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The Effect of Monetary Variable Shocks on Indonesian Portfolio Investment

Muhammad Khoirul Fuddin[1*], Firdha Aksari Anindyntha[2]
[1,2]Economic Development Department, Faculty of Economic and Business, University of Muhammadiyah Malang, Indonesia
E-mail: [1]khoirulfuddin@umm.ac.id, [2]firdhaaksari@umm.ac.id
[*]**Corresponding author**

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Abstract

Monetary variables can affect portfolio investment in the short or long term. The previous studies rarely discuss the effects of monetary variables in the long and short term on portfolio investment. This study looks at monetary indicators that affect investment portfolios in Indonesia. The methodology used in this research is to use the Vector Error Correction Model (VECM) to see the response of several variables in the short and long term. The findings suggest that monetary policy should pay special attention to Indonesia's money supply (M2) and savings to influence portfolio investment in the short term. The monetary policy transmission mechanism can use the money and expectation channels to optimize monetary variables to control investment. Meanwhile, in the long run, monetary policy portfolio investment control needs to pay attention to interest rates and savings and adjust to the set inflation target, which can be used in the interest rate channel.

Keywords:
Saving; investment; interest rates; money supply; monetary policy

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INTRODUCTION

Household consumption, the business sector for investment, and the foreign sector for export-import have influenced Indonesia's economic growth in recent years (Badan Koordinasi Penanaman Modal, 2021). These three variables are interconnected; when one variable decreases, it will immediately affect the other two variables. Investment is one of the main driving forces of the Indonesian economy, especially during the economic recovery period when a pandemic hit it.

Investment has a positive correlation with infrastructure development in Indonesia. The amount of GDP significantly affects the slow growth of infrastructure (Banerjee et al., 2020; Ekeocha et al., 2022; Rinika et al., 2021). The increase in GDP will support the government's development efforts, while the government will also be more active in building infrastructure to support and attract investors (Kyriacou et al., 2019; Wang et al., 2019; Xu et al., 2021). The completer and more available the infrastructure in Indonesia, the more investment coming into Indonesia will also increase. This investment is also able to create a favorable business climate. The more investment or investment made in Indonesia; the more new businesses will emerge. In the last few years up to the pandemic, portfolio investment has received much attention from the Indonesian people. The Indonesian people are starting to look at this portfolio investment because investors can divide their capital into specific types of investment, and investors get the most minimal risk in investing. (Nur Safitri et al., 2020; Spuchľakova et al., 2015; West et al., 2021).

By exercising reasonable control and management of investment, the driving wheels of Indonesia's economic growth will be stable and even increase. The size of the investment in a country is strongly influenced by fluctuating monetary variables (Dang et al., 2020). Monetary variables have a multiplier effect because their influence impacts not only the monetary variable itself but also the real sector, government spending, and the external sector, so it will ultimately affect a country's economic growth. Economic variables, especially those closely related to the monetary sector, need to be monitored for movements and shocks that occur in them because they will affect other variables or even affect themselves in the long or short term.

In a broader and general sense, macroeconomic and fiscal policies implemented in a country can affect investment. (Ani & Onu, 2022; Lassance & Vrins, 2021; Mutuku & Ng'eny, 2014). When discussing investment, it is much more specific; portfolio investment, which is part of private investment, will be significantly influenced by market capitalization, the weighted average rate of return on deposits, trade openness, and wide money circulation (M2). (Lassance & Vrins, 2021; Seetharaman et al., 2017; Sharif Chaudhry et al., 2014).

In previous research, discussions on investment tended to be related to investment in general, so it took time to identify whether the investment discussed was direct or indirect. The previous study also examined the variables that affect investment, seen from various monetary and fiscal variables. Still, it did not distinguish the period of influence

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of multiple variables on investment. On the other hand, this research will sharpen the research that has been done before in attempting to analyze the impact of shocks that occur in monetary variables on portfolio investment in the long term or short term, which has not previously been discussed. This study also specifies portfolio investment, not investment in general. The variables used in this study are also more focused on monetary variables in the hope of providing a specific description of what monetary policy should do to control investment portfolios in Indonesia. The research contributes to assisting the government in establishing a monetary policy transmission mechanism that can be applied in managing portfolio investment activities that enter Indonesia in the short and long term. This study aims to see the effect of monetary variables in Indonesia when experiencing short-term or long-term shocks and whether they impact portfolio investment.

METHODS

This research includes applied research, which uses secondary data measured in a time series. The data source is taken from the Statistik Ekonomi dan Keuangan Indonesia (SEKI), from 2008 in the first quarter to 2022 in the third quarter. The step estimation method used in this study is as follows:

The first step must be to test the stationarity of the data, also known as the unit root test (Gujarati, 2004). The first step is to test the stationarity of the data by testing it at the degree level; if it is still not stationary, it will continue from the first-order to the second-order difference.

