

# Dynamic Relationship Between External Debt, Inflation, and Exchange Rate in Lao PDR

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## Abstract

This study investigates the dynamic relationship between external debt, inflation rate, and the exchange rate of the Lao Kip (LAK) against the US dollar over the period of 2000 to 2021. Utilizing time series data and the Autoregressive Distributed Lag (ARDL) Model, we analyze the impacts of these economic variables in both the short and long run. Our estimation results reveal a significant long-term positive relationship between external debt and the inflation rate with the exchange rate. Inflation rate and external debt have a significantly positive impact on exchange rate in the long run, while short-term analysis indicate a negative relationship between external debt and the inflation rate with the exchange rate. economic shocks or short-term fluctuations may disrupt the exchange rate, the system has a strong tendency to return to its long-term equilibrium point at a brisk pace. The policy implications are discussed. Therefore, policymakers must maintain a stable and controlled inflation environment. Inflation targeting and other monetary policy measures can be utilized to ensure that inflation remains within a manageable range. Keeping inflation under control can help stabilize the exchange rate and safeguard the country's economic stability.

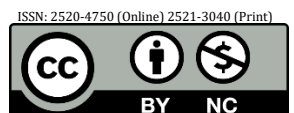


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## 1. Introduction

Exchange rate stability plays a pivotal role in fostering investment and facilitating trade, which are essential for economic development (Smith, 2020). In the case of the Lao PDR, recent economic challenges characterized by currency devaluation, high inflation, and their consequent impact on poverty and debt burdens underline the critical importance of maintaining a stable exchange rate (Jones & Wang, 2023). The consequences of Kip devaluation and inflation have led to an increased poverty rate and a growing debt repayment burden (Chen et al., 2021). Moreover, these economic challenges hinder the achievement of Sustainable Development Goals (SDGs) and escaping the Least Developed Countries (LDCs) status, which are key national objectives (Johnson, 2019). To address these economic and financial challenges, Lao PDR's National Development Agenda prioritizes the pursuit of a stable exchange rate, inflation control, and the avoidance of debt crises (Lao PDR Ministry of Finance, 2022). Notably, in June 2022, the Bank of Lao PDR issued savings bonds valued at 5 trillion kip with a six-month maturity and a 20 percent annual interest rate to alleviate the pressures arising from devaluation (Bank of Lao PDR, 2022). Furthermore, the central bank has implemented measures to tighten exchange regulations, limit daily foreign exchange transactions, and prioritize importers of essential products like petroleum (Bank of Lao PDR, 2022). This approach aims to curb exchange rate fluctuations and enhance stability. Additionally, the authorities have taken action against unlicensed and non-compliant exchange bureaus (Lao PDR Ministry of Finance, 2022). To provide further flexibility in managing exchange rates, the Bank of Lao PDR has increased the range within which commercial bank rates can deviate from the daily reference rate, allowing for more exchange rate flexibility (Bank of Lao PDR, 2022).

International practices demonstrate that most countries have made efforts to control exchange rate volatility at the optimal point to maintain the stability of their domestic currencies (Smith, 2018). Excessive exchange rate fluctuations can result from unexpected monetary shocks, making it costly and often futile for monetary authorities to manage the exchange rate, especially during speculative attacks on the currency (Johnson & Lee, 2020). In this context, policymakers strive for economic growth and price stability since exchange rate fluctuations are closely linked to price changes in the economic system (Brown & Nguyen, 2019). Therefore, it is crucial to promote price stability, investment, and economic growth in countries. However, the Lao government deploys various monetary policy instruments that not only stabilize the price level but also maintain the value of the national currency in Lao PDR (Lao PDR Ministry of Finance, 2021).

There are many factors affecting the depreciation of the Lao Kip currency. Among these, limited foreign exchange liquidity, a strong U.S. dollar, and small foreign reserves have contributed to the first devaluation (Chen et al., 2017). In addition, rising oil prices, the devaluation of the Lao kip, and rising foreign debt become a major cause of currency depreciation (Wang & Li, 2020). This consistency with empirical research that often identifies external debt as the primary cause of domestic currency devaluation in developing countries underscores the importance of effective debt management. The study also highlights the impact of external factors, such as the pandemic and the Russia-Ukraine war, on oil prices, which, in turn, directly affect exchange rates (Gupta et al., 2021). Notably, Lao PDR's foreign debt has been steadily increasing since the 1998-1999 economic crisis, as the government borrowed from international organizations, partner countries, and issued government bonds in countries like Thailand (Lao PDR Ministry of Finance, 2021). By 2018, foreign debt accounted for 54.3% of GDP, and by the end of 2021, government foreign debt constituted 53.81% of GDP (World Bank, 2021). Such increases in external debt, both in the form of loans and bonds, have had a direct and indirect effect on

exchange rate fluctuations, requiring the government's focused attention and prioritization for resolution. Moreover, inflation is identified as a significant factor affecting exchange rate fluctuations, which is observed in the period of the COVID-19 outbreak, trade tensions, and natural disasters (IMF, 2021). In 2022, inflation rates saw rapid growth from 6.3% in January to 38.46% in November, with an average increase of 20%, marking the highest inflation rate in more than two decades, and this significant inflationary pressure coincided with rapid exchange rate fluctuations.

Lao PDR, as a developing country, faces challenges in managing its economy. It operates as an importing country with a reliance on multiple currencies, and this dependence on various currencies can significantly impact the country's economy (Asian Development Bank, 2020). Failure to manage exchange rates effectively can lead to inflation, negatively affecting socio-economic development, as witnessed during the 1998-1999 period (Wang & Li, 2020). In response, Lao PDR has prioritized maintaining a stable national currency, fostering conditions for smooth and steady economic and social development. The Bank of Lao PDR has adopted a floating exchange rate system under government management to achieve this objective. To maintain the stability of the national currency, the bank has set targets for exchange rate appreciation or depreciation, limiting these rates to 5% per year (Lao PDR Ministry of Finance, 2021). This approach aims to build public confidence in the national currency (the LAK), curb inflation, and protect economic development.

The study is particularly pertinent as it delves into the current issues of exchange rate volatility, inflation, and external debt management, which continue to affect the Lao economy. Despite measures to manage exchange rates, such as widening the fluctuation framework for commercial banks and exchange shops, challenges persist (World Bank, 2021). The hyperinflation witnessed from 2019 to 2022, coupled with an increase in external debt, calls for comprehensive analysis and solutions. The study's significance arises from the need to address the challenges associated with exchange rate volatility and its repercussions on the economy, particularly in the context of Lao PDR. The study's primary objective is to capture the causes of exchange rate fluctuations in Lao PDR, with a specific focus on the associations between exchange rate variations, changes in external debt, and inflation rates. Understanding the links between these economic variables is vital to implement effective policy measures aimed at achieving stability in exchange rates, inflation, and overall economic growth, and contributes to a better understanding of economic dynamics in the region.

