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FINANCIAL ECONOMICS | RESEARCH ARTICLE

Individual differences and cognitive reflection across gender and nationality the case of the United Arab Emirates

Ray Saadaoui Mallek^{1*} and Mohamed Albaity¹

Abstract: This study aims to investigate the effect of gender differences and nationality on the Cognitive Reflection Test (CRT), as well as behavioural biases. A sample of 770 questionnaires was collected from undergraduate business students in public and private universities across the United Arab Emirates. The results suggested that low CRT values were dominant in males and females alike for non-UAE citizens in the age group of 18–22 years old, of whom at least one of the parents had a college degree. Subjects with higher cognitive reflection scores were significantly more likely to exhibit overconfidence, risk preference, and risk illiteracy. In addition, females scored lower than males, and non-UAE citizens scored higher than local citizens in the CRT. However, further analysis of the interaction between gender and nationality revealed that local females scored on average higher than non-UAE females.

Subjects: Middle East Studies; Gender Studies; Individual Differences/IQ; Cognition & Emotion; Behavioral Psychology; Investment & Securities

Keywords: Cognitive Reflection Test; gender effects; dual processes; risk literacy; risk preference

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PUBLIC INTEREST STATEMENT

The cognitive Reflection Test is a commonly used test to measure to what extent and how individuals are able to override their initial decision and move to a more rational decision when faced with problems. Our study investigates the disparity in gender and nationality on the Cognitive Reflection Test (CRT), as well as behavioural biases based on 770 questionnaires collected from undergraduate business students in public and private universities across the United Arab Emirates. The results suggested that subjects with higher cognitive reflection were significantly more likely to exhibit overconfidence, risk preference, and risk illiteracy. In addition, females scored lower than males, and non-UAE citizens scored higher than local citizens in the CRT. However, further analysis of the interaction between gender and nationality revealed that local females scored on average higher than non-UAE females.

1. Introduction

The assumption of rationality in the classical economic school of thought predicts that if the economy is in a downturn it will automatically adjust and normalise the negative impact. Similarly, if the economy is in an upswing it is not possible for investors to make abnormal profits in the asset market. Another theory that manages to explain why these outcomes occur is related to behavioural economics.

Behavioural economics has shed light on this issue by combining psychology with economics (DellaVigna, 2009; Gul & Pesendorfer, 2008; Mullainathan & Thaler, 2001). The theory suggests that people's decisions are influenced by heuristics and behavioural biases. Behavioural biases such as framing, anchoring, herding, regret, availability, and representativeness have been heavily investigated in the past decade especially after the global financial crisis (Cueva & Rustichini, 2015; Gerardi, Goette, & Meier, 2013; Kiss, Rodriguez-Lara, & Rosa-García, 2016). Behavioural biases affect people's process of decision-making and in turn their final decision. Studies have also shown that cognitive ability is a very important factor that affects people's lives and their achievement (Benjamin, Brown, & Shapiro, 2013; Choi, Lee, & Cioffi, 2011; Jensen, 1998; Oechssler, Roider, & Schmitz, 2009; Van Rooij, Lusardi, & Alessie, 2011a, 2011b). People will react differently to the same problem and therefore their decisions will have a different impact on their lives (Korniotis & Kumar, 2013). This can sometimes be explained by their cognitive ability. Studies show that cognitive ability influences behavioural biases (Agarwal & Mazumder, 2013; Benjamin et al., 2013; Gerardi et al., 2013; Grinblatt, Keloharju, & Linnainmaa, 2012; Oechssler et al., 2009). One commonly used test to measure cognitive ability, developed by Frederick (2005), is the cognitive reflection test (CRT). According to Kahneman (2011), cognitive reflection measures to what extent and how individuals are able to override their initial decision and move to a more rational decision when faced with problems.

