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The Influence of Global Liquefied Natural Gas (LNG) Price Instability on Indonesia's Balance of Payments Dynamics

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ABSTRACT

The evolution of the global energy landscape has established liquefied natural gas (LNG) as a critical component of the worldwide energy mix. Nonetheless, instability in global LNG prices presents significant challenges, particularly for export dependent nations like Indonesia. This study rigorously quantifies the impact of LNG price volatility on Indonesia's Balance of Payments (BOP) and subsequently proposes strategic policies to bolster national economic resilience. Utilizing a mixed-methods design, the research integrates advanced time-series econometric modeling specifically Vector Autoregression (VAR) and Impulse Response Function (IRF) analysis with a qualitative policy review spanning the period 2015–2024. Data include monthly LNG indices, BOP components, and macroeconomic controls, sourced from authoritative institutions such as the International Energy Agency (IEA, 2024), Bank Indonesia (2024), and the Ministry of Energy and Mineral Resources (2024). The empirical results demonstrate a significant, adverse effect of LNG price shocks on Indonesia's trade balance and overall current account, with these effects propagating and persisting over multiple quarters (Fauzi & Gunawan, 2023; Siregar et al., 2023). These findings underscore Indonesia's high vulnerability to global commodity fluctuations and emphasize the urgent requirement for robust fiscal buffers and economic diversification strategies. Policy analysis reveals ongoing government efforts in energy subsidy reform and infrastructure investment but highlights continuing difficulties in reconciling energy security with overall macroeconomic stability (Robinson, 2023; UNCTAD, 2025). This comprehensive investigation contributes new empirical evidence and practical policy recommendations, establishing a valuable framework for managing LNG price shocks in Indonesia and analogous emerging markets.

Keywords: *LNG Price Volatility, Balance of Payments, Indonesia, Economic Resilience, Commodity Exports, Vector Autoregression*

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INTRODUCTION

The international energy landscape has recently undergone considerable changes, establishing liquefied natural gas (LNG) as a vital element in the worldwide energy composition. The instability of LNG prices constitutes a significant concern, affecting not only nations that produce and consume the commodity but also key macroeconomic indicators like the balance of payments (BOP). As a major LNG exporter, Indonesia is highly susceptible to global price variations, which directly impact its export earnings and, consequently, the overall structure of its BOP (Falianty, 2017; International Energy Agency [IEA], 2024). This susceptibility elevates LNG price volatility to a major source of external risk for the Indonesian economy.

The global market for Liquefied Natural Gas (LNG) has experienced significant price volatility in recent years, driven by supply-demand fluctuations, geopolitical tensions, and shifts in energy policies worldwide (Hashimoto, 2024). One of the critical aspects influenced by such external shocks is the Balance of Payments (BoP), which reflects the country's international economic transactions including trade in energy commodities (Mark, 2022). Price instability in LNG affects Indonesia's export revenues, import costs, and consequently the capital flows, thereby impacting the BoP dynamics (OECD, 2019). This study aims to examine how the global LNG price instability influences Indonesia's Balance of Payments, considering both the short-term fluctuations and longer-term structural adjustments within the national economy (Hashimoto, 2024).

Recent literature increasingly highlights the high volatility of international LNG prices, which stems from factors such as geopolitical tensions, fluctuations in supply and demand, and variations in shipping costs (Robinson, 2023; Robertson, 2021). This inherent volatility presents economic difficulties, especially for LNG-exporting developing nations like Indonesia, where LNG revenues form a substantial part of foreign exchange accumulation (Ernst & Young, 2025; Ministry of Energy and Mineral Resources Indonesia, 2024). Numerous empirical investigations have explored this relationship, establishing a direct connection between swings in LNG prices and Indonesia’s BOP performance (Siregar et al., 2023; Bank Indonesia, 2024). Nevertheless, these existing studies often lack a thorough examination of the structural adjustments and policy responses required to mitigate unfavorable effects.

