

## Determinant of Property Price Through the Monetary Variables: An ARDL Approach

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*Received: November 2022 | Revised: February 2023 | Accepted: April 2023*

### Abstrack

The 2008 financial crisis demonstrates that studies on property price volatility are important because it impacts domestic economic conditions. This study identifies the volatility of property prices through monetary variables. This current study employs the ARDL method to determine the effect of monetary variables in the short and long term. The study results show that GDP as a proxy for income negatively affects residential property prices in Indonesia, and inflation positively affects property prices. There is a difference in the effect of domestic interest rates on property prices where there is a direct effect on domestic interest rates followed by the COVID-19 crisis. Meanwhile, foreign interest rates have a negative effect in the short term and a positive effect in the long term. This study implies that strong monetary operation through interest rates can maintain public expectations of prices, especially property prices.

**Keywords:** Property Price; Monetary Variables; ARDL

**JEL classification:** E4, E5, R32

**How to Cite:** Kurniawan M. L. A., Khasanah U., Baharudin S. A. (2023). Determinant of Property Price Through the Monetary Variables: An ARDL Approach, 24(1), 12-23. doi:<https://doi.org/10.23917/jep.v24i1.20588>

**DOI:** <https://doi.org/10.23917/jep.v24i1.20588>

### 1. Introduction

The 2008 global crisis stimulated research interest in asset or property price volatility, considering that fluctuations in the housing price sector could directly damage the domestic economy and financial stability. Furthermore, ITF policies could efficiently stabilize the pricing of basic goods and services, but they must prevent the fluctuation of asset price bubbles. Topic related to the interaction of monetary policy and asset prices has developed and been discussed in several studies. According to Rigobon & Sack (2003) little is known about the magnitude of the Federal Reserve's reaction to the stock market, in part because the simultaneous response of equity prices to interest rates makes it difficult to estimate. This paper uses an identification technique based on the heteroskedasticity of stock market returns to

measure the reaction of monetary policy to the stock market. We find a significant policy response, with a 5 percent rise (fall, there is a significant interaction between interest rates, asset prices, and stock prices in the short-term. This current research attempts to analyze alternative forecasts of how asset prices react to changes in monetary policy.

Figure 1 shows the fluctuation of Indonesia's property price index's growth. There is an opposite pattern between interest rates (as monetary policy) on housing prices in certain periods. Additionally, a decline in interest rates in 2017 and 2018 was responded to by an increase in house prices. In 2015:Q4, 2018:Q2, 2018:Q4, and 2019:Q2, house prices in Indonesia responded unfavorably to changes in interest rate rises. However, in 2017, the third and fourth quarters were the only exceptions to this tendency. The first quarter of 2021 reveals a

decline in interest rates followed by a decline in the price of the housing index in Indonesia. In addition, the property price index growth has increased at most by 0.5% in recent years. Thus, the graph in Figure 1 after 2017 tends to decrease. The effect of the pandemic shows that residential property prices have decreased. This is because the welfare effect in society has diminished throughout the pandemic, resulting in a decline in property demand. In certain years, there is an inclusive pattern between Indonesia's monetary policy and property price growth in Indonesia.

There have been several previous studies related to the property sector. Bernanke & Kuttner (2005) developed the sensitivity of the property sector to changes in monetary policy. Mishkin (2007) added the literature on the link between the property sector and transmission in monetary policy. There is a relationship between the property sector and monetary policy. Because, in some instances, the property sector is used as collateral for loans. Thus, it can affect the financial system's stability. As a mitigating tool for modifying monetary policy on assets to maintain domestic economic stability, it is crucial to do research on the interaction between monetary policy and asset prices.

Umaret al (2020) explained that the direct effect of the monetary policy transmission mechanism on property prices is the income effect. When interest

rates rise, the interest expense of any unpaid loan or new loan application will increase. Thus, disposable income will decrease. The fall in discretionary income can affect the level of consumption. The impact on the level of consumption is contingent on the movement of interest rates, followed by the tightening of monetary policy. The faster changes in interest rates will affect household disposable income. The size of the income effect depends on the household income proportion. The level of household consumption highly depends on the proportion of income. In that case, the household sector will have limited ability to apply for loans and may even increase the interest payments, which can reduce disposable income and consumption.

