



INDONESIAN TREASURY REVIEW

JURNAL PERBENDAHARAAN, KEUANGAN NEGARA DAN KEBIJAKAN PUBLIK

GLOBAL SHOCK TRANSMISSION TO THE BUDGET DEFICIT: THE ROLE OF FUEL SUBSIDIES AS FISCAL SHOCK ABSORBERS

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ABSTRACT

Research Originality – This study contributes to the fiscal sustainability literature by examining the incomplete transmission of global shocks to Indonesia's budget deficit. While much of the existing literature emphasizes inflationary effects, this paper shifts the focus to the global financial cycle and positions fuel subsidies as a mediating channel between international shocks and fiscal outcomes.

Research Objectives – This study's primary objective is to find out how the global factors affect the budget deficit through oil subsidies and also to evaluate the speed and effectiveness of fiscal adjustment to keep the fiscal deficit within statutory limits.

Research Methods – This study uses the Error Correction Model (ECM) and time-series data from 1990 to 2025. The study also contains various variables that relate to fiscal deficit, fuel subsidy, and global shocks such as global oil prices, exchange rates, and the volatility index. The ECM model is a model that is useful for capturing long-term equilibrium and short-run dynamics. The model focuses on the Error Correction Term to assess the responsiveness of fiscal policy to external imbalances.

Empirical Results – The results of the study show that there is a long-term cointegration relationship between fiscal deficit, fuel subsidy, and global shocks. It revealed that fuel subsidies function as a shock absorber to protect the government's fiscal position and the country's economy, such as people's purchasing power.

Implications – This study suggests that fiscal authorities should strengthen cash buffers, such as Budget Surplus (Saldo Anggaran Lebih, SAL), and focus on how to implement targeted digital subsidies to maintain the 3% GDP deficit limit to ensure social protection against external shocks.

Keywords: Budget Deficit; Error Correction Model; Fiscal Sustainability; Fuel Subsidy; Global Shocks; State Treasury

ARTICLE INFO

Article History

Received : April 13, 2026

Revised : August 7, 2026

Accepted : September 25, 2026

Published : September 30, 2026

JEL Classification: C22; H50; H62; Q48

How to Cite: Asido, P. T., & Ragimun. (2026). Global shock transmission to budget deficit: Role of fuel subsidies as fiscal shock absorbers. *Indonesian Treasury Review: Jurnal Perbendaharaan, Keuangan Negara, dan Kebijakan Publik*, 11(3), 215-226. <https://doi.org/10.33105/itrev.v11i3.1482>

INTRODUCTION

A well-managed budget deficit is regarded as a fundamental pillar of fiscal stability and investor confidence. In Indonesia, this commitment to fiscal stability has been regulated in Law Number 17 of 2003, which establishes a deficit ceiling of 3% of Gross Domestic Product (GDP) (Iba et al., 2022). Fiscal deficits can still play a constructive role when managed properly, particularly as countercyclical instruments that support development financing and help reduce the effects of global economic volatility. Accordingly, the government needs to enforce fiscal rules to strengthen policy credibility and build a more robust fiscal foundation for the domestic economy. However, maintaining a balance between fiscal discipline and economic stabilization is not easy for the government. Several considerations must be taken into account: the persistent deficit over a long period, the risk of increasing debt unsustainability, and limits on fiscal flexibility. In this context, the large-scale economy creates a bigger problem for the government, requiring a policy adjustment that remains consistent with the fiscal rules (Anus et al., 2025).

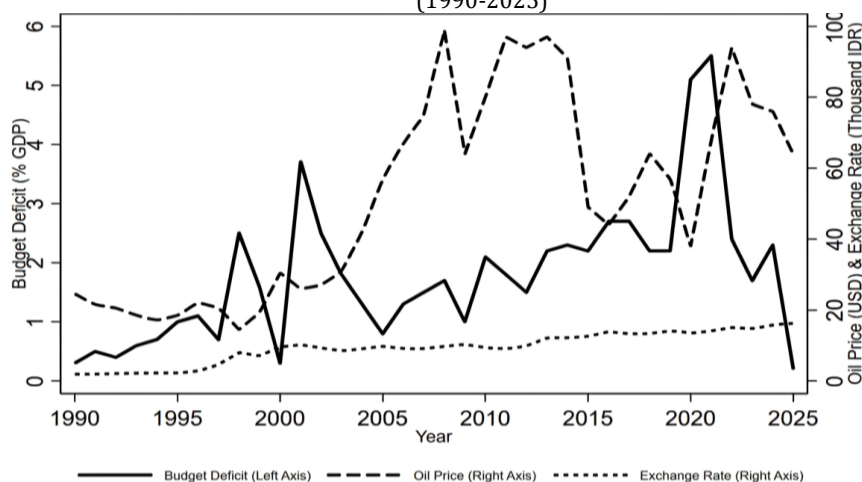
Indonesia's fiscal effectiveness is often tested by its sensitivity to external shocks, especially through global energy prices and exchange rate volatility (Febrian & Wahed, 2025). From 1990 to 2025, the Indonesian government used fuel subsidies as a primary shock absorber to protect the domestic economy from global fluctuations and maintain public purchasing power (Omotosho & Yang, 2024). However, this protection comes with a high fiscal cost. For example, the increase in global commodity prices, such as oil prices, in 2022, caused by geopolitical tensions and post-pandemic demand, led the government to increase subsidy allocations to peak levels, mirroring the Rp 502.4 trillion expenditure highlighted in recent inflationary studies (Setyanti & Harsa, 2026).