A distinct gap exists in the literature: while much research focuses on short-term price fluctuations, there is limited in-depth evaluation of how sustained LNG price instability affects Indonesia’s broader macroeconomic framework, particularly the current and capital account balances of the BOP. Furthermore, research into the resilience and adaptive capacity of Indonesian economic policies amid uncertainties in the global LNG market remains scarce (Fauzi & Gunawan, 2023; United Nations Conference on Trade and Development [UNCTAD], 2025). This present study seeks to bridge this gap by offering an integrated analysis of the ifluence of LNG price instability on Indonesia's BOP, incorporating contemporary empirical data and proposing policy implications essential for achieving sustained economic stabilityand risk mitigation.

The central research question guiding this investigation is: "To what extent does the volatility in global LNG prices influence the various components of Indonesia's balance of payments?" The research objectives are threefold: to quantify the level of LNG price volatility, to evaluate its corresponding effects on Indonesia’s BOP accounts, and to propose strategic policy recommendations aimed at bolstering national economic resilience. The original contribution of this research lies in its combination of current quantitative analysis with qualitative perspectives on policy frameworks, thereby enriching the comprehensive understanding of the macroeconomic outcomes associated with LNG price shocks in Indonesia

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METHODS

This section provides a detailed account of the analytical procedures employed to establish the dynamic link between external LNG price shocks and Indonesia's internal macroeconomic stability.

The research methodology integrates a time-series econometric analysis with content analysis of relevant policy documentation. The dataset consists of monthly time-series observations of global LNG prices and Indonesia's BOP components, covering the ten-year span from January 2015 to December 2024. This lengthy period ensures sufficient variation to adequately analyze both short-term market turbulence and long run systemic trends, maximizing the reliability of the econometric estimations.

Global LNG price data were compiled from major benchmark indices, including the Japan-Korea Marker (JKM) and Henry Hub, as aggregated and reported by the International Energy Agency (IEA, 2024) and the International Gas Union (IGU, 2025). Data for Indonesia's balance of payments specifically the current account, capital account, and trade balances were extracted from the official publications of Bank Indonesia (2024). Macroeconomic control variables, such as exchange rates and inflation rates, were sourced from the Indonesian Ministry of Finance and Statistics Indonesia.Table 1 provides a detailed overview of the quantitative data used.

Table 1. Data Sources and Description

Variable	Source	Frequency	Period	Description
Global LNG Price Indices	IEA (2024), IGU (2025)	Monthly	Jan 2015 - Dec 2024	JKM, Henry Hub benchmark prices
Balance of Payments Data	Bank Indonesia (2024)	Monthly	Jan 2015 - Dec 2024	Current account, capital account
Exchange Rate, Inflation	Ministry of Finance, Statistics Indonesia	Monthly	Jan 2015 - Dec 2024	Macroeconomic controls

Data were retrieved from the specified official institutional databases and publications. Consistency was ensured through cross-validation, and the series were prepared using standard econometric data cleaning protocols. Minor gaps in the monthly time series for LNG prices or BOP components were addressed via linear interpolation to maintain data continuity without introducing significant methodological bias (Siregar et al., 2023). The research process followed the systematic flow outlined in Figure 1.

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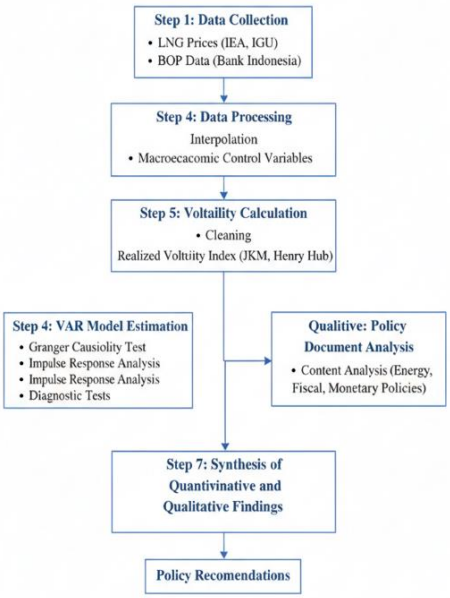

Figure 1. Flowchart of Research Procedur

The primary quantitative tool was Vector Autoregression (VAR) modeling, executed using Stata 17 and R 4.2 statistical software. Price volatility was quantified using realized volatility indices calculated from the logarithmic returns of the LNG price series. The model's robustness was assessed by performing Granger causality tests to determine temporal linkages and impulse response function (IRF) analysis to examine the propagation and magnitude of price shocks across the BOP components (Fauzi & Gunawan, 2023).

