



Asymmetric Oil Price Shocks and Macroeconomic Dynamics in ASEAN-5: A Panel VAR Approach

Tidiane Guindo

Department of Economics, Andalas Univeristy

Diterima: 27 07 2025 | Revisi: 22 05 2026 | Disetujui: 24 05 2026 | Diterbitkan: 24 05 2026

A B S T R A C T

This study examines the asymmetric effects of oil price shocks on key macroeconomic variables in the ASEAN-5 economies using an unrestricted panel Vector Autoregressive (VAR) model. The impulse response functions reveal that positive oil shocks tend to generate short-term output gains and persistent inflationary pressures, whereas negative shocks produce weaker and non-symmetric effects, particularly in trade and output. Among the variables, inflation responds most consistently and strongly, highlighting its role as the main transmission channel. Variance decomposition analysis further shows that nonlinear oil shocks account for up to 6.7% of the variation in CPI. These findings suggest that oil price volatility remains a key external factor for macroeconomic management in the ASEAN-5, with inflation risks outweighing output concerns in the short run.

Keywords: Oil price shocks; ASEAN-5; Non-linear effects; Panel VAR

ABSTRAK

Penelitian ini mengkaji dampak asimetris dari guncangan harga minyak terhadap variabel-variabel makroekonomi utama di negara-negara ASEAN-5 dengan menggunakan model panel Vector Autoregressive (VAR) tanpa batasan. Hasil fungsi respons impuls menunjukkan bahwa guncangan positif terhadap harga minyak cenderung memberikan dorongan output jangka pendek serta tekanan inflasi yang persisten, sementara guncangan negatif menghasilkan efek yang lebih lemah dan tidak simetris, khususnya terhadap perdagangan dan output. Di antara variabel yang dianalisis, inflasi menunjukkan respons paling konsisten dan signifikan, yang menegaskan perannya sebagai saluran transmisi utama. Analisis dekomposisi varians lebih lanjut menunjukkan bahwa guncangan minyak non-linear menyumbang hingga 6,7% variasi dalam CPI. Temuan ini mengindikasikan bahwa volatilitas harga minyak tetap menjadi faktor eksternal yang penting dalam pengelolaan makroekonomi di kawasan ASEAN-5, dengan risiko inflasi yang melebihi kekhawatiran terhadap output dalam jangka pendek.

Kata kunci : Guncangan harga minyak; ASEAN-5; Efek non-linear; Panel VAR; Inflasi; Perdagangan

How to cite:

Tidiane Guindo (2026). Asymmetric Oil Price Shocks and Macroeconomic Dynamics in ASEAN-5: A Panel VAR Approach. *Journal of Economics Development Issues*, Vol 9(no.1), pp 48-75.
<https://doi.org/10.33005/jedi.v9i1.405>.



INTRODUCTION

Oil price has long been recognized as a major determinant of macroeconomic performance, influencing inflation, output, trade balances, and fiscal stability in both advanced and emerging economies (Krishkumar et al., 2022; El Mahmah et al., 2019). As a critical input in transportation, manufacturing, and energy production, fluctuations in global oil prices are swiftly transmitted to domestic economies, particularly in energy-importing regions such as the ASEAN-5—comprising Indonesia, Malaysia, Thailand, Singapore, and the Philippines (ASEAN Centre for Energy, 2025). Recent studies confirm that oil price volatility directly translates into rising or falling input costs, which in turn affect domestic production, consumer prices, and export competitiveness (Aziz and Kallir, 2023; Chin, 2023). Moreover, the ASEAN-5's deepening integration into global supply chains amplifies its exposure to energy market shocks, particularly supply-side disruptions that strain industrial output and fiscal balances, especially in countries with energy subsidies or energy-intensive public investment (ASEAN Center for Energy, 2022; Sahid and Sin, 2019).

Aziz and Dahalan (2015) made an early contribution to this literature by applying a panel VAR framework to assess the macroeconomic impacts of oil price shocks on ASEAN-5 economies using data up to 2014. Their findings revealed asymmetric effects—whereby oil price increases and decreases had differing impacts on inflation and output. However, recent structural changes particularly those triggered by the COVID-19 pandemic, global supply chain dislocations, and renewed oil market volatility.

Thus, study revisits and extends that framework by integrating quarterly data up to 2024:Q2 and adopting more refined nonlinear oil price shock measures such as Scaled Oil Price Increase (SOPI), Scaled Oil Price Decrease (SOPD) and Net Oil Price Increase (NOPI), and MORK. These innovations allow for a deeper understanding of how oil shocks influence inflation, GDP, exports, and imports in today's markedly different economic environment. In particular, this research identifies a resurgence in inflationary vulnerabilities and asymmetric trade impacts across the ASEAN-5, shaped by exchange rate dynamics, supply chain fragilities, and evolving patterns of global demand.

Methodologically, this paper employs a panel Structural VAR model with Cholesky decomposition following Aziz and Dahalan (2015) and utilizing more recent data and improved econometric techniques. Compared to earlier research, this study offers three core contributions.

First, it examines whether asymmetric oil price shocks continue to significantly affect macroeconomic variables in the ASEAN-5, using updated quarterly data from 1991:Q1 to 2024:Q2. This is important because the extended data span captures recent global disruptions—such as the COVID-19 pandemic and geopolitical tensions—that may have altered the traditional oil-macroeconomy relationships. Assessing the continuity or change in these dynamics enhances the empirical relevance of policy responses.

Second, it investigates whether the intensity and persistence of these effects have shifted in light of recent structural disruptions such as the pandemic and ongoing inflationary pressures. This matters because understanding whether macroeconomic responses have become more volatile or more persistent can guide policymakers in designing more effective, timely, and resilient monetary and fiscal interventions, especially in a post-pandemic and high-inflation environment.

Third, it explores policy-relevant implications using updated panel SVAR techniques—namely impulse response functions and variance decomposition—to guide macroeconomic and energy resilience strategies across the region. This is crucial as it translates empirical findings into actionable insights, helping ASEAN-5 governments better manage inflation, trade shocks, and energy security through evidence-based policies tailored to current vulnerabilities and structural realities. These objectives aim to update and advancing the empirical framework of Aziz and Dahalan (2015) in the ASEAN region.

The remainder of this paper is structured as follows. Section 2 outlines the theoretical framework, focusing on the demand and supply channels through which oil price shocks impact macroeconomic performance, including the rationale for asymmetric responses. Section 3 describes the data sources and econometric methodology. Section 4 presents and analyzes the empirical results. Finally, Section 5 concludes with a summary of findings and policy recommendations.