The indirect effects are the wealth effect and the credit channel effect. This research will focus on the indirect effect of monetary policy transmission through the property sector. Monetary policy transmission through credit channel effects works if interest rates are high, it can reduce the "wealth" of the housing sector, and household access to credit becomes lower. Credit-constrained households must reduce their level of consumption. Iacoviello & Minetti (2008) stated that the volatility (high level of risk) of housing prices means that monetary policy shocks have a negative effect and drive the banking sector to give greater housing or property loans.

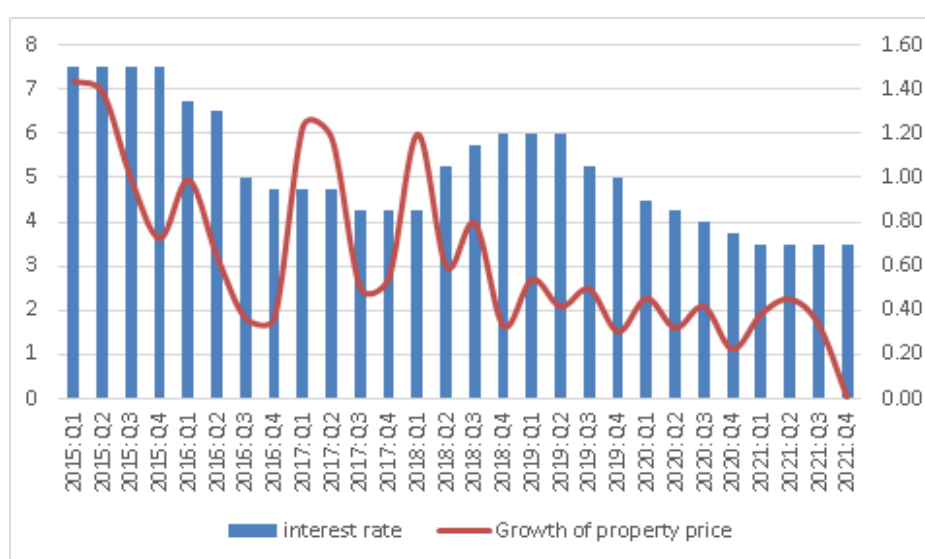


Figure 1. Interest Rate and Property Price Growth in Indonesia

Studies on the relationship between the monetary and property sectors have been extensively developed. Bjørnland & Jacobsen (2010) employed the VAR approach linking monetary and macroeconomic variables with housing prices in Norway, Sweden, and the UK. The results showed that housing prices would directly respond to interest rate changes. Research by Bredin et al (2007) utilized the same approach and showed that housing prices (using REITs data) respond negatively to interest rate changes. Both analyses reveal that house prices are sensitive to the monetary sector. Similar results also showed by research from Brooks & Tsolacos (1999). The study revealed that inflation and interest rates strongly affected the UK housing market share.

Research by Gupta et al (2010) stated that house price growth in South Africa responds negatively to monetary influences, and housing price responses depend on market segmentation. Another approach developed by Bredin et al (2007) by using Generalized Autoregressive Conditional Heteroskedasticity (GARCH) showed that there is a response from housing prices (REIT) to the uncertainty and volatility of monetary policy. A study by Elbourne (2008) utilized the SVAR approach. The result indicated a simulation of an impulse response of around a 12-15% decrease in consumption following monetary policy shocks through changes in property prices. The research results do not support evidence that credit channels and the wealth of monetary policy transmission play an important role in the variation in output in response to monetary policy changes.

