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**A VALUTÁK ÉRTÉKELÉSÉNEK HATÁSA A NIGÉRIAI
GAZDASÁGRA
THE EFFECT OF CURRENCY DEVALUATION ON THE NIGERIAN
ECONOMY**

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ABSTRACT

Currency devaluation is a significant economic issue in Nigeria, where the economy of the country depends heavily on oil exports. This devaluation can lead to economic challenges such as unemployment, inflation, and instability in foreign exchange rates because the value of the Nigerian Naira fluctuates.

The study aims to answer questions about the relationship between exchange rate, inflation rate, and government reserve with economic growth. The study conducted a descriptive summary of the economic data of Nigeria from 2003 to 2022. The results indicate clearly that the data follows a normal distribution, with a significant linear connection between the variables influencing currency devaluation. The R square indicates that these factors account for 99% of variations in GDP during the review period.

The Univariate time series auto-regressive integrated model (ARIMA) was been used for the regression analysis. A residual analysis showed a normality, and the model was been used to generate a forecast. Other relationships were been investigated, including Granger causality, Durbin-Watson non-autocorrelation, Portmanteau test for serial correlation, and Engle-Granger co-integration analysis. The analysis showed no short and long run relationship between the variables.

A diagnostic test using the ordinary least square revealed that all variables' data and structure were not stable and were been influenced by significant changes. A CUSUM test for the stability of parameters confirmed the null hypothesis. An interaction effect examination showed a strong influence of the variables.

In conclusion, the impact of the naira's devaluation on the Nigerian economy is significant with the exchange rate and government reserves negatively affecting economic growth while the inflation rate relates more positively. Considerations are to reduce external debt, implement policies that increase productivity in every sector, and implement consistent monetary and fiscal policies.

Keywords: *Currency devaluation, depreciation, exchange rate, government reserve, inflation, Gross domestic product (GDP), Nigerian Naira.*

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1. INTRODUCTION

1.1 Study Background

Currency devaluation is an economic situation with critical long-run consequences especially within the setting of a country like Nigeria. It is the deliberate decrease in the worth of the nation's currency compared to currencies from other countries. majorly due to its high dependence on oil exports, Nigeria's economic stability became highly vulnerable to fluctuations and changes in the value of its currency which is the Nigerian Naira. This is purposely to introduce a discussion that will throw light on the effects of the devaluation of the Naira on the Nigerian economy and to analyse both the positive and negative sides to it and the challenges it poses to businesses, policymakers and the general population.

As the Giant of Africa, Nigeria is a country whose economy is rich in diverse resources. However, over the years, the country has been experiencing economic challenges such as unemployment, inflation and instability in foreign exchange rates due to the fluctuations in the value of the Naira determined by factors both internally and externally. Hence the need for an occasional adoption of the strategy of currency devaluation by the Nigerian authorities to address the imbalance with a primary objective of achieving several economic goals such as increasing exports, foreign investment and stimulating economic growth.

Currency depreciation is the situation where the value of the currency becomes less than the equivalent amount compared to other currencies. This is commonly obtainable when there is no official currency value sustainability, which is normally in a floating exchange regime (Pettinger, 2017). According to Farlex (2012), currency depreciation is the decrease or reduction in the currency value as against other currencies. It is also a rapid move from a higher to a lower level, without control in comparison to currencies from other countries. Consequently decreasing imports, and stimulating exports, which is beneficial for a difference in a country's value of import (Black 2002).

Currency devaluation and currency depreciation are been used synonymously during this study though the former is a deliberate act while the forces of demand and supply induce the latter both are reductions in currency's value and affect the economy.

1.2 Research Gap Statement

Despite the extensive literature on the effect of currency devaluations, a notable gap in the analysis exists, which is the limitation of 2020 and does not include the year 2022. Hence, it is significant that a current analysis incorporates data from 2022 for more detailed clarity, Considering that the factors at play are influenced by seasonal fluctuations and trends, as well as the swift evolution and dynamics of the economy.

1.3 Study Objectives

- The objective of this research is to investigate the vulnerability of specific macroeconomic indicators (such as the exchange rate, inflation rate, and government reserves) to currency devaluation in Nigeria by the impact it will have on the economy
- Through the analysis arrive at conclusive submissions and considerations for decisions.

