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Analyzing the impact of the shadow economy on economic growth in Cambodia

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Abstract: A model of equations known as the VAR model has been employed to investigate the relationships among four endogenous variables: the growth rate of GDP, the shadow economy, the inflation rate, and final consumption expenditure. The initial response of GDP to shocks from the shadow economy is negative for the first three quarters, with the effect gradually decreasing from the fifth to the tenth quarter. In the first and second quarters, there is no observable impact on GDP due to shocks from the inflation rate; however, this shock becomes harmful between the third and fifth quarters before stabilizing and dissipating. The findings from the impulse response function suggest that GDP responds positively to changes in final consumption expenditure during the first two quarters, with the influence waning from the third quarter onward. Over the forecast horizon, the effect of the shadow economy on GDP variation is estimated to range from 3.38% to 6.11%, while the inflation rate's impact fluctuates between 0.06% and 5.05%, and final consumption expenditure contributes to changes between 0.31% and 0.34%. Furthermore, the analysis of forecast error variance decomposition throughout the projected period indicates that GDP variation is considerably influenced by the dynamics of the shadow economy, inflation rate, and consumption expenditure.

Keywords: *Economic growth, Shadow economy, Final consumption expenditure, Inflation rate, VAR model.*

1. Introduction

In recent decades, Cambodia has undergone significant economic transformation, evolving from a nation ravaged by conflict to one of the most rapidly advancing economies in Southeast Asia. Since the 1990s, the country has consistently achieved annual growth rates of approximately 7%, fueled by vital industries such as agriculture, textiles, tourism, and construction. This economic surge has successfully lifted millions out of poverty and attracted substantial foreign investment, establishing Cambodia as an emerging player in the regional economic landscape [1]. The industry serves as a prominent source of employment, especially for women, and represents a substantial share of the nation's exports. In addition to textiles, agriculture, with a focus on rice and rubber cultivation, remains vital to Cambodia's economic landscape, although its significance has diminished as other sectors have emerged. Furthermore, tourism has been a pivotal element in driving Cambodia's swift economic progress. The expansion of the tourism industry is bolstered by the nation's abundant cultural heritage and enhancements in infrastructure, positioning Cambodia as an increasingly favored destination within Southeast Asia [2].

The construction and real estate industries have experienced significant growth in recent years, driven by an increase in foreign direct investment, especially from China. This surge in investment has led to extensive infrastructure projects, upscale residential complexes, and various commercial initiatives, playing a crucial role in urbanization and job creation, particularly in Phnom Penh. Nevertheless, Cambodia is confronted with several challenges that may affect its long-term economic stability. Despite the remarkable growth, income disparity persists, with rural regions continuing to fall

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behind urban areas in terms of development [3]. The nation continues to rely significantly on the export of a limited range of products, which exposes it to risks from external factors, including variations in global demand and economic recessions. Furthermore, issues such as corruption, insufficient legal safeguards, and political instability have raised alarms regarding the business climate and possible obstacles to future expansion. In summary, while Cambodia's economic progress has been noteworthy, it is essential for the country to broaden its economic base, enhance governance, and tackle social disparities to secure sustainable development moving forward. With appropriate policy measures, Cambodia has the opportunity to sustain its growth path and evolve into a more developed and inclusive economy within Southeast Asia [4]. The shadow economy, frequently referred to as the informal or underground economy, encompasses economic activities that operate outside the purview of government regulation and are not captured in official statistical data. Although it is frequently perceived as a means of survival in developing nations, the shadow economy can exert both beneficial and detrimental influences on overall economic growth. Grasping its implications is essential for policymakers who seek to promote sustainable development. On the advantageous side, the shadow economy can offer prompt assistance to individuals and enterprises that find themselves marginalized from the formal economy due to burdensome taxation, intricate regulations, or restricted access to resources [5].

