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The Interrelationship between Economic Growth and Tax Revenues in Cambodia

H.E. Prof. Dr. Ratana Eng[1], Siphat Lim[2]
[1,2] CamEd Business School

ABSTRACT: The relationship between economic growth and the growth rate of tax revenues on goods and services, tax revenue on income, profit, and capital gain, and tax revenue on international trade and transaction was analyzed using a VAR model. All variables in this study were found to be integrated of order one, therefore the model was run using first differences. The lag length of the model was determined to be optimal at lag-two based on the information criterion. The estimated results of the model successfully passed all diagnostic tests, including tests for residual normality, serial correlation, and heteroscedasticity. Since all the inverse roots of the AR characteristic polynomial were within the unit circle, the model was deemed stable. The empirical findings from the VAR model indicated that the growth rate of tax revenue on income, profit, and capital had the most significant impact on economic growth, ranging from 2.3505% to 2.7155%. This was followed by tax revenue on goods and services, ranging from 0.5776% to 0.5954%, and tax revenue on international trade and transaction, ranging from 0.2747% to 0.5930%. Furthermore, the response of the growth rate of all tax revenues to changes in the economic growth rate exhibited a cyclical pattern around its mean.

KEYWORDS: Economic growth, FEVD, IRF, Tax revenues, VAR model.

INTRODUCTION

When the government imposes taxes, it obtains a portion or proportion of the domestic output of the country. This is one of the mechanisms through which the government administers the resources of a nation. Consequently, the Gross Domestic Product (GDP) and tax revenue collectively indicate the economic condition of a country as well as its potential for future expansion. The government acquires a percentage of the nation's GDP as tax revenue, which is determined by the tax-GDP ratio. Government expenditure plays a crucial role in fostering economic growth and the development of a nation. However, the extent of such spending primarily hinges on the revenues generated by the government, predominantly through tax revenues. In Cambodia, government revenues derived from taxation encompass six distinct types of taxes, including those on income, profit, capital gain, payroll and workforce, property, goods and services, international trade and transactions, as well as other miscellaneous taxes. Over the past five years, spanning from 2017 to 2021, the average proportion of total tax revenues to gross domestic product stood at approximately 17.35%. Simultaneously, the mean levies imposed on incomes, profits, capital gains, goods and services, as well as international trade and transactions, in relation to the gross domestic product, stand at 4.74%, 10.36%, and 2.34%, respectively. A greater ratio of tax to GDP signifies a robust financial standing of a nation. This demonstrates that a country's tax earnings are favorably linked to its potential GDP, thereby upholding a sturdy tax buoyancy. The average rate of actual growth in the gross domestic product amounts to approximately 4.3% annually from 2017 to 2021 [1]. Evidently, the proportion of tax revenue relative to domestic output experiences an upward trend nearly every year, thus necessitating an examination of the interconnectedness between economic growth and tax revenues.

Tax revenues in Cambodia primarily originate from three distinct categories: income, profit, and capital gain taxes; taxes on goods and services; and taxes on international trade and transactions. It is imperative to examine which of these tax indicators has the greatest impact on variations in economic growth. Furthermore, it is crucial to analyze how these three taxes respond in the event of an economic shock. The objectives of this research will be achieved by employing a system of equation model known as the Vector Autoregressive (VAR) model.

This paper is classified into five chapters. Chapter one represents introduction, while chapter two is literature review. The research methodology of this paper is described in chapter three. The fourth section discusses the empirical results, and finally, in the last section, a concluding remark has been given.

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LITERATURE REVIEWS

Fiscal policy is widely regarded as one of the most crucial economic policies implemented by policymakers. The relationship between taxation and economic growth has been extensively studied and is considered a significant issue in the field of economics [2]. Taxes hold a prominent position in the economic policies of all nations, and governments must be cognizant of the potential negative consequences that can arise from any tax increase on key economic indicators. Taxes serve as the primary source of income for any economy and possess the potential to exert a substantial influence on economic growth. However, existing research on the impact of taxes on economic growth lacks consensus, as it fails to definitively determine whether tax increases stimulate or hinder economic growth [3]. Similarly, [4] conducted an analysis using data from the United States and various tax types, ultimately concluding that taxes do indeed impact GDP growth. These authors demonstrated the correlation between fiscal policy, economic growth, taxes, government spending, and deficits in the United States, employing the econometric VAR model to achieve these results [5].