Frederick (2005) showed that in financial decision-making, risk and time preferences were closely related to cognitive ability. In other words, individuals with a high CRT score are more patient and risk-loving compared to individuals with a low CRT score. Some studies have indeed found a relationship between the CRT score and behavioural biases (Albaity, Rahman, & Shahidul, 2014; Cokely & Kelley, 2009; Toplak, West, & Stanovich, 2011). For example, Corngnet, Hernán-González, Kujal, and Porter (2014) found a positive relationship between CRT scores and the earnings in asset markets. Frederick (2005) and Toplak et al. (2011) showed a positive relationship between CRT scores and general measures of intelligence. Other studies documented that risk and time preferences were linked with CRT scores (Brañas-Garza, Garcia-Muñoz, & González, 2012; Frederick, 2005; Oechssler et al., 2009). With regards to gender differences, various studies have investigated and confirmed the difference of CRT scores between males and females in different samples (Campitelli & Gerrans, 2014; Pennycook, Fugelsang, & Koehler, 2015; Primi, Morsanyi, Chiesi, Donati, & Hamilton, 2016). Although a difference in CRT scores exists between the genders little research has carried out an in-depth analysis of the source of the gap in CRT scores due to gender (Primi, Donati, Chiesi, & Morsanyi, 2018).

In addition, previous research has reported that a difference in CRT scores exists based on gender, race and nationality. For instance, Albaity et al. (2014) and Albaity, Rahman, and Isa (2015) investigated gender, race, age, and nationality in Malaysia and found that males scored significantly higher than females and that Chinese students scored higher than Malay students in the CRT. Frederick's (2005) results showed that the difference between males and females in the CRT persisted, even along with the control of SAT math scores. Several independent studies have since integrated the gender effect (Albaity et al., 2015; Campitelli & Gerrans, 2014; Pennycook et al., 2015; Primi et al., 2016; Zhang, Highhouse, & Rada, 2016). Some have postulated that the gender gap in CRT performance may be ascribed to intensified anxiety toward solving mathematical problems (Primi et al., 2018). Albeit the gender effects in the CRT seem to be robust across various studies, not many studies have considered the basis of the gender gap in performance. Though the research on gender dissimilarities in decision-making styles has been inconsistent,

several studies have explained that women score higher than men on intuitive type 1 processes, and lower on rational type 2 processes (Najmaei, 2014). This study seeks to understand the basis of gender differences across nationality in the CRT and on behavioural biases. Eckel and Grossman (2008) and Croson and Gneezy (2009) concluded in their research that women were more risk-averse when compared to men. On the other hand, Sarin and Wieland (2016), Eckel and Grossman (2008) and Tanaka, Camerer, and Nguyen (2010) found that there was no significant difference in gender with regards to risk aversion. Some might argue that the level of financial literacy or risk literacy plays a role in people's ability to make rational decisions. Studies have found that a higher level of financial literacy is correlated with savings behaviour for retirement and holding stocks (Fornero & Monticone, 2011; Lusardi & Mitchell, 2011; Van Rooij et al., 2011a). Others have found that low levels of numeracy and financial literacy are related to low stock market participation, higher rates of loan defaults and high levels of misunderstanding about investment risk (Bateman et al., 2015; Christelis, Jappelli, & Padula, 2010; Gerardi et al., 2013; Van Rooij et al., 2011a).

Another important variable that is crucial to decision making is the level of confidence. Confidence is a very important trait in any context. For example, confidence is a driver of career success (Koellinger, Minniti, & Schade, 2007) as well as for individual well-being (Pirinsky, 2013; Taylor & Brown, 1988). On the other hand, overconfidence is a type of bias that might lead to a deviation of one's own abilities as well as relative to peers. Being overconfident might lead to positive as well as negative outcomes. For example, overconfidence can lead to positive impacts on ambition, morale and persistence (Johnson & Fowler, 2011; Ring, Neyse, David-Barett, & Schmidt, 2016). On the other hand, Barber and Odean (2001) found that overconfident investors diluted their payoff by trading excessively. Others found that those who were overconfident about their chances of success tended to engage excessively in competitive situations or they had less reaction to negative news leading to lower earnings (Camerer & Lovallo, 1999; Trinugroho & Sembel, 2011). With regards to the overconfidence link to the CRT, Hoppe and Kusterer (2011) found that subjects with higher CRT scores had significantly more precise self-assessment. In other words, individuals with high cognitive ability are not as overconfident as those with low cognitive ability. When testing gender differences Ring et al. (2016) found that males thought that they were better performers than their peers, however the same was not true among females.

