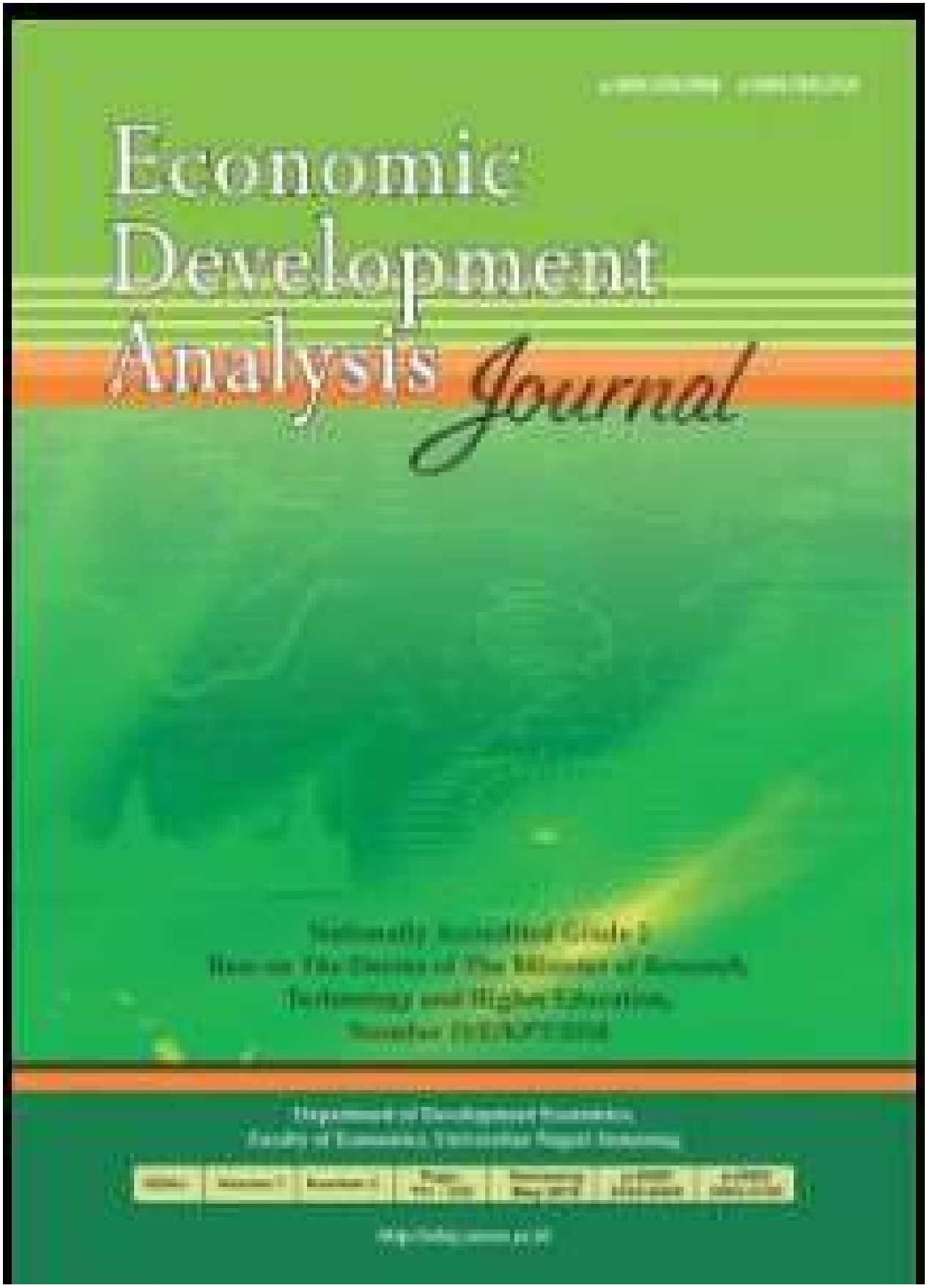
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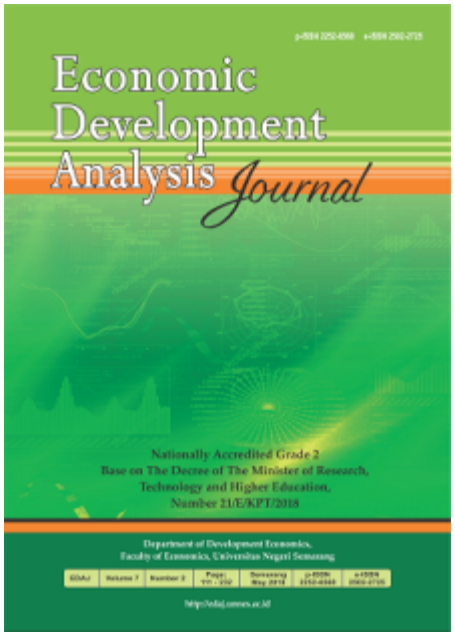