Theoretical Framework

1. Macroeconomic Implications of Oil Price Fluctuations

Fluctuations in oil prices have well-documented adverse effects on the aggregate economy, as highlighted extensively in economic literature (Aharon et al., 2023; Chin, 2023; Abu Eleyan et al., 2022) and Kisswani, 2021). Since the foundational work of Hamilton (1983) and Mork (1989), the literature on oil price shocks has expanded substantially, particularly toward emerging markets. An oil price shock, often categorized as a negative supply shock, typically leads to an increase in the general price level while simultaneously reducing output and employment (Dornbusch et al., 2001). On the demand side, elevated commodity prices tend to suppress consumer spending and business investment, resulting in a contraction of aggregate demand and further declines in output and employment.

The transmission of oil shocks occurs through both supply-side and demand-side channels, although the magnitude of their effects can be moderated by timely and effective policy interventions. Given that oil is a key input in many sectors and industries, a rise in oil prices increases production costs for firms, prompting a reduction in output (Jimenez-Rodriguez & Sanchez, 2005). When faced with resource constraints, firms may scale back production as the cost of oil as an input rises. Oil price shocks influence key macroeconomic variables—GDP, inflation (CPI), exports, and imports—through both supply and demand channels. As Hunt et al. (2001) explain, rising oil prices increase input costs, which can reduce non-oil output, especially under rigid wages and fixed capital stock, thereby negatively affecting GDP. These cost increases are often passed to consumers, triggering inflationary pressures (Hamilton, 1983). On the external front, higher oil prices raise import costs and may weaken export competitiveness, worsening the trade balance (Jiménez-Rodríguez & Sánchez, 2005). These theoretical linkages support the inclusion of these variables and motivate the investigation of their asymmetric responses to Oil price shocks in the ASEAN-5 context.

As previously discussed, rising oil prices elevate production costs, which in turn inflate commodity prices. These price increases reduce the real purchasing power of consumers and businesses, dampening overall demand for goods and services. Consequently, aggregate output and employment levels decline. Moreover, the reallocation of income from oil-importing to oil-exporting economies also affects global demand. As Hunt et al. (2001) note, the decline in demand in oil-importing countries often outweighs any corresponding increase in oil-exporting countries, especially when the marginal propensity to consume is higher among the former. Ultimately, an oil price increase induces a leftward shift in both the aggregate demand and aggregate supply curves, resulting in a higher price level and lower real output.

2. Why Does Asymmetry Effects of Oil Shock Arise?

High oil prices influence open economies both directly—through domestic energy costs and production expenses—and indirectly, via the economic linkages with trading partners (Taghizadeh et al., 2019). In the context of the ASEAN-5, these effects are heterogeneous due to the region's diverse energy profiles. Indonesia and Malaysia, being net oil and gas exporters, generally benefit from rising oil prices through increased export revenues (Kraal, 2019). Conversely, oil-importing economies such as Thailand, the Philippines, and especially Singapore, face higher input costs and inflationary pressures that can dampen GDP growth (Rehman et al., 2024). Interestingly, these interdependencies can blur the net impact of oil shocks. For instance, although Singapore is a major oil importer, its close trade integration with Malaysia and Indonesia allows for indirect benefits. As oil exporters experience revenue windfalls, they may increase their demand for Singaporean goods and services, particularly in manufacturing, logistics, and financial services (Chia, 2015). Thus, the overall effect of oil price increases on Singapore's economy depends on the relative strength of these direct negative and indirect positive channels.

Traditionally, the relationship between real oil prices and macroeconomic indicators in oil-importing countries has been modeled as symmetric—meaning that an increase in oil prices depresses economic activity, while a decrease spurs it to the same extent. However, empirical evidence increasingly supports the presence of asymmetric effects. Hamilton (1988) posits that adjustment costs linked to oil price changes can generate asymmetries. Rising oil prices reduce economic activity due to increased production costs and

inflationary pressures. Yet, falling oil prices do not necessarily result in proportionate economic gains, as firms and households may remain cautious amid uncertainty and delayed investment decisions.

In the ASEAN-5 context, this asymmetry is also influenced by monetary policy responses. Central banks may tighten monetary policy in reaction to oil-driven inflation, potentially exacerbating the contractionary impact of rising oil prices. Leduc and Sill (2004), as well as Jumah and Pastuszyn (2007), emphasize the role of such policy reactions in deepening the negative macroeconomic consequences. On the other hand, looser monetary policy in response to falling oil prices may not be as effective in stimulating economic recovery due to time lags and weak transmission mechanisms, particularly in economies with less-developed financial sectors. Ferderer (1996) further highlights that oil price volatility triggers financial uncertainty, which can deepen negative effects—particularly in economies like the Philippines and Thailand with vulnerable capital markets. While Aziz and Dahalan (2015) identified asymmetric impacts of oil price shocks on ASEAN-5 macroeconomic indicators using data up to 2014, they did not account for post-pandemic disruptions or updated nonlinear specifications. This study extends their framework by incorporating recent shocks and refined methodologies to reassess the asymmetric macroeconomic responses in today’s more volatile global environment.

METHOD

This study builds on the methodological foundation of Aziz and Dahalan (2015), who employed a panel Vector Autoregression (VAR) approach to explore the asymmetric effects of oil price shocks on ASEAN-5 economies. The current study updates and refines their framework in two main ways: by expanding the dataset to include recent structural disruptions and by incorporating enhanced shock specifications and estimation techniques to better capture today’s macroeconomic realities.

1. Data

The panel dataset covers quarterly observations from 1991:Q1 to 2024:Q2 for five ASEAN countries—Indonesia, Malaysia, the Philippines, Thailand, and Singapore. This extended timeframe captures critical events such as the COVID-19 pandemic, post-pandemic inflation, and recent oil market volatility. The four key macroeconomic variables analyzed are real GDP, inflation (CPI), exports, and imports—consistent with Aziz and Dahalan (2015) but updated with high-frequency data from the IMF’s International Financial Statistics (IFS).

