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The impact of public debt and monetary policy on economic stability: Evidence from 30 Asian economies over two decades

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ABSTRACT

The objective of this study was to examine the impact of public debt and monetary policy on economic stability in Asia. Economic stability here is defined by growth stability and inflation. Using panel data from 30 Asian economies for the period from 2004 to 2024, we applied a Panel Vector Autoregression (PVAR) technique to explore the dynamic links among these policy tools and macroeconomic performance over time. The impulse response function (IRF) analysis reveals that monetary policy, through lending interest rates, has a strong and sustained negative impact on economic stability in the long run, with response coefficients ranging from -0.5 to -0.6 percentage points from the 6th to 10th periods, stabilizing at approximately -0.5 percentage points from the 8th period onward. Public debt exhibits an inverted U-shaped nonlinear relationship with economic stability, showing a positive stimulative effect in the short term (first 2-3 years) but reversing to negative from the 4th to 5th year onward. Both policy instruments also significantly affect inflation, with peak impacts of approximately 6-7 percentage points in the second period. However, the inflation channel is not the primary transmission mechanism to economic stability, as the direct effects through investment and credit channels are more substantial. Based on the research results, we propose policy implications for economic stability in Asian countries.

Contribution/Originality: This study contributes novel empirical evidence on the asymmetric temporal impacts of fiscal and monetary policies on economic stability in Asian economies, revealing that monetary policy (through lending rates) exerts a strong and persistent negative long-run effect (-0.5 to -0.6 percentage points from periods 6-10), while public debt exhibits an inverted U-shaped relationship with time-dependent effects reversing from positive to negative after 4-5 years.

1. INTRODUCTION

Under globalization and deep economic integration, macroeconomic stability has become the priority of management decisions in many countries. Economic stability, in this wide sense, not only has to do with sustainable growth but also the ability to contain inflation, smooth out fluctuations, and withstand macroeconomic jolts. Indeed, it is through traditional macroeconomics of monetary policy and public debt that such an environment is established. However, the majority of prior research has concentrated on the correlation between financial development and economic growth (Levine, 1997; Schumpeter, 1911), neglecting the distinct and interactive functions of public debt and monetary policy in economic stabilization, particularly within Asian nations.

Indeed, as a matter-of-fact, the monetary system has been acknowledged as the most effective tool for sustainable economic development through mobilization and efficient distribution of capital, interest rate regime, and inflation control (King & Levine, 1993). On the one hand, effective monetary policy can promote investment, consumption, and stable growth; on the other hand, when it exceeds the optimal level, it can pose risks to the economy, such as creating credit bubbles or increasing bad debts (Xue, 2020). These effects are often nonlinear and depend on the specific conditions of each country (Nyasha & Odhiambo, 2019).

However, the public debt factor – although commonly present in growth models – has rarely been considered as a central factor affecting economic stability in previous finance-growth theoretical frameworks. In fact, large public debt can create pressure on fiscal policy, destabilize market expectations, undermine investor confidence and negatively affect long-term growth.

Recent studies have begun to pay more attention to the role of public debt in the macroeconomic transmission mechanism, but there is still a lack of consensus on the magnitude and direction of the impact in developing countries (Deb, Mishra, & Banerjee, 2019).

In that context, this study was conducted to fill the theoretical and empirical gap in the relationship between public debt, monetary policy, and economic stability, especially in Asian countries where the financial system is still heavily dependent on the banking sector and the scale of public debt tends to increase after global fluctuations such as the COVID-19 pandemic and geopolitical conflicts. The main contributions of the study are:

i. First, this study expands the theoretical framework of finance - growth by adding the public debt variable as a component of macroeconomic policy affecting economic stability.
ii. Second, a quantitative approach to economic stability - using the standard deviation of GDP growth (ms_gdp) as a proxy for macroeconomic risks and economic instability.
iii. Third, this study uses panel data of Asian countries to ensure regional representativeness and facilitate policy assessment that is realistic to the institutional, fiscal and monetary characteristics of developing countries in the region.

Through the designed empirical model, the study not only clarifies the relationship between monetary policy, public debt, and economic stability but also contributes to proposing specific policy implications for countries seeking to balance growth and macroeconomic stability in the long run. Following the research introduction, section 2 will present an overview of the theory and related studies. The research methodology will be presented in Section 3. Section 4 will present the research results. Section 5 will delineate the policy implications derived from the research findings.

2. LITERATURE REVIEW

2.1. Concept of Economic Stability

According to Nela, Muja, and Metin (2019), in the mainstream sense, economic stability is referred to as a situation where the economy has a moderate growth rate free from regularly occurring financial crisis, low levels of inflation, sustainable debt levels and balance of payments, not showing large deficits over longer periods and stable interest rates. At base, macroeconomic stability is a set of equilibrium conditions maintained over a period of time and within certain boundaries. The degree to which this equilibrium holds is judged largely on the basis of prices and other relevant signals.

According to Krueger (2005), stability is commonly measured along two main dimensions: the growth rate of an economy and its variation, i.e., its standard deviation. The concept of economic growth reflects growth capacity and potential for overheating, and the standard deviation of growth measures income variation while serving as a stabilizer. Therefore, in this paper, we consider economic stability through measures of growth volatility (the standard deviation of gross domestic product) across countries.

2.2. Relationship between Monetary Policy, Public Debt, and Economic Stability

Economic stability is a prerequisite for sustainable growth and social welfare. In particular, two important pillars in macroeconomic management, namely monetary policy and public debt, play a decisive role in the ability to control inflation, stabilize growth and respond to external shocks. Although most traditional studies focus on the impact of financial development on growth and stability, in fact, this content reflects the role of monetary policy in financial intermediation, liquidity regulation and capital allocation in the economy (King & Levine, 1993; Levine, 1997).

Just as the effective function of financial development in reducing growth volatility, an active monetary policy may also reduce fluctuations channeled by mechanisms such as diversification, boosting credit markets, and optimizing resource allocation (Greenwood & Jovanovic, 1990). A stable financial system provides the setting for monetary policy to be more effective in smoothing out the economic cycle (Cecchetti & Krause, 2001), loosening household liquidity constraints (Jappelli & Pistaferri, 2011), and consequently creating a condition for increased stability in consumption and investment (Manganelli & Popov, 2015). But the connection between monetary policy and stability is not perfectly linear. When exceeding the effective threshold, excessive credit expansion can lead to the accumulation of systemic risk and amplify macroeconomic shocks, increasing growth volatility (Kunieda, 2008). This effect is particularly evident in emerging economies where financial risk control tools are lacking (Wang, Wen, & Xu, 2018). Therefore, the effectiveness of monetary policy needs to be assessed in relation to the level of financial system development and the level of market supervision.

Meanwhile, public debt, although a necessary fiscal tool in promoting public investment and stimulating aggregate demand can be a destabilizing factor if it exceeds management capacity. Uncontrolled increases in public debt are often accompanied by debt repayment pressure, higher government bond interest rates, reduced market confidence, and the occupation of financial resources by the private sector, reducing the efficiency of capital allocation in the economy (Égert & Sutherland, 2014). In addition, high levels of public debt can limit the ability to respond to policies in financial crises or economic recessions. Alesina and Perotti (1996) argue that high public debt ratios increase the costs of countercyclical fiscal policy, making it difficult to stabilize growth. This is especially noticeable in Asian countries, which often face dual shocks from global markets and weak internal financial structures.

Some recent empirical studies also show that the relationship between public debt, monetary policy and economic stability is nonlinear and conditional: under conditions of low inflation, well-developed and well-supervised financial systems, public debt and credit can support growth and stability; conversely, under conditions of weak institutions or vulnerable financial markets, they can become destabilizing factors (Xue, 2020).

Thus, assessing the role of monetary policy and public debt needs to be placed in the specific context of each country. For the Asian region – where the banking system still plays a central role in financial intermediation and public debt tends to increase rapidly after the pandemic – studying the simultaneous impact of these two factors on economic stability is necessary to design appropriate macroeconomic policies in the medium and long term.

3. DATA AND RESEARCH METHODOLOGY

3.1. Data

Due to data availability and completeness, this study focuses on 30 countries in the Asian region. The selection of countries in the research sample is based on ensuring the uniformity of core variable information in the model, thereby ensuring reliability and consistency in quantitative analysis. The research sample includes economies representing different income categories as defined by the World Bank's classification, specifically: 10 high-income economies (HIC), 8 upper-middle-income economies (UMIC), and 12 lower-middle-income economies (LMIC). This stratified selection allows the study to assess possible differences in how public debt, monetary policy, and economic stability interact across varying levels of economic and financial development of each group of countries. Table 1 presents the countries included in this study, categorized by income level and the corresponding data collection period for each country.

