



# Heuristics Bias and Investment Performance: Does Age Matter? Evidence from Colombo Stock Exchange

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## **Author's contribution**

*The sole author designed, analysed, interpreted and prepared the manuscript.*

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## **ABSTRACT**

This study investigates the existence of heuristics biases in Colombo Stock Exchange and their effect on investment performance from individual investor's point of view. In specific, the effects of anchoring, availability bias, gamblers fallacy, overconfidence and representativeness are investigated. Further, the study inspects whether the heuristics biases differ between younger and older investors. The primary data were collected by survey from 425 individual investors. The data were analyzed using multivariate analysis such as Confirmatory Factor Analysis (CFA) and Structure Equation Modeling (SEM). The results show that there is a statistically significant effect of anchoring, availability bias, overconfidence and representativeness bias on investment performance. However, gamblers fallacy not significantly affects investment performance. Furthermore, statistically significant differences are found between the answers of younger and older investors. This study, hopefully, will help investors to be aware of the impact of their own heuristics bias on their decision making in the stock market, thus increasing the rationality of investment decisions for enhanced market efficiency.

*Keywords: Heuristics biases; investment performance; age; anchoring; availability bias; gamblers fallacy; overconfidence; representativeness; CSE.*

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## 1. INTRODUCTION

The stock market plays a key role in the growth of the economy of the country. The primary function of the stock market is the purchase and sale of stocks occur. The stock market movement and volatility affects the economic health of a country. In the view of Colombo Stock Exchange (CSE) is the one of the dynamic exchanges in South Asia. After the civil war end, CSE was the best performing stock exchange in the world in 2009 as it jumped 125.2 percent during that year. Although, the market capitalization represents 31 percent of GDP is still lower to compare with other emerging markets. On the other hand, the market has continued to experience unexplained volatility pertaining to both trade volume and market capitalization, with the resulting trends opposing those expected according to market fundamentals [1]. CSE's investors may place too much faith in their own forecasts that lead to bias in their actions [2]. Therefore, it is noteworthy to study and understand the behavioral bias of individual investor at CSE and factors influencing on their investment performance.

According to the traditional financial theory, a security's price equals its "fundamental value" as frictions do not exist and agents seem to be rational. The fundamental value is said to be the "discounted sum of expected future cash flows", in the context that investors are able to process all available information accurately and the discount rate is consistent with the accepted preference specification [3]. Consequently, Efficient Markets Hypothesis (EMH), which supports the opinion that actual prices reflect fundamental values, affirms that prices are right as they are determined by agents, who have sensible preferences and understand Bayes' law, which relates to conditional probabilities. Moreover, efficient market is the market where average returns on investment cannot be greater than what is warranted for its risk despite whatever investment strategy is applied [4]. According to EMH, stock prices reflect all past, publicly available and insider relevant information. Being different from this theory, behavioral finance believes that sometimes, financial markets do not have informational efficiency [5]. Further, traditional finance theories fail to explain anomalies in the market. Since conventional theories are based on the assumption of investors are rational and they make rational decisions [6,7,8]. But, in real life, investors' are often suffering from cognitive and

emotional biases and act in a seemingly irrational manner. Hence, studying behavioral finance plays an important role in finance, in which cognitive psychology is employed to understand human behaviors. In case the decisions of investors do not follow rational thinking, effects of heuristics biases should be identified. It will be more important if their cognitive errors affect prices and are not arbitrated away easily (Kim & Nofsinger, 2007). Consequently, behavioral finance theories aid to explain the reasons for such anomalies from traditional finance theories. Accordingly, investors' emotions, feelings, and intuition influence their investment decisions and performance can result in irrational behavior [9].

Previous researches in cognitive illusion have documented a range of decision-making heuristics biases. These biases can affect all types of decision-making, but have particular implications in relation to money and investing. The biases relate to how we process information to reach decisions and the preferences we have. The importance of studying such topic comes from the consequences that these heuristics biases could have on the investors' gains and losses and on the stock market as a whole. For example, the overconfidence bias can lead investors to pay too much brokerage costs and taxes and make them more vulnerable to high losses because of having too much trades and taking too much risk in the investments which they are overconfident about.. The representativeness bias could result in purchasing overpriced stocks because of the tendency to associate new event to a known event. Generally, deviation from the correct and optimal investment decisions in stock exchanges is one of the basic and most important problems and it often leads to poor returns for investors. Thus, identifying factors that lead to incorrect decisions, can lead to better investment decisions and performance [10]. According to the importance of cognitive illusion and behavioral finance in financial decisions and pricing in stock exchanges, this study investigates major heuristics biases.