In determining the level of stationarity of data, pay attention to the following models;

$$Y_t = \delta Y_{t-1} + U_t \quad (1)$$

When the above equation is reduced by Y_{t-1}, on the right and left sides, obtained

$$Y_t - Y_{t-1} = \delta Y_{t-1} - Y_{t-1} + U_t \quad (2)$$

$$\Delta Y_t = (\delta - 1) Y_{t-1} + U_t \quad (3)$$

We can simplify the equation with:

$$\Delta Y_t = \beta Y_{t-1} + U_t \quad (4)$$

Determining the number of lags (order) used in the Vector Autoregressive VAR or VECM model, The Akaike Information Criterion (AIC) and Schwarz Information Criterion (SIC) criteria used in determining the amount of lag. The lag selected in this study is the model with the smallest AIC value, with the following formula;

$$\ln(\text{AIC}) = \ln\frac{\sum \hat{u}_i^2}{n} + \frac{2k}{n} \quad (5)$$

$$\ln(\text{SIC}) = \ln\left(\frac{\sum \hat{u}_i^2}{n}\right) + \frac{k}{n} ln\,(n) \quad (6)$$

Where, $\hat{u}_i^2$ = the sum of the squared residuals; k = number of independent observations; n = number of observations.

The cointegration test carries out the long-term balance of the observed research variables. The Johansen cointegration test uses trace statistical analysis and or test statistics for the maximum eigenvalue and critical value at the confidence level = 5% with the following steps:

$$LR_{tr}(r|k) = -T\sum_{i=r+t}^{k}\log(1-\lambda_i) \quad (7)$$

The maximum eigenvalue test statistic:

$$LR_{max}(r|k) = -T\sum_{i=r+t}^{k}\log(1-\lambda_i) = LR_{tr}(r|k) - LR_{tr}(r+1|k) \quad (8)$$

For r = 0, 1, ..., k - , with

λ_i = The largest eigenvalue to – i from the matrix = $(\lambda_1 \leq \lambda_2 \leq \cdots \lambda_n)$ (9)

T = The number of observed observations

K = The number of dependent variables

This study used the Vector Error Correction Model (VECM) in data analysis. VECM is an analysis used when variables that will not be stationary using Vector Autoregressive (VAR) (Usman et al., 2017). In modern econometric analysis, to build a relational model between economic variables in a non-structural way, you can use the VAR and VECM models. (Zou, 2018). We can use VECM analysis to find the relationship and shocks between variables in the short and long term. So to write the equation of the monetary variables that affect portfolio investment in Indonesia, partially it can be written as follows:

$$PF = C_1 + a_{1i}\sum_{i=1}^{k} SB_{t-k} + a_{1i}\sum_{i=1}^{k} M_{t-k} + a_{1i}\sum_{i=1}^{k} S_{t-k} + a_{1i}\sum_{i=1}^{k} INF_{t-k} + \varepsilon_1 \quad (10)$$

$$SB = C_2 + a_{2i}\sum_{i=1}^{k} PF_{t-k} + a_{2i}\sum_{i=1}^{k} M_{t-k} + a_{2i}\sum_{i=1}^{k} S_{t-k} + a_{2i}\sum_{i=1}^{k} INF_{t-k} + \varepsilon_2 \quad (11)$$

$$M = C_3 + a_{3i}\sum_{i=1}^{k} PF_{t-k} + a_{3i}\sum_{i=1}^{k} SB_{t-k} + a_{3i}\sum_{i=1}^{k} S_{t-k}\ a_{3i}\sum_{i=1}^{k} INF_{t-k} + \varepsilon_3 \quad (12)$$

$$S = C_4 + a_{4i}\sum_{i=1}^{k} PF_{t-k} + a_{4i}\sum_{i=1}^{k} SB_{t-k} + a_{4i}\sum_{i=1}^{k} M_{t-k} + a_{4i}\sum_{i=1}^{k} INF_{t-k} + \varepsilon_4 \quad (13)$$

$$INF = C_5 + a_{5i}\sum_{i=1}^{k} PF_{t-k} + a_{5i}\sum_{i=1}^{k} SB_{t-k} + a_{5i}\sum_{i=1}^{k} M_{t-k} + a_{5i}\sum_{i=1}^{k} S_{t-k} + \varepsilon_5 \quad (14)$$

In conducting its analysis, VAR has specific instruments that have particular functions in explaining the interactions between variables in the model. The tools include the Impulse Response Function (IRF) and Variance decomposition (VD. IRF is used to see the vector moving average, which aims to see how long the shock of one variable affects other variables. VD to determine which variables have a significant role in changing the variable and other variables.

RESULT AND DISCUSSIONS

Shocks caused by financial variables affecting Indonesian investment portfolios can turn into short-term and long-term. In the short run, portfolio investments are sensitive to the money supply (M2) and savings shocks. Still, portfolio investments are insensitive to shocks caused by interest rates and inflation in the short run. On the other hand, in the long run, portfolio investments respond to shocks from interest rates, savings, and inflation. In contrast, monetary (M2) shocks do not affect Indonesian portfolio investments in the long run.

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The data used in this research is time series data. The problems of time series data are generally stochastic (having a non-stationary trend). The ADF (Augmented Dickey-Fuller) test uses a 5% significance level, as shown in Table 1. If the t-ADF value is less than the critical MacKinnon value, then it is concluded that it is stationary (does not contain a unit root). The unit root test is carried out at the level up to the second difference. Most variables do not pass the level and first difference tests, so the level of stationarity is at the second difference. The stationarity results are also reinforced by Figure 1. Figure 1 shows that each research variable is statistically at the degree of second difference because each variant shows a stationary trend. Based on the stationarity test that has been carried out using the Augmented Dickey-Fuller Test (ADF), it can be concluded that the variables used in this study do not tend to fluctuate so that they can be used to estimate the model.