To capture oil price shocks, the study employs five measures: quarterly oil price changes (DLOGROIL), Hamilton’s (1996) net oil price increase (NOPI), Lee et al.’s (1995) scaled oil price increase and decrease (SOPI and SOPD), and Mork’s (1989) oil price increase and decrease as adopted by Aziz and Dahalan (2015). All variables, except those related to oil price shocks, are represented in logs forms. Datasets were derived from the International Finance Statistics (IFS). The variables considered in this paper are real gross domestic product (GDP), real exports (EXPORT), real imports (IMPORT), inflation (CPI), and oil price shock. The oil price shock variables are divided into linear and non-linear measures. Section 3.2 will discuss the oil price variables in more detail. The selection of the four macroeconomic variables follows the work of Farzanegan and Markwardt (2009). However, real industrial GDP variables, as used in Farzanegan and Markwardt (2009), are substituted with real GDP. The choice of using GDP is therefore in line with the literature (see Lee et al., 1995, and Hamilton, 2003, among others). Descriptive statistics of the four series used in the panel VAR analysis are shown in Table 1.

Descriptive Statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
GDP	490	79.334	53.862	18.474	213.7
Export	490	66.311	51.309	7.407	216.165
Import	490	42.302	29.099	4.498	169.925
CPI	490	96.691	31.113	32.42	218.91

2. Oil Price Shock Variables

To examine the impact of oil price shocks on key macroeconomic variables, this study adopts five distinct measures of oil price shocks, aligning with established methodologies in the literature. These measures encompass both linear and non-linear specifications, enabling the analysis to capture a range of dynamics in oil price movements. The first measure is a Linear Oil Price Shock, calculated as the quarterly percentage change in real oil prices. This metric, denoted as $DLOGROIL_t$, assumes a symmetric effect of oil price increases and decreases on macroeconomic outcomes. The formula used is:

$$DLOGROIL_t = \left(\frac{\text{Real Oil Price}_t - \text{Real Oil Price}_{t-1}}{\text{Real Oil Price}_{t-1}} \right) \times 100$$

Here, Real Oil Price_t refers to inflation-adjusted oil prices (base year 2015 = 100). A positive $DLOGROIL_t$ indicates an oil price increase, while a negative value reflects a decline. The second measure is the Net Oil Price Increase (NOPI), proposed by Hamilton (1996). This non-linear specification captures unexpected oil price increases by comparing the current real oil price with the maximum value observed in the previous four quarters. The formula is:

$$NOPI_t = \max\{0, \text{roil}_t - \max(\text{roil}_{t-1}, \text{roil}_{t-2}, \text{roil}_{t-3}, \text{roil}_{t-4})\}$$

If the current price exceeds the highest price in the last four quarters, the excess amount is recorded as $NOPI_t$. Otherwise, the value is zero, indicating no significant price surge. The third and fourth measures are the Scaled Oil Price Increase (SOPI) and Scaled Oil Price Decrease (SOPD), developed by Lee et al. (1995). These indicators adjust oil price changes for historical volatility by dividing the percentage change by the standard deviation of oil price changes over the past twelve quarters:

$$SOPI_t = \max\left(0, \frac{DLOGROIL_t}{\sigma_{oil,t}}\right), \quad SOPD_t = \max\left(0, \frac{-DLOGROIL_t}{\sigma_{oil,t}}\right)$$

Here, $\sigma_{oil,t}$ denotes the rolling standard deviation. These measures provide insight into whether recent oil price changes are unusually large or small relative to past fluctuations. Finally, the fifth specification applies Mork's (1989) approach, which separates oil price increases and decreases into two distinct variables: $MORK_+$ and $MORK_-$. This allows for asymmetrical effects in the analysis of macroeconomic responses:

$$MORK_{+t} = \max(0, DLOGROIL_t), \quad MORK_{-t} = \min(0, DLOGROIL_t)$$

While $MORK_{+t}$ captures only positive oil price changes, $MORK_{-t}$ captures only negative ones. This differentiation is particularly important for energy-dependent economies, where increases in oil prices tend to have more pronounced effects than decreases.

3. Estimation Method

The paper uses panel VAR techniques developed by Love and Ziccino (2006) to estimate the variance decompositions and the impulse response functions as adopted by Aziz and Dahalan (2015). The panel VAR approach inherits the advantage from traditional VAR model that treats all the variables in the system as endogenous. Moreover, the panel VAR procedure also has the advantage from panel-data framework that allows for unobserved individual heterogeneity for all the variables by introducing fixed effects which enhances the consistency of the estimation. This panel VAR model can be specified as follows:

The panel VAR model is specified as follows:

$$X_{it} = \eta(L)X_{it} + \mu_i + \varepsilon_{it}$$

where X_{it} is a vector of stationary endogenous variables, $\eta(L)$ is a matrix polynomial in the lag operator defined as $\eta_1 L + \eta_2 L^2 + \dots + \eta_n L^n$, μ_i represents unobserved, time-invariant country-specific effects, and ε_{it} is a vector of idiosyncratic errors.

In panel VAR estimation, lagged dependent variables are often correlated with the fixed effects, posing a serious econometric challenge. Fixed effect mean-differencing alone would lead to biased coefficient estimates. The study therefore adopts forward mean-differencing transformation-or also referred to as the Helmert procedure-following the studies of Arellano and Bover (1995) along with that of Love and Zicchino (2006). This average of future observations itself removes for each panel unit this future average and maintains the orthogonality between transformed variables and lagged regressors. Hereafter, lagged regressors can be used as valid instruments that the system estimates through Generalized Methods of Moments (GMM).

In addition to the panel VAR estimates, impulse response functions (IRFs) and variance decompositions (VDCs) are derived. The IRFs trace the workings of a one-time shock to one of the innovations on current and future values of the endogenous variables when other shocks are kept constant. Conversely, the VDCs measure the share of the forecast error variance of each variable that can be attributed to different structural shocks within a particular forecast horizon.

For contemporaneous correlation among innovations, which makes it impossible to isolate the individual shocks on a variable, this study applies the Cholesky decomposition as per Sims (1980). The recursive structure is assumed to be under the assumption that the variables that are ordered earlier.

In the baseline ordering of the panel VAR, the variables are arranged as follows:

$$X_{it} = (\text{Oil Price Shock, CPI, Export, Import, GDP})$$

The obvious reasoning behind this ordering is that oil price shocks stand out as the most exogenous variable in the present system. The justification for such a situation arises from the limited ability of the ASEAN-5 countries to influence global oil markets, where their production and exports represent less than 3% of world oil output. Demand in international markets, speculative activity on oil market platforms, and policies regarding national strategic petroleum reserves of the larger consuming nations mainly drive global oil prices. The adjustment to oil price shocks is assigned priority to the consumer price index (CPI), while variables related to exports and imports follow, placing GDP last in order, which indicates that it reacts to the cumulative impact of all the preceding variables.

