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Monetary Policy Transmission Mechanism in Indonesia Period 2002: Q1 – 2020: Q4: Interest Rate and Asset Price Channel[1]

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Abstract: *This study aims to identify and analyze the influence of the monetary policy transmission mechanism on interest rate and asset price channels in Indonesia during the period 2002: Q1 – 2020: Q4 by using secondary data related to policy interest rates, operational target interest rates, information variables, and variables final target on the path of the monetary policy transmission mechanism. The analytical tool used in this study is the Vector Error Correction Model (VECM). The results of the analysis of the monetary policy transmission mechanism model on the interest rate channel show that in the short term, the investment loan variable has a negative and significant effect on CPI, while the investment credit interest rate variable has a negative and significant effect and in the long term the asset price channel monetary policy transmission mechanism model confirms that the coefficient of Error Correction Term (ECT) is positive, indicating there is no adjustment mechanism towards equilibrium. In the results of the Classical Assumption test, there are deviations from normality and heteroscedasticity assumptions which mean that the model of the monetary policy transmission mechanism of the asset price channel cannot be carried out and requires the use of other analytical tools.*

Keywords**:** *Asset price channel; Interest rate channels; Monetary policy transmission; VECM*

1. Introduction

This study will focus on comparing the effectiveness of the monetary policy transmission mechanism through the channel of interest rates and asset prices in the Indonesian economy. Several previous studies have shown that the ultimate goal of price stability is more influenced by the transmission mechanism of the interest rate channel. In general, the results and discussion of this study refer to the study of Dwi (2021). This study aims to determine and analyze the effect of the monetary policy transmission mechanism on the interest rate channel and asset prices in Indonesia in achieving the ultimate goal of price stability throughout the period 2002: Q1 – 2020: Q4.

Wulandari (2012) shows that when compared to the monetary policy transmission mechanism variable in the credit channel, the monetary policy transmission mechanism variable in the interest rate channel plays an important role in maintaining price stability in the Indonesian economy. Ascarya (2014) shows that in the dual financial system adopted by Indonesia, the Interbank Money Market (PUAB) interest rate and the Bank Indonesia Certificate (SBI) interest rate have the greatest impact in stimulating inflation, while the

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Sharia Interbank Money Market interest rate (PUAS) was able to reduce inflation. Higher inflation conditions resulting from interest rate signals are also confirmed by Tran (2018) with a case study on the Vietnamese economy. Furthermore, the research of Mentari et al. (2018) explains that although the interbank rate meets the criteria as an operational target in controlling inflation, the monetary policy transmission mechanism through the interest rate channel is no more effective than the inflation expectation channel.

In relation to the transmission mechanism of monetary policy in the asset price channel, the research of Vo and Nguyen (2017), with a case study on the Vietnamese economy, explains that the inflation variable responds to the asset price variable negatively and is not in accordance with the theoretical review. In the case of other emerging economies, such as Zambia, research by Patrick and Akanbi (2017) explains that the monetary policy transmission mechanism through the interest rate channel has little effect, while the monetary policy transmission mechanism through the asset price channel can be said to be unimportant in the case of the Zambian economy. On the other hand, in the case of the Indonesian economy, research by Arintoko (2021) shows that stock asset prices have a positive influence on the transmission of monetary policy on inflation indicators in Indonesia.

The difference from the results of previous studies regarding the transmission mechanism of monetary policy through the interest rate channel and asset prices, both in the case of the Indonesian economy and other developing countries, makes a review of the effectiveness of the monetary policy transmission mechanism in the interest rate channel and asset prices in Indonesia an interesting topic. Efforts to compare the effectiveness of the monetary policy transmission mechanism through interest rate channels and asset prices in Indonesia are motivated by the condition of the Indonesian financial market. Warjiyo and Juhro (2016) explained that as a country's financial market develops, the role of interest rate channels and asset prices becomes increasingly important. Figure 1 shows the depth of the financial market, which can be measured from the ratio indicator between stock market capitalization to Gross Domestic Product (GDP) and credit to GDP ratio. The data shows that although the Indonesian financial market is still relatively shallow, the ratio between stock market capitalization and GDP shows a consistent improvement until 2020. This condition indicates that the Indonesian financial market has the opportunity to develop and support the transmission of monetary policy.

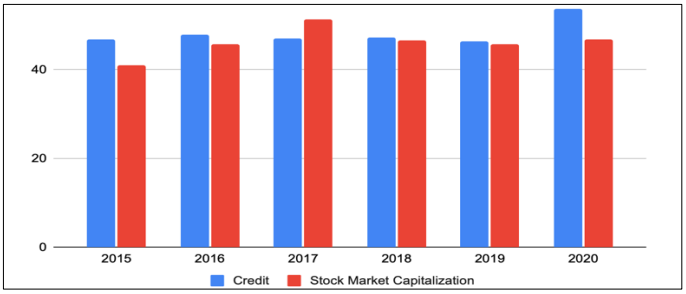

Figure 1. Depth of Indonesian Financial Market
Source: World Bank (2021)

2. Literature Review

Several studies on the transmission mechanism of monetary policy, especially in Indonesia, have been carried out quite a lot. Wulandari (2012), using the Structural Vector Autoregression (SVAR) model and interpretation using Forecasting Error Variance Decomposition (FEVD) analysis, shows that when compared to the monetary policy transmission mechanism variable in the credit channel, the monetary policy transmission mechanism variable in the interest rate channel plays an important role in maintaining price stability in the Indonesian economy.

Fuddin (2014), using the Vector Error Correction Model (VECM) and Impulse Response Function (IRF) analysis in the period 1961 – 2011, also confirms that when compared to the monetary policy transmission mechanism variable through credit channels, the monetary policy transmission mechanism variable is Interest rate channels, such as real interest rates, deposit rates, and lending rates, affect the movement of inflation variables in the initial period and then begin to fluctuate. The difference to the theory from the results of this study can be seen in the results of the IRF which states that changes in the deposit rate variable are actually responded positively by the inflation rate variable, where the highest response occurs in the second period.

Ascarya (2014) using the VECM model and interpretation of the IRF method, shows that in the dual financial system adopted by Indonesia, the Interbank Money Market (PUAB) interest rate and the Bank Indonesia Certificate (SBI) interest rate have the greatest impact in stimulating inflation, while the Islamic Interbank Money Market (PUAS) interest rate was able to reduce inflation. The study also explains that in the conventional financial system, an increase in consumption credit will increase inflation, while an increase in SBI and PUAB interest rates will reduce inflation and economic growth. Furthermore, the research of Mentari et al. (2018) using the VECM model and analysis period coverage from 2005: Q1 – 2016: Q4, explains that although the interbank rate meets the criteria as an operational target in controlling inflation, the monetary policy transmission mechanism of the interest rate channel is not more effective than the inflation expectation channel.

