Monetary Policy, Commodity Prices and the MYR/USD Exchange Rate: Evidence from a Nonlinear ARDL Model

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ABSTRACT

This study examines the effects of monetary policy rates and commodity prices on the MYR/USD exchange rate using monthly data from January 2015 to December 2025. The explanatory variables are the Malaysian Overnight Policy Rate, the United States effective federal funds rate, Brent crude oil prices, and gold prices. A nonlinear autoregressive distributed lag model is applied to assess whether positive and negative changes in these variables produce different exchange rate responses. The Akaike Information Criterion selects the NARDL (2,0,0,1,1) specification. The results indicate strong persistence in MYR/USD movements. Changes in Brent crude oil and gold prices produce significant short-run effects, while changes in the Malaysian Overnight Policy Rate and the United States federal funds rate are statistically insignificant. The Wald tests do not identify significant differences between the positive and negative effects of the explanatory variables. The bounds test also does not provide robust evidence of a stable long-run relationship. The findings suggest that short-run movements in international commodity prices are more closely associated with MYR/USD fluctuations than direct changes in Malaysian and United States policy rates.

Keywords: MYR/USD exchange rate, monetary policy, Brent crude oil price, gold price, nonlinear autoregressive distributed lag model

INTRODUCTION

Exchange rate movements have important implications for inflation, trade, investment, financial stability, and the cost of servicing foreign currency obligations. Understanding the factors that influence the Malaysian Ringgit against the United States Dollar exchange rate is therefore important for policymakers, businesses, and investors. A depreciation of the Ringgit increases the domestic cost of imported goods and foreign currency payments, while an appreciation may affect export competitiveness. Identifying the determinants of MYR/USD movements can provide a clearer understanding of how domestic monetary conditions and external market developments influence the value of the Ringgit.

Previous studies have examined the Malaysian exchange rate using different economic and financial determinants. Butt et al. (2023) considered oil prices, interest rate differentials, bid ask spreads, and order flows, while Ng and Geetha (2020) examined foreign reserves, inflation, and interest rates. Quadry et al. (2017) investigated the roles of differential money supply, differential interest rates, taxation, and world crude oil prices. Other studies considered broader macroeconomic factors, including inflation, exports, foreign direct investment, and terms of trade (Mohd Ali et al., 2022; Shukri et al., 2017). These studies demonstrate that the Ringgit is influenced by both domestic and international factors, although the relative importance of these determinants may vary across periods, data frequencies, and model specifications.

The Malaysian Overnight Policy Rate and the United States effective federal funds rate may influence the MYR/USD exchange rate through changes in borrowing costs, capital allocation, and investor expectations. Brent crude oil prices may also affect the Ringgit because changes in global energy prices influence Malaysia's trade receipts, production costs, and external position (Taasim et al., 2021). Gold prices may capture changes in global financial uncertainty and demand for safe assets. However, increases and decreases in these variables may not produce equal exchange rate responses. A rise in oil or gold prices, for example, may affect the Ringgit differently from a decline of the same magnitude.

This issue became particularly relevant during the period surrounding the COVID-19 pandemic, when monetary policy, commodity prices, and international financial conditions experienced substantial changes (Pinjaman et al., 2026). Previous studies found that the effects of the pandemic and United States monetary policy on exchange rates varied across countries (Jamal & Bhat, 2022; Yilmazkuday, 2022). However, limited evidence is available on whether positive and negative changes in monetary policy rates and commodity prices produce different responses in the MYR/USD exchange rate.

This study, therefore, examines the effects of the Malaysian Overnight Policy Rate, the United States effective federal funds rate, Brent crude oil prices, and gold prices on the MYR/USD exchange rate using monthly data from January 2015 to December 2025. The nonlinear autoregressive distributed lag approach is applied to distinguish between positive and negative changes in the explanatory variables and to estimate their short-run and long-run effects. The findings provide evidence on whether MYR/USD movements respond asymmetrically to monetary policy and commodity price shocks and offer policy insights into the domestic and external factors associated with Ringgit fluctuations.

LITERATURE REVIEW

Empirical studies on the determinants of the Malaysian exchange rate have employed different exchange-rate measures, explanatory variables, sample periods, and econometric methods. Quadry et al. (2017) examined the MYR/USD and MYR/GBP exchange rates using monthly data from January 2010 to January 2017 and an ARDL model. Their findings showed a negative long-run relationship between the MYR/GBP exchange rate and differential money supply and a positive long-run relationship with world crude oil prices. However, the results did not establish equally strong relationships for both currency pairs, suggesting that the effects of monetary and commodity variables may depend on the exchange rate examined.

