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Quantitative Easing and Economic Stability: Adaptive Strategies in Indonesia's New Trinity Framework

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Abstract:

This study investigates how Quantitative Easing (QE), as an unconventional monetary policy, affects Indonesia's macroeconomic stability amidst increasing global volatility. While QE is intended to stimulate liquidity and economic recovery, its implementation in emerging economies like Indonesia faces structural constraints involving inflation control, exchange rate management, and monetary policy independence. Using 64 quarterly observations from 2007 to 2023, this quantitative research applies nonlinear econometric models including Threshold Vector Autoregression (TVAR), Bayesian Vector Autoregression (BVAR), and Time-Varying Parameter Vector Autoregression (TVP-VAR) to capture regime-dependent and time-varying policy dynamics. The analysis focuses on Indonesia's macro-financial variables, including policy interest rate, inflation, GDP growth, REER, stock market index (IHSG), and government bonds (SUN). The study adopts the "new monetary trinity" framework, integrating financial stability alongside exchange rate and monetary autonomy. The main findings highlight nonlinear and time-varying relationships among variables: in low-volatility regimes, QE supports inflation control and bond stability, while in high-volatility regimes, it intensifies pressure on GDP and erodes monetary independence. The burden-sharing mechanism between the central bank and the government proves critical in sustaining liquidity and investor confidence. These insights underscore the need for adaptive, well-coordinated fiscal-monetary strategies to enhance resilience in Indonesia and other emerging markets.

Keywords: *Quantitative Easing, Monetary Trinity, TVP-VAR, Economic Stability, Adaptive Monetary Policy*

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1. Introduction

The 2008–2009 global financial crisis marked a turning point in global monetary policy, prompting central banks in advanced economies to adopt Quantitative Easing (QE) as an unconventional measure to inject liquidity, suppress interest rates, and stimulate growth through large-scale asset purchases (Basri & Sumartono, 2023; Beutel et al., 2023a). Although initially designed for developed markets, QE has also produced short-term spillover benefits for developing countries by strengthening

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exchange rates, reducing domestic interest rates, and stimulating investment and consumption (Fofack et al., 2019; Poutachidou & Papadamou, 2021). However, over time, these benefits are often offset by unintended consequences, such as inflationary pressures, depreciation of the real effective exchange rate (REER), and the erosion of monetary policy effectiveness due to increasing dependence on foreign capital inflows (Grewal & Trivedi, 2021; Mulaahmetovic, 2022). These dynamics illustrate the structural vulnerabilities of emerging economies, including Indonesia, when exposed to externally driven monetary cycles. To address these risks, scholars and policymakers increasingly advocate for the integration of monetary and fiscal policies as a strategy to preserve macroeconomic stability and policy autonomy (Liu & Molise, 2020a; Taguchi & Ganbayar, 2020).

The impossible trinity framework, also known as the monetary policy trilemma, introduced by Mundell and Fleming (Fleming, 1962; Mundell *et al*., 1963)**,** remains a foundational principle in international macroeconomics. It posits that a country cannot simultaneously achieve three key policy objectives: independent monetary policy, free capital mobility, and exchange rate stability (Pantelopoulos, 2021). A trade-off is inevitable: countries that maintain exchange rate stability and capital openness must relinquish monetary autonomy, while those that choose to retain policy independence must tolerate exchange rate volatility. This constraint is particularly salient for developing economies like Indonesia, which often face heightened vulnerability in balancing these objectives, especially during periods of global financial turbulence. Maintaining a stable exchange rate can limit the flexibility of monetary policy, while high capital mobility increases exposure to external shocks and speculative flows. These structural tensions underscore the fragility of macroeconomic management in emerging markets and form the theoretical basis for evaluating the consequences of unconventional monetary interventions such as QE.

The growing integration of global financial systems following the 2008 Global Financial Crisis (GFC) has prompted a reassessment of the original impossible trinity framework. Scholars such as Blanchard have proposed the addition of a fourth dimension that emphasizes the critical role of financial stability, including fiscal coordination and macroprudential policy, in safeguarding against systemic risks (Aizenman, 2013; Liu & Molise, 2020b). This expanded formulation, often referred to as the new monetary trinity, recognizes that financial stability is not merely an outcome but a necessary condition for effective macroeconomic management in open economies. Liu and Molise (2020b) demonstrate that integrating monetary tools with macroprudential regulation enhances policy effectiveness, particularly in managing capital flow volatility and preventing asset price distortions. By incorporating this additional dimension, countries can respond more flexibly to external shocks without abandoning the core objectives of the trilemma. For developing countries like Indonesia, this approach is especially relevant as it offers a strategy to reinforce exchange rate and inflation stability while mitigating vulnerabilities associated with financial globalization.

Empirical evidence from Indonesia further illustrates the inherent tensions within the impossible trinity framework. Research by Basri and Sumartono (2023) shows that efforts to stabilize the exchange rate during periods of global uncertainty often come at the expense of monetary policy independence. Beutel et al. (2023b) support this view, finding that countries with fixed or tightly managed exchange rate regimes are more exposed to external shocks and frequently adjust domestic policies to absorb capital flow volatility. These trade-offs become especially pronounced during episodes of global financial instability, when external pressures intensify and the space for autonomous monetary responses narrows. For Indonesia, navigating these dilemmas has proven increasingly complex, underscoring the need for more flexible and adaptive policy frameworks that go beyond traditional trilemma logic.

The COVID-19 pandemic has intensified the complexity of implementing QE in developing economies, including Indonesia, by amplifying existing structural vulnerabilities. In particular, capital flow volatility, global demand contraction, and elevated uncertainty have further undermined macroeconomic stability. Akbar (2022) observed that although QE expanded banking system liquidity and total assets, it did not lead to a substantial increase in credit distribution, especially in the private banking sector. Similarly, Malliaropulos and Migiakis (2018) found that the yield-suppressing effect of QE in developing countries is relatively muted compared to advanced economies, reducing its overall transmission strength. Moreover, attempts to maintain exchange rate stability through direct intervention often constrain the central bank's flexibility, while increased liquidity injections may generate inflationary pressures that complicate monetary policy trade-offs. These findings suggest that conventional assumptions about QE's effectiveness may not fully apply in emerging market contexts, calling for a deeper empirical analysis that accounts for regime-specific and time-varying policy responses.

Although several studies have explored the implementation of Quantitative Easing (QE) in Indonesia (Basri & Sumartono, 2023; Beutel et al., 2023b), none have employed an integrated econometric approach combining Threshold Vector Autoregression (TVAR), Bayesian Vector Autoregression (BVAR), and Time-Varying Parameter Vector Autoregression (TVP-VAR) to capture regime-specific and time-varying policy effects within the framework of the new monetary trinity. This study addresses that methodological and conceptual gap by applying nonlinear models to assess the asymmetric impact of QE under conditions of high and low volatility. In doing so, it offers a more granular understanding of how QE interacts with macro-financial variables such as inflation, exchange rates, and government bonds in an emerging market context. Additionally, this study responds to recent policy developments, particularly Bank Indonesia's post-2023 forward guidance, which emphasizes the importance of fiscal-monetary coordination and dynamic bond issuance as tools for market stabilization during periods of uncertainty (Warjiwo, 2024). By aligning empirical strategy with current policy directions, the study ensures not only analytical rigor but also strong relevance to the evolving challenges faced by central banks in emerging economies.

To enhance conceptual clarity, Figure 1 illustrates the evolution from the original Impossible Trinity to the New Trinity framework, highlighting the added role of financial stability and the central transmission function of Quantitative Easing (QE) in reinforcing macroeconomic resilience.

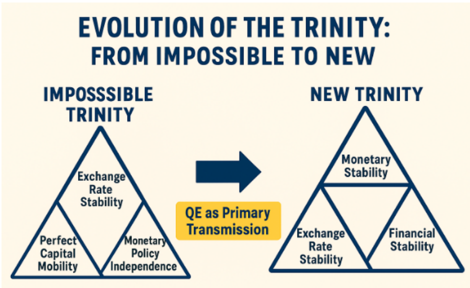

Figure 1. Evolution from Impossible Trinity to New Trinity Research-based Visualization

Note: QE as the Transmission Mechanism for the New Trinity
Quantitative Easing (QE) serves as the primary transmission mechanism linking the shift from the Impossible Trinity to the New Trinity. In a low-interest and high-volatility environment, QE:

- Stimulates monetary stability by injecting liquidity and guiding inflation expectations;
- Supports financial stability by maintaining asset prices and systemic liquidity;
- Enhances exchange rate stability and external competitiveness by managing capital flows and the real effective exchange rate (REER).

To empirically examine these dynamics, this study applies a multi-model nonlinear econometric strategy comprising Threshold Vector Autoregression (TVAR), Bayesian Vector Autoregression (BVAR), and Time-Varying Parameter Vector Autoregression (TVP-VAR). TVAR is employed to detect structural asymmetries across volatility regimes (Grewal & Trivedi, 2021), BVAR improves parameter estimation under uncertainty (Kuschnig & Vashold, 2021). and TVP-VAR captures the evolving nature of monetary transmission over time. Together, these models allow for a more comprehensive and flexible analysis of QE's macro-financial impact, particularly in the context of Indonesia's vulnerability to global shocks. By embedding the concept of the new monetary trinity into this methodological framework, the study offers a novel analytical lens for understanding adaptive monetary policy in emerging markets.

