CJBPP
Cambodia Journal for Business and Professional Practice
Volume 2
ISSN: 3078-4131 (Print)
DOI: https://doi.org/10.71215/cjbpp.202624

The Impact of Monetary Policy and Climate Change on Cambodia's GDP Growth: A VAR Analysis

CJBPP Vol. 2

Received: September 8, 2025
Revised 1st: October 16, 2025
Revised 2nd: Nov 12, 2025
Accepted: Nov 29, 2025

Sophat Phon[1*], Pidor Ngin [1], Sophalla Chou [2] & Sophy Khan [3]

*Corresponding Author Email: sophatph9@gmail.com

1. Institute for Banking Studies, National Bank of Cambodia, Cambodia
2. National Bank of Cambodia, Cambodia
3. Royal Academy of Cambodia, Cambodia

Abstract

This study examines the complex relationship between climate shocks, monetary policy, and Cambodia's GDP growth using IMF data from 1996–2022 with econometric models such as Ordinary Least Squares(OLS) and Vector Autoregression (VAR) model. The findings reveal that climate shocks affect short-term rise in GDP growth, largely due to early adaptation efforts and temporary boosts in agricultural activities. However, these effects are not sustained. GDP responds positively to climate shocks for a short run but diminishes and as negative effects in a long run, reflecting the vulnerability of Cambodia's agriculture-based economy to repeated or severe climatic events. This means that GDP rises up in a short run before declining, underscoring the temporary nature of such benefits. Monetary policy, supported by a managed-float exchange rate and Central Bank interventions, has stabilized growth, yet its impact is constrained by high dollarization, which limits control over interest rates and money supply. Expanding the use of the Riel would enhance policy flexibility and support climate adaptation. Overall, monetary policy alone cannot secure resilience; structural reforms in agriculture, financial systems, and climate-resilient infrastructure are essential. Data limitations, particularly the underrepresentation of the informal sector, remain an important consideration.

Keywords: *Monetary Policy, Climate Change, GDP Growth, Cambodia*

1. Introduction

Cambodia has witnessed substantial economic growth in recent decades, with its GDP increasing by approximately 7% annually since the early 2000s. As in figure 1 determines that illustrates Cambodia's GDP growth from 1996 to 2022. The vertical bars show total GDP in billions of USD, steadily increasing over time. The line graph tracks annual percentage change in GDP, revealing fluctuations, most notably a sharp decline around 2020 due to the global pandemic, followed by a strong recovery in 2021 and 2022. But along with economic growth, there are major environmental issues, such as the consequences of climate change. Understanding the intricate relationship between economic growth, monetary policy, and environmental issues is essential as Cambodia becomes more prosperous (Hoang & Huynh, 2020). This study examines the connections between Cambodia's monetary policy, climate change, and GDP growth. It explores the possible impacts of climate change on this dynamic as well as how monetary policy tools like interest rates and exchange rate management influence economic development (Lut & Moolio, 2015). A major factor in Cambodia's remarkable GDP growth has been the monetary policy framework. However, the nation as a whole is highly susceptible to the consequences of climate change, which may jeopardize its ability to continue growing (Asif et al., 2017).

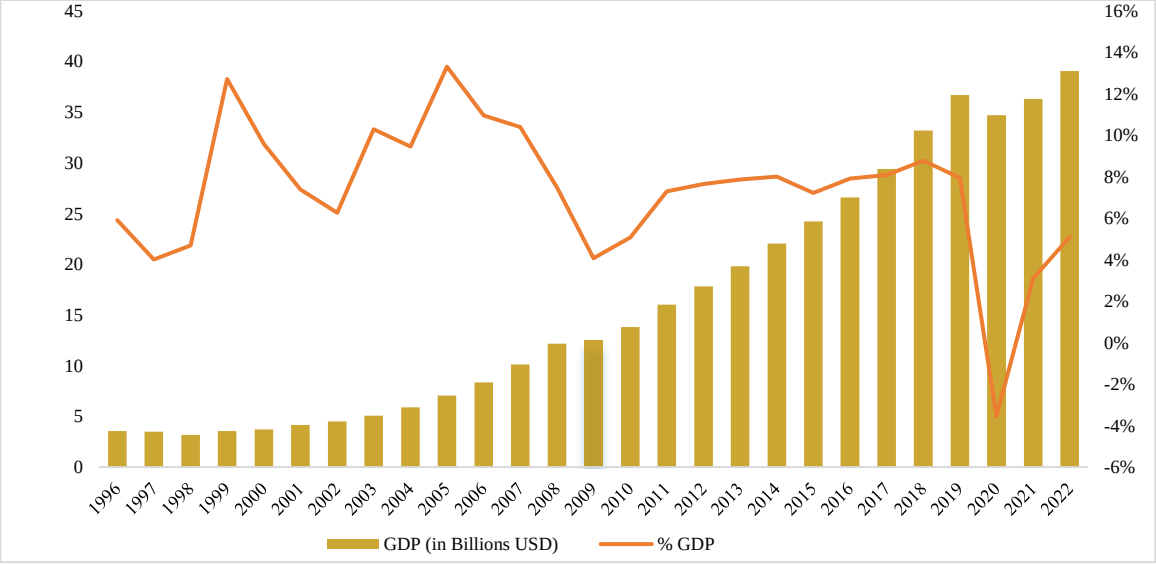


Figure 1: Cambodia's GDP Growth by Years

Source: IMF's World Economic Outlook Database

Cambodia has been susceptible to the consequences of climate change. Its dependence on agriculture sector, water resources, and natural resources is well-known, while there are issues like harsh weather, shifting patterns, and increasing water levels (United Nations Development Programme, 2023). According to the IMF data, Figure 2 shows that Cambodia's climate has warmed steadily since the 1990s, with rising temperatures, erratic rainfall, and more frequent droughts and floods. Key years like 2000, 2015, and 2020 saw severe climate impacts. The country remains highly vulnerable due to its reliance on agriculture and limited infrastructure. These issues have the capacity to uproot communities, destroy essential infrastructure, and interfere with agricultural productivity, all of which could affect the economic output of the country. Compared to other Asian nations, Cambodia has relatively low per capita greenhouse gas emissions, making it a great opportunity to pursue a low-emission growth path. Monetary policy plays a critical role in this scenario (Yangka et al., 2023). Additionally, by adjusting interest rates, maintaining exchange-rate stability, and implementing other policy instruments, the National Bank of Cambodia (NBC) exerts significant influence on investment decisions, controls inflationary pressures, and supports economic growth. However, navigating these complexities requires a clear understanding of how climate change affects traditional economic relationships and how monetary policy can be tailored to address these evolving challenges (NBC, 2023).

