Individual differences in ethno-gender as a function of cognitive style and behavioral biases

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Abstract

This study investigates the interaction between race and gender with respect to CRT (Cognitive Reflection Test) as well as to testing whether the behavioral biases are different across the interaction. The results indicate that males score higher than female in general in the three CRT questions. In addition, Chinese males and females scored higher than Malay males and females in all CRT questions. This result is relevant in finance and economic due to its applicability on decision making in general. Individuals face decisions daily and sometimes make an impulsive reaction due to many factors. Similarly, investors face such challenges and they need to make decision based on certain situations. However, stock market does not only include the investors who use system two more than one. Therefore, it is important that investors understand the influence of these systems on their decision making process.

Keywords: cognitive reflection test, behavioral biases, cognitive abilities, CRT, financial decision

1. Introduction

The classical economic theory predicts that the individual is always looking at maximizing his/her utility regardless of how they feel. Similarly, modern finance theory rely heavily on the assumption that investors’ goal is only to maximize their earning and in the process minimize their costs. This assumption is derived from the fact that economic unit is rationale. Rationality implies the maximization of utility or profit and nothing else. However, recent studies indicated that individual as well as investors in the market are normal and not rationale (Statman, 2008). Statman (2008) explains that besides the utilitarian based demand individuals usually have expressive as well as emotional benefits that they derive from their decisions. Although, Statman (2011) indicates that individuals have derive these benefits from being normal he emphasizes that individuals can be “normal smart” as well as “normal stupid” depending on situations faced. Stanovich and West (2000) put it differently where they point out that individuals can be either normatively/instrumentally rational or evolutionary rational when making a choice. The main difference between these two groups is that the normative rationality individual focus on maximizing utility as the main goal while the evolutionary rational include other heuristics in their decision.

Stanovich et al. (1998, 2000) indicated that errors on decision making are not purely random but it has a systematic component. This systematic component is associated with certain cognitive variables as well as biases. Assuming people are homogenous, treating behavioral tendencies as unexplained variance, looking at average effect rather than in depth effect and treating them differently based on their cognitive ability might be reasons for not exploring the relationship between cognitive ability and decision making (Frederick, 2005). Oechssler et al. (2009) indicated that the reason for dismissing behavioral biases in decision making process is either because they will average out each other or the arbitrage corrects them. Epstein (1994); Sloman (1996); Chaiken and Trope (1999); Kahneman and Frederick (2002), Evans (2010); Kahneman (2011) and Stanovich (1999) emphasized the distinction between two types of systems when a decision has to be made. West et al. (2012) explained these two systems as system 1 or type 1 which is an impulsive, fast and automatic processing of information and not computationally demanding. On the other hand system 2 is slow, analytical and requires concentration and “computationally expensive”. System one is characterized by its autonomy and as an

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impulsive in the sense it reacts immediately to stimuli. Conversely system 2 requires time, efforts and motivation to react and occasionally overrides system 1 processing. Most of the cognitive biases emerge from the system 1 processing and unless system 1 biases are presented in “evolutionary friendly2” format then system one tends to generate the correct answer and need not be overridden by system 2.

Literature have concluded that intelligence is related to reasoning performance (Chiesi et al., 2011; Toplak et al., 2011; Bruine de Bruin et al., 2007). However, West et al. (2012) stated that intelligence is not always related to information processing biases. Some biases were found to be independent of the intelligence. Frederick (2005) developed a tool that test the tendency of individuals to fall into cognitive biases. The tool called cognitive reflection test (CRT thereafter) is aimed at asking three simple questions that immediately trigger system one to operate. This results in establishing some kind of a relationship between behavioral biases and cognitive abilities. Frederick (2005) stated that individuals with higher cognitive ability are far better than those with lower cognitive ability in various ways such as life expectancy, earnings, memory and reaction interval and influenced by visual illusions. Similarly, studies have linked cognitive ability to economic behavior found that people with high cognitive abilities are less risk averse and more patient than low cognitive abilities people. On the other hand, Toplak et al. (2011) found that despite of having a strong relationship between CRT and intelligence it accounts for some of the variation in intelligence when other variables are controlled. West et al. (2012) and Oechssler et al. (2009) among others indicated that cognitive abilities and behavioral biases are linked. Some Studies that documented the connection between CRT and behavioral biases include West et al. (2012), Oechssler et al. (2009), Cokely and Feltz (2009), Toplak et al. (2011).

This study is aimed at using CRT questions to test whether the behavioral biases are related to cognitive abilities among different Malaysian races and gender. Frederick (2005) in introducing the three items CRT to measure cognitive ability found that they are predictive of the type of choices individuals make. In addition, when investigating the time preference relationship with CRT it was found that individuals with high cognitive ability are more patient than the individuals with low cognitive ability. This study directly investigates the differences in the interaction between race and gender in Malaysia. The Malaysian population is a mixture of Malay, Chinese and Indians and this population has a mixture of four major religious affiliations.

