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ENDOGENEITY TESTING: HEURISTIC BEHAVIOR AS A REFERENCE FOR BEGINNING INVESTORS IN MAKING INVESTMENT DECISIONS

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ABSTRACT

This study aims to examine the tendency of endogeneity on heuristic behavior as a reference for novice investors in making investment decisions. Endogeneity is a deviation in OLS modeling which shows that there is still a correlation between the independent variables in the model and the error, causing biased results. The issue of endogeneity is an interesting aspect of current research, and still creates pros and cons for researchers in the fields of finance and econometrics. In this study, 158 respondents were used who were novice investors. The selection of respondents was done randomly. In this study, four categories of variables were used, namely the dependent variable, namely investment decisions, the independent variable, namely financial risk tolerance, endogenous heuristic behavior variables and financial literacy instrument variables. The analysis method is carried out using ivregress 2sls which is processed with Stata. The test results found that endogeneity symptoms were detected in heuristic behavior of novice investors. This behavior appears and influences investment decisions because it is preceded by financial literacy, which rejects the insights that investors have about financial science or investment.

Keywords: Heuristic Behavior, Financial Risk Tolerance, Financial Literacy, Investment Decision & Endogeneity

INTRODUCTION

Advances in technology at this time have made it easier for humans to do various things that are beneficial to their lives. Advances in technology have also created a number of applications that can make it easier for someone to participate in investing in securities. The existence of investment-based applications sponsored by leading national or multinational security, financial institutions can easily be accessed by the public. The existence of this online application makes people's desire to invest in securities an easy thing to do (Hsu et al., 2021). The registration process is easy and fast electronically, making registration to become a securities investment player so easy to do.

The convenience offered by a number of these investment applications has encouraged the increasing desire of the people in the country to provide a number of funds, and participate in investing to buy securities offered on the secondary market. Each community that participates in investing certainly makes decisions with different motives. Sometimes the decisions taken by investors tend to be irrational, especially for those who have no experience in investing (Holden & Tilahun, 2022). Cognitive aspects and psychological biases owned by investors are related to what they believe to be a reference in making decisions.

According to the concept of behavioral theory, there are two assumptions in making investment decisions, namely rational decisions and irrational decisions (Toma, 2015). When an investor is able to make rational decisions, of course this is based on a complete description of information, as well as the fundamental and technical approaches they have taken, so that through these decisions investors are believed to be able to reduce the uncertainty or risk they face, while decisions that arise indirectly rational, this is due to speculative beliefs about positive prospects in the future, where investors only rely on logic and predictions or are not based on data analysis or an accurate investment approach.

Investor behavior that tends to make investment decisions irrationally is called heuristic behavior (Huang et al., 2018). Basically heuristic behavior can be grouped into several forms, namely representativeness, overconfidence, anchoring, gamblers and availability bias (Ahmad & Shah, 2020), each form of heuristic behavior will influence investment decisions taken by novice investors.

According to Kasoga, (2021), in general, investors who carry out heuristic behavior in investing only think about profits, and ignore risk factors. They only observe something that is pseudo, the success of the closest person or respected figure in investing, becomes a reference, creates a high sense of optimism to achieve future profits. Ahmad & Shah, (2022) stated that overconfidence behavior has created irrational investment decisions and has relatively low financial risk tolerance, and can reduce the performance of investments made. Gavrilakis dan Floros (2022) state that the heuristic behavior observed from overconfidence behavior influences investment decisions for novice auditors, besides that overconfidence has a negative effect on financial risk tolerance. Furthermore, Mayston (2009) states that heuristic behavior in the form of overconfidence has a positive effect on investment decisions made by novice investors.

Heuristic behavior that tends to be carried out by novice investors tends to be speculative, besides that novice investors, especially young investors, tend to have a low tolerance for financial risk (financial risk tolerance), so that these actions make the investment performance that has been carried out not optimal and sometimes even creates losses for investors. these investors (Ullah et al., 2018). Beginner investors tend to ignore uncertainty, lack of financial knowledge and investment, due to the level of education and investment experience that sometimes creates regret for novice investors to invest in securities, because of losses. Even though the bias of investor behavior in the form of heuristic behavior is still being carried out by most novice investors in investing, it is as if they have the thought that every decision to buy securities in particular will always benefit.

