

Mediating Analysis of Heuristic Behaviour between Neurofinance and Investment Decision-Making of Small and Medium Entrepreneurs: Evidence from a Field Experiment

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ABSTRACT

Entrepreneurs' behavioural biases and emotions play an important role in shaping the rationality and quality of investment decision-making. Although behavioural biases are often assumed to influence financial choices, their direct effect on entrepreneurial performance and investment outcomes may vary depending on the psychological condition of the entrepreneur. Emotions, particularly positive and negative emotions, are closely associated with investment achievement because they can influence confidence, risk perception, judgment, and decision consistency. This paper aims to analyse the mediating effect of heuristic behaviour between neuro function, represented by emotion, and investment decision-making among entrepreneurs. A field experiment was conducted involving forty-two entrepreneurs to measure their emotional responses, investment decision-making behaviour, and heuristic tendencies. Data were collected using three structured sets of questionnaires designed to capture positive emotion, negative emotion, heuristic behaviour, and the quality of investment decisions. The collected data were analysed using analysis of variance (ANOVA) and General Linear Regression to examine the direct and indirect relationships among the variables. The findings revealed a significant effect of emotion on investment decision-making. Specifically, negative emotion was found to significantly influence poor investment decisions, both directly and indirectly through heuristic behaviour. However, positive emotion did not show a significant direct or indirect effect on investment decision-making through heuristic behaviour. Based on the analysis, a neuro-behavioural investment decision-making model was developed. This model provides useful insights for entrepreneurs by helping them recognise emotional influences, reduce decision-making errors, and improve emotional control during investment activities. Future research is recommended to examine heuristic behaviour as a moderating variable, as heuristic behaviour only partially mediates the relationship between emotion and investment decision-making.

Keywords: Emotion, Entrepreneur, Heuristic Behaviour, Investment Decision-Making, Neurofinance

INTRODUCTION

Financial decisions have a major impact on individuals and businesses, involving investing, spending, and borrowing (Ismail et al., 2021). Companies typically rely on fund managers and boards for guidance (Nyamute, 2016), but business owners make their own investment decisions. According to Seloni et al. (2023), mistakes are common in entrepreneurship, but successful entrepreneurs learn from them. Emotional signals can

influence risk-taking and decision-making rationality. Hua and Wang (2018) suggest that biases and emotions of business owners can affect the rationality of investment decision-making. Entrepreneurs often manage their finances themselves, but this can lead to investment decisions that don't align with their goals (Wong et al., 2018). Nicolas (2022) further noted short-term financial constraints are just as crucial as long-term ones when it comes to investing in small and medium-sized enterprises (SMEs). This can force entrepreneurs to forgo investment opportunities to meet their working capital needs, which raises concerns about their decision-making and potential irrational behavior. This study related to Prospect Theory where decision-making under conditions of risk (McDermott, 2016). The challenge of decision-making under conditions of uncertainty is difficult to foresee the consequences of the events with clarity.

Behavioral biases can be categorized into emotional biases and cognitive errors. Emotional biases stem from feelings and intuition, while cognitive errors come from a lack of understanding or memory issues. Both types of biases can lead to poor financial and investment decisions (Ismail et al., 2021). Both biases can negatively impact investment and financial decisions. Emotions are important in neurofinance. Neurofinance is an emerging field that combines neuroscience, psychology, and finance to study how human brain activity influences financial decision-making (Srivastava et al., 2019). It aims to improve the understanding of financial decisions by exploring the neural mechanisms underlying these decisions which are emotions. Positive emotions can lead to better investment outcomes, while negative emotions may not always be reliable indicators for investment decisions (Torga et al., 2018). Newer data sources, like field experiments, may be more effective than lab experiments in measuring variables important to investment decision-making theories (Frydman & Camerer, 2016). However, little research exists on the neuroscience of investment decision-making in field experiments, leaving a gap in understanding for both practitioners and academics. Additionally, there is a lack of research on how entrepreneurs make investment decisions. Research has mainly focused on management skills and financial knowledge when studying why entrepreneurs discontinue their businesses (Costa et al., 2023; Adobor, 2020). However, little attention has been given to investment decision-making and the role of heuristic behaviour in influencing emotions and decisions. Heuristic behaviour refers to the use of mental shortcuts or "rules of thumb" that simplify decision-making and problem-solving processes (del Campo et al., 2016). It is also a cognitive strategy that humans use to manage the cognitive demands of daily life, make quick decisions, and solve problems efficiently. Thus, this research focused on the field of "neuro finance" aims to better understand how people make financial decisions.

