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Predicting Price Level Dynamics in Cambodia: A Scenario Analysis

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Abstract

This study aims to conduct a comprehensive scenario analysis to predict the dynamics of price levels in Cambodia. Employing a Vector Autoregression (VAR) model, the study examines the relationships among the inflation rate, foreign exchange rate, and money supply. Rigorous unit root testing and lag order selection ensure the appropriateness and accuracy of the modeling approach. The analysis reveals cyclical patterns and mean-reverting properties among inflation, foreign exchange rates, and money supply growth, emphasizing the need for proactive monetary policy measures by the National Bank of Cambodia. The empirical results indicate that foreign exchange rate fluctuations significantly influence inflation, underscoring the importance of effective foreign exchange rate management for domestic price stability. Additionally, variations in money supply impact inflation and foreign exchange rates, highlighting the significance of prudent monetary management for economic growth and price stability. The study underscores the necessity for policymakers' vigilance in responding to the dynamic interactions among inflation, foreign exchange rates, and money supply to stabilize the economy. The study acknowledges limitations, including the focus on quarterly data and the VAR model's assumptions of linear relationships and stationary data, and proposes future research directions to further enhance the understanding of price level dynamics in Cambodia.

Keywords: *Inflation rate, foreign exchange rate, money supply, VAR model, Cambodia.*

Introduction

In recent years, there has been a growing emphasis on the prediction of price levels due to the dynamic and unpredictable nature of commodity prices. Traditional forecasting models, which rely on extrapolating historical data, have demonstrated limitations in accurately predicting future price levels, especially during turning points and uncertain conditions. Consequently, there has been an increased interest in utilizing scenario analysis as a forecasting tool. Scenario analysis allows for the systematic consideration of a range of potential future conditions and the uncertainties that may impact them.

The forecasting of price levels holds significant importance in the realms of monetary policy and economic planning, as it aids in stabilizing the economy and guiding investment decisions. The case of the Cambodian economy offers a compelling case for analysis, given its transition from a centrally planned to a market-oriented economy. This substantial shift has resulted in notable changes in the country's monetary framework, subsequently influencing the behavior of inflation, foreign exchange rates, and money supply. The National Bank of Cambodia (NBC), serving as the central monetary authority, plays a crucial role in navigating these transformations and ensuring economic stability.

Over the past decade, significant developments have occurred within Cambodia's financial market system. The country's economic growth has contributed to the well-being of a majority of its population and has earned it the status of a lower middle-income country. The historical development, structure, and performance of the financial market system have been fundamental factors in this economic transformation, with noteworthy characteristics and achievements that have played a pivotal role in the country's development (Clark, 2020).

Macroeconomic analysis of Cambodia between 2012 and 2018 reveals a consistent annual GDP growth rate exceeding 7%, which is among the fastest in developing Asian countries. The country has maintained a low overall unemployment rate, moderate and controllable inflation, and a growing trade deficit. Additionally, there has been a steady increase in the net inflow of foreign direct investment and a growing foreign exchange reserve, indicating a strong growth momentum for Cambodia's macroeconomy (Tang & Li, 2021). With an estimated total population of 17.1 million in 2024, Cambodia is expected to experience

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a GDP growth rate of 5.8% and an inflation rate of 2.0% in the same year.

Numerous studies have explored the relationships between monetary variables and economic indicators in Cambodia. However, there remains a research gap in the specific area of price level forecasting. The present study aims to bridge this gap by conducting a comprehensive scenario analysis that focuses on predicting the dynamics of price levels in Cambodia. The study utilizes the Vector Autoregression (VAR) model to generate price level forecasts for various scenarios. By doing so, this research intends to contribute to the existing body of knowledge on monetary policy formulation and economic planning within the Cambodian context.

Literature Review

The Use of VAR Models in Price Level Forecasting

VAR models have emerged as a valuable tool for price level forecasting in various economic sectors. In the energy sector, the use of Time-Varying Parameter VAR models has enhanced the prediction of crude oil prices. These models incorporate model averaging and selection schemes, addressing variable uncertainty and outperforming other methods like Time-Varying Regression and Dynamic Model Averaging. They are especially effective when geopolitical risk is included as an endogenous variable (Drachal, 2021). Additionally, sparse VAR methods, which constrain certain parameters to zero, have shown significant reductions in forecast errors for crude oil prices (Krüger & Ruths Sion, 2019). The Ivanov-based least absolute shrinkage and selection operator, a sparse structure within the VAR framework, have also been proposed, outperforming conventional VAR models in forecasting crude oil spot prices (Ding *et al.*, 2022).

VAR models are effective in housing price forecasts and can reveal potential factors affecting prices through variance decomposition and impulse response, with the acknowledgment that regional differences exist in the factors influencing housing prices (Hao, 2023). Furthermore, combining credit supply indicators with house prices in simple VAR models significantly improved the forecasting of real economic activity in the US, yielding results comparable to professional forecasters (Kishor, 2021).

Variants of the VAR model, such as VARX with exogenous variables, have been applied in stock price forecasting, providing accurate forecasts and insights into financial variable relationships (Putri *et al.*, 2021). Additionally, an adaptive parameter VAR-Kalman Filter model has been found to outperform conventional VAR models in forecasting stock market performance and macroeconomic factors, indicating the potential benefits of adaptive methodologies in forecasting (Promma & Chutsagulprom, 2023).

Optimal model order selection has been refined in VAR model-based time series forecasting using criteria like the Akaike Information Criterion (AIC). For example, the VAR(10) model has demonstrated lower mean square error in forecasting gold prices, emphasizing the importance of model selection for accurate predictions (Abdullah, 2022). A modified VAR model also performed well in forecasting price levels during the COVID-19 pandemic (Gharehgozli & Lee, 2022). Moreover, Bayesian VAR models, particularly those with steady-state priors, have demonstrated superior forecasting accuracy for key macroeconomic indicators compared to classical VAR models, with the inclusion of more variables leading to enhanced forecast precision (Rudakouski, 2023).