The novelty of this study lies in two key contributions to the literature on monetary policy in emerging markets. First, it incorporates the new monetary trinity framework by integrating financial stability with exchange rate management and monetary autonomy to analyze the adaptive role of QE in complex global environments. Second, it applies a combined nonlinear econometric approach using TVAR, BVAR, and TVP-VAR to capture both regime-specific and time-varying effects of QE, offering a more detailed understanding of how such unconventional policies operate under different macroeconomic conditions. This integrated approach enables a deeper examination of policy transmission dynamics over time and highlights structural asymmetries between high- and low-volatility regimes. As emphasized by Kostika and Laopodis (2022), time-varying modeling is essential for capturing evolving economic relationships, while the influence of QE on bond markets in emerging contexts is further supported by empirical evidence from Jiang et al. (2023).

The monetary trinity framework, which highlights the interaction among independent monetary policy, capital flow mobility, and exchange rate stability, offers a relevant analytical basis for formulating more adaptive and responsive policy strategies in the face of global economic challenges. This is particularly important for developing countries like Indonesia, where structural constraints and external shocks often force difficult trade-offs in policy design. The findings of this study are expected to inform the development of more integrated and flexible fiscal-monetary frameworks that can sustain macroeconomic resilience and long-term stability.

2. Theoretical Background

Quantitative Easing (QE): Quantitative Easing (QE) is an unconventional monetary policy used by central banks to increase market liquidity through the purchase of financial assets such as government and corporate bonds. This policy aims to stimulate investment and consumption by expanding the money supply, which is expected to drive economic growth (Meszaros & Olson, 2019). The mechanism of QE works by raising bond prices and lowering yields, encouraging investors to shift toward higher-yielding assets (Poutachidou & Papadamou, 2021).

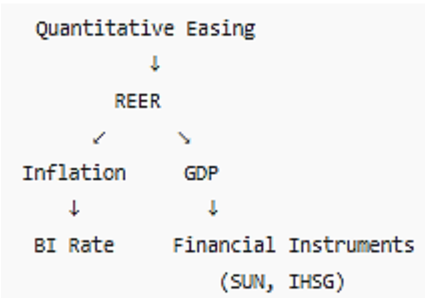

Figure 2. Transmission Mechanism of QE in the Indonesian Economy

Monetary Trinity: The Monetary Trinity is the inverse of the Impossible Trinity, which states that a country cannot simultaneously achieve exchange rate stability, independent monetary policy, and full capital mobility. This model forms the foundation of open economy macroeconomic analysis, first introduced by Mundell et al. (1963) and Fleming (1962). The Mundell-Fleming model highlights the interaction between monetary policy, fiscal policy, and exchange rates in the context of international capital flows. Under a fixed exchange rate regime, maintaining exchange rate stability often requires central banks to sacrifice monetary policy independence in order to sustain balance of payments equilibrium. Conversely, under a flexible exchange rate regime, a country may retain independent monetary policy, but at the cost of higher exchange rate volatility. This is particularly relevant for developing countries like Indonesia, where the implementation of QE heightens the challenges of prioritizing between exchange rate stability, inflation control, or monetary policy independence (Zakaria et al., 2023)**.**

The implications of this model are significant for understanding the impact of capital flows on economic stability. Large capital inflows can lead to currency appreciation, reducing export competitiveness and triggering structural imbalances in the economy. In this context, macroprudential policies such as capital flow management and exchange rate interventions become essential tools for safeguarding domestic economic stability amid rising external pressures (J. Forbes, 2021).

Although the Mundell-Fleming model provides a comprehensive analytical framework, its main limitation lies in focusing on short-term relationships while overlooking long-term structural dynamics, such as labor market developments and political stability. Therefore, the application of this model must be adapted to the specific context of each country, especially developing nations that face unique challenges in managing open economy policies (Radović-Marković et al., 2022).

Compared to Malaysia and the Philippines, Indonesia's experience with QE differs in structural terms. Unlike Malaysia's reliance on managed floats and higher capital openness, which enables more flexible responses to external shocks (Song & Lim, 2024; Thorbecke, 2024), Indonesia's QE is constrained by limited fiscal absorption (Mulyono, 2023), the complexity of a dual banking system (Karunia, 2025; Saputra, 2024), and a relatively shallow government bond market (Sihombing et al., 2023). These structural constraints make Indonesia more vulnerable to QE-related external shocks and necessitate stronger macroprudential coordination to maintain financial stability (Nasution, 2024).

Spillover Effect: Monetary policies in advanced economies, such as Quantitative Easing (QE), often generate significant spillover effects on developing countries. Low interest rates in advanced economies encourage capital inflows into emerging markets, which can increase liquidity but also trigger exchange rate volatility and inflationary pressures (Gamboa-Estrada, 2020; Shahmi et al., 2023). The appreciation of local currencies may reduce export competitiveness, while sudden capital outflows can lead to economic instability (Yalla et al., 2020).

Moreover, spillover effects undermine the monetary policy independence of developing countries, forcing central banks to adjust interest rates to maintain exchange rate stability (Grewal & Trivedi, 2021). To manage these impacts, macroprudential policies and tools such as connectedness indices are essential for developing countries to safeguard domestic economic stability amid global pressures (Diebold & Yilmaz, 2014)

Non-Linear Models in Monetary Policy: Non-linear relationship models suggest that the impact of monetary policy, including Quantitative Easing (QE), on economic variables is not always linear, but highly dependent on market volatility levels. Under high volatility conditions, policy effects are often distorted by external factors such as capital flows and market expectations (Seiler, 2024)

The application of non-linear models helps explain how policy effects vary depending on economic conditions. For example, studies have shown that large capital inflows to developing countries may lead to excessive currency appreciation, reducing export competitiveness and increasing inflationary risks (Basri & Sumartono, 2023).

In developing countries, high market volatility often complicates monetary policy responses to economic shocks. The use of non-linear models enables policymakers to understand how policies can be adapted to cope with changing market dynamics, helping to mitigate inflation risks and maintain economic stability (Taguchi & Ganbayar, 2020). Through non-linear analysis, policymakers can design more responsive and context-sensitive strategies, particularly when facing unique challenges arising from global economic integration.

Table 1 Comparison of Nonlinear VAR Models in QE Analysis

Feature	TVAR	BVAR	TVP-VAR
Nonlinearity	Captures regime shifts via thresholds	Incorporates priors, assumes linearity	Allows time-varying dynamics
Suitable for Regime Analysis	Yes	No	Yes
Estimation Complexity	Moderate	Moderate	High
Policy Application	Distinguishes high/low volatility effects	Improves forecasting under uncertainty	Tracks evolving responses across time
Use in Study	Regime differentiation of QE impact	Complementary estimation under uncertainty	Dynamic evolution of policy effectiveness

Source: Processed by the author

Monetary and Fiscal Policy Coordination: Macroeconomic stability in developing countries heavily depends on effective coordination between monetary and fiscal policies. Expansionary fiscal policies—such as increased government spending or tax reductions—can enhance the effectiveness of monetary policy instruments like Quantitative Easing (QE) by boosting domestic demand and fostering broader economic stability (Blanchard & Perotti, 2002).

In the Indonesian context, appropriate fiscal policy can help address structural constraints such as shallow financial markets and reliance on foreign capital. Strengthening domestic demand through fiscal measures can mitigate the adverse effects of capital flow volatility and reinforce economic stability. However, such coordination often faces challenges like political uncertainty and bureaucratic complexity (Hafidh, 2021).

Amid global challenges such as fluctuating international capital flows, close coordination between the central bank and the government is crucial for maintaining exchange rate stability, controlling inflation, and supporting economic growth. Through integrated policy frameworks, Indonesia can better respond to external shocks and achieve sustainable economic growth (Sari et al., 2024; Taguchi & Ganbayar, 2020).

Referring to the impossible trinity framework, this study hypothesizes that QE significantly contributes to economic stability through distinct mechanisms under low- and high-volatility regimes. This approach aligns with the new trinity concept, which incorporates financial stability as an adaptive response to global complexity. The study analyzes the relationship between the monetary trinity—exchange rate stability, perfect capital mobility, and monetary policy independence—using TVAR, BVAR, and TVP-VAR approaches.

3. Methodology

Data Type and Sources

This study employs a quantitative research design using secondary time-series data spanning from 2007 to 2023. The key macroeconomic variables include the policy interest rate (BI rate), inflation (INF), real GDP growth (GDP), real effective exchange rate (REER), government securities (SUN), and capital flow volatility (IHSG). These variables are selected to reflect monetary transmission dynamics in Indonesia under different global volatility regimes. Data sources include the World Bank and OECD (for INF and BI rate), BIS (REER), Indonesian Ministry of Finance (SUN), Investing.com (IHSG), and Trading Economics (GDP).