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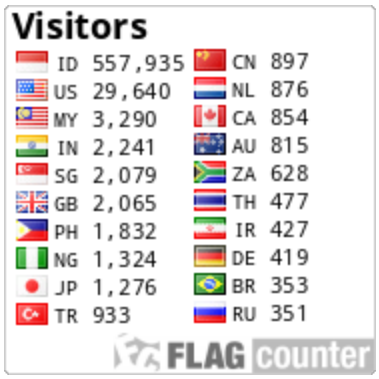

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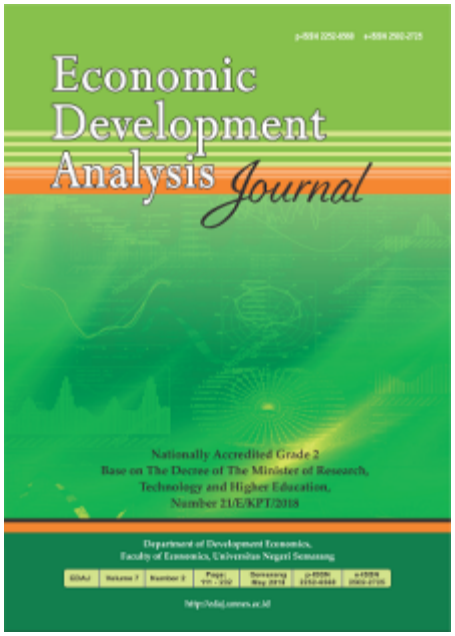

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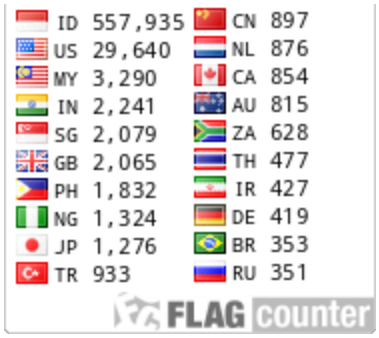

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Does Monetary Transmission Effective? Evidence from Indonesia

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Abstract

This study aims to examine the effects of monetary policy intermediate targets in Indonesia on real variables represented by output and nominal variables represented by inflation. This research is based on the autoregressive distributed lag model (ARDL) approach with bounds testing to cointegrating and error correction. The data analyzed were quarterly data for the period of 2001Q1 - 2020Q1. Intermediate targets in the monetary policy include deposit interest rate, lending interest rate, asset/stock price, and exchange rate. The results show that the deposit interest rate has a negative effect on inflation in the short run, meanwhile, the lending interest rate has a negative effect on inflation in the long run. Also, the lending interest rate has an effective effect on output in the short run. This study also proves that stock price has a positive effect on the monetary transmission to inflation. This finding is important considering that asset value and individual wealth can affect aggregate demand through the asset price channel. These findings have implications for the importance of monetary policy in stabilizing inflation and output in the short run and stabilizing inflation in the long run by emphasizing the interest rate channel.

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INTRODUCTION

Monetary policy, inflation, and economic growth are major and important issues that continue to be of concern to economists and policymakers. Monetary policies implemented in most countries have the aim of increasing economic growth (Dimitrijević & Lovre, 2012). Specifically, one of the roles of monetary economic policy in economic development in a country is to maintain price stability. Price stability is one of the most important objectives of monetary policy. In addition to the exchange rate, maintaining price stability is a necessary measure to create essential conditions for a country's economic growth. Furthermore, Gaspar and Smets (2002) suggested that price stability should be given top priority relative to output stability. Inflation can adversely affect the tendency of saving behavior and inefficient allocation of resources by encouraging speculative and non-productive investment. Therefore, inflation can have an unfavorable impact on the real sector. Price and exchange rate volatility can disrupt sustainable economic growth. Inflation and exchange rate volatility can reduce the attractiveness of foreign investment and encourage capital outflows. The monetary authorities on this issue should maintain vigilance against inflationary trends and control money in the economy.

In developed countries such as the United States and Europe, the monetary policy implemented by the central bank is a policy tool to achieve the goals of inflation and economic growth. In the long run, most economists agree that output is fixed so that changes in the money supply only cause changes in prices. This condition is commonly referred to as money neutrality in the long run. However, some of the previous empirical studies reject long-run monetary neutrality, including the results of studies conducted by Arintoko and Kadarwati (2009) for evidence in Indonesia and Issaoui et al. (2015) for evidence in the US. Conversely, in the short run, prices and wages do not change easily immediately, so that changes in the money supply can affect output. Thus, in the short run, there is no money neutrality.

Currently, the central bank, including in Indonesia, has implemented monetary policy targeting inflation to achieve stable economic growth and price stability. In implementing its policies, the central bank uses tools such as interest rates to adjust the money supply to support the running of the economy. The central bank will control the money supply when inflation increases. This policy is a contractionary monetary policy that aims to reduce inflation. The opposite applies when the central bank conducts expansionary monetary. Based on a study conducted by Taylor (2019), interest rates are proven to be a more reliable instrument because velocity is more volatile.