However, empirical evidence from Indonesia shows the opposite of previous studies and reveals a striking “incomplete transmission” phenomenon. As illustrated in Figure 1, over several years, especially in 2021–2022, a spike in global oil prices was followed by a contraction of the fiscal deficit from 5.50% to 2.35%. This unusual phenomenon, also found in 2017 and 2023, indicates that the correlation between global shocks and fiscal outcomes is not strictly linear but is likely influenced by fiscal adjustments and budget buffers, or the utilization of fiscal buffers like the budget surplus (Saldo Anggaran Lebih, SAL) (Chandia et al., 2022).

APPLICATIONS FOR PRACTICE

- Fuel subsidy serves as a critical buffer, yet its role as shock absorber creates an incomplete transmission of global energy prices to the budget deficit.
- Fiscal authorities should strengthen the fiscal buffers, such as SAL, to mitigate the direct impact of global volatility and exchange rate shocks without breaching the 3% GDP deficit limit.
- The government should undertake timely fiscal adjustments in response to commodity price surges to prevent structural budget imbalances and ensure long-term fiscal sustainability.
- Future research should explore non-linear adjustment mechanisms and digital subsidy targeting to enhance the efficiency of state treasury management amidst global uncertainty.

Figure 1 The Interplay of Global Oil Prices, Exchange Rates, and Indonesia's Budget Deficit (1990-2025)



Source: Processed by the authors

The global financial cycle also puts additional pressure on Indonesia's fiscal position, which this study represents with the Volatility Index (VIX). During periods of rising global uncertainty, investors tend to shift capital away from emerging economies, weakening the rupiah and increasing the cost of imported energy (Wei & Liu, 2025). Existing studies expecting, when the VIX declines and stabilizes global economic conditions will lower fiscal pressure, but, different outcome happened in Indonesia's fiscal experience in 2023, as the budget deficit continued to increase despite the decline of global risk indicators (Georgoutsos & Migiakis, 2025). This observation suggests that external shocks may not affect the national budget directly. Rather, the response of fiscal policy appears to be shaped by a broader policy framework, where the interaction between subsidy arrangements and fiscal adjustments is still not fully explained in existing literature.

Although many studies, such as Setyanti & Harsa (2026), have examined the correlation between subsidies, inflation, and poverty, there is a clear lack of analysis of the structural integrity of the budget deficit under pressure from the Global Financial Cycle. Most existing research focuses on short-run price stability but does not clearly explain how the state treasury should adjust fiscal imbalances to remain within legal limits. This research fills this gap by examining how global oil prices, exchange rates, and the VIX affect

the budget deficit through fuel subsidies from 1990 to 2025. It uses the Engle-Granger Error Correction Model (ECM) to capture and clarify the dynamics of the overshooting adjustment process and provide evidence of government responsiveness in sustaining the 3% GDP deficit limit.

Based on identified theoretical and empirical gaps, the objectives of the study are to empirically examine the transmission mechanism through which global shocks affect Indonesia's budget deficit via fuel subsidy mediation, to analyze the "incomplete transmission" phenomenon and expand the scope of analysis to assess the extent to which subsidies buffer external volatility, and to evaluate the speed of fiscal correction and identify whether an overshooting effect exists in Indonesia's policy response to global turmoil.

The novelty of this research lies in integrating the VIX index into the fiscal model to examine the state treasury's aggressive correction mechanism. This approach offers a new understanding of Indonesia's fiscal resilience amid heightened global financial volatility.

LITERATURE REVIEW

Developing countries often use budget deficit management as a stabilizing tool to maintain government fiscal sustainability. In theory, the difference between external shocks and fiscal balance is explained through the Small Open Economy (SOE) framework, which describes nations that act as "price takers" in the global market (Schmitt & Uribe, 2000). In this context, an SOE must accept global commodity prices and international financial conditions as exogenous variables (Kumhof & Laxton, 2013). For Indonesia, the transition to a net oil importer since 2004 has intensified its vulnerability, where changes in global energy prices directly dictate the cost of domestic energy provision (Dartanto, 2013; Fansyah et al., 2024). The transmission mechanism emphasizes that external shocks such as oil price fluctuations and exchange rate volatility are rapidly transmitted to the domestic fiscal sector through trade and capital flow channels (Han, 2023).

Fluctuations in global oil prices and exchange rates can substantially affect the structural integrity of the national budget. Exchange Rate Pass-Through (ERPT) describes the extent and speed with which currency fluctuations are transmitted to domestic prices. In an open economy, Rupiah depreciation increases the cost of imported oil in local currency (Heise et al., 2022). When the government intervenes through subsidies to prevent price shocks at the consumer level, the fiscal sector absorbs the resulting price pressure (Wahab & Idera, 2025; Aini et al., 2024; Fauziah & Kurnia, 2024). This is closely linked to Oil Price Pass-Through, in which global crude oil (Brent) serves as the primary benchmark for Indonesian Crude Price (ICP) (Susanto & Saputra, 2023). Global crude oil benchmarks reflect the fundamental dynamics of the energy market, and for Indonesia, any surge in these prices directly inflates the cost of energy provision and the subsequent fuel subsidy payout (Liu & Lee, 2025).