## **2. Literature review**

This study builds upon and complements existing research on the complex relationships between exchange rates, inflation, and external debt. The review of literature reveals a range of findings and perspectives that have informed the current investigation. The following key insights from both domestic and foreign studies have guided the research: Inflation and Exchange Rates: Choudri and Hakura (2001) demonstrated the pass-through effect of exchange rates on domestic price, indicating that higher inflation leads to higher pass-through effects. This view is in line with the research of Taylor (2000). Edwards (2006) found that countries with inflation targeting suffered diminishing pass-through effects of exchange rate volatility to the growth of sumer price index. Regarding to inflation rate, Chhibber et al. (1989), Makochekamwa (2007), and M.O. Odedokun (1995) have examined the determinants of inflation. They identified factors such as money supply growth, currency depreciation and inflation expectations have a positive impact on inflation, while per capita food production and overall economic growth tend to reduce CPI growth. B Imimole and A Enoma (2011) explored how depreciation of exhchange rate affects inflation in Nigeria and concluded that Naira

currency devaluation significantly affect long-term impact on inflation. Madura (2000) suggested that inflation differentials can be utilized for predicting exchange rate volatility in the long run.

Inflation Factors Affecting Exchange Rates: Studies by Thanitset (2013) and Niphaphon (2011) examined how inflation affects exchange rates in Thailand. Their results showed a positive relationship between inflation rates and exchange rates. However, Amphin Khomsukvongsan (2017) found that inflation or consumer price index had a negative impact on the LAK/US dollar exchange rate in Laos.

Exchange rate and inflation volatilities: Albuquerque and Portugal (2005) examined the relationship between exchange rate and inflation volatilities and found a relationship between exchange rate and inflation fluctuations. Berument (2002) observed the impact of exchange rates on inflation and emphasized their influence on inflation rates, particularly on the producer price index. Bayraktar and Arslan (2003) conducted research on the relationship between exchange rates, inflation and imports and found a cointegration and long-run relationship between these variables. Gl and Ekinici (2006) found a long-run relationship between nominal exchange rates and inflation and identified a causal relationship between nominal exchange rates and inflation.

Foreign debt and exchange rates: The results of BS Nazamuddin et al., Masuku (2012), Draz and Ahmad (2015), Kouladoum and Jean-Claude (2018), Cahyadin and Ratwianingsih (2020) and Afsaneh Zareei (2022) all point to one positive correlation between foreign debt and exchange rate. In contrast, Odera (2015) examined the impact of government external debt on real exchange rate volatility (REER) in a fully floating exchange rate system and found that external debt had a negative impact on the real exchange rate. This literature review highlights the diverse insights and viewpoints in the area of exchange rate dynamics, inflation and external debt. The different results underscore the need for context-specific analyzes and highlight the importance of this study in its contribution to understanding the unique economic dynamics of the Lao People's Republic. By combining the insights from previous research with the results of this study, a more comprehensive and context-specific understanding of the interplay of these economic variables can be achieved, leading to more informed policy recommendations and strategic economic decisions

### **3. Materials and Methods**

This study uses a two-fold methodological approach: a descriptive analysis and a quantitative analysis, which provides a comprehensive understanding of the fluctuations of the Lao Kip exchange rate (LAK) against the US dollar, external debt and the associated fluctuations in inflation rates over different time periods offers. Each method serves a specific purpose and complements the research objectives.

#### **3.1 Descriptive analysis**

The descriptive analysis method explains the dynamics of the LAK exchange rate against the US dollar and external debt over time, coupled with the changing patterns of inflation rates. This narrative uses graphical representations to effectively illustrate these relationships. The descriptive analysis is an essential basis for the subsequent quantitative studies.

#### **3.2 Quantitative Analysis:**

Quantitative analysis occurs through a structured sequence of statistical tests and model estimations. The methodology includes.

### 3.2.1 The ARDL Model specification of the study

**Model Selection:** The model chosen for this research is based on the frameworks proposed by Odera (2015), Cahyadin (2020), Thanitset (2013), Albuquerque and Portugal (2005) and Berument (2002). These models have been used as a theoretical basis for the development of the research model, offering a structured and informed approach to analyzing the relationships between exchange rates, external debt, and inflation.

The subsequent sections of this research paper will provide detailed explanations of the research methodology, testing processes, and model application. Through these comprehensive analytical methods, the study aims to offer insights into the perplexed relationships among these economic variables and their impact on the Lao PDR's economic landscape.

**Theoretical Model:** We ponder three variables, where the exchange rate is the function of external debt and inflation rate.

$$\text{Model 1: } \text{EXC}_t = F(\text{EXD}_t, \text{INF}_t) \quad (1)$$

Mathematically, the model can be expressed as a logarithmic approach for analyzing elasticities:

$$\text{Model 2: } \text{LNEXC}_t = \beta_0 + \beta_1 \text{LNEXD}_t + \beta_2 \text{LNINF}_t + \varepsilon_t \quad (2)$$

**Theoretical Model:** We ponder three variables, where the external debt is the function of exchange rate and inflation rate.

$$\text{Model 3: } \text{EXD}_t = F(\text{EXC}_t, \text{INF}_t) \quad (3)$$

Mathematically, the model can be expressed as a logarithmic approach for analyzing elasticities:

$$\text{Model 4: } \text{LNEXD}_t = \beta_0 + \beta_1 \text{LNEXC}_t + \beta_2 \text{LNINF}_t + \varepsilon_t \quad (4)$$

**Theoretical Model:** We ponder three variables, where the inflation rate is the function of external debt and exchange rate.

$$\text{Model 5: } \text{INF}_t = F(\text{EXC}_t, \text{EXD}_t) \quad (5)$$

Mathematically, the model can be expressed as a logarithmic approach for analyzing elasticities:

$$\text{Model 6: } \text{LNINF}_t = \beta_0 + \beta_1 \text{LNEXC}_t + \beta_2 \text{LNECD}_t + \varepsilon_t \quad (6)$$

Where:

- LNEXC<sub>t</sub> represents the log of the exchange rate at time t.
- LNEXD<sub>t</sub> represents the log of external debt at time t.
- LNINF<sub>t</sub> represents the log of inflation at time t.
- ε<sub>t</sub> denotes the error term.