In developing nations, small informal enterprises frequently serve a crucial function in generating employment, particularly in rural regions where formal job prospects are limited. The adaptability and minimal barriers to entry associated with informal businesses enable entrepreneurs to earn a livelihood and navigate economies that the formal sector cannot sufficiently accommodate. Consequently, the shadow economy can play a role in alleviating poverty in the short term and mitigating unemployment levels. However, a significant drawback is that these informal activities often bypass taxation, resulting in diminished government revenue. This reduction in funds restricts the government's capacity to invest in vital sectors such as infrastructure, healthcare, education, and social services, all of which are necessary for sustainable economic growth. Additionally, the existence of the shadow economy fosters inequitable competition for formally operating businesses, as informal enterprises typically evade regulatory expenses, labor regulations, and tax obligations [6]. The shadow economy, often referred to as the informal economy, exerts both detrimental and beneficial effects on economic growth, particularly in developing nations. This study aims to utilize a macro-econometric framework, specifically the Vector Autoregressive (VAR) model, to explore the interconnections among four endogenous variables: economic growth, the shadow economy, the inflation rate, and final consumption expenditure in Cambodia.

2. Literature Review

The shadow economy (SE), often known as the informal or underground economy, refers to the economic activities that operate outside of state regulation and do not appear (or only partially appear) in the official economy. This includes legal and illegal activities [7]. Understanding how the shadow economy influences economic growth is critical for policymakers, since it significantly impacts national development, income inequality, and public sector revenues. As a result, different methods for measuring the extent and impact of the shadow economy have been developed, including surveys, model-based estimation, and indicators. Over the years, various studies have employed different approaches and indicators to estimate the size and influence of the shadow economy. Scheider and Williams [8] for example, provide an in-depth discussion of the methods for measuring the shadow economy, including indirect methods like tax discrepancies and electricity consumption models. Medina and Schneider [9] extended this by creating updated datasets on shadow economies globally, identifying long-term trends and their implications. Likewise, Dell'Anno and Davidescu [10] attempted to analyze the Tanzanian Shadow Economy (SE) from 2003 to 2015, employing an econometric analysis based on a multiple indicators multiple causes (MIMIC) model and statistical testing of the SE's potential causes and indicators. The study indicated that in the early years, the shadow economy

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accounted for between 52% and 61% of official GDP. However, between 2013 and 2015, the SE began to shrink. The study also identified inflation, unemployment, and government spending as the primary drivers of shadow economic dynamics. Johnson, et al. [11] provided a foundational analysis of the causes and consequences of the shadow economy across multiple countries, highlighting that factors such as corruption, tax burden, and weak institutions are significant determinants of its size. Similarly, Loayza and Rigolini [12] explored the link between informality and economic performance, emphasizing that informality is not always a sign of failure but can also be a coping mechanism in economies with weak labor markets and institutions. Chen [13] argued that informal employment is often tied to the absence of social protection and gender disparities, particularly in developing countries, highlighting the socio-economic implications of the shadow economy. Additionally, Zaman and Goschi [14] claimed that any analysis of the impact of the shadow economy on economic growth using only one indicator appears to be inaccurate. As a result, the study introduced three pertinent variables: SE measured in euros per inhabitant, SE as a percentage of GDP, and SE of each EU member state as a percentage of the total 28-EU shadow economy, to investigate the impact of the shadow economy on Romania's economic growth between 1992 and 2012. The findings highlighted the significant role the shadow economy plays in Romania's growth and suggested a long-term, cointegrated relationship between Romania's formal and informal economies. Goel, et al. [15] extended this study by analyzing the impact of the shadow economy on US economic growth for over a century from 1870 to 2014 using the standard neoclassical growth model, adding two additional indicators, including the investment in physical capital (INV) and the human capital investment (EDU). The result indicated that before World War II, the shadow economy had a negative impact on US economic growth. However, following the end of World War II, the shadow economy appears to have had a positive impact on the growth of the US economy, signaling a shift in the relationship between the shadow economy and economic growth.

These varied findings have sparked a range of opinions about the shadow economy's influence on the official economy. Some researchers suggested that a growing shadow economy might actually benefit the official economy, especially during times of economic crisis. Given that businesses operating in the shadow economy can operate at a lower cost by evading high taxation and strict regulations. This helps to improve their competitiveness significantly Schneider and Enste [7]. La Porta and Shleifer [16] support this view, asserting that informality may offer a safety net for economic participants in times of uncertainty, though its long-term consequences vary. Agiropoulos, et al. [17] conducted a study to investigate the impact of the shadow economy on the economic stability of the European Union. The study discovered that the shadow economy appears to have a positive relationship with economic growth, especially in moments of crisis or when the official markets are otherwise struggling.