The monetary policy shows its power and plays an important role in the structural analysis of property prices (Bjørnland & Jacobsen, 2013); (Gupta et al., 2012); (Rahal, 2016). Research developed by Demary (2010) identified three main things: a) transmission of contractionary monetary policy, which leads to an increase in interest rates. It increases housing costs. Moreover, the demand for property becomes lower. Furthermore, it will decrease housing prices, b) Transmission through inflation states

that an increase in inflation has a heterogeneous impact on property prices, considering that real estate ownership is an investment and is used as a hedge against inflation. An increase in inflation will drive investment in real estate, impacting the increasing housing prices. When inflation increases, the monetary authority tends to increase interest rates which can lead to an increase in the cost of the property sector. It decreases the demand for the real estate and housing sector; c) The positive effect of the increased output is an increase in disposable income for consumption which can increase investment in the property sector. The higher economic growth will increase demand for the property sector. Thus, it can drive construction activity and property prices and interest rate have a strong relation to the housing price (Albuquerque et al., 2020).

Assenmacher-Wesche & Gerlach (2011) study utilizes panel data from 18 OECD countries. The results showed that monetary policy has a significant impact on housing prices. The results contrast with Hanck & Prüser (2020), who identified structural shocks using the BVAR approach. The estimation results showed that monetary policy strongly affects housing prices. According to Plakandaras et al (2020), monetary policy is a significant factor in the evolution of housing prices in the UK. Using monetary variables cannot be separated from foreign interest rates because they have implications for the development of domestic monetary policy Dawood (2019).

This current study applied the Autoregressive Distributed Lag Model (ARDL) approach in identifying the effect of monetary policy on asset price volatility in Indonesia to link the studies above. The first contribution consists of adopting the research developed by Miao et al (2022), which highlighted that monetary policy is executed through foreign interest rates. Because of this, developing countries like Indonesia are vulnerable to “bubble-driven” crises that can disrupt asset prices, investment, and capital flows. In addition, the determination of domestic interest rates considers fluctuations in foreign interest rates and to bridge the gap between

research developed by Miao et al (2022) are to identify the affect of foreign interest rate in short and long term. The second research contribution is to analyze more comprehensively the sensitivity of domestic interest rates before the COVID-19 pandemic (modified model) and after (full model) and their effect on residential property prices in Indonesia. Third, emphasize the role of foreign and domestic interest rate on residential property price in Indonesia.

## 2. Research Method

The study utilizes quarterly data from 2006Q1 to 2021Q4. The variables consist of the Residential Property Price Index (IHPR) using the base year 2002 = 100, the gross domestic product (GDP), inflation, money supply using the money supply in a broad sense, domestic interest rates, and foreign interest rates where interest rates are concerned. The Federal Reserve (The Fed) 's interest rate is used as the main reference for foreign central banks. The data was generated from the Central Bank of Indonesia and The Fed. This research examines the effect of monetary variables on the movement of the residential property price index in Indonesia. The model equation is as follows:

$$\text{LnIHPR}_t = \alpha_0 + \alpha_1 \text{LnGDP}_t + \alpha_2 \text{INF}_t + \alpha_3 \text{LnMS}_t + \alpha_4 r_t + \alpha_5 r_t^* + \varepsilon_t \quad (1)$$

$$\begin{aligned} \Delta \text{LnIHPR}_t = & \alpha_0 + \sum_{i=1}^{n1} \alpha_1 \Delta \text{LnIHPR}_{t-1} + \sum_{i=1}^{n1} \alpha_2 \Delta \text{LnGDP}_{t-1} + \sum_{i=1}^{n1} \alpha_3 \Delta \text{INF}_{t-1} \\ & + \sum_{i=1}^{n1} \alpha_4 \Delta \text{LnMS}_{t-1} + \sum_{i=1}^{n1} \alpha_5 \Delta r_{t-1} + \sum_{i=1}^{n1} \alpha_6 \Delta r_{t-1}^* + \alpha_7 \text{Trend} \\ & + \delta_1 \text{LnIHPR}_{t-1} + \delta_2 \text{LnGDP}_{t-1} + \delta_3 \text{INF}_{t-1} + \delta_4 \text{LnMS}_{t-1} + \delta_5 r_{t-1} + \delta_6 r_{t-1}^* \\ & + \mu_t \end{aligned} \quad (2)$$