### 3.2.2 Data and Methodology

#### Data Sources and Timeframe

For this study, we gathered annual data from 2000 to 2021, sourced from the World Development Indicators (WDI) database, constituting a sample of 21 observations. To enhance the quality of our analysis and address data characteristics, we applied various transformations to the variables. The purpose of these transformations was twofold: to reduce data variance and to mitigate skewness in the data distribution. By doing so, the coefficients in the model become interpretable as elasticities.

**Variables**

Table 1 outlines the variables utilized in this study, each of which plays a crucial role in comprehending and quantifying the economic dynamics within the Lao People's Democratic Republic (Lao PDR). The employment of the World Development Indicator dataset contributes to the precision and practical relevance of the empirical findings obtained in this analysis.

**Table 1** presents the variables used in this study

Variables	Description	Source
EXD	External debt stocks, total (current US\$)	WDI
INF	Inflation, consumer prices (annual %)	WDI
EXR	Official exchange rate (LCU per US\$, period average)	WDI

Source: World Development Index, 2022

**Estimation and Analysis**

To make the estimates and derive meaningful relationships between the variables, we used EViews as the primary analysis tool. The aim of our research was to examine both the long-term and short-term relationships between the variables of interest.

**Stationarity Testing:**

To ensure that the time series variables exhibit stationarity, we will execute the Augmented Dickey-Fuller test, as proposed by Dickey and Fuller in 1979, to conduct unit root analysis.

**ARDL model generation:**

To identify cointegration among the variables, signifying the existence of long-run relationships, we employed ARDL Bound Test. This method is instrumental in revealing whether the selected economic indicators are interrelated over an extended timeframe. Pesaran et al. (2001) introduced the Autoregressive Distributed Lag (ARDL) bound test method. When all the chosen variables exhibit stationarity at different orders, namely I(0) and I(1), the ARDL approach can be employed. In contrast, the cointegration test proposed by Johansen (1990) and Johansen and Juselius (1990) is widely recognized for assessing the presence of a long-term relationship, but it necessitates that all selected variables be stationary at I(1). The ARDL bound test, however, overcomes this requirement. We are suggesting the following ARDL model to analyze:

$$\text{Model 7: } \Delta \text{LnEXC}_t = \alpha + \sum_{i=1}^p \beta_i \Delta \text{LnEXD}_{t-i} + \sum_{j=0}^q \beta_j \Delta \text{LnINF}_{t-j} + \delta_1 \text{LnEXD}_{t-1} + \delta_2 \text{LnINF}_{t-1} + \mu_t \tag{7}$$

$$\text{Model 8: } \Delta \text{LnEXD}_t = \alpha + \sum_{i=1}^p \beta_i \Delta \text{LnEXC}_{t-i} + \sum_{j=0}^q \beta_j \Delta \text{LnINF}_{t-j} + \delta_1 \text{LnEXC}_{t-1} + \delta_2 \text{LnINF}_{t-1} + \mu_t \tag{8}$$

$$\text{Model 9: } \Delta \text{LnINF}_t = \alpha + \sum_{i=1}^p \beta_i \Delta \text{LnEXC}_{t-i} + \sum_{j=0}^q \beta_j \Delta \text{LnEXD}_{t-j} + \delta_1 \text{LnEXC}_{t-1} + \delta_2 \text{LnEXD}_{t-1} + \mu_t \tag{9}$$

In these models (7),(8) and (9), whereas LnEXC, LnEXD and LnINF, represent yearly exchange rate in Laos (LAK/USD), yearly external debt and yearly inflation represents consumer price index used as proxy for inflation and, 't' represents time trend, Δ indicates the first difference operator, p and q represents the optimal number of delays, β<sub>i</sub> to β<sub>j</sub> correspond to the short-term coefficients, and δ<sub>1</sub> to δ<sub>2</sub> represent the long-term coefficients, the error term μ<sub>t</sub> is characterized as a sign disturbing white. To check for the existence of a long-term relationship, we used the F statistic in the bound test. The null hypothesis posits that there is no cohesion between the variables. We will reject this null hypothesis if the F statistic exceeds the upper bound. This indicates that there is long-term cointegration between the variables.

### Error Correction Model (ECM):

In addition to cointegration analysis, the study incorporated an Error Correction Model (ECM). The ECM helped us assess short-term effects and balance adjustments. This model is crucial for understanding how economic variables respond to deviations from their long-term equilibrium relationships.

$$\text{Model 10: } \Delta \ln \text{EXC}_t = \alpha + \sum_{i=1}^p \beta_i \Delta \ln \text{EXD}_{t-i} + \sum_{j=1}^q \beta_j \Delta \ln \text{INF}_{t-j} + \theta \text{ECT}_{t-1} + \mu_t \quad (10)$$

$$\text{Model 11: } \Delta \ln \text{EXD}_t = \alpha + \sum_{i=1}^p \beta_i \Delta \ln \text{EXC}_{t-i} + \sum_{j=1}^q \beta_j \Delta \ln \text{INF}_{t-j} + \theta \text{ECT}_{t-1} + \mu_t \quad (11)$$

$$\text{Model 12: } \Delta \ln \text{INF}_t = \alpha + \sum_{i=1}^p \beta_i \Delta \ln \text{EXC}_{t-i} + \sum_{j=1}^q \beta_j \Delta \ln \text{EXD}_{t-j} + \theta \text{ECT}_{t-1} + \mu_t \quad (12)$$

Within equation (10), (11) and (12),  $\theta$  acts as a proxy for the adjustment rate. It represents the speed with which long-term deviations from the previous year are corrected in the current year in response to short-term changes. It is expected that the error correction specification (ECT) will show a negative sign and a p-value lower than 5%, confirming statistical significance.

