An Assessment of Accountants' Cognitive Abilities

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Abstract: Cognitive Science literature attributes to the cognitive system 1 the intuitive decision, and attributes the reflective decision to the system 2 (KAHNEMAN; FREDERICK, 2002). The intuitive system 1 is fast and straightforward, but it is more subject than system 2 to provide wrong decisions. On the other hand, the reflective system 2 is slower and more effort consuming. Therefore, it is not necessarily bad or good the usage of system 1, but it potentially affects the quality of judgment and decision making. Frederick (2005) developed the cognitive reflection test (CRT), i.e., a simple three item test for cognitive abilities to assess individuals' tendency to override a preponderant response alternative that is incorrect and to engage in further reflection that leads to the correct response. We assessed the CRT scores for a large sample of 11,719 Brazilian accountants, and investigate which demographic characteristics are the most associated with a more reflective (system 2) or intuitive (system 1) behavior. For the multivariate analysis we used the ordered logistic regression model. Findings support the Cognitive Science literature, that higher test scores on the CRT are correlated with gender (male) and age (young). Additionally, we identified that high CRT scores are indeed correlated with the educational level (post-graduate), income (high-income, or well-succeeded), and the type of accountants registration at the CFC (bachelor accountants, not technicians). Results also show that Brazilian professional accountants scored lower than college students from Canada (TOPLAK; WEST; STANOVICH, 2011), Germany (OECHSSLER; ROIDER; SCHMITZ, 2009; HOPPE; KRUSTERER, 2011) and the U.S.A. (FREDERICK, 2005). The findings invite accounting researchers to further investigate the impacts of such a behavior on judgment and decision making in accounting related issues, such as the interpretation of accounting standards and its implementation on the recognition, classification and measurement of transactions.

Key-words: behavioral accounting, judgment, decision making, cognitive abilities, cognitive reflection test, accountant, accounting.

1 Introduction

The exercise of judgment and decision making are fundamental to assure the quality of financial reports; it has been widely recognized in the professional literature and accounting handbooks (EPSTEIN & JERMAKOWICZ, 2009; PRICEWATERHOUSECOOPERS, 2014).

However, in most code law countries, listed companies were required to prepare financial statements in compliance with rules-based accounting standards, usually biased by the fiscal rules (NOBES, 1998; GRAY, 1988), in such an environment, accountants were not trained to reflect deeply about their judgments and estimates, probably because more important than faithfully representing the substance of transactions, would be the compliance with standards and detailed codes (ARDEN, 1997; COLASSE, 1997; HULLE, 1997). It is worth noting that the International Financial Reporting Standards (IFRS) require the disclosure of the judgments made in the process of applying the entity's accounting policies and that have the most significant effects on the amounts presented in the financial statements (IASB, 2013a - IAS 1, item 122). Indeed, the training materials prepared by the IFRS Foundation Education Initiative emphasize the most significant judgments and estimates necessary for properly applying either the Full IFRSs (IASB, 2013a) or the IFRS for SMEs (IASB, 2009).[1]

Even before the adoption of the IFRSs in Brazil, a few academics used to highlight the importance of judgment and decision making in accounting. Iudícibus (1998), for instance, teach that accountants should exercise the subjective allowed by accounting standards with

responsibility. Despite of such an awareness about the significance of judgments and decision making in accounting, and despite of the increasing literature on behavioral accounting (BELKAOUI, 1989; ASHTON & ASHTON, 1995; BONNER, 2008), until date, we do not know much about the accountants' cognitive abilities.

Therefore, in a large-scale survey, we assessed the accountants' tendency (i) to override a preponderant response alternative that is incorrect or (ii) to engage in further reflection that leads to the correct response. Based on Frederick (2005) cognitive reflection test (CRT), we investigated which (and how) demographic characteristics of Brazilian accountants are associated with a more reflective (or intuitive) behavior.

The remaining sections of this paper are organized as follows. The next section presents an overview of the precedent researches on behavioral accounting and judgments and decision making in accounting. Section three presents the CRT and comments on empirical researches that used the same test. The fourth section describes data collection approach, presents the sample of analysis, defines variables, and the model used. The sixth section presents the results. In the last section we discuss the results and present implications for future research.

2 Judgment and decision making in accounting

Psychology and Cognitive Science are mature fields of study, and their interactions with Finance and Economics are also mature (see FREDERICK, 2005; KAHNEMAN, 2011).[2] There are also applications of the psychological research into law (KOROBKIN & ULEN, 2000), and accounting (BELKAOUI, 2004; ASHTON; ASHTON, 1995; BONNER, 2008).

