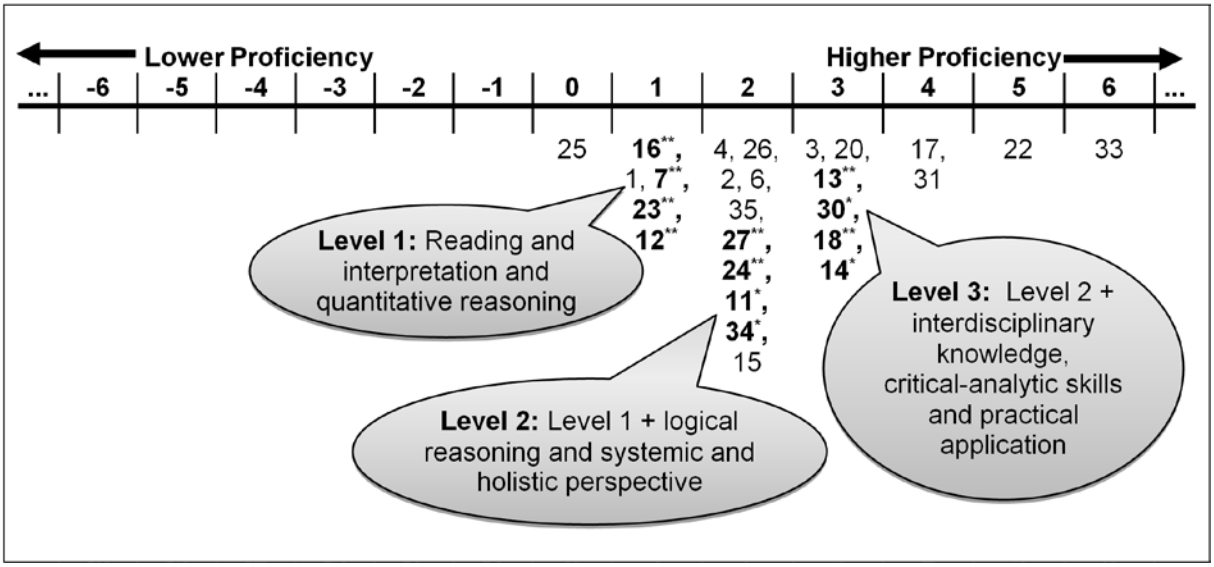
Source: elaborated by the authors.

In Table 3, it is shown that students who took secondary education at a public school, whose mother and father hold a higher education degree, who study more hours outside the classroom and who study at public HEI have slightly higher average proficiencies than students without these characteristics. It should be highlighted that the largest difference between the mean proficiency levels is found between students from public and private HEI. These results support the findings by Souza (2008) and Santos (2012), which were based on previous Enade tests.

In the next topic, the proficiency (performance) scale for the Enade/2012 is presented.

4.2 Proficiency (Performance) scale

The Proficiency scale of the students who took the Enade/2012 is displayed in Figure 7. All items are represented in the scale, but only the items highlighted (in bold) refer to "anchor" or "almost anchor" items.



Legend: * "Anchor" Item; ** "Almost anchor" item.

Source: elaborated by the authors.

Figure 7. Proficiency (performance) scale of Enade/2012 test in Accounting

Levels 1, 2 and 3, presented in Figure 7, were defined according to the "anchor" and "almost anchor" items, identified based on the rules presented in Figure 3. The knowledge and competences summarized at each level were identified according to the knowledge and competences required by the questions of the "anchor" and "almost anchor" levels. The items placed more to the left on the scale, demonstrated in Figure 7, demanded a lower proficiency level from the students. As an example, test question 25 required basic knowledge from the students on the accounting terminologies related to Accounting Theory and Financial Accounting. For the sake of a high probability to correctly answer that question, the students should merely understand the text of the professional standard, without requiring critical-analytic skills.

On the opposite, the items placed more to the right on the scale (Figure 7) required not only the mastery of more complex knowledge, but also critical-analytic skills, with a systemic and holistic perspective. To give an example, question 33 demanded interdisciplinary knowledge between Accounting Theory and Financial Accounting from the students, involving its applications in the identification, recognition, measuring and accounting disclosure process, besides requiring the mastery of accounting terminologies, critical-analytic skills and a systemic and holistic view to interpret and apply the theory and standards inherent in accounting. Question 22 demanded interdisciplinary knowledge between Internal Auditing and Information Systems from the students, involving its applications to the internal controls of the inventory subsystems and requiring the mastery of accounting terminologies, critical-analytic skills and a systemic and holistic view.