As the global community increasingly prioritizes sustainability, researchers across various disciplines are compelled to draw the attention of global decision-makers and policymakers to the necessary actions required to achieve this global objective. In order to accomplish this, concerted efforts must be made by multiple stakeholders to establish and direct machinery towards the attainment of these goals. Consequently, researchers have recently identified taxation as a primary, longstanding, and dependable source of revenue for every nation that necessitates reform in order to align with the agenda of the Sustainable Development Goals (SDGs) ([6]; [7]; [8]). Furthermore, taxation, as a means of financing government expenditure, plays a crucial role in the realization of a nation's developmental objectives. Existing studies have consistently demonstrated that taxation contributes to over 20% of the GDP of developing nations ([9]; [10]. The focus on the Sustainable Development Goals agenda has spurred recent growth in research in this field, as earlier researchers had extensively examined the relationship between taxation and economic growth, highlighting a gap that this study seeks to address ([11]; [12]; [13]; [14]).

The achievement of SDGs by nations in 2030 necessitates the development of public goods and services. This study addresses the gaps in understanding these issues. While there are alternative methods of generating revenue for nations, such as rates and debt financing, borrowing from lending nations carries risks and additional costs known as "borrowing costs." Improper management of debt can be detrimental to sustainability. Therefore, taxation is a superior means of revenue generation compared to debt revenue. Governments worldwide impose taxes on their citizens to enhance their revenue-generating capacity, which is the most common and reliable source of income for national development expenditures [15]. Other sources of revenue include debt and natural resources like crude oil. Extensive research has demonstrated the vital role of taxation, as countries cannot sustain themselves without taxes. Countries with poor tax collection face challenges in meeting their capital, developmental, and recurrent expenses. In contrast, debt financing is less popular due to the associated costs. While both debt and taxes impose burdens on taxpayers, the tax burden can be alleviated if citizens perceive the purpose for which taxes are paid. Therefore, countries are in a stronger position when tax revenue constitutes a significant portion of their national income, rather than relying heavily on debt financing ([16]; [17]; [18]).

The linkage between taxation and sustainable development is of utmost importance, as taxation serves as a crucial means of revenue generation in every economy. It is a widely recognized fiscal policy parameter that significantly influences government revenue and expenditure, ultimately contributing to the achievement of developmental objectives and sustainable economic growth and development ([19]; [20]). Therefore, taxation stands as one of the most powerful fiscal policies for any government striving to maintain sustainability, and it should be enhanced to effectively attain these goals. A nation that excels in tax revenue will possess the necessary financial resources to successfully execute various capital projects. An efficient tax system acts as a catalyst for revenue generation and expenditure, enabling nations to achieve robust and strong macroeconomic objectives. [21] has asserted that an increase in tax revenue leads to an expansion in government expenditure, facilitating the accomplishment of other developmental objectives through the implementation of capital projects. As economies grow, it is expected that tax revenue will correspondingly increase, providing governments with sufficient funds to cover their expenditures. Furthermore, [22] has posited that taxation can effectively support nations in achieving their macroeconomic objectives. The future sustainability of any nation hinges solely on its ability to generate revenue, implement effective tax policies, and undertake necessary reforms. A well-functioning tax system holds great significance for any country seeking sustainable tax revenue and efficient resource mobilization. Governments, on their part, must exhibit transparency and accountability in this domain to foster citizen commitment to tax payments; otherwise, the majority may resort to tax evasion and avoidance [23].

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In accordance with the findings of prior research, the aggregate tax revenue was taken into account. However, this paper aims to encompass the subsequent tax revenues collected by the General Department of Taxation (GDT), namely tax on goods and services (TGS), tax on income, profits, and capital gain (TIPC), and tax on international trade transaction (TITT).