Figure 1. Second Difference Stationarity of Portfolio Variables, Interest Rates, Amount of Money in Circulation, Savings, and Inflation

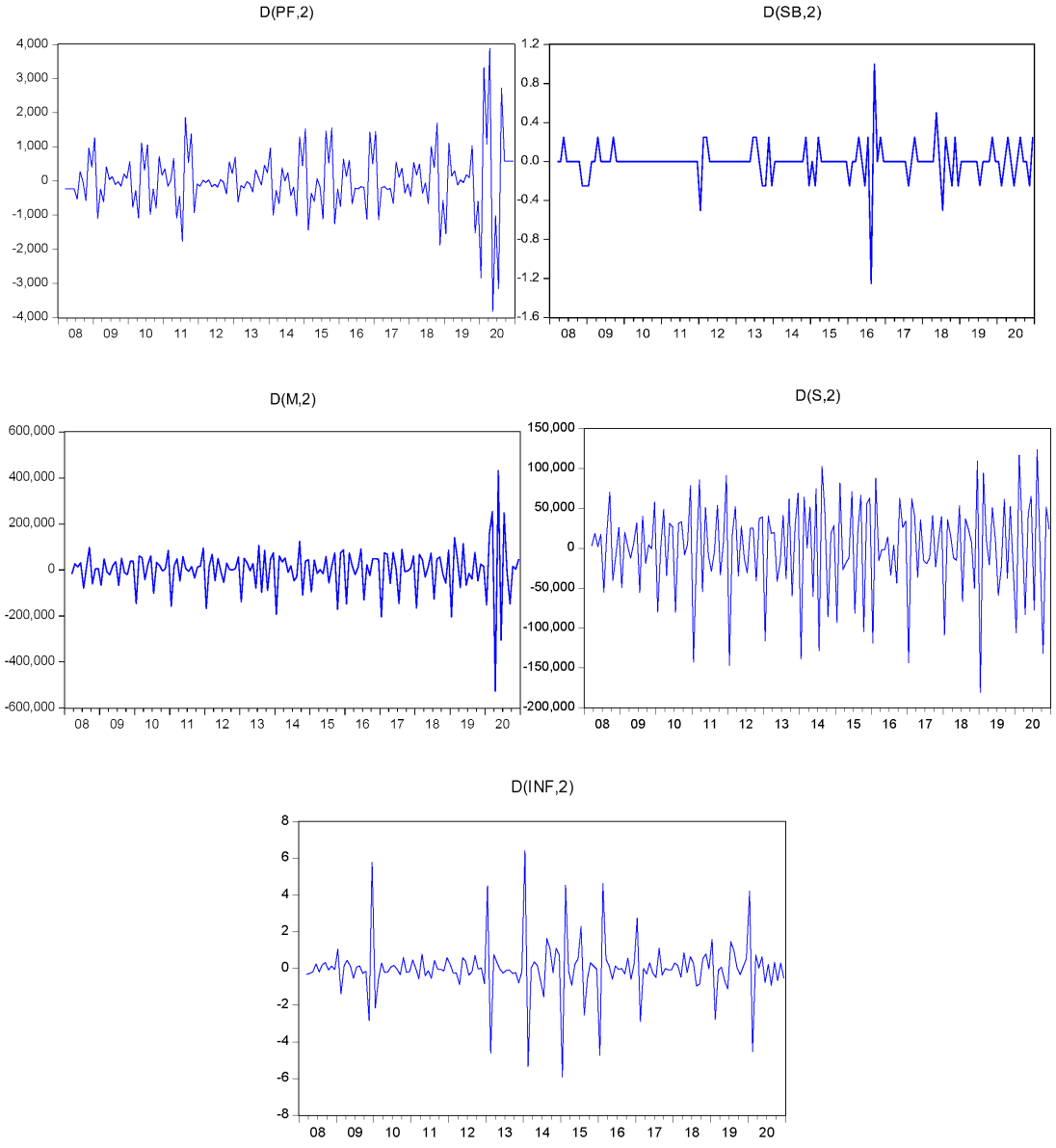

Table 1. ADF Test (Augmented Dickey-Fuller)

Data	Critical Value	Level		First Difference		Second Difference	
		Stat. ADF	p.value	Stat. ADF	p.value	Stat. ADF	p.value
PF	5%	-3.734558	-2.881400	-5.898573	-2.881685	-7.112792	-2.881830
SB	5%	-1.701121	-2.880336	-6.958871	-2.880211	-9.057193	-2.880722
M	5%	1.763227	-2.881685	-1.414085	-2.881685	-8.064005	-2.881685
S	5%	1.374094	-2.881685	-1.908580	-2.881685	-7.663622	-2.881685
INF	5%	-2.336054	-2.880088	-12.74347	-2.880211	-7.663622	-2.880591

Before performing VECM testing, it must determine the optimal lag in VECM estimation. Choosing the optimal lag is essential to overcome the occurrence of autocorrelation in the VECM system. The optimal lag length will search using the available information criteria. The selected lag candidates are the length of the lag according to the requirements of Likelihood Ratio (LR), Final Prediction (FPE), Akaike Information Critic (AIC), Schwarz Information Criterion (SC), and Hannan – Quin Crition (HQ).