Previous empirical studies have largely looked at whether the investors' behavioural bias effect on the stock market both in developed and developing countries [11]. However, they provide the conflicting evidences among the countries. On the other hand, Yalcin et al. [12] also supported that investor's age is noted to have a significant moderating impact between heuristic (e.g. salience, mental accounting and

representativeness) and investment decision making. Moreover, previous studies of investor profiles found that behavioural biases are varies from country to country (Pompian, 2008) and also dependent on investors' age (Chaudhary, 2013 [13]. The conflicting previous empirical findings, the narrow approach to the study variables warrant further investigation. It investigates the existence of heuristics biases for 405 investors in CSE and the effect of these biases on investment performance from investor's point of view. In Addition, it tests whether age matters in such issue. In fact, we focus on five well-known heuristics biases that are found in other developed and emerging stock markets. These biases are anchoring, availability bias, gamblers fallacy, overconfidence and representativeness. To the best of author's knowledge, this is the first study in Sri Lanka that tackles such important topic. It will be useful to researchers, academicians, regulators, companies and investors in CSE to understand the impact of heuristics biases on investment performance. The results of this study have several policy implications, they could help policy makers to understand the trading behavior from a cognitive perspective which in turn could have insights to explain irregular patterns in volatility, market return and portfolio selection.

## 2. LITERATURE REVIEW

Tversky and Daniel Kahneman [14] published their original work on biases and heuristics, they identified three main types of heuristics, or mental shortcuts: the representativeness heuristic, the availability heuristic and the adjustment and anchoring heuristic. These heuristics, they argued, give way to predictable biases and errors in judgment and decision making (i.e., violations of normative principles or axioms). Examples of normative rules that biases violate include the principles of dominance, invariance, and sunk cost. The principle of dominance holds that decision makers should choose the option that is never worse than the other options and that may provide a better outcome than the other options. The principle of invariance holds that the same information presented in different ways should be understood and weighed the same.

EMH (Efficient Market Hypothesis) which assumes that markets are efficient and investors are rational [8]. The intellectual dominance of the efficient-market revolution has more been challenged by economists who stress heuristics

elements of stock-price determination and by econometricians who argue that stock returns are, to a considerable extent, predictable [15]. Ritter [5] underlines how important is heuristics in simplifying decision making complex, in particular in uncertain, complex environments, It reduces the complexity by evaluating probabilities and predicted values through error and stereotypes-based trials to simpler judgments. In reality, the investors do not make strictly rational decisions, because they are influenced by emotional and mental factors, even during the information collection and evaluation process. During the last two decades, an increasing number of studies used a heuristics approach in explaining stock price movements in financial markets in both developed and emerging stock exchanges (Kaplanski and Levy, 2010) [16] However, Lim and Brooks [17] find that emerging markets are less efficient and in general experience more frequent price deviations. Earlier research on irrationality in emerging markets presented evidence that investors in China exhibit heuristics biases and make poor investment decisions leading to losses. [18] Several researchers worldwide have investigated the effect of heuristics biases on investment performance and whether this effect differs between younger and older investors.

### 2.1 Hypothesis Development

#### 2.1.1 Anchoring

Anchoring is first employed by Tversky and Kahneman [14] and refers to people's tendency to form their estimates about the likelihood of uncertain events or to predict or recall certain values or outcomes by considering an initial value and adjusting it upwards or downwards to yield a final judgment [19]. Kaustia et al. [20] find students and investment professionals anchor future expectations of stock returns to prior performance. This effect becomes smaller with experience and expertise, but does not disappear.

**H1:** There is a significant influence between anchoring and stock investment performance.

#### 2.1.2 Availability bias

Availability bias happens when a decision maker depends on knowledge that is readily available. It refers to people's tendency to determine the likelihood of an event according to the easiness of recalling similar instances and, thus, to

overweight current information as opposed to processing all relevant information [21]. Its estimation depends on frequency, probability, and causality relationships that relies on how easily information is recalled from memory [14]. Researchers find some evidence suggests that recently observed or experienced events strongly influence decisions [22]. Onsomu (2014) finds that investors are affected by availability bias and representativeness bias in Kenya. However, no significant effect of overconfidence bias has been found. Barber and Odean [23] show that investors tend to consider stocks that have recently caught their attention in making purchase decisions confirming the availability bias in US stock exchanges. Park et al. [24] find a significant confirmation bias in Korea that makes investors more overconfident and adversely affect their investments performance.