Changes in monetary policy affect aggregate demand as well as output and prices. These effects can be transmitted to the real economy in several ways (Ireland, 2008). The interest rate channel is the most popular traditional channel of monetary policy transmission. If the central bank will implement a tight policy, then the interest rate will be increased to encourage consumers to tend not to buy goods such as houses or cars. Meanwhile, firms are less likely to invest in new equipment, software, and buildings. This reduced level of economic activity will be in line with lower inflation. Lower demand means lower prices. Through this channel, the monetary policy increases liquidity to create economic growth. Meanwhile, liquidity will be reduced when inflation increases.

In the credit channel, changes in interest rates also affect the ability of banks to provide credit. An increase in interest rates will make banks less profitable in making loans. In this condition, banks are less willing to provide loans to borrowers.

Through the exchange rate channel, an increase in interest rates leads to currency appreciation. In this condition, the behavior of foreign investors seeking higher returns will increase the demand for their currency. The appreciation of the domestic currency will make export prices more expensive, thereby reducing exports and increasing imports because import prices are cheaper. This condition indicates a decrease in output. The opposite applies if the exchange rate is depreciating.

The results of previous studies regarding monetary policy and economic growth generally have not yet come to a convincing conclusion. According to Twinoburyo and Odhiambo (2018), although most of the previous studies tend to support the positive impact of monetary policy on economic growth in developing countries, the results are still mixed. This positive impact can be found in countries with relatively developed financial markets with central bank independence. However, this relationship tends to be weaker in developing countries with underdeveloped financial markets and weak integration of global markets.

Meanwhile, research results that focus on the linkage between monetary policy and inflation still show some variation. The variables representing monetary policy still vary. Research conducted by Cioran (2014) found that monetary policy interest rates have a significant direct relationship with inflation. These findings conclude that interest rates are an efficient instrument for the central bank to prevent inflation. Studies conducted by Amaefula (2016) and Ayub et al. (2014) also found evidence of a relationship between interest rates and inflation. Also, there have been many studies on the relationship between the money supply and inflation in explaining monetary policy performance. However, in the context of current monetary policy, the interest rate variable has become more relevant in measuring the performance of monetary policy implementation.

Inflation and economic growth can be used as a measure of the performance of current monetary policy implementation. Given the function of monetary policy for economic stabilization, the measurement of effectiveness can be directed at the two policy targets, namely inflation and output. It is important to need research that strengthens the conclusions from empirical evidence about the effect of monetary policy variables on inflation and output. If there are several transmission lines, the measurement of the effectiveness of monetary policy can be carried out by involving the main variables which include deposit interest rate, lending interest rates, stock price that represent asset prices, and exchange rate as the implementation of inflation targeting policies in Indonesia.

This study aims to examine the effects of monetary policy intermediate targets in Indonesia on real variables represented by output and nominal variables represented by inflation. Intermediate target variables include deposit interest rate, lending interest rate, asset/stock price, and exchange rate. The data analyzed are data on the implementation period of the use of policy interest rates as a representation of the implementation of inflation targeting in monetary policy in Indonesia. In this study output and inflation, which are the main targets of monetary policy, are examined independently and the two results are then compared. However, before deciding to separate the model, the causality between output and inflation will be examined. If both show independence, each model will be estimated partially. The results of data analysis in the inflation model will be discussed first before discussing the estimation results for the output model. Each model will be estimated using the Autoregressive Distributed Lag (ARDL) model to accommodate dynamic behavior.

RESEARCH METHODS

This study uses the ARDL model approach. The ARDL model is a model that is applied to dynamically analyze time-series data. As Greene (2008) states that the ARDL model is an ordinary least squares regression that includes the lag for the dependent variable as well as the explanatory variable as regressors. The ARDL model has been widely used in economic and financial research. Since the emergence of the model introduced by Pesaran and Shin (1999) and Pesaran, Shin, and Smith (2001), the ARDL model has been widely used, and in macroeconomic and financial research it has been popularly used, among them by Elfaki et al. (2020), Hatmanu et al. (2020), Abonazel and Elnabawy (2020), and Nguyen and Ngoc (2020). The use of the ARDL model has become popular because the ARDL approach is a method for testing the cointegrating relationship between the analyzed variables. Through the ARDL model, long-run and short-run effects can be estimated, among others, in studies conducted by Matlasedi (2017) and Chandio et al. (2019).

Specifically, the ARDL model is appropriate to use in analyzing the effects of monetary variables. Sharestha and Bhatta (2018) state that the ARDL is most appropriate to be applied in studies of money supply effects and exchange rates on prices in Nepal. The results obtained from the ARDL model are more robust and reliable than other models. The problem of a different order of integration in time series can be accommodated in this model. In research on the effects of monetary policy, Ekong and Ukoha (2018) show that the ARDL model can explain in analyzing the effects of monetary policy based on its transmission channel. Also, the ARDL model has been used by Asghar (2015) in a study that observes the effectiveness of monetary policy through the money supply variable on prices and output. Analysis with the ARDL model found evidence that monetary policy is effective in controlling prices and output in both the short and long run. This research is motivated to use the ARDL model which is proven suitable for analyzing the effectiveness of the monetary policy. In this study, the effects of monetary policy are investigated from the channel of deposit and lending interest rate, asset price represented by stock price and exchange rate.