Johari et al. (2017) applied the Natural Real Exchange Rate framework and ARDL bounds testing to estimate Malaysia's equilibrium real exchange rate. The study identified the terms of trade, youth dependency ratio, and foreign direct investment as important determinants of exchange-rate movements. It also found that Malaysia's exchange-rate misalignment was generally small and stable during most of the study period. These findings demonstrate that structural macroeconomic fundamentals may influence the Ringgit over longer horizons.

The relationships between the Malaysian exchange rate, inflation, interest rates, and foreign reserves were investigated by Kok et al. (2025) and Ng and Geetha (2020), and using monthly data from 2013 to 2015, Ng and Geetha (2020) reported a positive but statistically insignificant relationship between inflation and the exchange rate, while foreign reserves had a negative relationship with the exchange rate. The results indicate that the relevance of monetary variables may vary considerably across relatively short sample periods.

Mohd Ali et al. (2022) focused on the volatility of Malaysia's real effective exchange rate using annual data from 1980 to 2014. Their findings showed that the GDP deflator, exports as a percentage of GDP, and inflation were significant long-run determinants of exchange-rate volatility. In the short-run, inflation and the lending interest rate were statistically significant. However, the study examined real effective exchange-rate volatility rather than the monthly bilateral MYR/USD exchange rate, which limits direct comparison with the present analysis.

Commodity prices have also been identified as important determinants of the Malaysian exchange rate. Butt et al. (2020) examined the relationships between the nominal exchange rate and oil, palm oil, rubber, and natural gas prices using threshold cointegration methods. The results supported long-run relationships and asymmetric short-run adjustments between the exchange rate and the selected commodity prices. The study also found evidence of causal relationships between Malaysia's nominal exchange rate and several commodity prices, highlighting the importance of commodity markets to Ringgit movements.

Subsequently, Butt et al. (2023) combined macroeconomic and market-microstructure determinants within a nonlinear ARDL framework. Using daily Malaysian data, the study considered the interest-rate differential, oil prices, order flows, and bid-ask spreads. The results identified the interest-rate differential and bid-ask spread as important determinants of exchange-rate dynamics. The study also reported long-run asymmetry involving interest-rate differentials and oil prices and short-run asymmetry associated with market-microstructure variables.

The COVID-19 literature provides additional context for a sample that includes a period of substantial disruption to international financial and commodity markets. Jamal and Bhat (2022) used a panel ARDL model to examine six major COVID-19-affected economies. They found that increases in COVID-19 deaths were associated with currency depreciation and identified a unidirectional long-run relationship from COVID-19 deaths to exchange rates.

Yilmazkuday (2022) examined the spillover effects of United States monetary policy on the exchange rates of 11 emerging markets and 12 advanced economies. The findings showed that US monetary policy spillovers affected several countries before the pandemic but were evident for fewer economies during the pandemic. This suggests that the transmission of US monetary policy to exchange rates may vary according to international economic and financial conditions.

The reviewed studies provide mixed evidence on the roles of monetary conditions and commodity prices in explaining movements in the Malaysian exchange rate. These differences may reflect variations in exchange-rate measurement, variable selection, data frequency, sample period, and estimation method.

Previous Malaysian studies have also given limited attention to gold prices and have rarely examined the joint effects of the Malaysian Overnight Policy Rate, the United States federal funds rate, Brent crude oil prices, and gold prices on the bilateral MYR/USD exchange rate. In addition, many studies implicitly assume that increases and decreases in these variables produce similar exchange-rate responses, although monetary and commodity-price shocks may affect the Ringgit differently.This study addresses these gaps by applying the nonlinear autoregressive distributed lag framework developed by Shin et al. (2014). The NARDL approach decomposes each explanatory variable into positive and negative partial sums, allowing increases and decreases to generate different short-run and long-run effects. This framework therefore enables a more detailed assessment of whether the MYR/USD exchange rate responds asymmetrically to changes in domestic and United States monetary policy rates, Brent crude oil prices, and gold prices.

DATA AND METHODOLOGY

Data

This study uses monthly data from January 2015 to December 2025, providing 132 observations for each variable. The MYR/USD exchange rate is measured as the number of Malaysian Ringgit required to purchase one United States Dollar. A higher value indicates depreciation of the Ringgit, while a lower value indicates appreciation. The explanatory variables are the Malaysian Overnight Policy Rate, the United States effective federal funds rate, Brent crude oil prices, and gold prices. Their measurements, transformations, and data sources are presented in Table 1.