RESEARCH METHODOLOGY

The Vector Autoregressive (VAR) model, which comprises four endogenous variables, namely real gross domestic product (GDP), tax on goods and services (TGS), tax on income, profits, and capital gain (TIPC), and tax on international trade transaction (TITT), is utilized as a system of equations. A general reduced-form VAR model is formulated as follows.

$$Y_t = a + A_1 Y_{t-1} + A_2 Y_{t-2} + \cdots + A_p Y_{t-p} + \varepsilon_t$$

Where $Y_t = (DLNGDP_t, DLNTGS_t, DLNTIPC_t, DLNTITT_t)$ is an *(4 x 1)* vector of time series variables, a is an *(4 x 1)* vector of intercepts, $A_i (i = 1, 2, \dots, p)$ is *(n x n)* coefficient matrices, and ε_t is an *(4 x 1)* vector of unobserved variables. In this study, all variables have been subjected to natural logarithmic transformation (*LN*) and first-order differentiation (*D*). The resulting first-order differentiation of the natural logarithm of each variable within the system is construed as the growth rate. In order to execute the model, monthly time series data spanning from January 2017 to July 2022 were collected from the Ministry of Economy and Finance website [24], the Asian Development Bank database [1], and the International Monetary Fund's platform [25]. Monthly GDP was derived from annual data through the use of quadratic interpolation.

Initially, the analysis begins with the examination of graphical representations and descriptive statistics. These visual aids and the accompanying statistics table provide a summary of the statistical measures for each series within the group. Subsequently, a unit root test is conducted on each variable to determine the presence of a unit root. This test is crucial in identifying whether a variable possesses a unit root, as utilizing a variable with a unit root in a VAR Model would yield spurious and nonsensical results. The Augmented Dickey Fuller (*ADF*) test, which is the most commonly employed test, is utilized to ascertain the presence of unit roots in the variables. Upon completion of the tests, hypotheses are formulated, with the null hypothesis stating that the series possesses a unit root, and the alternative hypothesis positing the absence of a unit root. If any variable is found to possess a unit root, it is transformed into its first difference. Subsequently, the unit root test is repeated on each variable in its first difference form to determine the presence of a unit root [26]. Next, the optimal lag length for the VAR Model is determined using the Information Criterion (*IC*). The Ordinary Least Square (*OLS*) method is employed to estimate the parameters of the model. Once the parameter estimation is completed, diagnostic tests are conducted on the residual terms of the model. These tests include the normality test, autocorrelation Lagrange Multiplier (LM) test, and White Heteroskedasticity (No Cross Terms) test. Prior to conducting a Forecast Error Variance Decomposition (FEVD), Impulse Response Function (IRF), a stability test is performed [27].

EMPIRICAL RESULTS

Table 1. Descriptive Statistics

	DLNGDP	*DLNTGS*	*DLNTIPC*	*DLNTITT*
Mean	0.342068	0.771264	0.847325	0.722707
Median	0.424834	1.359644	0.419220	4.440858
Maximum	2.135855	61.49483	135.0670	70.13686
Minimum	-2.867912	-69.70120	-174.5730	-80.69040
Std. Dev.	0.526720	22.24373	61.16828	26.68887
Skewness	-2.945722	-0.015293	-0.073273	-0.461034
Kurtosis	23.79095	4.113077	3.886836	4.254764
Jarque-Bera	1284.176	3.409657	2.221873	6.667764
Probability	0.000000	0.181804	0.329250	0.035654
Sum	22.57649	50.90342	55.92345	47.69869
Sum Sq. Dev.	18.03318	32160.94	243201.3	46299.22
Observations	66	66	66	66

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The total sample size comprises 66 data points. Throughout the duration of the study, the average growth rate of GDP amounts to 0.342% per month. The growth rates of tax revenues on goods and services, income, profit and capital gain, and international trade and transaction are 0.771%, 0.847%, and 0.722% respectively. According to the results of the Jarque-Bera test of normality, each taxation data series follows a normal distribution, as indicated by the probability of the Jarque-Bera test exceeding the 5% significance level. Conversely, the null hypothesis of the test for economic growth rate data series is strongly rejected at the 1% significance level, leading to the conclusion that the series does not conform to a normal distribution.

As depicted in Figure 1, the trends observed in all the data utilized in this study demonstrate a mean reverting process. This implies that each data series, throughout the duration of the research, fluctuates around its mean in an upward or downward manner. This pattern can be classified as a stationary process, devoid of any unit root. To ascertain the presence of a unit root or non-stationarity in each data series, the Augmented Dickey-Fuller (ADF) test is employed for greater precision.