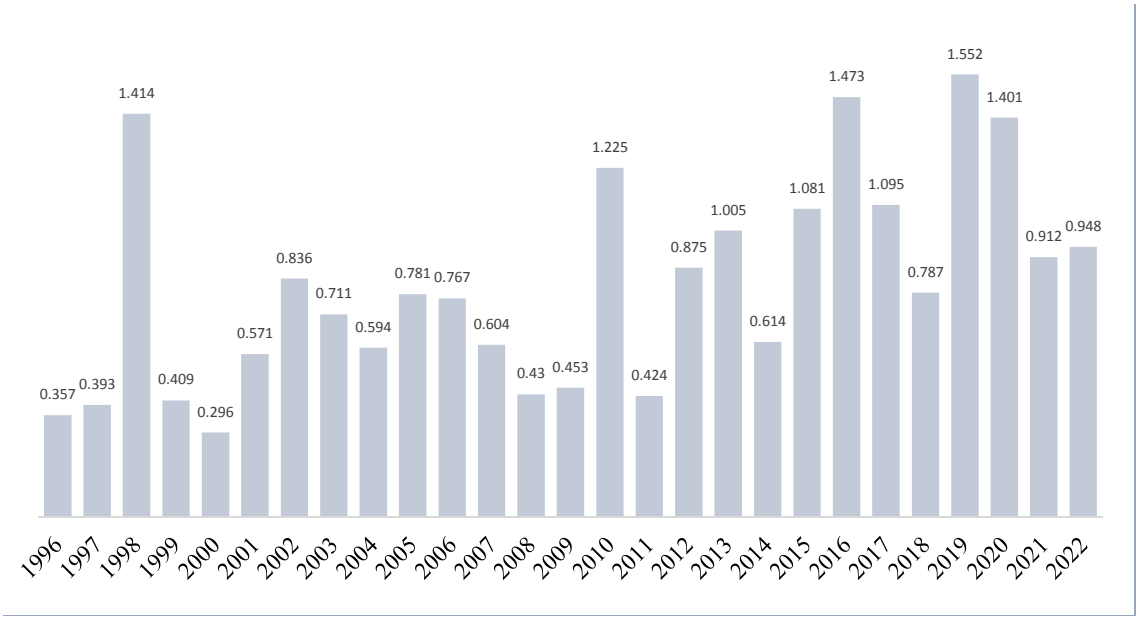


Figure 2: Cambodia's Climate Change by Years

Source: IMF's World Economic Outlook Data

This study seeks to give a detailed examination of the linked impact of monetary policy and climate change on Cambodia's GDP growth. The research will examine historical data from 1996 to 2022 using the IMF's World Economic Outlook Database, applying econometric tools, to provide specific conclusions and implications. The study will:

- Determine the impact of climate change on Cambodia's GDP by analyzing important industries and transmission pathways
- Evaluate the effectiveness of various monetary policy measures in reducing climate-related economic hazards
- Identify potential policy changes and recommendations for the National Bank of Cambodia to improve climate resilience and support long-term economic growth.

To achieve these goals, the study will review relevant literature and empirical studies to examine the different mechanisms via which monetary policy and climate change may affect GDP growth in Cambodia.

2. Literature Review

Central Bank and Its Role in Economy

Historically, Cambodia's economy has been characterized by a high degree of currency substitution due to the US dollar's strong position as a store of value and in domestic transactions (Phon, 2015). The way monetary policy is implemented and the government's capacity to raise seignior age revenue are both significantly impacted by this phenomenon. By implementing exchange rate management techniques and encouraging the use of the Riel, the country's currency, the National Bank of Cambodia has attempted to address this issue. The Central Bank has pursued a managed float exchange rate regime to maintain price stability and support economic growth (Hill & Menon, 2014). However, the economy's high level of dollarization limits the effective use of monetary policy tools because the Central Bank's ability to influence domestic interest rates and the money supply is constrained. Despite the challenges posed by currency substitution, the Central Bank has taken steps to promote the use of the Riel and gradually reduce the economy's reliance on the US dollar. However, the public's preference for the more stable and widely accepted US dollar has persisted, so these efforts have had little success (Hay, 2021). The Central Bank has also taken steps to encourage the growth of capital markets, enhance financial inclusion, and

fortify the financial sector in order to further support economic growth and development. These programs are meant to increase the effectiveness of financial intermediation and give households and businesses more access to credit (Chinhema, 2020). Additionally, the government's capacity to produce seigniorage revenue is greatly diminished due to the large proportion of foreign currency holdings in Cambodia's domestic liquidity services. This, in turn, may constrain the government's capacity to invest in climate change mitigation and adaptation measures, as well as other public goods that could support sustainable economic development.

Perspectives of Monetary Policy and GDP Growth in Cambodia

The Central Bank's role and monetary policy approach have been important factors in Cambodia's economic growth. To control the economy, the National Bank of Cambodia implements monetary policy, which includes managing the money supply, interest rates, reserve requirements, inflation, and exchange rate (NBC, 2023). The degree of dollarization in Cambodia limits the Central Bank's ability to directly affect the economy, but some monetary policy tools are still very important. First, the two key elements of the national bank's monetary policy strategy are keeping the exchange rate comparatively steady and reining in inflation. The National Bank of Cambodia can control capital flows and inflationary pressures by managing the Cambodian Riel under a floating exchange rate regime. A stable macroeconomic environment has been promoted by this exchange rate policy, which is essential for sustaining Cambodia's swift economic growth (Baksa et al., 2020). The National Bank of Cambodia closely monitors the exchange rate to maintain stability even though it does not formally peg the Riel to the US dollar. Trade and foreign direct investment can be encouraged by a stable exchange rate, which boosts GDP growth. However, other studies have emphasized the significance of managing the exchange rate and the function of monetary policy in promoting the nation's economic growth. Research indicates that a stable and effectively controlled exchange rate can support exports, draw in foreign investment, and lessen the impact of external shocks—all of which can support economic expansion (Ha & Hoang, 2020).

Second, the National Bank of Cambodia has managed the nation's money supply sensibly. The reserve requirements for commercial banks can be changed by the Central Bank, which affects the banks' ability to lend. Lowering reserve requirements promotes more lending, which increases company activity and may propel economic growth (Grauwe & Ji, 2024).

The Central Bank seeks to strike a balance between the need for credit expansion to support GDP growth and prevent undue inflationary pressures by maintaining adequate liquidity and reserve levels. The high degree of dollarization in the Cambodian economy limits the central bank's ability to successfully manage the domestic money supply and could make it more difficult to steer the entire economy (Joyeux & Worner, 1998).