Pre-Estimation and Diagnostic Testing

Time series modeling requires rigorous pre-estimation procedures to ensure data suitability for econometric analysis. As economic time series often display non-stationarity, the Augmented Dickey-Fuller (ADF) test is employed to detect the presence of unit roots in each variable. Only stationary variables are retained for further modeling to avoid spurious regressions.

To validate the reliability of the Vector Autoregression (VAR) estimations, a series of diagnostic checks are conducted. The Jarque–Bera test confirms that the residuals follow a normal distribution ($p > 0.05$) (Rajarathinam, 2024). The ARCH LM test indicates no presence of heteroskedasticity ($p > 0.05$) (Rahman et al., 2023), and Variance Inflation Factor (VIF) values for all regressors remain below the conventional threshold of 5, indicating no significant multicollinearity (Morales-Oñate & Morales Oñate, 2023). Collectively, these diagnostics confirm that the data meet the classical assumptions, providing a robust foundation for valid inference and further model estimation, including TVAR, BVAR, and TVP-VAR approaches.

Optimal Lag Selection
The selection of the optimal lag in the VAR model is conducted using AIC, HQ, SC, and FPE criteria, where the lag with the lowest value is considered optimal. According to Lütkepohl (1985), the HQ criterion is deemed more conservative in determining the optimal lag, especially for models with complex data structures

Threshold Vector Autoregression (TVAR)
The Threshold Vector Autoregression (TVAR) model extends the conventional VAR framework by accounting for nonlinear dynamics in time-series data. It captures asymmetric responses, regime shifts, and structural breaks that often occur in macroeconomic systems. Specifically, TVAR divides the endogenous variables into two or more regimes, each represented by a separate linear VAR system (Christopoulos et al., 2023).

The general form of the two-variable, two-regime TVAR model is:

$$Y_t = \begin{cases} C_1 + \sum_{j-1}^{p} A_{j,1}\, Y_{t-1} + \epsilon_{t,1}\,, & \text{if } \omega_{t-d} \leq \omega^* \\ C_2 + \sum_{j-1}^{p} A_{j,2}\, Y_{t-1} + \epsilon_{t,2}\,, & \text{if } \omega_{t-d} \leq \omega^* \end{cases} \qquad (1)$$

where (ω_t) is the threshold variable, (ω^*) is the threshold value, and $\epsilon_{t,1}$ represents the error term.

In this study, real GDP growth (GDP) is selected as the threshold variable, both theoretically and empirically. Theoretically, GDP acts as a proxy for macroeconomic cycles, distinguishing between expansionary and contractionary phases that directly influence the effectiveness of monetary policy transmission. Empirically, GDP yields the lowest Sum of Squared Residuals (SSR) during threshold searches, supporting its regime-defining role.

The threshold value (ω^*) is determined through a grid search procedure, which evaluates various candidate thresholds and selects the one minimizing forecasting errors. Additionally, bootstrapping techniques are used to test whether the nonlinear TVAR specification significantly outperforms a linear VAR alternative.

To assess dynamic responses within each regime, the model employs Impulse Response Functions (IRFs), which trace the effects of QE-related shocks on macroeconomic variables under different volatility conditions. This enables a more nuanced understanding of regime-dependent policy effectiveness.

Bayesian Vector Autoregression (BVAR)
Bayesian Vector Autoregression (BVAR) is used to analyze economic relationships by incorporating prior distributions and observed data through Bayes' theorem, resulting in a more accurate posterior distribution (Sobieraj & Metelski, 2021). This approach is based on Bayes' theorem, which states that for a parameter θ and a dataset y, the posterior distribution π (θ|y) is determined as follows:

$\pi\ (\theta|y) = \frac{\pi\ (\theta,y)}{\pi\ (y)} = \frac{f\ (y|\theta)\pi\ (\theta)}{f\ (y)}$ (2)

This equation reveals that the posterior distribution $(\pi\ (\theta|y)$ depends on the information contained in y , which is equal to the product of the likelihood function $f\ (y|\theta)$ and the prior distribution $(\pi\ (\theta))$, divided by the marginal probability density $f\ (y)$. Since the denominator $f\ (y)$ is independent of θ, it is often omitted, simplifying the equation to:

$\pi\ (\theta|y) \alpha\ f\ (y|\theta)\ \pi\ (\theta)$ (3)

Often,θ represents multiple parameters, each estimated through the model. The BVAR framework refines the estimation by integrating prior distributions, addressing the overfitting issue common in traditional VAR models, and improving predictive accuracy.

This approach improves predictive accuracy and avoids overfitting, a common issue in traditional VAR models. The selection of priors follows the Minnesota Prior framework, assuming tighter priors on longer lags and less restrictive assumptions on own-lag coefficients. This balances flexibility with parameter stability, especially useful in high-dimensional macroeconomic data.

Time Varying Parameter-Vector Autoregressive (TVP-VAR) Method

The Time-Varying Parameter Vector Autoregressive (TVP-VAR) model is widely used in modern macroeconometrics to evaluate how monetary policy, including Quantitative Easing (QE), influences economic stability over time. Unlike standard VAR models with constant coefficients, TVP-VAR allows the parameters to evolve dynamically, enabling the model to capture structural changes, crises, and shifting policy regimes with greater accuracy.

The general form of the TVP-VAR model is as follows (Hauzenberger et al., 2022) :

$$Y_t = X_t\beta_t + A_t^{-1}\Sigma_t\epsilon_t \quad (4)$$

Where:
Y_t is the k ×1 vector of endogenous variables at time t
X_t is the regressor matrix including lagged endogenous variables (Y_{t-1} , Y_{t-2} , …Y_{t-p})
β_t is the time-varying parameter vector
A_t is the contemporaneous structural matrix that changes over time
Σ_t is the covariance matrix of structural shocks that changes over time
ε_t is an independent disturbance vector with a standard normal distribution:$\varepsilon_t \sim N\,(0, I_k)$

Random Walk Assumption and Parameter Evolution

To capture structural shifts and evolving economic relationships, the TVP-VAR model employs random walk processes that govern both the evolution of coefficients and the variance of shocks. This feature enables the model to flexibly adapt to transitions triggered by crises, regime changes, or global financial turbulence, making it particularly effective for assessing the dynamic impacts of Quantitative Easing (QE).

The parameters evolve according to the following random walk specification :

$$\beta_{t+1} = \beta_t + U_{\beta,t}, \quad a_{t+1} = a_t + U_{a,t}, \quad h_{t+1} = h_t + U_{h,t} \qquad (5)$$

Where :

β_t is the time-varying vector of regression coefficients,

a_t captures contemporaneous relations between variables,

$U_{\beta,t}$, $U_{a,t}$, $U_{h,t}$, are independent stochastic disturbances with normal distributions, ensuring smooth temporal transitions

In terms of volatility, the log-variance of the structural shock components is also modeled as a random walk:

$$h_{jt+1} = h_{jt} + U_{h,t} \qquad (6)$$

Where :

$h_{jt} = log\, \sigma_{jt}^2$, and σ_{jt} denotes the standard deviation of the structural shock for variable *j* at time *t*,

This design allows the TVP-VAR framework to track how the effectiveness and transmission of QE evolve across different economic phases, providing deeper insights into the interplay between monetary interventions and macroeconomic stability over time.

Figure 3 below illustrates the overall econometric modeling workflow, which includes data preparation, diagnostic testing, and the application of nonlinear estimation techniques such as TVAR, BVAR, and TVP-VAR.

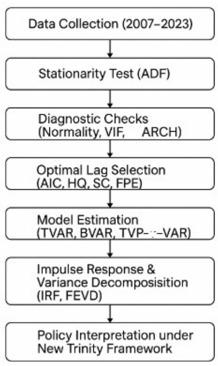

Figure 3. Econometric Modeling Workflow
Source: Author's elaboration

This modeling workflow reflects the sequential process followed in this study to assess the dynamic effects of QE on Indonesia's macroeconomic stability.

4. Empirical Findings/Result

Data Visualization

Time series data visualization provides insights into the trends and dynamics of macroeconomic variables over the study period. Figure 1 illustrates changes in the interest rate (BI), stock market index (IHSG), inflation (INF), Gross Domestic Product (GDP), real effective exchange rate (REER), and government bonds (SUN) from 2018 to 2023. Each variable reflects responses to monetary policy and global economic conditions, including the impact of the COVID-19 pandemic. This visualization is essential for understanding fluctuation patterns and inter-variable relationships prior to conducting further analysis.