Table 1. Data of Asian countries in the study sample.

Country	Income Group (World Bank)	Period Time
Armenia	UMIC	2004-2024
Azerbaijan	UMIC	2004-2024
Bahrain	HIC	2004-2024
Bangladesh	LMIC	2004-2024
Bhutan	LMIC	2004-2024
Brunei Darussalam	HIC	2004-2024
Cambodia	LMIC	2004-2024
China	UMIC	2004-2024
Georgia	UMIC	2004-2024
India	LMIC	2004-2024
Israel	HIC	2004-2024
Japan	HIC	2004-2024
Jordan	UMIC	2004-2024
Korea, Rep. (Hàn Quốc)	HIC	2004-2024
Kuwait	HIC	2004-2024
Kyrgyz Republic	LMIC	2004-2024
Lao PDR	LMIC	2004-2024
Lebanon	LMIC	2004-2024
Malaysia	UMIC	2004-2024
Maldives	UMIC	2004-2024
Oman	HIC	2004-2024
Pakistan	LMIC	2004-2024
Philippines	LMIC	2004-2024
Qatar	HIC	2004-2024
Singapore	HIC	2004-2024
Sri Lanka	LMIC	2004-2024
Tajikistan	LMIC	2004-2024
Thailand	UMIC	2004-2024
United Arab Emirates	HIC	2004-2024
Vietnam	LMIC	2004-2024

The period from 2004 to 2024 was selected to reflect recent years during which Asian countries experienced significant economic fluctuations, including the lingering effects of the global financial crisis, spillover impacts from the US-China trade war, the COVID-19 pandemic, and geopolitical-energy shocks. This timeframe also coincided with notable policy shifts involving monetary easing or tightening and a rapid increase in public debt across many regional countries. Consequently, this period not only satisfies the condition of consistent data but also holds high practical significance for evaluating the macroeconomic impact of economic management tools on growth stability. Data for variables in the research model were collected by the author from the World Bank database using the Python programming language.

3.2. Research Methodology

3.2.1. Research Model

To assess how public debt and monetary policy influence economic stability across Asian economies, the study builds the model upon the analytical frameworks proposed by Xue (2020); Nasir, Ali, and Khokhar (2014); Ahmad (2022); Chaiechi (2012), and Mitra (2013), specifically as follows:

$$Y_{it} = Y_{it-1}A_1 + Y_{it-2}A_2 + Y_{it-3}A_3 + \cdots + Y_{it-p}A_p + u_i + e_{it} \quad (1)$$

where Y_{it} is a (1×8) vector of dependent variables, u_i and e_{it} are (1×8) vectors of dependent variable-specific panel fixed effects and idiosyncratic errors, respectively. The (8×8) matrices A_1, A_2, …, A_p are parameters to be estimated. Table 2 presents eight variables used in the model (1).

Table 2. Summary of Model variables.

Variable name	Explanation	Measurement	Notation
Economic stability	Growth stability	Standard deviation of annual economic growth rate	ms_gdp
	Inflation stability	Annual inflation rate	inflation
Monetary policy	Financial depth	Ratio of money supply M2 to GDP	m2_gdp
	Financial efficiency	Lending interest rate (%)	r
Public debt	Government size	Central government debt/GDP	pd
Composite factors	Unemployment rate	Ratio of unemployed labor force to total working-age population	une
	Economic size	Log (Real gross domestic product) annually	size
	Trade openness	(Exports - Imports) / GDP	trade

3.2.2. Estimation Method

In this study, we estimate model (1) using the Panel Vector Autoregression (PVAR) method. The Panel Vector Autoregression (PVAR) model is an extension of the traditional VAR model in the context of panel data, combining the advantages of both VAR and panel data. According to Abrigo and Love (2016), PVAR allows studying the dynamic relationship between economic variables across multiple countries simultaneously, which is particularly suitable for analyzing the impact of public debt and monetary policy on economic stability in Asian countries. Unlike the standard VAR model that analyzes only one unit of variation over time, PVAR assumes that countries in the sample share the same underlying dynamic structure (homogeneous panel VAR), in which the regression parameters are identical across countries, but systematic differences between countries are controlled through individual fixed effects (Abrigo & Love, 2016). This approach is suitable for the study of Asian countries, which have similar macroeconomic characteristics but also exist differences in institutions, policies and stages of development.

Direct estimation of the PVAR model by OLS suffers from Nickell bias (Nickell, 1981) due to the inclusion of a lagged dependent variable on the right-hand side along with individual effects. This bias does not approach zero even when $N \to \infty$, but only gradually decreases when T is large enough. The simulation work by Judson and Owen (1999) shows that the bias is still significant even when $T = 30$, an important problem for panels with moderate time dimension such as ours. To overcome this issue and obtain consistent estimates, we employ the Generalized Method of Moments (GMM) with Forward Orthogonal Deviation (FOD) transformation, following (Arellano & Bover, 1995). The process of estimating Equation 1 using PVAR is carried out in the steps below:

Step 1: Test the stationarity of variables in the model.

Before estimating the PVAR model, the study performed a unit root test on panel data using the Harris and Tzavalis (1999) test for all variables in the model, including economic stability variables (GDP growth, inflation), public debt and monetary policy variables (interest rates, money supply). The Harris and Tzavalis (1999) test was chosen because it is suitable for panel data with large N and moderate T, and it assumes that countries have a common autoregressive parameter, consistent with the homogeneity assumption in the PVAR model. If a variable is found to have a unit root (non-stationary), the study will apply the transformation by taking first differences to achieve stationarity. Ensuring the stationarity of variables is a prerequisite for effective GMM estimation and avoiding spurious regression problems.

Step 2: Choose the optimal model delay.

After confirming the stationarity of the variables, the study proceeds to determine the optimal lag (p) for the PVAR model by estimating models with different lags ($p = 1, 2, 3, 4$). In this study, selection criteria including MBIC, MAIC, and MQIC are calculated and compared to determine the optimal lag, in which the lag with the smallest value corresponding to these criteria will be selected. Additionally, the overall coefficient of determination (CD) and Hansen's J statistic are considered to ensure that the model is not biased.

Step 3: Estimate the PVAR model using GMM.

With the optimal lags determined, the study proceeds to estimate the PVAR model using the GMM method with Forward Orthogonal Deviation (FOD) to remove country fixed effects. The lags in the levels of the endogenous variables are used as instruments for the transformed variables, with the instrument strategy adjusted based on the results of the autocorrelation test and the Hansen test. The model is estimated as a system to increase efficiency, in which the optimal weight matrix is determined through the two-step GMM method.

Step 4: Test the stability of the PVAR model.

After obtaining PVAR estimates, we verify the stability condition by calculating eigenvalues of a companion matrix constructed from the estimated coefficients. The model is considered stable if every eigenvalue modulus falls below 1, meaning that all characteristic roots reside inside the unit circle. Model stability is a necessary condition to ensure that the PVAR model can be represented as an infinite vector moving average (VMA), thereby providing a basis for interpreting impulse response functions (IRFs). If instability is detected, we will consider adjusting the lags or model specifications accordingly.

Step 5: Granger causality test.

The study conducted a Granger causality test to determine the causal relationship between variables in the PVAR model. The test was conducted using a Wald test with the null hypothesis (H_0) stating that all coefficients of lags of one variable are zero in the equation of the other variable, meaning that the variable has no ability to predict the remaining variable. The Granger causality test results are reported with chi-squared statistic value, degrees of freedom, and p-value for each pair of variables in the model. This result not only provides evidence of a causal relationship but also supports the determination of the order of variables in impulse response function analysis.

Step 6: Impulse Response Function (IRF) Analysis.