Behavioral Accounting (BA) "emphasizes the relevance of accounting information to decision making as well as the individual and group behavior caused by the communication of this information. Accounting is assumed to be action oriented; that is, its purpose is to influence action, or behavior, directly through the informational content of the message conveyed and indirectly through the behavior of accountants. Because accounting is considered a behavioral process, behavioral accounting can be described as the application of behavioral science to Accounting" (BELKAOUI, 1989, p. xi). Consequently, BA is open for many different researching methods, for example: interviews (BEATTIE et al, 2001; BEATTIE et al, 2012), surveys (GOVINDARAJAN, 1984; HARTMANN; MASS, 2011), and experiments (LIBBY, 1975; ROSMAN, 2011).

On the other hand, Judgment and Decision Making (JDM) research,[3] a sub-field of BA, focus on the behavior of individuals, and intensively uses surveys and experiments, where individuals are the respondents or subjects.

The study of JDM is of special interest in the context of the adoption of principles-oriented accounting standards, such as the IFRS, because the interpretation of such principles requires more intensive cognitive efforts than rules-based accounting standards. In the absence of any relevant reference or empirical evidence to support such a statement, we present three anecdotal evidences that compare the accounting policies generally accepted in Brazil until 2010 with those adopted as a consequence of the implementation of the IFRSs.[4]

Judgment on the recognition and measurement of the allowance for bad debts

The Brazilian fiscal law 4,506/1964 established the maximum amount for the deductible expense (i.e., tax shield) measured as 3% of the annual ending balance of accounts receivable. Later, the law 8,541/1992 reduced such a percentage by a half. Finally, the law 9.249/1995 prohibited the deductibility of the allowance for bad debt expense. There is a common sense that, while permitted, entities used to accrual the allowance for bad debts in their general purpose financial statements at the maximum amount allowed by fiscal rules (i.e., 3% for the period 1965-1992, and 1.5% for the period 1993-1995), and that in 1996 many companies

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stopped recognizing the allowance for bad debts - in financial reports - due to the fiscal rules prohibition. (CARDOSO, 2007, p. 152, note 4.)

Nowadays, there is a debate in the IFRS arena, because the IASB decided to change the recognition criteria of the impairment of financial instruments, from an incurred loss approach to an expected loss approach. Which requires much more cognitive efforts than old 3% and 1.5% rules.

Judgment on the measurement of depreciation

The fiscal rules (i.e., acts issued by the Brazilian Internal Revenue Service, numbers 162/1998 and 130/1999) establish a benchmark for estimating the useful life of items of property, plant and equipment. For instance, such rules suggest 25 years for buildings, 10 years for machinery, and 4 years for cargo dedicated motor vehicles. Until 2010, the Brazilian listed companies used to measure the depreciation expense of their buildings, machineries and vehicles based on a depreciation rate of 4%, 10% and 25%, respectively - on their "general purpose" financial statements.

During 2011 and 2012, the Brazilian market regulator (Comissão de Valores Mobiliários, from now on CVM)[5] required that the management of listed companies to explain why they did not apply the fair value as the deemed cost of items of property, plant and equipments as allowed by IFRS 1.

Judgement on the measurement of fair value

The fair value was introduced in the Brazilian accounting literature with the implementation of the IFRSs.

In 2011, Alexsandro Broedel Lopes, former director of the CVM, commented during a speech at the IFRS Conference[6], that, in 2009, the management of a listed company asked him if the CVM would publish a table of fair values for items of property, plant and equipment similarly to the fiscal rules suggestions for the useful life of such items. Such an example presents anecdotal evidence that judgment and decision making in accounting are still incipient in Brazilian business context.

Despite the theoretical weakness of anecdotal evidences, we are confident that studying the cognitive abilities of professional accountants is a necessary condition in order to improve the consistency of the IFRS implementation, especially in the context of code law jurisdictions that adopted the IFRSs. Indeed, we used Frederick's cognitive reflection test (CRT) to assess the cognitive abilities of Brazilian accountants. The next section describes the CRT.

3 Frederick's cognitive reflection test

CRT was introduced by Frederick (2005). It is criteria to measure how impulsively or more reflectively people make decisions. The CRT consists of three questions to which the intuitive (i.e., impulsive and spontaneous) answer is wrong. Correct answers indicate a higher degree of reflectivity and deliberate thinking. The quintessential item from the CRT was first discussed by Kahneman and Frederick (2002) in an article that reframed the heuristics-and-biases literature in terms of the concept of attribute substitution.