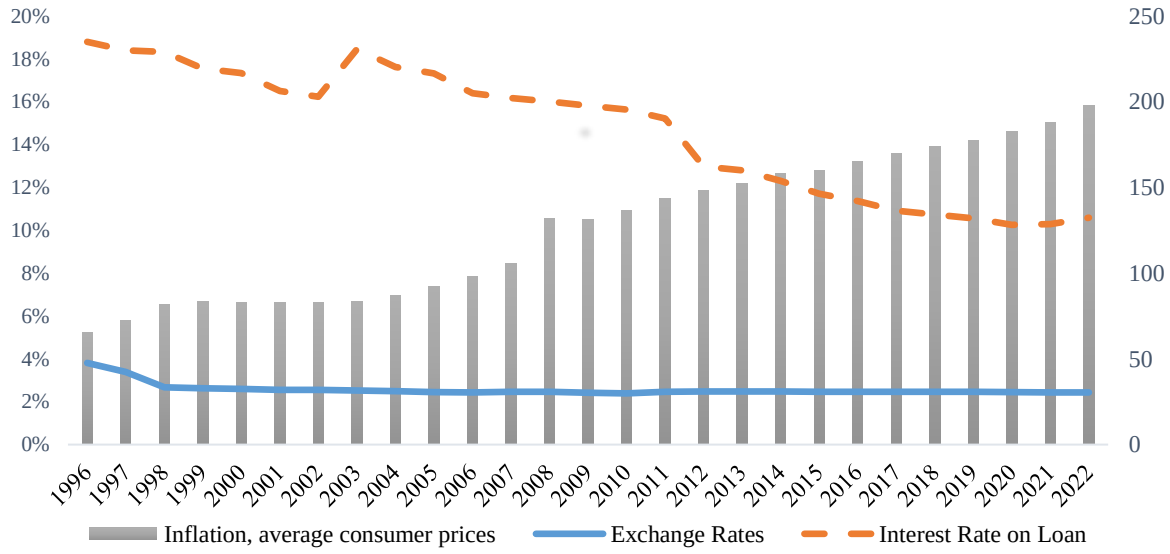


Figure 3: Cambodia‘s Inflation, Exchange Rate and Interest Rate on Loans

Source: IMF’s World Economic Outlook Database

Broad Money, Liquidity and Interest Rates on Growth

As figure 3 illustrates from 1996 to 2022, Cambodia’s inflation showed upward volatility, peaking in 2022. Exchange rates remained stable due to dollarization, while loan interest rates steadily declined from around 18% to 13%, reflecting financial sector reforms.

The Cambodia's overall economic performance has also been influenced by the Central Bank's use of reserve requirements, open market operations, and other instruments to affect interest rates and the money supply. Increasing in money supply(M2) generally indicates greater liquidity in the economy, which can then stimulate investments and contribute to GDP growth where interest rate levels have a significant impact on economic activity.

Hence, high interest rates can deter businesses from investing. This may result in less money being spent on investments and possibly slower economic growth (Akinwale, 2018).

Similarly, low interest rates, on the other hand, make borrowing more accessible, encouraging consumers to spend and companies to invest, which can boost the economy and propel GDP growth (Alazaki & Okumus, 2024).

Exchange Rates and GDP Growth

Interest rates shape exchange rates, investment, and overall economic activity. Higher domestic interest rates can attract foreign capital and appreciate the local currency, making imports cheaper but reducing export competitiveness and potentially slowing GDP growth(Samreth, 2010; Phon, 2015). Lower rates make borrowing easier for firms and households, supporting investment, consumption, and economic expansion while often weakening the currency in a way that boosts exports (Auerbach et al., 2020). The Central Bank must balance these effects to support growth without triggering excessive inflation. In Cambodia, the interest rate policy is limited by high dollarization. Financial institutions such as commercial banks or other institutions adjust lending rates based on liquidity conditions and external markets rather than domestic monetary policy signals. As a result, the National Bank of Cambodia has less influence over borrowing, saving, and investment decisions (Kang, 2005; Samreth, 2010; Phon, 2015).

Inflation and Uncertainty Growth

Inflation management remains central to Cambodia's monetary framework. Moderate inflation can support spending and investment, while high inflation erodes purchasing power, distorts price signals, and discourages long-term investment (Amaly et al., 2022; Ha et al., 2023). Research has shown that continually high inflation reduces growth by raising uncertainty and misallocating resources (Ghosh & Phillips, 1998; Jawad, 2013). A stable economy has been maintained by the Central Bank's adherence to low and steady inflation, which is bolstered by reserve requirement policies, interest rate changes, and exchange-rate regulation (Hill & Menon, 2014; Phon, 2015).

Hence, Cambodia's high use of the US dollar continues to constrain monetary independence to intervene in economy. Dollarization limits control over interest rates and the money supply, reducing the Central Bank's capacity to respond independently to economic shocks (Ra, 2008). Nevertheless, prudent monetary management and exchange-rate stability have supported strong economic performance over the past two decades (Baksa et al., 2020).

Overall, the relationship between monetary policy and GDP growth in Cambodia is complex. Strengthening domestic savings, increasing the role of the Riel, and building resilience to external and climate-related shocks will remain important for sustaining long-term growth.

The more use of foreign currency may also make it more difficult for the National Bank of Cambodia to handle economic disruptions and implement monetary policy in Cambodia. Furthermore, there is urgent concern over how climate change will affect Cambodia's GDP growth as mentioned in the following section.

Climate Change and Other Challenges in Cambodia

Cambodia is highly vulnerable to the impacts of climate change, and these effects pose serious risks to its long-term economic growth. Extreme weather events such as heatwaves, droughts, and floods have become more frequent and severe, destroying infrastructure, disrupting agricultural production, and forcing communities to relocate (Cambodia Climate Change Alliance [CCCA], 2018). Climate change issues such as droughts and floods brought on by unpredictable rainfall patterns endanger access to clean drinking water and lower agricultural productivity. Cambodia is also at risk from sea level rise, which has the potential to destroy infrastructure, flood coastal regions, and uproot local populations (NBC,2022). Cambodia's dependence on agriculture makes it particularly sensitive to climate shocks. Shifts in temperature and rainfall can reduce crop yields, leading to economic losses and food insecurity. Poverty and inequality further magnify these effects, since vulnerable communities often lack the resources needed to cope with climate-related shocks (Seasonal Outlook for Cambodia, 2023). Climate impacts also threaten tourism, another key source of income, as extreme weather and rising sea levels reduce the appeal and safety of tourist destinations (ADB, 2019).

Some research findings in recent years have increasingly focused on the links between monetary policy, climate change, and economic growth. While some studies find limited effects of monetary policy on growth (Daoui, 2023), others highlight its importance (Hosen, 2020; Nga, 2021). For example, money supply has been shown to positively influence economic growth in Sri Lanka (Hosen, 2020), while interest rate and exchange rate policies affect growth in the Central African Monetary Community (Nga, 2021). Studies on climate impacts also show strong effects on economic outcomes. Research from Vietnam and Africa demonstrates that shifts in rainfall and temperature significantly affect GDP, with

temperature increases having long-term negative impacts (Ali, 2012; Nguyen & Le, 2018; Warsame et al., 2023).

Some research highlights Cambodia's need to understand how climate pressures and monetary policy interact (Lay, 2020). According to Davies et al., 2014, declining rice yields due to changing rainfall and rising temperatures pose risks to the country's core agricultural sector and climate change also endangers human health, as increased waterborne diseases reduce productivity and strain health systems. Broader macroeconomic risks are also apparent. Under high-emission scenarios, the World Bank predicts significant long-term GDP losses for Cambodia, emphasizing the importance of adaptation and mitigation strategies. At the same time, opportunities exist for renewable energy and sustainable transportation (Asif et al., 2017).

Therefore, Cambodia's monetary policy framework has fueled strong economic growth, but challenges remain due to high dollarization. Baksa et al. (2020) present a macroeconomic model for Cambodia, emphasizing the importance of understanding how external shocks affect the economy. While research on Cambodia's monetary environment is expanding, there is still little empirical evidence on how specific monetary policy tools affect economic growth.

According to research in the context of South Africa, monetary policy frameworks must take climate change risks into account (Precious & Palesa, 2014). In light of climate change, research in Sri Lanka and the Central African Monetary Community shows how monetary policy can affect economic growth. As previously stated, understanding climate change and monetary policy and its interventions is crucial to Cambodia's economic development. Based on what has been discussed, the following framework is proposed for this study.