This research introduces a new model of neuro-behaviour in investment decision-making. It provides practical insights for better decisions and can be applied to individuals, society, and investment parties. The model adds to the current literature on neuroscience studies, specifically in neurofinance. This study aims to analyzes how emotions impact entrepreneurs' investment decisions and how heuristic behavior mediates this relationship.

Thus, below is the conceptual framework for neuro-behaviour in investment decision-making:

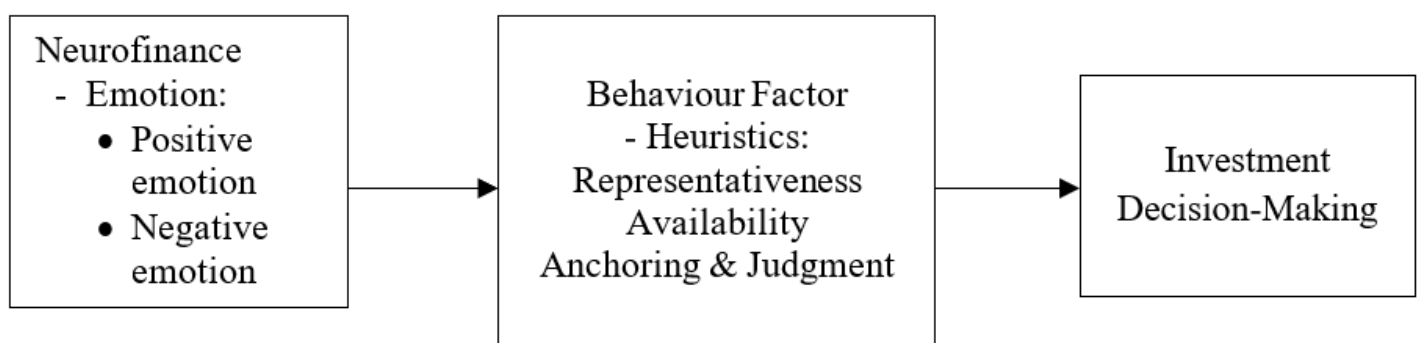


Figure 1: Conceptual Framework

Figure 1 shows the independent variable, dependent variable, and mediating variable. Neurofinance is an independent variable and emotion is identified as a neuro factor that consists of positive emotion and negative

emotion. The dependent variable is investment decision-making. Lastly, heuristics is a mediator in behavioural factors. Therefore, the research hypotheses are outlined as:

Hypothesis 1:

There is a significant effect of emotion on investment decisions.

Hypothesis 1a:

There is a significant effect of positive emotion on investment decisions.

Hypothesis 1b:

There is a significant effect of negative emotion on investment decisions.

Hypothesis 2:

The mediating effect is significant in emotion and investment decisions.

Hypothesis 2a:

The mediating effect of the heuristic significantly influences positive emotion and investment decision.

Hypothesis 2b:

The mediating effect of heuristic significantly influences negative emotion and investment decisions.

MATERIALS AND METHODS

This is casual research that aims to test whether emotions can cause a change in investment decision-making. However, it also considers the mediating variable of the heuristic. According to Hayes and Preacher (2014), a simple mediation model reveals a causal arrangement in which an independent variable affects the dependent variable indirectly through a mediator variable. Figure 1 reflects a causal sequence in which emotion affects investment decision-making indirectly through the mediator variable of heuristics. It means that emotion is postulated to affect heuristic, and this effect then propagates causally to investment decision-making. On the other hand, there is a possibility that emotion can also affect investment decision-making directly and emotion can indirectly affect investment decision-making as mediated by heuristic. It also identifies the control effect of the survey questionnaire consisting of the demographic profile such as the age of business, education level, and level of financial knowledge.

This research has non-contrived settings as it was conducted to establish cause-and-effect relationships using the natural environment which is called a field experiment (Sekaran & Bougie, 2016). The experiment is one of the best research designs to reveal a causal relationship between variables. The researcher interfered with the natural events in as much as the independent variable was manipulated. In this research, emotion was manipulated in positive and negative emotions. These manipulations as treatments were assigned to the experimental group and not to the control group. This is because this study conducts a true experimental design. The design of the experiment includes both experimental and control groups, and it records the information before and after the experiment for both groups. The experimental group is exposed to the treatments, called pre-test and post-test experimental (Sekaran & Bougie, 2016).