The intuitive answers are attributed to the "system 1" process of decision making, because it is the first answer that respondents' cognition suggests; therefore, system 1 is considered 'fast'. If such an answers is not identified being wrong, the "system 2" is not activated. However, if respondent reflectively tests whether the first answer is wrong and deliberately think about the problem again, she might find the correct answer; therefore, system 2 is considered 'slow' (TOPLAK; WEST; STANOVICH, 2011).

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To conduct the test in this paper, the questions asked to participants were those presented in Table 1.

Table 1 – Cognitive reflection questions applied in order to estimate participants' CRT scores.

1. A bat and a ball cost $110. The bat costs $10 more than the ball. How much does the ball cost?
2. If it takes 5 machines 5 minutes to make 5 widgets, how long would it take 100 machines to make 100 widgets?
3. In a lake, there is a patch of lily pads. Every day, patch doubles in size. If it takes 48 days for the patch to cover the entire lake, how long would it take for the patch to cover half of the lake?

The impulsive and correct answers are:

- Bat & ball: Impulsive answer: $100; correct answer: $50.[7]

- Widgets: Impulsive answer: 100 minutes; correct answer: 5 minutes.

- Lily pads: Impulsive answer: 24 days; correct answer: 47 days.

Frederick (2005); Toplak, West and Stanovich (2011) and other authors form the Cognitive Science literature have shown evidences that the CRT is a more potent predictor of performance on a wide sample of tasks from the heuristics-and-biases literature than measures of cognitive ability, thinking dispositions, and executive functioning. Therefore, in this paper, we rely exclusively on the CRT to assess accountants' cognitive abilities.

4 Methodology
Data collection and sampling

Data were collected via a longer questionnaire developed by some of the coauthors of this article in behalf of the Brazilian Association of Accountants (Conselho Federal de Contabilidade, hereafter CFC). Such a longer questionnaire was entitled "Professional Accountants Profile, edition 2012/13" (CFC, 2013). Questions were classified into two groups: (i) questions related to the profile report, that were developed in the interest of the CFC[8] and (ii) those related to the coauthors academic research interest.

Respondents were recruited via CFC's publications (e.g., newsletter, professional magazine and academic journal), and e-mail market. The target audience was the entire population of professional accountants. In June 2012, the closest data for which the CFC has accrued information, there were 492,664 professional accountants registered at CFC.[9] Hence, CFC invited all professional accountants to answer the questionnaire and sent them the link to access the questionnaire that was available at the internet through Survey Monkey. The invitation message presented the objectives of the research, explained that participation was not mandatory and data would be analyzed in aggregate, emphasized that anonymous was assured and respondents would not receive any reward.

A total of 12,578 professional accountants answered the questionnaire. As a check against respondents answering randomly, we eliminated the observations of respondents who answered unreasonable answers for the three CRT questions, and who did not answer their age or income.

After eliminations, the analyzed sample was comprised by 11,719 professional accountants. Table 2 presents the sample selection steps.

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Table 2 – Sample selection.

Total CRT survey answers:		12,578[a]
(-) Inconsistent answers (A1 ∪ A2 ∪ A3)[b]:		(753)
(-) Answers lower than 10 or higher than 110 for Question 1 (bat and ball) (A1):	(374)	
(-) Answers lower than 2 or higher than 96 for Question 2 (lily pads) (A2):	(269)	
(-) Answers lower than 1 or higher than 500 for Question 3 (machines) (A3):	(318)	
(-) Respondents who did not answer the age question:		(28)
(-) Respondents who did not answer the income question:		(78)
(=) Total of answers considered:		11,719[a]

a. The accounting professionals' population was 492,664 in June 2012, according to CFC database. It means that initial sample (12,578) has 2.6% of the population and the final sample (11,719) 2.4% (CFC, 2013).
b. A1 ∪ A2 ∪ A3 represents the union of inconsistent answers, once some respondents answered inconsistently more than one question.

The model and variables description

In order to achieve the purposes of this paper, namely, investigate which (and how) demographic characteristics of Brazilian accountants are associated with a more reflective (or intuitive) behavior, we apply the Cognitive Reflection Test (CRT) scores and some demographic features as dependent and independent variables, respectively. Prior to entering in modeling matters, we present the variables descriptions in the Table 3.