Conceptual Framework

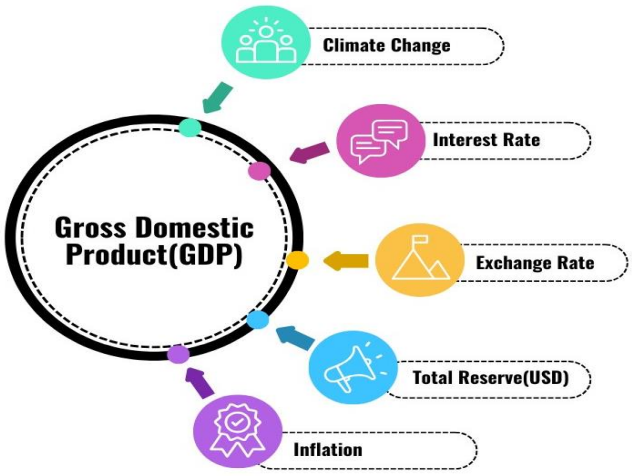


Figure 4: Conceptual framework

Source: Authors' illustration

3. Research Methods

Research Design

This research used a quantitative approach to measure the impact of the monetary policy and climate change on Cambodia's GDP Growth. The aim is to investigate the correlations between two or more variables with GDP growth in Cambodia with using econometric models. A time series study design was also applied (Hamilton, 2020).

Research Tool

The study used secondary data, which is time series data from IMF, namely monetary policy factors and climate change factors, to measure Cambodia's GDP growth. The study employed the OLS and VAR models to measure the variables, including monetary policy, climate change, and GDP growth.

Data Collection

The time series data over 27 years from 1996 to 2022 gathered from the IMF is used in this research. All the techniques of data collection are based on the IMF which are received from each country's entities. Each member country must submit this data to the IMF regularly through their central banks, ministries of finance, and national statistical offices.

Additionally, the IMF collaborates extensively with national authorities to validate and harmonize and improve data quality through technical assistance missions and surveillance assessments.

Data Analysis

This study analyzes and evaluates the impact of monetary policy and climate change on Cambodia's GDP growth using the Multiple Linear Regression and Vector Autoregression (VAR) model. The IMF data used in this study, which covers 27 years from 1996 to 2022, are highly suitable for these models. These regressions are performed using STATA17 and other software. Based on Green (2003), we can write the Linear regression model as follows.

GDP = *f* (Climate Change, Interest Rate, Exchange Rate, TReserve, INF) (1)

Or we can rewrite as follows:

GDP = *f* (CC, IR, ER, TR, INF) (2)

Where CC is climate change, IR is interest rate for deposit and loan, ER is the exchange rate per year, TR is reserve of Cambodia, INF is inflation.

To transform the above model to multiple regression form, a new equation can be written as follows:

$$GDP_{it} = \beta_0 + \beta_1 CC_{it} + \beta_2 IR_{it} + \beta_3 ER_{it} + \beta_4 TR_{it} + \beta_5 INF_{it} + \varepsilon_{it} \quad (3)$$

In this equation, μ is error term, β_0 is intercept and β_k is the coefficient of the independent variables from k = 1 to N.

To meet the research objective, a Vector Autoregression (VAR) model is utilized. The VAR model is a statistical model used to capture the linear interdependencies among multiple time series. According to Lutkepohl (2005), the VAR model can be derived as:

$$Y_t = \beta_0 + \beta_1 Y_{t-1} + \beta_2 Y_{t-2} + \ldots + \beta_i Y_{t-i} + \alpha_i X_{t-i} + \varepsilon_t \quad (4)$$

We can rewrite our equations as follows:

$$GDP_t = \beta_0 + \beta_1 GDP_{t-1} + \beta_2 GDP_{t-2} + \ldots + \beta_i GDP_{t-i} + \alpha_i CC_{t-i} + \ldots + \varepsilon_t \quad (5)$$

We then transform this function into a logarithm function as follows:

$$\log GDP_t = \beta_0 + \sum_{i=1}^{n} \beta_{1i} \log GDP_{t-i} + \sum_{i=1}^{n} \alpha_i \, CC_{t-i} + \ldots\ldots + \varepsilon_t \quad (6)$$

The Climate Change (CC) function is as follows:

$$CC_t = \beta_0 + \sum_{i=1}^{n} \beta_{1i} \log GDP_{t-i} + \sum_{i=1}^{n} \alpha_i \, CC_{t-i} + \ldots\ldots + \varepsilon_t \quad (7)$$

The Exchange Rate (ER) function is written as follows:

$$\log ER_t = \beta_0 + \sum_{i=1}^{n} \beta_{1i} \log GDP_{t-i} + \sum_{i=1}^{n} \alpha_i \, CC_{t-i} + \sum_{i=1}^{n} \beta_{3i} \log ER_{t-i} + \ldots\ldots + \varepsilon_t \quad (8)$$

The Interest Rate (IR) function is as follows:

$$IR_t = \beta_0 + \sum_{i=1}^{n} \beta_{1i} \log GDP_{t-i} + \sum_{i=1}^{n} \beta_{4i} \, IR_{t-i} + \ldots\ldots\ldots + \varepsilon_t \quad (9)$$

The Total Reserve (TR) function is written as:

$$\log TR_t = \beta_0 + \sum_{i=1}^{n} \beta_{1i} \log GDP_{t-i} + \sum_{i=1}^{n} \beta_{5i} \, TR_{t-i} + \ldots\ldots\ldots + \varepsilon_t \quad (10)$$

The Inflation Rate function is written as:

$$INF_t = \beta_0 + \sum_{i=1}^{n} \beta_{1i} \log GDP_{t-i} + \sum_{i=1}^{n} \beta_{6i} \, INF_{t-i} + \ldots\ldots\ldots + \varepsilon_t \quad (11)$$

We define variables such as dependent and independent variables and control variables in these functions as follows:

Table 1: Variables measured in the study

Variables	Notation	Variable Description	Measurement	Data Sources
DV	GDP	Gross Domestic Products	Billions of US dollars	IMF
IV	CC	Climate Change	Temperature changes by climatology.	IMF
	IR	Interest Rate	Loan IR percent per Annum	IMF
	ER	Exchange Rate	Exchange Rates, Domestic Currency per U.S. Dollar.	IMF
	TR	Total Reserve	Total Reserve, US Dollars.	IMF
CV	INF	Inflation Rate	Proxied from CPI value	IMF

Note: DV: Dependent Variable, IV: Independent Variable, CV: Control Variable

Table 1 shows the measurements and variable sources used in this model. Most variables are derived from IMF sources and macroeconomic statistics. These variables include Cambodia's GDP (measured in US billion dollars), climatic change, or temperature change as measured by climatology. Additionally, the interest rate is the rate which is loan interest rate percent per annum in Cambodia. The exchange rate is nominated by domestic currency per US dollar. The inflation rate is the rate calculated from the CPI value which is abstracted from the IMF data source.

