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Examining the roles of monetary and fiscal policies in Vietnam's economic growth amid global challenges: A Bayesian VAR and wavelet coherence approach

 Nguyen Quoc Huy¹,  Nguyen Vu Hoai Dong²,  Le Quoc Dinh^{3*}

^{1,2,3}Faculty of Finance and Accounting, Lac Hong University, Bien Hoa City, Dong Nai Province, Vietnam

Corresponding author: Le Quoc Dinh (Email: dinhle2807@gmail.com)

Abstract

This study examines the impact of fiscal and monetary policies on Vietnam's economic growth from 1996 to 2023, particularly in the context of significant global economic challenges, including the aftermath of the COVID-19 pandemic, WTO accession, and the US-China trade war. Employing a dual-method approach with Bayesian Vector Autoregression (BVAR) and Wavelet Transform Coherence (WTC), the findings reveal that fiscal policy, measured through public consumption expenditure, strongly and positively influences economic growth, especially during key periods such as 2001–2006 (pre-WTO accession) and 2016–2021 (amid the US-China trade war and the COVID-19 pandemic). In contrast, monetary policy, represented by broad money supply, negatively affected growth, particularly between 2006–2011, when high inflation followed Vietnam's WTO accession. The study concludes that fiscal policy should serve as the cornerstone of Vietnam's economic development, with close coordination with monetary policy to ensure stability and sustainable growth, especially during periods of significant volatility. Policymakers are encouraged to emphasize counter-cyclical fiscal measures and balance inflation control with growth promotion to navigate economic challenges effectively.

Keywords: Economic growth, Fiscal Policy, Monetary policy.

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1. Introduction

The global economy continues to grapple with significant challenges in its recovery following the COVID-19 pandemic. Excessive monetary easing during the pandemic, combined with the Russia-Ukraine conflict, has pushed commodity prices to unprecedented levels, triggering widespread inflation in the latter half of 2022 [1]. In response, many countries, particularly the United States and European nations, have shifted their focus from growth-driven strategies to controlling inflation through tighter monetary policies. Simultaneously, fiscal support packages for households and

businesses—critical during the pandemic—are being scaled back due to severe budget deficits and rising public debt in many nations. In Asia, the stagnant real estate market and ineffective macroeconomic policies in China have further hindered growth momentum [2]. As a result, global economic growth has slowed amid rising inflation, higher interest rates, and elevated financial risks. To address these challenges, most major central banks have embarked on extended monetary tightening cycles, including sustained interest rate hikes. Meanwhile, governments are reducing fiscal support as deficits widen and public debt nears critical thresholds, adding to the complexity of global economic recovery.

The growth rates of numerous economies have significantly declined in 2023 compared to 2022. For example, GDP growth in the euro area dropped from 3.3% to 0.7%, India’s growth fell from 7.2% to 6.3%, and South Africa’s growth slowed from 1.9% to 0.9%. Overall, GDP growth in advanced economies is projected to range from 1.4% to 1.5%, while emerging and developing economies are expected to grow around 4.0% over the next two years (see Table 1).

Table 1.
Global Economic Growth 2022–2024 (%).

Country/Region	2022	2023	2024 (Forecast)
Global	3.5	3.0	2.9
Advanced Economies	2.6	1.5	1.4
United States	2.1	2.1	1.5
EU	3.3	0.7	1.2
Japan	1.0	2.0	1.0
Developing Economies	4.1	4.0	4.0
Brazil	2.9	3.1	3.1
Russia	-2.1	2.2	1.1
India	7.2	6.3	6.3
China	3.0	5.0	4.2
ASEAN-5 (Thailand, Philippines, Malaysia, Indonesia, Vietnam)	5.5	4.6	5.5

Source: IMF (2023).

The high inflation environment has prompted major central banks worldwide to signal their readiness to tighten monetary policies further if necessary or, at the very least, maintain current policies until inflation returns to their target range. This has had various negative consequences for developing countries, including Vietnam. To address the global economic volatility, Vietnam must adopt a coordinated, flexible, and effective approach to monetary and fiscal policy. Monetary policy should prioritize controlling inflation, stabilizing the exchange rate, and supporting reasonable economic growth. Tools such as adjustments to policy interest rates, central exchange rates, and reserve requirements must be deployed flexibly and promptly, in alignment with both domestic and international market developments. Simultaneously, fiscal policy should take a leading role in driving economic growth and ensuring social welfare. Accelerating the efficient disbursement of public investment, particularly for key infrastructure projects, is essential to create new growth drivers for the economy. Additionally, timely and practical support policies for businesses and citizens—especially those most vulnerable to the impacts of global economic fluctuations and pandemics—are crucial. The synchronized and harmonious coordination of these two policies will generate a synergistic effect, enabling Vietnam to overcome challenges, maintain macroeconomic stability, and foster sustainable growth. This research aims to examine the impact of fiscal and monetary policies on Vietnam’s economic growth, particularly during crisis periods such as the 2007 global financial crisis and the Covid-19 pandemic. It seeks to provide insights into how coordinated policy measures can enhance resilience and drive long-term development.

To achieve the stated objectives, we employ a combination of the Bayesian VAR (BVAR) and Wavelet Coherence (WTC) methods. First, BVAR facilitates modeling the dynamic relationships between variables, enabling us to analyze the mutual impacts of monetary policy, fiscal policy, and economic growth over time. The Bayesian approach enhances estimation accuracy by incorporating prior information, thereby mitigating biases that may arise from small or noisy datasets—a common issue when studying Vietnam over the 1996–2023 period. BVAR is also flexible in handling models with numerous variables and complex interrelationships, making it highly suitable for macroeconomic and financial research where interactions evolve over time and are influenced by external shocks. Second, the Wavelet Coherence (WTC) method allows for the examination of relationships between two time series across different frequencies (short-term, medium-term, long-term) and at various points in time. This approach helps identify specific periods where monetary and fiscal policies exert strong or weak effects on economic growth. The integration of these two methods provides a comprehensive framework for understanding the temporal and frequency-dependent impacts of policy measures, offering valuable insights into their effectiveness under varying economic conditions.