The equation above uses the bound test as a cointegration test in the ARDL model by testing the F-statistic value. The initial hypothesis (null hypothesis) asserts that there is no cointegration or is described as ( $H_0: \delta_1 = \delta_2 = \delta_3 = \delta_4 = \delta_5 = 0$ ). Meanwhile, the alternative hypothesis holds that there is cointegration between variables. The examined F-statistics will be compared to the lower and upper band critical values, which we

PR is the residential property price index (in logarithm), GDP is a gross domestic product using constant prices 2010=100 (in logarithm), INF is inflation, MS is money supply using the money supply in a broad sense (in logarithm), r is the domestic interest rate and  $r^*$  is the foreign interest rate. The first step in estimating time-series data is the stationarity test, employing the unit root test with the Augmented Dickey-Fuller (ADF) and Philips Perron (PP) approach.

The long-term existence test in the autoregressive distributed lag (ARDL) model using the bound test approach is performed after the stationarity test. Pesaran et al (2001) when it is not known with certainty whether the underlying regressors are trend-or first-difference stationary. The proposed tests are based on standard F-and t-statistics used to test the significance of the lagged levels of the variables in a univariate equilibrium correction mechanism. The asymptotic distributions of these statistics are non-standard under the null hypothesis that there exists no level relationship, irrespective of whether the regressors are I(0) apply the bound test cointegration model to deal with differences in the level of integration between variables. The cointegration test with the bound test approach is used to estimate the long-term coefficients with the F-test. The ARDL model equation is as follows:

classify as I(1) and I(0). Based on the cointegration test, if the F-statistic value is greater than the upper limit, then  $H_0$  is rejected, indicating the existence of a long-term relationship. If the value of the F-statistic is less than the lower limit, then the long-term is not included in the model. The ARDL model based on Pesaran et al (2001) when it is not known with certainty whether the underlying regressors are trend-or first-difference

stationary. The proposed tests are based on standard F-and t-statistics used to test the significance of the lagged levels of the variables in a univariate equilibrium correction mechanism. The asymptotic distributions of these statistics are non-standard under the null hypothesis that there exists no level relationship, irrespective of whether the regressors are I(0 requires an Error Correction Model (ECM) with the adjustment method and error correction in the short-term to get the balance in the long-term, ECM estimation aims to obtain the value of the error correction term (ECT) by performing the regression of independent variables on the dependent variable. The equation formula can be written as follows:

$$ECT = (\text{LnIHPR}_t) - (\alpha_0 + \alpha_1 T + \alpha_2 \text{LnGDP}_t + \alpha_3 \text{INF}_t + \alpha_4 \text{LnMS}_t + \alpha_5 r_t + \alpha_6 r_t^* + \alpha_7 \text{Trend}) \quad (3)$$

The value of the formula above is used to measure the speed of adjustment. The ECT value is expected to be negative and significant to obtain a long-term balance with a range of 0 and 1. A value of 0 indicates no adjustment, while a value of 1 indicates a full adjustment for one period after a shock occurs. If the ECT value is positive and significant, it indicates convergence equilibrium, and there is no external influence/shock (independent variable). The CUSUM and CUSUMQ tests are applied to the model's residual value to test its developed model stability. The CUSUM test is based on the cumulative sum of recursive residuals. The estimate is considered stable if the CUSUM plot is within 5 percent of

the crucial value or if it does not cross the top and bottom lines on the CUSUM figure. However, the estimate is considered unstable if the CUSUM value is above the critical value of 5 percent, out of the top line, or below the CUSUM figure. The interpretation is consistent with the CUSUMQ test, based on the cumulative sum of squares of recursive residuals. Several diagnostic tests were performed to obtain a proper model (goodness of fit), as with the Jarque-Bera approach for normality and heteroscedasticity testing.

### 3. Results and Discussion

#### 3.1 Stationary Test

This current study applies the augmented dickey-fuller (ADF), and Philips-Perron (PP) approaches as the unit root tests to determine if time-series data contain a unit root problem. The unit root test applies two equations between trend and intercepts and intercepts or no trend. The difference between ADF and PP is that the PP model contains a correction for the heteroscedasticity problem in the data. Table 1 shows that four variables are stationary in I(0) form, which are gross domestic product (GDP), inflation (INF), domestic interest rates (r), and foreign interest rates (r\*). The ADF approach shows only one variable that is not stationary in forms I(0) and I(1), which is the gross domestic product variable. However, with the PP approach, all variables are stationary in form I(1), both in trend and no trend modes. This study did not employ the unit root test to form I(2) since it could produce spurious regression.