Table 3 – Variables descriptions.

Variable	Measure
Cognitive Score	Sum of Cognitive Reflection Test (CRT) scores, where each correct answer add one point in a scale that varies from 0 to 3. It's the response (dependent) variable of our model.
Gender	Categorical predictor (independent) variable which assumes 1 (one) if the participant is a woman and 0 (zero) otherwise.
Age	Quantitative independent variable that represents the age of the participants in years.
Register Type	Categorical independent variable that assumes 1 (one) if the participant is registered in CFC as an accounting technician[10] and 0 (zero) if registered as an accountant (i.e., completed the bachelor degree in accounting).
Formal Education Level	Categorical predictor variable with four levels (high school, bachelor, MBA and Phd/Master). For each level we apply a dummy variable assuming 1 (one) if the respondent belongs to that category, and 0 (zero) otherwise, so that each participant is classified in only one category.
Monthly income intervals	Categorical predictor variable with seven levels (until 1,866.00; 1,866.01 - 3,110.00, 3,110.01 - 6,220.00; 6,220.01 - 12,440.00; 12,440.01 - 18,660.00; 18,660.01 - 31,100.00, more than 31,100.00). For each level we apply a dummy variable assuming 1 (one) if the respondent belongs to that category, and 0 (zero) otherwise, so that each participant is classified in only one category.

To assess the relationship among dependent and independent variables stated above the most suitable technic of multivariate data analysis seems to be ordered logistic regression, in

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which, for each unit increased in a given independent variable, the CRT score (dependent variable) is expected to change by its respective coefficient, if the other variables are held constant. On the other hand, it provides another interpretation approach through the odds ratio[11], which is especially useful if the independent variable is a dummy. In our specific case, the probability of a higher cognitive score (3) versus lower (0) is odds ratio value times higher (lower) for the group that assumes value 1 (one) than for the other. For instance, if the odds ratio result for gender is 0.5, then the probability of an individual owning a high CRT score (equal to 3) is 0.5 times lower if it is a woman (according to Table 5, if participant is woman the gender variable assumes the value 1, as described in Table 3), while the other variables are held constant. Still, if the odds ratio result for gender is 1.5, then the probability of an individual owning a high CRT score (3) is 1.5 times higher (not lower) if it is a woman.

The ordered logistic regression model applied in the estimations reported in the following section is stated as at Equation 1.

$$\text{Cognitive Score} = \alpha_0 + \alpha_1 \text{Gender} + \alpha_2 \text{Age} + \alpha_3 \text{Register Type} + \alpha_4 \text{Formal Education Level} + \alpha_5 \text{Monthly income intervals} + \varepsilon \quad (1)$$

It is important to note that such estimation does not have an equivalent to the R-square value found in OLS regression. In spite of that, our main purpose is not to report how much of the cognitive score variance is explained by the predictors, but if and how the predictors are related with the response variable.

5 Accountants' cognitive abilities
Descriptive statistics

Aiming to provide an accurate description of the analyzed data, Table 4 summarizes each variable in details, namely, for each demographic classification of respondents, it presents CRT score mean, standard deviation, the frequency by number of hits[12] and the absolute number of observation per condition.

Among the reviewed literature, the most previous study assessed the CRT scores for samples comprised, almost exclusively, by college students (FREDERICK, 2005; HOPE; KUSTERER, 2011; OECHSSLER et al., 2009; TOPLAK et al., 2011). Thus, Moritz et al. (2013) is the only research we found that assess the CRT scores for professionals, instead of students. They reported a mean CRT score of 1.51 for 313 supply chain managers in which the distribution. The superiority in terms of CRT mean score for Moritz et al. (2013) when compared with the 1.42 CRT mean for Brazilian accountants could be explained by the educational level and/or income level differences between samples. As further analysis shows, such features tend to be positively associated with CRT scores.

On the other hand, Oechssler (2009) found a 2.05 CRT mean for a sample comprised by 1,250 individuals (90% of college students) whose mean age was 24 years, whereas we have only professionals accountants (we do not control for being a student or not) whose mean age is 40.35 years old. The further analysis also shows that age tend to be negatively associated with CRT scores.