Therefore, the purpose of this study is twofold. Since there are no previous studies linking gender and nationality to CRT performance, risk literacy and time and risk preferences, the first is to test the effect of gender and nationality differences on CRT performance and behavioural biases in a representative United Arab Emirates (UAE) college student sample. The second purpose is to investigate whether the CRT scores and behavioural biases are different across the interaction between gender and nationality.

The contribution of this study is as follows. First, the study contributes to the current literature by examining the differences in gender and nationality in the UAE. This is important for two reasons. First, the results of this paper can be generalised to the economies in the Gulf Cooperation Council (thereafter GCC) countries since they have the same culture and worldview. These countries are classified as collectivist according to the Hofstede individualism indicator. Second, these economies used to be oil-dependent; however, these countries are moving away from oil dependency especially due to the fall in oil prices. Hence, the financial services sector is one of the sectors that is growing in the GCC region and it is important for investors as well as for fund managers to learn more about the behaviour of their prospects. Third, the UAE Economy has grown vastly over the past 20 years and part of this growth has been accomplished by growth in the investment in financial assets. For example, the total value of the stock market as a percentage of GDP increased from 0.78% in 2003 to 26% in 2009. However, due to the global financial crisis, this rapid growth reversed to reach 5.5% in 2013. It is clear that the economy did not react immediately to the crisis and when the reaction occurred the economy did not bounce back that fast. Therefore, it is imperative for policymakers to acknowledge the fact that there are things that influence the behaviour of investors, whether they are individual or institutional.

2. Data and method

2.1. Participants

In this study, a questionnaire that included statements addressing the three CRT questions—as well as questions targeting behavioural biases such as risk preference, time preference, risk literacy, and overconfidence was distributed. The total number of questionnaires distributed was 1000 however only 880 questionnaires were returned. Out of these only 770 questionnaires were usable in the analysis (see Appendix A for the questions). The 110 questionnaires that were eliminated were due to them either being incomplete or because some of the respondents had seen some of the questions before. The participants were undergraduate business students from public and private universities across the UAE. All students participated voluntarily and gave their consent before engaging in the study. To ensure further anonymity, no personal information other than gender and nationality was included in filling out the questionnaire. The questionnaire was conducted in English since this is the medium of instruction at all UAE universities. The analysis consisted of running the t-test, ANOVA and cross tabulation tests to examine the proposed hypothesis of this study.

Prior studies on consumer behaviour research have found a significant accuracy of student responses when compared to other consumers. Many articles in behavioural finance, economics, and psychology have used students as their sample (Elliott, Hodge, Kennedy, & Pronk, 2007; Finney & Finney, 2010; Inman, 2007; Noussair, Trautmann, & Van de Kuilen, 2013; Statman, 2008; Weber, Blais, & Betz, 2002; Wood & Zaichkowsky, 2004). Ariely and Jones (2012) indicated that student participation was acceptable and reliable based on different reasons. First, young adults act very similarly compared to the working older regarding their core actions. Second, the endowment effect influences both students and experienced people. Finally, students and experienced individuals operate their brains and decision-making techniques under the same restrictions.

2.2. Measures

2.2.1. Cognitive reflection test

Cognitive ability is assessed by means of a three-item cognitive reflection test (CRT), as introduced by Frederick (2005). To this end, each of the three items of the CRT has an apparently impulsive (but wrong) answer that quickly springs to mind, and a reflective (but correct) answer that is easy to understand when explained. However, arriving at the right answer may necessitate overriding the initial, impulsive answer. Therefore, the test is intended to measure an individual's ability to be involved in cognitive reflection, and consequently to resist conveying the spontaneous but incorrect answer.