Table 1. Result of Stationery Test

Variable	ADF		PP	
	Trend	No Trend	Trend	No Trend
LnIHPR	-1.621	-0.192	-1.737	-0.253
LnGDP	-2.828	-1.239	-4.443***	-0.369
INF	-2.966	-1.704	-3.911**	-3.362**
LMS	0.603	4.184	0.619	3.883
r	-4.321***	-3.157**	-3.305*	-2.869*
r*	-3.617**	-3.887***	-1.912	-2.217

Variable	ADF		PP	
	Trend	No Trend	Trend	No Trend
	First Difference			
LnIHPR	-7.055***	-7.099***	-7.053***	-7.110***
LnGDP	-1.670	-1.539	-11.549***	-11.650***
INF	-6.551***	-6.634***	-7.116***	-7.077***
LMS	-11.006***	-9.105***	-11.125***	-9.157***
r	-4.728***	-4.663***	-4.644***	-4.540***
r*	-6.624***	-6.379***	-6.809***	-6.677***

Note: The \*\*\*, \*\*, and \* indicate the statistically significant level at 1%, 5%, and 10%, respectively.

### 3.2 Cointegration Test

The bound approach cointegration test is applied to test long-term stability. The model of the effect of monetary policy on property price fluctuations employs the Schwarz-Bayesian Criterion (SBC) approach to obtain the optimum

lag in the model. The optimum lag results in the model show a lag value of (2, 2, 2, 4, 3, 4). The results of the bound test show that the calculated f-value is greater than the critical value for both the lower and upper limits, indicating that the developed model is long-term balanced.

**Table 2. Result of the Cointegration Test**

F-Statistics	%	Lower Bound I(0)	Upper Bound I(1)
		Distributed lag (2, 2, 2, 4, 3, 4)	
7.236***	90%	2.204	3.21
	95%	2.589	3.683
	99%	3.451	4.764

Note: The \*\*\*, \*\*, and \* indicate the statistically significant level at 1%, 5%, and 10%, respectively.

### 3.3 ARDL Estimation

The research results show that the relationship between monetary policy and residential property prices has an inverse trend. The GDP variable as a proxy of income shows a negative effect. Umar et al (2020) explained that the size of the income effect depends on the proportion of household income. Suppose that the level of household consumption depends on the proportion of income. In that case, the household sector will have limited ability to make loans and may even increase the interest payments, which can reduce disposable income and consumption. In recent years, it has been shown that the low-interest rates policy during a pandemic has not significantly increased income. In the last year, the central bank has implemented contractionary monetary policies to neutralize the increase in

the inflation rate, which has had an impact on “restraining” income. It shows that the income effect negatively affects the residential property price index in both the short and long-term, in line with research developed by Umar et al (2020).

There is a change in the pattern of the effect of inflation on residential property prices. The higher inflation rate will increase the price. The volatility of the inflation response indicates that property price fluctuations can impact other sectors, which contributes to a rise in overall inflation. The results of research on the inflation variable align with the research of Spencer & Huston (2013) but also support the view of Alan Greenspan and others that the linkages between short-term rates, long-term rates, and the housing market deteriorated during that decade.

Originality/value: The model includes the Taylor Rule, a housing equation, and a mechanism linking the two relationships. The empirical results support elements of the camp that blames monetary policy for the recent housing crisis, and elements of the opposing camp which limits policy culpability. Specifically, it suggests excessive monetary ease and a structural change (for which the Fed cannot be blamed, who found that the coefficient value of inflation is below 1, indicating a “minimum” response from interest rates to price changes. Thus, the inflation coefficient value is close to zero. This is in line with Demary (2010) assertion that transmission through inflation increase has a heterogeneous impact on property prices, given that real estate ownership is an investment and is used as a “hedge” against inflation. In that way, an inflation increase will drive real estate investment. Moreover, the condition will increase housing prices. When inflation increases, the monetary authority tends to increase interest rates which can lead to an increase in the cost of the property sector. The condition decreases in demand for the real estate and housing sector. The strong effect of inflation is in line with research developed by Brooks & Tsolacos (1999) that inflation and interest rates strongly affect the evolution of housing in the UK.