Other researchers, on the other hand, argued that the shadow economy reduces formal economic growth by lowering tax revenues and limiting the state's ability to invest in infrastructure, human capital, and other essential drivers of economic development. Torgler and Schneider [18] for instance, highlighted that shadow economic activities pose long-term risks to economic stability, particularly in developed countries where the shadow economy is more likely to be involved in tax evasion and illegal activities. Schneider [19] also argued that countries with insufficient governance and institutions provide a fertile ground for a shadow economy, which in turn hinders innovation and productivity, thereby diminishing the efficiency of the formal economy. Dreher and Schneider [20] reinforced this argument, presenting evidence that shadow economies and corruption are often intertwined, compounding their negative effects on governance and growth. Nguyen and Su [21] highlighted that economic uncertainty, which is often exacerbated by poor governance, can push businesses toward the shadow economy. The study found that economic uncertainty increases the likelihood of informal economic activities as businesses seek to avoid instability in the formal market. North, et al. [22] discuss how the institutional framework of a country plays a pivotal role in determining the prevalence of informal activities. Schneider [23] in contrast, found that countries with low tax rates and fewer restrictions appear to have smaller shadow economies, promoting formal economic growth and healthier compliance. On the contrary, the countries with strict regulations and high tax rates were likely to be

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negatively impacted by the massive shadow economy, as it distorts competition and reduces tax revenues. Hence, the institutional quality of the country is a key factor in determining the shadow economy's impacts on economic growth. Scheider and Williams [8] also emphasized that the shadow economy is often larger in developing countries due to factors like weak institutions, high regulatory burdens, and limited enforcement, compared to the relatively smaller shadow economy in developed nations with stronger institutional frameworks. Assidi, et al. [24] emphasized that better governance can help alleviate the negative effects of the shadow economy and support sustainable development. Schneider and Enste [7] and Fuest and Schneider [25] agreed that businesses participating in the shadow economy are often due to the high taxation and social security payments, together with expanding state regulatory actions and labor market constraints (e.g., forced reduction in working hours). Alfano, et al. [26] also asserted that higher income inequality, coupled with weak institutional frameworks, fosters the growth of informal economic activities. In addition, the role of financial inclusion has also been increasingly recognized as an important factor in reducing the size of the shadow economy. Beck, et al. [27] discussed how financial development can help reduce inequality and indirectly limit the scope of informal activities. Younas, et al. [28] employed the two-step Arellano-Bond differenced Generalized Method of Moments (GMM) to analyze the impact of financial inclusion on the scale of economic growth. The study suggested that financial inclusion has a significant positive relationship with economic growth in developing countries, while the shadow economy tends to have a negative impact. Elgin and Oztunali [29] argued that while financial inclusion reduces the scope of informality, it must be complemented by macroeconomic stability to be fully effective. Similar studies also agreed that financial inclusion played a pivotal role in promoting economic growth while reducing the scale of the shadow economy [30-32]. Elshrif [31] moreover, suggested that financial inclusion has no significant relationship with the shadow economy. Both, however, could significantly boost the level of financial instability. Meanwhile, other variables such as income inequality, age dependency ratio, and credit to government and state-owned enterprises were shown to have a significant positive relationship with the informal economy. On the other hand, other variables such as income level, joblessness, secondary school enrollment, and trade openness were found to have a significant negative relationship with the informal economy. Recent research by Hallunovi and Vangjel [33] and Rashman, et al. [34] explored the connection between financial development, country risk, and the shadow economy. These studies confirm that well-developed and stable financial markets can help reduce the size of the informal economy, particularly in emerging economies where country risks are higher. Ajide and Dada [35] explored how globalization affects the shadow economy and found that increased globalization tends to reduce the size of the shadow economy. Dreher, et al. [36] similarly argued that globalization, by increasing market efficiency and competition, discouraged informal economic activities. In conclusion, substantial evidence indicates that the shadow economy can have both positive and negative impacts on economic growth; its overall effect is context-dependent. Factors like institutional quality, governance, globalization, financial inclusion, and economic stability are key in determining whether the shadow economy will foster or hinder growth. As such, ongoing research into these complex relationships is crucial for policymakers who seek to harness the benefits of the shadow economy while minimizing its adverse effects.