To solve question 17, the student should master knowledge on quantitative methods applied to Accounting that contribute to produce information for the decision process and possess critical-analytic skills to analyze the information presented. Question 31 demanded interdisciplinary knowledge involving Financial Accounting and Financial and Tax Legislation. To solve the question, the student should master Financial Accounting knowledge, mainly related to the identification of the amount of profit distributed to the partners or shareholders, in line with financial criteria and in accordance with tax legislation on the assumed profit. In this question, the mastery of accounting terminologies was also required, as well as the interpretation and application of Accounting standards, critical-analytic reasoning and a systemic and holistic perspective.

Based on the estimates measures, three proficiency levels were identified for the Enade/2012. These items are displayed in Table 4. The rules to define these items as "anchor" or "almost anchor" items were presented in topic 3.3 of this article.

Table 4
Classification of items per scale level

Panel A: Classification of Items		
Level	**Items**	**Classification**
Level 1	16, 7, 23 and 12	Almost anchor.
Level 2	11 and 34 27 and 24	Anchor. Almost anchor.
Level 3	30 and 14 13 and 18	Anchor. Almost anchor.

Panel B: Description of Items	
Item	**Description**
	Level 1
16	Requires knowledge about the standards ruling the profession of independent auditor concerning the aspect of professional independence. Involves descriptions of situations that characterize possible threats on the auditor's independence. Despite demanding knowledge of circumstances that affect the independence, requires understanding of the text of the professional standard, without demanding critical-analytic skills.
7	Requires ability to read and interpret texts, with a view to the ability to reach conclusions and/or make inferences based on the use of induction and/or deduction. In general, the question aims to identify whether the student can reach conclusions on a certain theme based on information implicit in the context presented.
23	Involves financial mathematical calculations to calculate the payback for the assessment of project feasibility. As the data are presented in tables, skills like the interpretation and critical analysis of the context the question is presented in are not required.
12	Demands knowledge of cost analysis in decisions involving the choice to purchase or produce goods. Involves a procedure to produce information for (low complexity) decision taking. Requires the mastery of accounting terminologies and the use of quantitative reasoning to identify and verify production costs.
	Nível 2
11	Requires knowledge on cost verification, specifically of the activity-based costing (ABC) model. Is part of the list of procedures to produce information for the decision process. Demands the mastery of accounting terminologies and the use of logical and quantitative reasoning to solve problems with a systemic and holistic view.
34	Requires the calculation of indicators for the analysis of financial statements through the understanding and knowledge of accounting terminology, as well as through the use of quantitative reasoning. Does not require the interpretation of these indicators.
27	Requires the development of a Cost-Volume-Profit (CVP) analysis to identify amounts to be sold by achieving the point of economic equilibrium. Is an auxiliary procedure to produce information for the decision process. The question demands knowledge of accounting terminologies and the use of logical and quantitative reasoning to solve problems with a systemic and holistic view.
24	Demands knowledge on the Statement of Value Added (SVA), specifically regarding its goal and the way the value added is calculated. Requires basic knowledge of accounting terminologies.
	Nível 3
30	Requires interdisciplinary knowledge between the verification of accounting income and taxes through the application of tax legislation to verify the actual profit. Involves the mastery of accounting terminologies, interpretation and application of accounting standards and critical-analytic skills with a systemic and holistic view.
14	Demands knowledge on the accounting identification, recognition, measuring and disclosure process. Involves the mastery of accounting terminologies, interpretation and application of the accounting theory and standards, as well as critical-analytic skills to identify the contextualized phase of the accounting cycle.
13	Demands knowledge of cost-volume-profit analysis to identify the production combination capable of maximizing the company's contribution margin in a context that involves factors that limit the production process. Consists of a procedure to produce information for the decision process and demands the mastery of accounting terminologies and the use of logical and quantitative reasoning to solve problems with a systemic and holistic view.
18	Demands knowledge and skill to verify results through absorption and variable costing models. Requires knowledge of accounting terminologies. Involves critical-analytic analysis with systemic and holistic view through quantitative reasoning for parallel cost verifications.

Source: elaborated by the authors.