The main research finding is to utilize the money supply variable as a monetary aggregate variable, domestic interest rates, and foreign interest rates as monetary variables, and estimate the effect of changes in Indonesia’s residential property prices. Money supply as a monetary aggregate shows a negative effect in the short-term and a positive effect in the long-term. From the 2008 global crisis to the pandemic era, there was a change in monetary policy, in which contractionary monetary policy was applied to manage the increasing inflation. Thus, monetary variables in the short-term had a negative effect. This is in line with Demary (2010), which stated that the transmission of contractionary monetary policy increases interest rates. The

higher interest rate increases the housing cost. This condition leads to decreasing property demand and lowering housing prices. The Table 4 below is the comparison between the effect of domestic interest rates between the full model (all data) and the modified model (before the COVID-19 crisis).

Table 4 shows that the results of the modified model contrast with research developed by Brooks & Tsolacos (1999), Bjørnland & Jacobsen (2013) and Albuquerque et al (2020), according to which there is a direct response between interest rates and residential property price volatility. The response of domestic interest rates directly occurred during the recession caused by the COVID-19 pandemic. This shows the sensitivity of domestic interest rates to property prices followed by a recession. The coefficient values of both models show a negative sign in line with research developed by Demary (2010), Gupta et al (2012), and Bredin et al (2007). Ertl (2017), in their research, stated that housing price elasticity depends on monetary policy conditions. Expansionary and contractionary monetary policies play an important role in determining housing price fluctuations. In addition to their sensitivity, Füss & Zietz (2016) state that the cause of inflation in the property sector can be caused by low-interest rate policies, which can push up property prices. Figure 2 depicts the relationship between domestic interest rate policy and the growth of residential property prices in Indonesia, where the policy of low domestic interest rates caused a 4.603% increase in residential property prices between 2012Q1-2013Q2. When the COVID-19 pandemic revealed that the property sector experienced an average growth of 0.355% when there was a decline in the domestic interest rate from a basic point of 4.5% to 3.75%. In contrast, when interest rates rose, it could “hold back” the rate of growth in property prices, as happened in the 2013Q4 – 2016Q1 range; this is in line with research by Füss & Zietz (2016).

Table 3. ARDL Estimation

Variables	Coefficient (t-stat)	Variables	Coefficient (t-stat)
<i>Short-run</i>		<i>Long-run</i>	
$\Delta \text{LnIHPR}(-1)$	0.219 (2.196)**	LnGDP	-1.431 (-5.694)***
$\Delta \text{LnGDP}$	-0.497 (-4.650)***	INF	0.011 (3.086)***
$\Delta \text{LnGDP}(-1)$	0.431 (4.641)***	LMS	1.037 (9.687)***
$\Delta \text{INF}$	0.007 (4.158)***	r	0.010 (1.608)
$\Delta \text{INF}(-1)$	0.003 (2.163)**	r*	0.051 (14.037)***
$\Delta \text{LnMS}$	-0.261 (-2.948)***	Constanta	10.262 (4.919)***
$\Delta \text{LnMS}(-1)$	-0.793 (-6.500)***		
$\Delta \text{LnMS}(-2)$	-0.563 (-4.060)***		
$\Delta \text{LnMS}(-3)$	-0.416 (-3.333)***		
$\Delta r$	0.009 (1.789)*		
$\Delta r(-1)$	-0.011 (-2.070)**		
$\Delta r(-2)$	-0.011 (-2.679)**		
$\Delta r^*$	-0.006 (-1.290)		
$\Delta r^*(-1)$	0.004 (0.575)		
$\Delta r^*(-2)$	-0.027 (-4.320)***		
$\Delta r^*(-3)$	-0.008 (-1.673)		
ECT	-0.611 (-7.673)***		
<i>Diagnostic Tools</i>			
Normality Test		0.106	
Autocorrelation		0.267	
Heteroskedasticity		0.119	