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Table 4 – CRT Scores for each accountant group.

| Accountants groups | | CRT Score | | Percentage Scoring 0, 1, 2 or 3 | | | | |
| | | | | "Low" | | "High" | | |
		Mean	St. Dev.	0	1	2	3	n
Gender	Male	1.54	0.99	14.91%	37.88%	25.84%	21.38%	7,794
	Female	1.19	0.91	22.22%	47.59%	19.03%	11.16%	3,925
Age intervals[a]	Age group 18 - 35	1.49	0.98	15.33%	40.49%	24.19%	19.99%	4,742
	Age group 36 - 50	1.4	0.98	17.90%	41.37%	23.07%	17.66%	4,733
	Age group 51 - 88	1.31	0.95	20.50%	41.98%	23.26%	14.26%	2,244
Register type	Accountants	1.49	0.97	15.26%	40.26%	24.71%	19.77%	8,827
	Technicians	1.21	0.94	23.76%	43.78%	20.06%	12.41%	2,892
Formal education level	High School	1.12	0.92	27.30%	43.88%	18.55%	10.26%	1,520
	Bachelor	1.38	0.96	17.84%	42.83%	22.74%	16.59%	5,022
	MBA	1.52	0.98	14.43%	39.37%	25.45%	20.76%	4,519
	Doctor/Master	1.71	0.98	10.79%	33.89%	28.42%	26.90%	658
Monthly income intervals (R$)[b]	until 1,866.00	1.19	0.95	24.54%	44.85%	17.98%	12.63%	2,241
	1,866.01 - 3,110.00	1.3	0.94	20.33%	43.56%	22.21%	13.89%	2,656
	3,110.01 - 6,220.00	1.45	0.95	15.00%	42.17%	25.15%	17.68%	3,654
	6,220.01 - 12,440.00	1.62	0.99	12.74%	36.38%	26.51%	24.37%	2,158
	12,440.01 - 18,660.00	1.67	0.99	11.74%	35.21%	26.85%	26.21%	622
	18,660.01 - 31,100.00	1.78	1.00	11.15%	29.62%	29.27%	29.97%	287
	more than 31,100.00	1.71	1.07	15.84%	27.72%	25.74%	30.69%	101
Total		1.42	0.97	17.36%	41.13%	23.56%	17.95%	11,719

a. The age intervals were applied as additional classification range. It's a quantitative variable in the ordered logistic model.
b. R$ or Real is the Brazilian official currency. As at July 2012 the exchange rate was US$ 1 = R$ 2.29; therefore, a monthly income of R$ 1,866 was equivalent to US$ 814.74; and a monthly income of R$ 31,100 was equivalent to US$ 13,579.01.

In addition to the brief remarks and comparisons about descriptive results presented above, the following sections present the inferential results and an in deep analysis of the association of CRT and demographic data.

Inferential statistics

The following Table 5 presents the estimations of ordered logistic regression model settled in Equation 1.

Notice that the following interpretation relies on the odds ratios at most, while no emphasis is given to the statistical significance of any variable. Partially due to the large sample size, all variables are statistically significant at 0.01%.

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Table 5 – Estimations of ordered logistic regression model.

Variables		Coef.	Odds Ratio	Statistics (z) [a]
Gender		-0.653	0.520	-17.35*
Age		-0.023	0.977	-14.18*
Register type		-0.193	0.825	-3.56*
Education level				
	Bachelor	0.229	1.257	3.3*
	MBA	0.321	1.379	4.27*
	Doctor/Master	0.673	1.960	6.67*
Monthly income				
	1,866.01 - 3,110.00	0.173	1.188	3.23*
	3,110.01 - 6,220.00	0.417	1.517	8.06*
	6,220.01 - 12,440.00	0.730	2.075	12.08*
	12,440.01 - 18,660.00	0.800	2.226	9.12*
	18,660.01 - 31,100.00	1.052	2.864	8.84*
	more than 31,100,00	0.918	2.505	4.73*

a. (*) means statically significant at .01 level.

Gender

In line with previous research (FREDERICK, 2005; HOPPE; KUSTERER, 2011; OECHSSLER et al., 2009), descriptive statistics suggests that men scored significantly higher than women on the CRT, as shown in Table 4. Inferential test, more precisely ordered logistic regression test, strongly confirm such a tendency for Brazilian accountants as shown in Table 5. The odds ratio value indicates that the probability of an individual owning a high CRT score (3) is 0.52 times lower if it is a woman, held constant all other variables.