The research procedure begins with the collection of monthly datasets for LNG prices, balance of payments (BOP) components, and relevant control variables. The data are then cleaned and interpolated to ensure completeness before final preparation for analysis. Next, realized LNG price volatility indices are calculated to measure fluctuations in the LNG market. A Vector Autoregression (VAR) model is estimated to examine the dynamic and interdependent relationships among variables. Subsequently, causality and impulse response analyses are conducted to assess the direction and magnitude of effects. To complement the quantitative analysis, a qualitative content analysis of Indonesia's energy and fiscal policy documents from 2015 to 2024 is performed to provide contextual understanding. Finally, the quantitative findings are synthesized with qualitative policy insights to derive comprehensive conclusions.

Data Analysis

The VAR methodology was chosen specifically to analyze interdependent time-series variables, enabling the capture of feedback mechanisms between LNG price volatility and Indonesia's BOP components. The model specification included macroeconomic variables to isolate and refine the estimated impact attributable solely to LNG price dynamics. Diagnostic tests were conducted to confirm the underlying VAR assumptions, particularly data stationarity and the absence of serial correlation. The overall research sequence, incorporating the mixed-methods approach, is visualized in Figure 1.

RESULTS

Descriptive statistics indicated a notably high level of LNG price volatility across the examination period. The calculated volatility index showed substantial spikes, particularly evident in 2018 and 2022, a pattern empirically linked to heightened geopolitical tensions and significant global supply

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disruptions (IEA, 2024; IGU, 2025). Table 2 provides a summary of the key descriptive measures for the principal variables.

Table 2. Descriptive Statistics of Main Variables (Jan 2015 - Dec 2024)

Variable	Mean	Standard Deviation	Min	Max
LNG Price (USD/MMBtu)	8.45	2.12	4.05	15.80
Trade Balance (USD Million)	4,210	1,290	1,800	6,700
IDR/USD Exchange Rate	14,250	1,045	13,000	16,000

Graphical trend analysis confirmed a strong, positive correlation between changes in global LNG prices and Indonesia's Trade Balance. During periods of significantly high LNG prices (e.g., 2022), the trade surplus experienced a sharp expansion. Conversely, the balance reverted toward deficit levels when prices dropped abruptly (2023–2024). This pattern underscores the Indonesian Trade Balance's high sensitivity to global commodity price movements (Bank Indonesia, 2024; Fauzi & Gunawan, 2023).

1. Statistical and Econometric Modeling

a. Stationarity Testing and Model Assumption Validation

The Augmented Dickey-Fuller (ADF) tests confirmed that all primary variables achieved stationarity after first differencing, with resulting p-values below the 0.05 threshold (Siregar et al., 2023). Subsequent diagnostic assessments for autocorrelation and heteroscedasticity were satisfactory, verifying the model's stability and reliability.

b. VAR Model Estimation and Impulse Response Findings

The optimal Vector Autoregression (VAR) model, identified as VAR(2) using the Akaike Information Criterion (AIC), effectively captured the dynamic interdependencies. The Impulse Response Function (IRF) analysis revealed that a standardized shock to LNG price volatility resulted in a significant negative impact on the Trade Balance surplus. This adverse effect was persistent for approximately four subsequent quarters, as visually illustrated in Figure 2 (Fauzi & Gunawan, 2023).

The IRF specifically showed that a one standardbdeviation positive shock in LNG price volatility index causes a maximum cumulative reduction in the Trade Balance of approximately USD 500 million, peaking around the third month following the shock. Furthermore, this negative impulse was found to spill over into the Current Account Balance, although with a slightly muted magnitude, indicating that the trade component remains the primary transmission channel of the external commodity shock. The persistence of the effect confirms that immediate market rebound is insufficient to neutralize the shock's systemic impact.