### Model Stability Assessment:

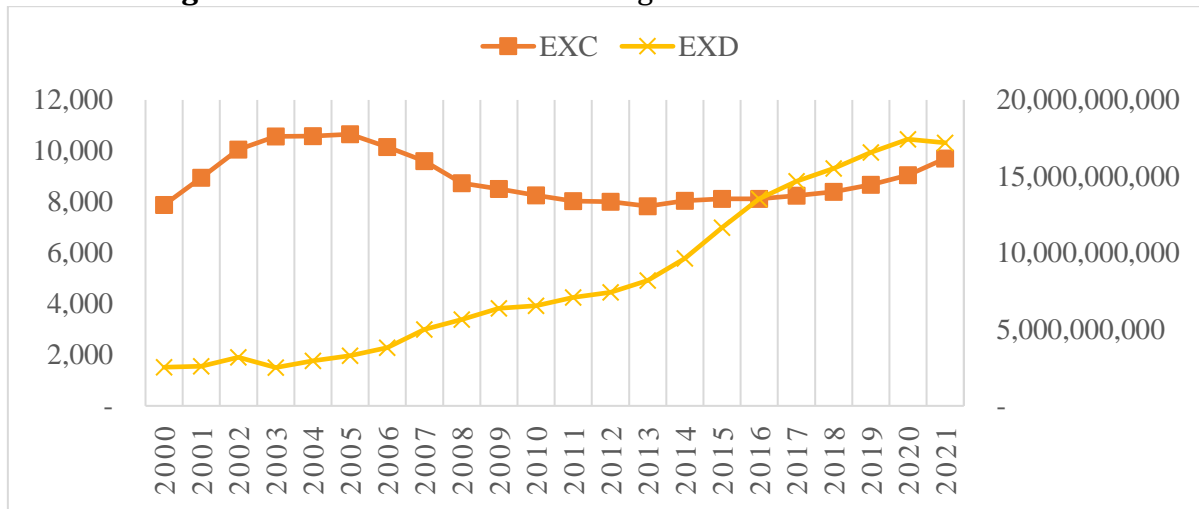
To ensure the stability of the models utilized, CUSUM and CUSUMQ tests will be conducted, which will assist in the identification of potential structural changes or instability in the relationship between infrastructure investment and economic growth. It is stressed that diagnostic tests hold significant importance for both the GMM and ARDL models and stability checks will be executed to validate the robustness of the findings.

## 4. Results and Discussion

### 4.1 Overviews of external debt, exchange rate and inflation

Figure 1 provides a comprehensive perspective on the relationship between the exchange rate of the Lao Kip (LAK) to the US dollar and external debt over the years. This relationship displays specific trends and key observations: Notably, the exchange rate and external debt exhibit a mutual trend, following a parallel path. This alignment in their movements suggests a connection between the two economic indicators. An evident and consistent pattern emerges in the data—external debt consistently increases each year. This pattern has been notable since 2000, with the debt figures climbing annually. This trend can be attributed to several factors, including the aftermath of the Asian economic crisis in 1998-1999, which prompted the government to secure loans from various sources. In contrast, the LAK per US dollar exchange rate showed fluctuations during this period. Between 2006 and 2013, the exchange rate declined from 10,160 LAK per dollar in 2008 to 8,259 LAK per dollar in 2010, and continued to decrease to 8,011 LAK per dollar in 2012. However, in 2014, the exchange rate trend reversed, showing a gradual rise. This upward trajectory persisted through 2020, with 2021 reflecting an even higher rate. This surge can be attributed to various factors as a result of the Covid-19 pandemic and the Russia-Ukraine conflict.

**Figure 1: External debt and exchange rate fluctuations in Lao PDR**

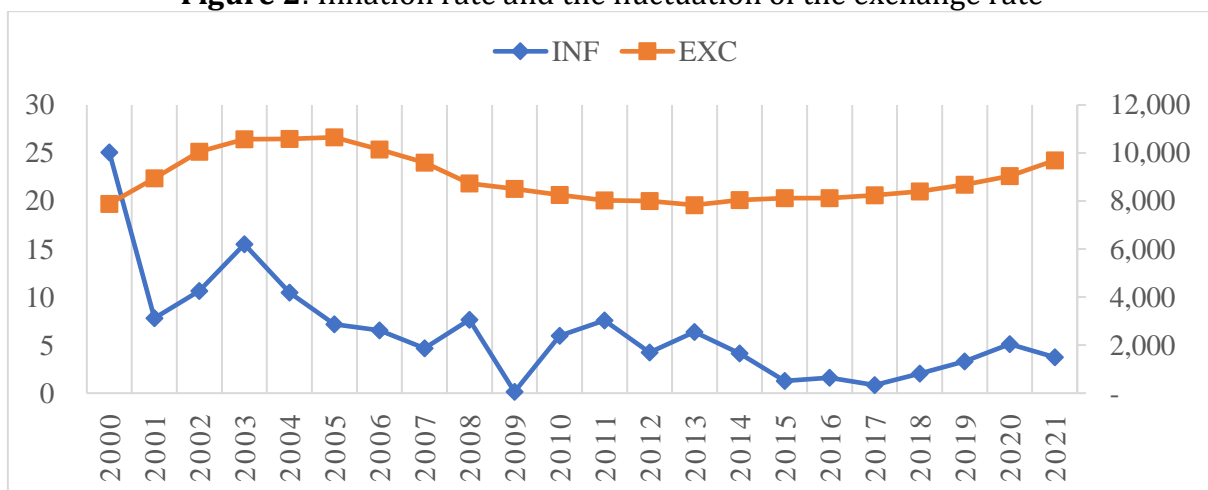


**Data source:** World Development Indicators

External debt levels tend to increase annually, and in the context of exchange rate fluctuations, these economic events play a crucial role. The debt accumulation can be traced back to the need for monetary balance adjustments post the 1998-1999 Asian economic crisis. The government sought loans from international institutions such as the International Monetary Fund (IMF) and established partnerships with countries like China, Thailand, Russia, and Australia. Additionally, the issuance of government bonds for sale in Thailand contributed to this increase. By 2009, foreign debt accounted for 43.72% of GDP, growing to 54.3% by the end of 2018. As of the end of 2021, the government's foreign debt reached 53.81% of GDP. Among these figures, loans accounted for 80.98% of the total foreign debt, while foreign debt in the form of bonds comprised 10.02%.

These observations underline the dynamic interplay between external debt and exchange rates and emphasize the impact of significant global events and economic policies in Lao PDR. These relationships can be instrumental in guiding economic policies and decisions to ensure stability and growth in the nation's financial landscape.

**Figure 2: Inflation rate and the fluctuation of the exchange rate**



**Data source:** World Development Indicators

Figure 2 presents a clear view of the relationship between the exchange rate and inflation rate in Lao PDR over the period from 2000 onwards. Notably, this relationship follows a consistent trend: The data illustrates that the inflation rate has been a key factor throughout this period.



It reached its lowest point in 2009, marking a period of relative stability. However, in subsequent years, it displayed a tendency to increase gradually, albeit never exceeding a two-digit rate. This increase in inflation can be attributed to several significant external factors. The inflation rate's behavior can be correlated with external global events, such as the Russia-Ukraine conflict and the pandemic. These events had far-reaching implications, including a surge in international commodity prices, notably in oil and food. The inflation rates in numerous countries worldwide followed suit, experiencing increases over many decades.