This study makes significant contributions to the literature in the following ways: First, it provides empirical evidence on the correlation between monetary policy, fiscal policy, and economic growth using two modern methodological approaches. The findings not only offer valuable insights for policymakers in Vietnam to design effective policies but are particularly useful in navigating crises and international conflicts. Second, as Vietnam continues to deepen its integration into the global economy through 17 bilateral and multilateral free trade agreements, studying the interaction of these policies has become more critical than ever. Notably, the year 2025 marks a pivotal point with the conclusion of Vietnam’s 2021–2025 socio-economic development plan. Understanding the role of monetary and fiscal policies—or their

combination—in fostering economic growth over recent years will enable policymakers to craft a more effective and sustainable five-year strategy aligned with domestic realities and the global context.

The remainder of this study is structured as follows: Section 2 presents a literature review. Section 3 introduces the data, model, and experimental results. Section 4 discusses the research findings. Finally, Section 5 concludes the study.

2. Literature Review

2.1. Theoretical Framework of Fiscal and Monetary Policy

The Taylor [3] is a pivotal model in monetary policy, guiding central banks in adjusting interest rates to stabilize the economy. According to this principle, central banks should raise interest rates when inflation exceeds its target or when economic output surpasses full employment levels to mitigate inflationary pressures. Conversely, lowering interest rates is recommended when inflation falls below the target or when economic output declines, with the aim of stimulating growth. However, in cases of stagflation—characterized by high inflation and declining economic output—the Taylor Principle necessitates a careful balance between prioritizing inflation control and fostering growth, ensuring the implementation of an appropriate and effective policy response.

Inflation and interest rates are closely interlinked, with each influencing the other in significant ways. High inflation typically prompts central banks to raise interest rates to slow economic growth, while low inflation often coincides with sluggish economic performance, encouraging rate cuts to lower borrowing costs and stimulate activity [4]. Lower interest rates can boost borrowing, spending, and economic recovery but may also increase inflationary pressures. Central banks play a crucial role in striking a balance between fostering economic growth, maintaining low unemployment, and ensuring stable wage levels, all while avoiding excessive growth that could drive up inflation [5]. Rising interest rates often attract international capital inflows, boosting investment and impacting exchange rates. However, high inflation can undermine the value of domestic currency by reducing its purchasing power, necessitating proactive and adaptive monetary policies to respond effectively to economic fluctuations [6-8]. In New Keynesian economics, monetary policy operates under the Taylor Principle, where nominal interest rates are adjusted in response to inflation and output deviations from target levels. This approach ensures flexibility and responsiveness to gaps between actual economic conditions and desired objectives [9, 10].

Fiscal policy is divided into two main types: active fiscal policy and automatic stabilizer fiscal policy. Active fiscal policy enables governments to adjust public spending and tax rates to keep aggregate demand aligned with potential output levels [11]. This approach includes two key strategies. First, expansionary fiscal policy, which seeks to stimulate economic growth during periods of slowdown or recession. This strategy is most effective when inflationary pressures are minimal, allowing for the implementation of stimulus measures without destabilizing prices. Second, contractionary fiscal policy, which is employed to curb excessive growth and high inflation, particularly when resources are overutilized. By controlling inflation, this strategy ensures long-term economic stability. Active fiscal policy relies on two primary tools: government spending and tax revenues. While government spending directly impacts aggregate demand through increased public expenditure, tax revenues indirectly affect the economy by altering disposable income for households and after-tax profits for businesses. The choice and emphasis on these tools shape the balance of revenues and expenditures in the budget, allowing policymakers to address specific economic challenges effectively.

Automatic stabilizers play a crucial role in mitigating economic fluctuations but cannot completely eliminate them. Consequently, changes in the budget deficit or surplus are not always attributed to active fiscal policy; they can also arise from the automatic mechanisms of the economy—known as automatic stabilizer fiscal policy. Furthermore, monetary policy and fiscal policy are deeply interconnected, with the effectiveness of one directly influencing the success of the other. This interplay ultimately shapes the overall coordination and impact of both policies. Notably, Sargent and Wallace [12] in one of the seminal studies on the interaction between monetary and fiscal policies, highlighted that policymakers jointly determine price levels while ensuring fiscal balance.

2.2. Studies on the Impact of Fiscal and Monetary Policies on Economic Growth

The impact of fiscal and monetary policies on economic growth has always been a topic of great interest to economists. Although numerous studies have been conducted in both developed and developing countries to assess the relative effects of these two policies, the results indicate that there is still no consensus on their impact on economic growth.

Chung, et al. [13] found that policy response functions vary significantly across different phases in the United States. This paper explores how changes in the environment, where monetary and fiscal regimes follow a Markov process, can alter the impact of policy shocks. In one regime, active monetary policy follows the Taylor principle, and taxes increase sharply when government debt rises; in another regime, the Taylor principle no longer holds, and taxes become an exogenous variable. Empirical evidence suggests that a single non-Ricardian equilibrium with constraints exists in this environment. Government decision-making rules will depend on the probability that fiscal and monetary shocks will have positive effects in the future.

Davig and Leeper [14] estimated the regime-switching rules for monetary and fiscal policies in the post-war period in the United States and proposed a policy process based on a calibrated dynamic stochastic general equilibrium model. This decision rule is unique and leads to a stationary long-run rational expectations equilibrium, where tax shocks always impact output and inflation. The neutralizing factors of taxes in the model arise only through the price level mechanism. Empirical evidence from the United States shows that, compared to a standard monetary model, tax shocks have a significantly greater dynamic effect. Since long-term policy behavior determines the existence and uniqueness of the equilibrium state,

in a regime-switching environment, qualitative inferences from a full-sample dataset are more accurate than those from separate policy regime analyses.