The Global Financial Cycle adds another layer of complexity to fiscal management. This theory states that international financial dynamics move in highly synchronized cycles influenced by liquidity conditions and risk sentiments at global financial centers (Rey, 2015; Proaño et al., 2025; Miranda-Agrippino & Rey, 2020), and highlights that cross-border capital flows and asset prices are significantly impacted by the risk appetite of international investors, often indicated by the Volatility Index (VIX) (Forbes & Warnock, 2012). For an emerging economy like Indonesia, an increase in the VIX, the "fear gauge," can trigger a "risk-off" episode, leading to capital outflows and exchange rate depreciation (Suganda, 2024). This transmission mechanism affects not only the financial sector but also spills over into the fiscal sector, as depreciation raises the cost of energy imports and requires higher subsidy outlays (Ahmed & Zlate, 2014; Chari et al., 2023).

The fiscal deficit is also a key fiscal policy tool that can support either expansionary or contractionary policy. It is measured as the difference between total state revenue and total spending. In Indonesia, the government has a legal limit of 3% of GDP to keep the economy stable and the budget in check (Alanamu et al., 2025). Fuel subsidies can help keep the economy stable by keeping people's buying power high (Okwa et al., 2024). Nonetheless, when the government overinvests in subsidies, it puts immense pressure on the country's fiscal capacity. It limits its ability to support other critical sectors, forcing it to rely heavily on borrowing to cover the shortfall (Banerjee, 2023). Empirical research, including Goltom (2026), shows that rising international oil prices directly increase government energy subsidy costs, placing a heavy fiscal burden on the government.

Although current studies already offer important insights, a notable gap still remains in the literature. Many studies have examined the important role of subsidies in influencing inflation and social welfare. Murjani (2022) provided evidence on how the budget deficit responds to pressures from the global financial cycle over an extended period, but this evidence remains limited.

Moreover, studies on incomplete transmission remain scarce, particularly in cases where rising subsidy burdens do not translate proportionally into fiscal imbalances. This gap leaves an incomplete understanding of how fiscal authorities actively adjust to maintain the deficit within budget limits despite

rising external global pressures. To fill this gap, this study uses the ECM to provide a more detailed analysis of both long-run equilibrium and short-run dynamics, while also allowing evaluation of the government's adjustment response to global shocks.

METHODS

The research uses a quantitative methodology to examine the dynamics of Indonesia's fiscal system using annual time-series data from 1990 to 2025. In the empirical model, the variables include global oil prices (Brent), exchange rates, and global financial volatility (VIX) as major external shocks, with the realization of fuel subsidies mediating the budget deficit. All data were obtained from reputable secondary sources, including the World Bank, the International Monetary Fund (IMF), and the Indonesian Ministry of Finance. To better capture the dynamics between these variables, this study utilizes the ECM. ECM is preferred because this study examines not only the long-run equilibrium relationship but also the fiscal system's short-run adjustment to disequilibrium caused by external shocks. This means fiscal policy reactions, including fuel subsidies, occur slowly rather than instantaneously, making ECM appropriate for estimating both the long-run equilibrium relationship and short-run dynamics through the Error Correction Term (ECT).

This study uses three different structural models to understand the transmission process. In the ECM approach, the models can help identify the short-run effect linked with the long-run adjustment process. It is especially effective for understanding how the state treasury overshoots while maintaining the 3% of GDP deficit ceiling. The models used in this research are specified as follows:

Model 1: Direct Impact on Fuel Subsidy

Short run:

$$\Delta SUB_t = a_0 + a_1 \Delta OIL_t + a_2 \Delta ER_t + a_3 \Delta VIX_t + \gamma_1 ECT_{t-1} + \varepsilon_t \quad (1)$$

Long run:

$$SUB_t = a_0 + a_1 OIL_t + a_2 ER_t + a_3 VIX_t + \varepsilon_t \quad (2)$$

Model 2: Direct Impact on Budget Deficit

Short run :

$$\Delta DEF_t = \beta_0 + \beta_1 \Delta SUB_t + \gamma_2 ECT_{t-1} + \varepsilon_t \quad (3)$$

Long run :

$$DEF_t = \beta_0 + \beta_1 SUB_t + \varepsilon_t \quad (4)$$

Model 3: Total Effect with Subsidy Interaction

Short run:

$$\Delta DEF_t = \theta_0 + \theta_1 \Delta OIL_t + \theta_2 \Delta ER_t + \theta_3 \Delta VIX_t + \theta_4 \Delta SUB_t + \gamma_3 ECT_{t-1} + \varepsilon_t \quad (5)$$

Long run:

$$DEF_t = \theta_0 + \theta_1 OIL_t + \theta_2 ER_t + \theta_3 VIX_t + \theta_4 SUB_t + \varepsilon_t \quad (6)$$

Where Δ represents the first-difference operator; DEF is the Budget Deficit (% of GDP); SUB is the Fuel Subsidy; OIL is the Brent Oil Price; ER is the Exchange Rate; and VIX is the Global Volatility Index. The coefficient γ represents the ECT, which measures the speed of adjustment. An ECT value of approximately -1.08, as found in this study's preliminary analysis, indicates an "overshooting" response where the fiscal authority aggressively corrects the budget to maintain the 3% GDP limit.