The data used in this study are quarterly time series data with the 2001Q1 - 2020Q1 period. The beginning of the period was the beginning of the implementation of inflation targeting, although not yet officially, however at the beginning of this period the policy interest rate called the BI rate was used. The variables selected as intermediate targets for monetary policy according to their channels include the deposit interest rate, the lending interest rate, the stock price, and the exchange rate are considered as intermediate variables in the transmission of policy through three main channels, namely the interest rate channel, the asset price channel, and the exchange rate channel. The variable of the deposit interest rate is represented by the time deposit interest rate, the lending interest rate variable is represented by the working capital interest rate, the stock price variable is the composite stock price index of the Indonesian stock exchange, and the exchange rate variable is represented by the rupiah exchange rate against the US dollar. Meanwhile, the inflation and output variables are the target variables for monetary policy. The explanation of all variables used in this study is presented in Table 1

Table 1. Definition of Variables

Variable	Term	Indicator	Source
Real output	LOUTPUT	Real gross domestic product in natural logarithm (2000=100)	BPS-Statistics Indonesia
Inflation	INF	Consumer price index inflation in % year on year (y-o-y)	Bank Indonesia
Time deposit interest rate	TDIR	percent per annum	Bank Indonesia
Working capital interest rate	WCIR	percent per annum	Bank Indonesia
Stock price index	LSPI	Composite stock price index in natural logarithm	Indonesia Stock Exchange
Rupiah exchange rate	LRER	US dollars per rupiah in natural logarithm	Bank Indonesia

Source: Data Processed, 2021

Before implementing the ARDL model, the first step is to perform unit root tests to determine the stationarity of the independent variables in the model, whether at I(0), I(1), or a mixture, and ensure that the dependent variable is stationary at I(1). The unit root test used is the Augmented Dickey-Fuller (ADF) test to get more reliable and precise results in the parametric test as stated by Shrestha and Bhatta (2018).

In treating inflation and output model estimates, independently or not, it is necessary to test the causality of inflation and output. If

inflation and output do not have a causal relationship, the ARDL estimation can be done independently. Therefore, the effectiveness of the influence of the independent variable on the objectives of monetary policy can be carried out and compared between the inflation target and the output target.

The ARDL model which is the basis for this analysis is a model in the general form which is then estimated in the form of an equation model with the bound test and error correction. The general form of the ARDL model is a model that follows Pesaran and Shin (1999) expressed in the following ARDL (k, l, m, n, p) model. Equations (1) and (2) show the equations in the inflation and output models, respectively.

$$\begin{aligned}\mathrm{INF}_t = \alpha + \textstyle\sum_{j=1}^{k} \phi_j\, \mathrm{INF}_{t-j} + \sum_{j=0}^{l} \beta_j\, \mathrm{TDIR}_{t-j} + \\ \sum_{j=0}^{m} \delta_j\, \mathrm{WCIR}_{t-j} + \sum_{j=0}^{n} \gamma_j\, \mathrm{LSPI}_{t-j} + \\ \sum_{j=0}^{p} \lambda_j\, \mathrm{LRER}_{t-j} + u_{1t} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (1)\end{aligned}$$

With expected parameters:

$$\phi_j < 0,\ \beta_j < 0,\ \delta_j < 0,\ \gamma_j > 0, \text{ and } \lambda_j < 0$$

$$\begin{aligned}\mathrm{LOUTPUT}_t = \alpha + \textstyle\sum_{j=1}^{k} \varphi_j\, \mathrm{LOUTPUT}_{t-j} + \\ \sum_{j=0}^{l} \beta_j\, \mathrm{TDIR}_{t-j} + \sum_{j=0}^{m} \delta_j\, \mathrm{WCIR}_{t-j} + \\ \sum_{j=0}^{n} \gamma_j\, \mathrm{LSPI}_{t-j} + \sum_{j=0}^{p} \lambda_j\, \mathrm{LRER}_{t-j} + u_{2t} \quad (2)\end{aligned}$$

with expected parameters:

$$\varphi_j < 0,\ \beta_j < 0,\ \delta_j < 0,\ \gamma_j > 0, \text{ and } \lambda_j < 0$$

Where it is assumed that u_{1t} and $u_{2t} \sim idd\ (0, \sigma^2)$. Variables of OUTPUT, SPI, and RER are in natural logarithm. To estimate the long-run and short-run effects, the model is based on equation (3).

$$\begin{aligned}\Delta y_t = \alpha + \beta y_{t-1} + \delta x_{t-1} + \textstyle\sum_{j=1}^{p} \gamma_j\, \Delta y_{t-j} + \\ \sum_{j=0}^{q} \lambda_j \Delta x_{t-j} + u_t \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (3)\end{aligned}$$

Where y are represents INF and LOUTPUT respectively, and x are (TDIR, WCIR, LSPI, and LRER).