It is important to mention that Frederick (2005) results kept constant even after the establishment of controls for other cognitive measures, specifically, sampling problems, differences in attention, effort expended to answer and mathematical ability. Moreover, in such a study the "high" CRT group (scores 2 or 3) was composed by two-thirds men, whereas the "low" CRT group (scores 0 or 1) was two-thirds women (FREDERICK, 2005). In the Brazilian accountants' sample, 76% of the "high" CRT group is composed by men, while for the "low" CRT group this ratio is reduced to 60%, despite the larger proportion of men in our sample (66% of the respondents are men, whereas Frederick (2005) did not report the exact proportion of its 3,428 observations, but stated that it was balanced).

Thus, Frederick (2005), in face of a mean CRT score of 1.47 for males versus 1.03 for females, suggests that men are more likely to reflect on their answers and less inclined to go with their intuitive responses. Then, our results present evidences that gender matters. Therefore, gender potentially affect judgment and decision making in accounting environment. Nevertheless, research addressing this specific point is necessary.

Age

Descriptive statistics shown in Table 4 present evidences that CRT scores correlate negatively with age. Note that younger groups of accountants demonstrate higher average CRT levels and, additionally, tend to present lower proportion of individuals in the "low" CRT group. The ordered logistic model estimations shown in Table 5 reinforce such evidence in order that, for each additional year old, the CRT rates of Brazilian accountants tend to decrease by 0.023, if all other variables are kept constant. Indeed, younger accountants (i.e., up to 35 years old) represent 43% of the high CRT group (i.e., scores 2 or 3), while respondents older than 50 years old represent only 17% of this group. On the other hand, younger accountants represent 39% of the low CRT group (i.e., scores 0 or 1), while respondents older than 50 years old represent 20% of this group.

Our results are as expected by Kahneman (2011) and Moritz et al. (2013), which coherently noted that some individuals may have skills and experience in making repeated decisions along years on end. In such settings, the intuitive system may play a decisive role in the judgment and decision making.

In this sense, facing age as a proxy for experience and taking into account the Frederick (2005) conclusion that CRT is a measure to avoid acting based on the initial response to a problem, then, our results suggest the older accountants tend to judge and decide more intuitively than the younger accountants. Despite the literature posits that experience may moderate bad decisions arising from this, in unexpected new situations in which no previous knowledge can be retrieved, accountants can simply underestimate the complexity involved taking wrong decisions. It seems likely to occur specially in an environment marked by accounting complexity[13] as has been witnessed in Brazil since the IFRS adoption.

Register Type

To date, in Brazil, there are two types of professional registrations: technicians[14] and professional accountants (graduated from a bachelor in accountancy). In accordance with the law that regulates the profession[15], until 1st Jun 2015, professionals that conclude the technical high school in accounting can be registered as technicians at the CFC. After 1st Jun 2015, only those who conclude the bachelor in accountancy will be able to register at CFC as professional accountants. Therefore, in order to reflect and explain Brazilian reality, our sample is comprised by both, technicians (25%) and bachelor accountants (75%).

Both technicians and professional accountants are allowed to sign the financial reports of the companies. However, technicians cannot audit financial reports.

The descriptive results in the Table 4 show that mean CRT score is 1.49 for bachelor professionals, whereas 1.21 for technicians. Moreover, the proportion of individuals in the lower CRT scores is greater for technicians. Such results are corroborated for the ordered logistic regression estimations, which present evidences that the probability of a professional owning a high CRT score (3) is 0.825 times lower if he (or she) is a technician. This conclusion comes from the odds ratio value reported in the Table 5, if we hold constant the others variables.

Then, the results prove that bachelor professionals are more likely to access system 2 (reflective) when taking decisions than technicians. Notwithstanding, note that being registered as a technician does not mean that the individual completed only the high school degree. Indeed, the technician group in our sample is comprised by 52% of respondents in the high school condition, whereas, among the other 48%, 34.5% completed the bachelor level,[16] 12% own a MBA degree and 1.5% completed master's degree or doctorate course.

Such heterogeneity in education level of accounting professionals of both categories led us to address this feature in details, as follows.

Formal education level

Our results are strong in the sense that Brazilian accounting professionals in the lower levels of formal education tend to apply System 1 in the decision making process more than those in the higher levels. Thus, the lower the educational level of the professional, the greater the chance it will make decisions intuitively.

The inferential results in Table 5 endorse the tendency observed in descriptive statistics presented in Table 4, so that, held constant all other variables, the probability of an accountant owning a high CRT score (3) is 1.257 times higher if he (or she) completed the graduate level (bachelor). The odds ratio values also indicate that this probability increases 1.379 times if the education level is MBA completed and reach 1.96 if the professional completed master's degree or doctorate program. All this comparisons are related to professionals who completed only the technical high school.