Stationary Test and Unit Root Test

To identify the stationary test on these variables, we used the Augmented Dickey Fuller (ADF) testing for null hypothesis of unit root occurred in a time series data. The VAR model is very significant in stationary or non-stationary data. This means that ADF tests determine the auto-correlation function (ACF) in our model. Hence, the ADF is functioned as follows:

$$y_i = \beta_{i1} y_{i-1} + \varepsilon_i \quad (12)$$

Or we can rewrite with subtracting y_{i-1} as both sides function as follows

$$y_i - y_{i-1} = \beta_{i1} y_{i-1} - y_{i-1} + \varepsilon_i \quad (13)$$

y_i can be rewritten as

$$\Delta y_i = \gamma y_{i-1} + \varepsilon_i \quad (14)$$

Whereas γ is $\beta_{i1} - 1$

As identified by Dickey and Fuller (1981), null hypothesis H_0: $\gamma = 0$ and alternative H_1: $\gamma \neq 0$.

4. Results

Table 2: Augmented Dickey-Fuller unit root test using the Cambodian data

Variable	MacKinnon P-Value	ADF statistics	Critical Values 1%	5%	10%	Specification	Order of Integration	Remarks
GDP	0.0155	-3.82	-4.38	-3.60	-3.24	Trend	I(0)	Stationary
CC	0.0000	-7.18	-4.38	-3.60	-3.24	Trend	I(0)	Stationary

(To be continued)

Table 2: Augmented Dickey-Fuller unit root test using the Cambodian data (continued)

Variable	MacKinnon P-Value	ADF statistics	Critical Values			Specification	Order of Integration	Remarks
			1%	5%	10%			
RR	0.0000	-5.31	-3.75	-3.00	-2.63	Trend	I(0)	Stationary
ER	0.0011	-3.47	-2.50	-1.71	-1.32	Drift	I(0)	Stationary
TR	0.0030	-3.03	-2.50	-1.71	-1.32	Drift	I(0)	Stationary
Inflation	0.0002	-4.219	-2.50	-1.71	-1.32	Drift	I(0)	Stationary

Source: Authors' calculations using STATA17

The results of the Augmented Dickey Fuller (ADF) unit root test on six macroeconomic variables from Cambodia, including GDP, CC, RR, ER, TR, and inflation, are shown in Table 2. MacKinnon p-values for each variable are less than 0.05, which means that, at the 5% significance level, the null hypothesis of a unit root is rejected. At the 1%, 5%, and 10% levels, each ADF test statistic is more negative than its corresponding critical values, supporting the idea that the series are stationary. Based on these data patterns, some variables (GDP, CC, RR) were tested using a trend specification, while others (ER, TR, and inflation) were tested using a drift specification.

Lag Selection

Table 3: Lag Selection

Selection-Order criteria
Sample: 1996-2022 Number of obs = 27

Lag	LL	LR	df	P	FPE	AIC	HQIC	SBIC
0	-15.9619				0.01755	1.6329	1.65626	1.73208
1	46.6417	125.21*	4	0.000	0.000085	-3.6947	-3.6246*	-3.39714*
2	51.0057	8.728	4	0.068	0.000084*	-3.7277*	-3.61096	-3.23186
3	51.9547	1.898	4	0.755	0.000114	-3.45043	-3.28687	-2.75613
4	54.9869	6.0645	4	0.194	0.000132	-3.36245	-3.15216	-2.46978
5	58.3718	6.7696	4	0.149	0.000153	-3.30652	-3.04951	-2.21548

Source: Author's calculations

Table 3 shows the lag-order selection criteria for the VAR model with 22 observations from 2001 to 2022. A few statistical measures, such as the Log-Likelihood (LL), Likelihood Ratio (LR) test, Final Prediction Error (FPE), Akaike Information Criterion (AIC), Hannan-Quinn

Information Criterion (HQIC), and Schwarz Bayesian Information Criterion (SBIC), are used to report results for lag lengths ranging from 0 to 5. With the highest information criteria values (AIC = 1.6329, HQIC = 1.6526, SBIC = 1.73208) and the largest FPE (0.01755) at Lag 0, the model exhibits poor fit and suggests the need for lagged variables. With significant improvement in the model (LR = 125.21, p = 0.000) at Lag 1, the information criteria values and FPE (0.000085) are sharply reduced. Both HQIC (–3.6246*) and SBIC (–3.397*) reach their minimum, indicating a good fit-parsimony balance. The model exhibits a slight improvement at Lag 2 (LR = 8.728, p = 0.068), with the least conservative criteria showing a slightly better fit as indicated by the lowest values of FPE (0.000084*) and AIC (–3.73*). Lags 3 to 5 do not significantly improve ($p > 0.1$), but information criterion values begin to rise, with the possibility of overfitting present. HQIC and SBIC think Lag 1 is the best choice, according to the results, while AIC and FPE favor Lag 2. When considering the more conservative criteria (HQIC and SBIC) and the small sample size (N = 22), the VAR(1) model is most likely the best specification. ***Descriptive Statistics***

To identify the variables in this research, Table 4 illustrates the descriptive statistics as follows.

Table 4: Descriptive Statistics

Variable	Obs	Mean	Std. Dev.	Min	Max	Variance	Skewness	Kurtosis
GDP*	27	10.991	0.5997	9.994	11.824	0.3597	-0.2005	1.7478
Climate Change	27	0.81511	0.3682	0.296	1.552	0.1355	0.49759	2.2107
Interest Rate	27	14.679	3.031	10.257	18.8	9.1873	-0.249	1.494
Exchange Rate*	27	0.00025	0.000031	0.00024	0.00038	9.60E+01	3.2138	12.292
Total Reserve*	27	21.7426	1.379	19.398	23.783	1.9019	-0.0616	1.7886
Inflation*	27	4.7900	0.3472	4.1847	197.995	0.1205	-0.1702	1.5076

*Logarithms variables. Inflation is the rate of average consumer price index.
Source: Authors' calculation using STATA17

Table 5 suggests that most variables are not highly correlated. This means that there are no serial correlations among the variables in this research. As seen in Table 5, climate change (CC) and interest rate (IR) are negatively corelated with GDP growth by 0.172 units. This suggests that the more climate change, the more decline in the economic growth. While exchange rates (ER) are positively correlated with economic growth. This means that increase in exchange rates is positively related to economic growth. The results also show

that inflation is negatively correlated with economic growth. This aligns with the theory of macroeconomic growth and inflation.

Table 5: Correlation and Multicollinearity Analysis among the Variables

Variable	dlogGDP	dlogCC	dlogRR	dlogER	dlogTR_USD	dlogInflation
dlogGDP*	1					
dlogCC*	-0.1724	1				
dlogIR*	-0.0371	-0.0601	1			
dlogER*	0.2241	-0.4147	-0.0802	1		
dlogTR_USD*	0.1217	0.2744	-0.1851	-0.2806	1	
dlogInflation*	-0.0264	0.0426	0.0065	-0.3711	1.1519	1

*dlogarithm is the differentiate logarithm variable.