Empirical Results

In the beginning of the analysis, the properties of the data were examined. Panel unit root tests are conducted with reported results as follows: Im-Pesaran-Shin (IPS) test by Im, Pesaran, and Shin (2003) and Breitung (1999) and Levin, Lin and Chu (2002) tests.

1. Test of Stationarity

Table 2 provides the results of the panel unit root tests carried out at levels and first differences for the variables constituting the model. The results are then evaluated in comparison with the critical values at 10%, 5%, and 1% significance levels, which are used to decide on the null hypothesis for the presence of a unit root. The test statistics indicate that all four main variables are non-stationary at levels, that is, integrated of order one, $I(1)$, are stationary after first difference, so they are integrated of order zero, $I(0)$. Therefore, first differencing was applied to these non-stationary variables to ensure their stationarity for robust estimation. On the other hand, the shocks in oil prices, namely DLOGROIL, an increase in the Mork, a decrease in the Mork, NOPI, SOPI, and SOPD, are stationary at levels by nature. This is because of the various ways these variables are constructed; each represents a rate of change or first difference of oil prices, capturing immediate fluctuations rather than long-term trends.

The various integration orders in the data set will render biased or misleading inference in the case of the application of cointegrated VAR. Hence, an unrestricted panel VAR model estimated in the levels is preferred in this analysis, as stated Mallick and Mohsin (2007, 2010). Based on the Akaike Information Criterion (AIC), Hannan-Quinn Information Criterion (HQIC), and Schwarz Bayesian Information Criterion (SBIC), the optimal lag length selected was 0, as all three criteria attained their minimum values at lag 0. Despite the optimal lag being 0, a lag length of 1 was used in the VAR model estimation to enable the computation of dynamic Impulse Response Functions (IRFs), in line with standard empirical practice.

Table 2. Panel unit root tests for panel ASEAN-5

Variables	GDP	EXPORT	IMPORT	CPI
Series at level				
Levin, Lin, and Chu t-stat ^a	3.4894 (0.9998)	1.7061 (0.9560)	3.1870 (0.9993)	3.2883 (0.9995)
Breitung t-stat ^a	3.5328 0.9998	2.5795 0.9951	3.8985 1.0000	7.101 1.0000
Im, Pesaran, and Shin w-stat ^b	0.7795 0.7821	1.3346 0.9090	1.3393 0.9098	1.4186 0.9220
Series at first difference				
Levin, Lin, and Chu t-stat ^a	-14.2651 (0.000***)	-12.5895 (0.000***)	-14.1575 (0.000***)	-6.3920 (0.000***)
Breitung t-stat ^a	-9.0900 (0.000***)	-9.7738 (0.000***)	-12.0507 (0.000***)	-6.3857 (0.000***)
Im, Pesaran, and Shin w-stat ^b	-15.6647 (0.000***)	-13.7912 (0.000***)	-15.2879 (0.000***)	-9.1914 (0.000***)

Notes: An intercept and trend are included in the test equation. The lag length was selected using the Modified Akaike Information Criteria. The numbers in the bracket are the p-values of the corresponding test statistics. * (**) *** denote statistical significance at the 10%, 5% and 1% levels.

^a Signifies that the null hypothesis is the unit root (with the assumption that the cross-sectional units share a common unit root process).

^b Signifies that the null hypothesis is the unit root assuming that the cross-sectional units have individual unit root processes.

2. Impulse Response Functions Results

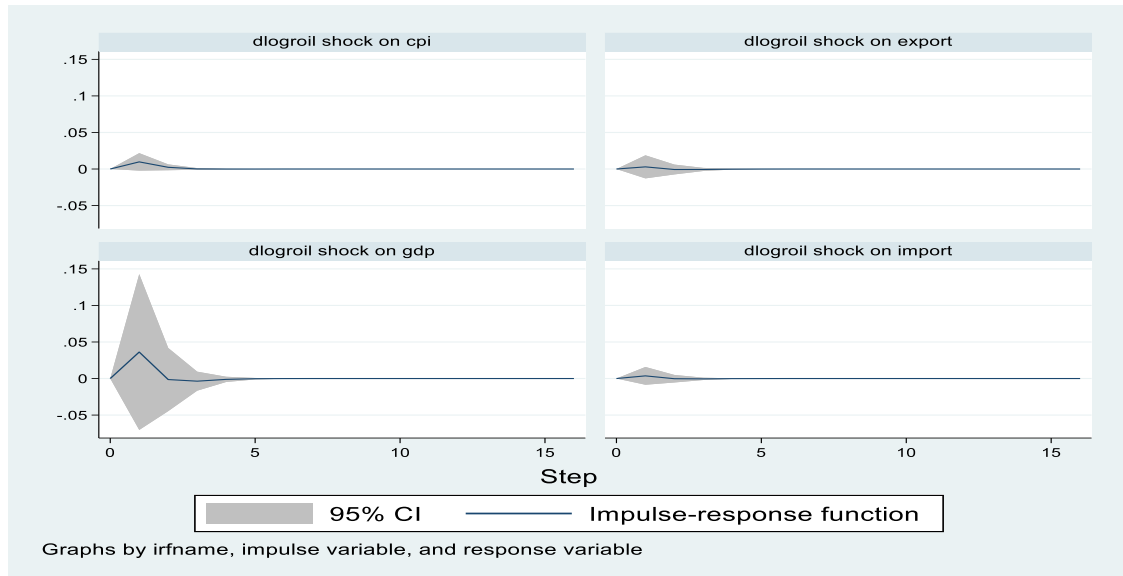
This section presents the macroeconomic responses of the ASEAN-5 economies—Indonesia, Malaysia, the Philippines, Thailand, and Singapore—to various oil price shocks using impulse response functions (IRFs) derived from a Panel Structural VAR (SVAR) framework. The IRFs are computed using Monte Carlo simulations to provide statistically robust confidence bands, following the approach of Love and Zicchino (2006). The focus is on evaluating the direction, timing, and relative strength of responses in key macroeconomic indicators—consumer prices (CPI), real GDP, exports, and imports—under both linear and nonlinear oil price shocks.

(i) Responses to Linear Oil Price Shocks (DLOGROIL):

A one-standard-deviation positive oil price shock, modeled through the linear specification (DLOGROIL), leads to statistically significant short-term increases in CPI, GDP, exports, and imports within the first two quarters—consistent with Aziz and Dahalan (2015). However, while their results showed only mild and temporary effects, this study finds a noticeably **larger magnitude** in GDP response before the reversal, suggesting a **heightened short-run output sensitivity** in the post-2014 period. The responses of inflation,

exports, and imports are similarly short-lived and modest, reaffirming the limited long-run impact of linear oil shocks.