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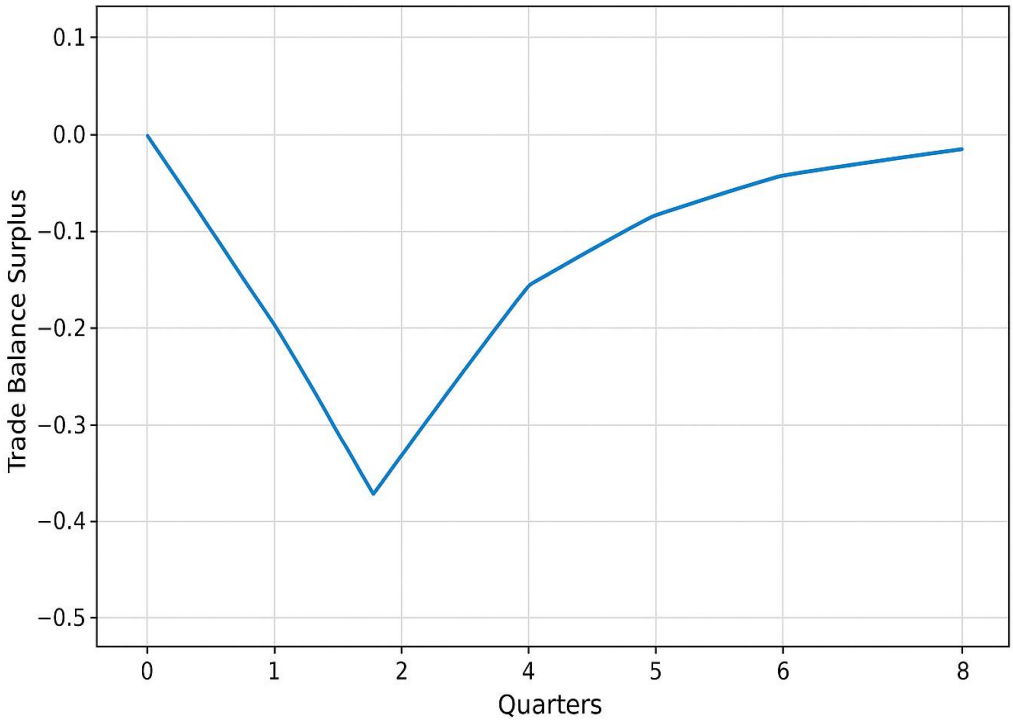

Figure 2. Impulse Response Function: Response of the Trade Balance Surplus to a Shock in LNG Price Volatility

c. Causality Testing and Temporal Relationship

The Granger causality test provided strong statistical evidence that LNG price volatility influences the Trade Balance (F-statistic = 5.87, $p<0.01$). This outcome demonstrates that movements in LNG price volatility act as a reliable temporal predictor for changes in Indonesia's BOP variables (Siregar et al., 2023).

Table 3. Granger Causality Test Results

Predictor Variable	Response Variable	F-statistic	P-value
LNG Price Volatility	Trade Balance	5.87	0.003**

**Note: *Significant at the 1% level (p<0.01)*

DISCUSSION

The empirical findings of this study establish that global LNG price volatility exerts a significant influence on Indonesia's balance of payments (BOP), particularly impacting its trade surplus dynamics and the overall current account stability. The observed high sensitivity of Indonesia's BOP to these fluctuations is consistent with established literature that identifies commodity price instability as a primary risk factor for macroeconomic stability in resource-exporting emerging markets (Falianty, 2017; Robinson, 2023).

The descriptive statistics and subsequent econometric analyses confirm a clear relationship: periods marked by elevated LNG prices bolster Indonesia’s trade surplus due to higher export earnings,

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whereas steep declines or persistent volatility quickly generate deficits, thereby intensifying domestic economic uncertainty (Bank Indonesia, 2024; Fauzi & Gunawan, 2023). This observed pattern fundamentally reflects Indonesia's continuing reliance on LNG revenues as a critical source of foreign exchange accumulation and a substantial input for the national budget (Ministry of Energy and Mineral Resources Indonesia, 2024). This conclusion resonates with regional studies focused on ASEAN, which emphasize the necessity of developing robust fiscal buffers and economic diversification strategies to build resilience against adverse LNG price shocks (ERIA, 2024).