In addition, several behavioral biases are investigated simultaneously such as conjunction fallacy, conservatism and risk and time preferences. In investigating the relationship between cognitive abilities and behavioral biases Oechssler et al. (2009) found that CRT is related with conjunction fallacy, conservatism, subjects’ timing and risk preferences. Conjunction fallacy or what is now known as “Linda problem” is the bias where the probability of the interaction of two or more events or their conjunction is thought to surpass the probability of the single general event. Tversky and Kahneman (1983) were the pioneers in developing a method of testing such a bias. They found that 85% of the participants fall into the conjunction fallacy. Similarly Oechssler et al. (2009) found a significant difference between different cognitive groups in terms of conjunction fallacy. On the other hand conservatism refers to fact that individual tend to underestimate high probabilities and overestimate low ones (Hilbert, 2012).

The rational of this study is derived from Albaity, Rahman and Islam (2014), Albaity and Rahman (2012a) and Albaity and Rahman (2012b) who study several behavioral traits of the Malaysian population as well as the relationship between CRT and demographic variables. Their findings state that differences existed between race and genders. Halpern et al. (2011) and Reily (2012) studied the gender difference stereotyping and found that the existed though was underestimated.

2. Materials and Methods

Questionnaire was distributed containing the three CRT questions plus questions targeting the behavioral biases. The sample consists of undergraduate as well as postgraduate students from two public universities in Malaysia. The total number of questionnaire distributed was 1000; 898
questionnaires were returned, and 880 were usable for the analysis. Since this study focuses on Malaysians the sample is reduced to 624 (417 Malay, 175 Chinese and 32 Indian). Since male Indians are only 10 and female 22 therefore Indians will be excluded from the sample. Only Malay and Chinese will be used for further analysis therefore the final sample is 592 respondents. The question measuring the CRT and the four biases can be found in Appendix 1. Questionnaire was conducted in English, since the medium of instruction of the two public universities. The CRT questions were adapted from Frederick (2005) and Oechssler et al. (2009). The questions were not foreign in nature to the respondents, in the sense that the correct answers were easily understood by the respondents when explained.

3. Results and analysis

The results in table one define the demographic profile of the respondents. Majority of the respondents are female, Malay and between 20 and 30 years old. As indicated earlier, Indians were excluded due to the very small number of respondents.

![Table 1. Demographic profile](image)

<table>
<thead>
<tr>
<th>Variable</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender</td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>67</td>
</tr>
<tr>
<td>Male</td>
<td>33</td>
</tr>
<tr>
<td>Race</td>
<td></td>
</tr>
<tr>
<td>Chinese</td>
<td>28</td>
</tr>
<tr>
<td>Indian</td>
<td>5</td>
</tr>
<tr>
<td>Malay</td>
<td>67</td>
</tr>
<tr>
<td>Age</td>
<td></td>
</tr>
<tr>
<td>20 YEARS OLD</td>
<td>23.3</td>
</tr>
<tr>
<td>21-30 YEARS OLD</td>
<td>70.9</td>
</tr>
<tr>
<td>31-40 YEARS OLD</td>
<td>3.4</td>
</tr>
<tr>
<td>&gt;41 YEARS OLD</td>
<td>2.4</td>
</tr>
</tbody>
</table>

Tables 2 below report the results of the t-test for comparing the mean difference of CRT questions based on the interaction between race and gender. Table 1 shows the results for mean differences between Malay and Chinese male and Malay and Chinese female participants. For the three CRT individual questions the result is significant indicating that there is a difference between Malay male and female. The results indicate that males outperform females in getting the three questions right. Similarly, when questions were paired and grouped the results is significant supporting earlier result. Malay males outperform females in all the individual questions as well as paired and grouped questions. This result confirms the findings by Albaity and Rahman (2012) and Albaity, Rahman and Islam (2014) where Malaysian males scored significantly higher than females. Since the three CRT questions are mathematical in nature the result is supported by Ismail and Awang (2008) study which that Chinese scored higher mean in mathematics than Malay students.

![Table 2. Difference in mean between Malay male and female](image)

<table>
<thead>
<tr>
<th>Questions</th>
<th>Gender</th>
<th>Mean Malay</th>
<th>Mean Chinese</th>
<th>t-test</th>
<th>t-test</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bat &amp; ball</td>
<td>Female</td>
<td>0.17</td>
<td>-3.61*</td>
<td>0.42</td>
<td>-3.34*</td>
</tr>
<tr>
<td></td>
<td>Male</td>
<td>0.34</td>
<td>0.67</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Widgets</td>
<td>Female</td>
<td>0.12</td>
<td>-4.60*</td>
<td>0.38</td>
<td>-3.50*</td>
</tr>
<tr>
<td></td>
<td>Male</td>
<td>0.33</td>
<td>0.64</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Table 3 report the results for the four main biases studied, namely, conjunction fallacy, conservatism, time preference and risk preference. The result show that Chinese male and female differ in terms of conjunction fallacy, conservatism and risk preference but not in or time preference. Chinese males scored higher only in conservatism while Chinese female scored higher in both conjunction fallacy as well as risk preference. On the other hand Malay male and female differ in the risk and time preference but not conjunction fallacy and conservatism. Malay male scored higher mean than female in risk and time preference.