The procedure begins with the Augmented Dickey-Fuller (ADF) test to ensure the variables are integrated of the same order, followed by the Engle-Granger Cointegration test on the residuals of the long-run models. Finally, diagnostic tests for normality, multicollinearity, and serial correlation (Breusch-Godfrey) are conducted to ensure the robustness of the results.

RESULT AND DISCUSSION

The first step in the empirical analysis is to examine the stationarity of the time-series data to avoid spurious regression. This study employs the Augmented Dickey-Fuller (ADF) test to identify the order of integration for all variables, including the budget deficit (DEF), global oil prices (OIL), exchange rates (ER), global financial volatility (VIX), and fuel subsidy realization (SUB). Stationarity of these variables is a prerequisite for the Engle-Granger Two-Step Procedure, as it ensures the long-run equilibrium relationship is statistically valid.

As shown in Table 1, the results reveal a mixed order of integration among the variables. The budget deficit (ln_DEF) and global volatility index (ln_VIX) are stationary at their levels, or $I(0)$, with p-values of 0.0098 and 0.0284, respectively. The stationarity of ln_DEF at level form is an important finding, indicating that Indonesia's fiscal deficit follows a mean-reverting process. This suggests that despite external shocks, the deficit consistently returns to its long-term average, likely due to the strict adherence to the 3% GDP deficit ceiling mandated by Law No. 17/2003.

Table 1 Unit Root Test Results for All Variables

Variable	ADF	Unit Root	Prob
ln_def	-3,436	I(0)	0.009
ln_sub	-6,829	I(1)	0.000
ln_oil	-5,499	I(1)	0.000
ln_er	-4,333	I(1)	0.000
ln_vix	-3,075	I(0)	0.028

Source: Processed by the authors

In contrast, fuel subsidies (ln_SUB), global oil prices (ln_OIL), and exchange rates (ln_ER) exhibit non-stationary behavior at their levels but become stationary after the first-difference transformation, confirming they are I(1) processes. Although the baseline ADF results indicate mixed integration orders, additional unit root specifications (ADF with drift/trend and Phillips–Perron tests) suggest that the integration properties are not entirely clear-cut. Following the residual-based cointegration evidence, the ECM framework is retained, while the limitation of mixed integration orders is explicitly acknowledged.

After confirming that all variables met the stationarity requirements, we performed the Engle–Granger residual-based cointegration test to determine whether the existence of a long-run equilibrium relationship existed among the variables. The results in Table 2 indicate that all estimated models produce residuals stationary at the 5% significance level, as reflected by ADF statistics exceeding the corresponding critical values.

Table 2 Cointegration Test Results

Model	ADF Statistic	Critical Value 5%	Prob
Model 1 Baseline	-4.079	-2.975	0.0010
Model 2 Subsidy Deficit	-4.599	-2.975	0.0001
Model 3 Full Transmission	-6.017	-2.975	0.0000

Source: Processed by the authors

The null hypothesis of no cointegration is rejected across all three specifications, indicating a stable long-run equilibrium relationship. Model 3 produces the strongest evidence of cointegration, with an ADF statistic of -6.017 and a probability value below 0.001, suggesting that the interaction among global oil prices (ln_OIL), exchange rates (ln_ER), global financial volatility (ln_VIX), fuel subsidy expenditure (ln_SUB), and the budget deficit (ln_DEF) remains stable over the sample period.

These findings imply that although external shocks may temporarily deviate Indonesia's fiscal position, the variables do not drift apart permanently. Instead, they systematically tend to return to their long-run equilibrium. Cointegration therefore provides the econometric justification for estimating the ECM, allowing both the long-run equilibrium relationship and the short-run adjustment process to be examined simultaneously.

The ECM estimates in Table 3 show both long-run and short-run relationships among the budget deficit (ln_DEF), fuel subsidy expenditures (ln_SUB), global oil prices (ln_OIL), exchange rates (ln_ER), and global financial volatility (ln_VIX).

The ECT in the budget deficit equation (ln_DEF) in Table 3 is negative and statistically significant at -1.080 . This indicates that the budget deficit serves as the primary adjustment variable when the system deviates from long-term equilibrium. In short, changes in global oil prices and exchange rates can destabilize the system. But the system doesn't just converge; it also overshoots, correcting more than 100% of the fiscal imbalance in the current period. This shows that the Indonesian fiscal authority responds quickly to economic changes by keeping the deficit at the legal limit of 3% of GDP and on a path back to the mean.

In the short term, the estimates in Table 3 identify several critical transmission channels and suggest an incomplete transmission mechanism. For instance, in the baseline model (Model 1), changes in global oil prices and exchange rates directly affect the fiscal deficit. However, as shown in the full transmission model (Model 3), the statistics of external factors are no longer significant once fuel subsidy expenditure (ln_SUB) is introduced. Essentially, fuel subsidies serve as a critical shock absorber or a "strategic buffer," where the subsidy budget internalizes global influence in the short term, such as immediate volatility in the international market, to effectively insulate external factors from spilling over into a wider fiscal deficit.