Barsky and Sims [15] applied a VAR model to investigate whether the transmission of fiscal policy is related to systematic responses from consumer confidence levels. Their study found that the endogenous response of consumer confidence indices plays a crucial role in explaining output fluctuations during recessions, while its role is less pronounced during normal economic periods. Specifically, the study highlighted that increases in output and productivity resulting from fiscal stimulus measures during recessions tend to occur gradually and persistently. This suggests that the effects of fiscal stimulus during a recession differ from those during normal times, as they primarily drive long-term productivity growth. In fact, fiscal expansion during a recession often focuses on public investment, leading to a rise in long-term productivity. This reflects the essential role of systematic responses from public confidence indicators in transmitting the effects of fiscal policy during crises, rather than merely reflecting sentiment. The study also emphasizes that fiscal policy during recessions not only has short-term effects on demand but also positively impacts productivity in the medium term.

Cevik, et al. [16] examined the relationship between fiscal and monetary policies in several emerging European countries that underwent economic transitions, covering the period from Q1 1995 to Q4 2010. Using a Markov regime-switching model, they found that the monetary and fiscal policy rules of these countries shift between active and passive regimes. Specifically, the empirical results indicate that the Czech Republic, Estonia, Hungary, and Poland implemented both active and passive monetary policies. In contrast, Slovenia and Slovakia primarily followed passive monetary rules. Regarding fiscal policy, Estonia, Hungary, Poland, and Slovenia showed transitions between active and passive fiscal regimes, while the fiscal policies of the Czech Republic and Slovakia tended to remain stable within a single regime.

Klein and Linnemann [17] used a VAR model to estimate the impact of government spending shocks on the U.S. economy. In this study, the recent Great Recession was identified by the strong impulse responses of output to fiscal shocks. This, along with the rather unusual responses of several other economic variables, highlighted the uniqueness of this period. Notably, the impulse response model of fiscal shocks did not fully align with the predictions of the New Keynesian model for an economy constrained by a lower bound of zero for nominal interest rates. It also did not suggest that the effects of fiscal policy frequently change based on the state of the business cycle. Instead, the Great Recession was distinctive in that government spending shocks significantly reduced the spread between government bond yields and corporate bond yields, while also having a strong positive effect on consumer confidence and private consumer spending.

Azad, et al. [18] studied the interaction between fiscal and monetary policies in Canada from Q1 1990 to Q4 2020, with a focus on assessing the impact of fiscal policy during the COVID-19 pandemic using an SVAR model. The results show that during this period, fiscal policy was more active than monetary policy, and the budget deficit contributed to economic growth in the short term. However, the study also indicates that these positive effects on GDP and private consumption will gradually diminish once the fiscal stimulus package ends. Furthermore, rising long-term interest rates, reduced investment, and increased inflation could pose challenges for the central bank's inflation control objectives. Additionally, the study examines the effect of government spending on interest rates, particularly focusing on long-term interest rates, and the role of economic agents' expectations in influencing interest rates in the U.S. through the use of a Bayesian VAR model. The findings suggest that when government spending increases, both short-term and long-term interest rates tend to rise. Notably, the increase in long-term interest rates following a positive government spending shock is primarily due to expectations that short-term rates will be higher in the future. This highlights the importance of coordinating fiscal and monetary policies to manage economic impacts.

Regarding the prioritization of fiscal and monetary policies, studies have found that monetary policy tends to have a relatively stronger impact than fiscal policy, not only in market-oriented economies such as the U.S., the U.K., Canada, Japan, France, and Germany but also in developing economies with similar conclusions [19, 20]. For instance, research by Ajayi [21] and Ajisafe and Folorunso [22] for Nigeria, and Ali, et al. [23] for four South Asian countries (Pakistan, India, Sri Lanka, and Bangladesh) supports this finding. However, some studies suggest that fiscal policy has a stronger effect than monetary policy, such as Chowdhury and Chowdhury [24] research on Bangladesh's economy, Olaloye and Ikhide [25] study on Nigeria, and Enache [26] research on Romania.

In Vietnam, to the best of our knowledge, only a few empirical studies have been published estimating fiscal and monetary policies for the country. Most economic research has focused on examining the individual impacts of fiscal or monetary policy on economic growth. For example, a study by Linh [27] found that both monetary and fiscal policies have a positive impact on GDP, with monetary policy having a more profound and lasting effect on GDP growth compared to fiscal policy. However, it is important to note that this study examined the effects of each policy on economic growth separately, without considering the combined impact of both policies in the research model. Recently, Khang, et al. [28] studied the combined effects of monetary and fiscal policies on economic growth in Vietnam. However, this study did not clearly define the individual impact of each policy, especially in the context of economic crises or political conflicts. To address these limitations, the current study is conducted with the following new points:

First, the study evaluates the coordination between monetary and fiscal policies on economic growth in Vietnam, while also analyzing the impact of each policy during specific periods, including economic crises and political instability.

Second, the innovative aspect of this research lies in the combination of two methods: BVAR (Bayesian Vector Autoregression) and Wavelet. The BVAR method helps analyze the relationship between economic variables in both the short and long terms, while Wavelet allows us to explore frequency fluctuations and their impacts across different time cycles. This combination provides a more comprehensive view of the effects of monetary and fiscal policies on economic growth in Vietnam, especially in the context of changing macroeconomic factors.

3. Research Methodology

3.1. Justification of Data and Variables

The study focuses on Vietnam, with data collected from the World Development Indicators (WDI) by the World Bank (WB). The symbols and measurement methods for all variables are detailed in Table 2. The final dataset consists of time-series data from Vietnam covering the period from 1996 to 2023.

Table 2.
Description of the Study Variables.