3. Methodology

This study is based on the examination of an econometric model known as the Vector Autoregressive (VAR) model. The VAR model incorporates four endogenous variables—specifically the growth rate of gross domestic product (GDP), the shadow economy (SE), the inflation rate (INF), and final consumption expenditure (CE)—is employed as a system of equations. A general reduced-form VAR model is constructed in the following manner.

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

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Where $Y_t = (GDP_t, SE_t, INF_t, CE_t)$ is an *(4 x 1)* vector of time series variables, a is an *(4 x 1)* vector of intercepts, $A_i(i = 1, 2, \ldots, p)$ is *(n x n)* coefficient matrices, and ε_t is an *(4 x 1)* vector of unobserved variables. In order to execute the model, yearly time series data spanning from 1994 to 2020 were collected from the World Bank (WB).

The analysis commences with a thorough review of graphical representations alongside descriptive statistics. These visual tools, complemented by a detailed statistics table, offer a concise overview of the statistical measures pertinent to each series within the dataset. Following this initial examination, a unit root test is performed on each variable to assess the existence of a unit root. This testing is essential for determining whether a variable contains a unit root, as incorporating such a variable into a VAR Model could lead to misleading and illogical outcomes. The Augmented Dickey Fuller (ADF) test, recognized as the most widely used method, is employed to evaluate the presence of unit roots in the variables. Upon the conclusion of the tests, hypotheses are established, with the null hypothesis asserting that the series contains a unit root, while the alternative hypothesis suggests that a unit root is absent. Should any variable be identified as having a unit root, it is then converted into its first difference. Following this transformation, the unit root test is conducted again on each variable in its first difference format to ascertain the existence of a unit root. Subsequently, the optimal lag length for the VAR Model is identified through the use of the Information Criterion (IC). The parameters of the model are estimated utilizing the Ordinary Least Squares (OLS) method. Before proceeding with the Forecast Error Variance Decomposition (FEVD) and the Impulse Response Function (IRF), a stability test is carried out.

4. Empirical Results

There are four variables integrated into a system of equations known as the VAR model, which includes the GDP growth rate, the shadow economy, the inflation rate and consumer spending as a percentage of GDP. The study period spans from 1994 to 2020 and consists of 27 observations. During this period, the average growth rate of GDP, the shadow economy, the inflation rate and consumer spending is 5.17%, 45.60, 5.63% and 87.77% respectively. As the Jaque-Bera test shows, the gross domestic product and the inflation rate are not normally distributed, as the null hypothesis of normal distribution is rejected for each data series. In contrast, the null hypothesis of the Jaque-Bera test is not rejected for the shadow economy and consumer spending (see Table 1).

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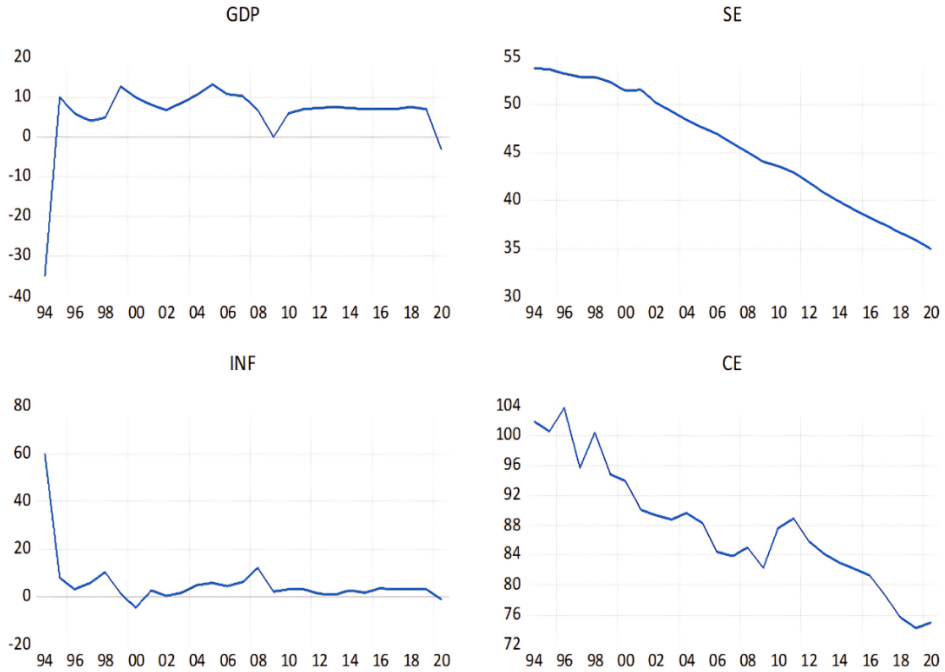