Table 3. Difference in mean between Malay and Chinese male and female

<table>
<thead>
<tr>
<th>Variable</th>
<th>Gender</th>
<th>Mean Malay</th>
<th>t-test</th>
<th>Mean Chinese</th>
<th>t-test</th>
</tr>
</thead>
<tbody>
<tr>
<td>Conjunction Fallacy</td>
<td>Female</td>
<td>1.79</td>
<td>-0.77</td>
<td>1.86</td>
<td>1.45***</td>
</tr>
<tr>
<td></td>
<td>Male</td>
<td>1.82</td>
<td></td>
<td>1.77</td>
<td></td>
</tr>
<tr>
<td>Conservatism</td>
<td>Female</td>
<td>60.02</td>
<td>0.96</td>
<td>50.43</td>
<td>-2.01**</td>
</tr>
<tr>
<td></td>
<td>Male</td>
<td>56.90</td>
<td></td>
<td>66.40</td>
<td></td>
</tr>
<tr>
<td>Time Preference</td>
<td>Female</td>
<td>1.51</td>
<td>-2.17*</td>
<td>1.42</td>
<td>-0.44</td>
</tr>
<tr>
<td></td>
<td>Male</td>
<td>1.62</td>
<td></td>
<td>1.45</td>
<td></td>
</tr>
<tr>
<td>Risk Preference</td>
<td>Female</td>
<td>1.20</td>
<td>-2.56*</td>
<td>1.42</td>
<td>1.94***</td>
</tr>
<tr>
<td></td>
<td>Male</td>
<td>1.33</td>
<td></td>
<td>1.28</td>
<td></td>
</tr>
</tbody>
</table>

*, ** and *** Significant at 1%, 5% and 10%

4. Conclusion

This paper is aimed at exploring the effect of cognitive ability on behavioral biases within Malaysia gender-ethnic groups. In general, males significantly outperform females in all the CRT questions similar to the findings of Albaity et al. (2014). In addition, the results indicate that Chinese males and females score higher than their Malay counterparts in both the individual and well as the combination
of the three CRT questions. The same cannot be said about the four selected behavioral biases. A significant difference was found between Chinese males and females in conjunction fallacy and conservatism while the same was found between Malay males and females in risk preference variable. The results also confirm the results by Oechssler et al. (2009) and Frederick (2005) in this study it is found that low CRT group are less patient, risk averse, tend to overestimate the probability of specific condition than the general one and more conservative in their belief than the high CRT group. This is an indication that system one is prominent in the majority of the study sample. This result is relevant in finance and economic due to its applicability on decision making in general. Investors face such challenges and they need to make decision based on certain situations. Christelis et al. (2010) found that cognitive abilities are strongly related to stock market participation. However, stock market does not only include the investors who use system two more than system one. Therefore, it is important that investors understand the influence of these systems on their decision making process.

5. References

Appendix 1

A bat and a ball together cost 110 cents. The bat costs 100 cents more than the ball. How much does the ball cost? _______ cents (bat & ball)

If it takes 5 machines 5 minutes to make 5 widgets, how long would it take 100 machines to make 100 widgets? ________ minutes. (Widgets)

In a lake, there is a patch of roses. 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 (lily pad)

In addition, the following questions were included to measure time preference, risk preference, conjunction fallacy and conservatism. The questions were as follows.

Time preference
If you are one of the winners who receive a prize of RM100 for this questionnaire, you can pick between two alternatives.
Alternative 1: we will transfer winnings immediately after the end of the experiment.
Alternative 2: we will transfer your winnings one month after the end of the experiment with 10% premium.

Risk preference
You have a choice between two alternatives
Alternative 1: you receive RM100
Alternative 2: you receive a lottery ticket that yields a 75% chance of winning RM200, with 25% probability it is worthless.

Conjunction fallacy
Consider the following description. “Linda is 31 years old, single, outspoken, and very bright. She majored in philosophy. As a student, she was deeply concerned with issues of discrimination and social justice, and also participated in anti-nuclear demonstrations”. Which of the following two statements is more likely to be true?
Statement 1: “Linda is a bank teller”.
Statement 2: “Linda is a bank teller and is active in the feminist movement”.

Conservatism
Imagine there are two urns—urn A and urn B. Urn A contains 3 blue balls and 7 red balls. Urn B contains 7 blue balls and 3 red balls. Balls are now randomly drawn from one of these urns where the drawn ball is always placed back into the same urn. Twelve such random draws yielded 8 red balls and 4 blue balls. What do you estimate the probability that the balls were drawn from urn A?