Warjiyo (2004) explains that the transmission mechanism of monetary policy through asset price channels can occur through changes in investor wealth (wealth effect) and changes in disposable income levels derived from investment returns on financial and physical assets (substitution effect and income). Anggraeni (2016), using the Residential Property Price Index (IHPR) as a proxy for physical asset variables and the Composite Stock Price Index (JCI) as a proxy for financial assets, shows that the contractionary monetary policy implemented by Bank Indonesia is able to overcome and anticipate economic warming due to asset price changes. Arintoko (2021), using the Autoregressive Distributive Lag (ARDL) model, shows that stock asset prices, which are represented by the JCI variable, have a positive influence on the transmission of monetary policy on inflation indicators in Indonesia. Vo & Nguyen (2017), with a case study on the Vietnamese economy and using the Vector Autoregressive (VAR) model, explains that the inflation variable responds to the

asset price variable, which is proxied through the Vietnam Composite Stock Market Index (VNIndex), negatively and does not match theory review.

Referring to the literature study and theoretical review, referring to the study of Dwi (2021) the hypothesis in this study was formulated as follows:

a. Interest rate channel monetary policy transmission mechanism
   1) It is suspected that the BI7DRR interest rate, interbank money market interest rate, consumer credit interest rate, investment credit interest rate, and time deposit interest rate have a negative and significant effect in achieving the final target of price stability in Indonesia throughout the period 2002: Q1 – 2020: Q4.
   2) It is suspected that the distribution of rupiah consumption credit by commercial banks, the distribution of rupiah investment credit by commercial banks, and Gross Domestic Product at Constant Prices (GDP ADHK) had a positive and significant effect in achieving the final target of price stability in Indonesia throughout the period 2002: Q1 – 2020: Q4.

b. Asset price channel monetary policy transmission mechanism
   1) It is suspected that the BI7DRR interest rate and the interbank money market interest rate have a negative and significant effect on achieving the final target of price stability in Indonesia during the period 2002: Q1 – 2020: Q4.
   2) It is suspected that the JCI, IHPR, distribution of rupiah consumption credit by commercial banks, distribution of rupiah investment credit by commercial banks, and GDP ADHK have a positive and significant impact in achieving the final target of price stability in Indonesia throughout the period 2002: Q1 – 2020: Q4.

3. RESEARCH METHOD

3.1. Variables and Data Sources

Referring to the study of Dwi (2021) the data used in this study are secondary data related to the BI7DRR interest rate variable interbank money market interest rate, interest rate on consumer credit and investment disbursed by commercial banks, commercial bank time deposit interest rates, consumer credit distribution and rupiah investment by commercial banks, GDP ADHK base year 2015, Consumer Price Index (CPI) base year 2012, JCI base year 1982, and IHPR base year 2015 obtained from Economic and Financial Statistics of Bank Indonesia (SEKI – BI), Central Agency Statistics (BPS), International Financial Statistics (IFS), Organization of Economic Co-Operation and Development (OECD), and Yahoo Finance.

3.2. Methods and Stages of Data Analysis

The functional model that will be estimated in this study includes a functional model for the monetary policy transmission mechanism of interest rate channels and asset prices as follows:

a. Interest rate channel monetary policy transmission mechanism

$$IHK_t = f\left(\frac{BI7DRR_t, PUAB_t, SBKK_t, SBKI_t, SBDB_t, LKONS_t,}{LINV_t, LPDB_t}\right) \quad (1)$$

b. Asset price channel monetary policy transmission mechanism

$$IHK_t = f(\frac{BI7DRR_t, PUAB_t, IHSG_t, IHPR_t, LKONS_t}{LINV_t, LPDB_t}) \quad (2)$$

Explanation:

IHK_t : Consumer Price Index (CPI) at time t (points)
$BI7DRR_t$: Bank Indonesia's new policy interest rate at the time t (%)
$PUAB_t$: Interbank Money Market (PUAB) interest rate at time t (%)
$SBKK_t$: Interest rate on rupiah consumption credit for commercial banks at the time t (%)
$SBKI_t$: Interest rate of commercial bank rupiah investment credit at the time t (%)
$SBDB_t$: Time deposit interest rate t (%)
$LKONS_t$: Logarithm of distribution of rupiah consumption credit for commercial banks in time t (Rp)
$LINV_t$: Logarithm of distribution of rupiah investment credit for commercial banks in time t (Rp)
$LPDB_t$: Logarithm of Gross Domestic Product at Constant Prices (ADHK GDP) at time t (Rp)

$IHSG_t$: Composite Stock Price Index (JCI) at time t (points)
$IHPR_t$: Residential Property Price Index (IHPR) at time t (points)

In particular, the BI7DRR and PUAB variables will be designated as exogenous variables. The analytical tool that will be used in this research is the VECM model. Widarjono (2019) explained that the VECM model can be used if the time series data is not stationary at the level but is stationary at the first differentiation level and the data used has cointegration. The VECM model to be estimated in this study was adapted from Ascarya (2014) as follows:

$$\Delta x_t = \mu_t + \Pi x_{t-1} + \sum_{i=1}^{k-1} \Gamma_i \Delta x_{t-i} + \varepsilon_t \quad (3)$$

Explanation:

x_t : Endogenous variables for each model
ε_t : Error term
Π : A matrix consisting of a matrix λandβ
λ : Adjustment matrix
β : Cointegration Vector
r : Cointegration rank
k : *Lag* on VAR shape model

Referring to El Ayyubi et al. (2018) and Palupy and Basuki (2019) the stages of data analysis to be carried out in this study are as follows:

a. Data stationarity test

This stage will be passed by performing the Augmented Dickey Fuller (ADF) test. According to Akbar and Rusgiyono (2016) the stationarity hypothesis testing of the data was carried out by comparing the absolute value of the ADF statistic with the critical

value of MacKinnon. If the absolute value of the ADF statistic < MacKinnon's critical value, then the data is not stationary.