Table 1: Variable measurement and data sources

Variable	Measurement	Transformation	Source
MYR/USD exchange rate	Malaysian Ringgit per United States Dollar	Natural logarithm	Board of Governors of the Federal Reserve System through FRED

Malaysian OPR	Monthly average of the prevailing Overnight Policy Rate	Percentage level	Bank Negara Malaysia
US federal funds rate	Monthly effective federal funds rate	Percentage level	Board of Governors of the Federal Reserve System through FRED
Brent crude oil price	US dollars per barrel	Natural logarithm	US Energy Information Administration
Gold price	US dollars per troy ounce	Natural logarithm	World Bank Commodity Price Data

The MYR/USD exchange rate, US federal funds rate, and gold price were obtained as monthly series. The Malaysian OPR was converted into a monthly average based on the prevailing official policy rate, while daily Brent crude oil prices were averaged by month. The MYR/USD exchange rate, Brent crude oil price, and gold price were transformed into natural logarithms for estimation. The Malaysian OPR and US federal funds rate were retained in percentage levels because policy rates can approach zero. To ensure comparability across the candidate lag specifications, all models were estimated using a common four-month initial holdback. The effective estimation sample therefore contains 128 observations from May 2015 to December 2025.

Methodology

This study applies the nonlinear autoregressive distributed lag model developed by Shin et al. (2014) to examine the relationship between the MYR/USD exchange rate, monetary policy rates, and commodity prices. The NARDL approach allows increases and decreases in each explanatory variable to produce different exchange rate responses in both the short-run and the long-run.

The dependent variable is the natural logarithm of the MYR/USD exchange rate. The explanatory variables are the Malaysian Overnight Policy Rate, the United States effective federal funds rate, the natural logarithm of Brent crude oil prices, and the natural logarithm of gold prices. The empirical relationship is expressed as:

$y_t = \mathrm{f}(OPR_t, FFR_t, B_t, G_t)$

where:

$y_t = \ln(MYRUSD_t)$

$B_t = \ln(BRENT_t)$

$G_t = \ln(GOLD_t)$

The Malaysian OPR and the United States federal funds rate are retained in percentage levels. Before estimating the NARDL model, the stationarity properties of the variables are examined using the Augmented Dickey Fuller test. The optimal lag length for each test is selected using the Akaike Information Criterion. The NARDL bounds testing approach can be applied when the variables are integrated at level, first-difference, or a combination of both, provided that none is integrated at second difference.

Nonlinear partial-sum decomposition

The NARDL model decomposes each explanatory variable into cumulative positive and negative changes. For an explanatory variable X, the positive partial sum is defined as:

$X_t^+ = \sum_{j=1}^{t} \Delta X_j^+ = \sum_{j=1}^{t} \max(\Delta X_j, 0)$

The negative partial sum is defined as:

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$X_t^- = \sum_{j=1}^{t} \Delta X_j^- = \sum_{j=1}^{t} \min(\Delta X_j, 0)$

The positive partial sum captures cumulative increases in the explanatory variable, while the negative partial sum captures cumulative decreases. This decomposition is applied separately to the Malaysian OPR, the United States federal funds rate, Brent crude oil prices, and gold prices.

General NARDL specification

The general NARDL model is expressed as:

$y_t = \alpha_0 + \sum_{i=1}^{p} \varphi_i y_{t-i} + \sum_{k=1}^{K} \sum_{j=0}^{qk}$

$(\beta_{kj}^+ X_{k,t-j}^+ + \beta_{kj}^- X_{k,t-j}^-) + \varepsilon_t$

Eq.1

Where p represents the autoregressive lag order, q_k represents the distributed lag order for explanatory variable k, and ε_t is the error term. The positive and negative coefficients measure the effects of cumulative increases and decreases in each explanatory variable. The optimal lag structure is selected using the Akaike Information Criterion. The search considers up to four monthly lags for the dependent and explanatory variables. All candidate models are estimated using a common sample to ensure that the information criteria are directly comparable.

Estimated NARDL specification

The Akaike Information Criterion selects the NARDL (2,0,0,1,1) specification. The lag order follows the MYR/USD exchange rate, Malaysian OPR, United States federal funds rate, Brent crude oil price, and gold price.

The selected model is expressed as:

$y_t = \alpha_0 + \varphi_1 y_{t-1} + \varphi_2 y_{t-2}$

$+ \beta_1^+ OPR_t^+ + \beta_1^- OPR_t^-$

$+ \beta_2^+ FFR_t^+ + \beta_2^- FFR_t^-$

$+ \beta_{30}^+ B_t^+ + \beta_{30}^- B_t^- + \beta_{31}^+ B_{t-1}^+ + \beta_{31}^- B_{t-1}^-$

$+ \beta_{40}^+ G_t^+ + \beta_{40}^- G_t^- + \beta_{41}^+ G_{t-1}^+ + \beta_{41}^- G_{t-1}^- + \varepsilon_t$

Eq. 2

The coefficients on the lagged MYR/USD exchange rate capture persistence and subsequent adjustment. The OPR and federal funds rate coefficients measure the contemporaneous effects of positive and negative policy rate changes. The Brent and gold coefficients measure the current and one-month-lagged effects of positive and negative commodity price changes.