Table 2. ADF Unit Root Test

		At Level			
		LNGDP	*LNTGS*	*LNTIPC*	*LNTITT*
With Constant	t-Statistic	-1.8372	-1.7335	-5.7712	-2.2641
	Prob.	*0.3596*	*0.4098*	*0.0000*	*0.1866*
		n0	n0	***	n0
With Constant & Trend	t-Statistic	-2.0043	-1.8302	-9.4732	-2.2477
	Prob.	*0.5878*	*0.6784*	*0.0000*	*0.4556*
		n0	n0	***	n0
Without Constant & Trend	t-Statistic	2.6677	0.5738	1.1140	0.4724
	Prob.	*0.9979*	*0.8377*	*0.9294*	*0.8142*
		n0	n0	n0	n0
		At First Difference			
		DLNGDP	*DLNTGS*	*DLNTIPC*	*DLNTITT*
With Constant	t-Statistic	-5.0009	-10.9204	-10.1138	-11.9436
	Prob.	*0.0001*	*0.0000*	*0.0000*	*0.0000*
		***	***	***	***
With Constant & Trend	t-Statistic	-5.0993	-10.8301	-9.9867	-11.8450
	Prob.	*0.0005*	*0.0000*	*0.0000*	*0.0000*
		***	***	***	***
Without Constant & Trend	t-Statistic	-2.5425	-10.9574	-9.3730	-12.0015
	Prob.	*0.0117*	*0.0000*	*0.0000*	*0.0000*
		**	***	***	***

Notes: (*)Significant at the 10%; (**)Significant at the 5%; (***) Significant at the 1%. and (no) Not Significant
*MacKinnon (1996) one-sided p-values.

There exist three distinct models of the Augmented Dickey-Fuller (ADF) test, namely the model with a constant, the model with a constant and trend, and the model without a constant. At the level, the tax revenue on income, profit, and capital gain exhibits no unit root according to the model with a constant and the model with a constant and trend, as the null hypothesis is strongly rejected at a 1% level of significance. Conversely, the data series for gross domestic product, tax on goods and services, tax on income, profit and capital gain, and tax on international trade and transactions are all non-stationary across all models of the ADF test. However, after transforming all the data series into their first differences, all the data series become stationary, as the null hypotheses of all models are rejected at both the 1% and 5% levels of significance.

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With regards to the results obtained from the ADF test, it can be concluded that the gross domestic product, tax revenues on goods and services, and tax revenues of international trade and transaction are each integrated of order one, denoted as I(1). On the other hand, tax revenues on income, profit, and capital gain are integrated of order zero, denoted as I(0), according to the ADF test model with constant and trend. Conversely, when the model is without constant and trend, the series is integrated of order one, I(1). Therefore, in order to avoid any spurious regression model, all variables need to be transformed by taking their first differences before proceeding with the estimation of the VAR model.