Variable	Description	Study	Source
GDP	Gross Domestic Product, measured in logarithmic form (Ln)	Azad, et al. [18] and Kassab [29]	WB
GE	Government final consumption expenditure, measured in logarithmic form (Ln)	Azad, et al. [18] and Kassab [29]	WB
ER	Exchange rate, measured in logarithmic form (Ln)	Azad, et al. [18]	WB
BM	Money supply, measured in logarithmic form (Ln)	Azad, et al. [18]	WB

GDP reflects the total value of all final goods and services produced within a country's economy over a specific period. Using GDP as a measure of economic growth helps assess the size and strength of the economy, providing a gauge of its level of development and growth. This measure is widely used in previous studies by Azad, et al. [18]; Kassab [29] and Khang, et al. [28].

Government final consumption expenditure (GE) and Broad money (BM) are two important indicators that reflect the effectiveness of fiscal and monetary policies. GE directly influences aggregate demand in the economy, stimulating economic activity when increased during recessions and adjusting when the economy overheats. By increasing or decreasing spending in areas such as education, healthcare, and infrastructure, the government can regulate demand in the economy to achieve stability and sustainable growth. Meanwhile, BM represents monetary policy, where the central bank can influence interest rates and credit through adjustments in the money supply, facilitating investment and consumption or, conversely, controlling inflation and maintaining financial stability. When combined, these two measures provide a powerful tool for managing the economy, maintaining stability, and maximizing economic growth effectiveness amidst global fluctuations [18, 28].

Additionally, the exchange rate has been included to examine its individual impact on economic growth, with the aim of reflecting the effects of currency fluctuations on other macroeconomic factors such as exports, foreign investment, and economic stability [18]. Incorporating the exchange rate into the model allows us to adjust for external factors, ensuring that the study's results on economic growth accurately reflect the influences from international markets and currency volatility. This is especially relevant in the context of Vietnam's increasing integration into the global economy, where external shocks such as economic crises, the COVID-19 pandemic, and the Russia-Ukraine war have a direct impact on exchange rates.

3.2. Research Methodology

3.2.1. BVAR Method

Following the approach of Uhlig [30] and Mountford and Uhlig [31] this study applies the Bayesian VAR model to analyze the response of economic growth to shocks from fiscal and monetary policies.

$$Y_t = A_1 Y_{t-1} + A_2 Y_{t-2} + \dots + A_k Y_{t-k} + u_t + \varepsilon_t(1)$$

With Y_t as the vector of endogenous variables of size 1×4 , which includes the four variables GDP, GE, BM, and ER, and k representing the optimal lag length.

In this study, we employ the Bayesian VAR (BVAR) method for model (1) for several key reasons. First, BVAR allows for the modeling of dynamic relationships between variables, facilitating the analysis of the interactions between GDP, GE, BM, and ER over time. Additionally, the Bayesian approach enhances the accuracy of estimates by incorporating prior information, thereby reducing the risk of bias when dealing with small or noisy sample data [32-35]. Which is particularly relevant for research in Vietnam covering the period from 1996 to 2023. This method is also flexible in handling models with multiple variables and complex relationships, making it suitable for macroeconomic and financial studies, where interacting factors may evolve over time and be influenced by external shocks. Unlike the classical VAR, Bayesian VAR combines prior information and sample data likelihood to generate a posterior distribution for the model parameters [36].

3.2.2. Posterior \propto Prior \times Likelihood

To evaluate the results of the BVAR model, it is necessary to examine the posterior distribution of the parameters using tools such as MCMC (Markov Chain Monte Carlo). This process ensures that the sample has converged and that the posterior distribution is accurately estimated. The test helps to determine whether the MCMC chains have converged to the target distribution, thus confirming the reliability of the parameter estimates and ensuring that the analysis results are accurate and trustworthy.

3.3. WTC Method

WTC allows us to explore frequency fluctuations and their impacts across different time cycles. This combination provides a more comprehensive view of the effects of monetary and fiscal policies on economic growth in Vietnam, particularly in the context of changes in macroeconomic factors. In breaking down our time series in the time-frequency space, we utilized the continuous wavelet transform. The wavelet coherence technique (WTC) is efficient in capturing localized dependencies in time and frequency domains through series. The cross-wavelet of two series X(t) and Y(t) can be expressed as:

$$W_n^{XY}(u, s) = W_n^X(s, \tau) W_n^{Y*}(s, \tau) \quad (2)$$

Where u represents the position, s is the scale, and * denotes the complex conjugate. The WTC can be calculated as follows:

$$R_n^2(s, \tau) = \frac{|S(s^{-1}W_n^{XY}(s, \tau)|^2)}{S(s^{-1}W_n^X(s, \tau)|^2)S(s^{-1}W_n^Y(s, \tau)|^2)} \quad (3)$$

Where S denotes the smoothing process for both time and frequency simultaneously. $R_n^2(s, \tau)$ is within the range $0 \leq R_n^2(s, \tau) \leq 1$.

4. Research Results

4.1. Descriptive Statistics Results

Table 3 presents the descriptive statistics for the variables (in Ln form) from 1996 to 2023. The GDP has an average value of 4.8055 and a standard deviation of 0.8944. The minimum value is 3.4453, and the maximum value is 6.0724. This indicates considerable fluctuation in GDP during the study period, with noticeable changes across different years. Similarly, the average values of the variables GE, ER, and BM are 22.9561, 9.7933, and 34.9466, with standard deviations of 1.3381, 0.2275, and 1.7596, respectively, showing a relatively stable level for these indicators during the study period.

Table 3. Descriptive statistical analysis.

Variable	Mean	Std.	Min.	Max.
GDP	4.8055	0.8944	3.4453	6.0724
GE	22.9561	1.3381	21.3892	26.3982
ER	9.7933	0.2275	9.3086	10.0769
BM	34.9466	1.7596	31.6624	37.1856

Figure 1 presents the pairwise correlation results, showing that the variables are highly correlated with each other and all are statistically significant. The results indicate that economic growth, monetary policy, fiscal policy, and exchange rate policy are closely related to each other. Additionally, Figure 1 displays that the variables do not follow a normal distribution, even after being transformed into their natural logarithms (Ln). This serves as the foundation for our approach using the BVAR and WTC methods.