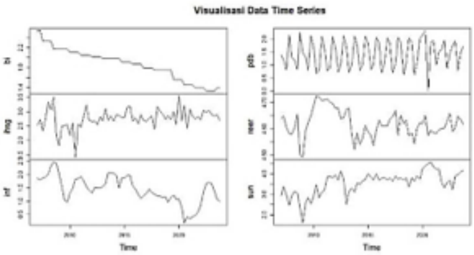

Figure 4. Data Visualization

Time series data visualization indicates that the interest rate (BI) exhibits a consistent downward trend, reflecting an accommodative monetary policy stance (https://www.bi.go.id, 2023). The Jakarta Composite Index (IHSG) shows significant fluctuations, with an early surge likely due to global financial turmoil (OJK, 2023a). Inflation (INF) is relatively volatile but declines toward the end of the period, indicating successful inflation control efforts (OJK, 2023b). Gross Domestic Product (GDP) demonstrates a strong cyclical pattern, with substantial fluctuations toward the end of the period due to the impact of COVID-19 (OJK, 2023b). The real effective exchange rate (REER) declined initially, followed by a partial recovery, signaling external pressure (Bank Indonesia, 2021). Government bonds (SUN) show a steady upward trend, reflecting increased issuance or growing demand for these instruments (Bank Indonesia, 2021)

Descriptive Statistics

The table below presents the descriptive statistics of the dataset used in the analysis. It includes the mean, standard deviation, median, range, skewness (distribution asymmetry), and kurtosis (distribution peakedness) for each variable. These statistics are essential for understanding the distribution characteristics, variability, and underlying patterns of the variables, which form the basis for subsequent modeling and analysis.

Table 2. Descriptive Statistics

Variabel	Mean	Std. Dev	Median	Range	Skewness	Kurtosis
BI	6.706	2.593	6.750	9.000	0.341	-1.111
IHSG	1.031	8.638	1.870	30.370	-0.312	-0.253
INF	4.707	2.580	4.350	10.700	0.889	0.238
PDB	1.237	2.741	1.640	9.240	-0.431	-0.882
REER	101.54	6.671	100.91	23.260	0.285	-1.138
SUN	39.7	21.601	40.37	92.380	0.379	-0.798

The descriptive statistics indicate substantial variation in certain variables, such as the IHSG and GDP, reflecting high volatility in the stock market and economic conditions. Meanwhile, variables like BI, INF, and REER exhibit more stable distributions.

The figure below presents boxplots for six main economic variables used in the analysis. These boxplots provide a visual overview of the data distribution, median values, interquartile ranges, and potential outliers for each variable. Boxplot analysis aids in identifying the stability and fluctuations of each variable, serving as a basis to evaluate the impact of Quantitative Easing policy on Indonesia's economic stability.

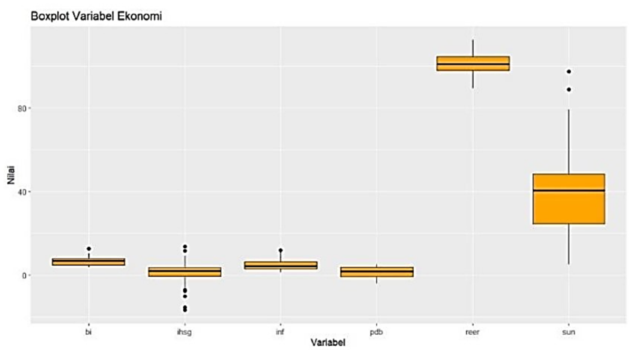

Figure 5. Boxplots of Variables

The boxplots show that the BI and REER variables have a narrow value range, reflecting high stability in policy interest rates and the real effective exchange rate, with symmetric distributions and few or no outliers. In contrast, IHSG, GDP, and SUN exhibit large fluctuations with wide value ranges, indicating high sensitivity to external changes. Outliers in the IHSG appear around values of -10, -5, and 0, reflecting significant stock market volatility and representing losses or declines in the stock index, which often occur during economic crises. Outliers in INF, around the value of 7, indicate inflation spikes caused by global economic shocks such as oil price increases or supply chain crises. Meanwhile, outliers in SUN near values of 90 and 95 reflect sharp increases in yields or the volume of government bond issuance, typically in response to urgent fiscal financing needs, for example during the pandemic. This information provides a crucial basis for further analysis using TVAR and BVAR models to understand the dynamic relationships among variables and the impact of economic policies.

The figure below presents the correlation matrix of the main economic variables used in the analysis. This matrix visually illustrates the strength and direction of relationships between variables such as policy interest rate (BI), inflation (INF), stock market volatility (IHSG), economic growth (GDP), real effective exchange rate (REER), and the bond market (SUN). Positive correlations are shown in blue, while negative correlations appear in red. The size of the circles reflects the strength of the correlation, where larger circles indicate stronger relationships, and more intense colors signify correlations closer to +1 (positive) or -1 (negative).

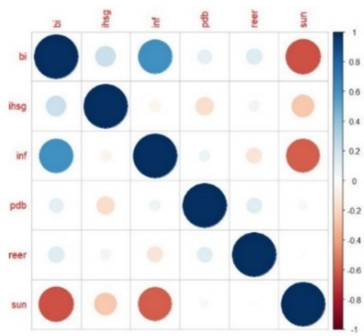

Figure 6 Correlation Plot

The correlation plot shows that the BI and INF variables have a strong positive correlation, indicating that increases in interest rates tend to be associated with rising inflation. Conversely, BI and SUN exhibit a significant negative correlation, reflecting that rising interest rates may have an inverse effect on the bond market. A strong positive relationship is also observed between REER and SUN, highlighting the close linkage between the real effective exchange rate and the bond market.

Some variables, such as GDP and IHSG, display weak correlations, suggesting insignificant or possibly indirect relationships. The information from this correlation matrix provides an important basis for evaluating interactions among variables in further analytical models like TVAR and BVAR, to better understand the impact of economic policies on macroeconomic stability

Stationarity Testing

Stationarity testing was conducted using the Augmented Dickey-Fuller (ADF) test to determine whether the variables contain a unit root. Stationarity is a crucial prerequisite before proceeding with time series analysis. The test results are compared with critical values at a specified significance level (5%). If the ADF test statistic is less than the critical value (i.e., more negative), the null hypothesis of a unit root is rejected, and the variable is considered stationary. The results indicate that some variables are stationary at levels, while others become stationary only after first differencing. The following table summarizes the test results before and after differencing.

Table 3. Stationarity Test Results

Variable	Statistics(ADF)	Critical Value (5%)	Conclusion	
BI	-8.068	-2.89	*Stationer*	*First Differencing*
IHSG	-7.461	-2.89	*Stationer*	*Level*
INF	-4.447	-2.89	*Stationer*	*First Differencing*
PDB	-13.487	-2.89	*Stationer*	*Level*
REER	-7.664	-2.89	*Stationer*	*Level*
SUN	-8.150	-2.89	*Stationer*	*First Differencing*

After conducting the Augmented Dickey-Fuller (ADF) test, the variables IHSG, GDP, and REER were found to be stationary at levels, as their ADF test statistics were smaller than the critical values at the 5% significance level. Meanwhile, the variables BI, INF, and SUN required first differencing to achieve stationarity, with their ADF test statistics after differencing also smaller than the critical values. Thus, all variables have met the stationarity requirement and are ready for further analysis.

Optimal Lag Selection

Selecting the optimal lag length in a VAR model is an important step to appropriately represent the dynamic relationships among variables. Lag selection criteria such as the Akaike Information Criterion (AIC), Hannan-Quinn Criterion (HQ), Schwarz Criterion (SC), and Forecast Prediction Error (FPE) are used to evaluate the model. The lag length that yields the lowest values for AIC, HQ, and FPE is typically considered the most optimal.

Table 4. Evaluation Results of AIC, HQ, SC, and FPE

Lag	AIC(n)	HQ(n)	SC(n)	FPE(n)
1	-2.124.903	-2.068.709	-1.982.027	5.943799×10^{-10}
2	-2.196.333	-2.091.974	-1.930.993	2.999931×10^{-10}
3	-2.208.283	-2.055.757	-1.820.477	2.883927×10^{-10}
4	-2.272.993	-2.072.302	-1.762.723	1.772720×10^{-10}
5	-2.296.519	-2.047.661	-1.663.784	1.861257×10^{-10}

Based on the evaluation results from the table above, the model with lag 5 shows the best AIC and FPE values, with an AIC of -2.296,519 and an FPE of 1.861257×10^{-10}, indicating optimal performance according to these information criteria. However, the HQ criterion favors lag 2, providing a better value of -2.091,974 compared to other lags, striking a balance between model complexity and data representation. Furthermore, according to Lütkepohl (1985), the HQ criterion is considered more conservative in determining the optimal lag, especially in models with complex data.

Table 5. Evaluation Results (Stability, Significance, and Autocorrelation)

Criteria	Lag 1	Lag 2	Lag 5
Stability	Stable	Stable	Stable
Polynomial Root (Max)	0.9718	0.9749	0.9915
Variable Significance	BI and INF	INF, BI, and GDP	Variables insignificant at lags 4 and 5
Residual Autocorrelation	Present (p = 3.405e-08)	Decreasing (p = 0.04746)	Further decreasing

This makes the selection of lag 2 more supportive of an accurate and stable model interpretation, considering the following: Variable Significance: At lag 2, more variables are significant compared to other lags. Residual Autocorrelation: Residual autocorrelation at lag 2 shows a significant improvement with p = 0.04746, approaching the significance threshold. Model Stability: The polynomial root at lag 2 remains below 1 (maximum 0.9749), ensuring the model's stability.