The Interconnectedness of Money Supply, Inflation, and Foreign Exchange Rates

Multiple studies have investigated the intricate relationships between inflation, foreign exchange rates, and money supply in various contexts. These studies have found various results, including positive, negative, and sequential causal relationships. For instance, Syamad and Rossanto Dwi Handoyo (2023) emphasized that an increase in money supply can lead to a depreciation of the foreign exchange rate in both the short and long term. Daoud and Al-Ezzi (2023) argued that foreign exchange rate dynamics are influenced by the money supply, with a direct relationship observed in the long term.

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Furthermore, the relationship between money supply, inflation, and foreign exchange rates is influenced by other macroeconomic factors. Agustina and Permadi (2023) contended that inflation is positively influenced by the money supply, foreign exchange rates, and fuel prices, suggesting that increases in these variables can contribute to higher inflation rates. Elshafei and Abdallah (2023) also stressed that broad money and foreign exchange rates can stimulate inflation by increasing purchasing power and aggregate demand.

However, it is important to note that the impact of money supply on inflation and foreign exchange rates can vary depending on the state of the economy. Buthelezi (2023) highlighted that different effects are observed during periods of low and high inflation or economic growth. Similarly, Elshafei and Abdallah (2023) found that money supply can have both positive and negative impacts on inflation in different states of economic growth.

In addition to the aforementioned factors, foreign exchange rates are influenced by a range of macroeconomic variables, including inflation, interest rates, and money supply. Syamad and Rossanto Dwi Handoyo (2023) and Daniel *et al.* (2023) asserted that the money supply has a significant impact on foreign exchange rate stability. Moreover, Basu *et al.* (2023) argued that the risk premium, which depends on factors such as the inflation rate and budget deficit, plays a role in the dynamic adjustment of foreign exchange rates.

Wang's (2021) empirical study of the US economy delved into the relationship between money supply, inflation, and unemployment using a three-dimensional VAR model. The study found that money supply as an intermediary target was effective, but adjusting consumption inflation had a lag. The study also highlighted a policy contradiction between employment rate and inflation rate.

Joshi (2021) explored the long-term and short-term relationship between money supply and inflation in Nepal. The study discovered a stable long-term relationship between money supply and inflation, suggesting policymakers should prioritize controlling inflation through monetary and fiscal policy mechanisms. Nguyen *et al.* (2022) focused on Vietnam and examined the impact of money supply on the inflation rate. The study's linear regression model analysis of money supply growth's effect on inflation in Vietnam supported the view that money supply growth and past inflation influenced inflation. Dekkiche's (2022) analysis, which covered the period 1990 to 2019, studied the relationship between money supply and inflation rate in Egypt. Using a Vector Error Correction Model, the study identified co-integrating links between the variables, with money supply being the primary long-term predictor of the inflation rate in Egypt.

Rustamova *et al.* (2022) studied the relationship between monetary aggregates (M0, M1, M2, M3) and the consumer price index in Azerbaijan from 2005 to 2018. Their analysis involved constructing long-term equilibrium and short-term error correction models, revealing that inflation was determined by various factors. Najiatun *et al.* (2022) conducted an investigation into the influence of money supply, inflation, and transaction volume on the consumer goods index in the capital market. The results showed that money supply and transaction volume had a substantial positive effect on the consumer goods index, while inflation had no significant effect. Simultaneous testing revealed that all variables significantly influenced the consumer goods index.

A study focused on Malaysia and Indonesia, found that money supply and geopolitical risk played significant roles in determining inflation in Malaysia in the long run, while only money supply influenced inflation in Indonesia (Yahya & Pamuncak, 2023). The study emphasized the importance of actively managing money supply and addressing geopolitical risk for effective inflation control.

Yohan *et al.* (2023) specifically analyzed the ASEAN 5 countries and highlighted the complexity of managing inflation during the COVID-19 pandemic. Through panel data regression analysis, they discovered that inflation rates in ASEAN 5 countries varied at different levels of money supply, indicating that inflation was influenced not only by monetary factors but also by demand-pull factors.

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Madurapperuma (2023) investigated the relationship between GDP growth, money growth, and inflation in Sri Lanka. The study's findings supported the idea that continuous increases in money supply led to inflation. It concluded that inflation had a negative impact on both short-term and long-term economic growth, emphasizing the need for appropriate monetary policies to control inflation and stimulate economic growth.

Stylianou *et al.* (2024) examined the relationship between money supply and inflation in Pakistan. The study employed the Augmented Autoregressive Distribution Lag (ARDL) bounds testing approach and found both short-term and long-term cointegration among inflation, money supply, unemployment, and interest rates. The results emphasized the importance of implementing dedicated policy measures to effectively manage inflation, including collaboration between the government and central bank.

In Cambodia, recent studies have utilized various econometric models to explore the interconnectedness of money supply, inflation, and foreign exchange rates. Sean *et al.* (2019) employed a Bayesian VAR approach to investigate the relationship among money supply, inflation, and foreign exchange rate in Cambodia. The study suggested that money supply in Cambodia depended on its previous values and induced depreciation of the foreign exchange rate, leading to an increase in inflation. The NBC had been cautious in managing money supply, resulting in relatively low shocks to inflation and foreign exchange rates.

In contrast, Song and Lim (2023) focused on establishing a money demand function in Cambodia using the ARDL approach to cointegration. They found that real income, consumer price index, and interest rate were cointegrated with real money demand. Real income had a positive impact on real money demand in the long run, while the general price level and interest rate had a negative impact. In the short run, real money balance adjusted to long-run equilibrium within two quarters after a shock. The study confirmed the long-term stability of the real money demand function in Cambodia through stability tests.

Ky and Lim (2023) conducted a study on the movement of monetary aggregates in Cambodia using a VAR model. Their analysis, which covered data from January 2002 to March 2023, revealed that inflation rate positively impacted the movement of monetary aggregates, while foreign exchange rate depreciation had a negative impact. The Forecast Error Variance Decomposition (FEVD) indicated that foreign exchange rate fluctuation mainly explained the variation of monetary aggregates.