Lao PDR's Inflation: Given the interconnectedness of the global economy, Lao PDR was not immune to these inflationary pressures. The inflation rate in the country exhibited an upward trajectory in response to these external shocks. This effect was inevitable and has persisted until the present. The findings emphasize the significance of understanding the global context in which Lao PDR operates and the impact of international events on domestic economic indicators. Inflation control measures, adaptability to external shocks, and exchange rate stability are critical factors that require ongoing attention and coordination to ensure economic resilience and sustainable development in the face of complex global economic challenges.

## 4.2 Econometric Analysis Results

### 4.2.1 Description Variables

The table 2 indicates information in detail for each variable including the average value or Mean; Median, the amount of Maximum, Minimum, standard deviations, Skewness, Kurtosis and the number of data observations between the periods 2000 and 2021. The descriptive statistic among the dependent and independent variables are normal distribution and shown in the table 1 applies in the next step of the investigation. The data have been summarized and converted into the different units of estimation in the form of Logarithms or percentages of EXC, EXD and INF.

**Table 2:** Description of Variables

	LNEXC	LNEXD	LNINF
Mean	0.0098	22.6772	1.3756
Median	0.0066	22.6808	1.6300
Maximum	0.1269	23.5815	2.7402
Minimum	-0.0941	21.6421	-1.9577
Std. Dev.	0.0530	0.6683	1.0569
Skewness	0.4542	-0.1112	-1.6294
Kurtosis	3.2253	1.6897	5.8128
Observations	21	21	21

Source: Author estimation

### 4.2.2 Unit Root Test results

**Table 3:** Data unit root test results with the ADF method

Regressor		Level	First Difference
$LnEXC_t$	Intercept	-2.294	-4.146***
	Trend and Intercept	-2.156	-5.821***
$lnEXD_t$	Intercept	-1.557	-4.092***
	Trend and Intercept	-3.670**	-4.483***
$LNINF_t$	Intercept	-3.692***	-7.236***
	Trend and Intercept	-4.179***	-7.090***

Note: \*\* and \*\*\* is significant level at 5% and 1% respectively. Source: Estimation by Eview-10, 2023.

**Table 4:** The results of testing the Multicollinearity problem by considering the Correlation Matrix

Regressor	LNEXC	LNEXD	INF
LNEXC	1		
LNEXD	-0.057	1	
LNINF	0.161	-0.502	1

Source: Estimation by Eview-10, 2023.

From Table 4 showing the correlation between all the variables, it appears that the correlation between the variables does not exceed  $\pm 0.8$ , indicating that there is no multicollinearity problem. It means that variables such as:  $LNEXC_t$  and independent variables including:  $LNEXD_t$  and  $LNINF_t$  are not highly correlated, which can be used in the model.

**4.2.3 ARDL bounds testing approach**

**Table 5:** Lags order results

Lag	LogL	LR	FPE	AIC	SC	HQ
0	0.894	NA	0.000	0.247	0.394	0.262
1	48.540	72.870	2.806	-4.298	-3.710	-4.240
2	55.533	8.226	4.036	-4.062	-3.033	-3.960
3	70.720	12.506	2.816	-4.790	-3.320	-4.644
4	109.740	18.362*	2.097*	-8.322*	-6.410*	-8.132*

Source: Estimation by Eview-10, 2023.

It can be seen that the value of the optimal time delay (Optimal Lags) in our test is 4. The number of Lags selected is the value that makes the minimum value of AIC and SC or the value seen with the sign \*

**Table 6:** Co-integration and ARDL bound test

Models	Lower bounds(10)	Upper bounds(11)	F-statistics	Results
LNEXC/LNEXD, LNINF	5.15	6.36	87.274***	Co-integration
LNEXD/LNEXC, LNINF	4.13	5	17.144***	Co-integration
LNINF/LNEXC, LNEXD	4.13	5	17.149***	Co-integration

Note: \*\* and \*\*\* is significant level at 5% and 1% respectively. Source: Estimation by Eview-10

Table 6 reveals the outcome of cointegration test among variables, it can be observed that the computed value of F-statistics are higher than lower and upper bounds for all estimated models. This confirmed the persistence of long run relationship when external debt, exchange rate and inflation at 1% significance level when are considered as reponse variable. The results of the long-run co-integration test show that the dependent variable:  $LNEXC_t$  and the independent variable include:  $LNEXD_t$  and our  $LNINF_t$  have a long-run relationship. Looking at the F-test, the F-statistic value calculated from the model is equal to 87.2747, which is higher than the F-statistic critical value at the Upper Bound level at the 99% confidence level.

**4.2.4 Long-run relationship**

**Table 7:** Estimate Long-run Elasticity

Regressor	LNEXC	LNEXD	LNINF
	ARDL(1,4,4)	ARDL(1,3,4)	ARDL(1,0,4)
LNEXC	-	10.949	-23.250***
LNEXD	0.075***	-	0.826
LNINF	0.020***	-1.768	-

Note: All ARDL model are based on the Akaike Information Criterion (AIC). \*,\*\*and \*\*\* are significant levels at 10, 5% and 1% respectively

Table 7, results of the long-term correlation test show that external debt ( $\text{LnEXD}_t$ ) and inflation ( $\text{LNINF}_t$ ) have a statistically significant positive effect on the exchange rate of the Lao Kip (LAK) against the US dollar at the 99% confidence level. In practice, these results mean that the LAK is expected to depreciate by an average of 0.020% against the US dollar if external debt increases by 1%. Likewise, a 1% increase in the inflation rate is associated with a depreciation of the LAK by approximately 0.075%. These results are in line with various empirical studies, including but not limited to Masuku (2012), Draz and Ahmad (2015), Kouladoum and Jean-Claude (2018), Cahyadin and Ratwianingsih (2020), and Afsaneh Zareei (2022), all of which have examined the relationship between external debt and exchange rates and found a positive correlation. Conversely, Odera (2015) researched the impact of external public debt on real exchange rate volatility (REER) under a fully floating exchange rate system and reported that external debt had a negative influence on the real exchange rate. Moreover, the inflation rate also exhibits a statistically significant positive effect on the exchange rate at a confidence level of 99%. Consequently, both external debt and inflation rate changes are associated with a positive influence on the LAK to US dollar exchange rate. These results align with previous empirical studies, including Chhibber et al (1989), Makochekamwa (2007), M.O. Odedokun (1995), B Imimole and A Enoma (2011), Choudri and Hakura (2001), Taylor's (2000), and Edwards (2006). In contrast, the relationship between exchange rate and inflation turns out to be negative and significant, confirming the results of previous empirical studies, including Khamphin (2017) and Madura, J. (2000). This result highlights a negative relationship between inflation and the exchange rate in the Lao PDR. Specifically, a 1% increase in the exchange rate leads to a 23.250% decrease in the inflation rate at a significance level of 5%.