Threshold Vector Autoregression (TVAR) Model

Threshold Vector Autoregression (TVAR) analysis is conducted to identify transition points (thresholds) in the relationships among economic variables. TVAR allows the model to be divided into two regimes based on significant threshold values, enabling a more detailed analysis of the relationship patterns. For each variable in the model, evaluation is performed based on Log-Likelihood, Threshold value, and Sum of Squared Residuals (SSR). These metrics help determine the most efficient and optimal variable for regime separation while providing insights into model stability and fit.

Table 6. TVAR Results

Variable	Log-Likelihood	Threshold	SSR
BI	327.951	2.047693	1.330102
IHSG	321.934	2.609334	1.230785
INF	300.530	1.840550	1.405764
PDB	336.935	2.047.693	1.078015
REER	311.533	4.618777	1.466074
SUN	319.395	3.140107	1.260991

Based on the results above, the GDP variable demonstrates the best performance with the highest Log-Likelihood of 336.9350 and the lowest Sum of Squared Residuals (SSR) of 1.078015. This indicates that the TVAR model using GDP as the threshold variable is the most efficient in representing the data with the smallest residual error.

Meanwhile, the BI and IHSG variables also show relatively good results, with high Log-Likelihood values and lower SSR compared to other variables. On the other hand, the REER variable has the highest threshold value at 4.618777, but its relatively large SSR of 14.66074 indicates a higher level of residual error. GDP is selected as the optimal threshold variable in the TVAR model due to its superior statistical performance in maximizing Log-Likelihood and minimizing SSR. This analysis highlights the importance of selecting an appropriate threshold to better understand the dynamic relationships among variables in the TVAR model.

The following graph shows the threshold variable used in the TVAR analysis, with Gross Domestic Product (GDP) as the threshold variable. The red horizontal line represents the threshold value set in the model, which is 2.0477. The movement of this threshold variable is observed from the first quarter of 2007 through the fourth quarter of 2023 (quarterly data). This graph is used to distinguish two regimes, namely the upper regime and the lower regime, based on whether the threshold variable's value is above or below the threshold line.

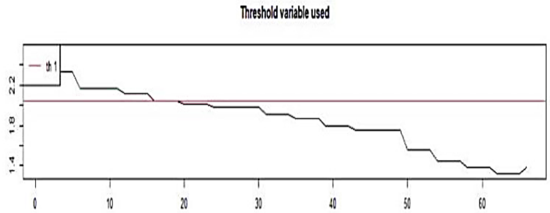

Figure 7. GDP Threshold Variable

In the graph above, the red horizontal line represents the threshold value of 2.0477, which serves as the boundary between the upper and lower regimes. At the beginning of the period, the threshold variable (GDP) is above the threshold line, indicating the system is in the upper regime, which corresponds to an economic expansion phase. However, over time, the threshold value gradually declines and predominantly moves below the threshold line. This shift reflects a transition to the lower regime, signaling economic pressure or slowdown. Overall, the graph shows that most of the analyzed period is dominated by the lower regime, depicting a less stable or decelerating economic condition. This change provides a clear illustration of the nonlinear dynamics of economic regimes and forms an important basis for understanding economic movements within the TVAR model framework.

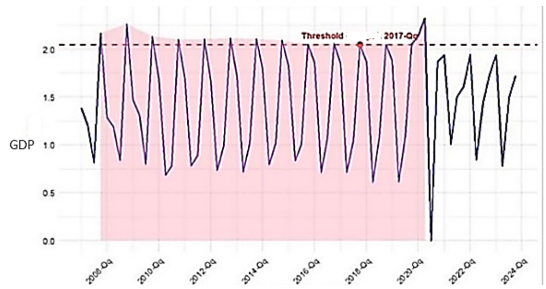

Figure 8. GDP Threshold Variable with Highlighted Area

The visualization of the GDP threshold with a highlighted area above depicts the development of GDP values from 2007-Q1 to 2023-Q4, with the red dashed horizontal line indicating the threshold value of 2.0477. The highlighted area (shaded in pink) marks the periods during which GDP values reached or exceeded this threshold.

The threshold was first reached in 2017-Q4, marked by a red dot and text annotation on the graph. After reaching this threshold, GDP values exhibited significant fluctuations with a recurring up-and-down pattern, but mostly hovered around the threshold.

Overall, the graph illustrates that: GDP experienced a consistent cyclical pattern throughout the observation period, reflecting economic cycles. The period of 2017-Q4 marks a critical point when GDP surpassed the threshold value. Following 2017-Q4, GDP temporarily fell below the threshold, especially between 2020-Q1 and 2021-Q4, likely influenced by external factors such as the COVID-19 pandemic. A recovery occurred in the subsequent years.

The following table presents the estimated coefficients from the Threshold Vector Autoregressive (TVAR) model for two regime conditions: the lower regime and the upper regime. The coefficients shown represent the influence of independent variables with certain lags on the dependent variable within each regime. Significance markers (***, **, *) indicate the confidence levels that these influences are statistically significant. Differences in coefficients between the two regimes illustrate the presence of nonlinearity in the dynamics of relationships among economic variables.

Table 7. TVAR Coefficients – Lower Regime

Equation	Intercept	bi -1	inf -1	reer -1	pdb -2
BI	-0.79615	0.77546 (***)	0.00976	0.08949	-0.00435
INF	490.817	0.30848	0.82954 (***)	-0.09322	-0.04261
PDB	431.142	-2.13194 (**)	-0.20231	-3.39395 (*)	-0.79680 (***)
REER	175.503	-0.18781	-0.01383	0.47029 (**)	-0.00003

The estimation results indicate that in the lower regime, the BI interest rate lagged by one period (BI-1) has a significant negative effect on GDP and REER, suggesting economic pressure when interest rates rise. Meanwhile, inflation lagged by one period (INF-1) exhibits a significant persistence effect, meaning current inflation is influenced by inflation in the previous period.

Table 8. TVAR Coefficients – Upper Regime

Equation	Intercept	bi -1	reer -1	pdb -2	reer -2
PDB	-7.906.098	-2.23236 (**)	3.76295 (*)	-0.55706 (***)	14.90658 (***)
REER	1.123.994	0.17877	-0.29061	0.01545	-108.628
SUN	-828.041	2.81924 (***)	335.517	-0.02195	-0.90218

In the upper regime, the negative impact of BI on GDP becomes increasingly significant, while REER and SUN exhibit stronger influences with significant positive and negative coefficients. This indicates that the relationships among economic variables become more complex in this regime. Overall, the differences in coefficients between the two regimes confirm a shift in the pattern of interactions among variables influenced by the threshold condition. The Threshold Vector Autoregression (TVAR) results identify two regimes separated by a threshold of 2.047693, with 80.3% of observations in the lower regime and 19.7% in the upper regime.

In the upper regime, the lag-1 GDP coefficient is significantly negative but positive at lag 2, whereas SUN lag 1 shows a stronger significant positive effect. REER lag 2 exhibits a significant negative influence, reflecting high volatility in this regime. In the lower regime, lag-1 GDP is significantly negative and positive at lag 2, while SUN lag 1 and REER lag 1 both show significant positive effects. The differences in coefficients across regimes indicate that relationships among variables are more complex and significant in the upper regime, reflecting a more volatile economic condition compared to the relatively stable lower regime.

Model Evaluation

The Durbin-Watson test is used to identify the presence of residual autocorrelation in the estimated TVAR model. Autocorrelation occurs when the residuals (errors) from one period are correlated with those of another period, which can compromise the validity of the model. The Durbin-Watson (DW) statistic ranges from 0 to 4, with the following interpretation: values close to 2 indicate no autocorrelation, values below 2 suggest positive autocorrelation, and values above 2 indicate negative autocorrelation. The table below presents the Durbin-Watson test results for each variable in the TVAR model, along with their p-values.

Table 9. Durbin-Watson Test Results

Variable	DW	p-value	Interpretation
BI	1.7563	0.1592	No significant autocorrelation. Residuals are good.
IHSG	2.0754	0.6209	No significant autocorrelation. Residuals are good.
INF	2.1186	0.6859	No significant autocorrelation. Residuals are good.
GDP	2.9160	10.000	No significant autocorrelation (tends to negative). Residuals are good.
REER	2.1054	0.6664	No significant autocorrelation. Residuals are good.
SUN	2.2057	0.7999	No significant autocorrelation. Residuals are good.

Based on the Durbin-Watson test results presented above, all variables (BI, IHSG, INF, GDP, REER, and SUN) have DW values close to 2 and p-values greater than 0.05. This indicates that there is no significant autocorrelation in the residuals for any of the variables in the TVAR model. Therefore, the residuals are random and free from systematic patterns that could compromise the quality of the model. This suggests that the TVAR model has been well estimated and can be reliably used for further analysis, such as Impulse Response Function (IRF) or shock analysis on the related economic variables.