Moreover, Vorlak *et al.* (2019) assessed the impact of foreign exchange rates on Cambodia's economic growth using an ordinary least squares regression model with data from 1995 to 2017. The study found a positive correlation between foreign exchange rates and GDP, while trade openness was negatively correlated with GDP. Other variables, such as broad money, inflation rate, and foreign direct investment, did not have a significant effect on Cambodia's GDP during the study period.

Despite the existing literature exploring the interconnectedness of money supply, inflation, and foreign exchange rates in Cambodia, there remains a research gap in the specific area of price level forecasting. To address this gap, the present study aims to conduct a scenario analysis focusing on predicting the price level dynamics in Cambodia. The study utilizes a VAR model to generate price level forecasts for various scenarios.

Methodology

The VAR model is employed in this study to examine the relationships among all variables in the system. With three endogenous variables, three equations are specified in the model as follows:

$$lnCPI_t = \partial_{10} + \sum_{i=1}^{p} \varphi_{11i} lnCPI_{t-i} + \sum_{i=1}^{p} \varphi_{12i} lnFX_{t-i} + \sum_{i=1}^{p} \varphi_{13i} lnM_{t-i} + \varepsilon_{1t} \quad (1)$$

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$$lnFX_t = \partial_{20} + \sum_{i=1}^{p} \omega_{21i} lnCPI_{t-i} + \sum_{i=1}^{p} \omega_{22i} lnFX_{t-i} + \sum_{i=1}^{p} \omega_{23i} lnM_{t-i} + \varepsilon_{2t} \quad (2)$$

$$lnM_t = \partial_{30} + \sum_{i=1}^{p} \delta_{31i} lnCPI_{t-i} + \sum_{i=1}^{p} \delta_{32i} lnFX_{t-i} + \sum_{i=1}^{p} \delta_{33i} lnM_{t-i} + \varepsilon_{3t} \quad (3)$$

The VAR model incorporates three endogenous variables: the consumer price index (*CPI*), the foreign exchange rate (*FX*) measured in KHR per US dollar, and the broad money supply (*M*). To ensure consistency, all variables are transformed using the natural logarithm (*ln*). It is worth noting that the first deviation (*D*) assigned to each dataset represents the growth rate. For instance, the growth rate of the consumer price index represents the inflation rate, while the positive or negative growth rate of the foreign exchange rate indicates appreciation or depreciation of the Riel, respectively. The model includes constant terms ∂_{j0} and white-noise disturbance terms ε_{jt}, where *j* is equal to 1, 2, or 3. The optimal number of lags *p* is determined for the model, with *i* ranging from 1 to *N* and time t ranging from 1 to *T*. Additionally, the parameters $\varphi, \omega,$ and δ need to be estimated as part of the model.

To avoid misleading regression results, all time series data in this study undergo a unit root examination using the Augmented Dickey-Fuller (ADF) test. The main objective of this test is to determine whether a time series data possesses a unit root. Rejection of the null hypothesis suggests that the series is not stationary. In such cases, the series is transformed into its first difference, and the test is repeated. It should be emphasized that a series exhibiting this pattern is classified as integrated of order one, denoted as *I(1)*. The order selection criteria for the VAR model are then applied using the AIC. A lower value of the criterion indicates a more accurate estimation of the model. Following a stability test, the analysis and interpretation of the FEVD and impulse response function are conducted based on the estimated VAR model.

This investigation makes use of quarterly data, specifically from the first quarter of 2002 to the third quarter of 2023. The data has been sourced exclusively from the International Monetary Fund's International Financial Statistics database. To conduct a scenario analysis, the in-sample dataset from 2023:Q1 to 2023:Q3 is utilized. In this particular period, it is assumed that the NBC increases the money supply by 5%each quarter. Subsequently, an out-of-sample forecast is performed for the period between 2023:Q4 and 2024:Q4 to assess the impact of the change in money supply on the price level and foreign exchange rate.

Empirical Results

Figure 1 illustrates the temporal dynamics of inflation rate, foreign exchange rate fluctuations, and the growth rate of the money supply from 2002:Q1 to 2023:Q3, encompassing a total of 87 quarterly observations. The data series exhibit cyclical patterns that fluctuate around their respective means, indicating a mean-reverting process, which is usually considered a stationary process.

Figure 1. Inflation rate, foreign exchange rate change, and growth rate of money supply

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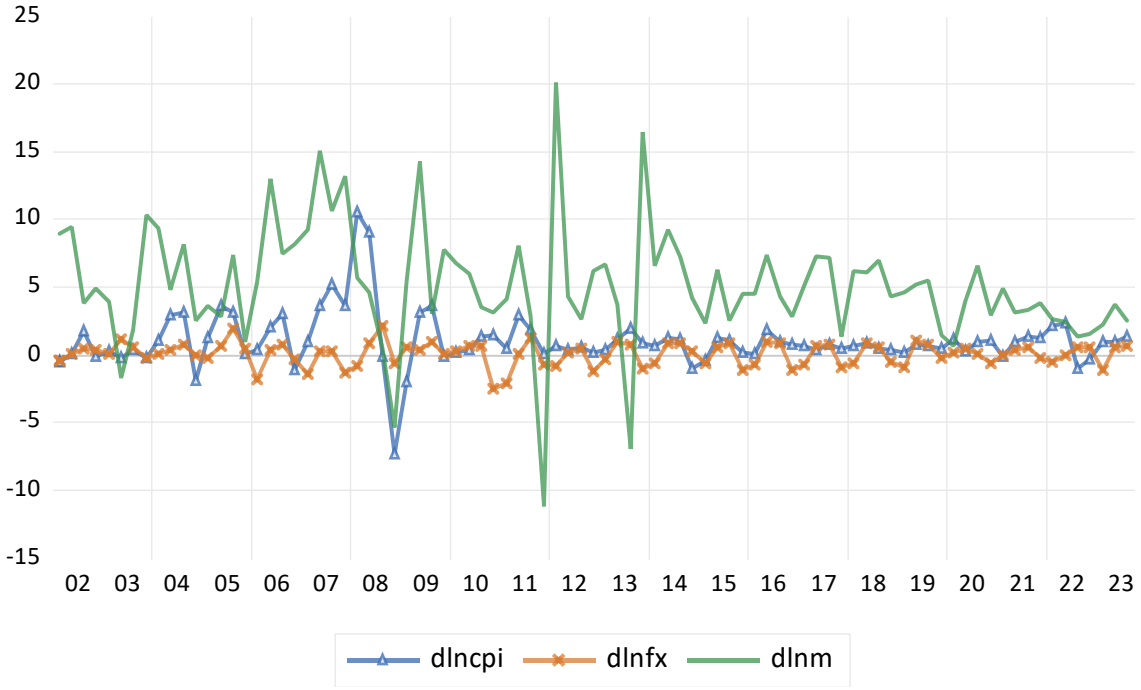