1.4 Research Questions

Given the stated points above, answers to the following research questions are the key areas of focus; first; Does exchange rate, inflation rate and government reserve (all of which represent currency devaluations) relate positively or negatively to economic growth? It is important to clarify the meaning of government reserve and exchange rate within the context of Nigeria. Hence, the term government reserve refers to the asset or funds held by the government specifically in the central bank to manage the financial obligations of the country and ensure fiscal stability.

These reserves can include foreign exchange reserves, gold, and other financial assets that the government accumulates over time. Foreign exchange reserves play a vital role as they help stabilize the nation's currency and bolster its exchange rate. Conversely, the exchange rate represents the value at which the Nigerian Naira (NGN) is traded for another currency. The Central Bank of Nigeria plays a key role in managing and regulating the exchange rate. They frequently engage in the market for foreign exchange to impact the Naira's value and uphold stability in the exchange rate

Secondly; Among the three variables examined within the study's framework, which one exerts the most substantial influence on the Nigerian economy? Consequently, finding answers to these questions forms the basis of objective principles of discussions in this study.

1.5 Scope of study

The subsequent section structure includes the following; examination of related literature whose scope is limited to 2020 with the aim of carrying out a more recent analysis that encapsulates the year 2022. Hence the scope of the study is from 2003 to 2022 The methodology specifies the approach for the analysis, the data analysis of results, summary, conclusions and considerations respectively.

2. LITERATURE REVIEWS

2.1 Brief History of the Nigerian Currency

Before the British colonization and the introduction of shillings and pence in 1880 as the national currency, Nigerians depended on cowries, beads, and other items of trade as a form of currency for exchange. The West African Currency Board (WCAB) in Nigeria, issued the first banknotes and coins from 1912 to 1959. The CBN (Central Bank of Nigeria) on 1 July 1959 gave the Nigerian currency banknotes an official change on 1 July 1962 to reflect the status of the country as a republic, with the inscription "The Federal Republic of Nigeria" rather than the previous "Federation of Nigeria." A necessity for change came in 1968 sequel to the fraudulent exploit of the currency banknote at the time of the civil war. Naira was named in January 1973, conceived from the word Nigeria and the willingness to switch to decimal rather than metric. (Central Bank of Nigeria, 2022).

Having a predilection for undertaking money proceedings and consequently improving the economy, made the Nigerian government introduced a new twenty naira (₦20) banknote on 11 February 1977 as the highest denomination, which became the first banknote in the country bearing the image of the Nigerian revolution torchbearer in July 1975, a prominent citizen. As a fitting tribute, the CBN issued the note on the first anniversary of his assassination. Thus, General Murtala Ramat Mohammed, the late head of state declared a national hero. On 2 July 1979, they issued (₦1, ₦5, and ₦10) new currency banknotes, reflecting the images of dignified Nigerians declared heroes on 1 October 1978, while the rear view of the note displayed various cultural aspects of the country and different colours for the various denominations for easier identification.

In April 1984, they changed the colours except for the 50 Kobo banknote to curtail the consistent currency laundering. In 1991, the 50K and ₦1 were both coined. The higher denominations of banknotes (₦100, ₦200, ₦500, ₦1000) were later introduced to facilitate an efficient payment system in the country and meet up to the expansion in economic activities. ₦2 coin was also introduced as economic reform alongside the other banknotes and re-issued in new designs, which included a ₦20 polymer substrate for the first time on 28 February 2007, and sequel to the success experienced on 30 September 2009, The CBN printed all lower denomination banknotes in a polymer substrate and issued the ₦50 and ₦100 commemorative polymer banknotes on 29 September 2010 and 19 December 2014, respectively to celebrate

the nation's 100 years of its existence and 50th anniversary of Independence. (Central Bank of Nigeria, p. 2022)

2.2 Empirical Review

Domestic currency reduction or an appreciation of foreign currency leads to a rise in the worth of assets owned by residents within the country. Spending might improve by more money demand when considering this, a rise in the asset's value is a wealth improvement. Similarly, when the foreign currency rises continuously then the demand for domestic currency will reduce while that of the foreign currency increases (Mundell, 1963).