A wide array of research in the areas of judgment and decision-making, as well as memory and reasoning, has demonstrated that the consequences of cognitive processes often thoroughly deviate from what is normatively considered to be rational behaviour. It was in the late 1990s that scholars became aware of the substantial variability across participants on each of the cognitive bias tasks (Cavojová, 2016; Schulze & Newell, 2016; Toplak et al., 2011). Thus, individual differences play a key role in the deviation between the outcomes of cognitive processes and those of normative models that have resulted in the growing body of correlational research of cognitive biases.

2.2.1. Risk preference

While as expected the utility theory considers individuals to be risk-averse, the prospect theory claims that people will be more eager to take risks to avert losses than to attain gains; that individuals will shift from risk aversion to risk-seeking behaviour when the parity of a gamble alters from positive to negative (Kahneman & Tversky, 1979). With respect to cognitive abilities, subjects with high CRT scores are significantly more eager to gamble compared to their counterparts (Frederick, 2005; Noori, 2016). The experiments of Dohmen, Falk, Huffman, and Sunde (2010) showed that high scoring CRT subjects were significantly more willing to take risks and that the correlation between risk aversion and cognitive ability existed for both males and females, and for young and old, though the relationship was weaker for females and younger individuals. Oechssler

et al. (2009) found that the high scoring CRT group tended to choose options that were risk neutral. The risk preference question, in this study, measures whether the individual is comfortable with safe investments or with risky investments.

2.2.3. Time preference

Several studies have supported the idea that smart people exhibit more patience (Oechssler et al., 2009). Benjamin et al. (2013) found that a group with a higher SAT math score was willing to choose a larger and later reward over a smaller earlier one. A comparable result was found when using the CRT test instead of the SAT math test (Albaity et al., 2014; Frederick, 2005). Dohmen et al. (2010) found that the high-scoring CRT group was significantly more patient and that the correlation between cognitive ability and patience existed for males rather than for females, and for young and old, though the relationship was weaker for younger individuals. The time preference question, in this study, measures whether individuals are willing to wait for a higher return compared with taking a lower return now.

2.2.4. Overconfidence

The overconfidence bias is a common behaviour in which people overvalue their capabilities to accomplish a particular task effectively (Brenner, Koehler, Liberman, & Tversky, 1996). With respect to cognitive abilities: while the more analytical decision makers are relatively more successful in evaluating the right number of correct answers, intuitive decision makers seem to be overconfident (Hoppe & Kusterer, 2011; Noori, 2016). In this study, the participants were asked five general knowledge questions. After responding to each of the items, the participants were requested to assess their degree of confidence to guess the number of correct answers. For the overconfidence question, we classified the answers into three groups by comparing the number of effective correct answers to the expected correct answers out of the five statements. If the respondent said five but effectively had only two correct answers, then they were considered overconfident, and vice versa.

2.2.5. Risk literacy

The Berlin Numeracy Test is a new psychometrically robust instrument designed to quickly assess statistical numeracy and risk literacy (Cokely, Galesic, Schulz, Ghazal, & Garcia-Retamero, 2012). It has been shown that numeracy is important in a range of everyday decisions and that low numeracy raises susceptibility to a variety of cognitive biases and fallacies, even when common intelligence is controlled (Peters et al., 2006). Four questions were adopted from Cokely et al. (2012) and Ghazal, Cokely, and Garcia-Retamero (2014) to measure the level of risk literacy. To create the risk literacy variables, the questions with correct answers were re-coded for the correct answers, therefore, creating 4 individual variables.

3. Results and discussion

The results of the study are reported in this section. We start with Table 1 which describes the demographic profile of the respondents. The majority of the respondents were females, non-local, between 18–22 years old, of whom at least one parent had a college degree. This profile was expected since most of the students were undergraduates.