b. Optimal *lag* test

According to Akbar and Rusgiyono (2016) the selection of lag length can refer to the minimum Akaike Information Criterion (AIC) criteria

c. VAR stabilitas stability test

According to Levendis (2018) equation (4) indicates the condition of the relationship between components in the VAR system which will remain proportional.

$$\lambda v = \beta v \quad (4)$$

If the VAR system is stable, then the value of Y_t and does not increase with increasing β. VAR stability conditions will be achieved if the eigenvalue or modulus value is less than one.

d. Cointegration test

The cointegration test in this stage will be carried out using the Johansen cointegration test. The cointegration test hypothesis is tested by comparing the value of the trace statistic and the max statistic with the critical value proposed by Johansen. If the value of the trace statistic and the max test statistic > critical value, then there is a long-term relationship between the independent and dependent variables.

e. VECM Estimate

According to Levendis (2018) if in equation (5) all the variables in the Y_t cointegrated vector are known, then the VECM equation will be represented as follows:

$$Y_t = \beta_0 + \beta_1 Y_{t-1} + \beta_2 Y_{t-2} + \cdots + \beta_k Y_{t-k} + \varepsilon_t \quad (5)$$

$$\Delta Y_t = \beta_0 + \Gamma_1 Y_{t-1} + \Gamma_2 Y_{t-2} + \cdots + \Gamma_{k-1} Y_{t-k} + \Pi Y_{t-k} + \varepsilon_t \quad (6)$$

Explanations: $\Pi = \alpha\beta'$ and $\beta' = (1 - \beta_0 - \beta_1)$

In equation (6), α is a dimensional matrix $n \times r$ containing short-term adjustment parameters, while β is a dimensional matrix $n \times r$ containing cointegration vector coefficients. In terms of lag length, the VECM model always has one less lag than the VAR model.

f. Classic assumption test

Referring to several literature reviews, the classical assumption test stages used in this study are as shown in Table 1 below.

Table 1. Classical Assumption Test and Criteria

Classic Assumption Test	Method	Criteria
Normality	Jarque – Bera	According to Hill et al ., (2011) if the Chi-Square probability > the significance level, then the residuals are normally distributed.
Heteroscedasticity	Breusch – Pagan – Godfrey	According to Gujarati (2003) the decision-making criteria of the Breusch-Pagan-Godfrey test is if the probability value of *chi-square* > *alpha* , then there is no heteroscedasticity problem.
Autocorrelation	*Lagrange Multiplier* (LM)	According to Gujarati (2003) if the probability of Chi-Square > the level of significance, then the model is free from the problem of autocorrelation

Source: Various sources (processed)

g. Model stability test

The stability test of the model used is the Cumulative Sum of Recursive (CUSUM) test. According to Lutkepohl & Kratzig (2004) at the 5 percent significance level, if the CUSUM value crosses the ± 0.948 line $\left[\sqrt{T-K}+2(\tau-K)/\sqrt{T-K}\right]$, then the model is said to be unstable.

h. Granger causality test

According to Akbar and Rusgiyono (2016) hypothesis testing requires that if the absolute value of F - statistic > F - table or if the probability value of F - value < significance level (1%, 5%, or 10%), then there is a causal relationship.

i. Impulse Response Function (IRF) Analysis

According to Levendis (2018) mathematically, the IRF analysis for the AR equation (p) can be formulated as follows:

$$X_t = \beta_1 X_{t-1} + \beta_2 X_{t-2} + \beta_3 X_{t-3} + \varepsilon_t \qquad (7)$$

The IRF analysis stage, referring to equation (7) in the form of AR (3), assumes that X_t and ε_t is zero for each period. If in the period the $t = 1$ variable X_1 receives one unit of shock from $\varepsilon_t = 1$, then the effect of the shock in that period $t = 1$ can be traced to several subsequent periods.

j. Forecast Error Variance Decomposition (FEVD) Analysis

According to Levendis (2018) , FEVD analysis functions similarly to the coefficient of determination test to explain the variation of a variable due to shocks to other variables and can be separated for different variables. The term forecast error is basically a residual. Meanwhile, the term variance decomposition describes the separation of variance from residuals into the components that cause it.

4. Results

4.1. Stationarity Test

The results and discussion of this study refer to the study of Dwi (2021), based on Table 2, it appears that the BI 7 Day Reverse Repo Rate (BI7DRR) interest rate variables, Residential Property Price Index (IHPR), Interbank Money Market (PUAB) interest rates, commercial

bank rupiah investment credit rates (SBKI), and interest rates Commercial bank rupiah consumption credit (SBKK) is stationary at the alpha level of 1 percent. Meanwhile, the variable Composite Stock Price Index (CSPI) is stationary at the alpha level of 5 percent and the Time Deposit Interest Rate (SBDB) variable is stationary at the alpha level of 10 percent. Furthermore, the Consumer Price Index (CPI) variables, the logarithm of commercial bank rupiah investment credit (LINV), the logarithm of commercial bank rupiah consumption credit (LKONS), and the logarithm of Gross Domestic Product at Constant Prices (LPDB), do not appear to be stationary.

Table 2. Level Stationarity Test Results

Variable	ADF Test Statistics	MacKinnon Critical Values			Information
		1%	5%	10%	
BI7DRR	-4.37	-4.08***	-3.47	-3.16	Stationary
CPI	-1.55	-4.08	-3.47	-3.16	Not stationary
IHPR	-7.31	-4.08***	-3.47	-3.16	Stationary
JCI	-3.77	-4.08	-3.47**	-3.16	Stationary
LINV	0.44	-4.08	-3.47	-3.16	Not stationary
LKONS	-0.96	-4.09	-3.47	-3.16	Not stationary
LPDB	1.27	-4.08	-3.47	-3.16	Not stationary
PUAB	-4.46	-4.08***	-3.47	-3.16	Stationary
SBDB	-3.21	-4.08	-3.47	-3.16*	Stationary
SBKI	-4.46	-4.08***	-3.47	-3.16	Stationary
SBKK	-4.22	-4.08***	-3.47	-3.16	Stationary

* significant at α= 10%; Source: Estimation results (processed)
** significant at α= 5%
*** significant at α= 1%

Based on Table 3, it appears that the CPI, IHPR, LKONS, LPDB, PUAB, SBDB, SBKI, and SBKK variables are stationary at the first differentiation level at 1 percent alpha. Meanwhile, the BI7DRR, JCI, and LINV variables are stationary at the first differentiation level at 5 percent alpha.