The average quarterly growth rates for the consumer price index, foreign exchange rate, and money supply were 1.040%, 0.062%, and 5.104%, respectively, over the study period. The inflation rate reached a minimum of -7.33% and a maximum of 10.52% per quarter. Regarding the foreign exchange rate, the lowest appreciation and highest depreciation were recorded at 2.52% and 2.16%, respectively. The money supply growth rate fluctuated between -11.19% and 20.06% per quarter.

Table 1 presents the summary statistics for the variables under investigation. The Jarque-Bera test suggests that, at a 5% significance level, only the foreign exchange rate changes follow a normal distribution.

Table 1. Summary statistics

	DLNCPI	DLNFX	DLNM
Mean	1.040591	0.062573	5.104717
Median	0.768417	0.262704	4.581277
Maximum	10.52339	2.162424	20.06308
Minimum	-7.330192	-2.520271	-11.19414
Std. Dev.	2.042912	0.834947	4.436660
Skewness	1.177810	-0.540555	0.017045
Kurtosis	12.11081	3.527729	6.184929
Jarque-Bera	321.0149	5.246448	36.77539
Probability	0.000000	0.072569	0.000000
Sum	90.53144	5.443833	444.1104
Sum Sq. Dev.	358.9202	59.95379	1692.820
Observations	87	87	87

To assess the stationarity properties of the time series, the study employs the ADF test, considering three different model specifications: with constant, with constant and trend, and without constant and trend. The null hypothesis of the ADF test posits the existence of a unit root, implying non-stationarity. The

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results, as presented in Table 2, indicate that the consumer price index and money supply exhibit unit root or non-stationarity in all three ADF test models. The foreign exchange rate series, on the other hand, is found to be stationary in the models with constant and constant with trend, but non-stationary in the model without constant and trend. At the first difference, each data series and model in the ADF tests exhibit stationarity, with the exception of the model excluding constant and trend components in money supply, which is deemed insignificant. Given that all data series are integrated of order one, *I(1)*, the subsequent analysis will employ a VAR model using the first differentiation.

Table 2. Unit root tests

	At Level				
		LNCPI	LNFX	LNM	
With Constant	t-Statistic	-1.4988	-3.9175	-1.9146	
	Prob.	***0.5295***	***0.0030***	***0.3242***	
		n0	***	n0	
With Constant & Trend	t-Statistic	-1.0939	-3.9360	-0.7521	
	Prob.	***0.9236***	***0.0148***	***0.9654***	
		n0	**	n0	
Without Constant & Trend	t-Statistic	3.9547	0.6262	9.8374	
	Prob.	***1.0000***	***0.8496***	***1.0000***	
		n0	n0	n0	
	At First Difference				
		d(LNCPI)	d(LNFX)	d(LNM)	
With Constant	t-Statistic	-7.9014	-4.3506	-9.2639	
	Prob.	***0.0000***	***0.0007***	***0.0000***	
		***	***	***	
With Constant & Trend	t-Statistic	-8.0251	-4.3064	-9.5343	
	Prob.	***0.0000***	***0.0051***	***0.0000***	
		***	***	***	
Without Constant & Trend	t-Statistic	-1.9575	-4.3273	-1.5898	
	Prob.	***0.0486***	***0.0000***	***0.1049***	
		**	***	n0	

Notes:

- The statistical significance of the findings is denoted using the following notation: (*) Significant at the 10% level, (**) Significant at the 5% level, (***) Significant at the 1% level, and (n0) Not Significant
- The lag length selection was based on the Schwarz Information Criterion (SIC)
- The probability values reported are derived from the one-sided p-values proposed by MacKinnon (1996)

The next step is the determination of lag length for the VAR model. Table 3 presents the various selection order criteria, including the likelihood ratio (LR) test, final prediction error (FPE), AIC, SIC, and HIC. The results indicate that the optimal lag length is not uniformly determined across the different criteria. The LR, FPE, and AIC suggest the inclusion of four lags, while the SIC and HIC point to the use of two lags. To maintain the appropriate degree of freedom, the estimation of the VAR model is carried out using two lags.

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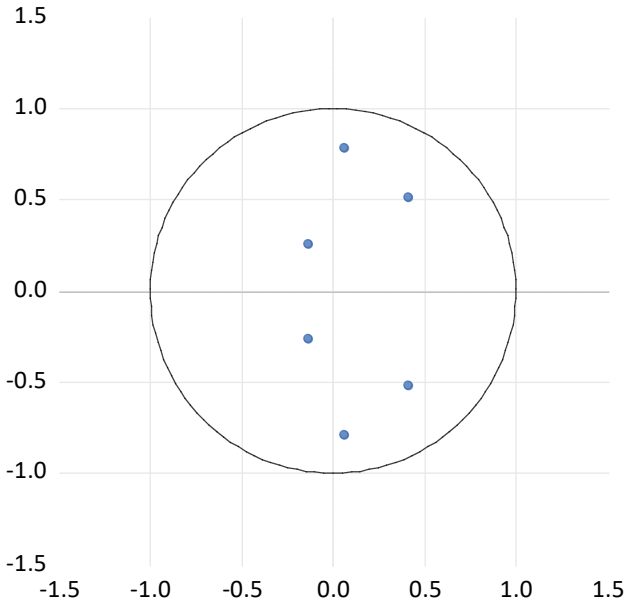
Table 3. Selection order criteria