Bounds test and asymmetry tests

The existence of a long-run relationship is examined using the bounds testing procedure developed by Pesaran et al. (2001). The null hypothesis states that no long-run relationship exists among the variables. The calculated test statistic is compared with the relevant lower and upper critical bounds.

A test statistic above the upper bound supports cointegration, while a statistic below the lower bound indicates the absence of cointegration. A statistic between the two bounds produces an inconclusive result. Long-run

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asymmetry is assessed by testing whether the long-run effects of positive and negative changes in each explanatory variable are equal. The null hypothesis is expressed as:

$H_0^{LR}\ \ LR_j^+ = LR_j^-$

Short-run asymmetry is assessed by testing whether the cumulative short-run effects of positive and negative changes are equal:

$H_0^{SR}\ \ SR_j^+ = SR_j^-$

Rejection of either null hypothesis supports an asymmetric response. Failure to reject the null hypothesis indicates that positive and negative changes do not have statistically different effects.

When the bounds test does not support cointegration, the long-run coefficients are interpreted cautiously as conditional model estimates rather than confirmed equilibrium relationships. Greater emphasis is therefore placed on the short-run coefficients and the formal Wald asymmetry tests.

Diagnostic and stability tests

The adequacy of the estimated model is evaluated using the Breusch-Godfrey and Ljung-Box tests for residual autocorrelation. The Ramsey RESET test is used to examine functional-form misspecification, while the Breusch Pagan test is applied to assess heteroskedasticity.

Parameter stability is examined using the CUSUM and CUSUM of squares tests. Heteroskedasticity and autocorrelation consistent standard errors with four monthly lags are reported to obtain more reliable statistical inference in the presence of heteroskedasticity and limited residual dependence.

ESTIMATED RESULTS

Descriptive Statistics

Table 2 presents the descriptive statistics for the variables in their original measurement units. The MYR/USD exchange rate, Brent crude oil price, and gold price are subsequently transformed into natural logarithms for estimation.

Table 2: Descriptive statistics

Variable	Unit	Observations	Mean	Median	Minimum	Maximum	Standard deviation	Skewness	Kurtosis	Jarque Bera p-value
MYR/USD exchange rate	RM per USD	132	4.2428	4.2092	3.5847	4.7655	0.2477	−0.0943	3.4719	0.5736
Malaysia OPR	Percent	132	2.7735	3.0000	1.7500	3.2500	0.5288	−1.1286	2.7406	<0.001
US federal funds rate	Percent	132	2.0035	1.4650	0.0500	5.3300	1.9192	0.6036	1.8189	<0.001

Brent crude oil price	USD per barrel	132	66.4425	65.3638	18.3785	122.7110	18.6038	0.2957	3.4128	0.2777
Gold price	USD per troy ounce	132	1,770.13	1,699.5	1,076.00	4,309.00	665.27	1.7293	6.1282	<0.001

The descriptive statistics are based on 132 monthly observations from January 2015 to December 2025. The MYR/USD exchange rate averaged RM4.2428 per United States Dollar and ranged from RM3.5847 to RM4.7655. Since the exchange rate is measured as Malaysian Ringgit per United States Dollar, a higher value indicates depreciation of the Ringgit.

The Malaysian OPR averaged 2.7735 percent and ranged from 1.7500 percent to 3.2500 percent. The United States federal funds rate averaged 2.0035 percent and showed greater variation, with values ranging from 0.0500 percent to 5.3300 percent. Brent crude oil prices averaged USD66.4425 per barrel and ranged from USD18.3785 to USD122.7110. Gold prices averaged USD1,770.1364 per troy ounce and recorded the largest dispersion among the variables.

The Jarque Bera results indicate that the MYR/USD exchange rate and Brent crude oil price do not significantly depart from normality in their original units. In contrast, the Malaysian OPR, United States federal funds rate, and gold price show significant departures from normality. These results are descriptive and do not affect the applicability of the NARDL approach.

Unit Root Test

The stationarity properties of the variables were examined using the Augmented Dickey Fuller test. The test equation includes an intercept, while the optimal lag length for each variable was selected using the Akaike Information Criterion. The results are presented in Table 3.

Table 3: Augmented Dickey Fuller unit root test results

Variable	Level ADF statistic	Level p-value	First-difference ADF statistic	First-difference p-value	Integration order
ln MYR/USD	−3.0791	0.0281	−7.1367	<0.001	I(0)
Malaysia OPR	−1.8830	0.3401	−4.1686	<0.001	I(1)
US federal funds rate	−2.1725	0.2164	−2.9677	0.0380	I(1)
ln Brent crude oil price	−2.2789	0.1789	−9.1708	<0.001	I(1)
ln gold price	1.9625	0.9986	−8.3357	<0.001	I(1)

Note: The null hypothesis of the Augmented Dickey Fuller test states that the series contains a unit root. The approximate critical value at the 5 percent significance level is −2.884.