Figure 1. Impulse Response of Oil Price Shock Variable (DLOGROIL) on CPI, EXPORT, IMPORT & GDP



I. (ii) Responses to Nonlinear Oil Price Increases (NOPI, SOPI, MORK+): Stronger and Persistent CPI Shocks

Figure 2. Impulse Response of Oil Price Shock Variable (NOPI) on CPI, EXPORT, IMPORT & GDP

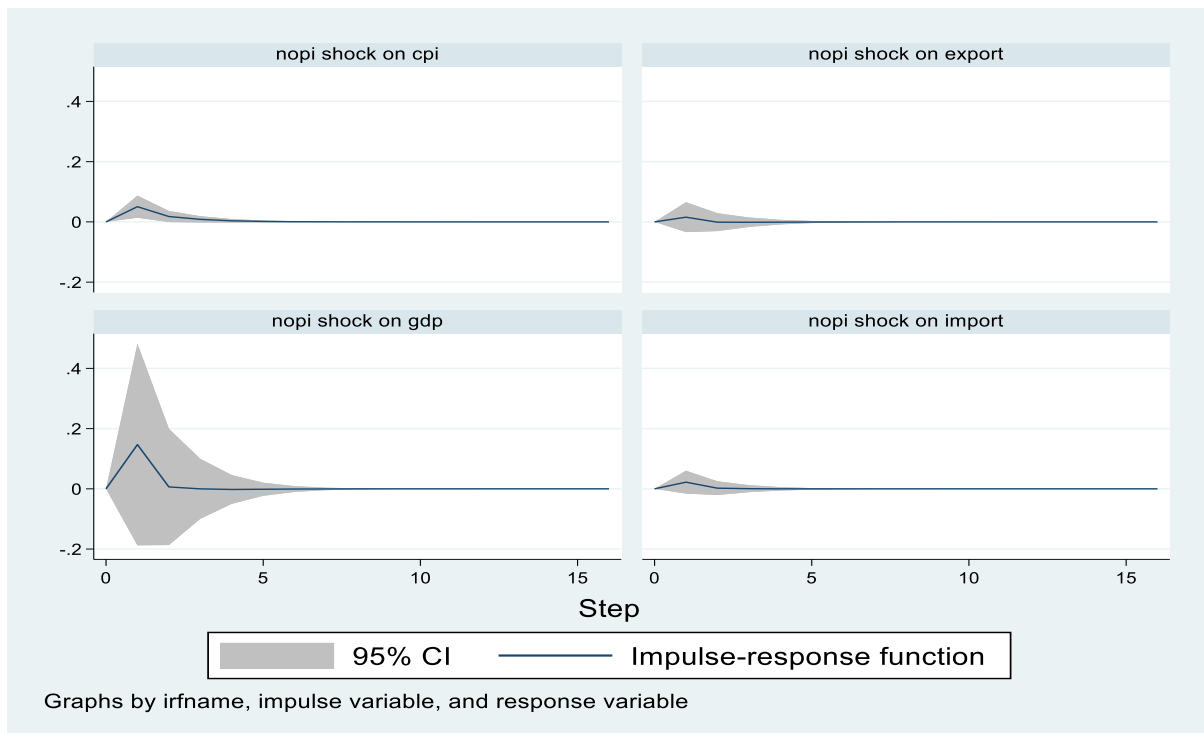


Figure 3. Impulse Response of Oil Price Shock Variable (SOPI) on CPI, EXPORT, IMPORT & GDP