Table 3. First Level of Differentiation Stationarity Test Results

Variable	ADF *Test Statistics*	*MacKinnon Critical Values*			Information
		1%	5%	10%	
D(BI7DRR)	-4.03	-4.09	-3.47**	-3.16	Stationary
D(CPI)	-8.32	-4.08***	-3.47	-3.16	Stationary
D(IHPR)	-5.87	-4.09***	-3.47	-3.16	Stationary
D(JCI)	-4.07	-4.10	-3.47**	-3.16	Stationary
D(LINV)	-3.98	-4.08	-3.47**	-3.16	Stationary
D(LKONS)	-4.60	-4.09***	-3.47	-3.16	Stationary
D(LPDB)	-6.70	-4.08***	-3.47	-3.16	Stationary
D(PUAB)	-4.87	-4.09***	-3.47	-3.16	Stationary
D(SBDB)	-4.72	-4.09***	-3.47	-3.16	Stationary
D(SBKI)	-5.24	-4.09***	-3.47	-3.16	Stationary
D(SBKK)	-4.30	-4.09***	-3.47	-3.16	Stationary

* significant at α= 10%; Source: Estimated results (processed)
** significant at α= 5%
*** significant at α= 1%

4.2. Optimal *Lag* Test

Lag test for the monetary policy transmission mechanism model of the interest rate channel at lag 3 provide the minimum AIC value, which is -12.9944.

Table 4. Optimal Lag Test Results of the Monetary Policy Transmission Mechanism Model Interest Rate Channel

Lag	*LogL*	AIC
0	-503.2140	14.3670
1	512.9931	-12,49981
2	560.5242	-12.45901
3	628,8007	-12,99446
4	672.5342	-12.8481

Source: Estimation results (processed)

Based on Table 5, it can be seen that the optimal lag test results for the monetary policy transmission mechanism model of the asset price channel at lag 3 provide the minimum AIC value, which is 24.0502.

Table 5. Optimal Lag Test Results of the Monetary Policy Transmission Mechanism Model for Asset Price Channels

lag	*LogL*	AIC
0	-1720,011	48,1114
1	-826.0495	24.2791
2	-782.3566	24.0654
3	-745,8095	24.0502
4	-719,100	24.3083

Source: Estimation results (processed)

4.3. VAR. Stability Test

Based on Table 6, the results show that all modulus values for both VAR models are less than 1. Therefore, it can be said that the VAR model analyzed in this study is stable and can be used for further analysis.

Table 6. VAR. Stability Test Results

Interest Rate Channel		Asset Pricing Channel	
Root	**Modulus**	**Root**	**Modulus**
0.994175 - 0.002205i	0.994178	0.999886	0.999886
0.994175 + 0.002205i	0.994178	0.978811 - 0.034982i	0.979436
0.917378	0.917378	0.978811 + 0.034982i	0.979436
0.852418	0.852418	0.903027	0.903027
0.831804 - 0.110531i	0.839115	0.712522 - 0.290804i	0.769581
0.831804 + 0.110531i	0.839115	0.712522 + 0.290804i	0.769581
-0.069632 + 0.795744i	0.798785	-0.691024	0.691024
-0.069632 - 0.795744i	0.798785	0.128788 + 0.618398i	0.631666
0.633111 - 0.448652i	0.775963	0.128788 - 0.618398i	0.631666
0.633111 + 0.448652i	0.775963	0.1201493 + 0.560929i	0.596021
-0.670667	0.670667	0.1201493 - 0.560929i	0.596021
0.399297 + 0.489574i	0.631760	-0.444324 - 0.395534i	0.594871
0.399297 - 0.489574i	0.631760	-0.444324 + 0.395534i	0.594871
-0.228239 - 0.556640i	0.601615	0.453788 + 0.369928i	0.585466
-0.228239 + 0.556640i	0.601615	0.453788 - 0.369928i	0.585466
0.501919	0.501919	-0.203104 - 0.452853i	0.496314
-0.484316	0.484316	-0.203104 +0.452853i	0.496314
0.116620 - 0.442478i	0.457588	-0.212797	0.212797
0.116620 + 0.442478i	0.457588		
-0.438393	0.438393		
-0.206828	0.206828		

Source: Estimation results (processed)

4.4. Cointegration Test

Table 7. Cointegration Test Results of the Monetary Policy Transmission Mechanism Model Interest Rate Channel

Hypothesized No. of CE(s)	Trace Statistics	0.05 Critical Value	*Prob.**
None	272.0808	125.6154	0.0000**
At most 1	154.0586	95.75366	0.0000**
At most 2	95.37641	69.81889	0.0001**
At most 3	50.67745	47.85613	0.0265**
At most 4	27.31652	29.79707	0.0941
At most 5	12.57354	15.49471	0.1314
At most 6	1.842862	3.841466	0.1746

* *p – value* MacKinnon – Haug – Michelis; Source: Estimation results (processed)
** significant at = 5%

Based on the cointegration test results in Table 7, it appears that there are 4 equations that have a trace statistic value that is greater than the critical value at 5 percent alpha. These results indicate that the monetary policy transmission mechanism model of the interest rate channel has 4 equations that are cointegrated. Based on the results of the cointegration test in Table 8, it appears that there are 4 equations that have a trace statistic value that is greater than the critical value at 5 percent alpha. Based on these results, it can be concluded that there is a long-term relationship between the independent variable and the dependent variable in the monetary policy transmission mechanism model of the asset price channel.

Table 8. Cointegration Test Results of the Monetary Policy Transmission Mechanism Model of the Asset Price Channel

Hypothesized No. of CE(s)	Trace Statistics	0.05 Critical Value	Prob.*
None	156.7855	95.7536	0.0000**
At most 1	81,1702	69.8188	0.0047**
At most 2	51.3575	47.8561	0.0226**
At most 3	31.6827	29.7970	0.0300**
At most 4	14.3576	15,4947	0.0736
At most 5	4.7094	3.8414	0.0300**

* *p – value* MacKinnon – Haug – Michelis; Source: Estimation results (processed)
** significant at = 5%

4.5. VECM Estimate

The short-term VECM estimation results for the interest rate channel monetary policy transmission mechanism model are shown in Table 10. Based on the estimation results in Table 9, it is known that the coefficient C (1) represents the Error Correction Term (ECT) and the coefficients C (2) – C (18) represent short term coefficient. The results of the long-term VECM estimation for the interest rate channel monetary policy transmission mechanism model are shown in Table 10 as follows. The significant ECT coefficient of the CPI variable at 1 percent alpha indicates a cointegration relationship between variables in the VECM system. The value of the adjustment coefficient for the CPI variable is -0.1016 indicating that the difference between the actual value of the CPI and its equilibrium value of 0.1016 will be adjusted within 1 quarter.