The natural logarithm of the MYR/USD exchange rate is stationary at level. Its ADF statistic of −3.0791 is more negative than the approximate 5 percent critical value of −2.884, while its p-value of 0.0281 is below 0.05. The variable is therefore classified as integrated at level. The Malaysian OPR, United States federal funds rate, natural

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logarithm of Brent crude oil price, and natural logarithm of gold price are nonstationary at level. However, all four variables become stationary after first differencing and are therefore classified as integrated of order one. The variables consist of a mixture of level-stationary and first-difference stationary series, while none is integrated of order two. These results satisfy the integration requirement for applying the NARDL bounds testing procedure (Pinjaman & Kogid, 2020; Pinjaman et al., 2025).

Optimal Lag Selection

The optimal lag structure was selected using the Akaike Information Criterion. The search considered autoregressive lags from one to four months and distributed lags from zero to four months for each explanatory variable. A total of 2,500 candidate specifications were estimated using a common sample to ensure that the information criteria were directly comparable.

Table 3: AIC lag selection

Model specification	AIC	BIC	HQIC	Observations
NARDL (2,0,0,1,1)	−698.6137	−652.9812	−680.0730	128

Note: The lag order follows the natural logarithm of the MYR/USD exchange rate, Malaysian OPR, United States federal funds rate, natural logarithm of Brent crude oil price, and natural logarithm of gold price.

The NARDL (2,0,0,1,1) specification produced the lowest AIC value among the candidate models and was selected for the subsequent analysis. The model includes two lags of the MYR/USD exchange rate, contemporaneous positive and negative components of the Malaysian OPR and United States federal funds rate, and one lag each for the positive and negative components of Brent crude oil and gold prices. A sensitivity analysis that extended the maximum lag length to six months produced the same preferred specification. This indicates that the selected lag structure is not sensitive to the initial maximum lag restriction.

NARDL Estimation Results

The preferred NARDL(2,0,0,1,1) model was estimated using 128 monthly observations from May 2015 to December 2025. The dependent variable is the natural logarithm of the MYR/USD exchange rate. An increase in the exchange rate indicates depreciation of the Malaysian Ringgit. Heteroskedasticity and autocorrelation consistent standard errors with four monthly lags are reported for statistical inference.

Table 5: Estimated NARDL(2,0,0,1,1) results

Variable	Coefficient	HAC standard error	t-statistic	p-value
Constant	0.2430***	0.0692	3.5143	0.0006
ln MYR/USD at t−1	1.1674***	0.0807	14.4748	<0.001
ln MYR/USD at t−2	−0.3400***	0.0771	−4.4105	<0.001
OPR positive partial sum	0.0046	0.0280	0.1647	0.8695
OPR negative partial sum	0.0002	0.0166	0.0142	0.9887
Federal funds positive partial sum	0.0031	0.0077	0.4009	0.6893

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Federal funds negative partial sum	0.0002	0.0088	0.0213	0.9831
ln Brent positive partial sum	0.0071	0.0212	0.3332	0.7396
ln Brent positive partial sum at t−1	0.0008	0.0168	0.0473	0.9624
ln Brent negative partial sum	−0.0445**	0.0204	−2.1813	0.0312
ln Brent negative partial sum at t−1	0.0423*	0.0245	1.7248	0.0873
ln gold positive partial sum	−0.1393**	0.0664	−2.0974	0.0382
ln gold positive partial sum at t−1	0.1086	0.0680	1.5970	0.1131
ln gold negative partial sum	−0.2456***	0.0838	−2.9318	0.0041
ln gold negative partial sum at t−1	0.2556***	0.0892	2.8652	0.0050

*Note: ***, **, and * indicate statistical significance at the 1 percent, 5 percent, and 10 percent levels, respectively. HAC standard errors with four monthly lags are reported.*

Both lagged exchange rate terms are statistically significant. A positive coefficient on the first lag indicates strong persistence in monthly MYR/USD movements, whereas the negative second lag suggests that part of the earlier movement is subsequently corrected. Neither the positive nor negative partial sums of the Malaysian OPR are statistically significant. Similar results are obtained for the United States federal funds rate. Under the selected monthly specification, changes in the two policy rates therefore show no significant direct contemporaneous relationship with the MYR/USD exchange rate.

For Brent crude oil prices, the positive components are statistically insignificant. By contrast, the contemporaneous negative component records a coefficient of −0.0445 and is significant at the 5 percent level. Because a decline in Brent prices enters the negative partial sum as a negative value, this result implies that lower Brent prices are initially associated with an increase in the MYR/USD exchange rate, indicating depreciation of the Ringgit. One month later, the negative Brent component carries a positive coefficient of 0.0423 and is significant at the 10 percent level. Given that the partial sum itself is negative, this coefficient implies a subsequent reduction in the MYR/USD exchange rate. Much of the initial response to a decline in Brent prices is therefore reversed in the following month.