Table 2 below reports the mean scores of the wrong and right answers for the three CRT questions. The responses to the three CRT questions are divided into two groups, either the

Table 1. Demographic profile of the respondents

Characteristic	Percentage
Female	60%
18-22	76%
Non-UAE	65%
At least one parent have college degree	69%

Table 2. The percentage of correct answers, mean scores and standard deviation for CRT questions

Questions	% Correct answer	% Wrong answer	Mean p-value	Std. Dev.
Bat & ball	34.3	65.7	0.34 0.000*	0.84
Widgets	25.1	74.9	0.25 0.000*	0.34
Lily pads	20.2	79.8	0.20 0.000*	0.40

Note: *,**and *** indicate significance at 1%, 5% and 10% respectively.

respondents scored high ability with 2 or 3 correct answers or low ability with 1 or 0 correct answers. One sample t-test was performed to examine whether the mean score of the correct answer for each question was significantly different from zero. The results suggested that all of the mean scores were significantly different from zero. Based on these results, it was clear that the number of correct answers decreased, the more computationally challenging that the questions became. For example, the mean score of the correct answer for question 1 was 0.34, while the mean score of the third question was 0.20.

In our sample, 52% of the subjects answered none of the questions correctly, 25% knew the correct answer to one question, 15% to two questions, and 8% answered all three questions correctly. On average, the subjects answered less than one (0.80) of the CRT questions correctly.

Table 3 shows the mean difference using the t-test for the CRT questions across gender, nationality, and the interaction between gender and nationality. The results for gender differences indicated that male subjects scored higher than female subjects in the three CRT questions. This result is similar to Albaity et al. (2015) and Noori (2016), who found that males, on average, scored higher than females. Some have hypothesised that the gender gap in CRT performance may be ascribed to enhanced anxiety toward solving mathematical problems (Primi et al., 2016).

In terms of nationality, non-UAE nationals scored higher than UAE citizens in all of the questions. Most of the studies conducted on CRT have focused on demographics such as gender, race, and

Table 3. Gender, nationality and their interaction mean difference test for CRT questions

Characteristic	Bat & ball (Q1)	Widgets (Q2)	Lily pads (Q3)
Male	0.51	0.35	0.33
Female	0.25	0.20	0.13
t-value	7.25*	4.48*	6.48*
UAE	0.22	0.20	0.09
Non-UAE	0.40	0.27	0.25
t-value	-5.03*	-2.20**	-5.77*
Female*Non-UAE	0.29	0.21	0.16
Female*UAE	0.38	0.28	0.23
t-value	3.00*	2.28**	2.65*
Male*Non-UAE	0.60	0.38	0.42
Male*UAE	0.26	0.21	0.13
t-value	-8.71*	-4.29*	-7.52*

Note: *,**and *** indicate significance at 1%, 5% and 10% respectively.

age, while few have investigated the effect of nationality on CRT questions (Albaity et al., 2014). Nationality is important, since 89% of the population of the UAE is made up of foreigners, and there are a variety of schools to accommodate specific nationalities. While there are (to our knowledge) no studies linking nationality to CRT questions, we believe that studies carried out on the link between race and CRT scores are relevant. For example, Albaity et al. (2014) found that Malaysian Malay nationals and Malaysian Indian nationals scored lower than Malaysian Chinese nationals in CRT questions. This could potentially be attributed to the different educational backgrounds of Malay, Indian, and Chinese citizens (who attend different schools), in spite of their shared Malaysian citizenship. In the same vein, our results indicated that the difference could have arisen from the fact that the majority of locals attend public schools, while the majority of other nationalities attend international schools. These schools have different syllabi and the outcome would therefore differ.