A country's production costs and prices increase by the depreciation of the country's currency, which consequently increases money demand (Cooper, 1971). This is because of the requirement of more money to buy comparatively inexpensive products from the importing country. The purchasing power of foreign goods reduces, as the price of imported items becomes more costly and consequently results in an increase in the acquisition and utilization of alternative products produced within the country hence having a consequential long-run effect on trade and the growth of the economy.

The establishment of the structural adjustment scheme in 1986 by the Babangida regime had the main purpose of achieving a steady and practical exchange rate to reduce the vulnerability levelled on the external sector by the economy, a consequence of the high depreciation of the Nigerian currency called the Naira. This is because it serves as a consequential macroeconomic variable, especially for an importing country with a significant effect on the economy and influences other variables as well (Ogikhenan, 2000).

Sequel to the inception of the structural adjustment programme, there have been shreds of evidence of strains in the Nigerian economy. This triggered the articulation of an excessive severe accumulation leading to a significant erosion of the local currency's value, while the local producers are been sabotaged by the import cost, a policy for industrial development was introduced with the purpose of encouraging exports. This policy necessitated the production of goods domestically rather than being imported, intending to stimulate the balance of payment and lessen the economy's vulnerability and exposure to negative external shocks (Ogikhenan and Eso, 2000).

The commitment of investors either negatively or positively is largely dependent on the currency exchange rate changes and the availableness of money in the economy. The depreciation of currency reduces its purchasing power and consequently the standard of living,

this makes imported goods very expensive leading to an escalation in the demand for money (Mundell, 1963; Dornbusch, 1976). When a unit of domestic currency is been exchanged for a higher or more unit of foreign currency, it shows a reduction in the exchange rate while the reverse shows an appreciation. Hence, the variance between the domestic and foreign currency is the exchange rate currency that takes superiority in the foreign exchange market (Hossain, 2002).

Oluwole J. (2020) argued that the depreciation of currency did not significantly affect the alteration in money demand over both short-term and long-term periods in Nigeria during the examined time frames. This conclusion was supported by trend analysis and the findings of the Autoregressive Distributed Lag model, which verified the claim. These findings do not support the notion that economic agents increase their demand for money to facilitate economic activities in response to currency depreciation, unforeseen circumstances, or increased investment in interest-bearing assets or securities.

Aguiar (2005) stressed the necessity of a nation whose imports are more than its exports to enforce methods to reduce the disequilibrium, which can also be through the devaluing of the nation's currency compared to currencies from other nations. The first currency devaluation in Nigeria was at the rate of 10 % in 1973, which was due to that of the US currency within the same period. Additionally, there was a significant growth of 773.5% in foreign exchange reserves in 1974 (Udo, et al., 2018). In 2015, the International Monetary Fund (IMF) reported that devaluation of currencies is been done by countries as a means to remedy the underlying trade and balance of payment. However, Todaro (1982) and Udo, et al. (2018) opined that currency devaluation aggravates a nation's problem of balance of payment and trade, which means is destructive to the development of the economy.

The relationship between the Nigerian naira and the United States dollar, along with other foreign currencies is been characterized by volatility, predictability, unpredictability, and instances of violence and immense hardship for the citizens, government, and the overall economy. This has increased the level of influence and significant economic importance the United States dollar has over other nation's currencies especially as regards exchange and trade thereby creating a dependence on the currency. Therefore, the Nigerian currency devaluation is largely dependent on the US dollar. Consequently, when the dollar experiences fluctuations, the currencies of other nations, including the naira experience an impact due to their interdependency on other countries, particularly the United States (Onwioduokit and Nwachukwu, 1998).

Because of the Bretton Woods system, Nigeria adopted the fixed exchange rate. Before 1971 Nigeria's exchange rate remained constant at N1 = \$0.40. However, in the 1970s, significant changes took place in the global financial system. These changes included a combination of high inflation and unemployment rates, coupled with low productivity and instability in industrialized nations. As a response to these challenges, many countries adjusted their exchange rate policies to maintain low consumer prices despite the high rate of global inflation contrary to Nigeria where the Naira was been fixed to the US dollar by the central bank while the currencies of the trading partners float for stability. To enhance the United States exports, the dollar has been devalued by 10% and consequently affected the value of the Nigerian naira with the same percentage reduction leading to an exchange rate of US \$1.52 to the Naira because it was pegged to the US dollar (Onwioduokit and Nwachukwu, 1998).