Table 9. Short Term VECM Estimation Results Monetary Policy Transmission Mechanism Model Interest Rate Channel

	Coefficient	Probability
C (1)	-0.101623	0.0000***
C (2)	-0.232774	0.0698*
C (3)	-0.099949	0.3928
C (4)	0.107048	0.8488
C (5)	-0.688085	0.2035
C (6)	0.678606	0.0868*
C (7)	0.020541	0.9623
C (8)	0.110385	0.3428
C (9)	-0.162915	0.1718
C (10)	1.154101	0.8548
C (11)	1.471506	0.7970
C (12)	1.407642	0.7164
C (13)	-10.81781	0.0034***
C (14)	3.833063	0.6710
C (15)	5.901863	0.5407
C (16)	-2.812590	0.0007***
C (17)	0.615830	0.0000***
C (18)	0.042202	0.6181

* significant at α= 10%; Source: Estimation results (processed)
** significant at α= 5%
*** significant at α= 1%

Table 10. Results of Long-Term VECM Estimation of Monetary Policy Transmission Mechanism Model Interest Rate Channel

Variable	Coefficient	t – statistics
SBKK (-1)	-8.642019	[-6.08426] ***
SBKI (-1)	12.15244	[5.83355] ***
SBDB (-1)	0.141176	[0.31145]
LKONS (-1)	15.22193	[2.55001] **
LINV (-1)	-23.82816	[-3.99219] ***
LPDB (-1)	-76.54855	[-4,88993] ***

* significant at α= 10%; Source: Estimation results (processed)
** significant at α= 5%
*** significant at α= 1%

Table 11. Short-Term VECM Estimation Results Monetary Policy Transmission Mechanism Model Asset Price Channel

	Coefficient	Probability
C (1)	0.017114	0.0000***
C (2)	-0.262359	0.0392**
C (3)	-0.134275	0.2063
C (4)	-0.000112	0.6745
C (5)	0.000598	0.0885*
C (6)	-7.29E-06	0.0337**
C (7)	-1.91E-06	0.5832
C (8)	13.43591	0.0106**
C (9)	10.38651	0.0515*
C (10)	5.575236	0.1095
C (11)	-8.956370	0.0090***
C (12)	-14.57195	0.2163
C (13)	-12.96467	0.2277
C (14)	-1.430497	0.0020***
C (15)	0.316664	0.0004***
C (16)	0.048370	0.5648

* significant at α= 10%; Source: Estimation results (processed)
** significant at α= 5%
*** significant at α= 1%

Based on the estimation results in Table 12, it is known that the coefficient C (1) represents the Error Correction Term (ECT) and the coefficient C (2) – C (16) represents the short-term coefficient. The significant ECT coefficient of the CPI variable at 1 percent alpha indicates a cointegration relationship between variables in the VECM system. However, the positive ECT coefficient value indicates that there is no short-term to long-term adjustment process. The results of the long-term VECM estimation for the interest rate channel monetary policy transmission mechanism model are shown in Table 12 as follows:

Table 12. Results of the Long-Term VECM Estimation of the Monetary Policy Transmission Mechanism Model Asset Price Channel

Variable	Coefficient	t – statistics
JCI (-1)	0.030025	[2.12495] **
IHPR (-1)	0.000484	[1.85876]
LKONS (-1)	178.1745	[4.89369] ***
LINV (-1)	-56,78589	[-1.30119]
LPDB (-1)	-518.1212	[-2.86693] ***

* significant at α= 10%; Source: Estimation results (processed)
** significant at α= 5%
*** significant at α= 1%

4.6. Classic assumption test

In Table 13 it can be seen that in the interest rate channel model, the chi-square probability is greater than various levels of significance, so it $H_0$is not rejected. This means that the residuals in the monetary policy transmission mechanism model of the interest rate channel are normally distributed. Meanwhile, it appears that in the asset price channel model, the chi-square probability is smaller than various levels of significance, so it is H_0rejected. This means that the residuals in the monetary policy transmission mechanism model of asset price channels are not normally distributed.

Table 13. Normality Test Results

Interest Rate Channel		Asset Pricing Channel	
Jarque - Bera	**Prob.**	**Jarque - Bera**	**Prob.**
3.4306	0.1799	32.01955	0.000

* significant at α= 10%; Source: Estimated results (processed)
** significant at α= 5%
*** significant at α= 1%

Table 14 shows that in the interest rate channel model, the chi-square probability is greater than the 5 percent significance level. This shows that the interest rate channel model is free from heteroscedasticity problems. Meanwhile, in the asset price channel model, the chi-square probability is smaller than the 5 percent significance level. This shows that the asset price channel model contains heteroscedasticity problems.

Table 14. Heteroscedasticity Test Results

Interest Rate Channel		Asset Pricing Channel	
Obs*R – Squared	**Prob. Chi Square**	**Obs*R – Squared**	**Prob. Chi Square**
34.15081	0.0630	34.8919	0.0207**

** significant at α= 5%

The table 15 shows that in the channel model of interest rates and asset prices, the chi-square probability is greater than the 5 percent significance level. This shows that both models are free from autocorrelation problems.

Table 15. Autocorrelation Test Results

Interest Rate Channel		Asset Pricing Channel	
Obs*R – Squared	**Prob. Chi Square**	**Obs*R – Squared**	**Prob. Chi Square**
34.15081	0.0797	3.4251	0.1804

** significant at α= 5%

4.7. Model Stability Test

The CUSUM test for the interest rate channel monetary policy transmission mechanism model (Figure 2) the cumulative value of the recursive residual is in the band with a sig. 5%. This indicates the stability of the estimation parameters in the research period on the monetary policy transmission mechanism model of the interest rate channel.

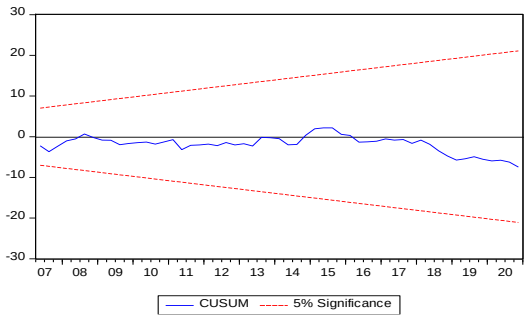

Figure 2. CUSUM Test Results of the Interest Rate Channel Monetary Policy

4.8. Granger Causality Test

Based on the results of the Granger causality test with a lag of 2 in Table 16, it appears that there are 3 variables that have a two-way relationship with the CPI, while there are 5 variables that have a one-way relationship with the CPI.