The long-run effect is the equilibrium effect of the independent variables on the dependent variable, in this case, inflation and output respectively. After the bound test is carried out to detect a long-run relationship, the error correction form can be presented in equations (4) and (6). The error correction form is a reparameterization of the ARDL model (Hassler & Wolters, 2006).

$$\begin{aligned}\Delta \mathrm{INF}_t = \alpha + \textstyle\sum_{j=1}^{k-1} \phi_j\, \Delta \mathrm{INF}_{t-j} + \\ \sum_{j=0}^{l-1} \beta_j\, \Delta \mathrm{TDIR}_{t-j} + \sum_{j=0}^{m-1} \delta_j\, \Delta \mathrm{WCIR}_{t-j} + \\ \sum_{j=0}^{n-1} \gamma_j\, \Delta \mathrm{LSPI}_{t-j} + \sum_{j=0}^{p-1} \lambda_j\, \Delta \mathrm{LRER}_{t-j} + \\ \mathrm{ECT}_{1t-1} + u_{3t} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (4)\end{aligned}$$

Where:

$$\begin{aligned}\mathrm{ECT}_{1t-1} = \mathrm{INF}_{t-1} - (\omega_1 \mathrm{TDIR}_{t-1} + \\ \omega_2 \mathrm{WCIR}_{t-1} + \omega_3 \mathrm{LSPI}_{t-1} + \omega_4 \mathrm{LRER}_{t-1} (5)\end{aligned}$$

with expected short-run parameters:

$$\phi_j < 0,\ \beta_j < 0,\ \delta_j < 0,\ \gamma_j > 0, \text{ and } \lambda_j < 0$$

and long-run parameters:

$$\omega_1 < 0,\ \omega_2 < 0,\ \omega_3 > 0, \text{ and } \omega_4 < 0$$
$$1 < \mathrm{ECT1} < 0$$

ECT: error correction term

$$\begin{aligned}\Delta \mathrm{LOUTPUT}_t = \alpha + \textstyle\sum_{j=1}^{k-1} \varphi_j\, \Delta \mathrm{LOUTPUT}_{t-j} + \\ \sum_{j=0}^{l-1} \beta_j\, \Delta \mathrm{TDIR}_{t-j} + \sum_{j=0}^{m-1} \delta_j\, \Delta \mathrm{WCIR}_{t-j} + \\ \sum_{j=0}^{n-1} \gamma_j\, \Delta \mathrm{LSPI}_{t-j} + \sum_{j=0}^{p-1} \lambda_j\, \Delta \mathrm{LRER}_{t-j} + \\ \mathrm{ECT}_{2t-1} + u_{4t} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (6)\end{aligned}$$

Where:

$$\begin{aligned}\mathrm{ECT}_{2t-1} = \mathrm{LOUTPUT}_{t-1} - (\rho_1 \mathrm{TDIR}_{t-1} + \\ \rho_2 \mathrm{WCIR}_{t-1} + \rho_3 \mathrm{LSPI}_{t-1} + \rho_4 \mathrm{LRER}_{t-1} \quad (7)\end{aligned}$$

with expected short-run parameters:

$$\varphi_j < 0,\ \beta_j < 0,\ \delta_j < 0,\ \gamma_j > 0, \text{ and } \lambda_j < 0$$

And for the long-run parameters:

$$\rho_1 < 0,\ \rho_2 < 0,\ \rho_3 > 0, \text{ and } \rho_4 < 0$$
$$-1 < \mathrm{ECT}_2 < 0$$

Equations (4) and (6) respectively show the error correction form of the inflation and output equations. The error correction form is a reparameterization of the ARDL model to be able to estimate the short-run effect that takes into account short-run fluctuations that are not the result of deviations from the long-run equilibrium.

RESULTS AND DISCUSSION

The unit root test results as reported in Table 2 indicate that TDIR is stationary at I (0) based on the test with intercept as well as with intercept and trend. The results of the unit root test conclude if they are supported by the results of the two test scenarios. Meanwhile, other variables, including the inflation and output variables as dependent variables are stationary at I (1). Therefore, even though all variables are not stationary in the same order, the model estimation can be done using ARDL on the condition that inflation and output as dependent variables are I (1).

This study assumes that inflation and output are independent, which implies that there is no significant relationship between the two, which generally indicates a Phillips curve relationship. Initial testing in this study indicated a very weak relationship. As stated by Galih and Safuan (2017), there is still an ambiguous and unclear relationship between output and inflation. Bullard and Keating (1995) even state that there is no association between inflation and real output. Therefore, because inflation and output can be used as targets in monetary policy in Indonesia, the effectiveness of monetary transmission against these two targets can be investigated independently and can be compared between the two.