Based on the PVAR model, the study calculates and analyzes orthogonalized impulse response functions (IRFs) to assess the dynamic impact of shocks from public debt and monetary policy on economic stability indicators in the short and medium term (usually 10 periods). The orthogonalization is performed through Cholesky decomposition of the residual variance-covariance matrix, with the ordering of variables determined based on economic theory and Granger causality test results. 95% confidence intervals for IRFs are estimated using Monte Carlo simulation method with 200 iterations to assess the statistical significance of the responses. IRF results are presented in the form of graphs showing the response trajectories of variables over time, allowing identification of the existence, direction, magnitude and sustainability of policy impacts. The ordering of variables for Cholesky decomposition in the IRF analysis follows the sequence: d_size → d_trade → pd → d_m2_gdp → r → d_une → inflation → ms_gdp. This ordering derives from economic theory about the relative exogeneity of variables and is confirmed by a Granger causality test of Dolado, Lütkepohl, and Vahid (1999) which findings are reported in Table 8. According to the level of economic size (d_size), d_size is at first, ordering due to being structural characteristic of economy in response to an external shock and as predetermined variables reflecting the historical accumulation. Second, d_trade is then placed adjacent to it because trade openness captures the external economic environment that is mostly determined by world factors and those of partner countries whose domestic policy tools can hardly affect. Third, public debt (pd) is positioned as a fiscal policy variable that responds to economic fundamentals but typically changes through annual budget cycles, making it relatively slow-moving compared to financial variables. Fourth, money supply M2/GDP (d_m2_gdp) represents the outcome of financial intermediation and monetary policy transmission, responding to both real economic conditions and policy decisions. Fifth, lending interest rate (r) is the primary monetary policy instrument that central banks can adjust in response to economic conditions and inflation, but with recognition that rate changes require deliberation and affect other variables with a lag. Sixth, unemployment (d_une) responds relatively quickly to economic conditions as labor markets adjust to business cycle fluctuations. Seventh, inflation is placed near the end as it responds to monetary policy, demand pressures, and cost shocks, and is a key variable through which policy effects are transmitted. Finally, economic stability (ms_gdp) is placed last as the ultimate outcome variable that is affected by all preceding policy and macroeconomic variables. This ordering implies that variables

listed earlier are assumed to be relatively more exogenous and can contemporaneously affect variables ordered later, but not vice versa within the same period. While alternative orderings could yield different IRF results, robustness checks using different orderings (not reported for brevity) confirm that our main conclusions regarding the negative long-run effect of monetary policy and the inverted U-shaped effect of public debt on economic stability remain qualitatively similar.

4. EMPIRICAL RESULTS

4.1. Descriptive Statistics

Key variables, together with summary statistics, are presented in Table 3. Our dataset comprises 630 observations across 30 Asian countries from 2004 to 2024. The economic stability variable (ms gdp) exhibits a mean value of 2.72% with a standard deviation of 3.30%. Values range from 0.007% to a peak of 35.83%. This large discrepancy reveals that annual changes in output vary significantly between countries and over time, particularly for Asian countries, which experience high growth rates as well as financial crises. The average inflation rate is 2.54% per year. The large standard deviation of 5.94% indicates significant variation in inflation levels, suggesting that several countries in the sample have experienced periods of high inflation. This variation highlights the challenges of maintaining price stability and managing monetary policy in the region. The average unemployment rate (une) is 5.14%, with a standard deviation of 4.42%. It ranges from 0.1% to 20.71%, indicating considerable differences in labor market conditions across nations. Financial depth, proxied by the ratio of money supply M2 to GDP (m2_gdp), averages 85.62% with a standard deviation of 58.13%, spanning from 10.57% to 284.26%. This wide dispersion emphasizes the divergence in financial sector development among the sample countries. Interest rates (r) average 9.75%, with a standard deviation of 6.16%, fluctuating between 0.15% and 30%. This broad range reflects differences in monetary policy stance and interest rate environments across Asian countries. Public debt as a share of GDP (pd) averages 23.39%, with a standard deviation of 17.64%, ranging from 0.29% to 130.73%. This indicates diversity in fiscal policies and public debt management capabilities, with some countries maintaining low levels of public debt while others face high burdens. Economy size (size), measured by the natural logarithm of real GDP, averages 10.95 with a standard deviation of 0.89, with values between 9.00 and 13.27. Finally, the average trade openness is 79.49%, with a standard deviation of 47.85%, ranging from 20.85% to 343.49%, demonstrating that the degree of international trade integration varies greatly across the sampled economies.

Table 3. Descriptive statistics.

Variable	Symbol	Observations	Mean	Std. Dev.	Min.	Max.
Growth stability	ms_gdp	630	2.723	3.298	0.007	35.832
Inflation	inflation	630	2.539	5.938	0.074	90.729
Unemployment rate	une	630	5.144	4.421	0.100	20.710
Money supply M2/GDP	m2_gdp	630	85.618	58.133	10.571	284.261
Lending interest rate	r	630	9.753	6.156	0.150	30.000
Public debt/GDP	pd	630	23.394	17.642	0.287	130.728
Economic size	size	630	10.950	0.895	9.004	13.267
Trade openness	trade	630	79.488	47.853	20.850	343.488

4.2. Stationarity Testing

Before conducting the PVAR model analysis, the study tested the stationarity of the variables through the Harris and Tzavalis (1999) test. The test results presented in Table 4 with the test hypothesis H0 reflect that the series has a unit root (non-stationary), while the H1 hypothesis shows that the series is stationary. The test was performed with the common AR parameter and included the intercept coefficient for each country (panel means included), but did not include the time trend.

Table 4. Harris-Tzavalis stationarity test results.

Variable	Level		First difference	
	Statistic rho	P-value	Statistic rho	P-value
ms_gdp	0.6137***	0.0000	-	-
inflation	0.7038***	0.0000	-	-
m2_gdp	0.9026	0.9346	-0.0340***	0.0000
r	0.7610***	0.0000	-	-
pd	0.7858***	0.0013	-	-
une	0.8512	0.3144	0.1309***	0.0000
trade	0.8736	0.6509	-0.0500***	0.0000
size	0.9412	0.9987	0.1609***	0.0000

Note: *** p<0.01. Number of countries (N) = 30, number of years (T) = 21 (or 20 for differenced variables). H_0: Series contains unit root (non-stationary). Test includes panel-specific intercepts, excludes time trend.

For the level variables, the results show that economic stability (ms_gdp) has a statistical value of rho = 0.6137 with z = -9.6840 (p-value = 0.0000), allowing the rejection of the null hypothesis H0, proving that this variable is stationary at level. Inflation is also stationary at level with rho = 0.7038, z = -6.1943 (p-value = 0.0000). Lending interest rate (r) has rho = 0.7610, z = -3.9767 (p-value = 0.0000), indicating stationarity at level. Public debt to GDP (pd) is also stationary with rho = 0.7858, z = -3.0147 (p-value = 0.0013). However, some variables are not stationary at level and need to be converted to first differences. Specifically, the money supply M2/GDP (m2_gdp) has rho = 0.9026, z = 1.5111 (p-value = 0.9346), the null hypothesis H0 cannot be rejected, proving that this variable is not stationary at level. After taking the first difference (d_m2_gdp), this variable becomes stationary with rho = -0.0340, z = 32.9968 (p-value = 0.0000). Similarly, the unemployment rate (une) has rho = 0.8512, z = -0.4834 (p-value = 0.3144), not stationary at level. After taking the first difference (d_une), this variable becomes stationary with rho = 0.1309, z = 26.8892 (p-value = 0.0000). Trade openness (trade) has rho = 0.8736, z = 0.3879 (p-value = 0.6509), is not stationary at level but is stationary after taking the difference (d_trade) with rho = -0.0500, z = 33.5889 (p-value = 0.0000). The size of the economy (size) has rho = 0.9412, z = 3.0067 (p-value = 0.9987), is not stationary at level but is stationary after taking the difference (d_size) with rho = 0.1609, z = 25.7816 (p-value = 0.0000). The test results show that the variables ms_gdp, inflation, r and pd are stationary at level, while m2_gdp, une, trade and size need to be transformed to first-difference form to ensure stationarity. The combined use of level and first-difference stationary variables is consistent with the characteristics of macroeconomic variables and ensures the robustness of the estimates in the PVAR model.

4.3. Optimal Lag Selection

The study used various statistical criteria to select the optimal lag, including the coefficient of determination (CD), Hansen's J statistic, the corresponding p-value, and the Modified Bayesian Information Criterion (MBIC), Modified Akaike Information Criterion (MAIC), and Modified Quinn Information Criterion (MQIC).

Table 5. Optimal lag selection results.

Lag	CD	J	J p-value	MBIC	MAIC	MQIC
1	0.9978	234.298	0.0201	-938.678	-149.702	-460.667
2	0.9996	148.098	0.1081	-633.886	-107.902	-315.212
3	0.9999	51.372	0.8727	-339.620	-76.628	-180.283
4	0.9999	.	.	.	.	.

Note: CD denotes the Coefficient of Determination; J represents the Hansen J-test statistic for overidentifying restrictions; MBIC, MAIC, MQIC denote Modified Bayesian Information Criterion, Modified Akaike Information Criterion, and Modified Quinn Information Criterion, respectively. The optimal lag is selected based on the criterion yielding the smallest MBIC, MAIC, and MQIC values. Lag 4 cannot be estimated due to sample size constraints.