This situation is aggravated by the implementation of proposed actions designed to maintain low consumer prices, even amidst global inflationary pressures. As a result, The naira's actual worth is considered inflated, and the implementation of the import substitution industrialization strategy requires a substantial share of imported inputs for each unit of production (Onwioduokit and Nwachukwu, 1998). The policies that led to an increase in the naira were been aborted in 1991 As a result of the decline in the oil sector and the initiation of current account deficits. Consequently, the monetary authorities introduced policies that led to the devaluation of the naira, while systematizing foreign exchange control policies with a comprehensive import licensing system and outright bans on certain commodities. The depreciation of the naira has had multiple effects on Nigeria's economic development and has led to a deterioration structure.

The depreciation of the naira has a major effect on imports; this is because it discourages imports due to the high cost involved. It becomes a problem since the economy depends largely on imports and the inclination to import is been necessitated, leading to inelastic import prices. In addition, a devalued currency encourages exports by the cheap cost and competitiveness in the international markets thereby improving demand. Despite these stated facts, what is obtainable in Nigeria is the fact that the international market ascertains the country's export products, which is contrary to the Naira exchange rate changes. Disequilibrium in the balance of payment and low per capita income as well as high external debt, unemployment and inadequate direct foreign investments are also some effects of the currency devaluation. Additionally, it undermines the global competitiveness of non-oil exports, complicating planning and forecasting across all levels. While leading to low

business dimensions usage, with a major hit on the small and medium-scale ventures due to the decreased exchange rate of dollar to naira (Onwioduokit and Nwachukwu, 1998).

An institutional framework for foreign exchange was been established through which realistic, market-driven exchange rates can be developed. To sum up, it can be ascertained that the Second-tier Foreign Exchange Market (SFEM) will make Nigeria's foreign exchange management more efficient and cheaper, but operating this market caused the Naira to depreciate sharply, causing the exchange rate to fall to N1.55355 to 1 US dollar in 1986. The naira lost 71% of its value during the last tender in 1988, which was Down to \$1.00 from N5.3530. On average, the naira depreciated against the US dollar to N0.7486, and N0.8083 in 1983 and N0.8083 in 1982 and 1985 respectively. The devaluation accelerated in 1986 as the situation became direr, with the currency averaging N3.9696 and in 1992; 1 US dollar was worth 19.4966 Naira. In the year 1993, the recorded average exchange rate stood at approximately 21.8861 naira per US dollar (Onwioduokit and Nwachukwu, 1998).

From the initial divestment in 1986 to 1994, the naira experienced a roughly 93% depreciation. However, from 1993 to 1999, an executive decree fixed the rate at N21.888 at \$1.00. Further drops to N103.1052, N120.9702 and N133.5004 in 2002, 2003 and 2004. Despite the implementation of several ameliorations in the market for foreign exchange, the unidirectional devaluation of the naira compared to other currencies remains a source of concern for both monetary authorities and foreign exchange users. Although some economic schools of thought point to insufficient policy execution resulting from a lack of synchronization between monetary and fiscal policies as the cause of the naira's depreciation, others contend that changes in the external sector and macroeconomic performance are the principal factors driving the continuous devaluation of the naira (Onwioduokit and Nwachukwu, 1998).