Global volatility creates increasing fiscal strain and demands domestic policy responses. In the short term, the government uses the fuel subsidy as a buffer by adjusting expenditure while also adjusting other budget components to keep the deficit within the 3% ceiling. The purpose of the adjustment is to mute the transmission mechanism. Instead of translating into deficit movements, fluctuations in oil prices and exchange rates are largely absorbed into subsidy allocation. Evidence from previous studies supports this mechanism. Several previous studies support this interpretation. Murjani (2022) identified a consistent association between increases in international oil prices and an increase in subsidy outlays, suggesting that

subsidies respond at the first level. Likewise, Setyanti & Harsa (2026) highlight the need for policy intervention to ensure macro-fiscal stability while facing external forces. From a broader perspective, as Bouis (2025) explains, this type of reaction is inherently based on a trade-off. Domestic stabilization efforts, in the short run, require higher fiscal expenditure, which must be balanced in the long run. It's imperative to verify whether the model satisfies the desired statistical criteria. Although the ECT results indicate a long-run equilibrium, this alone does not guarantee the reliability of the estimates. For this reason, we conducted a series of diagnostic tests for all model specifications, including tests for normality, heteroscedasticity, autocorrelation, and multicollinearity. These procedures ensure the estimated model is statistically sound and suitable for further interpretation in a policy context.

Table 3 ECM Estimation Results

Variables	Model 1 (Baseline)	Model 2 (Subsidy Only)	Model 3 (Full Model)
Panel A: Long-Run Results			
ln_Subside	-	0.541*** (0.000)	0.824*** (0.000)
ln_Oil	1.142*** (0.002)	-	0.182 (0.445)
ln_ER	1.520*** (0.000)	-	0.211 (0.512)
ln_VIX	0.224 (0.450)	-	0.105 (0.610)
Panel B: Short-Run Dynamics (ECM)			
Δln_Subside	-	-0.005 (0.961)	-0.149 (0.237)
Δln_Oil	0.214 (0.412)	-	-0.056 (0.913)
Δln_ER	0.415 (0.322)	-	0.371 (0.677)
Δln_VIX	0.182 (0.510)	-	0.271 (0.548)
ECT (-1)	-0.654*** (0.001)	-0.761*** (0.000)	-1.080*** (0.000)
Diagnostics			
R-squared (Short-run)	35.21%	32.41%	39.78%
F-statistic	6.88***	7.67***	3.83***

Source: Processed by the authors

Table 4 Diagnostic Test

Diagnostic	Model 1 (Baseline)	Model 2 (Subsidy Only)	Model 3 (Full Model)
Normality	0.004	0.002	0.000
Heteroscedasticity	0.454	0.871	0.550
Autocorrelation	0.185	0.198	0.459
Multicollinearity	1.290	1.080	1.000

Source: Processed by the authors

As reported in Table 4 on diagnostic test outcomes, the results indicate a well-behaved model across all specifications. For models 1, 2, and 3, the heteroscedasticity and autocorrelation tests do not raise immediate concerns, as indicated by p-values above the conventional 5% threshold. In practice, this allows the estimated coefficients to retain their desirable statistical properties, because the test results indicate that the residuals are relatively stable and free from systematic patterns. Based on the diagnostic test results, the estimator can still be interpreted within the BLUE framework without major distortion.

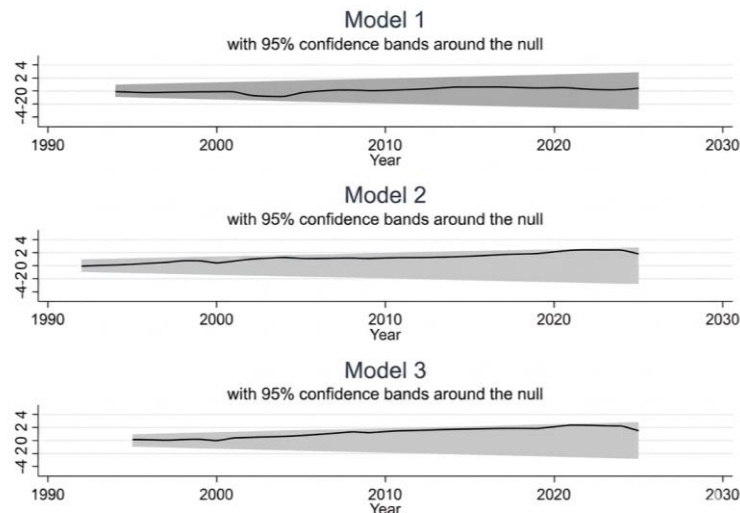
Although the most accurate tests may also be more accurate than the actual distribution, this belief does not necessarily support the traditional ECM model. In macroeconomic time series analysis, deviations from normality are common, as data often show significant predictive events and outliers, such as fluctuations in world oil prices, exchange rates, the Asian financial crisis, the global financial crisis, or the COVID-19 pandemic. Such events often attract asymmetry and "rough-and-tumble" components that are difficult to calculate on a scientific basis.