**H2:** There is a significant influence between availability bias and stock investment performance.

### 2.1.3 Gamblers fallacy

Gamblers' fallacy arises when people inappropriately predict that a trend will reverse. This may lead investors to anticipate the end of a run of good (or poor) market returns. The gambler's fallacy exhibits similar characteristics as the disposition effect, which postulates that investors sell winners too soon and hold losers too long. Individuals who are subject to status quo bias tend to choose an alternative that they chose previously even if it is no longer the optimal choice [25]. Waweru et al. [26] found that strong incidence of Gambler's fallacy presented with 78% of respondents believing that they could anticipate changes of trends in stock prices. Rao [27] also present evidence that the gambler's fallacy rather than the hot hand fallacy exists during shorter intervals. Thus, this fallacy may explain our results because we use only lags of weekly S&P 500 returns, which is a relatively short time period.

**H3:** There is a significant influence between gamblers fallacy and stock investment performance.

### 2.1.4 Overconfidence

Barber and Odean [28] find that investors who have high confidence in their trading skills often have high trading volume, with a negative effect on their returns. One outcome of heuristic simplification (i.e., self-deception) occurs when

people tend to think that they are better than they really are [29]. Barber and Odean [30] find that men are more overconfident than women as they trade more and earn lower returns in USA. Statman et al. [31] argued that, after high returns, subsequent trading volume will be higher, as investment success increases the degree of overconfidence. Also Fenton-O'Creedy et al., [32], using a sample of professionals, documented that overconfidence has a negative impact on trading performance. Similar with the above findings, Kirchler and Maciejovsky [33] argue that the overconfident investors who trade too much will experience reduced earnings and often invest in stocks that have negative earnings.

**H4:** There is a significant influence between overconfidence and stock investment performance.

### 2.1.5 Representativeness

Gilovich et al. [34] define representativeness as "an assessment of the degree of correspondence between a sample and a population, an instance and a category, an act and an actor or, more generally, between an outcome and a model." Representativeness can be reduced to 'similarity' (Kahneman and Tversky, 1972). Investors may also consider recent past returns to be representative of what they can expect in the future (DeBondt, 1985). Cooper et al. (2001) supported that investors can be influenced also by the name a company adopts, again consistent with the representativeness heuristic. They utilised a sample of 95 companies that changed to dot-com names during 1998 and 1999 and their findings shown that these companies earned statistically significant and sizably positive abnormal returns that did not appear to reverse in the following 120 trading days. Ji & Zhang [35] examine the representativeness heuristic by contrasting the buy and sell behavior of Canadian and Chinese investors in three experiments. They find that Chinese investors are less prone to exhibit the extrapolation bias than Canadian investors. Indeed, Chinese participants were more likely to predict a price reversal than trend continuation.

**H5:** There is a significant influence between representativeness and stock investment performance.

### 2.1.6 Age

Based on a survey, Rezik and Boujelbene [36] find that Tunisian investors' behaviors

are subject to two heuristics biases: representativeness and anchoring. Moreover, they find that age have an interaction with behavioral financial factors in investment decisions. In contrast, Onsomu [37] demonstrates that age does not matter in this topic. Finally, Rostami and Dehaghani (2015) document a significant relationship between heuristics biases and investing in Tehran stock exchange.

**H6:** Age has a moderating role in the relationship between heuristics and stock investment performance.

### 3. DATA AND METHODOLOGY

#### 3.1 Research Design and Methodology

##### 3.1.1 Conceptual model and hypothesis development

This study sought to establish the influence among investor behavior factors and individual investors' decision making at Colombo Stock Exchange. Among the demographic variables, influence of age on all primary constructs is considered as a moderator of this study. The following conceptual model is tested in this study.