As stated by Nanna (2000), the effectiveness of exchange rates is been related to the impact of different shocks. These shocks include changes in foreign currency reserves, which are been aimed at achieving fiscal modifications, as well as domestic shocks such as liquidity, domestic prices, and other economic fluctuations related to monetary instruments. According to Anyanwu (1997), the implementation of a progressive and timely devaluation strategy, coupled with effective fiscal management, may have been the crucial factor in achieving macroeconomic stability. However, an over focus on exchange rate auctions and the inter-bank market as mechanisms to maintain flexibility is visible. The exchange rate reduction in value was been seen as a consequence of the event documented in the Journal of Social Sciences and Public Policy, Volume 8, Issue 1, in the year 2016. The author also

contended that the United States dollar, as the most extensively traded currency, is vulnerable to fluctuations that often lack a direct correlation with underlying economic realities. There is a curiosity over the potential of the Nigerian currency, the naira, which is pegged to the United States dollar, can withstand comparable levels of volatility. According to Owolabi (1992)

Based on the recommendations put out by Obaseki and Bello (1996), in order to mitigate or eradicate the issue of over-valuation of the naira, it is crucial to implement fiscal and monetary restrictions alongside the adoption of suitable supply-increasing policies, with the aim of reducing inflation. According to Owolabi (1992), the implementation of a market-driven exchange rate has effectively addressed the issue of over-valuation. However, the author contends that the problem of over-valuation is been primarily caused by excessive liquidity within the system, stemming from expansionary fiscal and monetary policies, as well as the lack of discipline among certain speculative market participants.

In the works of Olisadebe (1991), He argued that in order to get sustained security in the exchange rate, it is necessary to enable the rate to fluctuate in an approach that promotes the attainment of other macroeconomic goals. This is because stability in the exchange rate does not necessarily mean a fixed exchange rate. According to Praise (1992), it is highly improbable to rely solely on a market-determined exchange rate scheme to achieve changes in structure and sustainable growth, especially in the case of Nigeria. This is due to Nigeria's status as an enclave sector heavily reliant on substantial windfalls from oil-related foreign exchange payments. Several studies (Anyanwu et al., 1997; Ojinnaka, 2000; Obadan, 1993; Mulfwang, 1999; Onwoduokit and Nwachukwu, 1998) have challenged the notion that The presence of foreign exchange earnings generated by the oil sector fosters a deceptive impression of economic prosperity and acts as an artificial source of revenue used to gauge or stabilize the exchange rate of the Nigerian currency, the naira. These studies argue that such a belief is been flawed since the organization of the Petroleum Exporting Countries determines the vulnerability of oil prices to external shocks.

According to David O.K (2013), for economic growth in developing nations, trade deregulation is paramount hence, interest and exchange rate systems are necessary for international finance and macroeconomic variables are key towards enhancing the development of the economy by underlying the effect from the use of the scheme. A research conducted by Roderick (1993), Ajakaiye (2002) and Afolabi (2006) has identified the consequence of exchange rates on the growth of the economies of many developing nations. Some of these are;

- A boost in the earnings of foreign exchange: A country's reserve of foreign exchange has an increment conversion factor effect on the country's economy due to its reactivity to the exchange rate. Hence when the currency's value rises, consequently the reserve of the foreign exchange also rises nonetheless the reverse is the case in Nigeria because of more imports than exports thereby leading to less growth of the economy.
- A rise in national currency's foreign exchange: Afolabi (2006) highlighted that for a nation's currency to strengthen relative to other currencies in the market for foreign exchange, there is need for an increase in the national currency's foreign exchange. This will improve trade in the domestic currency as well as attract more investors. However, in Nigeria, intense corruption and capital flight ruin the economy by reducing the value of the naira.
- High Inflation: An increased amount of naira is used up for importation in Nigeria which made the rate of inflation rise in external reserve although for developing nations inflation rises in external reserve and helps reduce its effects on the economy.
- High Maintenance cost: when a country's management is experiencing a high foreign exchange rate maintenance cost, it pushes the nation into loan and huge debt from the International monetary fund.

Through a time series regression framework, Morley (1992) in his analysis of the effects of real exchange rate and devaluation ordeal in developing countries. He came to the conclusion that the extent of the real exchange rate lessens the output of the depreciation through the development of the management for elements such as terms of trade, fiscal balance, supply of money, high import rate that reduces output and increase devaluation concurrently.

On the other hand, Kamin and Klau (1998) opined through their observation that in the long-run, currency devaluations are not deflationary and this knowledge came to be using error correction technique, which enabled them to link the output to the real exchange rate of 27 countries.