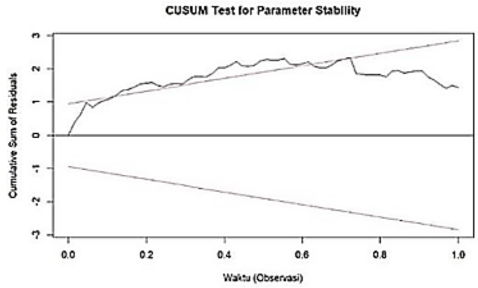

Figure 9. CUSUM Test

The figure above shows the results of the CUSUM test used to assess the stability of the model parameters. The plot displays the cumulative sum of residuals (black line) and the critical boundaries (red lines) around the zero axis. In this test, the cumulative residual line remains within the critical boundaries for most of the observation period. However, at several points around 0.6 to 0.8 of the observation time, there is an indication of an increase approaching the upper boundary, though it subsequently returns and stabilizes within the critical range.

These CUSUM test results indicate that the model parameters remain overall stable, as the residual line does not cross the critical boundaries. Although there are slight fluctuations nearing the upper boundary at certain periods, these are not significant enough to conclude parameter instability. Therefore, the model can be considered to have stable parameters throughout the observed period.

Impulse Response Function (IRF) Analysis

The Impulse Response Function (IRF) is an analytical tool used to observe how economic variables respond to shocks from other variables within the Threshold Vector Autoregression (TVAR) model. This analysis is crucial for understanding how the dynamics among variables evolve over time. The figure below illustrates the responses of each variable (BI, INF, REER, IHSG, GDP, and SUN) to shocks over the next 10 quarters.

Impulse Response Function (IRF) – High Regime

The graph below presents the Impulse Response Function (IRF) for the analyzed variables. The IRF depicts each variable's response to a shock originating from a specific variable within the TVAR framework. This visualization aids in understanding the dynamics among variables over a specific period following a shock. It shows the IRF for both high and low regimes of six variables within the Monetary Trinity framework: economic stability, financial stability, and monetary policy independence. This analysis aims to comprehend the dynamics of each category in response to shocks and the interactions among categories, identifying whether harmony or dilemmas exist.

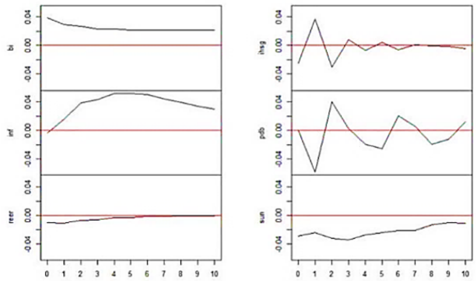

Figure 10. Impulse Response Function (IRF) – High Regime

Figure 1 shows that a 1% positive shock to the BI rate causes GDP to decrease by approximately 0.2% within 3 quarters, indicating contractionary effects under tight monetary conditions. Inflation initially spikes before gradually declining after the fourth quarter, while REER appreciates moderately. SUN rises, reflecting increased investor confidence in government securities, while IHSG displays high early volatility before stabilizing.

The negative BI response in the upper regime implies constrained monetary flexibility. High volatility and inflation pressure reduce the central bank's room to maneuver, as interest rate hikes further suppress growth. This aligns with the trilemma theory, where maintaining exchange rate stability under open capital flows limits independent monetary action.

In the economic stability category, inflation (INF) experiences a sharp increase until the 4th period before declining, while GDP exhibits a fluctuating pattern with gradual recovery. This indicates significant pressure from inflation on the economy, whereas GDP attempts to stabilize despite the shock.

In the financial stability category, the IHSG fluctuates sharply in the early periods but tends to stabilize near zero, while the REER shows a small but steady increase. REER contributes positively to financial stability, while IHSG volatility begins to subside.

In the monetary policy independence category, BI responds consistently negatively, indicating pressure on monetary policy. Conversely, SUN increases steadily after minor early fluctuations, reflecting a positive role in supporting monetary policy independence in the long term.

In the high regime, economic stability remains pressured by inflation, although GDP shows signs of recovery. Financial stability is relatively stable with positive contributions from REER and controlled IHSG. Regarding monetary policy independence, SUN supports stability while BI faces pressure that could potentially reduce independence. Overall, financial stability plays a dominant role in maintaining the harmony of the Monetary Trinity, despite ongoing challenges from inflation and BI policy pressures.

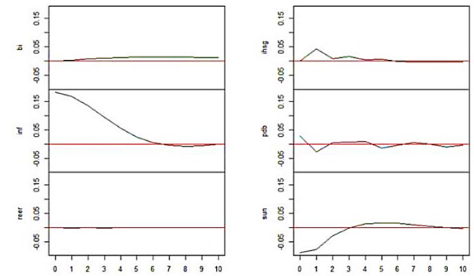

Figure 11. Impulse Response Function (IRF) – Low Regime

Figure 2 indicates that inflation shocks are short-lived and dissipate by the 6th quarter. GDP remains resilient, fluctuating slightly before returning to equilibrium. REER and IHSG show mild responses, while SUN exhibits steady upward trends after initial volatility. BI rate shows almost no reaction, suggesting stable policy expectations in the low-volatility environment.
In the low-volatility regime, policy tools are more effective, and inflation is more manageable. Monetary policy independence is preserved, as shown by the stable BI rate, and fiscal instruments like SUN play a stronger role in absorbing shocks.

The economic variables' responses to shocks are depicted in the figure above, showing the Impulse Response Function (IRF) in the low regime. In the economic stability category, inflation (INF) shows a significant positive response at the beginning of the period but sharply declines to zero by the 7th period, indicating that the shock effect dissipates over time. GDP remains relatively stable with minor fluctuations, demonstrating economic resilience to shocks.

In the financial stability category, the IHSG exhibits small fluctuations early in the period before stabilizing near zero, while REER displays a relatively flat response and does not contribute significantly. This confirms that financial stability in the low regime is minimally affected by occurring shocks.

In the monetary policy independence category, SUN experiences a significant increase until the 4th period before leveling off, indicating a positive role in supporting monetary policy. On the other hand, BI shows a flat response around zero, signaling minimal pressure on monetary policy independence in this regime.

In the low regime, economic stability is influenced by diminishing inflation pressure over time, while GDP remains stable. Financial stability shows minimal contributions from IHSG and REER, with small fluctuations. Regarding monetary policy independence, SUN provides a significant positive contribution, while BI remains stable. Overall, in the low regime, pressures on economic and financial stability tend to be more controlled, with SUN playing a dominant role in supporting monetary policy independence.

Table 10. Impulse Response Summary – High vs. Low Volatility Regimes

Variable	Direction of Shock	Response in High Regime	Response in Low Regime
BI	1%	GDP ↓, INF ↑ then ↓, REER ↑	GDP ~ stable, INF ↓ quickly, REER ~ flat
SUN	1%	Rises gradually	Rises with stronger magnitude
IHSG	1%	High initial volatility	Mild early fluctuation
REER	1%	Moderate appreciation	Insignificant change
INF	1%	Persists for 3–4 quarters	Dissipates within 6 quarters
GDP	1%	Declines then stabilizes	Remains near baseline

This table summarizes the differences in how each macroeconomic variable responds to a 1% shock under two regime conditions: High Volatility Regime and Low Volatility Regime, based on the results of the Threshold Vector Autoregression (TVAR) model. The comparison highlights the nonlinear dynamics of the economy in response to policy shocks and illustrates how the effectiveness of monetary instruments like Quantitative Easing (QE) varies across economic environments.

Bayesian Vector Autoregression (BVAR) Model

The Impulse Response Function graph below displays the responses of each economic variable to shocks originating from one variable to others within the Bayesian VAR (BVAR) model. Each row and column represents the response of a particular variable to a shock from the triggering variable

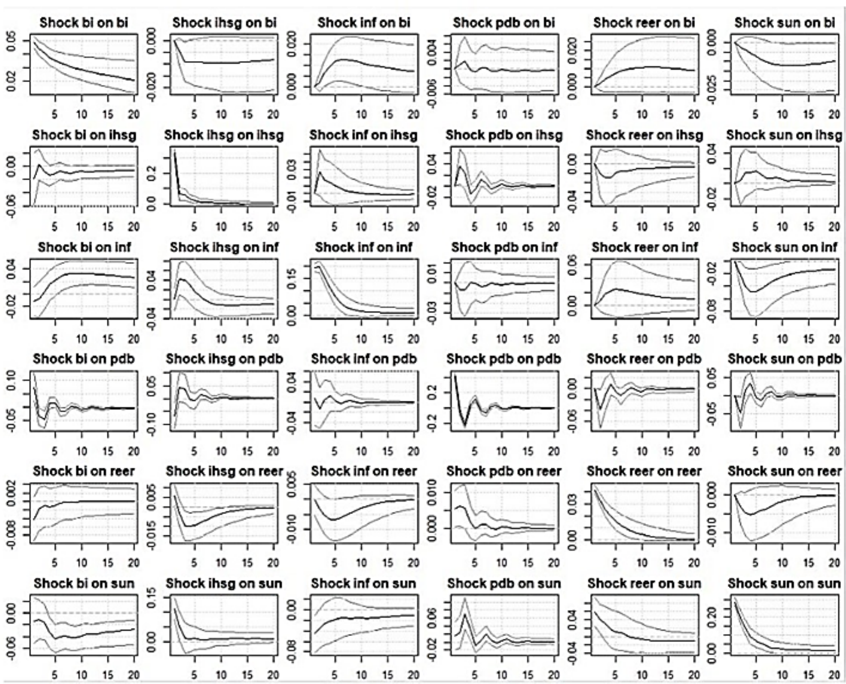

Figure 12. Impulse Response Function of the Bayesian VAR (BVAR) Model

The graph above shows the responses of each economic variable to shocks within the Bayesian VAR (BVAR) model. In the economic stability category, shocks to GDP generate fluctuating responses to itself before eventually stabilizing, while inflation (INF) responds positively at the beginning of the period before declining. Inflation shocks exert negative pressure on GDP, indicating that inflation tends to be a dominant factor suppressing economic stability in the short term.