Lag	LogL	LR	FPE	AIC	SIC	HIC
0	-519.3808	NA	58.78348	12.58749	12.67492	12.62261
1	-493.8001	48.69570	39.43082	12.18795	12.53767	12.32845
2	-463.8833	54.78748	23.84341	11.68393	12.29593*	11.92980*
3	-457.3823	11.43539	25.38224	11.74415	12.61843	12.09539
4	-445.0738	20.76144*	23.53754*	11.66443*	12.80099	12.12104

* Indicates the lag order selected by the criterion

After estimating the parameters of the VAR model, it is essential to perform a stability test by examining the inverse roots of the autoregressive (AR) characteristic polynomial. This test is crucial in ascertaining the stability of the model prior to generating the forecast error variance decomposition and impulse response function. As illustrated in Figure 2, all the characteristic roots are located within the unit circle, indicating that the system is stable. This observation is pivotal in analyzing the behavior and performance of the model under consideration, as the positioning of the characteristic roots inside the unit circle suggests that the system will not exhibit unstable behavior over time.

Figure 2. Inverse roots of AR characteristic polynomial



The forecast error variance decomposition (see Table 4), considering a time horizon of ten periods, reveals that the variation in the inflation rate is predominantly driven by the changes in the foreign exchange rate. Specifically, the contribution of foreign exchange rate changes increases from 10.85% in the second period to reach the highest level of 22.01% in the tenth period. The growth rate of the money supply also plays a role, contributing approximately 2.45% to the variation in price levels in the second period, reaching a peak of 9.81% in the seventh period before slightly declining in the subsequent periods. The transition from the second to the third period witnesses a minor increase in the pace of price fluctuations, which can be attributed to the fluctuations in foreign exchange rates and the growth rates of money supply. However, it is crucial to acknowledge that prices exhibit a certain level of rigidity over the medium and long term.

Regarding the foreign exchange rate, the fluctuations are influenced by minor changes in the inflation rate, ranging from 0.05% to 0.6% across the first to tenth forecast time horizons. The resulting impact is

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relatively small, measuring less than 1%. Concurrently, the growth in money supply drives foreign exchange rate fluctuations, typically ranging between 0.4% and 1.41% during the same period.

During the initial period, the fluctuations in money supply growth were attributed to a 1.78% impact from changes in the inflation rate and a 0.24% impact from fluctuations in the foreign exchange rate. However, as the analysis progresses from the second period to the tenth period, the changes in the money supply growth rate are primarily influenced by variations in the foreign exchange rate, ranging from 7.89% to 12.59%. In contrast, the impact of inflation rate changes on money supply growth fluctuates between 2.83% and 5.57% over the same period.

Table 4. Forecast error variance decomposition

Variance Decomposition of DLNCPI:				
Period	S.E.	DLNCPI	DLNFX	DLNM
1	1.475437	100.0000	0.000000	0.000000
		(0.00000)	(0.00000)	(0.00000)
2	1.830628	86.69666	10.84894	2.454403
		(5.38303)	(4.52360)	(3.29006)
3	1.980717	74.12773	17.10658	8.765689
		(7.64568)	(6.20522)	(6.22007)
4	2.033545	73.36777	16.90411	9.728125
		(7.71502)	(5.97469)	(6.31854)
5	2.101699	69.87788	20.96969	9.152432
		(8.15862)	(6.98058)	(6.08541)
6	2.111093	69.29854	21.01678	9.684685
		(8.35852)	(7.03850)	(6.30387)
7	2.124588	68.45212	21.74033	9.807551
		(8.56464)	(7.38890)	(6.31498)
8	2.127271	68.33727	21.87902	9.783716
		(8.61841)	(7.44762)	(6.29571)
9	2.129864	68.21218	21.98193	9.805887
		(8.73257)	(7.61679)	(6.30289)
10	2.130409	68.18156	22.00759	9.810858
		(8.74269)	(7.64360)	(6.30715)
Variance Decomposition of DLNFX:				
Period	S.E.	DLNCPI	DLNFX	DLNM
1	0.692467	0.050101	99.94990	0.000000
		(1.61376)	(1.61376)	(0.00000)
2	0.704126	0.058915	99.53522	0.405867
		(1.78598)	(2.79922)	(2.28052)
3	0.810006	0.152361	98.50878	1.338854
		(1.88650)	(3.23074)	(2.81416)
4	0.817843	0.277173	98.38156	1.341265
		(2.60160)	(3.81160)	(2.92093)
5	0.849198	0.351891	98.22426	1.423852
		(2.67000)	(3.97141)	(3.10601)
6	0.854170	0.526388	98.06112	1.412489
		(3.15011)	(4.46905)	(3.13041)
7	0.864800	0.517328	98.07014	1.412531
		(3.16362)	(4.48390)	(3.17482)

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2024
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8	0.867846	0.588224	98.00217	1.409601
		(3.34351)	(4.77658)	(3.23288)
9	0.871374	0.584685	97.99696	1.418356
		(3.34085)	(4.75854)	(3.23529)
10	0.873088	0.600464	97.98457	1.414962
		(3.40998)	(4.90202)	(3.27037)

Variance Decomposition of DLNM:

Period	S.E.	DLNCPI	DLNFX	DLNM
1	4.169415	1.786024	0.243100	97.97088
		(3.26302)	(2.05538)	(3.73516)
2	4.375804	2.829923	7.892536	89.27754
		(3.47723)	(5.48526)	(6.39799)
3	4.442730	4.948346	7.663433	87.38822
		(4.20423)	(5.54092)	(6.24649)
4	4.550661	5.632643	11.04479	83.32256
		(4.66902)	(6.32680)	(7.25492)
5	4.574248	5.586690	11.55808	82.85523
		(4.61176)	(6.52047)	(7.49041)
6	4.594152	5.560048	12.10842	82.33153
		(4.63046)	(6.64889)	(7.56877)
7	4.602743	5.562520	12.41298	82.02450
		(4.67689)	(6.76440)	(7.74901)
8	4.606079	5.573598	12.48727	81.93913
		(4.70623)	(6.78240)	(7.77499)
9	4.608510	5.572725	12.56609	81.86119
		(4.69493)	(6.85675)	(7.83071)
10	4.609308	5.573002	12.59396	81.83303
		(4.71767)	(6.86154)	(7.83770)