Heuristic behavior does influence the decisions of novice investors in making investment decisions (Hermansson & Jonsson, 2021). Even though heuristic behavior is an endogenous variable in addition to investment decisions. This is due to behavior imitating investment successes that have been made by other investors (heuristic behavior) which can be triggered due to a number of reasons, one of which is low financial literacy, or due to lack of experience in investing (Kumar et al., 2019). Endogeneity in regression shows that the independent variable still has a correlation with errors, thus creating biased results (Hair et al., 2019). When a variable has two functions, either as exogenous or endogenous, it indicates the existence of an instrument variable that triggers the formation of that variable.

The endogeneity problem that arises in an OLS equation is still little discussed in research studies, but research will certainly be important so that in selecting the variables to be tested into the OLS analysis a researcher also needs to ensure that endogeneity does not occur in the analytical model used, so that estimates of the results obtained are better or not biased. (Suresh, 2021) revealed that it is impossible to eliminate endogeneity in the OLS model, but it can be reduced, so that it will make the analytical model that is formed more fit.

RESEARCH METHODS

This type of research is causative where there is a problem of clausality of relationships that occurs in a number of research variables used in the model, so it is suspected that one of the variables that forms the analytical model framework used contains endogeneity problems (Hair et al., 2019). In this study, novice investors from the general public were used, such as students, government employees, the private sector in the city of Padang. The number of respondents used is 158 people. The data used is primary data, which is obtained through distributing questionnaires. The sample collection method was carried out using a purposive sampling method, in which investors who could be used as research respondents were investors who were investing in securities for the first time, through applications or through official securities services in the city of Padang.

In this study the variables used can be grouped into several variables namely dependent, independent variables, endogenous variables and instrument variables. In this study, the dependent variable is investment decisions which are measured using 5 statements adopted from (Braga & Fávero, 2017). The measurement for the independent variable is financial risk tolerance. The measurement of these variables is measured using 5 statements adopted from (Asfira et al., 2019).

In this study, researchers suspect that there is endogeneity, namely the heuristic behavior variable. Where variables are measured using 5 questions adopted from Kasoga (2021). The endogeneity problem is caused by the existence of instrument variables that trigger heuristic behavior in investing. In this study, the instrument variable was financial literacy as measured by 8 statements adopted from Mahmood et al., (2016). The measurement of research variables was carried out using a Likert Scale of 5. The analytical method used to answer the truth of the hypothesis was using a simultaneous analysis of 2 step least

squares. The equation model that is guided by this research is:

$$Kep\_Invest = a + \beta_1 Risk\_Tol + \beta_2 Heu\_Behavior + e \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \text{Pers 1}$$

$$Heu\_Behavior = a + Z_1 Finan\_Literacy + e \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \text{Pers 2}$$

$$Kep\_Invest = a + Risk\_Tall\ (Heu\_Behavior = Finan\_Litercy) + e \ldots\ldots\ldots\ldots\ldots \text{Per 3}$$

Keterangan

Kept_Invest = Investment Decision
Risk Tol = Financial Risk Tolerance
Heu_Behavior = Heuristic Behavior
Finan_Literacy = Financial literacy

The test procedure is carried out by testing deviations from the classical assumptions which consist of testing for normality. Normality testing is done by Skewness analysis. Normally each variable is determined from P <0.05 (Hair et al., 2019). The second classic assumption procedure used is the multicollinearity test which is performed using the Variance Influence Factor (VIF). Each independent variable will be free from multicollinearity deviation when it has a VIF < 10. Next is the autocorrelation test performed using the Durbin Watson test, the regression model will be free from autocorrelation deviation if it has a coefficient value that meets the notation $-2 \leq 2 \leq 2$ (Santoso, 2010). Next is the heteroscedasticity test using the Breusch Pagan / Cook-Weisberg Test, the regression model to be analyzed will be free from heteroscedasticity deviation if it has P > 0.0 (Gujarati, 2006).

After all assumptions are met, multiple regression analysis (OLS) or regression with two step list squares can be carried out. Hypothesis testing is done through t-test statistics. The hypothesis will be accepted when the t-hit value is > 1.96 and vice versa (Hair et al., 2019). The final test in this research is to test the accuracy of the endogeneity assumption through endogeneity testing where the assumption will be fulfilled when P < 0.05 and vice versa. Data processing is done using Stata 15.