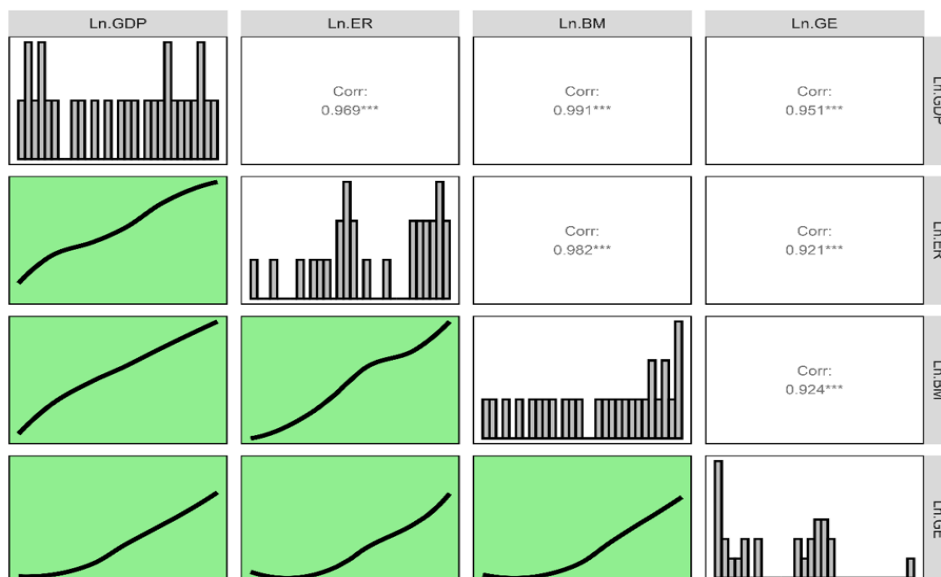


Figure 1. Pairwise Correlation Results Between Variable.

4.2. BVAR Results

4.2.1. Stationarity Test Results

Estimating a BVAR model requires that the variables in the model be tested for stationarity to ensure the accuracy and stability of the model. The Augmented Dickey-Fuller (ADF) test is commonly applied to check for stationarity in the data.

This is a widely used method in econometrics to determine whether a time series has a unit root, i.e., whether the series is non-stationary.

The stationarity test results are presented in Table 4. The BM variable is found to be stationary at the I(0) level, indicating that this variable is stable and does not exhibit any trend of increase or decrease over time. In contrast, the GDP, GE, and ER variables are found to be non-stationary at the I(0) level. First differences were taken for these variables, and the results indicate they are now stationary. The use of differenced variables is essential to eliminate non-stationarity, helping to ensure the BVAR model becomes stable and reliable, while also avoiding issues such as biased estimates and inaccurate results when analyzing the long-term effects between the variables.

Table 4.
Stationarity Test Results for Variables.

Variables	ADF test		
	Original Series	First Difference	Stationary Level
GDP	-0.6621	-3.3375**	I(1)
GE	1.0894	-4.2721***	I(1)
ER	-0.9515	0.0007***	I(1)
BM	-4.7453	X	I(0)

4.2.2. Determining the Optimal Lag

Unlike determining the lag length in a VAR model through the AIC (Akaike Information Criterion), the Bayesian method allows for lag selection by calculating the posterior probability of each model based on the observed data. The Bayesian approach not only evaluates the accuracy of the model but also considers its simplicity and efficiency, providing a more comprehensive and optimal approach to determining the model's structure. The test results presented in Table 5 show that the posterior probability at lag 1 is 97.42%. This indicates that the model with lag 1 has the highest posterior probability and is the optimal model based on the observed data. Therefore, this study adopts lag 1 as the optimal lag for the model.

Table 5.
Optimal Lag Selection in the Model.

Lag	Log (ML)	Prior Probability	Posterior Probability
Lag 1	60.1801	0.2500	0.9742
Lag 2	56.5430	0.2500	0.0256
Lag 3	51.6108	0.2500	0.0002
Lag 4	42.9985	0.2500	0.0000

4.2.3. Model Stability Test

Next, we conduct a stability test for the BVAR model, which is a crucial factor in ensuring the accuracy and reliability of the estimates and forecasts.

Table 6.
Model Stability Test.

Eigenvalue Module	Mean	Standard Deviation	MCSE	Median
1	0.9763	0.0332	0.0003	0.9844
2	0.9663	0.0376	0.0005	0.9701
3	0.9222	0.0485	0.0004	0.9156
4	0.8499	0.0686	0.0006	0.8480

Probability that the eigenvalues lie within the unit circle: 0.9960

Table 6 presents the results of the model stability test. The eigenvalue modules consist of 4 matrices (representing the 4 study variables with the optimal lag of 1). Unlike the frequentist method, the regression results table displays the regression coefficients and applies a Bayesian approach using the Metropolis-Hastings (MH) algorithm. The regression model was simulated 10,000 times, with each iteration providing a regression coefficient. Therefore, the regression results table shows the mean values. Additionally, the Bayesian method provides the standard deviation (Std. Dev) for the regression coefficients and the Monte Carlo standard error (MCSE). According to Flegal, et al. [37] the smaller the MCSE approaches zero, the more stable the MCMC chain is. These authors also suggest that an MCSE value smaller than 6.5% of the standard deviation is acceptable, and smaller than 5% is optimal. In Table 6, the MCMC chains all meet the convergence requirement, indicating the stability of the model. Moreover, the probability of the eigenvalues lying within the unit circle is 99.60%, indicating a high level of model stability. Therefore, it can be concluded that the model satisfies the stability requirement. The next step is for the author to proceed with the impulse response analysis.