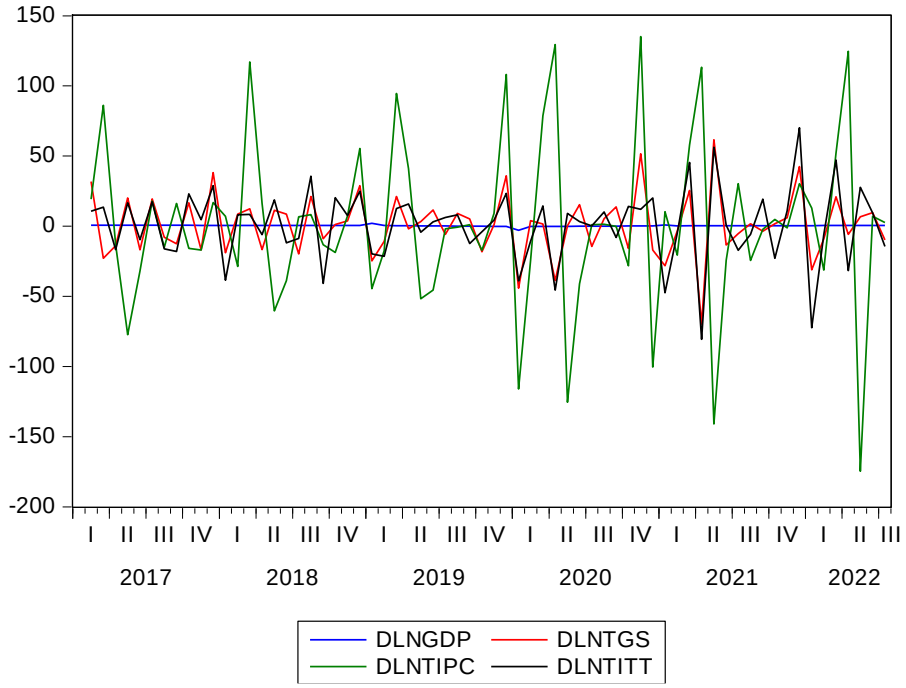

Figure 1. Growth Rate of GDP, TGS, TIPC, and TITT

It is imperative to ascertain the optimal lag length of the VAR model. Table 3 presents five distinct information criteria, including the sequential modified Likelihood Ratio (LR) test statistic (each test at a 5% level), Final Prediction Error (FPE), Akaike Information Criterion (AIC), Schwarz Information Criterion (SC), and Hannan-Quinn information criterion. Of the five information criteria, with the exception of AIC, the VAR model with a lag of two produces the lowest IC, thereby determining the optimal lag length of the model.

Table 3. VAR Lag Order Selection Criteria

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-902.2413	NA	1.55e+08	30.20804	30.34767	30.26266
1	-867.2289	64.18944	82172945	29.57430	30.27241	29.84737
2	-822.0486	76.80652*	31303289*	28.60162	29.85823*	29.09315*
3	-805.7291	25.56709	31559241	28.59097*	30.40607	29.30096
4	-797.0228	12.47906	41713700	28.83409	31.20768	29.76254
5	-779.9525	22.19137	42732040	28.79842	31.73050	29.94532
6	-764.2748	18.29072	47371447	28.80916	32.29973	30.17451

There exist four endogenous variables within the system of VAR model, thereby resulting in four equations. Upon estimating all parameters of the VAR model through the OLS estimating method, it becomes possible to predict the residual terms of each equation and subsequently conduct a test of normality.

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Table 4. VAR Residual Normality Tests

Component	Skewness	Chi-sq	df	Prob.
1	-2.351403	58.97702	1	0.0000
2	0.071733	0.054886	1	0.8148
3	0.784882	6.571091	1	0.0104
4	-0.061957	0.040946	1	0.8396
Joint		65.64394	4	0.0000

The results of the calculated Chi-square test indicate that the error components one and three do not follow a normal distribution, as their p-values are less than 0.05. Conversely, the null hypothesis for components two and four cannot be rejected, as the probability of the calculated Chi-square exceeds the 5% significance level.

In addition to the normality tests conducted on the VAR residuals, we also perform a Lagrange Multiplier (LM) test to examine the presence of serial correlation in the VAR residuals. The null hypothesis of this test posits that the residual terms at lag one and two are not serially correlated, as indicated by the LM-statistic's probability distribution, which follows a Chi-square distribution with 16 degrees of freedom (df), and yields results greater than the 5% significance level.

Table 5. VAR Residual Serial Correlation LM Tests

Lags	LM-Stat	Prob
1	25.40705	0.0630
2	16.43501	0.4230

Probs from chi-square with 16 df.

The homoscedasticity of the residual terms is confirmed by the VAR residual heteroscedasticity tests, which indicate that the variance remains constant. These tests only consider the levels and squares of the terms, without including any cross terms. The calculated Chi-square value is 151.8299, with 160 degrees of freedom and a probability of 0.6654. This probability is greater than the 5% level of significance, leading to the conclusion that the null hypothesis of homoscedasticity cannot be rejected. Additionally, it is noteworthy that all individual components are also found to be insignificant.