#### 3.2 Questionnaire Design

Standard questionnaire is used in the study that is divided into three sections. The questionnaire is finalized after accommodating the experts' opinion to ensure the construct validity. Further,

the reliability of the questionnaire is verified with the help of Cronbach's alpha. Questionnaire is divided into three parts. The section A included the structured questions to measure the heuristics bias, viz, anchoring, availability bias, gamblers fallacy, overconfidence and representativeness. Section B covered the standard questions related to stock investment performance. The last section C included the questions for demographic profile. Final questionnaire based on a five-point Likert scale consists of 30 measure items based on the previous studies (Refer Appendix 1).

#### 3.3 Data and Sample

For this purpose, the quantitative approach survey has been conducted on the registered individual investors at CSE. Out of this population, 520 questionnaires are distributed randomly during the period of November 2018 to Feb 2019 through stock brokering companies as online survey web link. only 448 questionnaires are received and a total of 425 valid questionnaires are considered for analysis after removing the incomplete questionnaires. Multivariate analysis such as Confirmatory Factor Analysis (CFA) and Structure Equation Modelling (SEM) supported by AMOS 20.0 software are used to address the research objectives. In SEM, relationships between theoretical constructs are represented by regression or path coefficients between the factors [38] Further, In order to achieve the research objective of the moderating effect, the interaction effect analysis approach suggested by Byrne [39]. Data analysis

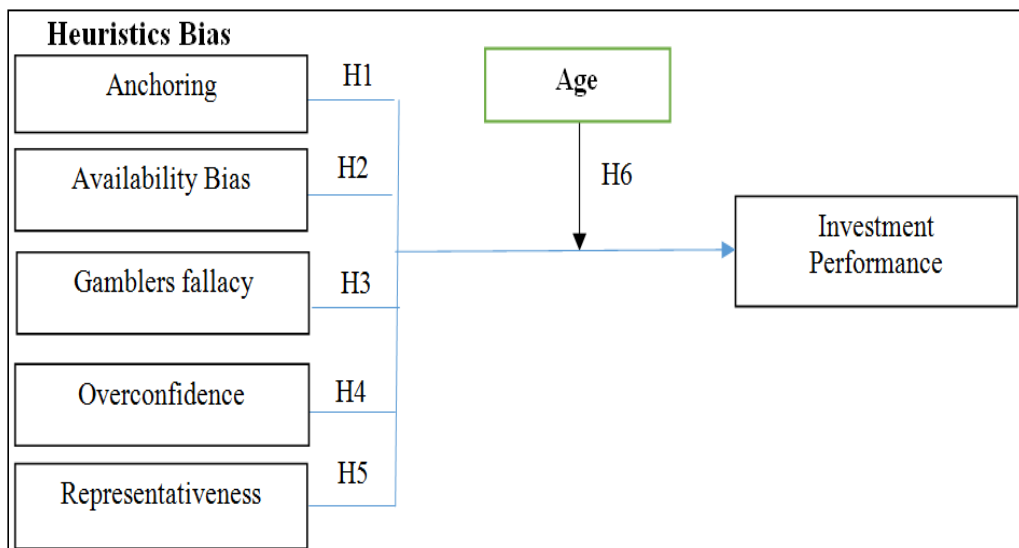


Fig. 1. Conceptual framework

proceeded in two stages: first, we assess the overall measurement quality by using confirmatory factor analysis (CFA) to test research instrument reliability and validity, after that an analysis of structural model was also conducted for finding whether the model would fit results of the proposed theoretical models. To assess model fit, this study used some criteria, this study reports the six fit measures were used, Goodness-of Fit Index (GFI) and Comparative Fit Index (CFI), Root Mean Square of Error Approximation (RMSEA), Root Mean Residual (RMR), Tucker-Lewis Index (TLI) and CMINI/DF index. As for RMSEA and RMR, their values below 0.05 for each indicate close fit, while values below 0.08 indicate an adequate fit [40], Cudeck et al. 1993).

## 4. RESULTS AND DISCUSSION

### 4.1 Demographic Profile

Table 1 summarizes the respondent's demographic characteristics, which indicates that sample is composed of 216 males (50.8%) and 106 females (49.2%) respondents. Ages 31-40(43%) account for the biggest portion of the sample, followed by ages 21-30 (28%), ages 41–50 (18%), ages over 50 (9%) and ages 18-20 (4%). Bachelor degree qualification was held by 167 (nearly 40%) of investors, followed by Master Degree (16%), Advanced Level (nearly 13%), Under-graduate (nearly 13%), G.C.E (O/L) and lower (nearly 8%), other professional (nearly 5%), and PhD Degree (nearly 4%).