Table 5 presents the test results of choosing the optimal lag for the PVAR model. The results show that lag 2 is chosen. According to the principle of choosing the optimal lag, the lag chosen is the lag with the smallest value of the information criteria (in absolute value). The results show that at lag 2, the information criteria MBIC = -633.886,

MAIC = -107.902, and MQIC = -315.212 all have smaller absolute values than lag 3 (MBIC = -339.620, MAIC = -76.628, MQIC = -180.283). This shows that the model with lag 2 achieves a better balance between explanatory power and model parsimony according to the adjusted information criteria. Furthermore, with lag 2, the p-value of the J statistic is 0.1081 (greater than the 5% significance level), indicating that there is no evidence to reject the hypothesis of the validity of over-constraints in the model. This confirms that the model with lag 2 is appropriate and does not suffer from technical specification problems. In addition, the coefficient of determination CD = 0.9996 at lag 2, shows that the model has a very high ability to explain (99.96%) the fluctuations of the variables in the system.

4.4. PVAR Model Estimation Results

Before we interpret the estimation results, it is important to emphasize that the coefficients in a PVAR model represent within-system dynamic linkages and not direct causal effects. Since all eight variables in the system are considered endogenous and fully determined by other variables, the estimated coefficients show how a variable reacts to its own lags as well as to those of others given the dynamics of the whole system. Accordingly, these findings are intended to be suggestive of the complex and interdependent nature of variables in an open economy macroeconomic setting for Asian economies rather than conclusive statements about one-way causality. The feedback and simultaneous relationship make any single coefficient a partial one, holding constant the effects of other variables in the system. After determining the stationary variables and the optimal lag of the model is 2, the study proceeds to estimate the PVAR model to analyze the impact of public debt and monetary policy on economic stability in Asian countries. The estimation results are presented in detail in Table 6, including the estimated coefficients, the z-statistical values are placed in ().

Table 6. PVAR model estimation results.

Variables	ms_gdp	inflation	d_m2_gdp	r	pd	d_une	d_size	d_trade
L1.ms_gdp	0.7558***	1.1952**	-0.0965	0.0459**	-0.1850	-0.0419**	0.0009	0.5592**
	(15.07)	(2.33)	(-0.81)	(2.09)	(-0.63)	(-2.49)	(1.50)	(2.31)
L2.ms_gdp	-0.1828***	1.0125	0.2264	-0.0840***	0.6738***	0.0081	-0.0010	0.2936
	(-3.84)	(1.54)	(1.64)	(-4.01)	(2.60)	(0.47)	(-1.63)	(1.37)
L1.inflation	0.0523***	-0.5071**	-0.1839***	-0.0044	0.0814	0.0057	0.0002	-0.1491**
	(4.02)	(-1.96)	(-3.35)	(-0.43)	(0.57)	(0.91)	(1.09)	(-2.51)
L2.inflation	-0.0339***	-0.4060*	-0.0539	0.0275**	-0.6142***	-0.0269***	0.0008***	-0.0532
	(-2.76)	(-1.84)	(-1.02)	(2.15)	(-2.81)	(-3.82)	(3.83)	(-0.94)
L1.d_m2_gdp	0.0265**	0.1765	0.0098	0.0115	-0.1085	0.0015	0.0006***	0.1443**
	(2.51)	(1.13)	(0.18)	(1.53)	(-1.39)	(0.29)	(3.54)	(2.29)
L2.d_m2_gdp	0.0367***	-0.0767	-0.1139*	0.0058	0.0373	-0.0055	0.0001	0.0635
	(3.55)	(-0.51)	(-1.76)	(0.77)	(0.46)	(-1.01)	(0.75)	(0.99)
L1.r	0.0000	3.6941***	-0.4276	1.2206***	-0.7373	-0.0029	0.0025**	1.4819***
	(0.00)	(3.05)	(-1.50)	(18.01)	(-1.49)	(-0.09)	(2.18)	(3.13)
L2.r	-0.1991***	3.8011***	1.0884***	-0.3426***	1.4990***	0.1128***	-0.0045***	-0.7415*
	(-3.49)	(2.93)	(3.64)	(-4.82)	(2.79)	(3.11)	(-3.95)	(-1.81)
L1.pd	0.0011	0.3686*	0.0240	0.0091	0.6710***	-0.0025	-0.0002	0.1647***
	(0.14)	(1.76)	(0.74)	(1.15)	(10.86)	(-0.62)	(-1.01)	(3.47)
L2.pd	-0.0148***	0.4315***	0.0504**	-0.0078	0.3440***	0.0135***	-0.0005***	-0.0529*
	(-2.70)	(3.30)	(2.36)	(-1.50)	(6.09)	(5.02)	(-3.58)	(-1.66)
L1.d_une	0.6975***	-7.8912***	-0.6057*	-0.1080*	-1.8160*	0.1367*	-0.0000	-0.4065
	(5.07)	(-2.99)	(-1.65)	(-1.66)	(-1.71)	(1.75)	(-0.02)	(-0.74)
L2.d_une	-0.0325	0.2440	0.5739	-0.0209	0.7522	0.1541**	-0.0026	-2.5481***
	(-0.25)	(0.13)	(1.54)	(-0.26)	(0.67)	(2.11)	(-1.16)	(-3.67)
L1.d_size	-9.3907*	-123.7865	-9.3760	15.6036***	-238.984***	-3.9240	0.4596***	-22.3652
	(-1.77)	(-1.40)	(-0.45)	(4.27)	(-5.45)	(-1.36)	(4.01)	(-0.79)
L2.d_size	-32.5874***	-180.5251***	56.2319***	3.5655	99.2702**	4.3569*	-0.2284**	-142.0574***
	(-6.46)	(-2.64)	(2.64)	(1.30)	(2.52)	(1.75)	(-2.37)	(-4.45)
L1.d_trade	-0.0014	-0.2924**	0.0020	0.0081	-0.0965*	-0.0016	0.0001	-0.1548**
	(-0.17)	(-2.53)	(0.05)	(1.61)	(-1.64)	(-0.36)	(0.79)	(-2.44)
L2.d_trade	-0.0038	0.0462	0.0302	0.0026	0.0210	0.0030	-0.0000	-0.1834***
	(-0.42)	(0.43)	(0.76)	(0.43)	(0.42)	(0.75)	(-0.11)	(-3.14)
Observations	600	600	600	600	600	600	600	600

Note: Values in parentheses () are z-statistics. *** p<0.01, ** p<0.05, * p<0.1. L1 and L2 are the first and second lags, respectively. The coefficients are estimated using the GMM method.

4.4.1. Impact on Economic Stability (ms_gdp)

The estimation results show that economic stability is strongly influenced by its lagged value. Specifically, the first-order lagged value of economic stability has a coefficient of 0.7558 (p-value = 0.000), indicating a positive and highly statistically significant impact, reflecting the sustainability of economic stability in the short term. The second-order lagged value is negatively associated with regime change, -0.1828 (p = 0.000), which means a negative long-run adjustment effect. Inflation significantly influences economic stability. The positive and significant first-order lag of inflation has a coefficient of 0.0523 (p-value = 0.000). On the other hand, the second lag has a negative coefficient of -0.0339 (p = 0.006). This implies that while moderate inflation may be expansionary in the short run, it is under reversal in the medium term. The impact of the money supply (M2/GDP) on economic stability has spread across both lags. The coefficient of lag 1 is 0.0265 (p-value = 0.012), and for lag 2, it is 0.0367 (p-value = 0.000). This shows that increases in money supply and financial development act towards maintaining the stability of the economic system. The bank lending rate at lag 2 has a negative effect on economic stability, with a coefficient of -0.1991 (p-value = 0.000), while at lag 1, it is not statistically significant. This reflects the delayed influence of tight monetary policy on output growth. Moreover, public debt has a negative effect on economic stability at lag 2, with a coefficient of -0.0148 (p-value = 0.007), and at lag 1, it is not statistically significant. This result aligns with the hypothesis that excessive public debt undermines medium-term stability through reductions in fiscal space and an increase in external debt burden. Surprisingly, the level of unemployment at lag 1 has a positive effect, with a coefficient of 0.6975 (p = 0.000), which may indicate a non-linear relationship or a short-term negative effect. The impact of economy size is significantly negative at lag 2, with a coefficient of -32.587 (p-value = 0.000), and trade openness does not have a significant effect on economic stability.