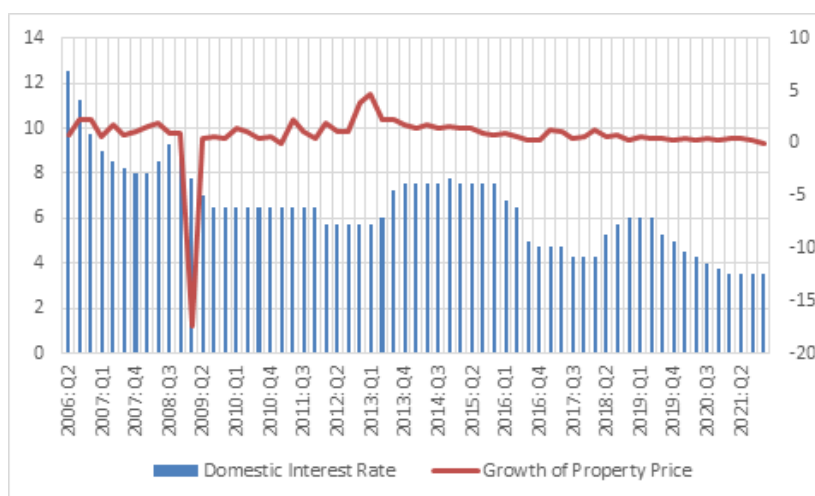
Note: The \*\*\*, \*\*, and \* indicate the statistically significant level at 1%, 5%, and 10%, respectively.



**Table 4. Result of Domestic Interest Rate**

Variables	Coefficient (t-stat)	Variables	Coefficient (t-stat)
<i>Short-run Full Model</i> (2, 2, 2, 4, 3, 4)		<i>Short-run Modified Model</i> (2, 4, 0, 4, 3, 4)	
$\Delta r$	0.009 (1.789)*	$\Delta r$	0.006 (1.133)
$\Delta r(-1)$	-0.011 (-2.070)**	$\Delta r(-1)$	-0.008 (-1.563)
$\Delta r(-2)$	-0.011 (-2.679)**	$\Delta r(-2)$	-0.007 (-1.619)
ECT	-0.611 (-7.673)***	ECT	-0.636 (-7.533)***
<i>Diagnostic Tools</i>		<i>Diagnostic Tools</i>	
Adj R-Squared	0.770	Adj R-Squared	0.817
F-Bound Test	7.236	F-Bound Test	6.717
Normality	0.106	Normality	0.554
Autocorrelation	0.267	Autocorrelation	0.340
Heteroskedasticity	0.119	Heteroskedasticity	0.139

Note: The \*\*\*, \*\*, and \* indicate the statistically significant level at 1%, 5%, and 10%, respectively.