4.2.4. IRF Results

The Impulse Response Function (IRF) provides insights into how the variables in the model respond to a shock in one of the variables, allowing us to understand the transmission of each shock to the individual variables. Table 7 presents the IRF results for the four variables: GE, BM, ER, and GDP. Specifically:

When a shock occurs from an increase in GE (government expenditure), GDP increases significantly from the second period onward (0.0153) and continues to grow over time. This indicates that during the study period (1996-2023), government expenditure has played a significant role in boosting economic growth. The shock from GE has a negative impact on BM and a positive impact on ER, although these effects are not significant. This suggests that the increase in government expenditure during this period has been a crucial factor in driving economic growth in Vietnam.

When there is a shock from an increase in BM, the response of GDP is slightly negative, with a value of -0.0014 in the second period, gradually decreasing to -0.0033 in the fourth period. This suggests that an expansion of the money supply may not directly stimulate economic growth in the short term, and it could even cause a slight negative pressure due to factors such as inflation or lag effects. Similarly, the impact of the money supply on ER is minimal, almost negligible. This indicates that an expansion of the money supply has an insignificant effect on the exchange rate in the short term, possibly due to other stabilizing factors like foreign exchange management or central bank regulation. However, the shock from the money supply stimulates an increase in government expenditure over time, with the value rising from 0.0456 in the second period to 0.1273 in the fourth period. This could reflect that the expansion of the money supply creates conditions for the government to increase spending in support of the economy.

When there is a shock from an increase in the ER, it positively impacts economic growth. This effect increases over time, from 0.0625 in the second period to 0.1302 in the fourth period, indicating that exchange rate adjustments could help promote economic growth. Similarly, the increase in the exchange rate leads to a noticeable rise in the money supply, from 0.1828 in the second period to 0.4485 in the fourth period, reflecting the connection between exchange rate fluctuations and monetary tools. Conversely, the impact of the exchange rate on government spending is negative, with the value decreasing from -0.5519 in the second period to -1.3663 in the fourth period. This suggests that changes in the exchange rate could increase the cost of imports or affect budget resources, leading to a reduction in government spending.

Table 7.
IRF Result.

Period	Impulse: GE			Impulse: BM		
	Response = GDP	Response = BM	Response = ER	Response = GE	Response = GDP	Response = ER
1	0	0	0	0	0	0
2	0.1533	-0.0030	0.0015	0.0456	-0.0014	0.000045
3	0.2822	-0.0054	0.0276	0.0879	-0.0025	0.000049
4	0.3948	-0.0073	0.0387	0.1273	-0.0033	0.000244
Period	Impulse: ER			Impulse: GDP		
	Response = GDP	Response = BM	Response = GE	Response = GE	Response = BM	Response = ER
1	0	0	0	0	0	0
2	0.0625	0.1828	-0.5519	-0.2371	0.0383	0.0044
3	0.1037	0.3298	-0.9999	-0.4328	0.0715	0.0066
4	0.1302	0.4485	-1.3663	-0.5962	0.1000	0.0073

When there is a shock from an increase (or decrease) in GDP, the money supply also increases (or decreases), suggesting that economic growth creates conditions for the expansion of monetary policies to support the economy. Similarly, the exchange rate also increases (or decreases) in response, although the impact is relatively small, reflecting the relative stability of the exchange rate amid changes in GDP. On the other hand, a shock from GDP, representing a sudden increase (or decrease) in economic activity, will negatively (positively) affect government spending. The results in the table show that the response value is -0.2371 in the second period and -0.5962 in the fourth period, meaning that when GDP increases, government spending gradually decreases over time. Conversely, when GDP decreases, government spending tends to increase. This implies that when an economic recession occurs (such as during an economic crisis or the COVID-19 pandemic), the government may increase public spending to stimulate aggregate demand and support the economy through the crisis. This reflects the role of fiscal policy in stabilizing the macroeconomy by adjusting public spending in line with the economic cycle.

Thus, it can be concluded that in Vietnam, fiscal policy is generally more proactive than monetary policy during the period from 1996 to 2023, especially during economic downturns. This finding is consistent with the work of Khang, et al. [28]; Azad, et al. [18] and Kassab [29] who argue that an increase in fiscal spending boosts economic growth, and that in times of economic downturn, fiscal spending continues to play a dominant role. Additionally, during a recession, the State Bank of Vietnam may be concerned that expanding the money supply while public spending increases could lead to inflationary pressures, especially in an economy susceptible to price fluctuations like Vietnam. To avoid a "stagflation" scenario (stagnation combined with inflation), the money supply may be tightened. Moreover, during a downturn, businesses and households often reduce their demand for loans and investment due to pessimistic economic expectations, leading to a natural decline in credit growth. In this context, the Central Bank may limit the money supply because new

capital flows may not be effectively absorbed into productive activities, avoiding the risk of creating unnecessary liquidity in the financial system.

4.2.5. WTC Result

To test the robustness of the obtained results, we use Wavelet estimation. Additionally, Wavelet allows us to explore frequency fluctuations and impacts across different time cycles. This provides a more comprehensive view of the impact of monetary and fiscal policies on economic growth in Vietnam. The results are presented in Figures 2, 3, and 4. In these figures, the vertical and horizontal axes represent frequency and time, respectively. The vertical axis indicates short-term, medium-term, and long-term horizons through frequency intervals of 2.8, 4-5.6, and 5.6-8. The color scale from blue to red indicates low to high dependence between the series. Right-pointing arrows (\rightarrow) represent positive correlation, while left-pointing arrows (\leftarrow) represent negative correlation. Arrows pointing left and upward (\nwarrow) or right and downward (\searrow) indicate that the second variable causes the first variable. Conversely, arrows pointing right and upward (\nearrow) or left and downward (\swarrow) indicate that the first variable causes the second variable. In Figures 2, 3, and 4, the first variables are BM, GE, and ER, and the second variable is GD. The results provide several interesting insights, specifically:

Figure 2 shows the Wavelet Transform Coherence (WTC) between BM and GDP in Vietnam from 1996 to 2023. Between 2006 and 2011, the arrows point left and downward, indicating a strong negative correlation between BM and GDP at low frequency (2.8 years), with BM acting as the leading variable. This means that, in the short term, an increase in money supply has a negative impact on GDP. This result is consistent with the findings from the Bayesian Vector Autoregressive (BVAR) model. It suggests that an expansion of the money supply may not directly stimulate economic growth in the short term, potentially causing small negative pressures due to factors such as inflation or delayed effects. Indeed, this period coincides with Vietnam's accession to the WTO in 2007, which led to numerous changes in economic and trade policies. However, the economy also faced significant challenges, such as high inflation (peaking in 2008 and 2011)¹ and global financial instability (the 2008 financial crisis). As a result, the expansion of money supply to support economic growth may not have had an immediate effect due to issues like inefficient investments, an underdeveloped financial system, and high inflationary pressures.