In the financial stability category, the IHSG exhibits sharp fluctuations early on after receiving shocks to itself but tends to stabilize in subsequent periods. Meanwhile, the REER responds to shocks with a stable declining pattern and appears more controlled. This suggests that REER plays a more stable role in maintaining financial stability compared to the initially volatile IHSG.

In the monetary policy independence category, shocks to BI show a consistent downward trend, indicating pressure on interest rate policy. Conversely, SUN responds positively with gradual increases, highlighting its role as an instrument supporting monetary policy stability in the long term.

Overall, financial stability plays a stronger role in maintaining the harmony of the Monetary Trinity, supported by REER's stability. On the other hand, inflationary pressures in the economic stability category and the downward trend of BI in the monetary policy independence category pose major challenges requiring stronger policy coordination to achieve economic balance.

Forecast Error Variance Decomposition (FEVD)
The Forecast Error Variance Decomposition (FEVD) graph below is used to analyze the relative contribution of each shock to a specific variable in the study. FEVD helps us understand the extent to which shocks from one variable influence other variables over a given time horizon. This analysis is crucial for evaluating dynamic relationships among variables within the framework of economic policy and macroeconomic stability.

The figure displays FEVD results for six main variables—BI (Bank Indonesia Rate), IHSG (Jakarta Composite Index), INF (Inflation), GDP (Gross Domestic Product), REER (Real Effective Exchange Rate), and SUN (Government Bonds)—over a 10-period horizon. Each panel in the graph depicts the dynamics of internal shocks and shocks from other variables affecting the changes in each variable.

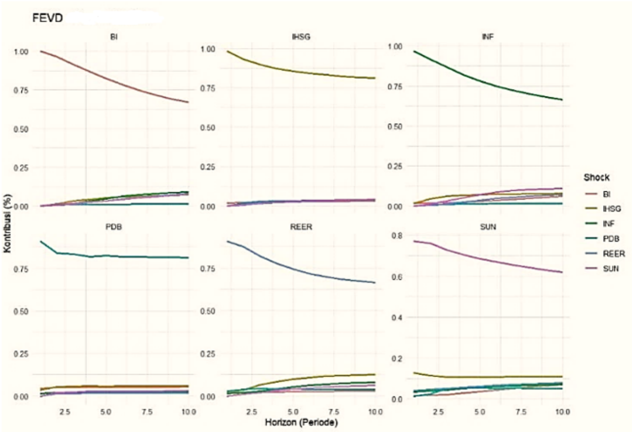

Figure 13. Forecast Error Variance Decomposition of the Bayesian VAR (BVAR) Model

Figure 4 illustrates that inflation's variance is increasingly explained by shocks from SUN and IHSG over time, indicating stronger external influence. GDP variance is driven by inflation and REER. BI's response shifts from internal to external drivers, showing reduced autonomy. SUN variance is increasingly influenced by BI and IHSG, reinforcing the interdependence of fiscal and financial variables.

The graph above illustrates the contribution of shocks to each variable over a 10-period horizon. Inflation (INF) shows a declining influence from its own shocks, while contributions from SUN and IHSG gradually increase, indicating that inflation is increasingly affected by external factors. GDP remains relatively stable but begins to be influenced by INF and REER, highlighting the roles of inflation and the real effective exchange rate in economic growth. IHSG continues to be predominantly influenced by its own shocks, demonstrating resilience to external disturbances.

Meanwhile, REER experiences a decline in internal influence with rising contributions from SUN and INF, suggesting the role of fiscal policy and inflation in maintaining exchange rate stability. BI is initially influenced by internal factors, but over time the contributions from INF and SUN increase, reflecting responsiveness to external dynamics. Lastly, SUN shows a decrease in internal influence, whereas contributions from BI and IHSG rise, indicating a strong linkage between monetary policy and financial market stability.

Based on the FEVD results, the dynamics of the Monetary Trinity reveal a complex interaction among economic stability, financial stability, and monetary policy independence. In economic stability, inflation (INF) poses the main challenge with rising external pressures, while GDP attempts to remain stable despite influences from inflation and exchange rates (REER). This condition reflects the dilemma between inflation control and economic growth.

For financial stability, IHSG tends to remain stable with dominant internal shocks, while REER becomes increasingly influenced by external factors such as inflation and SUN. This suggests that financial stability is still relatively robust but requires coordinated policy support to manage volatility.

Regarding monetary policy independence, BI faces pressures that reduce its contribution, while SUN plays an important balancing role, supporting financial market stability and linking monetary and fiscal policies. Therefore, strong policy coordination is essential to ensure that the three pillars of the Monetary Trinity move harmoniously toward sustainable macroeconomic stability.

Model Time Varying Parameter- Vector Autoregression (TVP-VAR)

The TVP-VAR model is used to analyze the impact of monetary policies such as Quantitative Easing (QE) on economic stability by capturing the evolving dynamics of economic relationships over time, especially during periods of uncertainty (Antonakakis *et al*. 2019; Papathanasiou *et al*. 2023; Xu *et al*. 2023). The TVP-VAR analysis evaluates changes in the relationships among economic variables, including the BI rate, with dynamic coefficients reflecting the economy's response to monetary policy. The estimation includes descriptive statistics to better understand the role of the BI rate in maintaining economic stability.

Table 11. TVP-VAR Model Results for BI

Parameter	Min	1st Qu.	Median	Mean	3rd Qu.	Max	Bandwidth	Pseudo R-squared
(Intercept)	0.03557	0.03986	0.0446	0.0452	0.0502	0.05723	2.3144	0.9779
y.l1 (Lag 1)	0.7856	0.7958	0.8048	0.8045	0.8134	0.8221		
y.l2 (Lag 2)	0.1478	0.1542	0.1602	0.1603	0.1664	0.173		

The bandwidth value of 2.3144 indicates that the model is more stable and parameter changes occur gradually, focusing more on long-term trends in the TVP-VAR model. The Pseudo R-squared of 0.9779 signifies a high-quality model with nearly 98% accuracy. The intercept ranges from 0.03557 to 0.05723 with a mean of 0.04521, reflecting the baseline of the dependent variable that changes over time. The lag-1 coefficients range between 0.7856 and 0.8221, while lag-2 coefficients range from 0.1478 to 0.1730, indicating a significant impact from previous periods. The figure illustrates the changes in coefficients based on significant economic periods.

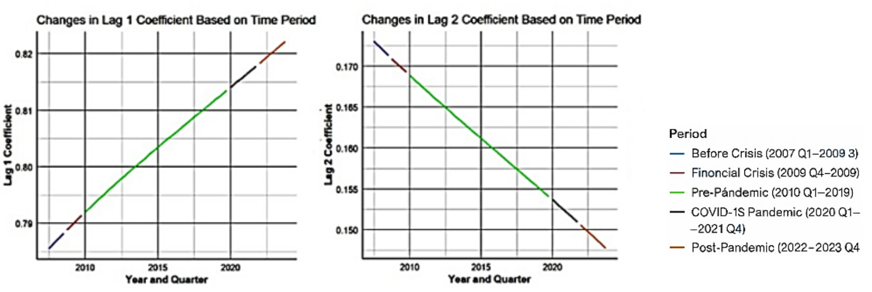

Figure 14. Changes in Lag 1 and Lag 2 Coefficients

The lag 1 coefficient remained stable at 0.79 before the crisis, declined during the crisis, and then increased to 0.82 post-pandemic, indicating a strong monetary response. Lag 2 decreased from 0.170 to 0.150 during the pandemic before recovering. The intercept graph shows the changing trend of the relationship between variables over time.

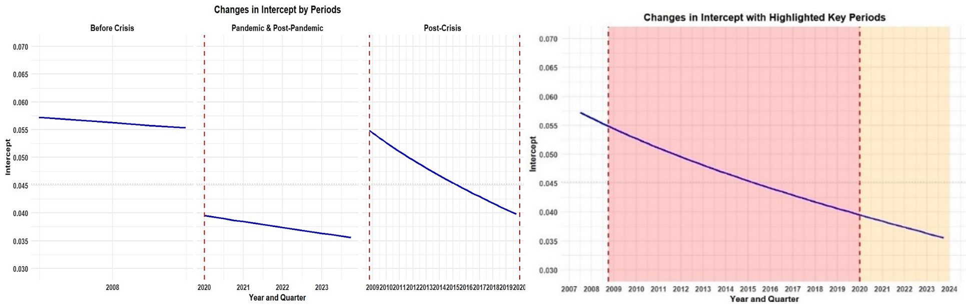

Figure 15. Changes in Intercept Values Over Time

The figure illustrates a declining trend in the intercept from 2007 to 2023, with a sharp decrease during the 2020–2021 pandemic period. Prior to the 2007–2008 crisis, the decline was gradual, while during the 2008–2009 crisis, the decrease was modest. Post-pandemic, the decline slows down, reflecting economic adaptation. These changes in the intercept represent policy challenges in maintaining economic stability amid global pressures.