Turning to gold prices, the contemporaneous positive component has a coefficient of −0.1393 and is significant at the 5 percent level. An increase in gold prices is consequently associated with a lower MYR/USD exchange rate during the same month, representing appreciation of the Ringgit. Its lagged positive component is not statistically significant.

A decline in gold prices also produces a significant immediate response. The contemporaneous negative component has a coefficient of −0.2456 and is significant at the 1 percent level. Since the negative partial sum takes a negative value, the coefficient implies that falling gold prices are initially associated with an increase in the MYR/USD exchange rate and a depreciation of the Ringgit. In the following month, the negative gold component records a positive coefficient of 0.2556 and remains significant at the 1 percent level. This opposing sign indicates a reversal of the initial exchange rate response. Current and lagged effects should therefore be evaluated jointly rather than interpreted as independent responses.

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Wald Tests for Asymmetry

Wald tests were conducted to assess whether positive and negative changes in the Malaysian OPR, United States federal funds rate, Brent crude oil prices, and gold prices produced statistically different effects on the MYR/USD exchange rate. Separate tests were performed for short-run and long-run asymmetry. The null hypothesis states that the positive and negative effects are equal.

Table 6a: Wald tests for positive and negative asymmetry

Variable	Horizon	Difference between positive and negative effects	Wald F-statistic	p-value	Decision
Malaysian OPR	Short-run	0.0044	0.0139	0.9062	Symmetry not rejected
US federal funds rate	Short-run	0.0029	0.0465	0.8296	Symmetry not rejected
Brent crude oil price	Short-run	0.0516	2.1706	0.1434	Symmetry not rejected
Gold price	Short-run	0.1063	0.7172	0.3989	Symmetry not rejected
Malaysian OPR	Long-run	0.0044	0.0139	0.9062	Symmetry not rejected
US federal funds rate	Long-run	0.0029	0.0465	0.8296	Symmetry not rejected
Brent crude oil price	Long-run	0.0101	0.3287	0.5675	Symmetry not rejected
Gold price	Long-run	−0.0407	0.7987	0.3734	Symmetry not rejected

Table 6b: Joint Wald test results

Horizon	Number of restrictions	Wald F-statistic	p-value	Decision
Short-run	4	1.0240	0.3981	Joint symmetry not rejected
Long-run	4	1.0253	0.3974	Joint symmetry not rejected

Note: The null hypothesis states that positive and negative changes have equal effects. Rejection of the null hypothesis at the 5 percent significance level would indicate asymmetry.

As shown in Table 6(a-b), none of the individual short-run Wald tests is statistically significant. Brent crude oil records the largest short-run Wald statistic of 2.1706, but its p-value of 0.1434 remains above the 5 percent

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significance level. The results therefore do not establish that increases and decreases in Brent crude oil prices produce significantly different short-run effects on the MYR/USD exchange rate. Similar conclusions apply to gold prices, the Malaysian OPR, and the United States federal funds rate.

Evidence of long-run asymmetry is also absent. The p-values range from 0.3734 for gold prices to 0.9062 for the Malaysian OPR. Consequently, the null hypothesis of equal positive and negative long-run effects cannot be rejected for any explanatory variable. The identical short-run and long-run statistics for the Malaysian OPR and federal funds rate reflect the absence of additional distributed lags for these variables in the selected NARDL specification. Joint testing produces the same conclusion. The joint short-run Wald statistic is 1.0240 with a p-value of 0.3981, while the joint long-run statistic is 1.0253 with a p-value of 0.3974. Both results fail to reject the respective symmetry hypotheses. Although several individual Brent crude oil and gold price coefficients are statistically significant in the estimated NARDL model, coefficient significance alone does not establish asymmetry. Asymmetry requires the positive and negative effects to differ significantly from each other. Based on the individual and joint Wald tests, the findings do not support systematic asymmetric responses of the MYR/USD exchange rate to monetary policy rate or commodity price changes.

Bounds Test for a Long-run Relationship

To determine whether a stable long-run relationship exists between the MYR/USD exchange rate and the positive and negative components of the explanatory variables, a finite sample bounds test was conducted. The test follows Case III, which includes an unrestricted intercept without a deterministic trend.