Figure 3 illustrates the Wavelet Transform Coherence (WTC) between government expenditure (GE) and GDP in Vietnam from 1996 to 2023. Between 2001-2006 and 2016-2021, the arrows point right and upward, indicating a strong positive correlation between GE and GDP at low and medium frequencies (5-6 years cycle), with GE identified as the leading variable. This suggests that changes in GE occur first and have a positive impact on GDP in both the short and medium term. This highlights the crucial role of government expenditure in driving economic growth in Vietnam, demonstrating the effectiveness of fiscal policies in stimulating growth over the next 5 years. During the 2001-2006 period, GE had a clear impact on the economy in 2001 and continued to increase over the next 5 years. This laid the foundation for Vietnam's deeper integration into the global economy, especially with its WTO accession in 2007. The government implemented various stimulus policies, invested in infrastructure, and increased public spending to boost economic growth, creating a solid foundation for sustainable development in the years that followed. In the 2016-2021 period, Vietnam faced numerous challenges from both internal and external factors, such as the US-China trade war and the COVID-19 pandemic. Nevertheless, the Vietnamese government boldly applied public expenditure policies to support the economy, including stimulus packages and investment in major projects like infrastructure, healthcare, and business support. Similar to the previous period, government spending was effectively used as a tool to maintain and boost growth. Despite the challenges posed by the COVID-19 pandemic, timely support policies helped stabilize GDP growth in both the short and medium term. Investments in healthcare, digital technology, and economic sector support helped mitigate the negative impacts of external shocks. During the pandemic crisis, government expenditure became a leading factor, aiding in economic recovery and stimulating production, investment, and consumption. This study's results are consistent with the findings of the BVAR model and align with previous research by Khang, et al. [28]; Azad, et al. [18] and Kassab [29] which emphasize that public expenditure is a key driver of economic growth.

Figure 4 illustrates the Wavelet Transform Coherence (WTC) between exchange rate (ER) and GDP in Vietnam from 1996 to 2023. Between 2008 and 2010, the arrows point right and upward, indicating a strong positive correlation between ER and GDP at low frequency (2.8-year cycle), with ER identified as the leading variable. This suggests that changes in the exchange rate occur first and have a positive impact on GDP in the short term. Unlike the strong impacts of government expenditure (GE) and BM on GDP, the effect of the exchange rate (ER) on economic growth is minimal, as reflected by the limited presence of arrows. This indicates that the exchange rate has a restricted and unstable influence on GDP growth during crisis periods. While the exchange rate may have an impact during specific periods, its effect is not as pronounced and consistent as the effects of fiscal and monetary policies such as government spending and money supply expansion. This reflects Vietnam's economic dependence on two main factors: fiscal policy and monetary policy, rather than the exchange rate.

¹ In 2008 and 2011, Vietnam experienced its highest inflation rates, at 23.11% and 18.68%, respectively. <https://databank.worldbank.org/data/Vietnam-indicators/id/80abfab3#>

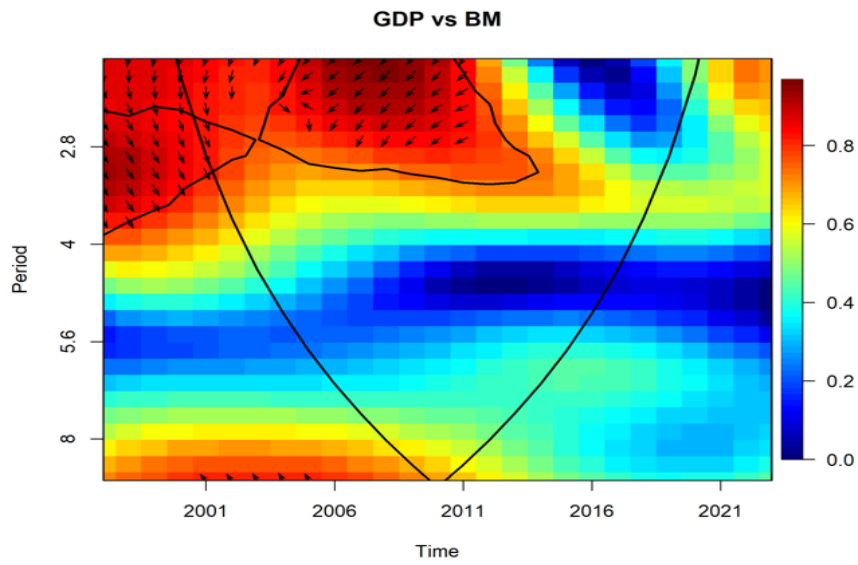


Figure 2.
WTC between GDP and BM.