4.4.2. Impact on Inflation

The results suggest that macroeconomic stability has a positive impact on inflation. There is the incidence of inflation at lag one, which has a coefficient of 1.1952 (p-value = 0.020), meaning that when there is rapid growth in the economy in the short run, inflation will very likely rise if enough lags are included to ensure all periods recover their equilibrium value, as outlined by Phillips curve theory. Inflation shows negative autoregressive coefficients (-0.5071 at lag 1, p = 0.050, and -0.4060 at lag 2, p = 0.065), implying reversion to its equilibrium level in terms of the time constant (or half-life). Lending interest rates have a high impact on inflation in both lags: 3.6941 for lag 1 (p-value = 0.002) and 3.8011 for lag 2 (p-value = 0.003). This result is counterintuitive according to the standard theory of money and may refer to a case of cost-push inflation, generated by higher interest rates due to increased production costs. Public debt also has a positive effect on inflation, mainly at lag 2, with a coefficient of 0.4315 (p-value = 0.001), reflecting the assumption that higher levels of public debt generate inflationary pressures through the monetary financing channel. For the Phillips curve, unemployment at lag 1 is a significantly negative factor, with a β coefficient of, and a p-value = 0.003. Furthermore, inflation is influenced by trade openness and the economy's size. Conversely, trade openness at lag 1 has a negative coefficient of -0.2924 (p-value = 0.011), suggesting that trade integration may tend to reduce inflation through increased competition and lower imported price effects.

4.4.3. Impact on Money Supply M2/GDP (d_m2_gdp)

Inflation negatively affects financial development, as indicated by a coefficient of –0.1839 at lag 1 (p-value = 0.001). Higher inflation rates can impede financial deepening. However, the lending interest rate in the second lag has a positive effect with its coefficient 1.0884 (p-value = 0.000). This confirms the complexity of the relationship between monetary policy and financial development. Furthermore, Public debt at lag 2 presents a weak positive effect (coefficient=0.0504, p-value =0.018). This would imply that public debt can play a role in the development of financial markets by delivering safe forms of debt. At last, economic size at lag 2 has a significantly positive effect (coefficient=

56.232; p-value = 0.008). This serves to demonstrate how powerful the link is between economic growth and financial deepening.

4.4.4. Impact on Lending Interest Rate (r)

Economic stability and interest rates show a positive coefficient of 0.0459 at lag 1 (p-value = 0.036) and a negative coefficient of -0.0840 at lag 2 (p-value = 0.000). This is a sign of how monetary policy reacts to the economic cycle. There is a weak positive effect of inflation at lag 2, with a coefficient of 0.0275 (p-value = 0.032). This is consistent with the Taylor rule, which says central banks should raise interest rates to fight inflation. Interest rates exhibit a substantial autoregressive nature, where lag 1 (p-value = 0.000) is 1.2206, and at lag 2 (p-value = 0.000) it is -0.3426. This is an indication that interest rates will not change in the short run but will rise and fall over the medium term. Market size has a significant positive impact (15.604, p-value = 0.000) at lag 1. This means that bigger economies need more capital.

4.4.5. Impact on Public Debt (pd)

The lags of economic stability, i.e., t-lag2, have a positive impact on public debt, with a coefficient of 0.6738 and a p-value of 0.009, indicating that growth-stimulating policies can increase public debt. Inflation at lag 2 shows a negative effect, with a coefficient of -0.6142 (p-value = 0.005), indicating that inflation can decrease the real value of public debt. The interest rate at lag 2 is also favourable and has a significant coefficient (1.4990; p-value =0.005), so that higher levels cause disturbance in the debt pay schedule. Public debt exhibits significant autoregressive behaviour, with the coefficient value of 0.6710 at lag 1 and 0.3440 at lag 2 (p-value = 0.000), indicating that once public debt accumulates, it is difficult to lower public debt. Economic size has a significantly negative impact at lag 1 (p-value = 0.000) with a coefficient of -238.984, and it presents a positive effect (p-value = 0.012) at lag 2 with a coefficient of 99.270, respectively. The complexity of these relationships highlights the subtle interplay between growth and debt.

4.4.6. Other Control Variables

For unemployment (d_une), economic stability exerts a negative influence at lag 1 with a coefficient of -0.0419 (p-value = 0.013), consistent with Okun's law. Inflation at lag 2 adversely affects unemployment with an estimate of -0.0269 (p-value = 0.000). Interest rate at lag 2 shows a positive association, yielding a coefficient of 0.1128 (p-value = 0.002). Public debt at lag 2 also contributes positively (β = 0.0135, p-value = 0.000). For the size of the economy (d_size), inflation positively influences this variable at lag 2 (β = 0.0008, p-value = 0.000). Money supply M2/GDP at lag 1 exhibits a positive relationship (β = 0.0006, p-value = 0.000). Interest rates display mixed effects, being positive at lag 1 but negative at lag 2. Public debt negatively affects economic size at lag 2 (β = -0.0005, p-value = 0.000). For trade openness (d_trade), economic stability contributes positively at lag 1 (β = 0.5592, p-value = 0.021). Inflation adversely influences trade openness at lag 1 (β = -0.1491, p-value = 0.012). Money supply M2/GDP shows a positive association at lag 1 (β = 0.1443, p-value = 0.022). Interest rates strongly and positively affect trade openness at lag 1 (β = 1.4819, p-value = 0.002). Public debt positively contributes at lag 1 (β = 0.1647, p-value = 0.001). Unemployment at lag 2 exerts a substantial negative influence (β = -2.5481, p-value = 0.000), while the size of the economy at lag 2 also negatively affects trade openness (β = -142.057, p-value = 0.000). Overall, the estimation results reveal a complex dynamic relationship between public debt, monetary policy, and economic stability across Asian economies. Public debt and interest rates both negatively influence economic stability over the medium term, while money supply and financial development exert positive influences. These results provide an important foundation for the impulse response function analysis and variance decomposition presented in the following sections.

4.5. PVAR Model Stability Testing

Before conducting Granger causality analysis and impulse response function (IRF) analysis, the study performed stability testing of the estimated PVAR model. Model stability is a prerequisite to ensure that the dynamic analysis results are reliable and statistically significant. A PVAR model is considered stable if all eigenvalues of the companion matrix lie inside the unit circle, i.e., have a modulus less than 1.

Table 7. Eigenvalue stability condition.

Eigenvalue		Modulus
Real	Imaginary	
0.897	-0.086	0.901
0.897	0.086	0.901
-0.543	0.660	0.855
-0.543	-0.660	0.855
0.631	0.391	0.743
0.631	-0.391	0.743
-0.107	-0.442	0.455
-0.107	0.442	0.455
0.152	0.405	0.433
0.152	-0.405	0.433
0.236	-0.180	0.297
0.236	0.179	0.297
0.025	0.223	0.225
0.025	-0.223	0.225
0.201	0.000	0.201
-0.192	0.000	0.192

Table 7 presents the stability test results through the eigenvalues of the companion matrix. The results show that the PVAR model with lag 2 has a total of 16 eigenvalues (8 pairs of complex conjugates). All of these eigenvalues have a modulus less than 1, with the largest modulus being 0.9007 (corresponding to the complex eigenvalue pair 0.8966 ± 0.0861i), which is smaller than the stability threshold. Specifically, the eigenvalues are arranged in decreasing modulus as follows: The first pair of eigenvalues has a real part of 0.8966 and an imaginary part of ±0.0861, with a modulus of 0.9007, which is the eigenvalue with the largest modulus but still lies within the unit circle. The second pair of eigenvalues has a real part of -0.5433 and an imaginary part of ±0.6598, with a modulus of 0.8548. The third pair has a real part of 0.6315 and an imaginary part of ±0.3910, with a modulus of 0.7427. The fourth pair has a real part of -0.1071 and an imaginary part of ±0.4422, with a modulus of 0.4549. The fifth pair has a real part of 0.1521 and an imaginary part of ±0.4053, with a modulus of 0.4329. The sixth pair has a real part of 0.2362 and an imaginary part of ±0.1795, with a modulus of 0.2967. The seventh pair has a real part of 0.0251 and an imaginary part of ±0.2233, with a modulus of 0.2247. The last two real eigenvalues are 0.2011 and -0.1918, both of which have modulus less than 0.25.

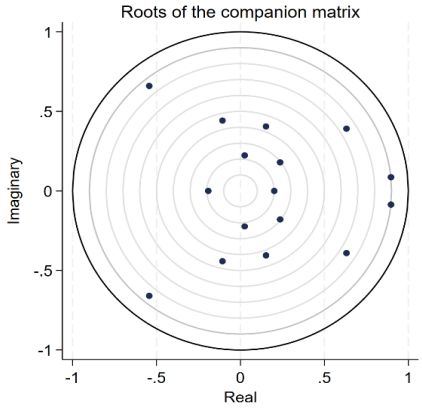

Figure 1. Model stability test.