Furthermore, it seems that in fact, cognitive reflection score is tightly associated with formal education level, because controlling for register type, namely, analyzing only respondents technician condition, we found the mean CRT score is: (i) 1.61 for technicians who completed master's degree or doctorate course; (ii) 1.45 for those that attended MBA; (iii) 1.25 for accounting bachelors; and (iv) 1.11 for those who completed only the technical high school. Whereas, if we take only bachelor professionals, the numbers are 1.72, 1.53 and 1.41,[17] respectively, what demonstrates that both variables, register type and formal education level, are important to understand the accountants' cognitive abilities. Additionally, based on Table 4, it is possible to identify that among the professionals that have at most the bachelor degree, 63% have a low CRT score (i.e., scores 0 or 1) and, on the other hand, among professionals that have at least the MBA as a post-graduate degree such a percentage drops to 53%.

No other similar analysis was found among the reviewed literature, then, it is not possible to draw comparisons in terms of the relationship between cognitive reflection score and education level, as well as between CRT and register type, once the latest is a peculiarity of Brazilian institutional environment.

Monthly income

A pronounced positive association was found between cognitive reflection score and monthly income for Brazilian accountants. The descriptive results stated in Table 4 point out an approximately linear increasing of the mean CRT score according to income growth, except for the last two income intervals, in which we observe a slight decrease.

Such tendency was also clear in the ordered logistic regressions estimations. Interpreting the results shown in Table 5, especially the odds ratio values, the probability of getting the highest cognitive score (3) is 1.188 times greater for accountants who earn between R$ 1,866.01 and 3,110.00 when compared with professionals in the first interval (until R$ 1,866.00), if we hold constant all other variables. The odds ratio grows up along the increasingly income ranges until reach a top in which the probability is 2.864 times higher for professionals in the 18,660.01 - 31,100.00 income condition in comparison with the former interval. A slight decrease of the growing CRT tendency is once again observed for the highest income range, confirming the descriptive findings.

Thus, the evidences presented are in the sense that accountants with higher monthly incomes tend to apply the more reflective system of cognition in the judgment decision making. Despite we have no further empirical prove, this results can hold relation with the

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fact that positions of greater responsibility tend to be better rewarded, as well as the judgments and decisions demanded from 'better succeeded' professionals may contain greater complexity, thus probably requires more reflective abilities.

6 Concluding remarks

Judgment and decision making in accounting is an increasing avenue of research (BONNER, 2008), however, in its 40 decades of relevant publication, we did not have a large-sample assessment of accountants' cognitive abilities. This paper provides such an assessment in regard to the cognitive reflection test developed by Frederick (2005). Indeed, we analyze CRT scores in relation to demographic variables such as gender, age, type of registration, formal education level, and income.

Either based on the analysis of proportions or on the ordered logistic regression's odds ratios, the results suggest that (i) young, (ii) male, (iii) post-graduated, (iv) high-income and (v) those professionals registered as bachelor accountants make more reflective decisions than (i) mature, (ii) female, (iii) not bachelor, (iv) low-income and (v) professionals registered as technicians. According to Kahneman and Frederick (2002), Frederick (2005) and Kahneman (2011), intuitive answers are attributed to the fast 'system 1', while reflective answers are attributed to the slow 'system 2'. Individuals that are more intuitive use to rely more frequently on the answers provided by system 1. Therefore, the results show that mature, female, low-income professionals registered as technicians tend to be more confident on their system 1, than the other group of accountants.

Even if the working sample represents only 2.4% of the Brazilian population of accountants, it is reasonably balanced in terms of accountants' gender, age, educational level, income and type of registration. It is also well balanced in terms of the geographic distribution over the Brazilian territory. Notice that Brazil has continental dimensions and its territory is politically divided among 27 federal states. Our sample has respondents from each state (data not presented in the paper, see CFC, 2013). Therefore, the working sample fairly and qualitatively represents the population of Brazilian accountants.

Except by the variable *register type*, which classifies accountants as technicians or bachelor accountants, all other variables are suitable for classifying accountants from any jurisdiction. Therefore, the results presented in this paper may be of interest of a wide audience, not only those interested in the Brazilian context.