More importantly, impartial and consistent cooperation in ECM fields is not uncommon. Model accuracy decreases with the number of observations. As summarized in Table 4, the Breus–Godfrey and Breus–Pagan tests show no evidence of significant differences between the two variables, while the Cumulative Sum (CUSUM) test indicates parameter stability throughout the observation period. In addition, the robustness check using the Autoregressive Distributed Lag (ARDL) function yields qualitatively consistent long-run results, further supporting the conclusion that the main results are not driven by long-run non-normality. Consequently, the criticisms focus on empirical definitions and norms.

After the diagnostic test, this study's dataset covers multiple economic variables and years, including periods of global turbulence, so it is necessary to check parameter stability. To meet this requirement and assess whether the parameter coefficients are stable, this study used the CUSUM test. This test helps ensure that the model's relationship is not driven by a specific sub-period but reflects a consistent pattern across the sample.

The stability check using the recursive CUSUM approach, as shown in Figure 2, shows no indication of instability across the estimated models. Throughout the observation period, the recursive CUSUM statistic remains within the 95% confidence bounds, suggesting that the coefficients do not experience a systematic shift over time. This study covers several years of global disturbances. Even with episodes such as the Asian Financial Crisis in 1997/1998 and the COVID-19 pandemic, the models maintain stability and show no structural breakdown. This supports a consistent relationship between external variables and Indonesia's fiscal indicators, rather than relying only on specific crisis periods.

Figure 2 Cumulative Sum



Source: Processed by the authors

Although the ECM estimation satisfies the classical diagnostic assumptions and the CUSUM test confirms parameter stability, additional verification is needed to ensure that the estimated long-run relationship does not depend solely on the Engle-Granger specification. Therefore, this study performs an additional robustness check using the ARDL approach. Unlike the Engle-Granger framework, ARDL accommodates variables integrated of both $I(0)$ and $I(1)$, making it an appropriate alternative specification for validating the consistency of the long-run fiscal transmission mechanism identified in this study.

To address potential concerns about the mixed order of integration across variables, we conducted an additional robustness analysis using the ARDL approach. Unlike the Engle-Granger procedure, ARDL is appropriate when explanatory variables include a mix of $I(0)$ and $I(1)$ processes. Therefore, ARDL estimation serves as an alternative specification to assess whether the principal findings remain consistent under a different econometric framework.

Table 5 ARDL Test

Variable	Long-run Coef	p-value
ln_SUB	-0.233	0.166
ln_VIX	0.155	0.704
ln_ER	0.934**	0.018
ln_OIL	0.377	0.402
ECT	-1.050***	0.001
Bounds Test		
Statistic	Value	
F-statistic	3.192	
Decision	Inconclusive at 5%	
Diagnostic Test		
Test	p-value	Result
BG LM	0.1370	No autocorrelation
Breusch-Pagan	0.0890	No heteroskedasticity
Normality	0.0008	Residual non-normal

Source: Processed by the authors

Table 5 reports the estimated long-run coefficients. The results are broadly consistent with the ECM estimation. Exchange rates continue to have a statistically significant positive effect on Indonesia's fiscal deficit ($\beta = 0.934$, $p = 0.018$), whereas fuel subsidies, global oil prices, and global financial volatility remain

statistically insignificant. Moreover, the ECT is negative and highly significant (-1.050 , $p < 0.01$), confirming a stable adjustment toward the long-run equilibrium.

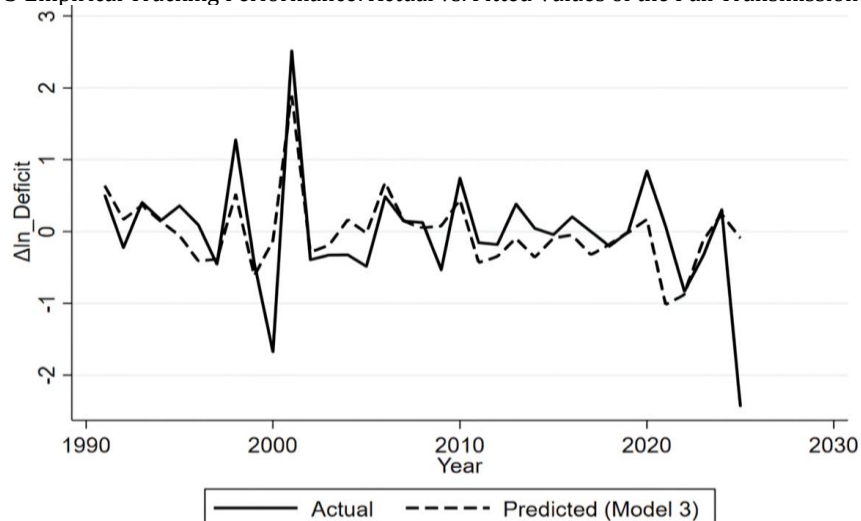
Although the Pesaran Bounds Test is inconclusive at the conventional 5% significance level ($F = 3.192$), the significant error-correction coefficient, together with the consistency of the estimated coefficients, provides additional evidence for the robustness of the long-run relationship identified in the baseline ECM estimation. Therefore, the ARDL findings do not contradict the main conclusions of this study; rather, they reinforce the interpretation that exchange-rate movements constitute the primary long-run transmission channel affecting Indonesia's fiscal deficit.