Table 2. Determination of Lag Length

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-5110.105	NA	1.86e+24	70.06993	70.17210	70.11144
1	-4965.763	276.8194	3.62e+23	68.43511	69.04818	68.68421
2	-4877.110	163.9473	1.52e+23	67.56315	68.68711	68.01984
3	-4808.775	121.6934	8.40e+22	66.96951	68.60437*	67.63379
4	-4776.407	55.42312	7.63e+22	66.86860	69.01434	67.74046
5	-4742.068	56.44873	6.78e+22	66.74066	69.39729	67.82011
6	-4677.490	101.7328*	3.99e+22*	66.19849*	69.36602	67.48553*
7	-4653.641	35.93687	4.14e+22	66.21425	69.89267	67.70888
8	-4635.639	25.89333	4.67e+22	66.31012	70.49943	68.01233

Table 2 concluded that the sixth lag is the best lag length, where the majority of the criteria for Likelihood Ratio (LR), Final Prediction (FPE), Akaike Information Criterion (AIC), and Hannan – Quin Crition (HQ) are found at lag 6, while Schwarz Information Criterion (SC) is in lag 3. The function of conducting data stability tests on research variables is that when the data is stable. The results of the Variance Decomposition (VD) and Impulse Response Functional (IRF) analysis performed on VECM estimation can predict the variables analyzed automatically. A VECM system is stable if all roots or roots have a modulus of less than one. The results of data stability can result in Table 3.

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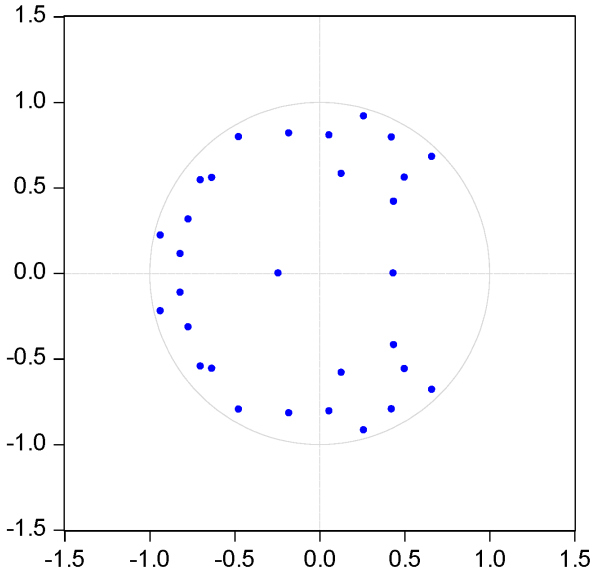
Table 3. Roots of Characteristic Polynomials

Root	Modulus	Root	Modulus
-0.935128 - 0.222092i	0.961140	-0.179694 + 0.817908i	0.837415
-0.935128 + 0.222092i	0.961140	-0.771578 + 0.315424i	0.833561
0.261140 + 0.917972i	0.954394	-0.771578 - 0.315424i	0.833561
0.261140 - 0.917972i	0.954394	-0.817263 - 0.113781i	0.825146
0.661959 - 0.680459i	0.949323	-0.817263 + 0.113781i	0.825146
0.661959 + 0.680459i	0.949323	0.058000 - 0.805907i	0.807991
-0.473918 - 0.795681i	0.926125	0.058000 + 0.805907i	0.807991
-0.473918 + 0.795681i	0.926125	0.500339 - 0.559087i	0.750278
0.424757 + 0.794548i	0.900958	0.500339 + 0.559087i	0.750278
0.424757 - 0.794548i	0.900958	0.437422 - 0.419222i	0.605875
-0.700012 - 0.545130i	0.887233	0.437422 + 0.419222i	0.605875
-0.700012 + 0.545130i	0.887233	0.128720 + 0.580566i	0.594664
-0.632330 - 0.557228i	0.842819	0.128720 - 0.580566i	0.594664
-0.632330 + 0.557228i	0.842819	0.434373	0.434373
-0.179694 - 0.817908i	0.837415	-0.242543	0.242543

The results of data stability testing, it that there is no modulus < 1 value and that the variables used in the study are already in stable condition. Data stability testing can also be done in another way, as shown in Figure 2. In Figure 2, each point within this circle proves that the variable used is stable. Later, the Variance Decomposition (VD) and Functional Response Impulse (IRF) analysis results will show that the VECM estimation can predict the observed variable. From the results of these tests, it can be that the data used in estimating the VECM model is stable and can be used to analyze in the short and long term in VECM analysis.

Figure 2. Inverse Roots AR Characteristic Polynomial



The purpose of the cointegration test in this study is to determine whether the group of variables that are not stationary at that level meets the requirements of the integration process, namely where the variables are stationary at the same degree, namely the second difference. Based on the results shown in Table 4, the cointegration test in this study used the cointegration test from the Johansen Trace Statistics test.