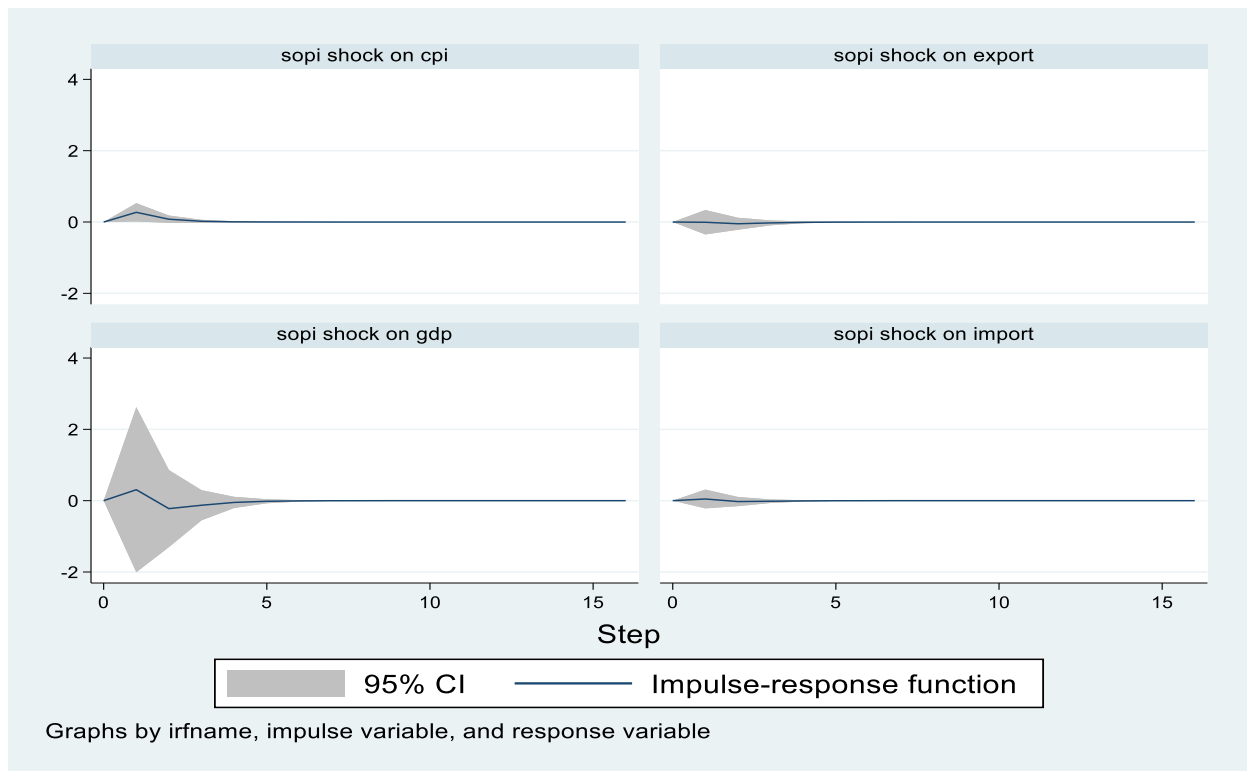
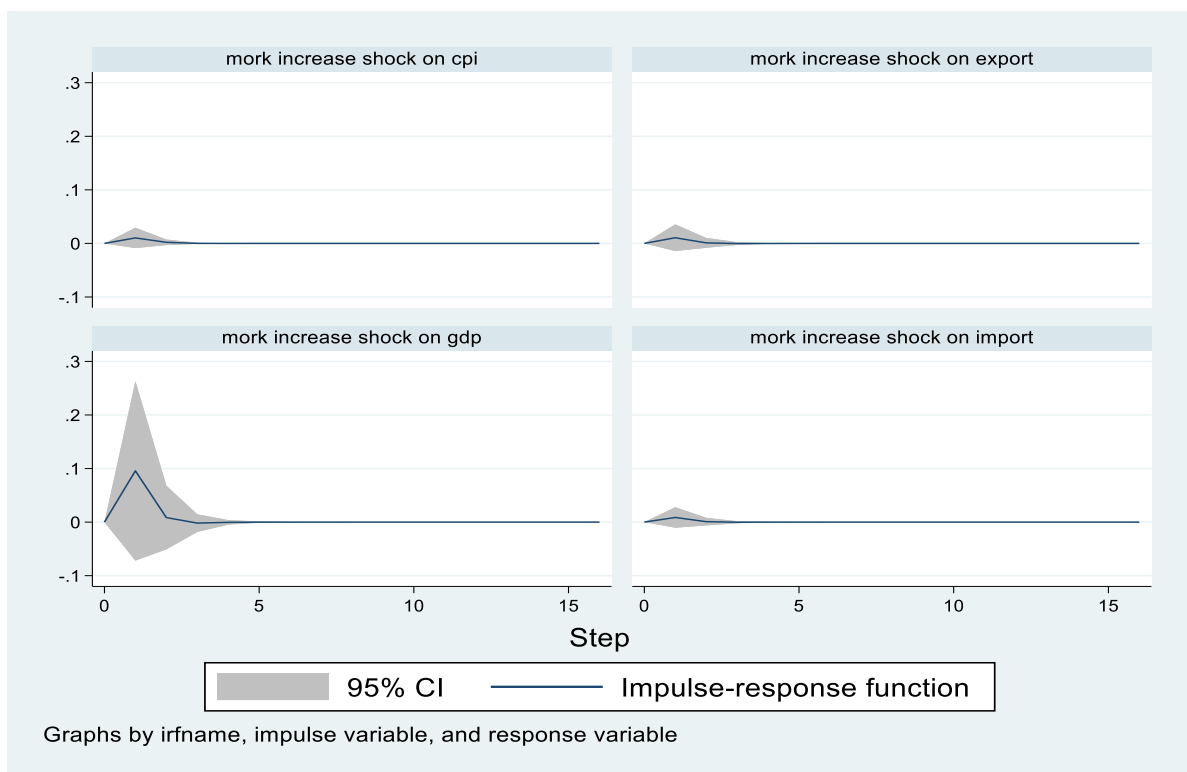


Figure 4. Impulse Response of Oil Price Shock Variable (Mork Increase) on CPI, EXPORT, IMPORT & GDP



The impulse responses from nonlinear oil price increase (NOPI, SOPI, MORK+) measures reveal more persistent and statistically significant effects than those from the linear specification. Specifically, real GDP

risers clearly during the first two to three quarters and does not immediately revert to baseline, indicating a stronger short-run sensitivity to unanticipated oil price hikes. This contrasts with Aziz and Dahalan (2015), who found that GDP declined in response to nonlinear positive shocks without short-term gains. In this study, inflation exhibits a modest but prolonged rise, while exports and imports show short-lived positive responses that fade within a few quarters—consistent with earlier findings. These results suggest that the post-2014 period may have altered the transmission mechanism, especially for output responses under positive oil shocks.

2. (iii) Responses to Nonlinear Oil Price Decreases (SOPD, MORK-): Limited and Non-Opposite Effects

Figure 5. Impulse Response of Oil Price Shock Variable (SOPD) on CPI, EXPORT, IMPORT & GDP

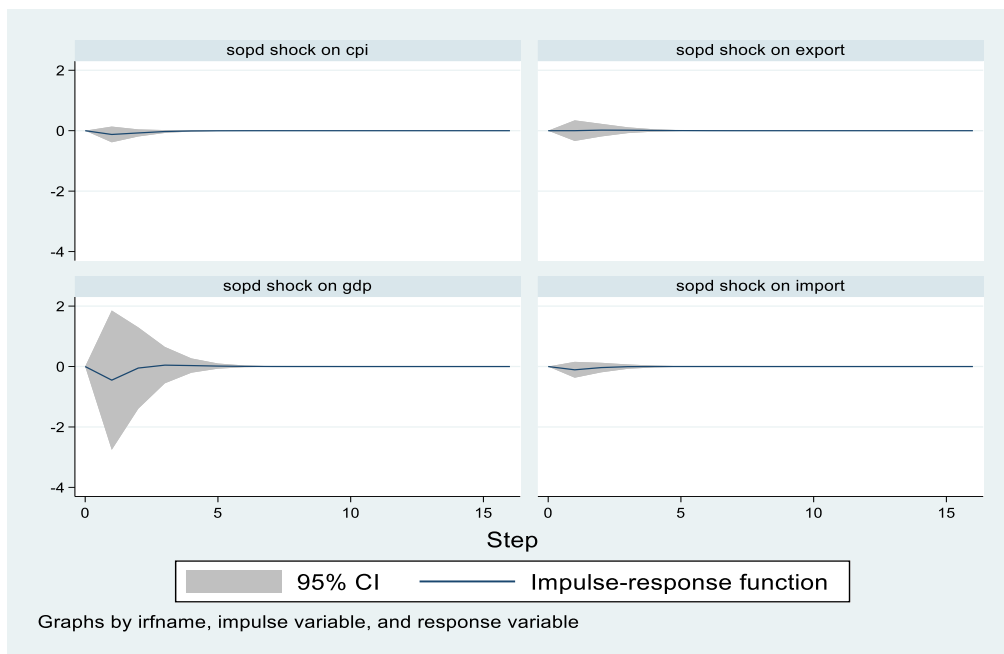
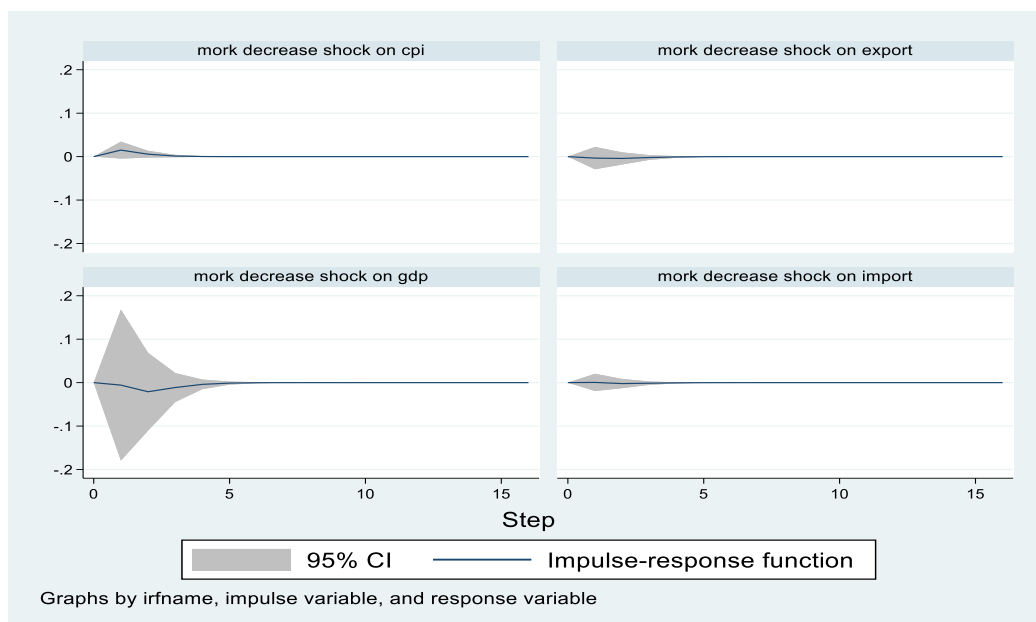