Source: Author's calculation

Regression Analysis

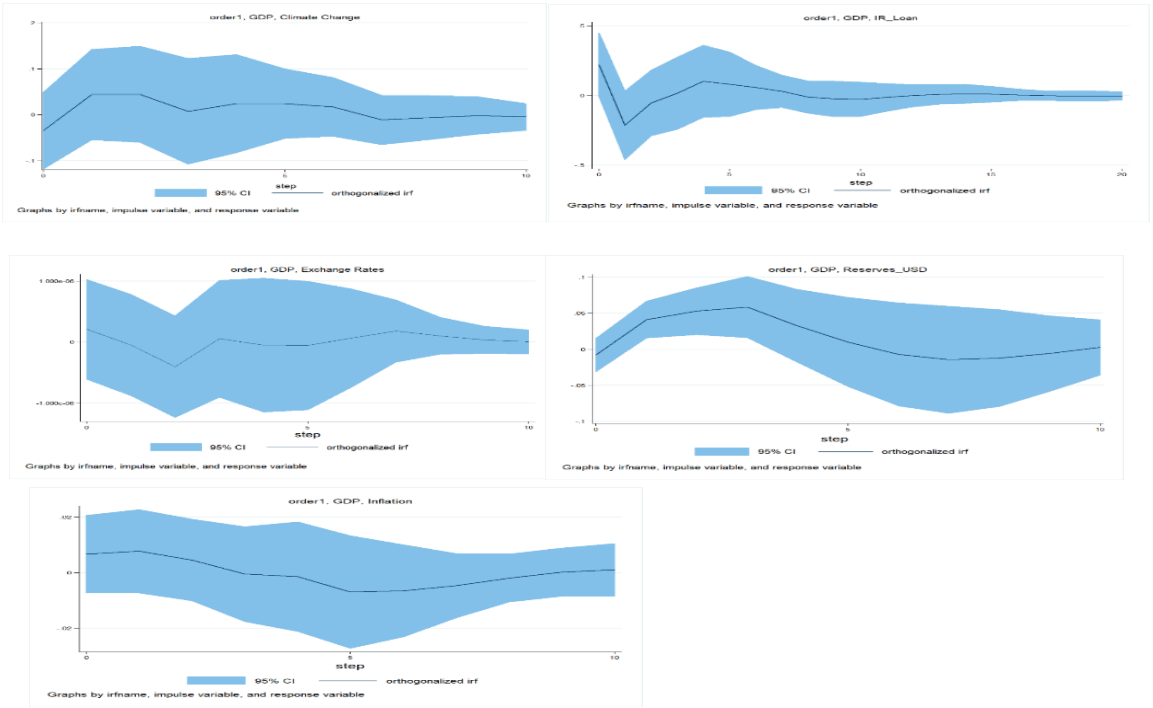
IRF Function

After running the VAR model, there are five main illustrations discussed below while other regression findings are in Annex 1. The initial impact of climate change on GDP is near zero, but it quickly rises to a positive peak around Step 3. This suggests that an unexpected improvement in climate conditions or mitigation of climate risks stimulates GDP growth in the near future. After peaking, the effect fluctuates, becoming slightly negative around Step 6 and returning to zero by Steps 9-10. This suggests that the positive effect is transient and fades over time. The second illustration shows the GDP response to IR_Loan.

A sharply negative response at Step 0 indicates that an increase in loan interest rates immediately reduces GDP. This is consistent with standard macroeconomic theory, which suggests that higher borrowing costs discourage investment and consumption. For medium-term recovery, the negative impact decreases around Steps 4-5 and approaches zero by Step 10, indicating that GDP adjusts to shocks and stabilizes in the long run. Early estimates are precise (within a narrow confidence interval), but uncertainty gradually increases after Step 7. The GDP's response to Exchange Rate changes shows that very slight variations in the first few steps (range of ±1e-06) and a response that hovers around zero, the initial impact is modest. In medium-term changes, the magnitude is consistently small, despite the response fluctuating between positive and negative,

suggesting that exchange rate shocks have little to no effect on GDP in this model. These estimates appear to be highly uncertain and unreliable, as indicated by the wide confidence bands relative to the small response size.

Figure 5: Impulse Response Function and Its Regressions



Note: Inflation is proxied from CPI data

Source: Authors' illustration from the VAR regression

Discussion of the findings

As GDP reacts to foreign exchange reserves in US dollars, the first few steps show a positive response, which peaks at about Step 2, indicating that increased reserves first increase GDP by bolstering stability and economic confidence. With the medium period: by Step 10, the positive effect has stabilized close to zero after decreasing and turning negative around Step 6. This concludes that reserve accumulation has a temporary effect. This finding is broadly consistent with the findings of Aizenman and Lee (2007), claiming that international reserves serve as a buffer against external shocks, enhancing confidence in investors. However, studies by Ghosh et al. (2017) and Rodrik (2006) show that accumulating national reserves has opportunity costs, particularly from sterilization interventions, with low-return overseas assets, and incorrect allocation of resources. These costs may overshadow the initial benefits,

especially if reserves exceed those needed for preventive measures. After Step 6 in the above illustration, estimates exhibit growing uncertainty, although they are initially fairly accurate.

5. Conclusion and Implications

This study shows a complex but meaningful relationship between climate change, monetary policy, and GDP growth in Cambodia using IMF data from 1996 to 2022. Climate change appears to boost GDP in the very short term, suggesting that early adaptation efforts may temporarily support economic activity. However, this effect fades over time, highlighting how repeated or severe climate shocks undermine resilience in an economy that relies heavily on agriculture.

The results show that GDP responds positively to climate shocks up to Stage 3, then declines by Stage 10, reflecting the short-lived nature of these gains. This pattern underscores how long-term exposure to floods, droughts, and other climatic events weakens the agricultural sector, which is a major contributor to GDP (UNDP, 2023). These findings are consistent with previous studies showing that rural economies often face long-term losses that outweigh any immediate benefits of climatic variation (Asif et al., 2017).

Monetary policy has helped stabilize Cambodia's economy through a managed-float exchange rate and active central bank interventions. These measures have supported investment and growth, but their effectiveness is limited by the country's high level of dollarization. With reduced control over interest rates and the money supply, the Central Bank has less capacity to cushion climate-related shocks. Greater use of the Riel would expand policy flexibility, increase seigniorage, and create more space to support climate adaptation efforts.

In sum, climate adaptation in Cambodia cannot rely on monetary policy alone. Structural transformations, especially in agriculture and financial architecture, are essential. Policies that promote Riel usage, strengthen climate-resilient infrastructure (such as irrigation), and build institutional capacity will be key to converting short-term climate responses into long-term resilience.

REFERENCES

Akinwale, S. (2018). Bank lending rate and economic growth: Evidence from Nigeria. *International Journal of Academic Research in Economics and Management Sciences, 7*(3), 111-122.

Amaly, M. H., Hirzi, R. H., & Basirun, B. (2022).Comparison of the ANN backpropagation and ARMA methods for inflation forecasting in Indonesia. *Jambura Journal of Probability and Statistics, 3*(2), 61-70.

Alazaki, Z., & Okumuş, N. (2024). Monetary Policy and Interest Rates. *A General Overview of the Syrian Economy,* 1.

Aizenman, J., & Lee, J. (2007). International reserves: precautionary versus mercantilist views, theory and evidence. *Open Economies Review, 18*(2), 191-214.

Asif, F., Marschke, M., & Ngin, C. (2017). Assessing the potential of a low-carbon future for Cambodia. *Journal of Renewable and Sustainable Energy*, *9*(2), 021404.

Auerbach, A. J., Gorodnichenko, Y., & Murphy, D. (2020, May). Effects of fiscal policy on credit markets. In *AEA Papers and Proceedings* (Vol. 110, pp. 119-124). 2014 Broadway, Suite 305, Nashville, TN 37203: American Economic Association.