Finally, standard diagnostic tests indicate that the ARDL specification satisfies the assumptions of homoskedasticity and no serial correlation, while the residual normality assumption remains violated. This pattern aligns with the baseline ECM estimation and likely reflects large macroeconomic shocks during the sample period, including the Asian Financial Crisis and the COVID-19 pandemic. Consequently, the overall empirical findings remain robust across alternative model specifications.

Having confirmed the robustness of the ECM estimates using the complementary ARDL specification, the analysis next evaluates how well the preferred model reproduces Indonesia's observed fiscal dynamics over time. While coefficient estimates provide statistical evidence on the direction and significance of the relationships, they do not fully illustrate the model's ability to capture the evolution of fiscal movements in practice. Therefore, the next step compares the fitted values from the Full Transmission Model (Model 3) with the actual budget deficit series. This comparison offers an intuitive assessment of the model's empirical tracking performance and helps determine whether the estimated transmission mechanism is consistent with the historical behavior of Indonesia's fiscal balance.

Although the regression output makes the study relevant, it often summarizes average relationships and may not fully capture short-term fluctuations. Because the study observes episodes in which the fiscal balance is linked to external shocks, it needs a more dynamic perspective. To address this, the study adds another discussion focusing on Model 3 and the full transmission model. To assess how well the model can replicate real-world fiscal movements, rather than just theoretical ones, the study compares Model 3's fitted values with the actual series to assess how the model performs in practice.

Figure 3 Empirical Tracking Performance: Actual vs. Fitted Values of the Full Transmission Model



Source: Processed by the authors

To see the model's movements in a way that statistical analysis alone cannot capture, the CUSUM test presented in Figure 3 is examined. The dashed line, which represents the fitted values, depends on the combined effect of global oil prices, exchange rates, and fuel subsidy adjustments. When comparing the estimated model 3 with the actual fiscal series, the two lines follow the same pattern for most of the period. The two series also remain fairly close, demonstrating the model's ability to track the actual movements in Indonesia's fiscal sector. As a result, the study has shown the model's ability to capture how external pressures and domestic factors interact in practice, rather than just producing a purely estimated result. The pattern is also becoming more crucial, with the fitted series continuing to adjust following major fiscal changes, implying that the model remains closely connected to the actual dynamics observed in the Indonesian fiscal sector.

A closer look shows that the model linked to global commodities captures both upward and downward movements, including the increases in the early 2000s. Thus, the results indicate that movements are not explained by a single fiscal factor; other factors, such as oil prices and exchange rates, also play a vital role

in shaping the overall direction of the deficits. However, the fitted model does not perfectly replicate every fluctuation, and this gap offers important insight into interpreting the results. It underscores an intermediate adjustment process that appears to operate before external shocks are fully transmitted into the fiscal balance. In Indonesia, fuel subsidies largely carry out this process, adjusting in response to external pressures to protect domestic economic interests by absorbing effects and, in turn, reducing the immediate impact on the budget deficit. As a result, the transmission mechanism is not fully direct; it passes through several stages of fiscal adjustment before broader deficit changes become visible.

This study adds a new dimension to interpreting the results, particularly for the latter part of 2024 and 2025. During this period, the actual deficit corrected more quickly than the estimates. At first glance, this discrepancy may appear to be a mismatch between the model and the data, but this pattern can be explained as part of the adjustment mechanism itself. This gap reflects an overshoot response, consistent with the ECT derived from the previous estimate. Rather than a gradual return to equilibrium, fiscal adjustment appears to exceed the expected correction within a relatively short period. This situation demonstrates how effective policy plays a pivotal role in responding to international impacts on the domestic economy. Reallocating spending, revising budgets, and raising additional revenues may contribute more to fiscal correction than automatic adjustments from macroeconomic variables alone.

This study aims to understand better how the global energy crisis affects Indonesia's agricultural sector. At first, the results may seem bleak, but they show a significant financial impact on revenue. Other available data, such as oil price excesses, suggest that economic growth in an energy-exporting country will slow as global oil prices rise. In contrast, in Indonesia, a spillover effect can be observed because the agricultural sector is not directly affected by the loss of agriculture. This is due to the decline in asset utility, as assets serve not only as a source of income but also as a safety net in the financial system that protects the national economy and society. If external demand increases, the government should first absorb some of it through subsidies before spending rises and domestic demand falls. As a result, financial results do not always align with stock prices. This study provides a different perspective from previous studies, which show a relationship between oil prices and agricultural innovation. Although subsidies increase with oil prices, as Murjani (2022) confirms, they reflect a faster policy response than oil prices. The strong regulatory effect is reflected in the ECT of -1.080, indicating that Indonesian financial authorities make rapid corrective adjustments. Thus, an overshoot pattern emerges, suggesting that financial assets mediate the relationship between financial confidence and economic stability. To maintain investor confidence, support the national economy, and manage the deficit at 3% of GDP, strategic measures such as cost measures and mid-year budget adjustments are often needed to address financial aid challenges.

Unlike previous studies that primarily document a direct relationship between global oil prices and financial deterioration, this study shows that Indonesia's transmission mechanism is incomplete and operates through an intermediate stage of financial adjustment. Fuel subsidies serve not only as fiscal expenditures but also as effective transmission hedges that absorb much of the external shock before it is reflected in budget deficits. This finding extends the literature by providing empirical evidence that Indonesian monetary authorities strategically use subsidy adjustments to maintain macroeconomic stability while complying with statutory monetary law.