Table 16. Granger Causality Test Results of the Monetary Policy Transmission

Null Hypothesis	F – stats	Prob.
BI7DRR does not Granger Cause IHK2012	9.26999	0.0003***
IHK2012 does not Granger Cause BI7DRR	5.08277	0.0087***
PUAB does not Granger Cause CPI2012	2.09407	0.1309
CPI2012 does not Granger Cause PUAB	13.3426	1.E-05***
SBKK does not Granger Cause IHK2012	5.14951	0.0082***
IHK2012 does not Granger Cause SBKK	9.49176	0.0002***
SBKI does not Granger Cause IHK2012	5.47631	0.0062***
IHK2012 does not Granger Cause SBKI	7.44886	0.0012***
SBDB does not Granger Cause IHK2012	3.82213	0.0267**
IHK2012 does not Granger Cause SBDB	1.20624	0.3056
LKONS does not Granger Cause IHK2012	9.48589	0.0002***
IHK2012 does not Granger Cause LKONS	2.26019	0.1120
LINV does not Granger Cause IHK2012	7.89825	0.0008***
IHK2012 does not Granger Cause LINV	0.86091	0.4273
LPDB does not Granger Cause IHK2012	5.22314	0.0077***
IHK2012 does not Granger Cause LPDB	0.56848	0.5690

* significant at α= 10%**; significant at α= 5%; *** significant at α= 1%

Based on the results of the Granger causality test with a lag of 2 in Table 17, it appears that there are 2 variables that have a two-way relationship with the CPI, while there are 5 variables that have a one-way relationship with the CPI.

Table 17. Granger Causality Test Results Model Transmission Mechanism of Monetary Policy Channel Asset Price

Null Hypothesis	F – stats	Prob.
BI7DRR does not Granger Cause IHK2012	9.26999	0.0003***
IHK2012 does not Granger Cause BI7DRR	5.08277	0.0087***
PUAB does not Granger Cause CPI2012	2.09407	0.1309
CPI2012 does not Granger Cause PUAB	13.3426	1.E-05***
LKONS does not Granger Cause IHK2012	9.48589	0.0002***
IHK2012 does not Granger Cause LKONS	2.26019	0.1120
LINV does not Granger Cause IHK2012	7.89825	0.0008***
IHK2012 does not Granger Cause LINV	0.86091	0.4273
LPDB does not Granger Cause IHK2012	5.22314	0.0077***
IHK2012 does not Granger Cause LPDB	0.56848	0.5690
JCI does not Granger Cause CPI2012	5.37450	0.0068***
CPI2012 does not Granger Cause JCI	4.38221	0.0162**
IHPR does not Granger Cause IHK2012	0.09431	0.9101
IHK2012 does not Granger Cause IHPR	7.69296	0.0010***

* significant at α= 10%; ** significant at α= 5%; *** significant at α= 1%

4.9. IRF Analysis

Based on the results of the IRF analysis of the monetary policy transmission mechanism model of the interest rate channel, sequentially it can be explained that the LPDB, SBKK, and SBDB variables are the variables that drive the largest increase in the CPI. Meanwhile, sequentially, it can also be explained that the LKONS, SBKI, and LINV variables are the variables that drive the biggest decline in the CPI. Graphically, the IRF analysis for the interest rate channel monetary policy transmission mechanism model can be explained as follows:

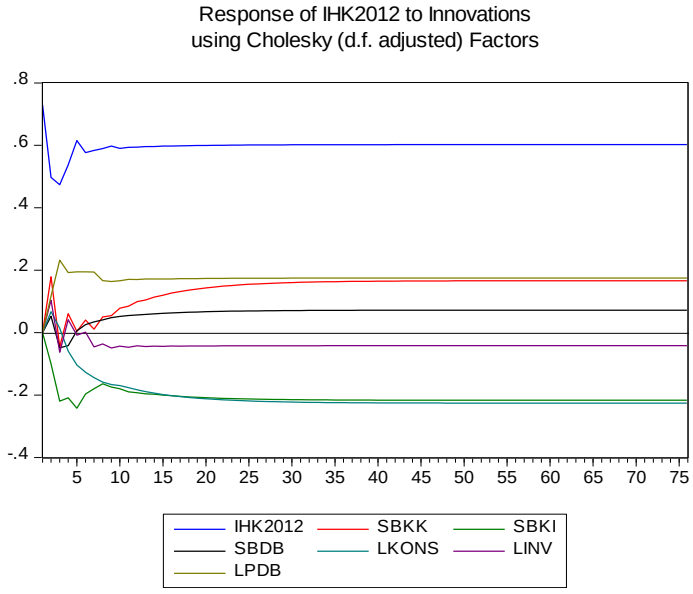

Figure 3. Result of IRF Analysis of Monetary Policy Transmission Mechanism Model Interest Rate Channel

4.10. FEVD Analisis analysis

Based on the results of the FEVD analysis over a time horizon of 19 years, it appears that the variation of the CPI variable is sequentially influenced dominantly by the CPI variables (70.94 percent), SBKI (8.67 percent), LKONS (8.71 percent), LPDB (6 percent), SBKK (4.41 percent), SBDB (0.88 percent), and LINV (0.36 percent). Graphically, the FEVD analysis for the interest rate channel monetary policy transmission mechanism model can be explained as follows:

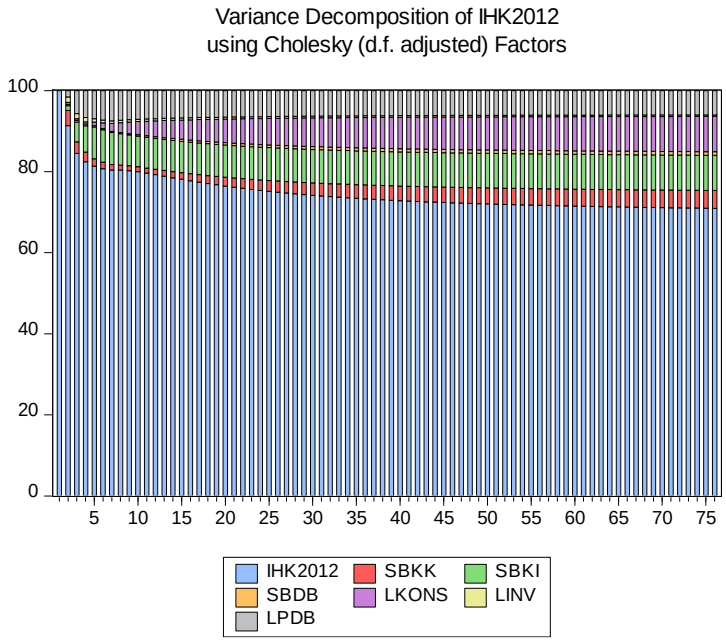

Figure 4. FEVD Analysis Results of Monetary Policy Transmission Mechanism Model Interest Rate Channel