Impulse Response Function (IRF) Analysis

This analysis shows the responses of IHSG, SUN, REER, INF, GDP, and the BI Rate to shocks in the BI interest rate. The figure reveals the relationship between monetary policy and economic stability within the Monetary Trinity framework, as well as the dynamic patterns of variables moving toward equilibrium following a shock.

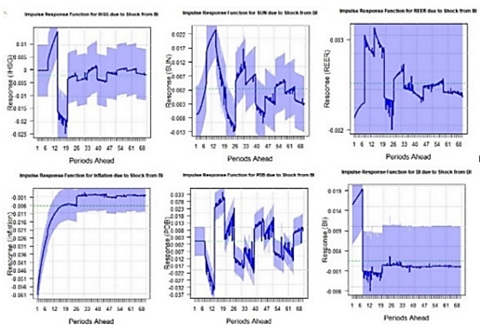

Figure 16. Impulse Response Function (IRF) – TVP-VAR

Figure 7 shows dynamic responses to BI rate shocks over time. IHSG initially rises then stabilizes; SUN recovers after an early dip; REER depreciates for 6 quarters; inflation falls significantly, and GDP fluctuates before stabilizing.

This IRF supports findings in the high regime: BI rate shocks contract GDP and reduce inflation, especially during crisis periods. SUN's positive response implies that bond issuance acts as a stabilizing instrument in times of uncertainty.

The IRF graph shows the responses of IHSG, SUN, REER, inflation, GDP, and the BI Rate to shocks in the BI interest rate. IHSG rises until the 6th quarter before stabilizing, SUN initially responds negatively before recovering, REER depreciates until the 6th quarter, inflation sharply declines, and GDP fluctuates before stabilizing.

Within the context of the Monetary Trinity, there is a dilemma among exchange rate stability, capital mobility, and monetary independence. Maintaining REER may come at the expense of monetary policy, while sustaining the attractiveness of IHSG can pressure inflation and GDP. Proper fiscal and monetary coordination, supported by SUN, can ensure long-term stability against global shocks.

5. Discussion

This study reveals complex and regime-dependent relationships among macroeconomic variables within the Monetary Trinity framework, incorporating exchange rate stability, financial stability, and monetary policy independence. These findings align with Blanchard (2013) and Yunita et al. (2017), who argue that the impact of Quantitative Easing (QE) is highly contingent on prevailing economic regimes—particularly between low- and high-volatility environments. In low-volatility regimes, this study finds that the real effective exchange rate (REER) acts as a robust stabilizer, consistent with its role in controlling imported inflation and supporting external competitiveness (Taguchi & Ganbayar, 2020). Meanwhile, financial stability is maintained through the issuance and strategic management of government bonds (SUN), echoing Warjiyo and Juhro's (2019) emphasis on the importance of fiscal-monetary coordination. Under high-volatility regimes, however, these stabilizing mechanisms become less effective: inflation surges and market fluctuations significantly erode monetary policy autonomy, corroborating findings by Grewal and Trivedi (2021) on the diminishing effectiveness of domestic monetary policy under global financial pressure. This contrast across regimes underscores the necessity for adaptive QE strategies tailored to volatility conditions, thus providing conceptual refinement to existing empirical literature.

A comparative perspective underscores that Indonesia's experience with QE diverges in important ways from other emerging economies such as India, Brazil, and South Africa, thereby contextualizing the novelty of this study. In India, QE is implemented alongside strong domestic consumption and robust fiscal transmission mechanisms, which enhances its effectiveness (Arapovic & Mulaahmetović, 2023). In contrast, Indonesia's limited fiscal absorption capacity, as highlighted by Mujaddid and Suwito (2024), restricts the full realization of QE's stimulative potential. Brazil places greater emphasis on inflation targeting through a strong central bank communication strategy, while South Africa implements QE under high external vulnerability, which amplifies currency risks. These differences illuminate Indonesia's structural constraints—particularly the fragility of its fiscal-monetary interface and the dependence on foreign capital flows—which demand a more adaptive and institutionally coordinated QE design. This study contributes to the literature by showing that the success of QE is not only regime-dependent but also institutionally contingent, suggesting a need for differentiated frameworks in emerging markets (Wibowo, 2023; Widiastuti et al., 2023).

Bayesian Vector Autoregressive (BVAR) analysis confirms that inflation (INF) remains the main structural challenge to sustaining economic growth, consistent with Warjiyo and Juhro's (2019) emphasis on inflation targeting in emerging markets. Meanwhile, the Real Effective Exchange Rate (REER) demonstrates a stabilizing effect in the external sector, acting as an anchor during episodes of exchange rate volatility. Long-term financial stability is also observed, as the IHSG tends to revert to equilibrium despite short-term turbulence in capital markets. The yield curve behavior of government securities (SUN) under QE reflects dual outcomes: it supports investor sentiment through lower yields but may simultaneously heighten fiscal dominance risks if not accompanied by sound fiscal discipline. These findings extend the argument of Aviliani, Siregar, and Hasanah (2014), who link long-term stability with enhanced Foreign Direct Investment (FDI) and institutional qualityThe BI rate's responsiveness to inflation illustrates a constrained autonomy in interest rate policy, reinforcing the importance of aggregate demand-supply dynamics (Siregar & Ward, 2001, 2002). This study contributes conceptually by showing that SUN and REER are not only instruments of stabilization but also channels of coordination in the evolving structure of Indonesia's new trinity framework.

From a fiscal risk perspective, the reliance on bond-financed QE raises critical concerns regarding long-term debt sustainability, as emphasized in recent fiscal literature. As SUN issuance expands, the government must ensure fiscal discipline to prevent inflationary pressures and avoid crowding out in financial markets. This issue becomes more significant with the growing share of domestic QE post-pandemic.

The importance of coordinating monetary and fiscal policies is emphasized by Perry Warjiyo and Solikin (2019), who argue that integration across policy domains offers a strategic response to global challenges. The 1997/1998 crisis illustrated how synergy between fiscal and monetary policy helped resolve macroeconomic imbalances (Siregar & Ward, 2001, 2002). Consequently, coordination via instruments like SUN and REER remains vital for sustaining economic stability.

This study has limitations stemming from data coverage restricted to 2023 and reliance on TVAR, BVAR, and TVP-VAR models. To deepen future analysis, researchers should consider incorporating Dynamic Stochastic General Equilibrium (DSGE) models, which may enhance understanding of the long-term impact of QE and the fiscal–monetary interaction in emerging market settings.

The study affirms that achieving harmony within the new trinity framework necessitates adaptive and integrated policymaking. By aligning financial stability, exchange rate stability, and monetary autonomy through instruments like SUN and

REER, Indonesia will be better positioned to navigate evolving global economic conditions..

6. Conclusions

This study provides deep insights into how Quantitative Easing (QE) affects Indonesia's economic stability, particularly within the context of global challenges and the dynamics of the Monetary Trinity. The main findings highlight nonlinear relationships among economic variables, differing between low and high volatility regimes.

In the low volatility regime, the economy demonstrates relative stability, marked by controlled inflation, stable exchange rates, and positive contributions from financial instruments such as Government Bonds (SUN). However, in the high volatility regime, inflationary pressures and market volatility intensify stress on the exchange rate, GDP, and policy interest rates. The burden-sharing scheme between the government and Bank Indonesia plays a vital role in maintaining liquidity and financial stability, especially in the face of increasing external pressures.

The study also introduces the concept of the new trinity, which incorporates financial stability as a key element in designing monetary and fiscal policies. This stability is achieved through the management of instruments like SUN and the real effective exchange rate (REER), which serve as main pillars to preserve liquidity and economic competitiveness amid external shocks.

Based on these findings, several policy recommendations are proposed. In high-volatility regimes, Bank Indonesia should limit QE to short-term securities and strengthen coordination with the Ministry of Finance to prevent bond yield spikes. Enhanced communication strategies are also essential to anchor expectations and reduce policy uncertainty.

Future research should explore the evolving interaction between QE and new instruments such as Central Bank Digital Currency (CBDC) and green bonds. Investigating how digital or climate-linked instruments complement QE could provide deeper insights into sustainable policy design in emerging markets.

These conclusions underscore the importance of adaptive policies responsive to global dynamics. Close coordination between fiscal and monetary policies, transparency, and consistent policy communication are essential to maintaining harmony among exchange rate stability, free capital flows, and monetary policy independence. This adaptive, forward-looking approach offers a resilient framework for Indonesia and other developing countries to navigate global volatility and pursue long-term economic stability.

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