This research focused on investment decision-making in consideration of neuro function. The population is SMEs in Kelantan. Forty-two entrepreneurs were selected as the experimental units from different sectors such as manufacturing, services, and other services. The experiments were conducted on a one-day basis from 9 am to 4 pm at Pusat Usahawan MARA (PUSMA), Kota Bharu, Kelantan. It involved four-time experiments to

complete all forty-two entrepreneurs. The independent variable is emotion in which neuro function considers two types of emotion which are positive emotion (happy and excitement) and negative emotion (sad and fear) whereas the dependent variable is investment decision-making. The mediating variable is heuristic as behaviour factor that can be measured on three different heuristics behaviour. They are representativeness, availability bias, and anchoring and adjustment. This research used field experiments to investigate how emotional state explains the reasons why people are not rational in making investment decisions.

This research employs a one-factor experimental design to compare the effects of two emotions which are positive emotion and negative emotion with a control group. Hence, the experimental units were divided into two experimental groups and one control group. The two treatments either the treatment of positive emotion or negative emotion were then assigned randomly to the subjects in two experimental groups where they had to watch the video clips that can change their mood either positive or negative. Whereas the control group was given a session of emotion control by the researcher.

Following Dunn and Hoegg (2014), subjects received positive emotion treatment, and watched four video clips of excitement and happy emotions derived from drama and comedy genres as well as documentaries, while for negative emotion treatment, each subject watched four video clips of fear and sadness in genres of horror, drama, and trackjacker. Two video clips were selected for each excited, happy, fearful, and sad emotion to provide subjects with emotional priming. All video clips were pre-tested and validated to ensure that they effectively generated the target emotion.

All the subjects were asked to fill out the emotion questionnaire before the experiment began. Then, after the experiment ended, the subjects were immediately asked to fill in the same emotion questionnaire. The subjects ranked their current emotions at that time to identify the changes in the subjects' emotions from the video clips. Then, the subjects repeatedly assessed themselves on investment decision-making through the same investment decision-making questionnaire. Finally, they had to rate themselves on the given scenarios of heuristic behaviour from the heuristic questionnaire. The repeated measures of questionnaires such as the emotion questionnaire and investment decision-making questionnaire were rearranged in the order of the questions to avoid memorization of the questions (Yang, 2017). The process involved in this experiment ended within 60 minutes for each subject which included the pre-test process, treatment process, and post-test process.

Then, the data were analysed by examining the analysis of variance (ANOVA) using SPSS. Whereas the analysis of mediation used SPSS PROCESS Macro Version 3.3 (PROCESS V3.3) developed by Hayes (2018). PROCESS was used to analyse the general linear regression of multicategorical emotion (control group, positive group, and negative group). A general linear modeling approach was articulated by the researcher in estimating the direct and indirect effects when the independent variable was multi-categorical (Hayes & Preacher, 2014).

The nature of this research is to analyse the issue of SMEs' investment decision-making. Thus, this research offers to determine the issue using the entrepreneur as a unit of analysis. This is because it involves the owners of SMEs in making important decisions from the financial perspective. According to Muhammad et al. (2009), the advantage of this perspective will neglect an averaging effect of several good and bad decisions made by the decision maker. Simultaneously, it increases the understanding of decision-making.

RESULT AND DISCUSSION

A one-way ANOVA was used to examine the different effects of emotion between the mean of investment decisions among the control group, negative emotion group, and positive emotion group. The results of the ANOVA are displayed in Table 1. The mean values of investment decisions were calculated for the control group (5.6429), negative emotion (4.4571), and positive emotion (5.8286) groups. The significant effect of emotion on investment decision-making has been shown in ANOVA where F-value = 37.234 with p-value = <0.0001 was less than the significance value of 0.05. The effect was large ($\eta^2 = 0.6563$) with 65.63% of changes in investment decisions explained by emotion factor. Thus, hypothesis 1 which is there is a significant

effect between emotion and investment decisions was supported. The mean difference in Tukey's test showed that significant difference effects existed between the control group and the negative emotion group (p -value $= < 0.0001$); and between positive emotion and negative emotion (p -value $= < 0.0001$). Therefore, hypotheses 1a and 1b were supported.

Table 1: Summary of ANOVA for Investment Decision

Group	N	Mean	ANOVA		Tukey Test- Multiple Comparison	
			F	p-value	Mean Different	p-value
Control (C)	14	5.6429	37.234	<0.0001	1.18571* (C - N)	<0.0001
					-0.18571 (C – P)	0.534
Negative (N)	14	4.4571			-1.18571*(N – C)	<0.0001
					-1.37143* (N – P)	<0.0001
Positive (P)	14	5.8286			0.18571 (P – C)	0.534
					1.37143* (P – N)	<.0001

Note: $\eta^2 = 0.6563$

Table 2 shows the result of the mediating effect of heuristics on emotion and investment decisions. It found that the mediating effect of the heuristic was significant on emotion and investment decisions with-F-value = 54.2335 and p -value $= < 0.0001$. Thus, hypothesis 2, which is the mediating effect, is significant in emotion and investment decision, and was supported.