As can be seen in Panel B of Table 4, students with Level 1 proficiency are able to perform tasks related to the reading and interpreting of texts and standards, arithmetic calculations and financial mathematics to solve low complexity problems. As we move on to Level 2, the items will demand not only quantitative, but also logical reasoning from the students. In addition to reading and interpretation of texts and standards, at this level, systemic and holistic perspectives related to the production of information for decision making are also necessary.

At Level 2, item 24 on the Statement of Value Added (SVA) should be highlighted. Although it does not require highly complex skills and knowledge, positioning the item at that level of the scale suggests the need for greater attention to the course curricula. Due to the recent convergence process and curriculum issues, the study of this statement may have been compromised. As can be seen, this item has been ranked as of medium complexity, but only requires general knowledge on the purpose and the SVA components, without further requirements, like in the cases of other questions at this level which required logical reasoning and a systemic and holistic perspective.

At Level 3 (Table 4), besides the mastery of knowledge and skills required in previous levels, such as quantitative and logical reasoning and systemic and holistic perspectives, items at this level require interdisciplinary knowledge of accounting contents and critical and analytical skills. At Level 3, reading and Interpretation of texts and standards are the starting point for practical application of knowledge mastered by the student. As expected, the domain of knowledge, skills and competencies are cumulative from the displayed levels. The range includes initially simpler domains, requiring, as the level increases, more complex areas of students.

In Table 5, the amounts of students classified according to the proficiency levels set out in Figure 7 are presented.

Table 5
Classification of students per proficiency range

Ranges	Number of Students	Frequency
Inferior to 1	35,120	75%
Level 1	10,169	22%
Level 2	1,724	4%
Level 3	85	0%
Total	**47,098**	**100%**

Source: elaborated by the authors.

Based on the study of the students' individual proficiency, the results show that, out of 47,098 students, 35,120 (75%) ranked below level 1, or had a proficiency level represented by IRT θ lower than the first range (Level 1) of the proficiency scale (Figure 7), which means that most students are not even able to master the knowledge and minimum skills required for the examination; 10,169 (22%) students are proficient at Level 1; only 1,724 students (1%) at Level 2, and only 85 students master the knowledge required at Level 3.

Similar to studies by Scher et al. (2014), Coelho et al. (2014) and Primi et al. (2011), the application of IRT to the Enade test in Accounting was feasible. Specifically, as performed by Primi et al. (2011), it was possible to establish performance ranges to segregate the types of knowledge were segregated, skills and competencies required to fit students into each range.

5. Conclusion and Suggestions for Future Research

This study aimed to measure the performance (proficiency) of Accounting students on Enade, using IRT. Based on the estimation by means of 3PL, deriving from IRT, the proficiency of Accounting students who took the Enade / 2012 was measured and a standardized scale was created.

The analysis of the items (questions) showed evidence of the test's ability to measure the proficiency of students at different levels of cognitive mastery required by the test. In this context, the IRT demonstrated ability to capture the distribution of Accounting students' proficiency across the levels required by the test.

The survey results showed that the Enade items represent a high degree of difficulty for the group that performed the test. Both in the regional analysis, or based on other characteristics (e.g. parental education, time to study or undergraduate course at public or private HEI), the students' proficiency tends to be low, i.e. below 0, considering the 0.1 scale.

Most students who performed the test did not even show the cognitive mastery of scale Level 1. This result corroborates the low performance of students appointed by the INEP report (2014) for this test and specifically appoints in what aspects and knowledge learning weaknesses can be found. Unfortunately, this negative performance was also observed in previous accounting tests (Santos, 2012). As these assessments are intended to monitor the situation of undergraduate education, it is important that action is taken, involving public policies to revert this situation. In this case, it should be investigated whether the cause of the degree of difficulty of the test items is related to the complexity of the questions or to the inefficient application of educational resources and public policies adopted in HEIs, making the teaching-learning process unsatisfactory.

It is also worth noting that, while studies based on CTT address the issue of performance in an aggregated manner, the analysis by means of IRT permitted the timely identification of the knowledge, abilities and skills required at each level of the scale. When dismembering the proficiency levels, demonstrating the required knowledge, punctual actions of teachers, HEI and the respective authorities are possible, acting on specific aspects in which learning disabilities were demonstrated.

Given the benefits mentioned and presented by IRT in this study, further research related to the determinants of Accounting students' performance could adopt measures provided by models based on IRT as a base for student performance measuring. This analysis would make it possible to study determinants based on different levels of proficiency, contributing to the advancement of studies related to this area.