5. Discussion

The discussion and interpretation of the economy in this study will only discuss the results of the monetary policy transmission mechanism model of the interest rate channel. This is because, based on the results of data processing, it appears that the monetary policy transmission mechanism model of the asset price channel has a positive ECT coefficient and is unable to meet the normality and heteroscedasticity assumption tests.

Based on the VECM estimation results for the BI7DRR variable, it appears that the BI7DRR variable has a positive and significant effect on the CPI. These results indicate the occurrence of a price puzzle in the monetary policy transmission mechanism of the interest rate channel. This condition is possible because monetary policy interacts with fiscal policy. Although monetary policy is directed at stabilizing prices, an expansionary fiscal policy will increase inflation (Sutawijaya & Lestari, 2013). In addition, this kind of condition is also possible if the central bank tends to be passive and does not apply a forward-looking policy formulation strategy in response to inflation, so that inflation expectations in the economy push inflation dominantly (Bhattacharya, 2014).

The results of the VECM estimation for the PUAB variable, it appears that the PUAB variable has a positive and insignificant effect on the CPI. These results indicate the occurrence of a price puzzle in the monetary policy transmission mechanism of the interest rate channel. The results of this study are not in accordance with the results of research by Ascarya (2014) and Mentari et al. (2018). This condition is certainly contrary to the fact that until the 4th quarter of 2020, there were 87.15 percent of financial sector players in Indonesia were conventional commercial banks (Indonesia Financial Services Authority (OJK), 2020).

Based on the results of the VECM estimation for the SBKK variable, it appears that in the short term the SBKK variable has no significant effect on the CPI variable. Meanwhile, in the long term, the SBKK variable has a negative and significant effect on the CPI variable. The results of the IRF analysis for the SBKK variable show that the shock to the SBKK variable is actually responded positively by the CPI variable and does not show stability. Meanwhile, the results of the FEVD analysis for the SBKK variable showed a contribution of 4.41 percent of the SBKK variable in explaining the variation of the CPI variable. In general, these results indicate that, as an information variable, the SBKK variable has been successfully transmitted to the real sector to achieve the ultimate goal of price stability, especially in the long term. In addition, the contribution given by the SBKK variable in explaining the variation of the CPI variable shows a large contribution to the variation of the CPI variable which will first be transmitted to the consumption credit distribution variable. The higher the interest rate on consumer credit, the lower interest in consumption (substitution effect) (Herlina, 2018). The SBKK variable which does not have a significant effect in the short term and the shocks are responded positively by the CPI variable indicates an adjustment process from the short to the long term, where the SBKK variable takes a certain amount of time to be able to influence the CPI variable with slight changes caused by the error term.

The results of the VECM estimation for the SBKI variable, it appears that in the short term the SBKI variable in the previous 1 period has a positive and significant effect on the CPI variable. Meanwhile, in the long term, the SBKI variable has a positive and significant effect on the CPI variable. The results of the IRF analysis for the SBKI variable show that the shock to the SBKI variable is responded negatively by the CPI variable and does not show stability. Meanwhile, the results of the FEVD analysis for the SBKI variable showed a contribution of 8.67 percent of the SBKI variable in explaining the variation of the CPI variable. When compared with the SBKK variable, it appears that the SBKI variable has a higher contribution in explaining the variation of the CPI variable. Investment credit interest rates can be viewed as a cost of capital for investment, where an increase in investment credit interest rates will reduce investment demand and ultimately reduce aggregate demand. In general, the price puzzle that arises from the SBKI variable is possible because lending for investment purposes is not intended for distribution of productive projects, for example investment credit loans are actually diverted to carry out high-risk trading activities, so that the transmission of policy interest rates towards information variables does not affect people's decisions to apply for investment credit loans.

Based on the results of the VECM estimation for the SBDB variable, it appears that in the short term and long term the SBDB variable has no significant effect on the CPI variable. The results of the IRF analysis for the SBDB variable show that shocks to the SBDB variable are actually responded positively by the CPI variable and do not show stability. Meanwhile, the results of the FEVD analysis for the SBDB variable show a contribution of 0.88 percent of the SBDB variable in explaining the variation of the CPI variable. This result is not in accordance with the findings of Ascarya (2014) which explains that the deposit rate variable is able to reduce inflation. Deposit interest rates are a component of people's income (income effect) and conversely credit interest rates are considered as consumption financing (substitution effect) (Warjiyo, 2004). When compared with the contribution of the SBKK variable in explaining variations in the CPI variable, it appears that the monetary policy transmission mechanism of the interest rate channel in Indonesia is dominated by the substitution effect. The price puzzle that occurs in the SBDB variable is possible because the SBDB variable used in this study is the interest rate on time deposits within a 24 mounth tenor. The difference in the period of behavior of Indonesian consumers and the banking sector in reviewing credit assets indicates that the longer the tenor of a time deposit, the longer the adjustment to changes in the reference interest rate will be (Wibowo & Lazuardi, 2016). The positive response of the CPI variable to shocks in the SBDB variable is possible because the longer the tenor of a time deposit, the more customers tend to place large amounts of funds for transactions for several future periods, for example the annual cost of education. When time deposits with large funds have reached the tenor, the owner of the time deposit will conduct transactions in the economy using a relatively large amount of money. This condition encourages an increase in aggregate demand and inflation.