Figure 1.
GDP, SE, INF, and CE graphs.

Table 1.
Summary statistics.

Statistics	GDP	SE	INF	CE
Mean	5.71	45.60	5.63	87.77
Median	7.07	46.00	3.12	87.64
Maximum	13.25	53.79	59.97	103.76
Minimum	-34.81	34.99	-4.28	74.28
Std. Dev.	8.77	6.20	11.35	8.10
Skewness	-3.84	-0.20	4.27	0.31
Kurtosis	18.32	1.69	21.06	2.43
Jarque-Bera	330.61	2.10	448.76	0.79
Probability	0.00	0.35	0.00	0.67
Observations	27	27	27	27

To prevent spurious outcomes, it is essential to perform a unit root test before advancing to the subsequent phase of estimating the VAR model, given that this study utilizes time series data. The ADF test is employed to evaluate the presence of a unit root in all data series examined in this research. There are three distinct ADF models: one with a constant, one with both a constant and a trend, and one without either. The empirical findings from these three models have demonstrated that each time series data analyzed is stationary at level, thereby allowing the VAR model to be estimated using the level data set. It is crucial to ascertain the optimal lag length of the model to ensure its appropriateness.

Table 2.
ADF unit root test.

Model	Statistic	At level			
		GDP	SE	INF	CE
	t-Statistic	-12.743	2.386	-3.368	-1.086
	Prob.	0.000	1.000	0.024	0.706
With constant		***	n0	**	n0
With constant & trend	t-Statistic	-12.295	-3.619	-3.754	-2.887

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	Prob.	0.000	0.048	0.041	0.182
		***	**	**	n0
	t-Statistic	-4.667	-9.140	-2.099	-1.942
	Prob.	0.000	0.000	0.037	0.051
Without constant & trend		***	***	**	*
	Statistic	At First Difference			
Model		d(GDP)	d(SE)	d(INF)	d(CE)
	t-Statistic	-13.876	-4.309	-6.461	-8.015
	Prob.	0.000	0.003	0.000	0.000
With constant		***	***	***	***
	t-Statistic	-13.633	-4.991	-6.256	-7.841
	Prob.	0.000	0.003	0.000	0.000
With constant & trend		***	***	***	***
	t-Statistic	-14.414	0.068	-6.548	-6.666
Without constant & trend	Prob.	0.000	0.694	0.000	0.000
		***	n0	***	***

Note: (*)Significant at the 10%; (**)Significant at the 5%; (***) Significant at the 1% and (no) Not Significant Probability based on one-sided p-values.

The ideal lag length for a VAR model is determined by various information criteria, including the final prediction error (FPE), Akaike information criterion (AIC), Schwarz information criterion (SC), and Hannan-Quinn information criterion (HQ). It is important to note that a lower value of these information criteria indicates a superior model. As shown in Table 3, all criteria, with the exception of LR and SC, recommend that a lag length of two is optimal for the VAR model.

Table 3.
VAR lag order selection criteria.

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-271.41	NA	43557.49	22.03	22.23	22.09
1	-181.72	143.5169*	122.45	16.14	17.11243*	16.41
2	-161.19	26.27	95.49*	15.78*	17.53	16.26*

The special features of the VAR model are the analysis of the impulse response function (IRF) and the forecast error variance decomposition (FEVD). However, these analyses are only reliable if the estimation of the VAR model does not show explosive or unrealistic behaviour over time, in short, it must be a stable model for future prediction, so it is a must that the stability test is performed. Since all inverse roots of the characteristic AR polynomial lie within a unit circle, as shown in Figure 2, the model is stable.