### 4.2 Reliability and Validity of Constructed Model

Table 2 represents the means, standard deviation and reliability statistics for the constructs. The Kaiser Meyer- Olkin Measure of Sample Adequacy (KMO) was 0.883 and satisfying the assumptions of EFA. The Cronbach's alpha anchoring, availability bias, gamblers fallacy, overconfidence, representativeness and investment performance is 0.891, 0.827, 0.902, 0.897, 0.918 and 0.912 respectively. This implies that good internal consistency of reliability of the study is accepted (Hair et al. 2010).

After sampling adequacy, KMO of each individual variable less than 0.5 were excluded from the factor analysis: one at a time, smaller taken first (Hair et al., 2010). As can be seen in

Table 2, initially, the researcher dropped five items in the constructs, named Availability bias (AB) [AB2], Gamblers fallacy [GF] [GF4], Representativeness [RP] [RP4], Overconfidence (OC) [OC5], and Investment Performance (IP) [IP5] were below the minimum level of 0.5 on account of factor loading. The standardized factor loadings of all items significantly ranged from 0.591 (AB1) to .933 (A2) exceeding the recommended level of 0.5 (Hair et al., 2010) and this implies that the validity and reliability of the scales were deemed adequate. Finally, the Total Variance Explained (TVE) assesses the amount of variance that is explained by an underlying factor in relation to the amount of variance due to measurement error (Hatcher, 1994). The TVE of each individual variable should satisfy a minimum of the acceptable level of 50 percent (Cummins and Lau, 2005). AVE of all latent constructs were in the range between 0.50 (Disposition Effect) and 0.74 (Representativeness) which were above the recommended threshold of 0.50 (Fornell & Larcker 1981). Moreover, we also computed the composite reliability (CR) for each construct. In all cases the CR was above the minimum threshold of 0.70, in addition, all cases CR is greater than AVE which is another indicator of strong convergent validity (Hair et al. 2010). It revealed that all constructs in this study have adequate convergent validity. Further, correlation matrix proves the discriminant validity (refer appendix 2).

### 4.3 Structural Equation Model (SEM)

#### 4.3.1 Heuristics bias and investment performance

The influence of heuristics bias (Anchoring, Availability Bias, Gamblers fallacy Overconfidence and Representativeness) on investment performance was examined using Structural Equation Modeling (SEM). The overall model Chi-square chi square / degree of freedom is 1 .618,  $P > .05$  ( $p = .000$ ), that is close to 3 for indicating a well-fitting model. The overall value of GFI (Goodness of Fit Index) is 0.814 and CFI (Comparative Fix Index) is 0.953 [41]. The value of RMSEA (Root Mean Square Error of Approximation) is 0.028. The suggested value of RMSEA is between 0.05 and 0.08 for an adequate fit (Kline, 2005), and TLI is .918, indicative of a well-fitting model [41] (refer appendix 3). These results prove that model has a good fit for further investigation.

**Table 1. Summary of respondents' characteristics (n= 425)**

<b>Characteristics</b>	<b>Investor grouping</b>	<b>Frequency</b>	<b>Percentage (%)</b>
Gender	Male	216	50.8
	Female	209	49.2
Age (years)	18-20	18	4
	21-30	119	28
	31-40	175	43
	41- 50	75	18
	50 +	38	9
Education	G.C.E (O/L) and lower	34	8
	Advanced Level (A/L)	56	13.2
	Under-graduate	55	13
	Bachelor	172	40.5
	Master	69	16.2
	PhD Degree	16	3.8
	Professional	23	5.4