The results of the VECM estimation for the LKONS variable, it appears that in the short term the LKONS variable has no significant effect on the CPI variable. Meanwhile, in the long term the LKONS variable has a positive and significant effect on the CPI variable. The results of the IRF analysis for the LKONS variable show that the shocks to the LKONS variable are actually responded negatively by the CPI variable and do not show stability. Meanwhile, the results of the FEVD analysis for the LKONS variable showed a contribution of 8.71 percent of the LKONS variable in explaining the variation in the CPI variable. The lower the interest rate on consumer credit, the public's demand for consumer credit will increase. This condition indicates that inflation in the Indonesian economy is also influenced by financing for consumption credit which drives changes in aggregate demand. This finding is in line with the results of the IRF and FEVD analysis of the SBKK variable which shows that the consumption credit interest rate has been successfully transmitted to increase consumption credit. The contribution of the LKONS variable in explaining the large variation of the CPI variable again confirms the existence of a substitution effect in the transmission mechanism of monetary policy in the interest rate channel in Indonesia. Similar to the findings on the SBKK variable, the coefficient of the LKONS variable which does not have a significant effect in the short term and the shock is responded negatively by the CPI variable indicating an adjustment process from the short to the long term, where the LKONS

variable takes a certain amount of time to be able to influence the CPI variable with slight change caused by error term.

Based on the results of the VECM estimation for the LINV variable, it appears that in the short term the LINV variable in the previous 2 periods has a negative and significant effect on the CPI variable. Meanwhile, in the long term the LINV variable has a negative and significant effect on the CPI variable. The results of the IRF analysis for the LINV variable show that shocks to the LINV variable are actually responded negatively by the CPI variable and do not show stability. Meanwhile, the results of the FEVD analysis for the LINV variable showed a contribution of 0.36 percent of the LINV variable in explaining the variation of the CPI variable. This finding is not in accordance with the results of Herlina (2018) which explains that the transmission mechanism of monetary policy through the interest rate channel through the cost effect with the Keynesian approach is effective in transmitting monetary policy to the real sector. The price puzzle that occurs in the LINV variable is also in accordance with the price puzzle that occurs in the SBKI variable. This condition again confirms the possibility that credit disbursement for investment purposes is not intended for the distribution of productive projects. When compared with the contribution of the LKONS variable, it appears that the monetary policy transmission mechanism of the interest rate channel in the real sector of the Indonesian economy is still dominated by the substitution effect.

VECM estimation for the LPDB variable, it appears that in the short term the LPDB variable has no effect on the CPI variable. Meanwhile, in the long term, the LPDB variable has a negative and significant effect on the CPI variable. The results of the IRF analysis for the LPDB variable showed that the shocks to the LPDB variable were responded positively by the CPI variable and showed stability in the 70th period. Meanwhile, the results of the FEVD analysis for the LPDB variable showed a contribution of 6.00 percent of the LPDB variable in explaining the variation of the variable CPI. This condition indicates that the increase in real GDP tends to have not been able to encourage an increase in inflation in Indonesia. This is possible because one of the components of aggregate demand, namely the LINV variable, shows the findings of the price puzzle. Although the contribution of the LINV variable is relatively small in explaining variations in the CPI variable, the behavior of economic actors in the real sector which tends not to respond to changes in policy interest rates and information variables will cause a distorted effect on aggregate demand (Fuddin, 2014).

6. Conclusions and Recommendations

Based on the results and discussions that have been described in the previous chapter, it can be concluded several things; The variable of short-term investment credit distribution has a negative and significant effect on the CPI variable in Indonesia throughout the period 2002: Q1 – 2020: Q4. Meanwhile, the interest rate variable for short-term investment credit has a positive and significant effect on the CPI variable in Indonesia throughout the period 2002: Q1 – 2020: Q4. Other variables, such as consumer credit interest rates, time deposit rates,

consumption credit distribution, and real GDP in the short term were confirmed to have no significant effect on the CPI variable in Indonesia during the period 2002: Q1 – 2020: Q4.

The variable interest rates for long-term investment loans, long-term consumption credit, and the BI7DRR interest rate have a positive and significant effect on the CPI variable in Indonesia throughout the period 2002: Q1 – 2020: Q4. Variables of long-term consumer credit interest rates, long-term investment lending, and long-term real GDP have a negative and significant effect on the CPI variable in Indonesia throughout the period 2002: Q1 – 2020: Q4. Meanwhile, the variable interest rates for long-term deposits and interbank money market rates did not affect the CPI variable in Indonesia during the period 2002: Q1 – 2020: Q4.

Based on the VECM estimation results, it appears that the ECT coefficient for the monetary policy transmission mechanism model of the asset price channel has a positive sign. These results indicate that the monetary policy transmission mechanism model of the asset price channel does not undergo an adjustment mechanism towards long-term equilibrium. The results of the classical assumption test of the asset price channel monetary policy transmission mechanism model show deviations from the normality and heteroscedasticity assumptions. Therefore, it can be concluded that the monetary policy transmission model of the asset price channel cannot be interpreted further using the VECM analysis tool.

Policy recommendations that can be implemented by relevant stakeholders in an effort to increase the effectiveness of the monetary policy transmission mechanism through interest rate and asset price channels in Indonesia: Bank Indonesia must be consider the effect of the delay/ time lag of monetary policy more carefully. The application of the Flexible Inflation Targeting Framework (FITF) monetary policy framework needs to consider the possibility of future shocks, such as the increasingly massive innovation of digital financial assets. So far, Bank Indonesia has taken the right steps by launching the Money Market Development Blueprint (BPPU) 2025. Money market development which includes initiatives to encourage digitalization, strengthen financial market infrastructure, strengthen the monetary policy stance, and manage risk in the economy needs to be integrated in a focused manner. and consistent without being influenced by political dynamics to ensure the achievement of BPPU's 2025 vision.

The Financial Services Authority (OJK) is deemed necessary to encourage increased public financial inclusion and literacy. It is deemed necessary to increase financial inclusion more massively to support the transmission of monetary policy implemented by Bank Indonesia. So far, OJK has taken the right steps by aligning the Indonesian Financial Literacy and Inclusion National Strategy (SNLKI) 2021 – 2025 with BPPU 2025. Researchers suggest coordination between Bank Indonesia and OJK, for example in the Financial System Stability Committee (KSSK) together with the Ministry of Finance. Finance, to continue to be optimized consistently according to the blueprint that has been designed without any deviant political intervention.

Further research, with a similar topic, is recommended to use the output gap variable to obtain a more comprehensive picture of the monetary policy transmission mechanism of interest rate channels and asset prices in influencing the final target of price stability in the Indonesian economy. In addition, further research is recommended to use analytical tools other than VECM that are able to explain the monetary policy transmission mechanism of the asset price channel in order to produce a valid model.

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