Table 2: Mediation Analysis Result: The Effect of Emotion on Investment Decision through Heuristic

Models	Coeff	MSE	t-value	p-value	LLCI	ULCI
Heuristic						
F-value = 0.0640, p-value = 0.9381, $R^2 = 0.0036$						
Constant	5.3000	0.1299	40.8049	<0 .0001	5.0373	5.5627
D1 (a_1)	-0.0619	0.1991	-0.3110	0.7575	-0.4646	0.3408
D2 (a_2)	-0.0524	0.1700	-0.3082	0.7596	-0.3962	0.2914
Post-test Investment						
F-value = 54.2335, p-value = <0.0001, $R^2 = 0.7391$						
Constant	5.6429	0.1327	42.5335	<0 .0001	5.3745	5.9112
D1 (Direct Effect) (c'_1)	-1.5237	0.1583	-7.3047	<0 .0001	-1.4769	-0.8359
D2 (Direct Effect) (c'_2)	0.2774	0.1694	-1.2427	0.2216	-0.1324	0.5534
Heuristic (b)	0.4732	0.1517	3.1203	0.0034	0.1166	0.7803

Mediation (through Heuristic)	ab	BootSE	Bootstrapped CI	
D1 (Indirect Effect) (a_1, b)	-0.0293	0.1478	-1.4471	-0.8666
D2 (Indirect Effect) (a_2, b)	-0.0248	0.1582	-0.0960	0.5284

Additionally, Table 2 also showed the positive emotion (D2) did not give any effect either directly ($c'_2 = -0.2774$, p -value = 0.2216) or indirectly ($a_2, b = -0.0248$; CI: -0.0960, 0.5284) on investment decision. Thus, hypothesis 2a was not supported. On the other hand, negative emotion (D1) significantly reduced the investment decision directly ($c'_1 = -1.5237$, $p = 0.0034$) and indirectly through heuristic ($a_1, b = -0.0293$; CI: -1.4471, -0.8666). It indicated that negative emotion had a significant effect on poor investment decisions. Therefore, hypothesis 2b was supported. Those results showed that the investment decision was reduced by 1.52% on negative emotion. Besides that, the investment decision was 0.03% lower (compared with the control group) through the indirect effect of the heuristic. Therefore, it can be concluded that heuristics mediated the effect of emotion on investment decision-making. Thus, partial mediation existed as shown by the model in Figure 2.