Table 2. Unit Root Test of Variables

Variables	ADF test	
	With Intercept	With Intercept and Trend
INF	-2.4073	-3.5197**
LOUTPUT	-1.4308	-0.4949
TDIR	-3.2914**	-3.9532**
WCIR	-2.2977	-4.2377***
LSPI	-1.8239	-1.0705
LRER	-0.2132	-2.3817
ΔINF	-6.6691***	-6.6367***
ΔLOUTPUT	-3.4922**	-3.5767**
ΔTDIR	-5.0904***	-5.1910***
ΔWCIR	-4.2299***	-4.2277***
ΔLSPI	-6.0405***	-6.2773***
ΔLRER	-8.7220***	-9.0674***

*** *p-value* < 0.01 and ** *p-value* < 0.05

Source: Data Processed, 2021

The results of the causality test between these two variables are reported in Table 3. Based on the results of the causality test at the level, inflation does not cause output at all lags. Conversely, to conclude that output causes inflation is very weak, because it is only proven at lags = 4 with p-value <0.05 and lags = 2 and lags = 10 with p-value <0.10. Likewise, for the first difference, the test results accept the null hypothesis on all lags and conclude that there is no relationship between inflation and output. Therefore, the results of this test become the basis for implementing the ARDL model estimation independently of the inflation model and the output model.

Table 3. Results of Granger Causality Test for Inflation and Output

H_0	F-Statistic				
	Lags = 2	Lags = 4	Lags = 6	Lags = 8	Lags = 10
INF does not Granger cause LOUTPUT	0.1212	0.7490	0.7801	0.4704	0.3969
LOUTPUT does not Granger cause INF	2.8050*	3.4494**	1.1328	1.7100	1.3951*
ΔINF does not Granger cause ΔLOUTPUT	0.0081	0.8375	0.7271	0.4494	0.4779
ΔLOUTPUT does not Granger cause ΔINF	0.0010	0.5203	1.0607	1.5131	1.5408

** *p-value* < 0.05 and * *p-value* < 0.10
Source: Data Processed, 2021

Based on the reports in Table 4, the estimation results between the inflation model and the output model give different results. The estimation of the inflation model obtained the best model, namely the ARDL (2,6,6,8,8) model, meanwhile, the estimation of the output model obtained the best model, namely the ARDL (5,8,3,2,7) model. Both models have passed the problem of non-normality, serial correlation, heteroscedasticity, and model instability

Table 4. Statistical Diagnostic Checks of Inflation and Output ARDL Models

Diagnostic Elements	ARDL (2,6,6,8,8) Model of Inflation	ARDL (5,8,3,2,7) Model of Output
R^2	0.9354	0.9998
Adjusted R^2	0.8626	0.9997
F-stat	12.8625***	7725.58***
AIC	3.5074	-7.5799
SIC	4.7054	-6.6085
JB stat	0.5954	1.9741
BG LM test F-stat	0.9514	0.4254
BPG Het. test F-stat	0.8145	0.9746
CUSUM test	Stable	Stable

*** p-value < 0.01
Source: Data Processed, 2021

The results of the bound test on the existence of a long-run relationship in the inflation model and the output model are presented in Table 5. The test results show that there is a long-run relationship in both the inflation model and the output model. The F statistic of the bound test shows that the null hypothesis is rejected even at a critical value of 1% for the inflation model and a critical value of 2.5% for the output model. Because there is a long-run relationship, the model estimation can be continued in the error correction model for both models.

The results of parameter estimation in the long-run equation can be seen in Table 6. For the long-run inflation model, only WCIR is significantly related to inflation. The estimation parameter for WCIR has a negative sign which corresponds to the expectation. If the lending interest rate, which is represented by the interest rate for working capital, rises, inflation will decrease, and vice versa. The increase in lending interest rates increases the cost of capital so that the planned investment expenditure decreases, and vice versa. The pull of aggregate demand from the investment will decrease due to an increase in interest rates which then causes inflation to decrease. So, the lending interest rate has a significant negative effect on inflation in the long run. Partially, only the variable of lending interest rate has a long-run effect on inflation. These results support the general theory of the negative correlation between inflation and interest rates. The results of this study also

support the results of previous empirical studies, including the results of a study undertaken by Jonsson and Reslow (2015). In general, when interest rates fall, the economy will increase and inflation will also increase, and vice versa. This negative correlation has always been the basis of monetary policy in controlling inflation through the interest rate instrument.

Table 5. ARDL Bound Tests of Cointegration

Bound Test of ARDL Inflation Long-Run Form				
F-statistic (Bound test) = 5.3580*** (H_0: no levels relationship)				
Critical values	1%	2.5%	5%	10%
Lower bound values	3.81	3.40	3.05	2.68
Upper bound values	4.92	4.36	3.97	3.53
Bound Test of ARDL Output Long-Run Form				
F-statistic (Bound test) = 4.6386** (H_0: no levels relationship)				
Lower bound values	3.74	3.25	2.86	2.45
Upper bound values	5.06	4.49	4.01	3.52

***Significant at the 1% level; **Significant at the 5% level

Source: Data Processed, 2021

During the study period, there was a significant decrease in inflation as indicated by a significant negative trend. So during the implementation period of the application of policy interest rates and inflation targeting, there was a decrease in the inflation trend. The performance of the implementation of inflation targeting can be considered capable of controlling inflation in the long run. The results of this study are in line with the findings of a study conducted by Eroglu et al. (2017) that the inflation targeting strategy is effective in reducing inflation during the study period.