This test determines whether there is a long-term effect on the variables to be studied. If there is cointegration, then proceed with VECM. However, VECM cannot continue if it is unstable. Based on the Johansen Trace Statistic test results above, the results show that the variables are cointegrated in the long run, which by the trace statistic > critical value of 5%. So, in the long run, the variables will influence each other, which is shown by the asterisk. So, after various stages and stationary data at the second difference level and cointegration occurs, the Vector Error Correction Model (VECM) is the final estimation model suitable for use.

The Granger causality test (Granger Causality Test) is to see whether the two variables have a reciprocal relationship. In other words, does one variable have a significant causal relationship with different variables because each variable in the study has the opportunity to become an endogenous or exogenous variable? The bivariate causality test in this study used the VAR Pairwise Granger Causality Test and used a five percent significance level. The following table presents the analysis results of the Bivariate Granger Causality test. The results of the Granger Causality Test are shown in Table 5.

Table 4. Cointegration Test Johansen Trace Statistics Test

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.460054	265.9096	69.81889	0.0000
At most, 1 *	0.357541	175.3156	47.85613	0.0000
At most, 2 *	0.278041	110.2751	29.79707	0.0000
At most, 3 *	0.222970	62.38442	15.49471	0.0000
At most, 4 *	0.158111	25.29977	3.841466	0.0000
Unrestricted Cointegration Rank Test (Maximum Eigenvalue)				
Hypothesized No. of CE(s)	**Eigenvalue**	**Max-Eigen Statistic**	**0.05 Critical Value**	**Prob.****
None *	0.460054	90.59409	33.87687	0.0000
At most, 1 *	0.357541	65.04043	27.58434	0.0000
At most, 2 *	0.278041	47.89071	21.13162	0.0000
At most, 3 *	0.222970	37.08465	14.26460	0.0000
At most, 4 *	0.158111	25.29977	3.841466	0.0000

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Table 5. Granger Causality Test

Null Hypothesis:	Obs	F-Statistic	Prob.
M does not Granger Cause INF	150	2.70018	0.0165
INF does not Granger Cause M		2.47968	0.0262
PF does not Granger Cause INF	150	0.05389	0.9994
INF does not Granger Cause PF		1.75766	0.1123
S does not Granger Cause INF	150	2.94077	0.0099
INF does not Granger Cause S		1.56111	0.1631
SB does not Granger Cause INF	150	0.64438	0.6945
INF does not Granger Cause SB		0.08732	0.9974
PF does not Granger Cause M	150	4.24689	0.0006
M does not Granger Cause PF		1.68817	0.1284
S does not Granger Cause M	150	3.28348	0.0048
M does not Granger Cause S		0.83274	0.5466
SB does not Granger Cause M	150	0.53472	0.7811
M does not Granger Cause SB		1.84678	0.0945
S does not Granger Cause PF	150	1.52410	0.1747
PF does not Granger Cause S		0.92532	0.4789
SB does not Granger Cause PF	150	0.82188	0.5548
PF does not Granger Cause SB		0.48481	0.8188
SB does not Granger Cause S	150	1.93585	0.0793
S does not Granger Cause SB		2.33458	0.0354

Inflation variables do not significantly impact portfolio investment and vice versa. The money supply variable does not substantially affect the portfolio investment variable (0.1284), rejecting the null hypothesis. Therefore, there can be a unidirectionality between the investment portfolio variables and the money supply. Only investment portfolio variables affect the money supply, not vice versa. (Otiwu, 2022; Elhendawy, 2022; Filho, 2017). Interest rate variables do not significantly affect portfolio investment and vice versa. Portfolio investment variables have no statistically significant effect on interest rate variables, as evidenced by Prob values greater than 0.05, namely 0.1747 and 0.4789. Each accepts the null hypothesis. Therefore, there is no mutual causality between savings and investment portfolio variables (Seftarita et al., 2019; Shakil et al., 2018; Waqas et al., 2015).

The results of the VECM estimation will show short-term and long-term relationships between portfolio investment, interest rates, money supply, savings, and inflation. In this estimation, portfolio investment is the dependent variable, while the independent variables are interest rates, money supply, savings, and inflation. The results of the VECM

estimation to analyze the short-term and long-term effects of the dependent variable on the independent variables can be found in Table 6.

Table 6. Relationship between Monetary Variables and Portfolio Investment in the Short Term