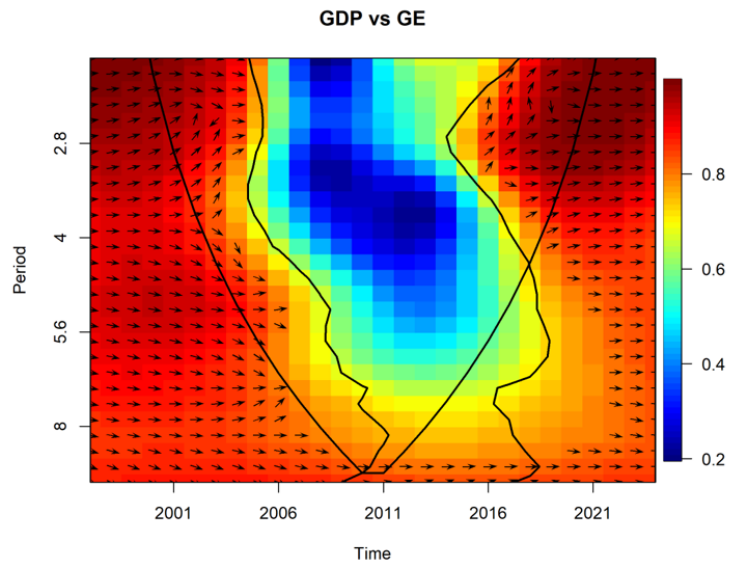


Figure 3.
WTC between GDP and GE.

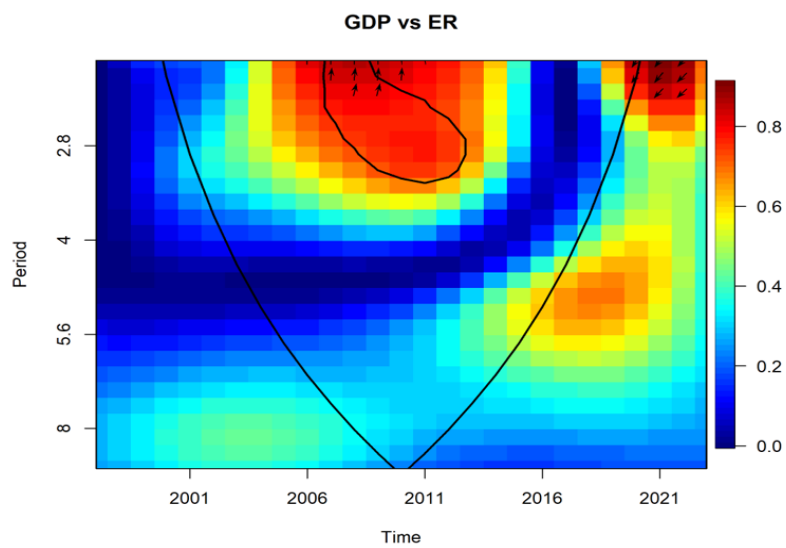


Figure 4.
WTC between GDP and ER.

5. Conclusion and Policy Implications

After the COVID-19 pandemic, the global economy continues to face challenges in its recovery process. The excessive monetary easing in many major economies during the pandemic, along with the Russia-Ukraine conflict, has driven up commodity prices, leading to widespread inflation globally since the second half of 2022. Many countries, particularly the United States and Europe, have had to prioritize controlling inflation by continuing to tighten monetary policy, rather than focusing on promoting growth as they did previously. Vietnam is not immune to the global economic slowdown. The slowdown in international trade and investment flows has caused the Vietnamese economy to slow down somewhat, despite the advantages of free trade agreements and the shifting of global investment flows. To cope with the volatile global economic context, Vietnam needs to coordinate monetary and fiscal policies in a flexible, effective, and synchronized manner. Monetary policy should focus on controlling inflation, stabilizing the exchange rate, and supporting reasonable economic growth. At the same time, fiscal policy should play a leading role in promoting economic growth and ensuring social security. This study aims to analyze the impact of monetary and fiscal policies on economic growth in Vietnam from 1996 to 2023. We employed a two-method approach combining BVAR and WTC, and the results show consistency between the two methods. Specifically, fiscal policy, measured by public consumption expenditure, has a strong impact on economic growth, especially during the periods 2001-2006 (before Vietnam joined the WTO) and 2016-2021 (during the US-China trade war and the COVID-19 pandemic). Monetary policy, measured by broad money supply, had a negative impact on economic growth, particularly in the 2006-2011 period. This period coincided with Vietnam's accession to the WTO in 2007, which led to numerous changes in economic and trade policies, and the Vietnamese economy also faced several challenges, such as high inflation. Therefore, expanding the money supply to support economic growth may not have been immediately effective due to issues like inefficient investment, an underdeveloped financial system, and high inflationary pressures. Additionally, we examined the impact of exchange rates on economic growth, and the results show that an increase in the exchange rate (i.e., depreciation of the domestic currency) supports exports, thereby stimulating economic growth, although the effect is relatively small. This study helps us achieve the initial research goal of examining the impact of fiscal and monetary policies on economic growth in Vietnam, particularly during periods of crisis, such as the global financial crisis of 2007 and the COVID-19 pandemic. This study offers new insights compared to previous research by using a combined approach with BVAR and WTC. We have provided evidence of the impact of fiscal and monetary policies, as well as the interaction between these two policies on economic growth, especially during specific periods: 2006-2011 for monetary policy and 2001-2006 and 2016-2021 for fiscal policy.

From the results above, we propose the following recommendations:

First, policymakers should prioritize fiscal policy, specifically public spending, especially during times of economic difficulty or crisis. Public spending should be focused on infrastructure, healthcare, and education investments to create sustainable growth drivers in the long term. Additionally, there needs to be close coordination between fiscal and monetary policies, particularly during years of significant economic volatility, such as the COVID-19 pandemic or the global financial crisis, to ensure the stability and development of the economy.

Second, monetary policy should be adjusted flexibly and promptly to support economic growth during recessionary periods. The State Bank of Vietnam should maintain reasonable interest rates to stimulate investment and consumption in the economy while ensuring inflation control. During crises, lowering interest rates can create favorable conditions for businesses and households to access credit, thereby boosting production and consumption. However, caution is required when adjusting monetary policy to avoid negative effects on financial stability and exchange rates.

A limitation of this study is that the variables representing fiscal and monetary policies are public consumption expenditure and broad money supply, respectively. These variables may not fully capture the complete impact of fiscal and monetary policies on the economy, as these policies may involve other factors such as taxes, public investment, and interest rates. Therefore, future research will address this issue.

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