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Guidelines for Authors

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To submit articles to the *Revista de Educação e Pesquisa em Contabilidade* - REPEc, authors should follow the standards and criteria set by REPEc. From January 2013 the guidelines of the American Psychological Association (APA) with regard to citations and references should be followed. Submissions not complying with the standards will be rejected.

Articles submitted to the journal must be original, i.e., cannot have been published or submitted to another journal.

Articles may be written in Portuguese, English or Spanish, with at least 5,000 and maximum 10,000 words, including tables, figures, notes and references. A maximum of 5 (five) authors are allowed per article. All papers accepted will be translated and published in three languages: Portuguese, English and Spanish.

Articles containing tables or figures, they [the tables and figures] should be in a format that allows them to be edited. In case some of these Figures or Tables have been imported from other programs such as Excel, Power Point etc.., the source file must also be sent as Supplementary File.

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At the moment of submission, the articles should contain:

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- An **abstract** written in the language of origin of the article (Portuguese, English or Spanish) with at least 150 and at most 250 words, single space between lines, in a single paragraph and without paragraph input. At the end of the abstract should be placed **three to five** keywords;
- The article itself, written in Portuguese, English or Spanish, with at least 5,000 and at most 10,000 words, including tables, figures, notes and references.
- The pages of the articles should be properly numbered in the upper right corner, typed with Word for Windows, under the following conditions:

- A4 paper (210 x 297 mm);
- Times New Roman, size 12;
- Spacing: single;
- Paragraph input: 1.25;
- Margins: 3cm top, 2cm bottom, 3cm left, 2cm right;
- Tables and figures in Times New Roman, size 10;
- Citations and references must comply with current standards of the APA (American Psychological Association).

3. Tables and Figures[1]

Tables and figures should be used in articles whenever their information make text comprehension more efficient, without repeating information already described in the text.

3.1 Tables

The table should usually show numeric or textual information organized in an orderly exposition of columns and rows. Any other statement should be characterized as textual figure.

The table should be displayed with its information visible and sufficient for their understanding and should be formatted as follows:

Table editor	Word for Windows 97 or superior. In case authors have drawn their tables in Microsoft Excel or in a similar program, please remake the tables using the feature in Word.
Font	Times New Roman, size 10.
Line spacing	Simple.
Spacing before and after paragraphs	3 pt.
Table colors	Use only black and white (grayscale).
Title	The table title must be brief, clear and explanatory. It should be placed above the table, in the top left corner, and on the next line, just below the word Table (with a capital initial), followed by the number that designates it. The tables are presented with Arabic numerals in sequence and within the text as a whole. Eg: Table 1, Table 2, Table 3, and so on.
Citation of tables	When citing tables in the text, type only the number referring to the table, for example Table 1, Table 2, Table 3 and so on. (the word 'Table' should be presented with the first letter capitalized). Never write 'table below', 'table above' or 'table on page XX' because the page numbers of the article may change while formatting.
Table notes	The font used in the notes of the table should be Times New Roman, size 10, single spaced. The notes should be described in the footnote of the table, and they serve to indicate the Source of the information of the table, and other information important to understanding the table.

1 Most of these guidelines were adapted from the Manual for Submissions of the *Revista de Administração Contemporânea* – RAC, available at www.anpad.org.br.

3.2 Figures

The figure should show a flow chart, a chart, a photograph, a drawing or any other illustration or textual representation.

The figure should be displayed with its information visible and adequate for its understanding, and should be formatted as follows:

Font	Times New Roman, size 10.
Figure colors	Use only black and white (grayscale).
Format	Figures should be submitted in an editable format.
Title	It explains the figure concisely, but discursively. The title should be placed under the figure and numbered with Arabic numerals in sequence, preceded by the word Figure (with initial capital). Eg: Figure 1, Figure 2, Figure 3, etc.. After the title, any other information necessary for clarification of the figure or source must be added as a note.
Captions	The caption is the explanation of the symbols used in the figure and must be placed within the limits of the figure.
Size and proportion	Figures must fit the dimensions of the journal. Therefore a figure should be drawn or inserted into the article so that it can be reproduced in the width of a column or page of the journal to which it will be submitted.
Citations in the main text	When citing a figure in the text type only the number referring to the figure, e.g. Figure 1, Figure 2, Figure 3 and so on. (the word 'Figure' should be presented with the first letter capitalized). Never write 'figure below' figure above ', or even 'figure on page XX' because the page numbers of the article can be changed during formatting.

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