Source: Survey data

**Table 2. Validity and reliability of model**

<b>Constructs/Scale items</b>	<b>Cronbach's alpha</b>	<b>Standardized factor loading</b>	<b>t-value (CR)</b>	<b>Composite reliability</b>	<b>Average variance extracted</b>
<b>Anchoring</b>	<b>0.891</b>			<b>.78</b>	<b>0.58</b>
A1		.724	-		
A2		.933	17.584		
A3		.730	13.521		
A4		.716	13.642		
A5		.702	14.743		
<b>Availability bias</b>	<b>0.827</b>			<b>.82</b>	<b>0.52</b>
AB1		0.591	-		
AB3		0.756	10.732		
AB4		0.702	11.387		
AB5		0.695	9.277		
<b>Gamblers fallacy</b>	<b>0.902</b>			<b>.91</b>	<b>0.72</b>
GF1		.840	16.351		
GF2		.836	19.478		
GF3		.874	19.741		
GF5		.786	16.665		
<b>Overconfidence</b>	<b>.897</b>			<b>.87</b>	<b>0.61</b>
OC1		.907	-		
OC2		.724	13.204		
OC3		.801	12.947		
OC4		.803	14.944		
<b>Representativeness</b>	<b>0.918</b>			<b>.90</b>	<b>0.69</b>
RP1		.873	-		
RP2		.822	21.576		
RP3		.746	22.500		
RP5		.808	25.658		
<b>Investment performance</b>	<b>.912</b>			<b>.89</b>	<b>0.67</b>
IP1		.804	-		
IP 2		.935	15.299		
IP 3		.902	15.410		
IP 4		.842	14.720		

**Table 3. Results of heuristics bias and stock investment performance**

	Unstandardized solution				Standardized solution	Hypothesis results
	Estimate	S.E.	C.R.	P	Estimate	Supported
IP $\leftarrow$ Anchoring (H1)	.278	.012	1.361	.011	.226	Supported
IP $\leftarrow$ Availability Bias (H2)	.265	.074	3.077	.003	.207	Supported
IP $\leftarrow$ Gamblers fallacy (H3)	-.051	.089	-.809	.508	-.081	Not Supported
IP $\leftarrow$ Overconfidence (H4)	-.320	.069	-2.395	.007	-.152	Supported
IP $\leftarrow$ Representativeness (H5)	.314	.053	9.741	.011	.457	Supported

The first objective sought to identify and priorities the heuristics bias influence on the stock investment performance of individual investors at CSE. The related hypotheses H1, H2, H3, H4, and H5 were tested. A summary of the test of hypotheses shows that the first Hypothesis 1 is accepted because a statistically significant positive influence is found between anchoring and stock investment performance (similar to the findings of Kaustia et al. 2008). Moreover, hypothesis 2, assuming that the Availability Bias positively influences stock investment performance, is also accepted (statistically significant relationship). This result is in line with the findings of DeBondt, (1993) and Cooper et al. (2001). In contrast, hypothesis 3 cannot be accepted, because there is no statistically significant association between Gamblers fallacy and stock investment performance, this is found to be the insignificant negative association between Gamblers fallacy and investment performance than originally hypothesized. As it can be seen from the regression weights, Gamblers fallacy is not the predictor of stock investment performance in the model. However, the results inconsistent with Rao and Diego (2009). Hypothesis 4 is accepted, indicating that there is a statistically significant negative association between overconfidence and stock investment performance. Literature suggests that overconfident investors are overconfident as a result of the overloading information, thus makes decision-making faulty because individual investors become overconfident regarding their abilities (Kalra et al., 2012). A logical explanation may be that overconfident people think and act in a more impulsive way. This result is a similar finding with Also Fenton-O'Creivy et ai. [32], Trivers (2002). Hypothesis 5 is also accepted, showing that representativeness positively influences stock investment performance, implying that there is a significant positive association between representativeness and

stock investment performance. The finding is similar with Cooper et al. (2001).

#### 4.4 Moderating Role of Age

In this study, the moderation tests were conducted using the full model in terms of hypothesized relationships. The examination of the moderating effect is conducted in an interaction effect analysis approach suggested by Hayes (2013). The outcome of the SEM is displayed in the Tables 3 and 4. The hypothesized structural model for the moderating effect of age was represented the good fit for the current data. The fit statistics, CMIN/DF=1.4523; RMSEA =.022; RMR =.0545; GFI = .813; TLI = .941; CFI= .934) were all indicative of a good fit.