Cholesky One SD (DF Adjusted) Innovations

Cholesky ordering: DLNCPI DLNFX DLNM

Standard errors: Monte Carlo (100 repetitions) standard deviations presented in parentheses
The impulse response functions, as depicted in Figure 3, provide further insights. The first row shows that the inflation rate initially reacts favorably to the increase in the growth rate of money supply, but the impact of the shock weakens over time, leading to a reduction in the response from the third to the sixth period, followed by a resurgence between the seventh and eighth periods. The inflation rate also exhibits a cyclical pattern in its response to changes in the foreign exchange rate. During the initial two quarters, there is a negative response, indicating a decrease in inflation rate, followed by a positive reflection from the third to the fifth period, suggesting an increase in inflation rate. As time progresses, the response to the shock starts to diminish between the sixth and seventh period, only to rebound and stabilize until the tenth period. Furthermore, the inflation rate demonstrates a downward reaction to its own shock during the initial period until the middle of the fourth period, before a change in dynamics leads to a reversal in the situation.

The second row of Figure 3 illustrates the response of foreign exchange rate changes to various shocks. The foreign exchange rate change shows a relatively weaker response to the shock of inflation rate. However, during the initial three periods, the response of foreign exchange rate change to money supply growth rate highlights a negative influence, which gradually becomes positive and continues until the end of the fourth period, after which the shock diminishes from the fifth to the tenth period. Interestingly, the

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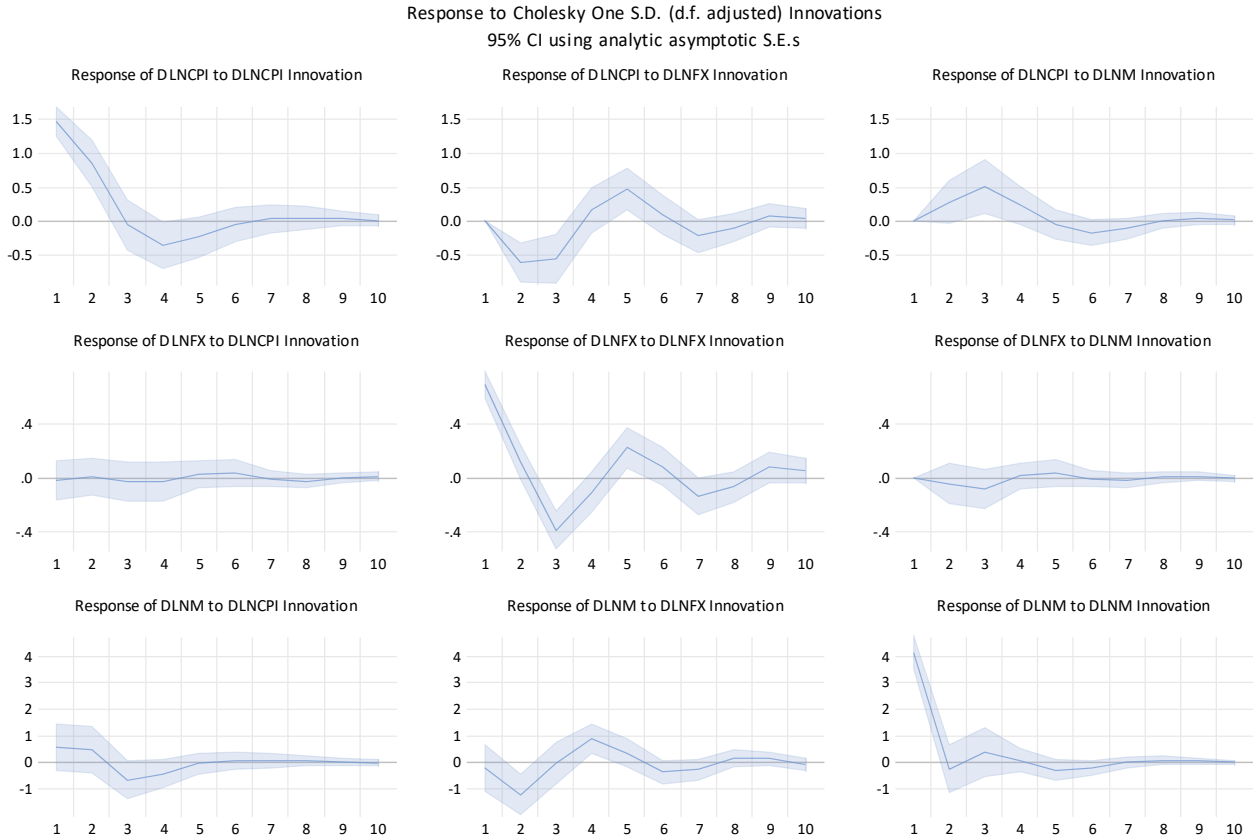
response of foreign exchange rate change to its own shock exhibits a cyclical pattern, with significant fluctuations around the mean value from one period to another.

The final line in Figure 3 depicts the reaction of money supply growth to both its own shock and the shocks of foreign exchange rate changes and inflation rates. Initially, there is a decrease in the response of money supply to inflation rate shocks during the first three periods, followed by an upward trend from period three to period five, with the shock dissipating from period six onwards. The response of money supply to foreign exchange rate shocks is negative during the first two periods, before undergoing a reversal from the third to the fourth period, where the response becomes positive but gradually diminishes from the sixth period onwards, with a slight resurgence between the seventh and eighth periods.