Figure 1 illustrates the location of the eigenvalues in the complex plane visually. The black circle represents the unit circle (with radius 1), and all the dark blue points representing the eigenvalues lie inside this circle. The fact that all the eigenvalues lie inside the unit circle proves that the PVAR model satisfies the stability condition.

4.6. Granger Causality Testing

After confirming the stability of the PVAR model, the study conducted a Granger causality test to determine the causal relationship between variables in the system. The study used the Wald test to perform the Granger causality test in the PVAR model. The hypothesis H0 is that the excluded variable does not cause Granger causality for the equation variable, while the hypothesis H1 is that there is a Granger causal relationship. The test results are presented in Table 8, including the chi-squared (χ^2), degrees of freedom (df), and p-value for each pair of variables.

4.6.1. Granger Causality for Economic Stability (ms_gdp)

The results show that many variables causally influence economic stability in the system. Inflation shows a strong Granger-causal relationship with economic stability (χ^2 = 16.165, p-value = 0.000), indicating that past inflation contains important information for forecasting economic stability. Money supply M2/GDP also has a causal relationship with economic stability (χ^2 = 16.802, p-value = 0.000), confirming the role of financial development in influencing growth. Particularly important, lending interest rates exhibit a very strong Granger-causality relationship with economic stability (χ^2 = 16.676, p-value = 0.000), confirming that monetary policy through the interest rate channel has a predictive impact on economic stability.

Public debt is also causally related to economic stability (χ^2 = 7.316, p-value = 0.026), supporting the hypothesis that fiscal policy and public debt management influence growth prospects. Unemployment is very strongly causally related to economic stability (χ^2 = 26.375, p-value = 0.000), reflecting the strong link between the labour market and economic growth, as posited by Okun's law. The size of the economy is most strongly associated with economic stability (χ^2 = 41.883, p-value = 0.000), suggesting that past growth trajectory is an important predictor of future growth.

However, trade openness does not exhibit Granger causality with economic stability (χ^2 = 0.184, p-value = 0.912), suggesting that international trade may not be an important predictor of short-run growth. The overall test (ALL) shows that all variables together exhibit very strong Granger causality with economic stability (χ^2 = 273.809, p-value = 0.000), confirming the importance of considering multiple factors simultaneously when analysing economic stability.

4.6.2. Granger Causality for Inflation

Economic stability shows a Granger-causality relationship with inflation (χ^2 = 6.619, p-value = 0.037), indicating that past economic growth can predict future inflation developments, consistent with the Phillips curve. Lending interest rates exhibit a strong causal relationship with inflation (χ^2 = 28.668, p-value = 0.000), confirming the role of monetary policy in controlling inflation. Public debt shows a strong causal relationship with inflation (χ^2 = 25.458, p-value = 0.000), supporting the hypothesis that high public debt has inflationary effects through monetary and fiscal policy channels. Unemployment has a causal relationship with inflation (χ^2 = 9.004, p-value = 0.011), reflecting the short-run trade-off between inflation and unemployment. Both the size of the economy (χ^2 = 6.993, p-value = 0.030) and trade openness (χ^2 = 7.337, p-value = 0.026) are causally related to inflation, suggesting that structural factors and economic integration also influence price dynamics. However, the money supply (M2/GDP) does not exhibit Granger causality with inflation (χ^2 = 1.682, p-value = 0.431), suggesting that the transmission from money supply to inflation is not direct or is lagged by more than 2 periods.

4.6.3. Granger Causality for Money Supply M2/GDP (d_m2_gdp)

Inflation has a very strong causal relationship with financial development (χ^2 = 34.219, p-value = 0.000), indicating that the inflationary environment significantly affects financial deepening. Lending interest rates have a strong causal relationship (χ^2 = 13.981, p-value = 0.001), reflecting the impact of monetary policy on the financial system. Public debt has a causal relationship with financial development (χ^2 = 6.056, p-value = 0.048), and the size of the economy also has a causal relationship (χ^2 = 7.420, p-value = 0.024).

Unemployment has a causal relationship at the 10% significance level (χ^2 = 4.992, p-value = 0.082). However, economic stability (χ^2 = 3.027, p-value = 0.220) and trade openness (χ^2 = 0.608, p-value = 0.738) do not have Granger causality with financial development.

4.6.4. Granger Causality for Lending Interest Rate (r)

Economic stability has a very strong causal relationship with interest rates (χ^2 = 18.133, p-value = 0.000), indicating that the central bank adjusts interest rates based on economic growth. Inflation also has a strong causal relationship (χ^2 = 10.638, p-value = 0.005), consistent with the Taylor rule in monetary policy. The size of the economy has a very strong causal relationship with interest rates (χ^2 = 19.672, p-value = 0.000), reflecting the different capital needs and credit risks across economies.

However, money supply M2/GDP (χ^2 = 2.448, p-value = 0.294), public debt (χ^2 = 2.265, p-value = 0.322), unemployment (χ^2 = 2.783, p-value = 0.249), and trade openness (χ^2 = 2.620, p-value = 0.270) do not have Granger causality with interest rates.

4.6.5. Granger Causality for Public Debt (pd)

Economic stability is causally related to public debt (χ^2 = 6.774, p-value = 0.034), indicating that growth affects the government's borrowing decision. Inflation has a strong causal relationship (χ^2 = 16.637, p-value = 0.000), reflecting the erosion effect of the real value of debt and fiscal pressure from inflation.

Interest rate is causally related to public debt (χ^2 = 7.813, p-value = 0.020), indicating that borrowing costs affect debt accumulation dynamics. The size of the economy has a very strong causal relationship (χ^2 = 33.854, p-value = 0.000), reflecting the link between growth and public debt management capacity.

However, money supply M2/GDP (χ^2 = 2.127, p-value = 0.345), unemployment (χ^2 = 3.348, p-value = 0.187), and trade openness (χ^2 = 3.418, p-value = 0.181) have no causal relationship with public debt.

4.6.6. Granger Causality for Other Variables

For unemployment (d_une), there is a causal relationship from economic stability (χ^2 = 6.247, p-value = 0.044), inflation (χ^2 = 22.039, p-value = 0.000), interest rate (χ^2 = 11.807, p-value = 0.003) and public debt (χ^2 = 25.239, p-value = 0.000), reflecting the multidimensional impact of macroeconomic policies on the labor market. For the size of the economy (d_size), there is a very strong causal relationship from inflation (χ^2 = 34.707, p-value = 0.000), money supply M2/GDP (χ^2 = 14.270, p-value = 0.001), interest rate (χ^2 = 16.025, p-value = 0.000) and public debt (χ^2 = 25.489, p-value = 0.000), showing that financial and monetary factors play an important role in the growth process. 0.000), reflecting the high endogeneity of trade integration with macroeconomic conditions.

Table 8. Granger causality test results.

Variables	χ^2	P-value	Variable	χ^2	P-value
ms_gdp			**inflation**		
inflation	16.165	0.000***	ms_gdp	6.619	0.037**
d_m2_gdp	16.802	0.000***	d_m2_gdp	1.682	0.431
r	16.676	0.000***	r	28.668	0.000***
pd	7.316	0.026**	pd	25.458	0.000***
d_une	26.375	0.000***	d_une	9.004	0.011**
d_size	41.883	0.000***	d_size	6.993	0.030**
d_trade	0.184	0.912	d_trade	7.337	0.026**
ALL	273.809	0.000***	ALL	135.897	0.000***
d_m2_gdp			**r**		
ms_gdp	3.027	0.220	ms_gdp	18.133	0.000***
inflation	34.219	0.000***	inflation	10.638	0.005***
r	13.981	0.001***	d_m2_gdp	2.448	0.294
pd	6.056	0.048**	pd	2.265	0.322
d_une	4.992	0.082*	d_une	2.783	0.249
d_size	7.420	0.024**	d_size	19.672	0.000***
d_trade	0.608	0.738	d_trade	2.620	0.270
ALL	69.308	0.000***	ALL	64.982	0.000***
pd			**d_une**		
ms_gdp	6.774	0.034**	ms_gdp	6.247	0.044**
inflation	16.637	0.000***	inflation	22.039	0.000***
d_m2_gdp	2.127	0.345	d_m2_gdp	1.031	0.597
r	7.813	0.020**	r	11.807	0.003***
d_une	3.348	0.187	pd	25.239	0.000***
d_size	33.854	0.000***	d_size	4.545	0.103
d_trade	3.418	0.181	d_trade	0.699	0.705
ALL	59.926	0.000***	ALL	44.744	0.000***
d_size			**d_trade**		
ms_gdp	3.356	0.187	ms_gdp	9.004	0.011**
inflation	34.707	0.000***	inflation	18.387	0.000***
d_m2_gdp	14.270	0.001***	d_m2_gdp	6.203	0.045**
r	16.025	0.000***	r	10.037	0.007***
pd	25.489	0.000***	pd	12.705	0.002***
d_une	1.356	0.508	d_une	13.504	0.001***
d_trade	0.649	0.723	d_size	19.879	0.000***
ALL	86.780	0.000***	ALL	154.777	0.000***

Note: *** p<0.01, ** p<0.05, * p<0.1. H_0: Excluded variable does not Granger-cause equation variable. H_1: Excluded variable Granger-causes equation variable. Test uses Wald statistic with degrees of freedom df = 2 (Corresponding to 2 lags in the model).