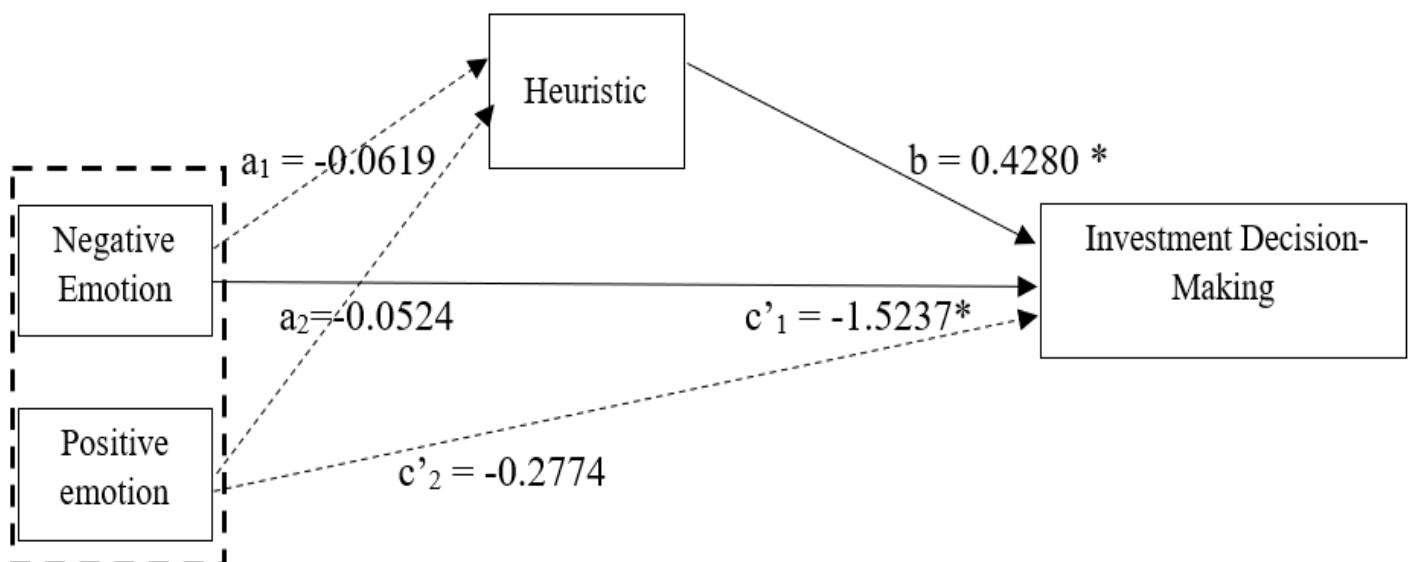


Figure 2: Heuristic: Partial Mediation of Emotion on Investment Decision

When making investment decisions, SMEs can be influenced by both negative and positive emotions. Negative emotions may cause entrepreneurs to act on investment messages in harmful situations, leading to poor decisions. On the other hand, positive emotions can lead to investing in secure opportunities and making good decisions. It's important to avoid making decisions based solely on gut feelings, as this approach can often result in incorrect investment choices (Tarditi et al., 2020; Wang, 2024). Negative emotions indirectly impact SMEs' investment decisions through the mediation of heuristics, leading to poor outcomes. This is consistent with previous studies (Tarditi et al., 2020; Torga et al., 2018) that suggest investment messages trigger negative emotions, leading to harmful decision-making. Heuristics provide an immediate solution for SMEs but can also lead to social concern dominating the decision-making process. The investment decision-making process is influenced by heuristics and has been proven to provide an immediate and sufficient solution to SMEs based on the information they gather (Nigam et al., 2018; Gal et al., 2013). On the other hand, positive emotions do not significantly affect investment decisions for SMEs. Those experiencing positive emotions rely on past experiences, evaluate information meticulously, and base decisions on experience and maturity to avoid mistakes (Tarditi et al., 2020; Torga et al., 2018).

The mediation analysis shows that heuristic and its dimensions partially mediate emotion and investment decisions. However, only negative emotions affect the SMEs in poor investment decisions indirectly as compared to the control group. The results are consistent with Tarditi et al. (2020) and Torga et al. (2018) which revealed that negative emotion is prompted by investment message that leads investors to fall into harmful decisions. This is because they are more prominent in social concern even when the investment does not give further development to the business such as illegal investment. The investment decision is mediated by heuristics and proven that the SMEs guarantee an immediate sufficient solution from the information they gathered (Nigam et al., 2018; Gal et al., 2013).

As for positive emotion, the mediating effect of the heuristic did not show any difference with the control group in investment decisions among SMEs. This is because those who have positive emotions depend more on their previous investment activities and propel them to continue with positive activities to ensure positive effects (Tarditi et al., 2020; Torga et al., 2018). They are more structured, and they thoroughly analyze the information gathered. In addition, the investment that they made relied on experience and maturity to control emotions to avoid making mistakes (Torga et al., 2018).

CONCLUSION

To recap, this research was conducted to determine whether emotions based on positive and negative emotions among entrepreneurs (SMEs) influence investment decision-making. On the other hand, this research included the mediating variable which is heuristic to examine its mediation effect on emotion and investment decision-making. An experimental analysis was used to emphasize the effect of those variables. Two main hypotheses were tested to determine the effect of emotion on investment decision-making using ANOVA as well as the mediating effect of heuristics behaviour on emotion and investment decision-making using general linear regression. The theoretical implication implies that positive emotions can improve investment decisions, while negative emotions can lead to risk-averse decisions. Evidently, in the Prospect Theory, Kahneman and Tversky mentioned that when negative emotions are involved, they can affect the perception of investment losses and gains leading to more risk-averse decisions. Psychological factors play a significant role in investment decision-making. The practical implications imply that entrepreneurs should control their emotions, especially negative ones when making investment decisions. Professionalism is key to ensuring business success. Companies that are five years old have a high risk of failure and need to focus on survival to avoid discontinuation. However, the findings of this study may not fully generalize across different regions or industries because it relies on a localized experiment focused strictly on how emotions mediate investment decision only, hence future research should utilize larger, more diverse entrepreneurial samples and employ longitudinal designs to track decision-making changes over time. Scholars should also integrate variables such as emotional intelligence and risk perception, leverage advanced neurophysiological tools to capture deeper cognitive data, and develop practical training programs that help investors actively mitigate these behavioral biases.

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CONFLICT OF INTEREST

We would like to clarify that this publication is not affiliated with any known conflict of interest and that there has been no financial support for this work that may have affected its findings.

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