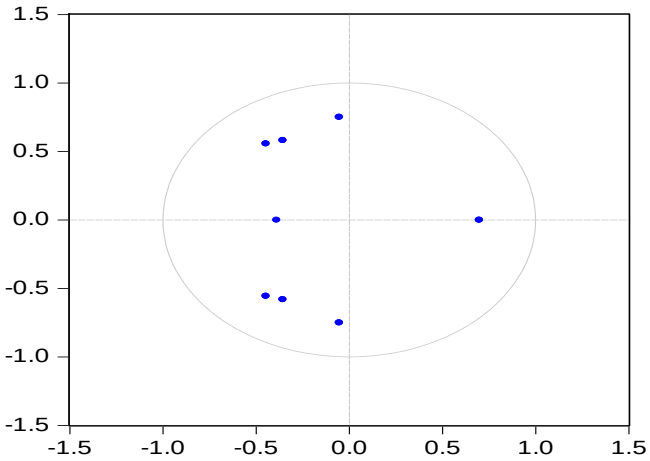

Figure 2. Inverse Roots of AR Characteristic Polynomial

There are two crucial aspects that need to be examined based on the empirical findings of the VAR model, namely the impulse response function and forecast error variance decomposition. However, it is imperative to evaluate the stability of the model before drawing any conclusions. To accomplish this, it is necessary to utilize the stability test depicted in Figure 2. As all of the inverse roots of the AR characteristic polynomial are situated within the unit circle, it can be concluded that the estimated VAR model is stable.

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The growth rate of tax revenue on goods and services demonstrates a cyclical pattern in response to the shock of economic growth. Initially, in the first period, the response to the shock is negative. However, between periods two and three, the response becomes positive, and subsequently fluctuates around the mean from period four onwards before eventually dissipating in period seven. Similarly, the growth rate of tax revenue on income, profit, and capital gain follows a comparable pattern to that of tax revenue on goods and services.

Table 6. VAR Residual Heteroskedasticity Tests: No Cross Terms (only levels and squares)

Joint test:					
Chi-sq	df	Prob.			
151.8299	160	0.6654			
Individual components:					
Dependent	R-squared	F(16,47)	Prob.	Chi-sq(16)	Prob.
res1*res1	0.210722	0.784255	0.6946	13.48619	0.6369
res2*res2	0.149087	0.514675	0.9263	9.541574	0.8894
res3*res3	0.252172	0.990542	0.4822	16.13900	0.4433
res4*res4	0.066869	0.210504	0.9993	4.279610	0.9983
res2*res1	0.304047	1.283328	0.2472	19.45898	0.2456
res3*res1	0.154170	0.535418	0.9137	9.866853	0.8735
res3*res2	0.138779	0.473356	0.9481	8.881879	0.9182
res4*res1	0.263037	1.048451	0.4276	16.83435	0.3964
res4*res2	0.091709	0.296595	0.9948	5.869361	0.9894
res4*res3	0.161926	0.567560	0.8920	10.36326	0.8470

It exhibits a prolonged positive response to the shock from period two to period five, after which it begins to fluctuate around the mean until period nine, at which point it dissipates. Furthermore, the growth rate of tax revenue on international trade and transactions displays a negative response between periods one and two. However, between periods two and three, the response becomes positive, only to decrease from period three to period four before ultimately dissipating.

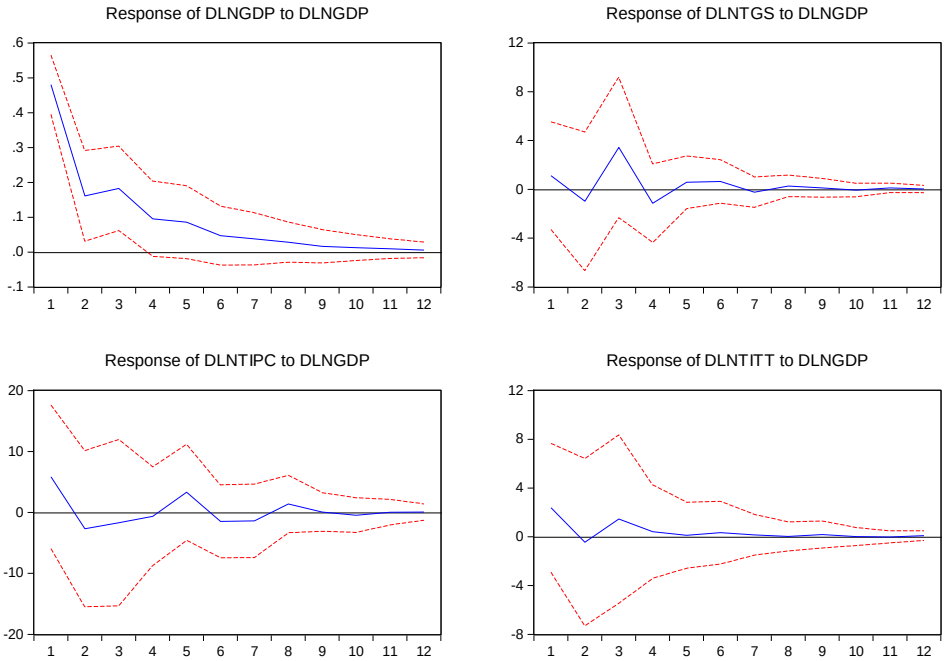

Figure 3. Response to Cholesky One S.D. Innovation ± 2 S.E.