As can be seen in Table 4, the interaction, IP  $\leftarrow$  ABX Age ( $\beta = -.310$ , CR= -2.110,  $P < .05$ ), is significant, indicating that age moderates the relationship between availability bias and investment performance. In a similar vein, the interaction, IP  $\leftarrow$  RP X Age ( $\beta = -.021$ , CR= -2.116,  $P < .05$ ) is significant indicating that age moderates the relationship between representativeness and investment performance. Additionally, the interaction, IP  $\leftarrow$  OC X Age ( $\beta = -.415$ , CR= -1.770,  $P < .05$ ), is significant, indicating that age moderate the relationship between overconfidence and investment performance. On the other hand, the interaction, IP  $\leftarrow$  Anc X Age ( $\beta = -.039$ , CR= -1.814,  $P > .05$ ), is not significant, indicating that age does not moderate the relationship between anchoring and investment performance. Moreover, the interaction, IP  $\leftarrow$  GF X Age ( $\beta = .015$ , CR= .695,  $P > .05$ ), is not significant, indicating that age does not moderate the relationship between Gamblers fallacy and investment performance.

Overall, the study found that 50% variance in investment performance is explained jointly by heuristics bias (anchoring, availability bias



**Table 4. Interaction effect-both unstandardized solution and standardized solution**

		Unstandardized solution				Standardized solution	Hypothesis results
		Estimate	Supported	C.R.	P	Estimate	Supported
IP	← Anc	.735	.281	2.967	.003	.601	
IP	← AB	.692	.178	3.676	***	.322	
IP	← GF	-.381	.247	-1.141	.254	-.232	
IP	← OC	-.067	.113	-.595	.552	-.049	
IP	← RP	.349	.140	2.488	.013	.298	
IP	← Age	.010	.007	1.514	.130	.127	
IP	← Anc x Age	-.039	.008	-1.814	.101	-.545	Not supported (H6a)
IP	← AB x Age	-.310	.005	-2.110	.035	-.308	Supported (H6b)
IP	← GF x Age	.015	.007	.695	.475	.212	Not supported (H6d)
IP	← OC x Age	-.415	.003	-1.770	.015	-.185	Supported (H7e)
IP	← RP x Age	-.021	.004	-2.116	.033	-.312	Supported(H7f)

Note: Path significance: \*\*\*  $p < 0.001$ ; \*\*  $p < .01$ ; \*  $p < .05$

gimballing fallacy, overconfidence and representativeness), age and their interaction effect (IP <--- Anc X Age, IP <--- AB X Age, IP <--- GF X Age, IP <--- OC X Age and IP <--- RP X Age). It has thus been observed that there is variance improvement on the performance (32% to 50%). The finding of the results is consisted with Rekek and Boujelbene [35].

## 5. CONCLUSIONS

Recent research finds that individual investors are inclined toward behavioral biases and that they make investing mistake. However, are South Asian stock market investors more inclined or less inclined toward behavioral biases in stock investment decision, as compared to developed market investors? To address this question, we study Sri Lankan investors. In empirical tests, we find that Sri Lankan individual investors are bias in investment decision and make losses. They are reluctant to realize their losses (i.e., they suffer from heuristics bias), they tend to be overconfident (e.g., they are under diversified and they trade too often), and they exhibit a representativeness bias (i.e., buying recent short-term winners). Further, the researcher found that among the heuristics bias, anchoring, availability bias and representativeness have the positive significant influence on sock investment performance. Alternatively, overconfidence has the significant negative impact on stock investment performance at CSE. Additionally, the age also confirmed that it has a significant

moderating effect on the relationship between heuristics bias such as availability bias, overconfidence and representativeness over stock investment performance. The whole story made an original contribution to the behavioural finance literature in the context of emerging markets and important implications to individual investors. In addition, Findings of this study provides a better understanding to stock brokers and financial advisors about the investors' behavioral bias and make investment decision accordingly. Further, they could offer better advice according to clients' cognitive illusion behavior of heuristics and age.

This study is limited to individual investors and further study could focus on institutional investors. Further research in the future, we recommend that a larger sample size of investors be incorporated and extended to cover other areas and states to accurately depict the whole phenomenon of the Sri Lankan investors' decision making and also to confirm the findings of this study. Behavioral finance is a large and relatively new field in Sri Lankan context, hence presenting limitless of fresh opportunities and challenges ahead. There are a vast number of heuristic biases [28] left to be examined. Other biases like the Ambiguity aversion, Commission bias, Omission bias and Outcome bias can be researched thoroughly to analyze their impact on investment performance. These factors might prove to be important determinants of the investors' risk taking appetite.

## COMPETING INTERESTS

Author has declared that no competing interests exist.