Variable	t - Statistic				
	D(PF,2)	D(SB,2)	D(M,2)	D(S,2)	D(INF,2)
CointEq1	[-1.70710]	**[-2.83510]**	[-1.14370]	[1.04768]	**[5.43623]**
D(PF(-1),2)	[0.27416]	[0.55908]	[0.95291]	[0.06647]	**[-2.81250]**
D(PF(-2),2)	[1.96300]	[1.08115]	**[-3.26378]**	**[-2.08566]**	**[-2.88636]**
D(PF(-3),2)	**[-11.2632]**	[1.89914]	[-0.74799]	[-1.24761]	[-1.84193]
D(PF(-4),2)	[-0.15117]	[-1.12712]	[0.71154]	[1.26290]	[-1.65307]
D(PF(-5),2)	[0.49514]	[-0.41806]	**[-2.53355]**	[-1.43942]	[-1.35958]
D(PF(-6),2)	**[-7.14840]**	[1.93730]	[-1.13418]	[-0.53571]	[-0.35038]
D(SB(-1),2)	[-0.57667]	**[-6.13307]**	[1.60248]	**[2.41636]**	[-0.74796]
D(SB(-2),2)	[0.46502]	**[-2.24723]**	[0.41921]	[0.48382]	[-0.19850]
D(SB(-3),2)	[-0.54729]	[-1.74018]	[1.07255]	[0.52750]	[-0.64269]
D(SB(-4),2)	[1.63662]	[-1.35028]	[0.46872]	[-0.18736]	[-0.94767]
D(SB(-5),2)	[1.74694]	[0.23060]	[0.73568]	[1.47476]	**[-2.39784]**
D(SB(-6),2)	[-0.11597]	[0.01255]	[1.24887]	[0.85996]	[-0.84770]
D(M(-1),2)	**[2.23346]**	**[2.92932]**	**[-3.56529]**	[-1.26357]	**[-4.99376]**
D(M(-2),2)	[1.35132]	**[2.43979]**	**[-2.92524]**	[-1.44709]	**[-3.96429]**
D(M(-3),2)	[-0.14920]	[1.60447]	[-2.33403]	[-1.45261]	[-3.17569]
D(M(-4),2)	[-1.17883]	[1.17288]	[-2.38626]	[-1.16729]	[-1.75187]
D(M(-5),2)	[-1.44951]	[0.57764]	[-1.14530]	[-0.99380]	[-0.62962]
D(M(-6),2)	[-0.60379]	[-0.13532]	[0.42435]	[-0.04718]	[-0.34570]
D(S(-1),2)	**[-2.44200]**	**[-3.43281]**	[-0.50586]	**[-3.16410]**	**[5.53997]**
D(S(-2),2)	[-1.59858]	**[-3.59589]**	[-1.23051]	**[-2.65356]**	**[4.77828]**
D(S(-3),2)	[0.03083]	**[-3.51166]**	[-1.21712]	[-1.76154]	**[4.02709]**
D(S(-4),2)	[1.53847]	**[-4.10523]**	[-1.56918]	**[-2.01823]**	**[2.76430]**
D(S(-5),2)	**[2.28156]**	**[-3.25449]**	**[-2.49074]**	**[-2.04878]**	[1.24833]
D(S(-6),2)	[1.42017]	**[-2.09006]**	**[-2.18484]**	[-1.07520]	[1.01823]
D(INF(-1),2)	[-1.26700]	[-2.36418]	[-1.78856]	[0.29002]	[1.77699]
D(INF(-2),2)	[-1.38257]	**[-2.35687]**	[-1.09075]	[-0.08091]	[1.95528]
D(INF(-3),2)	[-1.46986]	**[-2.68431]**	[-0.89928]	[0.06217]	**[2.47271]**
D(INF(-4),2)	[-1.48148]	**[-3.37140]**	[-0.43559]	[-0.01178]	**[2.94494]**
D(INF(-5),2)	[-1.28137]	**[-3.82200]**	[-0.77678]	[0.02582]	**[2.77955]**
D(INF(-6),2)	[-0.02657]	**[-4.88050]**	[-0.46984]	[-0.29699]	[1.21874]

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In the short term, changes in portfolio investment at lag three and six significantly affect the current portfolio investment. Meanwhile, the circulation of the money supply in M2 affects portfolio investment in lag 1; savings affect the portfolio in lags 1 and 5, while inflation in the short term does not affect the portfolio in the short term. Meanwhile, the changes in the investment portfolio do not affect interest rates. The shock caused by the variable interest rate and the money supply (M2) in lags 1 and 2 will impact portfolio investment. The shock generated by savings from the initial lag to the end impacts portfolio investment. The shock caused by inflation at lags 2 to 6 impacted short-term portfolio investment.

The shock caused by interest rates and inflation in the short term does not affect the money supply (M2). Portfolio investment involves lags 2 and 5 on the money supply (M2). As for the shock caused by the money supply (M2) itself, it affects lags 1 and 2 on the M2 variable. The shock caused by saving impacts lags 5 and 6 on the money supply (M2). Besides that, the shock caused by the money supply (M2) and inflation has no effect on savings in the short term. Savings respond to the shock that occurs in portfolio investment in lag 3. The shock in interest rates is only answered at the beginning of lag one by savings, while savings respond to the shock caused by the savings itself at lags 1, 2, 4, and 5 in the short term. The shock caused by interest rates and inflation is responded to by inflation in the last lag in the short term. In contrast, the shock caused by portfolio investment, money supply (M2), and savings are responded to at the initial lag by inflation in the short term.