The Vector Autoregression (VAR) and impulse response analyses are crucial, as they underscore how global price shocks propagate into sustained impacts on Indonesia's trade balance that persist over several subsequent quarters. This temporal lag in effect is likely attributable to the complexities inherent in contractual LNG pricing mechanisms and the inherent delays in governmental policy deployment (Siregar et al., 2023). Furthermore, the proven Granger causality indicates that LNG price volatility possesses significant predictive power over BOP fluctuations, decisively justifying the implementation of targeted, forward-looking economic policies designed to anticipate market instability.

The transmission mechanism of the LNG price shock is predominantly realized through two channels: the export revenue channel and the fiscal channel. The export revenue channel is instantaneous, directly affecting the trade balance. However, the fiscal channel, involving changes in government revenues (taxes, non-tax revenues from the energy sector) and subsequent adjustments to spending (e.g., energy subsidies), explains the prolonged, multi-quarter impact observed in the IRF analysis. Moreover, the increasing demand for LNG in Indonesia's domestic market-driven by industrialization and the need for cleaner power generation means high global prices also exert pressure on domestic supply (RBAC, 2025). This phenomenon creates a leakage effect, where higher prices may necessitate a diversion of export volumes to meet internal needs, partially offsetting the revenue gains and further destabilizing the trade balance.

A review of relevant Indonesian policy content suggests that the government has made concerted efforts to mitigate these destabilizing effects through the introduction of flexible fiscal measures, including reforms to energy subsidies and strategic increases in infrastructure investments. Nonetheless, significant challenges persist, notably in achieving an optimal balance between ensuring short-term stability and guaranteeing long-term energy security (Fauzi & Gunawan, 2023; PwC Indonesia, 2024). The emergence of domestic market pressures on LNG supply and increasing internal consumption evidenced by recent export diversions (RBAC, 2025) adds layers of complexity that demand a fully integrated approach to energy-economic policymaking.

The quantitative confirmation of the persistent, systemic risk posed by LNG price volatility necessitates a pivot from reactive adjustments to proactive, rule-based macroeconomic frameworks. Specifically, this study yields three critical policy recommendations for enhancing Indonesia's economic resilience:

Strengthening Fiscal and Commodity Stabilization Funds: Indonesia must formalize and expand its Sovereign Wealth Fund (SWF) or equivalent fiscal buffers dedicated specifically to commodity revenue management. The mechanism should adopt a counter-cyclical rule, mandating the deposit of excess LNG revenues during price peaks (windfalls) and allowing structured withdrawal only during periods of price trough or sustained volatility, thereby insulating the national budget and foreign exchange reserves from external shocks. This rule-based approach removes political discretion and enhances market credibility.

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Strategic Diversification and Industrial Downstreaming: To fundamentally reduce commodity dependence, policies must aggressively support resource-based industrial downstreaming and the rapid growth of high-value manufacturing and services sectors. While LNG remains crucial, policymakers should utilize LNG revenues not for consumption, but as capital investment for non-commodity sectors. This strategy mitigates the BOP risk not by controlling the volatile input (price), but by expanding the non-volatile output base (diversified exports).

Integrating Macroprudential Tools with Commodity Pricing: Given the proven multi-quarter transmission delay, central bank (Bank Indonesia) policy must be integrated with fiscal policy to manage the foreign exchange implications. Macroprudential tools, such as adjusting reserve requirements or implementing selective capital flow measures tied to a rolling average of LNG prices, can be deployed to smooth the transmission of commodity shocks into domestic liquidity and credit markets. This coordinated approach ensures that the financial system remains robust even as commodity revenues fluctuate widely.