**Figure 2. Domestic Interest Rate and Growth of Property Price**

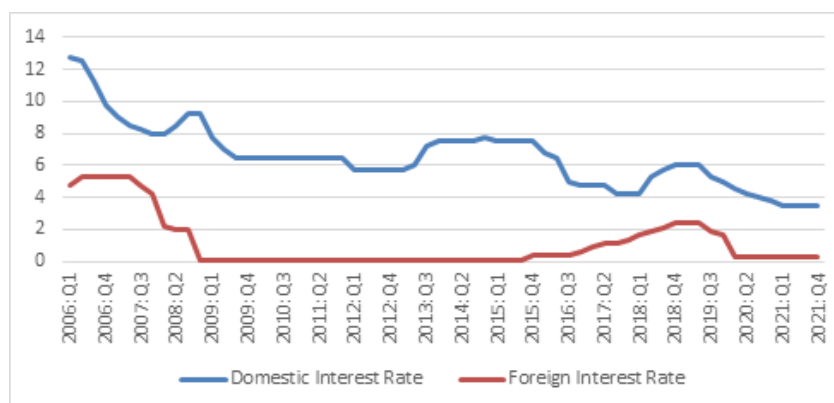


Figure 3. Domestic Interest Rate and Foreign Interest Rate

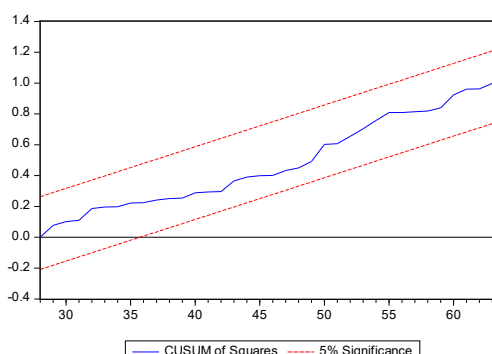
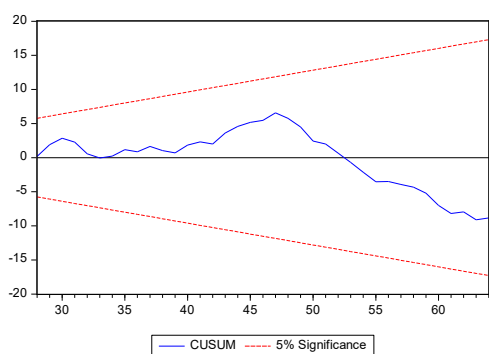
There is a difference between the short-term and long-term effects of foreign interest rates on property prices. Foreign interest rates have a negative effect in the short-term. This shows that an increase in foreign interest rates diminishes the demand for domestic bonds, leading to an increase in domestic interest rates, which impacts decreasing property demand. The increase in foreign interest rates resulted in a capital outflow, thereby reducing the resources for companies to invest in the property sector. The collapse in the property sector substantially decreased the “wealth” in property ownership.

There is an identical pattern between domestic and foreign interest rates (see Figure 3). This indicates that there is a strong interaction between the two variables. In accordance with research developed by Maćkowiak (2007) and Miao et al (2022), domestic interest rate

increases in various developing countries triggered by a contraction in monetary policy in the United States will result in a major and robust economic pattern.

### 3.4 Stability Test

To analyze the stability of the long-term relationship of monetary policy to residential property prices in Indonesia, The CUSUM and CUSUMQ test approaches are applied in this study. The estimation is considered stable when the CUSUM and CUSUMQ tests are based on the cumulative sum of recursive residuals. Suppose the CUSUM and CUSUMQ plots reach a critical value of 5 percent or remain within the top and bottom lines in the CUSUM and CUSUMQ figures. However, the estimate is considered unstable if the CUSUM and CUSUMQ values surpass a 5 percent threshold or the top or lower line.



The figure shows that the CUSUM and CUSUMQ values, which serve as the stability test, are within 5% of critical value or do not deviate from the top and bottom lines in the CUSUM and CUSUMQ images; therefore, it can be concluded that the model built with the ARDL method is stable.

#### 4. Conclusions

The 2008 crisis caused by asset price bubbles in the US could spread and exacerbate domestic economic conditions in the US, more than it affected foreign economies, including Indonesia; with that, it was crucial to conduct research on property assets as an early warning system for asset fluctuations in domestic economic conditions. This study identifies the effect of monetary variables through the volatility of property asset prices in Indonesia. The results of the study indicate that the income variable using the GDP variable as a proxy has a negative effect on residential property prices in Indonesia, whereas the inflation variable has a positive effect. This is because an increase in inflation will boost investment in real estate, resulting in a rise in housing prices. There was a different effect between before COVID-19 and after COVID-19, namely the influence of domestic interest rates, which directly occurred during the recession caused by the COVID-19 pandemic; this demonstrates the sensitivity of domestic interest rates to property prices during a recession. The foreign interest rate variable has a negative effect, indicating that an increase in foreign interest rates might lower the demand for domestic bonds, leading to an increase in domestic interest rates and a fall in property demand. The implications of this research show that housing price expectations are supported by anti-deflationary policies (low-interest rates) in the long-term, which strengthens monetary operations through interest rates to maintain public price expectations, especially property prices. The limitation of this study is using GDP variable as a proxy for income not using business cycle as variables.

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