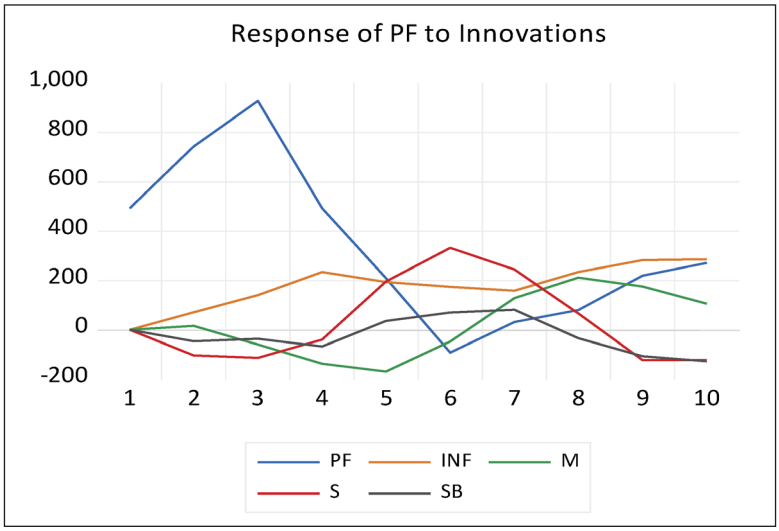
In the long term, the shock caused by inflation affects portfolio investment (Boughrara & Dridi, 2017; Oyerinde, 2019; Singh & Joshi, 2019). The shock caused by interest rates is responded to by portfolio investment (Arintoko & Insukindro, 2017; Çayır, 2021; Khajavi et al., 2020). The shock that occurs in inflation in the long term is also responded to by portfolio investment (Fan et al., 2018; Tekin, 2021). The money supply (M2) has no impact on investment portfolios in Indonesia in the long run.

Table 7. Relationship between Monetary Variables and Portfolio Investment in the Long Term

Variable	t - Statistik			
	D(SB(-1))	D(M(-1))	D(S(-1))	D(INF(-1))
D(PF(-1))	**[4.08156]**	[-1.81162]	**[2.07258]**	[-5.87294]

Based on the impulse response function (IRF) in Figure 3, at the beginning of the period up to period nine, the portfolio investment response was still very fluctuating (up and down) since the shock occurred in the observed monetary variables, namely inflation, interest rates, savings and the money supply (M2). Furthermore, after the 9th period, the fluctuations began to decrease. Inflation was no longer as volatile as in the previous period. In other words, the IRF chart shows stability.

Figure 3. Portfolio Impulse Response Function to Monetary Variables



The variance decomposition in this study is to see the ability of the monetary variable to influence investment portfolios in Indonesia. Table 6 shows that the power of inflation, the money supply (M2), savings, and interest rates to affect portfolio investment has increased in each period. Monetary variables at the beginning of the period cannot affect investment portfolios. Still, the longer the period used, the more monetary variables can influence investment portfolios in Indonesia.

Table 8. Portfolio Variance Decomposition to Monetary Variables

Period	SE.	PF	INF	M	S	SB
1	493.7536	100.0000	0.000000	0.000000	0.000000	0.000000
2	902.7293	97.76096	0.620421	0.031266	1.330410	0.256947
3	1309.431	96.73389	1.454922	0.222861	1.391469	0.196861
4	1427.522	93.32252	3.919958	1.119000	1.248823	0.389700
5	1479.048	88.94796	5.359988	2.340041	2.928351	0.423655
6	1531.050	83.36886	6.297197	2.277223	7.455813	0.600906
7	1566.343	79.69587	7.048123	2.850990	9.559633	0.845383
8	1601.568	76.47758	8.873213	4.482147	9.315111	0.851944
9	1658.565	73.06889	11.17171	5.309289	9.238292	1.211818
10	1717.474	70.65025	13.20461	5.330911	9.130397	1.683831

Several two-way causality relationships between monetary variables are analyzed in influencing investment portfolios in Indonesia. There is a two-way causality between the variable inflation and the amount of money in circulation. When there is a change in the money supply, it will affect the movement of inflation in a country. This result aligns with causality studies on inflation and interest rates positively correlated in several countries

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(Ceesay & Njie, 2021; Cheti & Ilembo, 2021; Sharew Denbel et al., 2016). Inflation also has a two-way causality relationship with interest rates; this reinforces the statement that interest rates are a monetary variable that can effectively control inflation in a country (Amata et al., 2016; Mirza & Rashidi, 2018; Nawab et al., 2021). Indonesia's interest rate and money supply variables also have a two-way causality relationship. Based on the analysis of the research conducted, the interest rates given by financial institutions, both from the point of view of savers and borrowers, will affect the amount of money circulating in society. An increase in interest rates tends to reduce the amount of money circulating in the community and vice versa (Barakat et al., 2015; Li, 2017; Rasool et al., 2020).

Furthermore, this study also found a causal relationship in several monetary variables. A one-way causality relationship occurs in the savings and inflation variables, where savings can influence inflation in Indonesia. Still, inflation is unable to affect the circulation of savings. (Dash & Kumar, 2018). Most of the savings in Indonesia are still very much influenced by the amount of one's income and interest rates. Savings can also affect the amount of money circulating in a country (Beshir, 2017; Silaswara et al., 2020). The more enthusiastic the public is in carrying out saving activities, the more money in circulation sourced from financial institutions has the potential to change. Still, the money supply in Indonesia cannot affect the amount of savings in Indonesia, according to the previous explanation. Savings can also control inflation in a country (Ben Naceur et al., 2014; Borowski & Jaworski, 2023; Milenković et al., 2020). The high nominal savings will be able to reduce inflation in Indonesia. Conversely, if the savings rate decreases, it will impact the amount of money in circulation in society and increase even more, eventually leading to an increase in the inflation rate.