RESULTS AND DISCUSSION

This study aims to prove that there is an influence between financial risk tolerance and heuristic behavior on the decisions of novice investors in the city of Padang. Apart from that, this research also wants to prove the existence of an endogeneity problem where the heuristic behavior which is the endogenous variable is expected, where this variable occurs because of the existence of an instrument variable, namely financial literacy. Based on the results of data processing, the demographics of the respondents are shown in Table 1 below:

Table 1 Respondent Demographics

Information	N	%
Sex		
Male	91	57.59
Female	67	42.41
Status		
Married	72	45.57
Single	86	54.43
Age		
0 – 19 Years	9	5.70
20 – 29 Years	46	29.11
30 – 39 Years	57	36.08
40 – 49 Years	24	15.19
50 – 59 Years	8	5.06
> 60 Years	14	8.86
Education		
Diploma	13	8.23
Bachelor	79	50.00
Master	66	41.77
Investment Experience		
< 1 Month	84	53.16
1 – 2 Month	9	5.70
3 Month	65	37.97
Total	158	100

In table 1 it can be seen that most of the respondents were male, namely 57.29%, while the respondents were female, amounting to 42.41%. Other information that the researchers obtained from field observations was that 54.43% of the respondents were single, while 45.57% of the other respondents were married. If observed from the age characteristics, it is known that 36.08% of respondents are aged between 30 years to 39 years, while the respondents with the least number are those aged between 50 years to 59 years, namely only 5.06%. In the identification of the observation results it was also known that most of the respondents had an undergraduate level education, this expression was recognized by 50% of respondents while respondents with an education level of D3 were the least number of respondents, namely only 8.23% of respondents, from the results of field observations that had been carried out obtained partial information Most of the respondents admitted that they had only invested less than one month. This expression was stated by 53.16% of respondents while the respondents with the smallest number were respondents who had just invested between 1 month and 2 months which were recognized by 5.70% of respondents.

The first stage in data processing in this study was to test the classical assumptions which included normality testing, multicollinearity testing, autocorrelation testing and heteroscedasticity testing. When the variables that support the OLS regression model or the two step list square are free of these assumptions, the hypothesis testing stage can be carried out and the regression analyzed is declared fit.

The normality test is carried out using the Skewness test, according to the test results the results obtained are described in Table 2 below:

Table 2 Skewness Normality Test Results

	Obs	Prob > Chi^2	Cut Off	Conclusion
Investment Decision	158	0.0542	0.05	Normal
Heuristic Behavior	158	0.0530	0.05	Normal
Financial Risk Tolerance	158	0.1017	0.05	Normal
Financial Literacy	158	0.2021	0.05	Normal

The results of the normality test seen in the Stata output show that each research variable used has a probability ≥ 0.05. Thus each variable consisting of investment decision heuristic behavior, financial risk tolerance and financial literacy has a normal distribution. Thus the next stage of data processing can be implemented immediately.

Furthermore, the second classical assumption test tests the occurrence of any correlation between independent variables in a regression equation model, namely through multicollinearity testing. In accordance with the results of data processing, the results obtained are described in Table 3 below:

Table 3 Multicollinearity Test Results

	VIF	1/VIF	Conclusion
Heuristic Behavior	3.89	0.257	No Multicollinearity
Financial Risk Tolerance	3.87	0.259	No Multicollinearity
Financial Literacy	2.55	0.392	No Multicollinearity

Based on the results of data processing, it can be seen that each independent variable included in the OLS regression equation model, which consists of heuristic behavior, financial risk tolerance and financial literacy, has a VIF coefficient ≤ 10 so that it can be concluded that each of these variables is free from multicollinearity deviations. Thus further data processing procedures can be implemented immediately.

The procedure for the third stage of classical assumption analysis is to test the serial correlation over time using the autocorrelation test. A fit regression model does not contain serial correlations. Testing was carried out using the Durbin Watson test (DW). In accordance with the results of data processing, the results obtained are described in Table 4 below:

Table 4 Durbin Watson Autocorrelation Test Results

Lag (P)	Chi^2	df	Prob > Chi^2	Conclusion
1	0.912	1	0.3396	No Autocorrelation

In accordance with the table above, it can be seen that the probability value obtained is 0.3396. Thus the P value > 0.05, the decision is that Ho is accepted so that the multiple regression model which will be used as a requirement for conducting simultaneous analysis in research is free from autocorrelation deviations. Thus further data processing stages can be carried out immediately