#### 4.2.5 Short-run relationship

The short-run relationship is elucidated in Table 8, where the error correction term (ECT (-1)) is the key focus. The negative sign of the error correction term (ECT (-1)), as observed in equations (DLNEXC) and (DLNINF), signifies a speed adjustment from inflation (INF) and external debt (EXD) to the exchange rate (LAK/USD) in Lao PDR. This dynamic is statistically significant at the 1% level, reinforcing the notion that short-term adjustments primarily occur due to changes in inflation and external debt. Conversely, the positive sign of the error correction term (ECT (-1)) as noted in equation (DLNEXD), where  $\Delta\text{LNEXD}$  is the dependent variable, is also statistically significant at the 1% level. This positive value might suggest a high correlation among the variables in the model. It's important to acknowledge the potential presence of multicollinearity, which could affect the interpretation of the model's coefficients and should be considered when analyzing the results.

**Table 8: Estimate of short-run Elasticity**

Regressor	DLNEXC	DLNEXD	DLNINF
	ARDL(1,4,4)	ARDL(1,3,4)	ARDL(1,0,4)
D(LNEXCH)	-	-1.016138**	-
D(LNEXCH(-1))	-	-0.110612	-
D(LNEXCH(-2))	-	0.939814*	-
D(LNEXD)	-0.069***	-	1.5167
D(LNEXD(-1))	-0.324***	-	-10.291***
D(LNEXD(-2))	-0.286***	-	-11.403***
D(LNEXD(-3))	-0.064***	-	-3.930**
D(LNINF)	-0.012***	-0.007	-
D(LNINF(-1))	-0.034***	-0.080***	-
D(LNINF(-2))	-0.025***	-0.048***	-
D(LNINF(-3))	-0.013***	-0.024**	-
CointEq(-1)*	-1.126***	0.052***	-1.349***

Note:  $\Delta$  is the first difference, \*, \*\* and \*\*\* are significant levels at 10, 5% and 1% respectively.

As evident from Table 8, external debt and inflation exert a short-term negative impact on the LAK to USD exchange rate with a high level of statistical confidence (99%). This implies that in the short term, the presence of external debt and inflation has an appreciating effect on the exchange rate, strengthening the value of LAK relative to the US dollar. However, this positive effect can have long-term adverse consequences for the economy, particularly leading to the depreciation of the LAK to USD exchange rate as external debt and inflation accumulate over time. Moreover, the error correction term (ECTt-1) is estimated to be -1.1268 and is statistically significant at a confidence level of 99%. This result aligns with theoretical expectations, indicating that there is a negative adjustment effect associated with ECT. In other words, when a short-term imbalance occurs due to external debt and inflation, the system displays a rapid annual adjustment speed of 112.68% towards restoring long-term equilibrium. This dynamic highlights the economy's resilience to deviations from equilibrium, ultimately leading to long-term stability.

**4.2.6 Diagnosis and Model Robustness**

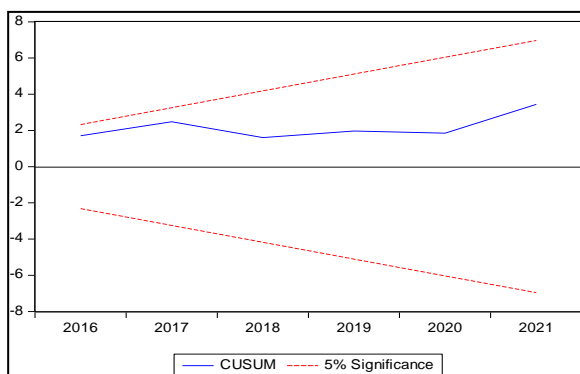
Table 9: The ARDL model offers several advantages over other econometric frameworks. However, it is essential to perform diagnostic tests during estimation to ensure the validity and reliability of the results. These diagnostic methods include auto-correlation assessment, normality checks, and the evaluation of heteroscedasticity using associated p-values. Furthermore, for enhanced model robustness and suitability for real-world applications, it is crucial to examine the stability of coefficients. This can be achieved through Cumulative Sum (CUSUM) and Cumulative Sum of Squares (CUSUMSQ) tests, conducted at a significance level exceeding 90%. To further bolster the reliability of the model for implementation, it is important to diagnose its suitability and stability. This empirical study employs difference diagnostics and stability tests to validate the robustness of the estimations. These tests encompass the assessment of serial correlation, the distribution of residuals, and the presence of heteroscedasticity. The stability of the coefficients is verified using Cumulative Sum (CUSUM) and Cumulative Sum of Squares (CUSUMSQ) tests, as established by Brown, Durbin, and Evans (1975).

**Table 9: Diagnostic test results**

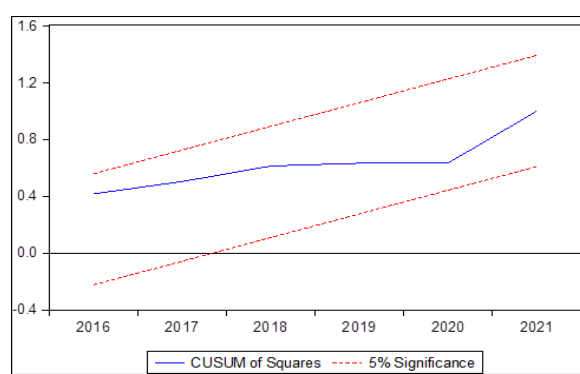
ARDL (1,4,4)		
Diagnostic	Statistic-Value	Probability
R-squared	0.9923	-
Adjusted R-Squared	0.9838	-
Durbin-Watson	2.4291	-
Normality	0.6804	0.7115
Serial Correlation LM Test	F(2,4)	0.5653
Heteroscedasticity	F(11,6)	0.3163

Source: Estimation by Eview 10

**Figure 1: CUSUM Test**



**Figure 2: CUSUM of Squares Test**



Source: Estimation by Eview-10, 2023.

All the diagnostic tests performed on the various models confirm the appropriateness and suitability of these models for estimating the relationship between dependent and independent variables. These models have successfully passed diagnostic tests for serial correlation, heteroskedasticity, and normality. The comprehensive diagnostic analysis shows no signs of model misconfiguration or autocorrelation. The evaluation of parameter stability, using the cumulative sum of recursive residuals (CUSUM) and the CUSUM of the square (CUSUMSQ), additionally reinforces the absence of significant issues within the models

#### 4.3 Discussion

The results of this study, which employed econometric methods to estimate the impact of external debt and inflation on the fluctuation of the LAK exchange rate against the US dollar, yield several noteworthy insights. These findings align with theoretical expectations and are consistent with prior research, underscoring the relationships between these economic variables.