Table 7(a): Bounds test and level relationship assessment

Test item	**Statistic**	**p-value**	**Decision**
Bounds F-statistic	2.4022	Not applicable	No robust evidence of a long-run relationship
Finite sample lower bound p-value	Not applicable	0.0500	Marginally above the 5 percent level
Finite sample upper bound p-value	Not applicable	0.3301	Null hypothesis not rejected
Joint test of asymmetric explanatory variable level terms	1.6708	0.1131	Level terms are not jointly significant
Error correction coefficient	−0.1726	0.0009	Negative and statistically significant

Table 7(b): Finite sample critical bounds

Significance level	**Lower bound I(0)**	**Upper bound I(1)**
10 percent	2.0771	3.2285
5 percent	2.4026	3.6384
1 percent	3.1263	4.5135

Note: The null hypothesis states that no long-run level relationship exists. A statistic above the upper bound supports cointegration, while a statistic below the lower bound indicates no cointegration. A statistic between the two bounds produces an inconclusive result.

At the 5 percent significance level, the bounds F-statistic of 2.4022 is marginally below the lower critical bound of 2.4026 as shown in Table 7(a-b). The finite sample lower bound p-value of 0.0500 also lies slightly above the conventional significance threshold. These findings do not provide sufficient evidence to reject the null hypothesis of no long-run relationship. When evaluated at the 10 percent level, the test statistic falls between the lower bound of 2.0771 and the upper bound of 3.2285. The evidence of cointegration is therefore inconclusive at this level. Given the marginal position of the test statistic, the results do not confirm the presence of a stable long-run relationship.

Further support is provided by the joint test of the asymmetric explanatory variable level terms. Its F-statistic of 1.6708 and p-value of 0.1131 show that the level components are not jointly significant at the 5 percent level. This outcome further weakens the evidence of a long-run relationship.

Despite the bounds test result, the error correction coefficient is negative and statistically significant. Its estimated value of −0.1726 suggests that approximately 17.26 percent of any deviation from equilibrium would be corrected within one month. However, the significance of this coefficient alone cannot confirm cointegration when the bounds test and joint level test do not support a stable long-run relationship.

Diagnostic and Stability Tests

Several diagnostic tests were conducted to evaluate residual behaviour, functional form, parameter stability, and dynamic stability. Table 8 summarises the results.

Table 8: Diagnostic and stability test results

Test	Statistic	p-value	Decision
Breusch Godfrey LM, 2 lags	6.4062	0.0406	Short lag serial correlation detected
Breusch Godfrey LM, 12 lags	15.1786	0.2318	No serial correlation
Ljung Box Q, 12 lags	7.2574	0.8401	No residual autocorrelation
Breusch Pagan heteroskedasticity test	28.1417	0.0136	Heteroskedasticity detected
White heteroskedasticity test	118.9340	0.4328	No general heteroskedasticity detected
ARCH LM, 12 lags	13.2116	0.3538	No ARCH effects
Jarque Bera normality test	8.5368	0.0140	Residuals are not normally distributed
Ramsey RESET	0.9338	0.3360	No functional form misspecification
CUSUM	0.5738	0.8970	Parameters are stable
Hansen stability test	3.2584	Not applicable	Parameters are stable

Note: The 5 percent critical value for the Hansen parameter stability test is 3.75. The CUSUM and CUSUM of squares paths remain within the corresponding 95 percent critical bounds.

Evidence of residual dependence is confined to the shorter horizon. The Breusch-Godfrey statistic at two lags is significant at the 5 percent level, indicating short-lag serial correlation. In contrast, the twelve-lag Breusch-Godfrey test and the Ljung-Box test are statistically insignificant. These findings suggest that residual dependence is not persistent over the longer monthly horizon.

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Results for residual variance are mixed. The Breusch Pagan test rejects the null hypothesis of constant variance, while the more general White test does not detect heteroskedasticity. No ARCH effects are identified either. Given the Breusch Pagan result and evidence of short lag serial correlation, HAC standard errors with four monthly lags are retained for coefficient inference.

Residual normality is rejected by the Jarque Bera test, which records a p-value of 0.0140. Non-normality does not invalidate the estimated coefficients, although it reinforces the importance of using robust standard errors rather than relying solely on conventional OLS inference.

The functional form also appears satisfactory, and with a p-value of 0.3360, the Ramsey RESET test fails to reject the null hypothesis of correct specification. No evidence therefore suggests that important nonlinear combinations of the included regressors have been omitted from the estimated equation.

Parameter stability is supported by several tests. The CUSUM statistic is insignificant, and its path remains within the 95 percent critical bounds. Similarly, the CUSUM of squares path remains within its critical limits. The Hansen stability statistic of 3.2584 is also below the 5 percent critical value of 3.75.

CONCLUSION

This study examined the relationships between monetary policy rates, international commodity prices, and the MYR/USD exchange rate using monthly data from January 2015 to December 2025. The NARDL approach was applied to determine whether increases and decreases in the Malaysian Overnight Policy Rate, the United States effective federal funds rate, Brent crude oil prices, and gold prices generated different exchange rate responses. Based on the Akaike Information Criterion, the NARDL(2,0,0,1,1) specification was selected as the preferred model.