4.7. Impulse Response Function (IRF) Analysis

4.7.1. Direct Impact of Public Debt and Monetary Policy on Economic Stability

This section focuses on analyzing the direct impact of two important policy instruments public debt (a proxy for fiscal policy) and lending rates (a proxy for monetary policy), on economic stability in Asian countries. The results of the IRF analysis are presented in Figure 2.

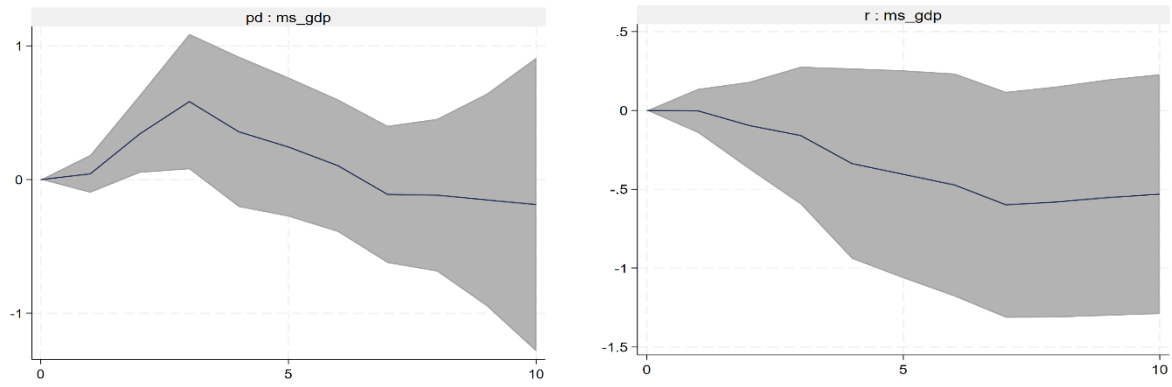

Figure 2. Direct impact of public debt and monetary policy on economic stability.

The IRF results show an inverted U-shaped nonlinear relationship between public debt and economic stability. In the short term (first 2-3 years), public debt has a positive stimulative effect, but this effect quickly declines and turns negative from the 4th-5th year onwards. However, it should be noted that the wide confidence intervals in most periods indicate that the impact of public debt on economic stability varies greatly among the countries in the sample, reflecting the diversity in debt management capacity, institutional quality and economic structure in Asian countries. With the impact of lending interest rates, in the first period, the response of economic stability is almost zero, indicating a lag in the monetary policy transmission mechanism. This is consistent with the macroeconomic theory of policy lag, when changes in interest rates take time to impact the borrowing, investment and consumption decisions of economic entities. However, the confidence interval in the first period is quite narrow and lies around zero, indicating the consistency of the initial response across countries. From the second period, the response of economic stability begins to turn clearly negative and continuously declines. The negative impact gradually increases in intensity and continues to be maintained, even deepening, in the long run. In periods six to seven, the negative response reaches its lowest point with a fall of roughly -0.5 percentage points. From the eighth period onward, the negative effect stabilizes at about -0.5 percentage points, indicating its persistence. Notably, the 95% confidence interval lengthens over longer periods while remaining entirely negative (in period 10, it ranges from about -1.3 to -0.1). The long-term persistence of the negative effect suggests that high interest rates, tight money policies and also a heavy hand in monetary policy may cause great cumulative damage to an economy. As this era illustrates, companies are saddled with high capital costs. Consequently, capital investment is eaten up over long spells of time. This will definitely undermine the country's productive forces and technological innovation capabilities. Further, high interest rates over a prolonged period will serve econometrically to force down wages. In that case, the labour market will become an environment with disastrous results for employment, income, and living standards, thus creating a harmful vortex that siphons off economic growth.

4.7.2. Transmission Mechanism Through the Inflation Channel

In addition to their direct effects, public debt and monetary policy can also influence economic stability through an indirect transmission channel via inflation. This section analyzes the two-stage transmission mechanism: (1) the impact of public debt and interest rates on inflation, and (2) the impact of inflation on economic stability. The results are presented in Figures 3 and 4.

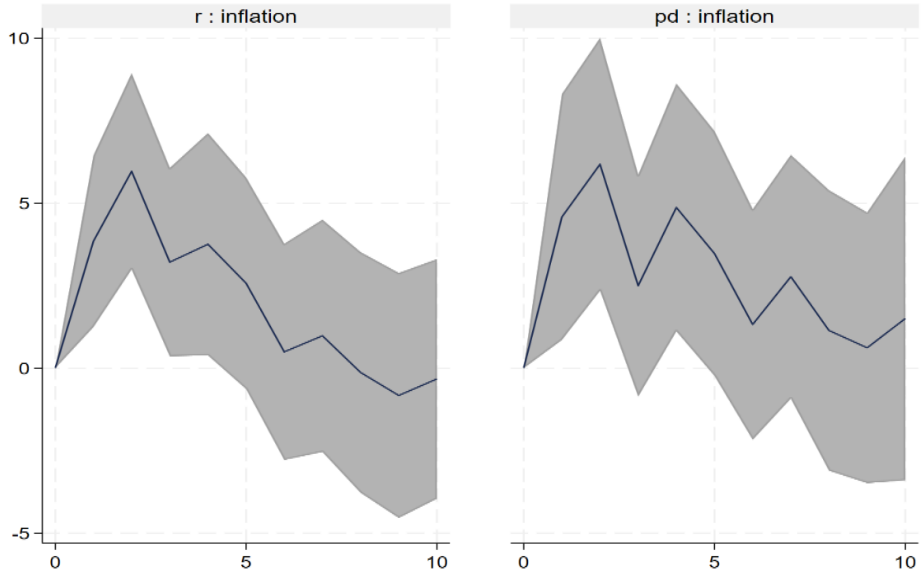

Figure 3. Direct impact of public debt and monetary policy on inflation.

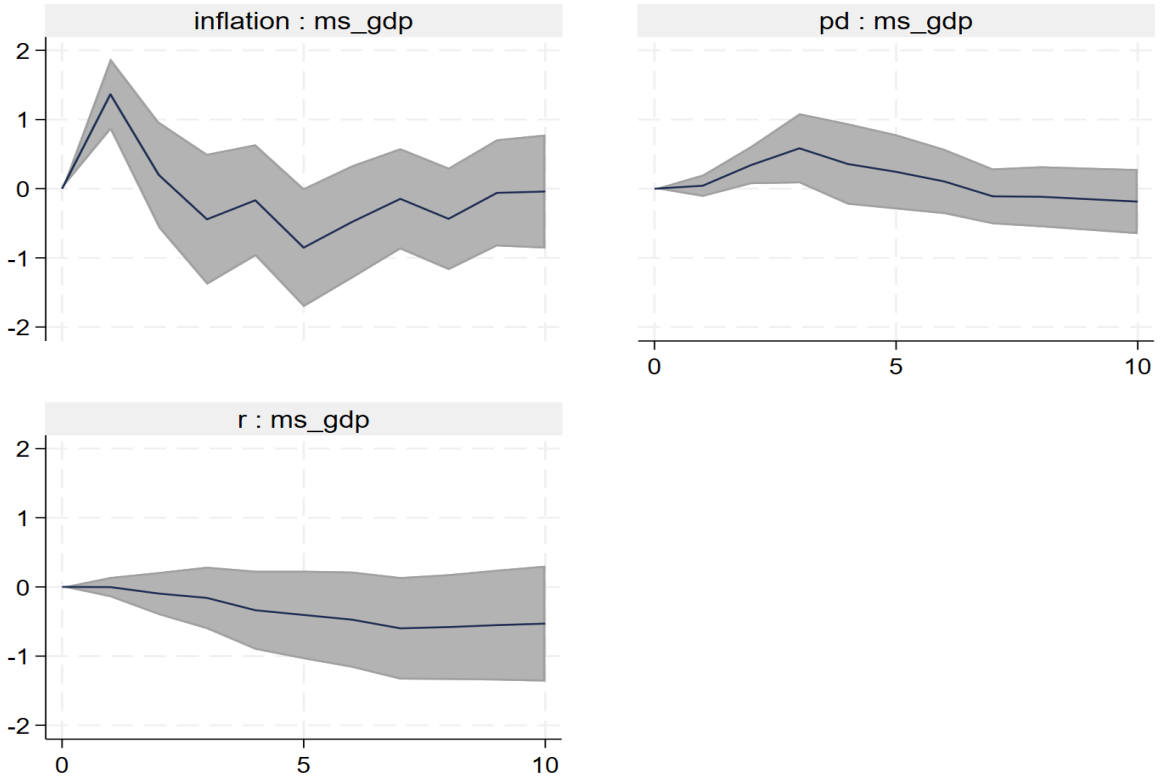

Figure 4. Direct impact of public debt, monetary policy, and inflation on economic stability.