Table 6. Long-run Coefficients

Variables	ARDL Model of Inflation			ARDL Model of Output		
	Coefficient	Std. Error	t-statistic	Coefficient	Std. Error	t-statistic
TDIR	2.8891	1.3534	2.1347**	-2.5672	25.2880	-0.1015
WCIR	-5.6965	2.7634	-2.0614**	2.4481	24.6122	0.0995
LSPI	6.4320	4.3499	1.4787	0.9494	7.6698	0.1238
LRER	-14.4103	10.6745	-1.3500	1.3689	16.7505	0.0817
t	-0.6525	0.3190	-2.0452**			

*** *p-value* < 0.01, ** *p-value* < 0.05, and * *p-value* < 0.10

Source: Data Processed, 2021

Regarding the long-run output model, this study did not find the effect of the interest rate, asset price, and exchange rate variables partially on output in the long run. However, these results support a new consensus in macroeconomics that the principles of monetary policy are aimed at stabilizing short-run output and long-run price stabilization, as stated by Fontana and Palacio-Vera (2007). Therefore, in this context, there is no long-run relationship between output and nominal variables such as interest rate, asset price, and exchange rate. So, with these principles and findings, the characteristics of monetary policy are appropriate for short-run, not long-run output stabilization.

The results of the short-run estimation in the error correction form are reported in Table 7. The results show that the negative sign in the estimation parameters for the lag of inflation and output indicates the dynamic behavior of short-run inflation and output which is characterized by short-run fluctuations. An absolute coefficient of ECT_1 that is greater than ECT_2 indicates that the speed of adjustment in the disequilibrium to

the long-run equilibrium state is significantly higher in inflation than in output. These results indicate that the speed at which inflation returns to equilibrium is higher than output after changes in the monetary variables as explanatory variables are the same in both models.

Table 7. Results of ARDL Error Correction and Short-Run Effects

Variables	k	ARDL Model of Inflation		k	ARDL Model of Output	
		Value	Wald t-stat		Value	Wald t-stat
C		-59.8331***			0.0493***	
$\sum_{j=1}^{k-1} \phi_j \Delta INF_{t-j}$	2	-0.2079*				
$\sum_{j=0}^{k-1} \varphi_j \Delta LOUTPUT_{t-j}$				5	-1.3920	-2.7407***
$\sum_{j=0}^{k-1} \beta_j \Delta TDIR_{t-j}$	6	-9.0137	-3.5287***	8	0.0229	3.4632***
$\sum_{j=0}^{k-1} \delta_j \Delta WCIR_{t-j}$	6	21.6562	4.1154***	3	-0.0226	-2.8601***
$\sum_{j=0}^{k-1} \gamma_j \Delta LSPI_{t-j}$	8	34.3822	2.9231***	2	-0.0439	-2.6867**
$\sum_{j=0}^{k-1} \lambda_j \Delta LRER_{t-j}$	8	29.2345	0.8558	7	0.1605	2.9664***
ECT_{t-1}		-0.6395***			-0.0023***	
R^2		0.8214			0.9760	
Adjusted R^2		0.6718			0.9621	
F-stat		5.4908***			70.1132***	
AIC		3.3624			-7.6958	
SIC		4.3986			-6.8540	

*** *p-value* < 0.01, ** *p-value* < 0.05, and * *p-value* < 0.10

Source: Data Processed, 2021

The parameter estimation results for the inflation model show that the parameters of TDIR and LSPI are significant through the Wald test. Wald test is used to test the significance of the total short-run effect of the variables of TDIR and LSPI on inflation. These results imply that deposit interest rates represented by time deposits have a significant negative effect on inflation. An increase in deposit interest rates will encourage households to increase their savings and reduce consumption so that aggregate demand decreases. Reduced aggregate demand then reduces inflation in the short run, and vice versa. Thus, the monetary transmission is effective in influencing inflation through deposit interest rate and asset price represented by the stock price.

Asset prices represented by stock prices also have a significant effect on inflation in the short run. An increase in stock prices will increase household wealth. An increase in wealth will encourage consumers' demand to provide a boost to inflation from the demand side, and vice versa. This finding is enough to get attention when other studies prove that there is no asset price channel effect on monetary transmission. One of the results of research conducted by Singh (2012) shows that changes in asset prices do not affect the inflation path. However, the transmission of asset price channel in the future will be very important for any central bank because it is a monetary policy transmission channel related to the market value of assets and individual wealth as important variables.

Meanwhile, related to the output model, the parameter estimation results only show that WCIR has a significant negative effect following

expectations. An increase in lending interest rates represented by working capital interest rates will reduce investment spending and in turn, will reduce output. Likewise, the opposite applies if the lending interest rate falls. Thus, the effective monetary transmission in the short run is the effect of lending interest rates on output.