Although the global financial volatility (VIX) coefficient is not statistically significant in the proposed ECM, this finding should not be interpreted as evidence that global financial conditions are irrelevant to Indonesia's financial performance. Instead, the nonsignificant coefficient suggests that global financial uncertainty affects Indonesia's financial performance largely indirectly rather than directly. Increased global risk-sentiment events typically affect emerging economies through exchange rate depreciation, commodity price volatility, capital flow reversals, and tighter financial conditions, all of which this study captures through exchange rate and global oil price variables. Consequently, the VIX's explanatory power is largely transmitted through these macroeconomic mechanisms, reducing its independent statistical significance in the final series. Therefore, this study's novelty lies not in showing the VIX's direct monetary impact, but in explaining how many global shocks are co-transmitted through Indonesia's fiscal adjustment mechanism, where fuel subsidies act as a major transmission buffer before these shocks affect budget deficits.

Moreover, this study follows a different pattern from broader ASEAN findings, including Pham et al. (2023), that Indonesia's fiscal deficit is reflected through the exchange rate. In this model, the exchange rate's short-term effect is not directly observed, although imported energy prices generally increase with currency depreciation. Policy-based delays shape the transmission process, preventing immediate adjustments. The government primarily uses subsidies to absorb some of the pressure, particularly through administrative fuel prices such as solar and pertalite, which are maintained under regulated pricing schemes. Under this arrangement, the fiscal burden initially increases through subsidy spending before gradually shifting to the broader budget position. As a result, short-term exchange rate fluctuations are not

immediately translated into deficit movements. This paradigm therefore indicates deliberate fiscal buffers, prioritizing social stability over quick adjustments to external price pressures.

The International Monetary Fund's (Bouis, 2025) extended global financial cycle framework also helps explain the interplay between global financial volatility (VIX) and Indonesia's financial conditions. Compared to many emerging market economies, which often face "twin deficits" following heightened instability, Indonesia's financial response has been more contained. Rapid policy interventions appear to have played a crucial role in preventing further deterioration in financial stability. However, the buffer approach still has significant limitations, particularly the trade-off between social protection and long-term stability. In this case, subsidies can stabilize the economy; however, they also entail high opportunity costs. Fiscal funds tend to be increasingly allocated toward consumption, while productive expenditure and investment gradually get sidelined. Setyanti & Harsa (2026) highlight the risks of this approach, identifying potential fiscal vulnerabilities behind such short-term stability. While existing policies have helped stabilize the economy in the short term, fiscal stability remains closely tied to the occurrence and intensity of external shocks. From a policymaking perspective, the results imply that fuel subsidies should be seen not only as fiscal costs but also as macroeconomic stabilization instruments. Given that subsidies have absorbed most external shocks before affecting the fiscal position, future reforms should focus on making subsidies more efficient, with the ultimate goal of reducing and eliminating them. With better-targeted digital systems and transfer mechanisms, the government can retain the stabilizing effects of subsidies while avoiding long-term fiscal problems.

CONCLUSION

This study examines the link between global energy shocks and Indonesia's fiscal imbalance, focusing on spending on its fuel subsidy program. Using the ECM, the study finds that the fuel subsidy acts as a fiscal transmission shock absorber, absorbing a considerable share of external shocks before they appear in the fiscal deficit. Rather than letting oil price and exchange rate movements directly affect the fiscal situation, the Indonesian government uses spending on subsidy programs as a buffer to support the domestic economy while keeping fiscal policy compliant with the law. The significance and negative sign of the ECT indicate that a rapid adjustment mechanism is in place and that fiscal authorities actively work to correct the fiscal balance after an external shock. In addition, the robustness check using the ARDL method yields results similar to those of the baseline ECM model.

Beyond proving that a long-term fiscal adjustment framework exists, this study also contributes to the literature by showing an indirect transmission of global energy shocks into the Indonesian fiscal balance. Fuel subsidies not only play a role in government expenditure but also serve as an instrument of active fiscal stabilization in mitigating the transmission of external shocks to the budget deficit. In terms of policy, this implies that future reforms should focus on making fuel subsidies more efficient rather than ending them completely. This can be done by improving digital targeting of subsidies, the cost redistribution process, and fiscal buffer space so the government can maintain the same role without adding future fiscal pressure to cut.

However, certain limitations of the work must be considered. First, the paper uses annual observations, which may not capture frequent fiscal changes driven by external forces. Second, although the results are supported by complementary ARDL analysis, the paper does not specify whether fiscal reactions are linear or become nonlinear during economic crises or other reforms. Third, the paper discusses the connection between fiscal volatility and energy shocks but does not consider other factors that may play an important role in shaping the fiscal transmission mechanism.

Further research should build on this study by using nonlinear econometric methods, such as the Threshold Vector Error Correction Model (TVECM) or regime-switching models, to assess whether fiscal policy responses vary across economic environments. Expanding the scope to include variables related to energy transition policies, carbon taxation, or broader fiscal policies should better clarify how emerging economies adapt to evolving global energy and financial crises through fiscal policy shifts.

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