In their research on the exchange rate movement in Nigeria, Eme & Johnson (2010) studied the direct and indirect correlation between the Gross domestic product (GDP) and the country's exchange rate within a determined period of (1986-2010). They opined that the effect of currency devaluation on the economy of Nigeria is a consequence of monetary regulations implemented to prevent the economy of the nation from collapsing. The devaluation of a

nation's currency is been perceived as a favourable strategy for countries experiencing an economic downturn, Hence. the positive outcomes of devaluation are often tagged along by negative effects, including higher costs of imported goods and diminished efficiency and reduced or absent foreign competition leading to competitiveness in domestic sectors.

Some of the positive effects of the naira devaluation on the Nigerian Economy include:

- One consequence of this phenomenon is that it serves as a catalyst for producers in some areas to augment their production levels and expand their exports.
- According to Osundina and Osundina (2016), the strengthening of the currency, specifically the naira occurs with a decline in oil prices.
- A rise in the results of the exchange rate subsequently increases output, but the positive impact on the balance of payment is been offset by changes in price.
- The demand for imports of domestically produced goods has been stimulated by raising the value of imports as well as enhancing the exports sectors competitiveness in the global market.

On the contrary, the depreciation of the Naira in Nigeria's economy has adverse consequences, mostly manifesting in the escalation of inflationary pressures that detrimentally been impacted on businesses.

- The phenomenon in question leads to a decrease in the buying power possessed by individuals within a given society.
- There has been a rise in the rate of unemployment.
- The implementation of this policy enhances the monetary structure of the country.
- The exchange rate is been given a certain level of freedom.
- Implement a price hike on domestically produced items.
- A higher ratio of exports to imports has the potential to augment overall demand, hence potentially contributing to inflationary pressures. According to Adeyemi (2020),

2.3 Nigerian Economy Overview

The COVID pandemic induced a recession in 2020 and weakened the macroeconomic stability though the economic growth has recovered. Oil production has drastically reduced, with petroleum subsidies consuming a larger share of the gross oil revenues, thus incapacitating the country from benefiting from the surging global oil price. Other aspects are the devaluation of the currency, restrictions on trade, global commodity shocks, trade restrictions, and

monetization of the deficit surging inflation, leading millions of Nigerians into poverty. Notwithstanding, the projected economic growth is at an average rate of 3.2% in 2022-2024. However, it is subject to more insecurities and oil reduction risks along with elevated inflation and consistent fiscal and debt constraint (World bank, 2022).

In this review period, the economy of Nigeria has sustained its performance and growth level, evident in the level of development of its real gross domestic product to 3.11% in the first quarters of 2022 and 3.54% in the second quarter. This growth is majorly due to the autonomous impact of the economic segment excluding the oil industry in the second quarter of 2022, with a contribution of 93.67% to the aggregate real GDP and a high margin as compared to the previous year of 2021, which was recorded 92.58.

The real sector financing, accommodative monetary policy stance as well as expansionary budgetary expenditures accelerated this growth driven by trade, transportation, information and communication, manufacturing sub-sectors, and financial and insurance services. Whereas the growth rate of the oil sector's real, GDP was operating in the negative in the first and second quarters of 2022, from -26.04% and -11.77% as against the corresponding quarters of 2021 with -2.21% and -12.65% with continuous inflationary pressure, Increased inflation from 15.60% in January to 18.60% in June 2022 as against 16.47% and 17.75% in the previous year 2021. However, the high rate of inflation in the period was ascribed to the impacts of the Russian –Ukraine war on imports, energy prices, expansionary fiscal expenditures as well as internal security problems. (Central bank of Nigeria, 2022)

2.3.1 Development Challenges

The identifiable developmental challenges are oil dependency and economic diversification, insufficient infrastructure, ineffective institutions, governance issues, and poor public financial management systems creating room for Inequality. Unemployment and social and political unrest are at the peak of the high poverty levels (World bank, 2022).

3. METHODOLOGY

This study employs a quantitative research design, utilizing secondary data obtained from the Central Bank of Nigeria (CBN) statistical bulletin and the National Bureau of Statistics (NBS). The data covers the period from 2003 to 2022 and includes information on exchange rates, inflation rates, gross domestic product (GDP), and government reserves. To assess the association linking the dependent and independent variables, the econometric time-series regression analysis was been employed. The model was been modified for this study such that Gross domestic product is a function of exchange rate (EXCH), inflation rate, and Government External Reserves (GER).