Figure 3. Impulse response function



To further examine the impact of monetary policy adjustments, the study conducts an out-of-sample forecast scenario analysis. The baseline scenario assumes no restrictions on the growth rate of the money supply, while the alternative scenario (scenario 1) assumes that the NBC will consistently increase the money supply by 5% per quarter from 2023:Q1 to 2023:Q3. The results (see Table 5 and Figure 4) indicate that the average inflation rate per quarter under the baseline case is 1.062%, while under the scenario case, it is 1.111%, suggesting that the expansionary monetary policy will lead to a higher price level.

Table 5. Baseline and scenario analysis, inflation rate (%), 2023:Q4-2024:Q4

TIME	DLNCPI_0	DLNCPI_1
2023Q4	1.465	1.609
2024Q1	0.992	1.120

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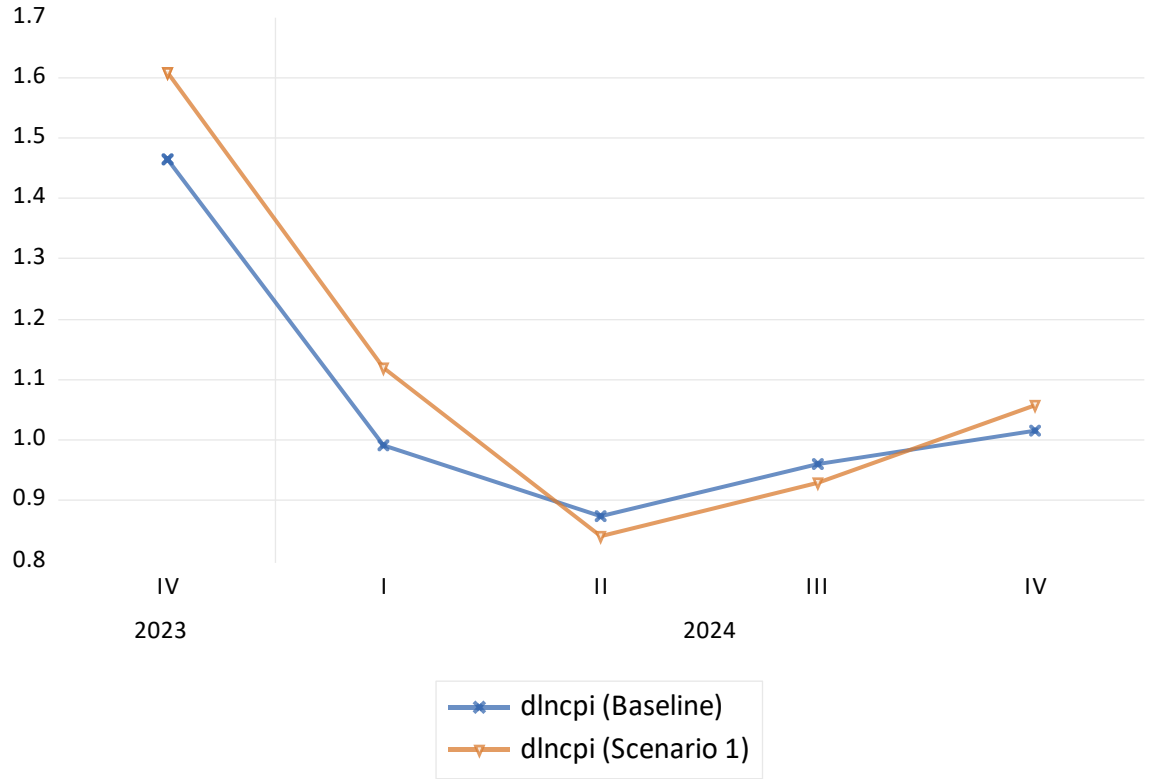
2024Q2	0.875	0.841
2024Q3	0.961	0.930
2024Q4	1.015	1.058
	1.062	1.111

Figure 4. Scenario analysis of inflation rate (%), 2023:Q4-2024:Q4



Additionally, the implementation of the expansionary monetary policy is found to have a positive impact on the foreign exchange rate, with an average devaluation of 0.081% per quarter in relation to the US dollar during the forecasting period from the fourth quarter of 2023 to the fourth quarter of 2024 (see Table 6 and Figure 5).

Table 6. Baseline and scenario analysis of foreign exchange rate (%), 2023:Q4-2024:Q4

TIME	DLNFX_0	DLNFX_1
2023Q4	0.083	0.189
2024Q1	-0.006	0.063
2024Q2	0.036	-0.023
2024Q3	0.108	0.056
2024Q4	0.094	0.122
	0.063	0.081