The next stage of classical assumption testing is to test heteroscedasticity using the Breusch Pagan / Cook-Weisberg Test. In accordance with the results of data processing obtained description of the results as follows:

Table 5 Breusch-Pagan Heteroscedasticity Test Results

Model	Chi^2	Prob > Chi^2	Cut Off	Conclusion
1	3.9611	0.3304	0.05	No Heteroscedasticity

Based on the results of the heteroscedasticity test, the probability value obtained is 0.3304. The processing is done using an error rate of 0.05. Thus P > 0.05. Thus Ho is accepted so that it can be concluded that the variables that make up the multiple regression equation model in this study are free from heteroscedasticity deviations. Thus the stages of data processing can be done immediately.

After all the test assumptions are met, the first step before conducting simultaneous testing using a two step least square analysis is to perform an OLS multiple regression analysis. In accordance with the results of data processing that has been carried out, the description is shown in Table 6 below:

Table 6. Multiple Regression Equation Testing Results (OLS)

Dependent Variable: Investment Decision

	Coef	Prob	Cut Off	Conclusion
Financial Risk Tolerance	0.699	0.000	0.001***	Significant
Heuristic Behavior	0.124	0.053	0.10*	Significant
(Constanta)	2.437	0.000	0.05**	Significant
	R^2	0.837		
	F-prob	0.000		

The OLS model obtained shows that each independent variable consisting of financial risk tolerance and heuristic behavior has a significant effect, namely at the error rate of 0.05 and 0.10*. The test results also show that the model is quite good because it has a coefficient of determination (R-Square) of 0.837 and the results of the F-statistics test show significant results (P <0.05). In the OLS regression equation model, it can be seen that the heuristic behavior variable can function as an endogenous variable and has a significant influence on investment decisions for novice investors. The emergence of heuristic behavior as an endogenous variable is triggered by the low financial literacy of novice investors.

Prior to the simultaneous analysis, the second stage that the researchers carried out was to test the effect of financial literacy as an instrument variable on heuristic behavior. In line with the data processing that has been done, the results are shown in Table 7 below:

Table 7 Testing the Effect of Instrumental Variables on Endogenous Variables

Dependent Variable: Heuristic Behavior

	Coef	Prob	Cut Off	Conclusion
Financial Risk Tolerance	0.405	0.000	0.001***	Significant
(Constanta)	7.078	0.000		
	R^2	0.562		

The test results show that financial literacy is indeed proven to be an instrument variable, because it influences the heuristic behavior of novice investors. This can be seen from the positive regression coefficient value of 0.404 and statistically strengthened with P <0.05. Thus it can be concluded that even though a novice investor has high financial literacy, they still increase their tendency to carry out heuristic behavior in investing in securities, especially stocks in the secondary market.

After the two stages of the regression analysis model is carried out then. Endogeneity testing using simultaneous analysis can be carried out. Data processing is done with two step least square. Based on the processing results that have been carried out, the results are shown in Table 8 below:

Table 8 Two Step Least Square Test Results

Dependent Variable: Investment Decision

	Coef	Prob	Cut Off	Conclusion
Heuristic Behavior	0.686	0.003	0.01*	Significant
Financial Risk Tolerance	0.318	0.050	0.05**	Significant
(Constanta)	-1.653	0.452		
	R^2	0.757		
	F-prob	0.000		
Instrumented:	Heuristic Behavior			
Instruments:	Financial Risk Tolerance, Financial Literacy			

In accordance with the results of the ivregress two step least square test, it can be seen that the coefficient value of the heuristic behavior variable has a coefficient that is not much different from the OLS test, namely 0.699 slightly corrected to 0.685, the thing that has changed is the value of the constant in the OLS analysis which has a positive sign and changes to a negative sign. The results of testing the heuristic behavior and financial risk tolerance variables have P < 0.05 so it can be concluded that each variable has a significant effect on the investment decisions of novice investors in the Indonesia Stock Exchange.

The final stage of endogeneity testing is to test whether the heuristic behavior variable is really influenced by the instrument variable which is financial literacy, so that it becomes a reference in making decisions. investment. Testing is done by performing test of endogenous test. Based on the processing results that have been carried out, the results obtained are described in Table 9 below:

Table 9. Endogenous Platform Test Results

Model	Coef	Prob	
Durbin (Score) chi^2 (1)	9.799	0.0017	Variable are Endogenous
Wu-Hausman F (1.154)	10.181	0.0017	

In the table above, from the two endogenous test procedures, it can be seen that the Durbin probability value (score) chi2 is 0.0017, the same is true for the results of the Wu-Hausman F test. The value obtained shows P < 0.05 so the decision is to reject Ho, thus it is proven heuristic behavior variable is an endogenous variable. This shows that financial literacy is a trigger for heuristic behavior in novice investors in Padang City.