Further international research could investigate if the findings presented in this paper are similar to those that could be obtained in other jurisdictions, especially in countries which environment are similar to the Brazilian environment. For such an assessment, the frameworks presented by Gray (1988) or Nobes (1998) could be of great use.

Further research on judgment and decision making in accounting could investigate if the CRT score is associated with heuristic-bias and specific decision in the accounting context. For example: (i) the interpretation of verbal probabilities (DOUPNIK; RICHTER, 2003 and 2004; DOUPNIK; RICCIO, 2006) is associated with the accountants' cognitive abilities?; (ii) the classification of items in accordance with vague standards (PENNO, 2008; CARDOSO; AQUINO, 2010) is associated with the accountants' cognitive abilities?; (iii) the identification of impression management (MERKL-DAVIES; BRENNAN, 2011; JONES, 2011) is associated with the accountants' cognitive abilities?.

Researchers interested in 'Accounting and Gender' could investigate the association of CRT scores and the fact that women hired into public accounting were not progressing up the ranks as expected (DALTON; HILL; RAMSAY, 1997).

Researchers interested in 'Accounting Education' could further investigate the association of CRT scores and the formal education; and those interested in 'Accounting Career' could investigate the association of CRT scores and individual's income.

Additionally, researchers not interested in Accounting, but in Cognitive Sciences, could analyze the impact of respondents' recruitment strategy on the CRT scores. Notice that, different from the majority of the researches that assessed CRT score recruited college students and offered them a monetary reward, we recruited professional accountants and did not offer them any monetary reward. The CRT scores reported in this study are lower than the score presented in the reviewed literature.

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[1] Please, refer to IASB (2013b); also refer to the IFRS Foundation continuing professional development training material (available at http://www.ifrs.org/Use-around-the-world/Education/CPD/Pages/CPD-training-

material.aspx), and the training modules on the IFRS for SMEs (available at http://www.ifrs.org/IFRS-for-SMEs/Pages/Training-material.aspx).

[2] Indeed, Daniel Kahneman received the Noble Prize in 2002 "for having integrated insights from psychological research into economic science, especially concerning human judgment and decision-making under uncertainty" (source: http://www.nobelprize.org/nobel_prizes/economic-sciences/laureates/2002/kahneman-facts.html).

[3] Bonner (2008, p.2) defines *judgment* as "forming an idea, opinion, or estimate about an object, an event, a state, or another type of phenomenon", and defines *decision* as "making up one's mind about the issue at hand and taking a course of action".

[4] The first set of financial statements prepared by Brazilian listed companies in accordance with the IFRS was related to the fiscal year ended 31 December 2010, with data from 2009 presented for means of comparability. The convergence towards IFRS was mandatorily required by law 11,638/2007.

[5] CVM has powers and responsibilities similar to those carried out by the U.S.A. Securities and Exchange Commission.

[6] IFRS Conference in Latin America and the Caribbean, São Paulo, 27 and 28 October 2011.

[7] Frederick's originally worded the bat & ball question as follows: "A bat and a ball cost 110 cents. The bat costs 100 cents more than the ball. How much does the ball cost?". Therefore, the impulsive answer is 10 cents and the correct answer is 5 cents (Frederick, 2005). Silva (2005), who first submitted the CRT questions to Brazilian respondents, adapted the values to became more realistic in comparison to the general prices in the Brazilian market, but the gist were keep in the way that do not influence on the result. We decided to apply the Silva (2005) version.

[8] The report is available at http://portalcfc.org.br/wordpress/wp-content/uploads/2013/12/livro_perfil_2013_web2.pdf.

[9] Notice that in Brazil, professional accountants are required by law to register themselves at the CFC in order to properly provide accounting services.

[10] We present further information about such a classification in the section 5.

[11] Odds ratio = e^c, where c is the variable coefficient.

[12] CRT scores 3 for the respondents that answered all 3 questions correctly; 2 for respondents that answered 2 questions correctly; 1 for respondents that answered only 1 question correctly; and 0 for respondents that did not answer any question correctly.

[13] Beattie et al. (2011, p. 14-16) present a large body of studies that supports the IFRS complexity.

[14] Technicians refer to professionals who graduated from a technical high school, what means they passed through an accounting apprenticeship while in high school.

[15] The laws that regulate the accountancy profession are decree-law 9295/1946 and law 12249/2010.

[16] Those technicians that hold a bachelor degree, probably, graduated in another field (e.g., Economics, Law, Business Administration etc.).

[17] Obviously, there is no bachelor professional whose higher level of education is the high school.