Figure 6. Impulse Response of Oil Price Shock Variable (Mork Decrease) on CPI, EXPORT, IMPORT & GDP



Under negative oil price shocks (SOPD, MORK⁻), macroeconomic responses are not mirror images of positive shocks. Inflation shows some decline, but the effects are less pronounced than under positive shocks. Real GDP, unexpectedly, declines slightly in the first quarter after a price drop, hinting at adjustment frictions or reduced revenues in energy-related sectors. Imports initially fall and then rebound mildly, while exports show minimal reaction. These asymmetric and muted effects align with the literature emphasizing incomplete pass-through and structural rigidities in oil-importing developing economies. Notably, **real GDP declines significantly** in the first quarter after a price drop, indicating contractionary pressure even in a favorable oil price environment. This contradicts the expected positive stimulus effect and is consistent with **Mork (1989)** and **Kilian & Vigfusson (2011)**, who emphasized the asymmetric nature of oil price impacts.

The contraction could be due to weakened energy-related sectors, investor uncertainty, or limited pass-through to consumers—factors discussed by **Apergis and Miller (2009)** in sectoral analyses of ASEAN stock markets. Similarly, real imports initially decline, reflecting cautious consumer behavior and external demand dynamics, but then rebound, especially under the MORK⁻ specification. This suggests a **lagged positive effect** from reduced energy costs—a finding echoed in **Abu Eleyan et al. (2022)**, who noted dynamic and time-varying trade responses to oil shocks in ASEAN. All the variables are statistically significant under negative shocks but with weaker magnitudes than in positive shocks. Export responses are mixed: mostly unchanged under SOPD and slightly negative in the first quarter under MORK⁻ before normalizing. These findings reinforce the **incomplete symmetry** of macroeconomic responses and support the case for adopting **nonlinear oil shock models**, as recommended by **Lee et al. (1995)** and **Hamilton (2003)**. The results demonstrate clear **asymmetry** in the responses of ASEAN-5 economies to oil price changes. While positive shocks (NOPI, SOPI, MORK⁺) induce stronger output and moderate inflation followed by reversals, negative shocks (SOPD, MORK⁻) do not yield proportionate or opposite effects. The most persistent responses are observed in **output**. The IRF results confirm asymmetric macroeconomic responses to oil price shocks in ASEAN-5 economies. However, the economic magnitude of these effects—especially on real Inflation, exports, and imports—is modest. GDP remains the most responsive variable, particularly under nonlinear positive shocks. These findings suggest that while oil price volatility can influence short-term macroeconomic conditions, the broader real-sector effects are limited, reinforcing the relative resilience of ASEAN-5 economies to oil market fluctuations.

The impulse response function (IRF) results of this study align broadly with those of Aziz and Dahalan (2015), especially in confirming the asymmetric effects of oil price shocks on macroeconomic variables in ASEAN-5 economies. Both studies find that positive oil price shocks lead to short-term inflationary pressures and declining GDP in the long run, while nonlinear models better capture the asymmetric dynamics between oil prices and economic activity. However, this paper provides a more nuanced view by identifying a statistically significant initial increase in GDP following a linear oil price shock—suggesting a short-lived stimulus—before a sharper contraction, a pattern not as clearly emphasized in Aziz and Dahalan's work. Furthermore, in the context of nonlinear negative oil price shocks (SOPD and MORK⁻), this study observes a notable contraction in GDP and imports during the early quarters, contradicting the standard assumption of symmetric macroeconomic responses. Unlike Aziz and Dahalan (2015), this analysis incorporates more recent empirical literature and interprets the findings through broader structural and policy lenses, including the role of energy-related sectors, investor sentiment, and external demand.

(iv) Robustness Checks

The impulse response functions derived from the baseline ordering are founded on the premise that prices can flexibly adjust – [Oil Price variable, CPI, EXPORT, IMPORT, GDP]. In this ordering, the level of price (CPI) accommodates positive shocks to oil prices with no lag. Conversely, for robustness checks, our IRF estimates were conducted with symmetric and asymmetric definitions of oil price shocks. The second alternative ordering works off the premise of price rigidity – [Oil Price variable, EXPORT, IMPORT, CPI, and GDP]. The IRFs derived from this ordering resemble the IRFs of the baseline ordering. However, irrespective of the alternative ordering based on price flexibility versus price rigidity, the macroeconomic responses remain unchanged, hence making the earlier-IRF results robust with respect to changes in variable ordering, while justifying their short-run and long-run responses.