Then, we will look at the primary variable in this study, namely portfolio investment. Portfolio investment has a two-way causality relationship with savings. When savings experience an increase in volume, it will have an impact on reducing portfolio investments made by the community; this is quite reasonable because it is by the theory that a portion of the remainder of all expenditures that the community has made will be stored in the form of savings or investment. So that people will choose to make portfolio investments or carry out saving activities (Akınbobola et al., 2017; Pujari & Mamilla, 2022). A one-way causality relationship occurs in portfolio investment with the money supply. The increasing number of investment portfolios in a country can reduce the money supply in society because portfolio investment is one of the instruments to control the money supply in a country (Tamunosiki, 2017). Meanwhile, the results of the causality analysis between inflation and portfolio investment show no connection. This result is because the driving factor determining portfolio investment is not due to the inflation conditions in a country but instead due to the profits obtained by someone who invests. (Fratzscher et al., 2021; Schumacher, 2018).

In the short term, the monetary variables affecting portfolio investment are the money supply (M2) and savings. People's desire to hold money will influence the decision to make portfolio investments in the short term (Kasthuri & Nirmala, 2019; Mamvura & Sibanda, 2020). The more people hold money for consumption or just

in case, the fewer people's decisions to make portfolio investments and vice versa. In the short term, it can be ascertained that there will be more and more public needs to consume goods or services or for certainty as a precaution. There is still uncertainty in the economy, which will significantly affect the decision to make portfolio investments in the short term.

The size of people's savings kept in financial institutions such as banks also influences the decision to make portfolio investments in the short term. The greater the public's desire to save, the less portfolio investment will be made, and vice versa (Alper, 2018; Bacchetta et al., 2022; Di Tella & Sannikov, 2021). One of the obstacles in Indonesia related to the low level of portfolio investment activity is the need for knowledge related to risk management expertise and management related to portfolio investment. Most people prefer to save money in banks because they are considered safer.

In the long term, portfolio investment in Indonesia is influenced by monetary variables, which, when implemented, will have an impact sometime later. Monetary variables impacting long-term portfolio investment are interest rates, savings, and inflation. In the long run, the influence of interest rates is quite reasonable, considering the interest rates applied for saving or credit cannot be felt directly by economic actors. New economic actors can feel the impact of interest rates after a change in the determination of interest rates (Aryento et al., 2022; Detemple & Rindisbacher, 2005; Lian et al., 2019). For example, when lending rates in Indonesia are increased, borrowers will not immediately feel this. Still, they will only feel the impact when they later pay installments on credit they accessed through financial institutions.

Savings is the only monetary variable in this study that has a short-term or long-term impact on portfolio investment in Indonesia. This is reasonable, considering that the greater the yield provided by financial institutions when people save, the more the public will automatically increase their savings at financial institutions. Meanwhile, the community will only feel the effects of saving activities in the future, depending on the type of savings they choose.

Changes in inflation in Indonesia have a long-term influence on portfolio investment. The interest rate or profit sharing and the inflation conditions in a country at maturity determine the gains or losses that portfolio investment actors obtain. So, the current inflation effect will not affect portfolio investment. Future inflation when payment is due, or profit-sharing will affect how much investment will be made now and the profit that will be obtained at maturity. (Edo & Kanwanye, 2022; Lian et al., 2019).

CONCLUSION

The shock caused by monetary variables influencing investment portfolios in Indonesia can turn into short-term and long-term. In the short term, portfolio investment responds to shocks in the money supply (M2) and savings, while portfolio investment does not respond to shocks caused by interest rates and inflation in the short term. Meanwhile, in the long term, portfolio investment responds to shocks caused by interest

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rates, savings, and inflation. In contrast, shocks to the money supply (M2) do not affect portfolio investment in Indonesia in the long term.

In the short term, a monetary policy transmission mechanism can use the money and expectation channels to optimize monetary variables to control investment portfolios in Indonesia. The use of the money channel is entirely justified because, in the short term, the money supply will significantly influence the public to hold money for consumption, prudent, or saving activities. In the end, these three activities will affect investment portfolios in Indonesia. Meanwhile, using the expectation path can also be an alternative to monetary policy in controlling portfolio investment in the short term. The line of expectation will affect people's expectations of holding money or making portfolio investments. Still, of course, this line of anticipation can be used much more frequently when there is uncertainty about the economic conditions that exist in Indonesia in the short term.

In the long term, the transmission mechanism that relies on portfolio investment in Indonesia is almost the same as the policy carried out in the short term. In the long term, a new transmission policy option can be used, namely monetary policy transmission through the interest rate channel. The interest rate channel policy is adequate, primarily related to portfolio investment. Considering that portfolio investment is an investment that can be taken advantage of in the future where the profit obtained will depend on the interest rate given at maturity. This is the reason why the interest rate channel policy has an essential role in controlling portfolio investment in Indonesia in the long term.

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