This means the GDP as the dependent variable serves as a proxy for the overall performance and health of the Nigerian Economy. In contrast, the independent variables are; the exchange rate which represents currency devaluation. The Inflation rate, which can be a consequence of currency devaluation, and the government reserves in foreign currency, which influence currency devaluation. This functional relationship is as thus:

$$GDP=c+\beta_1\cdot EXCH+\beta_2\cdot INF+\beta_3\cdot GER+\epsilon \text{ Which means } GDP = F(EXCH, INF, GER)$$

Where:

GDP = The gross domestic product is the primary gauge of the total worth of all final goods and services produced within Nigeria over a specified timeframe, subtracting the value of imports

c = Constant term

β_1, β_2 , and β_3 are the coefficients of the respective independent variables.

ϵ is the error term.

EXCH = The exchange rate refers to the rate at which the Nigerian naira (NGN) is traded for another currency.

INF = The inflation rate signifies the pace at which prices escalate over time, leading to a decline in the purchasing power of money.

GER = Government External Reserves: the asset or funds held by the government specifically in the central bank to manage the financial obligations of the country and ensure fiscal stability.

4. RESULT ANALYSIS

The econometric time series Regression technique is been used, the method employed is the ARIMA model to ascertain the validity and reliability of the parameter estimates.

4.1. Descriptive statistics

Summary Statistics, using the observations 1 – 20 **Table 1**

Variable	Mean	Median	Minimum	Maximum
GDPConstantMarketPri	58367	62306	33347	75769
Exchange rate	218.09	155.74	116.3	448.55
Inflation rate	151.31	149	65	225.18
Government Reserve	3.32E+10	3.78E+10	1.07E+06	5.28E+10
Variable	Std. Dev.	C.V.	Skewness	Ex. kurtosis
GDPConstantMarketPri	13962	0.23922	-0.4779	-1.2497
Exchange rate	107.81	0.49434	0.88771	-0.6718
Inflation rate	43.215	0.28561	-0.10523	-0.74957
Government Reserve	1.58E+10	0.4743	-1.261	0.56289
Variable	5% Perc.	95% Perc.	IQ range	Missing obs.
GDPConstantMarketPri	33501	75650	25769	0
Exchange rate	116.81	446.77	172.86	0
Inflation rate	66.585	224.63	73.135	0
Government Reserve	1.14E+06	5.27E+10	1.31E+10	0

This shows the characteristics of the data variables categorised into three main aspects, the measures of tendency, the variability measures and the distribution frequency. Under the review period, the GDP is at a mean of 58367 and has a variability of 13962. The exchange rate is at a mean of 218% with a variability of 107% and the inflation rate has a mean of 151% with a variability of 43% while the government reserve is at a mean of 3.3% with a variability of 1.1%. The summary statistics clarify if the information will fit a normal distribution or not. In this case, the skewness and kurtosis of a normal distribution are close to zero, which means there is a likelihood of a deviation from a normal distribution. This gives reason to conduct a normality test, which is a hypothesis test used to assess if a dataset follows a normal distribution. The normal distribution is a specific type of probability distribution characterized by a bell-shaped curve. In the normality test, a default hypothesis indicates the normality of

the sequential component. If the p values are, all less than .005 this suggests that the p alternate hypothesis is true meaning the series is not null.

Table 2

Test for Normality

Test	Inflation rate	Exchange rate	Government Reserve	GDP constant Market price
Jarque-Bera test	0.505124	3.00286	5.56458	2.06282
p-value	0.776808	0.22281	0.0618966	0.356504

Interpretation: Generally, the Jarque-Bera test indicates $p > 0.05$, suggesting that the data follows a normal distribution therefore, I can proceed with parametric statistical tests that assume normality

4.2 Stationarity test for unit root using the Augmented Dickey-Fuller.

This is commonly employed in time series analysis to ascertain that the sequential component data set displays a non stationarity of the unit root. When each data point is been subtracted from its previous data point, it is called the first difference. Here, the null hypothesis is set for non-stationarity meaning the series has a unit root, Alternatively, the hypothesis posits that the time series data becomes stationary post-differencing, indicating the absence of a functional unit