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## Appendix 1

Concepts/ Construct	Variable	Measurement Item five point likert scale	Measurement code
Heuristic Bias	1.1 Anchoring Kaustia et al. (2008) Waweru et al. (2008) Khan et al. (2017)	1.1.1 Suppose you own a stock that is now at 52 weeks highest price level, you are likely to sell the security at this price level because in your opinion, it has achieved the maximum price level	A1
		1.1.2 The overall economic growth of Sri Lanka has been decline for the past many year. You foresee a similar trend of growth in coming year.	A2
		1.1.3 Suppose you bought the stock of ABC PLC at Rs 12. Couple of months ago, the stock reached at Rs 20. You thought to sell it then but somehow you could not. Unfortunately the stock dropped to Rs 15 and currently trading at 15. Now to sell this stock, you are likely to wait until it returns to Rs 20.	A3
		1.1.4 I use the purchase price of stocks as a reference point in trading .	A4
		1.1.5 My trading is affected by recent experiences in the market.	A5
	1.2 Gamblers fallacy Prosad et al. (2015) Lin (2011) Ngoc (2014) Waweru et al. (2008)	1.2.1 I prefer to sell stocks as soon as their price starts increasing.	GF1
		1.2.2 You are normally able to anticipate the end of good or poor market returns at the NSE.	GF2
		1.2.3 I prefer to keep holding on to stocks even if their past performance is not very encouraging.	GF3
		1.2.4 I avoid selling shares that have decreased in value and readily sell shares that have increased in value.	GF4
		1.2.5 I prefer to keep holding on to stocks if their purchase price is greater than their current market price (Reverse coded item).	GF5
	1.3 Availability bias Prosad et al. (2015) Ngoc (2014) Waweru et al.(2008)	1.3.1 I prefer to invest in the well-known companies that have wider media coverage.	AB1
		1.3.2 I prefer to invest in the companies which I know their history and management.	AB2
		1.3.3 I prefer to invest locally and not to diversify my portfolio internationally	AB3
		1.3.4 I prefer to buy local stocks than international stocks because the information on local stocks is more available	AB4
		1.3.5 You consider the information from the domestic market is reliable reference than the foreign market for your investment decisions.	AB5
1.4 Overconfidence Wood (2004). Prasad et al. (2015).	1.4.1 I have sufficient knowledge of Sri Lankan stock market.	OC 1	
	1.4.2 I am not confident of my ability to pick better stocks than others (Reverse coded item).	OC 2	

		1.4.3 I take full control and responsibility of my portfolio performance.	OC 3
		1.4.4 My past investment successes are attributed to my own skills and understanding.	OC 4
		1.4.5 I am likely to purchase investments that have been recommended by friends or colleagues (Reverse-coded).	OC 5
	1.5 Representativeness Waweru et al. (2008)	1.5.1 You buy 'hot' stocks and avoid stocks that have performed poorly in the recent past	RP 1
		1.5. 2 You use trend analysis to make investment decisions.	RP 2
	Wong Wee Chun and Lai Ming Ming (2009)	1.5.3 I tried to avoid investing in companies with a history of poor earnings.	RP 3
		1.5.4 I rely on past performance to buy stocks because I believe that good performance will continue.	RP 4
		1.5.5 Good stocks are firms with past consistent earnings growth.	RP 5
Investment Performance	Risk, Return and Satisfaction Pasewark and Riley (2010) Wood and Zaichkowsky (2010) Hunjra et al. (2107)	2.1My investment in stocks has demonstrated increased returned /cash flow growth in past 05 years	IP 1
		2.2 You feel satisfied with your investment decisions in the last year (including selling, buying, choosing stocks, and deciding the stock volumes).	IP 2
		2.3 Your rate of return is equal to or higher than the average return rate of the market.	IP 3
		2.4 The return rate of your recent stock investment not meets your expectation. (Reverse coded item).	IP 4
		2.5 My investment in stocks has a high degree of safety	IP 5

## Appendix 2

	AN	AB	GF	OC	RP	IP
Anchoring (AN)	0.58					
Availability Bias (AB)	0.009	0.52				
Gamblers fallacy (GF)	0.021	.034	0.72			
Overconfidence (OC)	0.369	.015	.201	.61		
Representativeness (RP)	0.014	.021	.032	.020	.69	
Investment Performance (IP)	0.021	.017	.014	.015	.013	.67

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