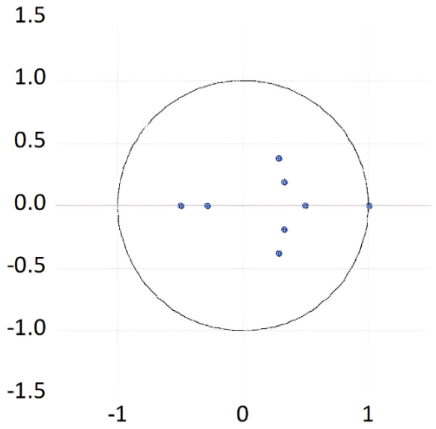

Figure 2.
Inverse roots of AR characteristic polynomial.

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Although this study incorporated four variables into the VAR model, the analysis of the impulse response function and the forecast error variance decomposition will be conducted solely using the GDP equation, in alignment with the objectives of this research.

The GDP's reaction to the shadow economy shock is negative during the initial three quarters, whereas the impact of the shock diminishes from the fifth to the tenth quarter thereafter. In the first and second quarters, there was no response in GDP attributed to the shock of the inflation rate. This shock became detrimental between the third and fifth quarters, after which it returned to equilibrium and dissipated. The results derived from the impulse response function indicate that GDP exhibits a positive reaction to variations in final consumption expenditure during the initial two quarters, with the effects diminishing from the third quarter onward.

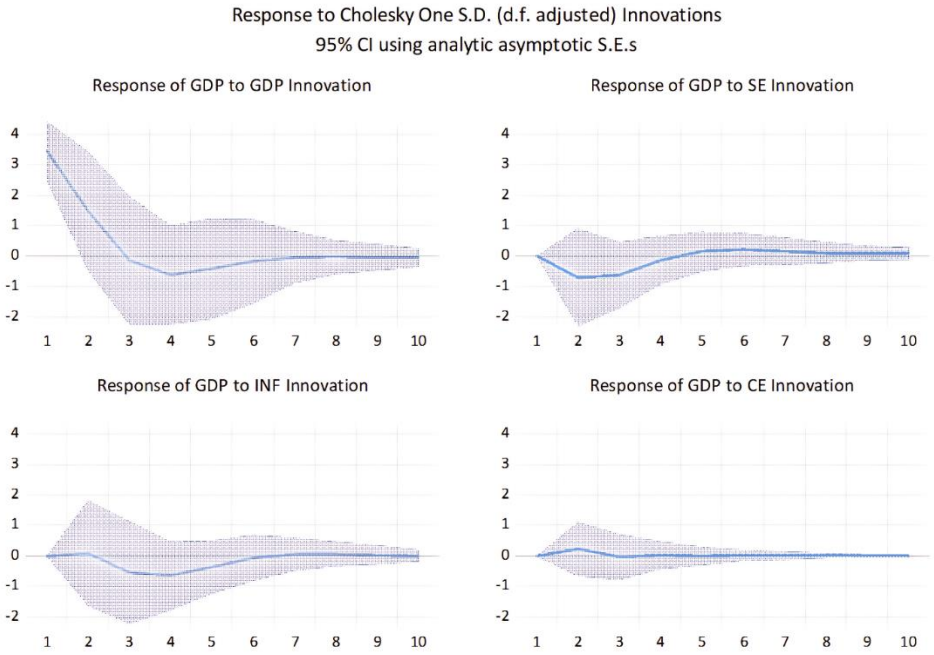

Figure 3.
Impulse response function.

The impulse response function demonstrates how a shock to one variable in the system affects and develops over time, thereby influencing other variables. Grasping this concept is essential for understanding the dynamic relationships that exist among the variables in the VAR model. However, it is important to note that the impulse response function does not account for the variation of one variable that is caused by changes in other variables within the system, which is where the forecast error variance decomposition becomes significant. This analysis aids in determining the variables that have the greatest impact on the forecast error variance of a specific variable. Within a multivariate framework, each variable may be affected by disturbances not only from itself but also from other variables present in the system. The decomposition of forecast error variance provides a measure of the extent to which future uncertainty in each variable is linked to shocks from other variables as opposed to its own historical values.

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Table 4.
Variance decomposition of GDP.