Strong persistence characterises monthly movements in the MYR/USD exchange rate. The positive first lag coefficient indicates that exchange rate movements tend to continue into the following month, while the negative second lag coefficient suggests a subsequent partial correction. Historical exchange rate movements therefore contribute substantially to the explanatory performance of the model.

Changes in the Malaysian OPR and the United States federal funds rate are statistically insignificant under the selected specification. This finding indicates that direct monthly changes in the two policy rates are not significantly associated with MYR/USD movements during the study period. It does not imply that monetary policy is irrelevant to the exchange rate. Rather, its influence may operate indirectly through interest rate differentials, capital flows, liquidity conditions, market expectations, portfolio allocation, and foreign exchange market activity.

This result differs from Butt et al. (2023), who identified the interest rate differential as an important determinant of the Malaysian exchange rate. The difference may arise because the present study includes the Malaysian and United States policy rates separately rather than constructing an interest rate differential. Variations in data frequency, sample period, variable measurement, and model specification may also explain the contrasting findings.

More noticeable short-run responses are observed for Brent crude oil and gold prices. A decline in Brent crude oil prices is initially associated with depreciation of the Ringgit, although much of the response is reversed in the following month. This pattern suggests that the exchange rate adjustment to negative oil price movements is temporary rather than persistent. The finding provides a more qualified interpretation than Quadry et al. (2017), who reported a long-run relationship between world crude oil prices and the Malaysian exchange rate.

Gold price movements also produce significant short-run associations. An increase in gold prices is associated with an immediate appreciation of the Ringgit. Declines in gold prices initially correspond with Ringgit depreciation, followed by a reversal in the subsequent month. These opposing current and lagged coefficients indicate that the exchange rate response adjusts quickly and should not be interpreted from individual coefficients alone. Gold prices may capture changes in international risk sentiment and demand for safe assets, but they should not be regarded as a direct instrument for managing the Ringgit.

Despite the significance of several Brent crude oil and gold price components, the Wald tests do not identify statistically significant differences between their positive and negative effects. Symmetry is not rejected for any of the monetary policy or commodity price variables in either the short run or the long run. The joint Wald tests produce the same conclusion. Consequently, the results do not support systematic asymmetric behaviour in the MYR/USD exchange rate under the preferred specification. Failure to reject symmetry does not prove that the effects are identical, but it indicates that the estimated differences are not statistically strong enough to establish asymmetry.

Evidence of a stable long-run relationship is also limited. The bounds F-statistic of 2.4022 is marginally below the 5 percent lower critical bound of 2.4026. At the 10 percent level, the statistic lies between the lower and upper bounds, producing an inconclusive outcome. In addition, the asymmetric explanatory variable level terms are not jointly significant. Although the error correction coefficient is negative and statistically significant, this result alone is insufficient to confirm cointegration. Any implied long-run coefficients should therefore be regarded as conditional estimates rather than confirmed equilibrium relationships.

The findings also provide a cautious interpretation of exchange rate developments during a sample that includes the COVID 19 pandemic. The insignificant federal funds rate coefficients suggest that United States monetary policy may have affected the Ringgit through broader international channels rather than through direct monthly policy rate changes. This interpretation is consistent with Yilmazkuday (2022), who found that United States monetary policy spillovers varied across countries and periods. Pandemic-related disruptions may also have influenced the Ringgit through commodity markets, global risk perceptions, portfolio movements, trade conditions, and investment flows.

From a policy perspective, the results do not support the use of OPR adjustments primarily as a direct instrument for influencing short-run MYR/USD movements. The OPR remains important for domestic price stability, economic activity, and financial stability, but its direct monthly association with the exchange rate is not statistically significant in this analysis. Exchange rate assessment should therefore consider a wider set of indicators, including commodity prices, interest rate differentials, capital flows, foreign reserves, trade performance, global financial conditions, and market expectations.

Several limitations should be considered when interpreting the findings. Monthly data may not capture high-frequency exchange rate responses that occur immediately after monetary policy announcements or commodity price shocks. The model also represents the entire sample rather than estimating separate pre-pandemic, pandemic, and post-pandemic relationships. Dividing the monthly sample into these periods would produce insufficient observations for reliable NARDL estimation.

Future research could employ daily licensed data, structural break models, or regime interaction approaches to examine whether the relationships changed across different economic conditions. Additional variables such as interest rate differentials, foreign reserves, capital flows, order flows, bid ask spreads, and measures of global financial uncertainty may provide a broader explanation of MYR/USD movements. A conventional linear ARDL specification could also be estimated as a robustness test because the Wald results do not support statistically significant asymmetry.

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