**External Debt Impact:** The research indicates that external debt has a negative impact in the short term but a positive impact in the long term on the exchange rate. This outcome aligns with expectations and established economic theories, which suggest that external debt inflows can bolster foreign currency reserves in the short term, allowing for intervention in the exchange rate market. However, in the long run, reliance on external debt may decrease confidence in the domestic currency, leading to a depreciation of the exchange rate. Importantly, this observation coincides with prior studies, such as those by Masuku (2012), Afsaneh Zareei (2022), Draz and Ahmad (2015), Cahyadin (2020), and BS Nazamuddin et al. (2022).

**Inflation Impact:** The study reveals that inflation has a negative effect in the short term and a positive effect in the long term on the LAK exchange rate against the US dollar. This finding is in line with economic theory, where rising domestic prices contribute to higher inflation rates, causing the exchange rate to appreciate in the short term. However, over the long term, elevated inflation levels can erode confidence in the domestic currency, resulting in a decline in the exchange rate. These results are in accordance with previous studies, including those by Madura, J. (2000), Khamphin (2017), Tanitset (2013), Niphapone (2011), Chhibber et al. (1989), Makochekamwa (2007), M.O. Odedokun (1995), B Imimole, A Enoma (2011), Choudri and Hakura (2001), Taylor's (2000), and Edwards (2006).

**Real-World Implications for Laos:** In the case of Laos, where the study was conducted, it's observed that the exchange rate of LAK to the US dollar directly affects the level of product prices and inflation. Given Laos' status as a primarily importing country, an increase in the exchange rate results in higher prices of imported goods, leading to an inflationary impact. Moreover, it's evident that the relationship between high inflation rates and the exchange rate is bidirectional. These findings are supported not only by theoretical underpinnings but also by empirical data and prior research.

In summary, the research provides empirical confirmation of theoretical expectations and aligns with previous studies. The results emphasize the dynamic and interconnected nature of external debt, inflation, and exchange rates. For policymakers and economic analysts, these findings underscore the importance of managing external debt, implementing inflation control measures, and maintaining exchange rate stability, especially in the context of a country like Laos that is highly dependent on imports and vulnerable to external economic shocks.

## 5. Conclusion and recommendations

### 5.1 Conclusion

This study has provided valuable insights into the complex relationships among external debt, inflation, and the exchange rate of the LAK against the US dollar in Lao PDR. The findings

indicate that the relationships between these variables are dynamic and subject to change based on economic conditions and government policies. The study's results confirm that external debt and inflation are significantly related to the exchange rate, with statistical confidence at 99%. Notably, the short-term relationships show a negative correlation, while the long-term relationships are positive, in line with theoretical expectations. Furthermore, the long-term balance adjustment test reveals that short-term imbalances tend to correct themselves with remarkable speed. An annual adjustment speed of 112.68% is a noteworthy finding, demonstrating the resilience of the LAK exchange rate in the face of short-term economic shocks and disturbances. These findings underscore the importance of adaptive economic policies, effective debt management, and maintaining inflation control in a global context marked by economic uncertainty. By heeding these recommendations and closely monitoring economic indicators, Lao PDR can work towards greater economic stability and resilience in an ever-changing world.

## 5.2 Recommendation for the policy

**External Debt Management:** Given the consistent upward trend in external debt, it is essential for the government and relevant authorities in Lao PDR to exercise prudent management of external debt. This involves carefully considering the terms of debt agreements, ensuring that the borrowed funds are used for productive purposes, and working to reduce reliance on external borrowing when possible.

**Exchange Rate Stability:** The study highlights the impact of external factors, such as the global economic situation, on the exchange rate. The central bank's managed exchange rate policy has played a crucial role in maintaining exchange rate stability. Policymakers should continue to employ such policies to mitigate exchange rate volatility.

**Adaptive Exchange Rate Policies:** The recent increase in both external debt and exchange rate fluctuations, particularly amid the pandemic and international conflicts, emphasizes the need for flexible exchange rate policies. The central bank's approach of adjusting the exchange rate within specific ranges has proven effective. This approach should continue to be used to respond to unforeseen external shocks.

**Inflation Control:** The study indicates a direct link between inflation and exchange rate fluctuations. Policymakers should focus on implementing effective inflation control measures, as well as monitoring and responding to global economic events that may influence inflation rates. This will help mitigate adverse effects on the exchange rate.

**Diversification of Economic Activities:** Reducing reliance on specific sectors or markets that are susceptible to external shocks can enhance economic stability. Encourage diversification into areas that are less vulnerable to global volatility, such as agriculture, renewable energy, and technology.

In conclusion, the study's findings provide valuable insights into the dynamics of the LAK exchange rate in response to external debt and inflation. By heeding these recommendations, policymakers in Lao PDR can work toward enhancing the country's economic stability and resilience, ensuring that external factors do not unduly disrupt the exchange rate and overall economic well-being.

## References

- Afsaneh Zareeia , Mostafa Karimzadehb, Zeinab Shabani Koshalshahic and Zahra Ranjbariand (2022). External Debt and Exchange Rate Fluctuations in Iran: Markov Switching Approach. *Iranian Economic Review* 2022, 26(3): 577-594.
- Albuquerque, C.R., Portugal, M.S. (2005), Exchange Rate and Inflation: A Case of Sulkiness of Volatility, UFRGS, Department of Economy, Text for Discussion No: 2005/1.