Baksa, D., Bulíř, A., & Heng, D. (2020). *A simple macrofiscal model for policy analysis: An application to Cambodia* (IMF Working Paper No. WP/20/202). International Monetary Fund. https://doi.org/10.5089/9781513556857.001

Chanthol, H. (2021). Money demand and inflation in a highly dollarized economy: Fighting inflation in Cambodia (MPRA Paper No. 109805). Munich Personal RePEc Archive. https://mpra.ub.uni-muenchen.de/109805

Chinhema, S. (2020). The Relationship between Change Management and Organizational Effectiveness in the Zimbabwean Banking Industry. *The International Journal of Business& Management: International Journal of Innovative Research & Development (GlobeEdu), 8*(4).

Daoui, M. (2023). *Monetary Policy and Economic Growth in Developing Countries: A Literature Review*. arXiv preprint arXiv:2303.03162.

De Grauwe, P., & Ji, Y. (2024). How to conduct monetary policies. The ECB in the past, present and future. *Journal of International Money and Finance*, 143, 103048. https://doi.org/10.1016/j.jimonfin.2024.103048

Ghosh, A., & Phillips, S. (1998). Warning: Inflation may be harmful to your growth. *Staff Papers*, *45*(4), 672-710.

Ghosh, A. R., Ostry, J. D., & Tsangarides, C. G. (2017). Shifting motives: Explaining the buildup in official reserves in emerging markets since the 1980s. *IMF Economic Review*, *65*(2), 308-364.

Green, W. H. (2003). Econometric analysis, 5th ed. *Upper Saddle River. NJ: Prentice Hall*.

Ha, D. T.-T., & Hoang, N. T. (2020). Exchange rate regime and economic growth in Asia: Convergence or divergence. *Journal of Risk and Financial Management*, *13*(1), 9.

Hameed, I. (2010). Impact of monetary policy on gross domestic products (GDP). *Interdisciplinary journal of contemporary research in business*, *3*(1), 1348-1361.

Hiep Hoang, H., & Minh Huynh, C. (2021). Climate change, economic growth and growth determinants: Insights from Vietnam's coastal south central region. *Journal of Asian and African Studies*, *56*(3), 693-704.

Hamilton, J. D. (2020). *Time series analysis*. Princeton university press.

Hill, H., & Menon, J. (2014). *Trade policy challenges in a small, open, fragile, postconflict economy: Cambodia* (Working Paper No. 141). Asian Development Bank. https://www.adb.org/sites/default/files/publication/111031/reiwp-141-trade-policy-challenges-cambodia.pdf.

Hor, C. (2021). Assessing the dynamic tourism inter-industry linkages and economic structural changes in Cambodia's economy. *Journal of Economic Structures*, *10*(1), 18.

Idan, A. M., & Badan, Z. Q. (2022). The influence of monetary policy on the economic growth in European Union countries. *Cuadernos de Economía*, *45*(127), 156-162.

Joyeux, R., & Worner, W. E. (1998). Price and exchange rate determination between the Mekong river economies of Cambodia and Thailand. *Journal of the Asia Pacific Economy, 3*(3), 424-445.

Kang, K. (2005). Is dollarization good for Cambodia? *Global Economic Review, 34*(2), 201-211.

Lay, S. H. (2020). Bank credit and economic growth: Short-run evidence from a dynamic threshold panel model. *Economics Letters, 192*, 109231.

Lut, M., & Moolio, P. (2015). The impact of monetary policy on economic growth in Cambodia. *Journal of Management for Global Sustainable Development, 1*(1), 40-63.

Nga, N. (2021). Monetary policy, exchange rate, renewable energy and economic growth: An empirical analysis of Vietnam. *Accounting, 7*(6), 1315-1324.

Nguyen, N. T. K., & Le, M. B. (2018). CO2 emissions and economic growth in Vietnam: An ARDL bound testing approach. *Asian Journal of Economic Modelling, 6*(1), 47-55.

National Bank of Cambodia. (2023). Annual report 2023. https://www.nbc.gov.kh/download_files/publication/annual_rep_eng/NBC%20Annual%20Report%202023%20Eng.pdf

Phon, S. (2015). Dollarization and Dedollarization: The Typical Dilemma of Economy in Cambodia. *Available at SSRN 3119078*.

Precious, C., & Palesa, M.-K. (2014). Impact of monetary policy on economic growth: A case study of South Africa. *Mediterranean journal of social sciences, 5*(15), 76-84.

Rodrik, D. (2006). The social cost of foreign exchange reserves. *International economic journal, 20*(3), 253-266.

Samreth, S. (2010). Currency substitution and seigniorage-maximizing inflation: the case of Cambodia. *Applied Economics, 42*(15), 1907-1916.

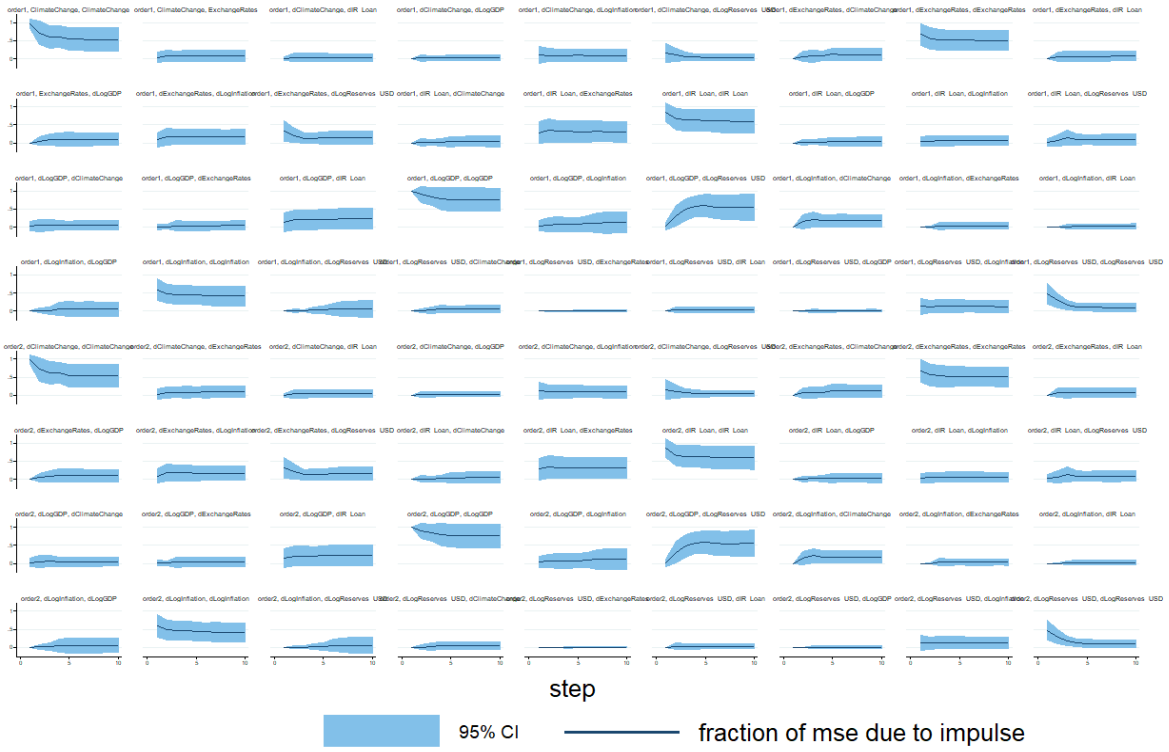
United Nations Development Programme. (2023, January 1). *Cambodia – South-Eastern Asia*. https://www.adaptation-undp.org/explore/south-eastern-asia/cambodia

Warsame, A. A., Sheik-Ali, I. A., Hussein, H. A., & Barre, G. M. (2023). Assessing the long- and short-run effects of climate change and institutional quality on economic growth in Somalia. *Environmental Research Communications*, *5*(5), 055010.