In the short run, the exchange rate does not affect inflation, meanwhile, the exchange rate has a positive effect on output. These results are inconsistent with the initial study conducted by Arintoko and Insukindro (2017). The difference in the study period and the concept of the variables used causes this problem. In many empirical studies, fluctuations in the short run do sometimes not correspond to the logic of the theory as in the long run or cointegrating relationships. In the short run the exchange rate, inflation, and output tend to fluctuate with one another. Therefore, there is no significant relationship between the exchange rate and inflation in the short run, meawhile, the positive relationship between the exchange rate and the output shows a relationship that is contrary to the logic of the theory. An increase in the exchange rate tends to be good news, and a decrease tends to become bad news. Good news and bad news determine economic sentiment that affects consumer and business behavior. The hike in the exchange rate can be good news that will encourage consumers and producers to be more confident, thus boosting output through increased consumption and production. This finding is corroborated by the results of a study conducted by Białowolski (2019) which shows that consumers with low confidence tend to increase savings rather than consumption with a precautionary aim.

The results generally show that monetary transmission by interest rates in the long run only occurs to inflation by lending interest rates. Meanwhile, there is no monetary transmission to output in the long run. However, in general, effective monetary transmission through deposit interest rates and stock prices to inflation in the short run. Meanwhile, monetary transmission to output also occurs through lending interest rates. This finding is significant compared to several other empirical studies that have found no transmission effect. For example, a study conducted by Brito and Bystedt (2010) proved that there is no effect on monetary transmission by interest rates on inflation and output.

Overall, monetary transmission by interest rates to inflation is more effective than to output. The effect of transmission to inflation occurs in the short and long run. Meanwhile, the effect of transmission to output only occurs in the short run. The results of this study are in line with previous studies conducted by Wulandari (2012), which found evidence that the interest rate channel plays an important role in monetary transmission to inflation rather than to output. Furthermore, of course, the results of this study support the new consensus view of macroeconomics regarding the monetary policy that it has a role in stabilizing short-run output and stabilizing long-run inflation. This study also finds evidence on the importance of the effectiveness of monetary transmission on inflation in the short run as the implementation of inflation targeting in Indonesia. Also, this study found empirical evidence of the effect of asset price transmission on short-run inflation.

Meanwhile, the effect of the exchange rate on inflation is not found in this study. So this study does not find the effectiveness of monetary transmission through the exchange rate channel for transmission to inflation in both the short and long run. Also, the effect of the exchange rate on output is significant but not in line with expectations. The effect of changes in exchange rates tends to be good news and bad news which determine economic sentiment positively on output. This finding is different from the results of previous studies including the results of the study by Poon (2011). The results of this study indicate that the implementation of monetary policy through the exchange rate channel is more effective than the interest rate channel in controlling inflation in ASEAN 5 countries. The special case in Indonesia in the inflation targeting period provides more relevant evidence regarding the effectiveness of the monetary policy on inflation through interest rates. The results of this study are in line with the findings of a study

conducted by Ekong and Ukoha (2018). These results indicate that the interest rate channel is effective in transmitting monetary policy to real output. The results of this study are also in line with the results of a study undertaken by Cioran (2014) which states that interest rates have a significant direct relationship to inflation and interest rates are an efficient instrument to control inflation.

CONCLUSION

This research has investigated the effect of intermediate targets through monetary policy channels on inflation and output as the main targets. This study provides more meaningful evidence by developing models that have the structure of equations represented by intermediate target variables in monetary transmission channels. The findings of this study provide significant empirical evidence regarding the effectiveness of the monetary policy in Indonesia. The results of this study provide enrichment of literature at the academic level and policy analysis.

Deposit interest rates have a significant negative effect on inflation in the short run, meanwhile, lending interest rates have a significant negative effect on inflation in the long run. The lending interest rate is also an effective effect on output in the short run. This finding is consistent with the new macroeconomic consensus view that the principle of monetary policy is to stabilize output in the short run and stabilize prices in the long run. Also, the finding that stock prices have a positive effect on the monetary transmission to inflation is important. In the future, the role of asset value and individual wealth is very important because they both affect aggregate demand which can have an impact on inflation and output.

In the short run, changes in the exchange rate tend to be as good news or bad news that drives demand and then has an impact on output. So, changes in exchange rates have a positive impact on output. However, these findings do not match expectations according to the logic of the theory.

In the short run there are indications of fluctuations in inflation and output throughout the inflation-targeting period, but with a downward trend. This shows that along with inflation targeting there will be a decline in inflation as expected by policymakers.

The results of this study have implications for the importance of monetary policy as an inflation stabilization policy in both the short and long run by emphasizing the interest rate channel. Asset price channels also need to be a focus in line with the importance of the market value of assets and individual wealth in increasingly rational consumption and investment behavior. The central bank needs to maintain its credibility so that inflation targeting policies are more effective in stabilizing inflation and output in the future.

However, this research still assumes that the effect on the transmission is symmetric. It is possible that the effect on transmission can differ when the monetary variable increases and decreases to inflation and output. Therefore, it is suggested that in future research, a model can be developed by separating the increasing and decreasing monetary variables so that the effect may be asymmetric.

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