Figure 5. Scenario analysis of foreign exchange rate (%), 2023:Q4-2024:Q4

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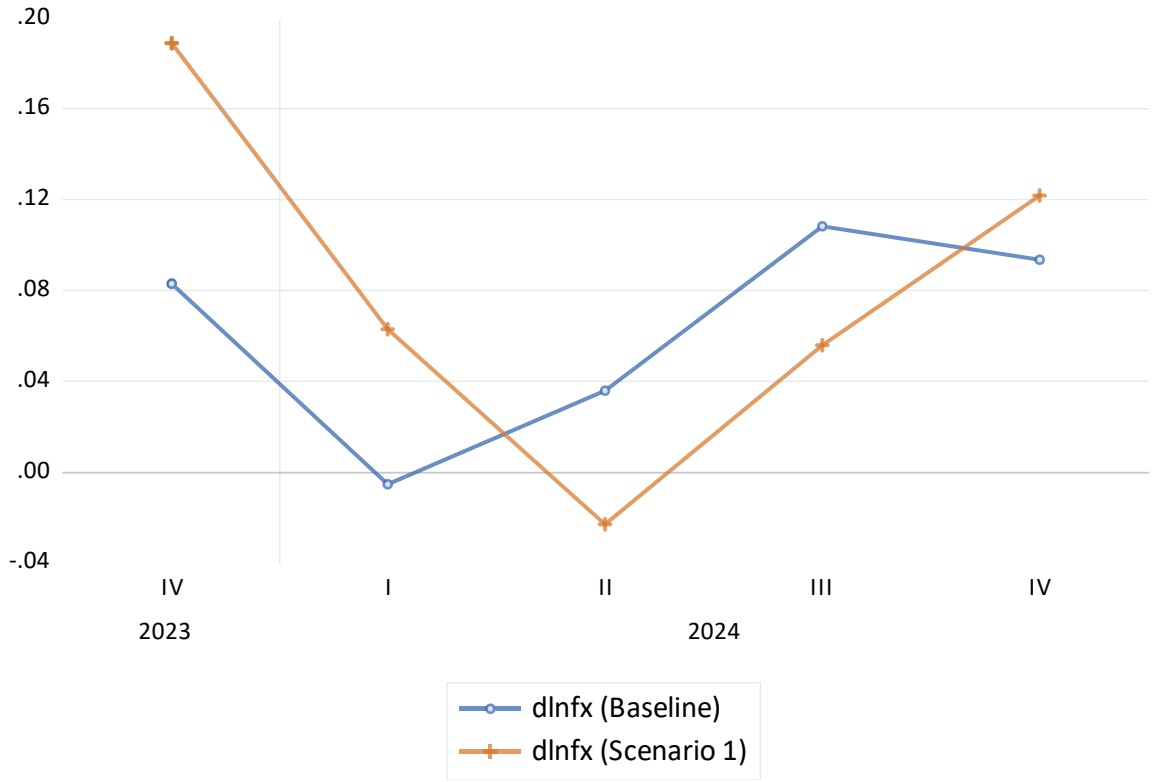

The study's empirical results have significant implications for the conduct of monetary policy by the NBC. The results underscore the need for the NBC to adopt a comprehensive and adaptive approach to its policy framework, with a strong emphasis on foreign exchange rate management and the careful calibration of money supply growth.

The cyclical patterns and mean-reverting properties observed in the dynamics of the inflation rate, foreign exchange rate, and money supply growth suggest that policymakers should embrace a flexible and adaptive approach to monetary policy. The NBC should closely monitor these macroeconomic variables and be prepared to make timely adjustments to stabilize the economy and maintain price and foreign exchange rate stability.

The empirical results further highlight the dominant role of foreign exchange rate fluctuations in driving inflation rate dynamics, with the foreign exchange rate contributing up to 22.01% of the inflation rate's forecast error variance decomposition. This underscores the critical importance of foreign exchange rate management in the NBC's monetary policy framework. The NBC should closely monitor and manage the foreign exchange rate to mitigate its impact on domestic price levels.

Additionally, the study demonstrates that increases in the money supply growth rate contribute to higher inflation and foreign exchange rate devaluation. This emphasizes the crucial role of money supply management in the NBC's policy toolkit. The NBC should carefully calibrate the pace of money supply growth to strike a balance between economic growth and price stability.

The impulse response functions reveal the complex and cyclical nature of the interactions among inflation, foreign exchange rate, and money supply. Policymakers should be cognizant of these dynamic relationships and be prepared to respond with appropriate policy measures to stabilize the economy and mitigate the adverse effects of shocks.

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Furthermore, the scenario analysis indicates that an expansionary monetary policy, characterized by a consistent increase in the money supply, leads to higher average inflation rates and foreign exchange rate devaluation. This suggests that the NBC should exercise caution when implementing expansionary policies, as they may result in undesirable inflationary pressures and currency depreciation, which could undermine economic stability.

Conclusion

This study aims to conduct a comprehensive scenario analysis that focuses on predicting the dynamics of price levels in Cambodia. Employing a VAR model, the study examines the relationships among the inflation rate, foreign exchange rate, and money supply. The time series data underwent rigorous unit root testing using the ADF test to ensure data stationarity and appropriateness for modeling. Furthermore, the selection of the lag order in the VAR model was determined using the AIC, ensuring an accurate model estimation.

The empirical results highlight the cyclical patterns and mean-reverting properties present in the dynamics among the inflation rate, foreign exchange rate fluctuations, and money supply growth in Cambodia, underscoring the need for proactive and adaptive monetary policy measures by the NBC. The findings indicate that foreign exchange rate fluctuations play a pivotal role in driving inflation rate dynamics, with foreign exchange rate changes contributing significantly to the forecast error variance decomposition of inflation rates. This emphasizes the critical importance of effective foreign exchange rate management in the NBC's policy framework to ensure domestic price stability. Additionally, the impact of changes in money supply growth on inflation and foreign exchange rate devaluation underscores the significance of prudent money supply management in achieving the dual objectives of economic growth and price stability.

The impulse response functions highlight the intricate and dynamic relationships among inflation, foreign exchange rate, and money supply, emphasizing the need for policymakers to be vigilant and responsive to these interactions. By being attuned to these dynamic interplays, the NBC can implement timely and effective policy measures to stabilize the economy and offset the adverse effects of external shocks. Furthermore, the scenario analysis underscores the potential impact of expansionary monetary policy on inflation rtes and foreign exchange rate devaluation, signaling the need for the NBC to exercise caution when implementing such policies.

While the study provides valuable insights into price level dynamics in Cambodia, several limitations should be acknowledged. The focus on quarterly data may limit the granularity of analysis, warranting further investigation using higher-frequency data. Furthermore, the VAR model's assumptions of linear relationships and stationary data may oversimplify complex economic interactions, suggesting the exploration of more sophisticated modeling techniques.

Future research could explore the impact of additional macroeconomic variables on price dynamics in Cambodia, such as interest rates and fiscal policy measures, to provide a more comprehensive understanding of the economic landscape. Further research could also delve into the implications of structural breaks or regime shifts on price level dynamics, offering insights into policy responses during periods of economic turbulence. Moreover, incorporating qualitative data or sentiment analysis from stakeholders could enrich the analysis by capturing market expectations and policy sentiments influencing price level dynamics. Exploring nonlinear modeling approaches or machine learning techniques could enhance predictive accuracy and capture complex, nonlinear relationships among economic variables more effectively.

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