Yangka, D., Rauland, V., & Newman, P. (2023). Carbon neutral Bhutan: sustaining carbon neutral status under growth pressures. *Sustainable Earth Reviews*, *6*(1), 2-16.

Appendix

Illustration 1: Response shock functions

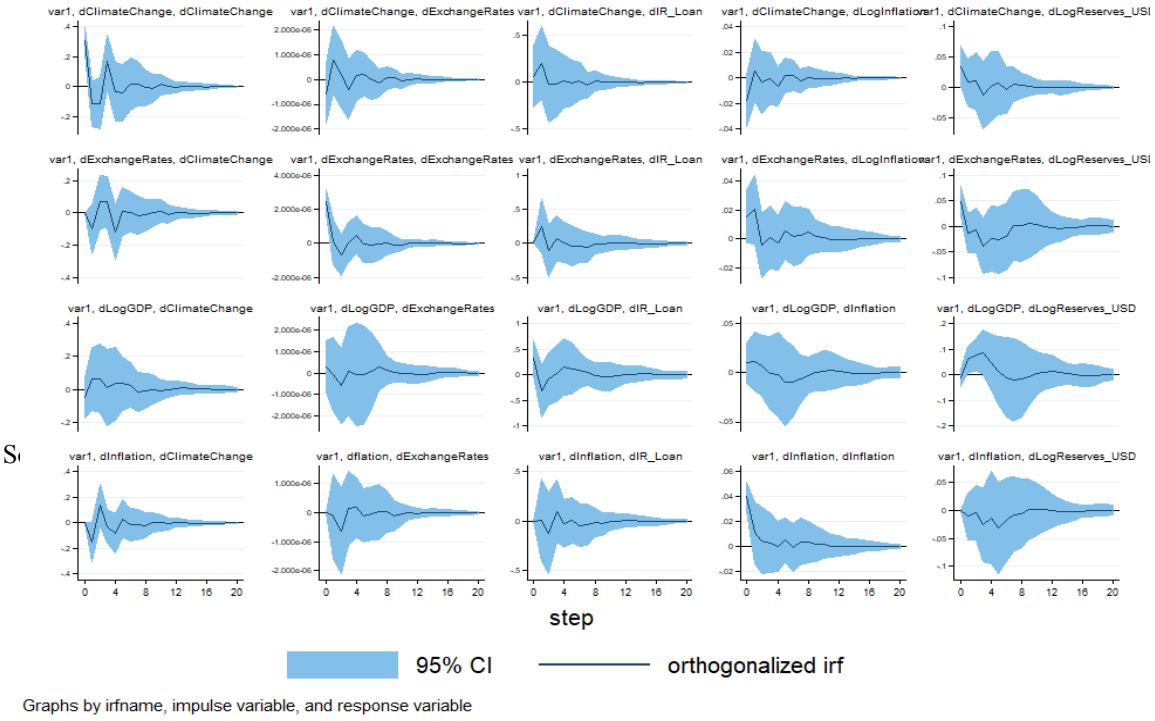


Source: Author's calculations by IMF data source from STATA 17

Illustration 2: Response shock functions

step	(1) oirf	(1) Lower	(1) Upper	(2) oirf	(2) Lower	(2) Upper
0	-.034347	-.117641	.048947	-.034347	-.117641	.048947
1	.043823	-.054662	.142307	.043823	-.054662	.142307
2	.044731	-.059842	.149304	.044731	-.059842	.149304
3	.007728	-.107262	.122717	.007728	-.107262	.122717
4	.024366	-.082394	.131127	.024366	-.082394	.131127
5	.024359	-.051079	.099798	.024359	-.051079	.099798
6	.017195	-.046424	.080813	.017195	-.046424	.080813
7	-.011032	-.06494	.042875	-.011032	-.06494	.042875
8	-.006035	-.054089	.042018	-.006035	-.054089	.042018
9	-.001577	-.042412	.039259	-.001577	-.042412	.039259
10	-.004525	-.033679	.024628	-.004525	-.033679	.024628

95% lower and upper bounds reported
(1) irfname = order1, impulse = dLogGDP, and response = dClimateChange
(2) irfname = order2, impulse = dLogGDP, and response = dClimateChange



Graphs by irfname, impulse variable, and response variable

Authors' Biography

Phon Sophat earned his first PhD in Economics in 2019 from Thammasat University, Thailand with BOT/ADB scholarship. Currently, he is a second PhD candidate in International Development at Nagoya University, Japan, with a Nagoya University Scholarship from 2023 to 2026. He has participated in many national and international

conferences and has been a speaker at many well-known institutions such as UNESCAP, NBC, Sophia University in Japan, and Konrad International in Germany, among others. Dr. Phon's filed of research includes microfinance sector, econometrics, business and macroeconomics. His focus is econometric applied on the modelling of economic trends on the macro levels. Currently, He has authored more than 20 research papers and books. He is professor at National University of Myanmar, Global campus, Royal Academy of Cambodia, Cambodia, Human Resource University and RULE-Lumiere Lyon2 University, France, for undergraduate and graduate levels. He has been teaching at higher educational levels for nearly 20 years in the relevant fields.

Ngin Pidor works as deputy director of Institute for Banking Studies, Cambodia and a lecturer in the Faculty of Information Technology at NUM, has a rich academic background and professional experience. He is PhD candidate at National University of Management, Cambodia and his master's degree in business information technology from RMIT University Australia in 2016. He also graduated from the Royal University of Phnom Penh with master's and bachelor's degrees in 2008 and 2003. He is also a Deputy director of the Information Technology department, with 15 years of experience in the IT banking sector, IT project management, Blockchain and FinTech.

Chou Sophalla works at the National Bank of Cambodia. He holds an MBA in Accounting and Management Systems from Yokohama National University, Japan, and a BBA in Management from the National University of Management, Cambodia. Over more than 20 years he has focused on banking supervision, deposit protection, and bank resolution, contributing research on financial regulation, risk management, and monetary policy. Alongside his work at the central bank, he has taught courses in banking, finance, accounting, public finance, and risk management at several Cambodian universities.

Sophy Khan is PhD candidate at Royal Academy of Cambodia with cooperated with a Korean University. She graduated with a master's degree in private law from the Royal University of Law and Economics, Cambodia, from 2011 to 2013. Furthermore, she has participated in many local and international conferences in Thailand, Malaysia, Indonesia and Europe. Her main focus is on monitoring and evaluation (M&E) of business and project implementation. And she was also granted the Excellent Women Leadership Award from Marissa Wesely, USA in cooperated with Harpswell Foundation, USA, in 2019.

Authorship Disclaimer

The authors are solely responsible for the content of this article. The views expressed herein are those of the authors and do not necessarily reflect the views of the journal, its editors, or the publisher.