Table 4 below shows the comparative results between genders for the risk and time preferences, risk literacy, overconfidence and the CRT questions. The results suggest the existence of a difference between males and females in terms of risk preference, risk literacy and overconfidence. In all cases, the difference is towards males. For example, males appear to be more risk-loving than females (Halko, Kaustia, & Alanko, 2012). In addition, among the four questions of risk literacy, three were found to be significantly different between males and females. The mean score suggested that males were on average more risk literate than females. The same trend appeared when we aggregated the risk literacy questions (Primi et al., 2018). Similarly, females scored a lower mean in overconfidence than males. This is in line with previous findings that indicated that males usually exhibit higher overconfidence than females (Barber & Odean, 2001; Bengtsson, Persson, & Willenhag, 2005). Lastly, the CRT questions showed that males scored higher than females in all of the questions. These results corroborate the results found by Campitelli and Gerrans (2014), Pennycook et al. (2015), Primi et al. (2016). Some have postulated that the gender gap in CRT performance may be ascribed to intensified anxiety toward solving mathematical problems (Primi et al., 2016).

Carrying out the same analysis on nationality revealed a similar result to the gender result with the exception that the overconfidence effect disappeared when nationality was considered (Table 5). Local respondents were inclined to be risk takers, were less risk literate, were less overconfident, and had lower cognitive abilities than non-UAE respondents.

In order to avoid sampling bias, we carried out an in-depth analysis of gender and nationality. We multiplied the gender by the nationality to obtain more detailed results.

Table 4. Behavioural biases and cognitive reflection test by gender

Behavioural biases and CRT	Gender		
	Male (Mean)	Female (Mean)	Mean difference p-value
Risk Preference	0.35	0.24	0.00*
Time Preference	0.64	0.59	0.16
Risk Literacy Q 1	0.14	0.08	0.00*
Risk Literacy Q 2	0.19	0.10	0.00*
Risk Literacy Q 3	0.13	0.10	0.15
Risk Literacy Q 4	0.12	0.06	0.00*
Risk Literacy total	0.59	0.33	0.00*
Overconfidence	0.48	0.37	0.00***
CRT	0.37	0.16	0.00*

Note: *,**and *** indicate significant at 1%, 5% and 10% respectively.

Table 5. Behavioural biases and cognitive reflection test by nationality

Behavioural biases and CRT	Nationality		
	UAE (Mean)	Non-UAE (Mean)	Mean difference p-value
Risk Preference	0.33	0.26	0.03**
Time Preference	0.57	0.62	0.15
Risk Literacy Q 1	0.07	0.11	0.05***
Risk Literacy Q 2	0.05	0.17	0.00*
Risk Literacy Q 3	0.07	0.13	0.02**
Risk Literacy Q 4	0.07	0.09	0.35
Risk Literacy total	0.26	0.50	0.00*
Overconfidence	0.38	0.42	0.30
CRT	0.13	0.28	0.00*

Note: *,**and *** indicate significant at 1%, 5% and 10% respectively.

Table 6 reports the results of these interactions, in terms of risk-taking; the significant results indicated that female non-nationals were risk-averse, compared to the national female subjects. Risk literacy did not show a consistent trend between female non-nationals compared to female nationals and it was not significantly different. Female non-nationals were found to be significantly more overconfident than their counterparts. For the CRT questions, female nationals scored significantly higher than their counterparts. On the other hand, Table 7 shows that male non-nationals had a higher risk preference and time preference than nationals. Similarly, male non-nationals were more literate about risk than male nationals. Male non-nationals were more overconfident than male nationals. Lastly, regarding the difference of the CRT questions, the results suggested that non-nationals scored higher on average than nationals.

Table 8 compares the results of the low and high CRT scores against the behavioural biases. Our results demonstrated that high CRT scorers were more willing to take risks than their counterparts. With regard to the risk literacy, the result suggested that most of the correct answers were skewed towards high CRT scorers, which supported their risk preference behaviour. Lastly, high CRT subjects were more overconfident compared to low CRT scorers.