DISCUSSION

Effect of Financial Risk Tolerance on Investment Decisions

In accordance with the results of hypothesis testing it was found that financial risk tolerance has a positive effect on the investment decisions of novice investors in Padang City. These results indicate that the higher the tolerance that investors have, the greater their decision to invest in securities in the secondary market. This situation shows that novice investors are aware of the risks they will face in investing in stocks, but they still make the decision to buy stocks with the right analysis and approach. Beginner investors tend to speculate, and are more suggestive of the success of other investors, so that the decisions taken tend to be irrational and contain high risks. The findings obtained are supported by the research results of (Eker & Anbar, 2019) which state that suggestions for the success of other investors, as well as overconfidence, are often reasons for making investment decisions for novice investors. Dewanti & Pratiwi (2021) stated that novice investors often ignore risk factors and

prefer to make decisions based on speculation to get profits.

Effect of Heuristic Behavior on Investment Decisions

Based on the results of testing the second hypothesis, it was found that heuristic behavior has a positive effect on investment decisions observed in novice investors in Padang City. These findings show suggestions for the success of a number of other investors, becoming a reference that encourages the stronger decision of novice investors to spend their funds buying shares offered by companies on the secondary market. Overconfidence in themselves that they will achieve similar success with other investors, can not restrain the decision of novice investors to buy stocks recklessly. The findings obtained are supported by the research results of Mahmood et al., (2016) heuristic behavior is the reason for novice investors in making investment decisions. The same thing was described by Suresh (2021) heuristic behavior has a positive effect on investment decisions for novice investors. Furthermore, Tran et al., (2021) revealed that the tendency to imitate is an irrational trend for novice investors in making investment decisions.

Endogeneity Problems in Heuristic Behavior Affecting Investment Decisions

Based on the results of the two step least squares analysis and endogenous testing, it is proven that heuristic behavior as one of the factors that triggers the formation of novice investors' decisions in investing contains endogenous variables with financial literacy. The results obtained show that most beginners are individuals who have fairly good financial literacy, but still practice imitating behavior, overconfidence, gambling, and ignore important analysis in investing such as technical and fundamental analysis. The results obtained show that the endogeneity problem can be corrected, so that it can reduce the endogeneity value, but it still cannot be completely eliminated. The description of the research results obtained is supported by Fong et al., (2021), and the results of Cupák et al., (2022) stated that in the behavioral research concept the problem of endogeneity that creates biased research results will always exist, endogeneity certainly cannot be completely eliminated. however, efforts can be made to create corrections through the development of the Iviregress Two Step Least Square, as well as conducting an analysis of the Generalized Method of Moments (GMM)

CONCLUSION

In accordance with the results of testing the hypothesis using simultaneous analysis through Two Step Least Square analysis it was found that in general novice investors have a high awareness of the risks they will face in investing, but their tendency to carry out heuristic behavior such as having suggestions for success in investing, has excessive self-confidence so that it tends to create various irrational behaviors in behaving. Besides that, endogenous has proven that heuristic behavior as one of the factors that triggers the formation of novice investors' decisions in investing contains endogeneity with financial literacy variables. The results obtained show that most beginners are individuals who have fairly good financial literacy, but still practice imitating behavior, overconfidence, gambling, and ignore important analysis in investing such as technical and fundamental analysis. The results obtained show that the endogeneity problem can be corrected, so that it can reduce the endogeneity value, but it still cannot be completely eliminated.

The researcher realizes that the endogeneity research discussed in this article still has a number of weaknesses considering the limited experience and knowledge that the researcher has, such as in making models, to experience in analyzing because besides simultaneous analysis through Two Step Least Square, identification of endogeneity can be carried out through analysis of the Generalized Method of Moments (GMM). Therefore, future researchers are expected to be able to use this article as motivation to research endogeneity in financial finance. Considering that this topic will continue to be popular for the next few years, it is an interesting thing to create novelty research for researchers at doctoral and PhD levels.

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