Figure 3 (left panel) shows that a positive interest rate shock causes inflation to rise sharply, peaking at around 6-7 percentage points in the second period, contrary to conventional monetary theory. This result reflects the cost-push inflation phenomenon common in Asian economies, where high interest rates increase firms' capital costs and are passed on to selling prices. This positive effect persists for around 3-4 periods before gradually decreasing to near zero, but the wide confidence intervals indicate high heterogeneity across countries. This warns that using interest rates to control inflation in Asia can be counterproductive, requiring a combination of other policy tools.

Next, Figure 3 (right panel) shows that public debt also has a strong positive impact on inflation, peaking at around 6-7 percentage points in the second period, similar to the impact of interest rates. This impact has an oscillating pattern with two peaks (periods 2 and 4) and lasts longer, remaining positive at 1-2 percentage points in the 10th period. The transmission mechanism is mainly through the monetary financing channel, increased aggregate demand, weakened confidence in fiscal stability, and pressure on the exchange rate, causing imported inflation. The very wide confidence interval shows that the impact of public debt on inflation depends largely on the debt management capacity and institutional quality of each country.

Figure 4 (top left panel) shows that inflation has a positive short-term impact on economic stability, peaking at around 1.2-1.5 percentage points in periods 1-2, possibly due to the stimulus effect on consumption, the depreciation of real debt, and the short-term Phillips curve. However, after the second period, this impact declines rapidly to near zero and fluctuates unclearly in the medium and long term, with a very wide confidence interval including both positive and negative values. This suggests that the relationship between inflation and growth is nonlinear and complex, depending on the inflation threshold, volatility, and the adaptability of the economy. This result supports the view that price stability should be an important policy priority, as inflation does not bring sustainable growth benefits.

Thus, it can be seen that the inflation channel is not the main transmission channel of public debt and monetary policy to economic stability. Although both interest rates and public debt have a strong impact on inflation (6-7 percentage points), inflation does not have a clear and sustainable impact on economic stability in the medium and

long term. The direct impact of interest rates on economic stability (-0.5 to -0.6 in the 6-10 period) is much stronger and clearer than the indirect channel through inflation. This shows that other direct channels such as the investment channel, the credit channel, and the expectation channel play a more important role in explaining the impact of macroeconomic policy on economic growth in Asian countries.

The evidence that positive interest rate shocks lead to inflation also requires some careful thought, theory-wise, since it may seem counter-intuitive in light of conventional monetary transmission. A number of possible explanations from the theoretical and empirical literature in developing countries could explain this effect.

First, the cost push channel is an important transmission mechanism in Asian credit-constrained economies with firms relying heavily on bank borrowing for working capital finance (Barth & Ramey, 2001; Ravenna & Walsh, 2006). Higher interest rates increase firms' financing costs for intermediate inputs, labor, and inventory holdings. In less competitive markets or when firms have market power, these higher costs are passed through to output prices as "cost-push" inflation. This effect is especially strong in countries with underdeveloped capital markets and high reliance on bank lending, characteristics typical of many Asian countries in our sample.

Second, it might derive from exchange rate pass-through and capital flows dynamics. In open economies with imperfect capital mobility, higher domestic interest rates are likely to pull in short-term capital inflows, causing the exchange rate to appreciate in the short run. But when capital starts flowing back or if worries about debt sustainability emerge, currency will depreciate and make imports more expensive, adding to inflation. Additionally, in countries that maintain managed exchange rate systems, the sterilization of capital inflows may offset the deflationary forces with more restrictive rates, but adjustment to exchange rates would still influence domestic prices (Frankel, 2010).

5. POLICY IMPLICATIONS

Based on the research results, we propose the following policy implications.

Regarding public debt management, the research results show that public debt has a nonlinear impact on economic stability: positive in the short term (first 2-3 years with a level of +0.5 percentage points) but turning negative from the 4th year onwards. This suggests that Asian countries need to establish and strictly adhere to safe public debt thresholds, which usually range from 60-70% of GDP for emerging economies. Governments should build a clear legal framework on public debt limits, accompanied by effective monitoring and handling mechanisms. When the public debt/GDP ratio exceeds the warning threshold, there should be a specific roadmap to reduce debt through economic growth, cutting ineffective spending, and tax reform. In addition, the positive short-term impact of public debt on growth shows the potential of expansionary fiscal policy, but only if borrowed capital is used effectively. Governments should prioritize the use of public debt to invest in areas with high and long-term multiplier effects, such as high-quality infrastructure (transportation, energy, telecommunications), education and human resource training, research and development and technological innovation, and public health. It is necessary to avoid using public debt for recurrent expenditure, ineffective subsidies, or poor-quality public investment projects. Establishing a system to evaluate the impact and efficiency of debt use is necessary to ensure that every dollar of debt creates long-term growth value.

Regarding monetary policy, the most important finding of the study is that high interest rates actually increase inflation (6-7 percentage points) instead of decreasing it as traditional theory suggests, due to the cost-push inflation phenomenon prevalent in Asia. This shows that central banks cannot rely solely on interest rates to control inflation but need to combine other tools. Macroprudential policy should be used to manage credit and financial system risks. Capital flow management may be necessary to limit the impact of short-term capital flows on exchange rates and inflation. Apply selective foreign exchange intervention to stabilize exchange rates in the context of large shocks, especially for small and open economies. The results show that high interest rates have a strong and sustained negative impact on economic stability (-0.5 to -0.6 percentage points from period 6-10), significantly stronger than

the impact of public debt. Central banks should adopt a flexible monetary policy strategy that takes into account both growth and employment objectives, not just inflation. In the context of low and stable inflation, interest rates should be maintained at appropriate levels to support credit and investment. When monetary tightening is necessary, interest rates should be raised gradually and the impact on the economy should be closely monitored, ready to adjust if the negative impact is too large. Coordinate closely with fiscal policy to achieve an optimal balance between macroeconomic objectives.

Regarding the coordination of fiscal and monetary policies, the differences in the direction and intensity of the impact of fiscal and monetary policies show the importance of close coordination between these two policies. Countries should establish a macro-policy coordination council (comprising representatives of the Ministry of Finance, the central bank, and relevant agencies) to regularly exchange information, analyze the situation, and coordinate policy decisions. Develop a clear policy coordination framework with specific responsibilities: monetary policy focuses on price stability and the financial system, while fiscal policy is responsible for long-term growth and income distribution. Establish policy rules to create consistency and predictability, reducing conflicts between the two policies. It is especially important to ensure fiscal sustainability so that the central bank can focus on the inflation target without being pressured to finance public debt. The findings show that there are complex trade-offs: high interest rates reduce growth but increase inflation (rather than reducing it), while public debt stimulates short-term growth but harms long-term growth and creates inflationary pressures. Policymakers need to adopt a balanced and flexible approach, accepting some level of inflation (in the range of 2-4%, as targeted by many Asian central banks) to support growth, rather than pursuing ultra-low inflation that can harm economic activity. Establish early warning systems to detect policy conflicts and macroeconomic risks in a timely manner. Use quantitative analysis tools (such as DSGE models, stress testing) to assess the combined impact of policies before decisions are made. Enhance communication and policy explanations to the public to manage expectations and minimize the negative impact of difficult decisions.

Although the research objectives have been achieved, there are some limitations of this study that need to be considered. First, in this study, a PVAR model with an optimal lag of two periods was chosen for the analysis. This optimal lag may only be appropriate for the data used in this study. Therefore, the model may not fully capture the long-run dynamic interactions beyond 10 periods and may not assess the impact of policy on economic stability. Second, the wide confidence intervals observed in the impulse response functions reflect significant heterogeneity among the 30 Asian economies, suggesting that institutional quality, debt management capacity, and economic structure of each country may significantly moderate the impact of policy, but these contextual factors have not been considered in this model. These two limitations may serve as suggestions for further research in the future.

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