Table 6. Behavioural biases and cognitive reflection test by female/nationality

Behavioural biases and CRT	Female*Nationality		
	FN (Mean)	FNN (Mean)	Mean difference p-value
Risk Preference	0.32	0.22	0.00*
Time Preference	0.62	0.58	0.26
Risk Literacy Q1	0.11	0.08	0.18
Risk Literacy Q 2	0.14	0.12	0.28
Risk Literacy Q 3	0.11	0.12	0.49
Risk Literacy Q 4	0.09	0.06	0.12
Risk Literacy total	0.45	0.38	0.22
Overconfidence	0.34	0.44	0.02**
CRT	0.27	0.18	0.00*

FN for Female National, FNN for female non-national. Note: *,**and *** indicate significance at 1%, 5% and 10% respectively.

Table 7. Behavioural biases and cognitive reflection test by male/nationality

Behavioural biases and CRT	Male*Nationality		
	MN (Mean)	MNN (Mean)	Mean difference p-value
Risk Preference	0.26	0.33	0.07***
Time Preference	0.59	0.67	0.04**
Risk Literacy Q1	0.08	0.16	0.00*
Risk Literacy Q 2	0.09	0.26	0.00*
Risk Literacy Q 3	0.09	0.16	0.02**
Risk Literacy Q 4	0.06	0.14	0.00*
Risk Literacy total	0.33	0.73	0.00*
Overconfidence	0.37	0.53	0.00*
CRT	0.16	0.45	0.00*

MN for male national, and MNN for male non-national. Note: *,**and *** indicate significance at 1%, 5% and 10% respectively.

Table 8. Cognitive reflection test and behavioral biases

Behavioural biases	Cognitive Reflection Test CRT		
	Low CRT	High CRT	Mean difference p-value
Risk Preference	0.27	0.39	0.00*
Time Preference	0.59	0.62	0.55
Risk Literacy Q 1	0.06	0.24	0.00*
Risk Literacy Q 2	0.08	0.31	0.00*
Risk Literacy Q 3	0.08	0.21	0.00*
Risk Literacy Q 4	0.05	0.21	0.00*
Risk Literacy total	0.26	0.96	0.00*
Overconfidence	0.38	0.48	0.02**

Note: *,**and *** indicate significance at 1%, 5% and 10% respectively.

Considering the ubiquity of CRT's involvement in decision-making studies, it is important to determine to what extent it is tied to our individual differences. While we found strong evidence of a link between the CRT score and several behavioural biases, individual characteristics seem to be prominent, namely gender and nationality. Our results endorsed the strong gender components in the CRT and behavioural biases performance. We also studied whether risk literacy manifested gender differences. The results showed that males are more risk literate than females. In addition, females were less overconfident than male subjects. However, male subjects exhibited higher cognitive abilities than females. Particularly, our results proved that high CRT scorers were more willing to take risks

In controlling for nationality, we found that UAE respondents were inclined toward risk, were less risk literate, were less overconfident, and had lower cognitive abilities than non-UAE respondents. Likewise, national female subjects were inclined to take more risks than their counterparts. Our results reveal that female nationals had higher risk literacy than male nationals. However, both male and female non-nationals were found to be more overconfident than their counterparts. Finally, our results revealed that female nationals had higher CRT scores than female non-nationals, but that the opposite was true for male subjects.

4. Conclusion

This study aimed to investigate the effect of differences in gender and nationality on the CRT, as well as several behavioural biases. In addition, the interaction between gender and nationality on the CRT as well as behavioural biases. Females appeared to score lower than males in most of the behavioural biases and the CRT. This implies that gender plays a role in financial decision-making. The same can be concluded about national respondents and the interaction between gender and nationality. Moreover, the CRT can be used by fund managers to gauge the risk appetite of investors regardless of gender or nationality.