Period	S.E.	GDP	SE	INF	CE
1	3.4709	100	0.000	0.000	0.000
		0.000	0.000	0.000	0.000
2	3.8473	96.2192	3.3767	0.0628	0.3413
		-10.5869	-7.8936	-7.5401	-2.1846
3	3.9371	92.0004	5.7481	1.9186	0.3330
		-13.4261	-9.6090	-10.2729	-2.8899
4	4.0398	89.7861	5.5594	4.3356	0.3189
		-14.6264	-9.5151	-11.5641	-2.6291
5	4.0783	89.0879	5.5926	5.0066	0.3129
		-15.6749	-9.5465	-12.3723	-3.4406
6	4.0873	88.8492	5.8276	5.0057	0.3175
		-15.8598	-9.7098	-12.2869	-3.6047
7	4.0910	88.6953	5.9634	5.0214	0.3199
		-15.8520	-9.7247	-12.4805	-3.3517
8	4.0932	88.6039	6.0289	5.0448	0.3223
		-16.0175	-9.7787	-12.6087	-3.9341
9	4.0946	88.5548	6.0720	5.0497	0.3235
		-15.9942	-9.6944	-12.6780	-3.9400
10	4.0958	88.5146	6.1132	5.0476	0.3246
		-16.3349	-9.7864	-13.0276	-3.8195

In the initial forecast period, the fluctuations in GDP are not attributed to all variables within the system. However, in the subsequent period, the changes in GDP are accounted for by 3.38%, 0.06%, and 0.34% due to the variations in the shadow economy, inflation rate, and consumption expenditure, respectively. From the third to the tenth period, the primary driver of GDP variation is the shadow economy, followed by the inflation rate, with consumption expenditure contributing the least. Throughout the forecast horizon, the impact of the shadow economy on GDP variation ranges from 3.38% to 6.11%, while the inflation rate's influence varies between 0.06% and 5.05%, and final consumption expenditure accounts for changes between 0.31% and 0.34%. Additionally, the analysis of forecast error variance decomposition over the projected period reveals that GDP variation is significantly affected by the dynamics of the shadow economy, inflation rate, and consumption expenditure.

5. Conclusion

A model of equations referred to as the VAR model has been utilized to explore the interconnections among four endogenous variables: the GDP growth rate, the shadow economy, the inflation rate, and final consumption expenditure. The ADF test conducted across all models indicated that the time series data analyzed is integrated of order zero, denoted as I(0). Consequently, the VAR model is implemented utilizing the data at its level. The optimal lag length for the model is determined to be two, as indicated by various information criteria, including the final prediction error, the Akaike information criterion, and the Hannan-Quinn information criterion. The analysis of the impulse response function revealed that the growth rate of GDP exhibits a negative reaction to shocks stemming from the shadow economy and inflation, whereas it responds positively to shocks related to final consumption expenditure. This outcome clearly demonstrates that an increase in the shadow economy is likely to exert a substantial adverse effect on economic growth in Cambodia. The shadow economy significantly influences variations in economic growth among the three endogenous variables, followed by the inflation rate, which exerts a moderate impact. In contrast, final consumption expenditure contributes the least to the fluctuations in economic growth.

The government needs to tackle the fundamental issues that lead individuals and businesses to operate informally. By streamlining tax regulations, enhancing the business climate, expanding access

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to financial services, fortifying legal and institutional structures, and offering incentives for formalization, governments can motivate businesses and workers to transition from the informal sector to the formal economy. Additionally, successful public education initiatives, social safety nets, and specific incentives for small enterprises and workers are essential in making this transition more appealing.

This study primarily centers on the analysis of macroeconomics and the shadow economy as a means to assess the informal economy, regardless of its size, through the use of index numbers that still reflect macroeconomic principles. It is deemed a valuable area for future research to explore the critical factors contributing to the growth of the informal economy within the nation. The insights gained from this research could assist policymakers in formulating more effective regulations and strategies aimed at transitioning the informal sector into the formal economy.

Transparency:

The authors confirm that the manuscript is an honest, accurate, and transparent account of the study; that no vital features of the study have been omitted; and that any discrepancies from the study as planned have been explained. This study followed all ethical practices during writing.

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