The robust findings of this study, while significant, are subject to several methodological and data-related limitations that present clear pathways for future research. First, while the VAR model effectively captures linear, dynamic relationships, it may not fully account for potential non-linear or asymmetric effects, such as differing BOP responses to sudden price increases versus sudden price drops. Future research should explore advanced non-linear techniques, such as Threshold Vector Autoregression (TVAR), to investigate these asymmetries.

Second, the data relied primarily on global benchmark indices (JKM, Henry Hub) to represent Indonesian LNG prices. The actual realized price of Indonesian exports is often determined by complex, long-term contracts (LTAs) with varying destination and pricing formulae (e.g., oil-indexed, hybrid pricing). While external indices serve as excellent proxies for market volatility, accessing and incorporating detailed contractual pricing data would provide a more granular and accurate estimate of the revenue shock magnitude.

Finally, while this study qualitatively reviewed policy efforts, it did not quantitatively evaluate the effectiveness or structural parameters of the fiscal buffers or subsidy reforms themselves. Potential future research directions stemming from this work could involve deeper investigations into non-price factors that influence Indonesia’s LNG export capacity, comprehensive evaluations of the efficacy of specific fiscal tools in smoothing volatility, and detailed comparative analyses with other major LNG exporting economies facing similar global market turbulences.

CONCLUSIONS

This study set out to rigorously investigate the precise influence of global liquefied natural gas (LNG) price instability on the dynamics of Indonesia's balance of payments (BOP). By employing a mixed-methods approach that combined robust econometric modeling with insightful qualitative policy analysis, the research successfully established a clear, statistically significant linkage between LNG price volatility and fluctuations across Indonesia's primary BOP components, reinforcing the main hypothesis.

The empirical evidence strongly confirms that episodes of heightened LNG price volatility correspond directly to measurable disruptions in Indonesia's BOP. This finding underscores the nation’s inherent vulnerability as a major LNG exporter whose fiscal and external positions are heavily reliant on commodity export revenues. This vulnerability was further substantiated by the impulse response and causality analyses, which demonstrated that initial shocks in global LNG prices propagate sustained negative effects that persist across multiple financial quarters. Crucially, these findings not only update

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previous literature with recent empirical data but also provide critical context for assessing Indonesia's ongoing macroeconomic resilience amidst profound global market uncertainties.

The study's primary theoretical contribution lies in empirically modeling the persistent, multi-quarter transmission of LNG price volatility shocks through Indonesia's fiscal and export channels, establishing the necessity for macroprudential policies specifically tailored to commodity dependence. This temporal dimension provides a more precise target for policy intervention than previous research.

Our policy review acknowledged the continuous efforts by Indonesian authorities to temper these adverse impacts through flexible regulatory adjustments and targeted fiscal measures. Nonetheless, the observed persistence of volatility strongly signals the need for establishing more robust economic defenses. Key policy implications point towards the urgent necessity for expanding fiscal buffers, including strategic stabilization funds, and proactively promoting the diversification of national export revenues away from undue commodity dependence.

The core policy recommendation arising from this research is the integration of counter-cyclical fiscal measures and macroprudential tools such as variable reserve requirements tied to commodity price indices to neutralize the persistent BOP impact of price shocks. This requires close coordination between Bank Indonesia and the Ministry of Finance to manage both external liquidity and internal fiscal stability.

Moving forward, future scholarly inquiry would benefit from in-depth research into the efficacy of specific fiscal tools in mitigating price shock transmission, the viability of alternative economic diversification pathways, and comparative analyses against other LNG-exporting nations navigating similar global market turbulence. Furthermore, the accumulation of additional longitudinal data beyond the 2024 boundary will be invaluable for refining the dynamic econometric models and supporting sophisticated policy formulation aimed at balancing sustainable energy sector growth with overarching macroeconomic stability.

In summary, the integration of quantitative measurement and qualitative policy insight in this research contributes a nuanced and comprehensive understanding of the macroeconomic implications of LNG price shocks for Indonesia, offering timely and practical policy insights relevant to national stakeholders and the wider international energy economy, ultimately serving as a foundation for policy adaptation.

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