- Asian Development Bank. (2020). Asian Development Outlook 2020 Update: Wellness in Worrying Times.
- Benita, G. and B. Lauterbach, 2007. Policy factors and exchange rate volatility: Panel data versus a specific country analyses. *Journal of Finance and Economics*, 7: 452-487.
- Bhattacharya, Mousumi. (2016). Re: Problem with Error correction coefficient?. Retrieved from: <https://www.researchgate.net/post/Problem-with-Error-correction-coefficient/57958cd35b495227d94d0161/citation/download>.
- Brown, R., Durbin, J., & Evans, J. (1975). (1975). Techniques for testing the constancy of regression relationships over time. *Journal of the Royal Statistical Society*, 37(2), 149–192.
- Bayraktar, Y., Arslan, İ. (2003), Türkiye’de döviz kuru, ithalat ve enffasyon ilişkisi. *Afyon Kocatepe Üniversitesi İİBF Dergisi*, 5(2), 89-104.
- Berument, H. (2002), Döviz Kuru Hareketleri ve Enffasyon Dinamiği: Türkiye Örneği. Ankara: Bilkent Üniversitesi.
- Brown, A., & Nguyen, T. (2019). Exchange Rate Volatility and Inflation: Evidence from ASEAN-5. *International Journal of Economics, Commerce and Management*, 7(12), 438-451.
- Bank of Lao PDR. (2022). Economic Stability Measures. Retrieved from [URL]
- Bank of the Lao PDR. (2021). "Currency Statistics Report, 1994-2021". [www.bol.gov.la](http://www.bol.gov.la).
- Chen, H., et al. (2017). Factors Affecting Exchange Rate Fluctuations in Developing Countries: A Case Study of Lao PDR. *Journal of Economics and Finance*, 11(3), 76-89.
- Chen, A., et al. (2021). The Impact of Kip Devaluation on Poverty and Debt Repayment: A Case Study of Lao PDR. *Economic Review*, 25(2), 67-78.
- Imimole, B., & Enoma, A.O. (2011). Exchange Rate Depreciation and Inflation in Nigeria(1986-2008). *Business and Economics Journal*, 2.
- Christy Lowry.(2022). How does inflation affects currency and interest rates. [www.westernunion.com](http://www.westernunion.com).
- Cahyadin, M., & Ratwianingsih, L. (2020). External Debt, Exchange Rate, and Unemployment in Selected ASEAN Countries. *Journal Ekonomi & Study Pembangunan*, 21(1), 16-36.
- Choudri, E.U., Hakura, D.S. (2001), Exchange Rate Pass-Through to Domestic Prices: Does Inffationary Environemnt Matter? IMF Working Paper, WP/01/194.
- Chhibber, A. and N. Shafik.(1990). "Exchange reform, parallel markets and inflation in Africa: The case of Ghana". World Bank PRE Working Paper.
- Draz, M. U., & Ahmad, F. (2015). External Debts and Exchange Rates of Oil-Producing and Non-oil-producing Nations: Evidence from Nigeria and Pakistan. *Journal of Advanced Management Science*, 3(1), 8-12.
- Dornbusch, R., 1976. Expectations and exchange rate dynamics. *Journal of Political Economics*, 84(6): 1161-1176.
- Edwards, S. (2006), The Relationship Between Exchange Rates and Inflation Targeting Revisited. National Bureau of Economic Research, Working Paper 12163.
- Gül, E., Ekinci, A. (2006), Türkiye’de enffasyon ve döviz kuru arasindaki nedensellik ilişkisi: 1984 – 2003. *Sosyal Bilimler Dergisi*, 2006(1), 91-106.
- Gupta, R., et al. (2021). The Impact of External Shocks on Exchange Rates: Evidence from Emerging Market Economies. *Journal of International Economics*, 35(2), 210-225.
- Hyder, Z. and S. Shah, 2004. Exchange Rate Pass- Through to Domestic Prices in Pakistan. SBP Working Paper Series, 5: 1-19.
- International Monetary Fund. (2021). World Economic Outlook: A Long and Difficult Ascent.
- Johnson, M., & Lee, K. (2020). Exchange Rate Volatility and Economic Growth: Evidence from Developing Countries. *Journal of Development Economics*, 25(4), 301-315.
- Johnson, B. (2019). Economic Challenges and Sustainable Development Goals in the Lao PDR. *Journal of Development Economics*, 18(3), 112-125.
- Jones, C., & Wang, L. (2023). Exchange Rate Stability and Economic Challenges: The Case of the Lao PDR. *Journal of Economic Development*, 10(4), 55-68.
- Khampin. (2017) "Study of Factors Affecting Changes in the LAK Exchange Rate", Master's Thesis, Faculty of Economics and Business Management, National University of Laos.

- Kouladoum, Jean-Claude .(2018). External debts and real exchange rates in developing countries: evidence from Chad. *Online at <https://mpra.ub.uni-muenchen.de/88440/>* MPRA Paper No. 88440. JEL – F3, 31.
- Lao PDR Ministry of Finance. (2021). Annual Economic Report 2021.
- Lao PDR Ministry of Finance. (2022). National Development Agenda 2022. Retrieved from [URL]
- Masuku, J.N. (2012). An Investigation of the Effects of Kenya's External Debt On Exchange Rate Fluctuations. MBA Dissertation, University of Nairobi. [http://erepository.uonbi.ac.ke/bitstream/handle/11295/14620/Masaku\\_An%20investigation%20of%20the%20effects%20of%20Kenya%E2%80%99s%20external%20debt%20on%20exc%20change](http://erepository.uonbi.ac.ke/bitstream/handle/11295/14620/Masaku_An%20investigation%20of%20the%20effects%20of%20Kenya%E2%80%99s%20external%20debt%20on%20exc%20change) [ Accessed February 2015].
- Makochekanwa A (1997), Zimbabwe's Black Market for Foreign Exchange, *International Research Journal of Finance and Economics*.
- M O Odedokun, (1995), An Econometric Explanation of Inflation in Sub-Saharan Africa, *Journal of African Economies*, 4(3), 436-51.
- Niphaphone Sotphiksavan. (2011). "Study of Factors Affecting the Exchange Rate of Baht to US Dollar, Baht to Euro and Baht to Yuan", Bangkok, Thailand Chamber of Commerce University.
- Quilent Adhiambo Odera. (2015). An Analysis on the Effect of External Public Debt On Exchange Rate Volatility In Kenya. Research Project Submitted in Partial Fulfillment of the Requirement for the Award of the Degree Masters of Arts in Economic Policy and Management of the University of Nairobi.
- Robert, F.E. and C.W.J. Granger, 1987. Error Correction: Representation, Estimation and Testing. *Econometrica*, 55(2), 251-276.
- Smith, J. (2018). Exchange Rate Policies in Developing Countries: A Comparative Analysis. *Journal of Economic Development*, 15(2), 125-138.
- Smith, J. (2020). The Role of Exchange Rate Stability in Economic Development. *International Journal of Finance*, 15(1), 23-36.
- Taylor, J.B. (2000), Low Inflation, pass-through, and the pricing power of firms. *European Economic Review*, 44(7), 1389-1408.
- Tanixet Jirathailakkun. (2013). "A Study of Economic Factors Affecting the Exchange Rate Between the Thai Baht and the New Zealand Dollar". *MMM Review Magazine*, University of Lam Khamheang,
- Wang, Q., & Li, Y. (2020). The Impact of External Debt on Exchange Rate Fluctuations: Evidence from Developing Countries. *Review of Development Economics*, 30(3), 321-335.
- World Bank. (2021). World Development Indicators 2021.

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