(v) Variance Decomposition Analysis

Variance decomposition is used to assess the relative contribution of oil price shocks—both linear and nonlinear—to the forecast error variance of key macroeconomic variables. This approach provides a clearer picture of the economic importance of oil price fluctuations in explaining variations in output, trade, and prices across ASEAN-5 countries. Table 3 presents variance decomposition results across short (Q2), medium (Q5), and long-run (Q20) horizons. While several oil price shock measures yield statistically significant variance shares, the overall magnitude of these contributions is generally small—especially for GDP and trade indicators.

Table 3. Variance decomposition

Specification	Quarter	GDP	Exports	Imports	CPI
DLOGROIL	2/QTR	0.42	0.13	0.33	2.46
	5/QTR	0.42	0.13	0.33	2.58
	20/QTR	0.42	0.13	0.33	2.58
NOPI	2/QTR	0.60	0.31	1.05	5.85
	5/QTR	0.60	0.31	1.05	6.69
	20/QTR	0.60	0.31	1.05	6.69
SOPI	2/QTR	0.06	0.00	0.11	3.87
	5/QTR	0.10	0.09	0.15	4.20
	20/QTR	0.10	0.09	0.15	4.20
SOPD	2/QTR	0.12	~0.00	0.54	0.76
	5/QTR	0.13	0.02	0.59	1.08
	20/QTR	0.13	0.02	0.59	1.08
MORK+	2/QTR	1.16	0.64	0.72	1.08
	5/QTR	1.16	0.65	0.73	1.12
	20/QTR	1.16	0.65	0.73	1.12
MORK-	2/QTR	0.004	0.06	0.002	1.97
	5/QTR	0.07	0.17	0.06	2.25
	20/QTR	0.07	0.17	0.06	2.25

Three key observations emerge from the variance decomposition analysis. First, the sensitivity of real GDP to oil price shocks is limited across all specifications, with variance shares never exceeding 1.2%. Even under the most impactful scenario—MORK+—the effect remains marginal at 1.16%, indicating that ASEAN-5 economies are likely buffered by structural factors such as economic diversification, flexible exchange rate regimes, and stabilizing fiscal policies. Second, the trade channel responses are also modest, with exports showing minimal sensitivity and imports reaching a maximum variance share of 1.05% under NOPI. Imports are somewhat more responsive than exports, particularly under nonlinear positive (MORK+, NOPI) and negative (SOPD) shocks; however, these reactions appear economically limited and likely reflect temporary cost adjustments or anticipatory consumer behavior rather than deep structural shifts. Third, inflation (CPI) stands out as the most affected variable, with variance shares reaching 6.69% under NOPI and 4.20% under SOPI, highlighting its vulnerability to unexpected and nonlinear oil shocks. Nonetheless, even inflationary responses tend to stabilize by the fifth quarter, indicating that while oil price shocks can exert meaningful short-term pressure on prices, they are unlikely to generate prolonged macroeconomic instability. The variance decomposition analysis in this study generally supports the findings of Aziz and Dahalan (2015) while providing more granular insights into the asymmetric transmission of oil price shocks across macroeconomic variables. Both studies find that inflation (CPI) is the most sensitive variable to oil price

shocks, particularly under nonlinear specifications like NOPI and SOPI, which confirm the dominance of cost-push inflation in ASEAN-5 economies. However, this study identifies greater magnitude in CPI responses, with NOPI accounting for up to 6.69% of CPI variance—substantially higher than the 2–3% levels reported in the earlier work—highlighting a more pronounced inflationary effect of net oil price increases. Additionally, while Aziz and Dahalan (2015) emphasize moderate impacts on trade variables, this study differentiates sharply between exports and imports, showing that imports are more responsive, especially to negative shocks (e.g., SOPD at 0.59%). This detail suggests a stronger demand-side adjustment to oil price declines, a nuance less explored in the original study. GDP variance remains low across both studies, reinforcing the view that ASEAN-5 economies are structurally resilient to oil price volatility, though this study highlights MORK+ as the most influential specification (1.16% on GDP), compared to the more uniform impacts reported by Aziz and Dahalan. Overall, while both analyses confirm asymmetric shock transmission, this paper expands the interpretation by providing deeper insight into trade asymmetry and inflation persistence, supported by more recent methodological refinements and higher-frequency variance reporting (Q2, Q5, Q20).

Conclusion and Recommendations

This study builds upon and extends the earlier work of Aziz and Dahalan (2015) by applying an updated panel VAR framework to assess the asymmetric effects of oil price shocks in ASEAN-5 countries from 1991:Q1 to 2024:Q2. By incorporating more recent macroeconomic disruptions—most notably the COVID-19 pandemic and increased global oil market volatility—this research offers a timely reassessment of oil-macro-economy dynamics in the region. The IRF obtained from the linear oil price specification (DLOGROIL) indicated that oil price movements lead to declines in GDP in the long term after experiencing growth in the short term. However, only marginal impacts are seen in CPI. Analysis from the non-linear oil price specifications produced comparable results. Hamilton's (1996) NOPI, Lee et al.'s (1995) SOPI, and Mork's (1989) positive oil price shock measures negatively affect output growth both in the short term and in the long term. For non-linear oil price decrease specifications, real output respond negatively in the short term before recovering to its pre-shock level in the long term. The significant difference between the effect of oil price increases and decreases (as observed from IRF) suggest an asymmetric relationship between aggregate economic activity and oil prices. The variance decomposition analysis confirms that inflation (CPI) is the most responsive macroeconomic indicator, with up to 6.69% of its forecast error variance explained by oil shocks. However, the impact on real GDP and trade indicators remains below 1.2%, suggesting a relatively contained macroeconomic vulnerability to oil price movements.

These findings reinforce the importance of inflation targeting and short-term policy responsiveness, especially during periods of elevated energy price volatility. At the same time, the muted effects on GDP and trade highlight the structural resilience of ASEAN-5 economies, likely supported by improved macroeconomic frameworks, diversified export bases, and flexible policy instruments. While the asymmetry in responses remains evident—particularly the stronger effects of oil price increases compared to decreases—the limited magnitude of most macroeconomic adjustments cautions against overstating the systemic risk posed by oil shocks. Future research could explore sector-specific dynamics or country-level heterogeneity in greater depth, as well as the interaction between oil prices and monetary or fiscal policy actions. In conclusion, although oil shocks continue to influence ASEAN-5 economies asymmetrically, the overall macroeconomic effects are moderate, with inflation being the most sensitive channel. These insights are valuable for policymakers aiming to fine-tune inflation control measures and energy resilience strategies in the face of global price uncertainties, while also recognizing the relatively stable performance of other macroeconomic fundamentals.

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