In terms of financial decision-making, individuals—active or passive investors as well as fund managers—should design portfolios based on these differences where one size does not fit all. Looking at the risk appetite of investors, local or otherwise, is not sufficient. Since decision-making is not based solely on risk and return, other factors that influence decision-making have to be investigated. The identification of behavioural anomalies that will influence financial risk behaviour will provide insights into the knowledge about financial decisions as well as behavioural finance. It is not only that demographics are the only factors that explain decision-making behaviour, but also the way in which the decision is made. In other words, fund managers can use CRT scores as a nudging mechanism to direct investors toward suitable investment strategies.

More generally, quantifying behavioural biases is very important and should progress from single-item to multi-item questions. Thus, different demographics should be considered such as age, religion, income, and education. Similarly, different biases should be investigated such as trust, envy, and happiness. Another dimension that has been investigated in this study is nationality. Future research could look into the segmentation within the non-national group, such as the region or religiosity of the respondents. In addition, a sample of investors, professionals, and working people might be considered in the future for comparison with the current study.

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Appendix A. Wording of Survey Questions and Key Variables

- (1) A bat and a ball together cost \$1.10. The bat costs \$1.00 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? ____ Minutes
- (3) In a lake, there is a patch of lily pads. Every day, the 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? (____ days)
- (4) Suppose that you won \$2 million as a prize in a lottery and there are two options, which one do you choose:
 - (1) take the prize immediately and
 - (2) take the prize after a month with 5% premium.
- (5) Please answer the following 5 questions related to general knowledge.
 - Which is the biggest country in the world by land area?
 - a) Russia b) China c) Canada d) USA
 - Who is the writer of Hamlet?
 - a) Shakespeare b) Avicenna c) Dr.Zarinkoob d) Shaw

- When did Tsunami earthquake happen?
a) 2001 b) 2002 c) 2003 d) 2004
 - How many planets are in solar system excluding Pluto?
a) 7 b) 8 c) 9 d) 10
 - What's the capital of Finland?
a) Luxembourg b) Amsterdam c) Madrid d) Helsinki
- (6) How many general knowledge questions do you think you answered correctly? ____
- (7) You have the choice between two alternatives. Alternative 1: You receive \$10,000. Alternative 2: You receive a lottery ticket that yields a 75% chance of winning \$20,000 . With 25% probability it is worthless. Which alternative do you choose?
- (8) Out of 1,000 people in a small town 500 are members of music band. Out of these 500 members in the band 100 are men. Out of the 500 inhabitants that are not in the band 300 are men. What is the probability that a randomly drawn man is a member of the band? Please indicate the probability in percent. ____ %
- (9) Imagine we are throwing a five-sided die 50 times. On average, out of these 50 throws how many times would this five-sided die show an odd number (1, 3 or 5)? ____ out of 50 throws.
- (10) Imagine we are throwing a loaded die (6 sides). The probability that the die shows a 6 is twice as high as the probability of each of the other numbers. On average, out of these 70 throws how many times would the die show the number 6? _____out of 70 throws.
- (11) In a forest 20% of mushrooms are red, 50% brown and 30% white. A red mushroom is poisonous with a probability of 20%. A mushroom that is not red is poisonous with a probability of 5%. What is the probability that a poisonous mushroom in the forest is red? _____
- (12) Some information about you (circle where appropriate)
- | | | |
|------------|------------------|---------------------|
| Gender | Age | Nationality |
| (1) Male | (1) 18–22 | (1) UAE citizen |
| (2) Female | (2) 23–25 | (2) Non UAE citizen |
| | (3) 26 and above | |
-
- | | | |
|--|---|----------------------------|
| Does your Father/Mother have a college degree? | What is your Grade Point Average (GPA). | How religious are you |
| (1) Yes | (1) Less than 2 | (1) Very Religious |
| (2) No | (2) Between 2 and 2.5 | (2) Somewhat Religious |
| | (3) Between 2.5 and 3 | (3) Somewhat Not Religious |
| | (4) Between 3 and 3.5 | (4) Very Unreligious |
| | (5) More than 3.5 | (5) Rather not say |



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