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With regards to the variance decomposition of economic growth, it is observed that during the first period, variations in tax on goods and services, tax on income, profit and capital gain, as well as tax on international trade and transaction, do not cause any variation in the growth rate of domestic output. In the second period, the variation in economic growth is primarily caused by the variation in the growth rate of tax on income, profit, and capital gain, which amounts to 2.7155%. Furthermore, the variation in economic growth can be explained by 0.2497% and 0.1737% of the variation in the growth rate of tax on international trade and transaction and tax on goods and services, respectively. Between the third and twelfth periods, the variation in economic growth is caused by the variation in tax on goods and services, tax on income, profit, and capital gain, and tax on international trade and transaction, ranging between 0.5776% and 0.5954%, 2.3505% and 2.4016%, and 0.2747% and 0.5930%, respectively.

Table 7. Variance Decomposition of DLNGDP

Period	S.E.	DLNGDP	DLNTGS	DLNTIPC	DLNTITT
1	0.480547	100.0000	0.000000	0.000000	0.000000
		(0.00000)	(0.00000)	(0.00000)	(0.00000)
2	0.514938	96.86096	0.173784	2.715501	0.249760
		(3.87199)	(1.65803)	(2.71198)	(1.49916)
3	0.547768	96.72806	0.595496	2.401656	0.274785
		(3.94926)	(2.01763)	(2.62025)	(1.50634)
4	0.556696	96.59369	0.579011	2.337509	0.489793
		(4.10560)	(2.12278)	(2.55764)	(1.62911)
5	0.563292	96.65708	0.570038	2.294278	0.478604
		(4.27881)	(2.18450)	(2.51891)	(1.75901)
6	0.565451	96.60718	0.565768	2.303796	0.523261
		(4.44345)	(2.23456)	(2.58491)	(1.88269)
7	0.567045	96.51155	0.571377	2.334565	0.582510
		(4.58189)	(2.25139)	(2.61260)	(1.89883)
8	0.567788	96.51074	0.571469	2.335733	0.582061
		(4.68529)	(2.25739)	(2.64209)	(1.97808)
9	0.568058	96.50102	0.575559	2.333522	0.589896
		(4.74173)	(2.27284)	(2.64142)	(2.00169)
10	0.568260	96.48069	0.575574	2.350595	0.593137
		(4.80027)	(2.27720)	(2.68329)	(2.01931)
11	0.568347	96.47957	0.577331	2.349970	0.593127
		(4.85787)	(2.29026)	(2.68940)	(2.05288)
12	0.568380	96.47877	0.577644	2.350525	0.593065
		(4.89438)	(2.29557)	(2.72026)	(2.05539)

CONCLUSION

The primary aim of this study is to investigate the tax revenue sources that have the greatest impact on economic growth, specifically focusing on tax revenue on goods and services, tax revenue on income, profit, and capital gain, and tax on international trade and transaction. Additionally, this research aims to observe the response of these tax revenues to economic growth shocks. The empirical results obtained from the VAR model indicate that the growth rate of tax revenue on income, profit, and capital has the most significant impact on economic growth, with a range of 2.3505% to 2.7155%. This is followed by tax revenue on goods and services, with a range of 0.5776% to 0.5954%, and tax on international trade and transaction, with a range of 0.2747% to 0.5930%. Furthermore, the response of the growth rate of all tax revenues to the shock of economic growth rate exhibits a cyclical pattern moving around its mean, which is an interesting finding of this research.

The examination of the correlation between gross domestic product and tax revenues would become a more intriguing subject if the contemporaneous effect between variables in the system is incorporated through the utilization of a structural VAR model. Moreover,

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for a more comprehensive analysis, two variables, namely trade openness and foreign direct investment, should be incorporated into the model. Additionally, it is imperative to conduct out-of-sample forecasting and scenario analysis to evaluate the influence of tax revenues on economic growth and vice versa.

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