Table 3

Augmented Dickey-Fuller test first difference

Test with constant	Inflation rate	Exchange rate	Government Reser	GDP
Test statistic: tau_c(1)	0.292484	2.39201	-6.11833	-1.86635
Asymptotic p-value	0.978	1	6.19E-08	0.3486
Test with constant and Trend	Inflation rate	Exchange rate	Government Reser	GDP
Test statistic: tau_c(1)	-6.1645	-0.335503	-129.088	-1.58818
Asymptotic p-value	4.54E-07	0.9897	0.0001	0.798

Interpretation of the test statistic: The test statistic for GDP, inflation rate and government reserve is more negative than the critical value, which is .005 while for the exchange rate, the constant static test is slightly positive while with the addition of trend is more negative than the critical value. Therefore, this generally indicates that the first difference is stationary. This

implies that differencing the original time series data once has made it stationary, which is often a prerequisite for using certain time series models or performing statistical analyses.

4.3 Univariate Time series (ARIMA Model)

The auto-regressive integrated model (ARIMA) is a widely used time series forecasting model in statistics and econometrics. In this study, the model is been used to understand and analyse the underlying structure and patterns within the time series data as well as predict economic indicators. The component of the ARIMA model used for this study is the Auto-Regressive Component. It reflects the autocorrelation within the time series, describing the linear connection between the present results and designated prior results. The Moving Average portrays the time series movement on the average, capturing the association linking the current and past forecasted errors. The Integrated element illustrates the differencing of the time series data to render it stationary.

Table 4

Autocorrelation function
Indicate significance at the 1%, 5%, 10% levels
Using standard error $1/T^{0.5}$

	LAG	ACF	PACF	Q-stat	[p-value]
GDP	4	0.4273	-0.1428	43.1587	[0.000]
Exchange rate	4	0.3785	0.1136	35.0078	[0.000]
Inflation rate	4	0.0089	0.1237	6.9757	[0.137]
Government Reserve	4	-0.2611	0.3444	13.2568	[0.010]

This graph scrutinizes the estimated coefficients associated with the Autoregressive and moving average terms of the model. Graphical representations are in the appendix. They signify the intensity and orientation of the connections between earlier observations and the present one, as well as the influence of past forecast errors on the current value, dependent and independent variables. In the review period, the correlation matrix indicates a powerful optimistic correlation connecting the dependent and the independent variables. It also depicts that all the independent variables are important factors that influence the GDP of the Nigerian economy positively as they move in the same direction hence increase in these variables is associated with economic growth as seen in the GDP.

Both the Autocorrelation Function and Partial Autocorrelation Function plots are ascertain the right lag order (p and q). These plots can reveal how many previous results influence the present. The first plot is ACF with a declining function and the second is PACF. When the autocorrelation function shows, a declining trend with the highest bar being at the first, it is suggested to start the value of p at 1 which doesn't mean the final value of p is 1 but to start the modelling by taking the value of p at 1. The second plot with just one strike and dotted line suggests starting the model at one too.

4.4 Regression

Table 5

Model 10: ARIMA, using observations 2004-2022 (T = 19)

Dependent variable: (1-L) GDPat2010ConstantMarketPri

Standard errors based on Hessian

	<i>Coefficient</i>	<i>Std. Error</i>	<i>z</i>	<i>p-value</i>	
Const	2257.07	493.168	4.577	<0.0001	***
phi_1	0.261928	0.476486	0.5497	0.5825	
theta_1	0.192294	0.486711	0.3951	0.6928	
Mean dependent var	2232.754		S.D. dependent var	1559.39	
Mean of innovations	-19.11517		S.D. of innovations	1361.889	
R-squared	0.990193		Adjusted R-squared	0.989616	
Log-likelihood	-164.1793		Akaike criterion	336.3586	
Schwarz criterion	340.1363		Hannan-Quinn	336.9979	
		<i>Real</i>	<i>Imaginary</i>	<i>Modulus</i>	<i>Freq</i>
AR					
	Root 1	3.8178	0	3.8178	0
MA					
	Root 1	-5.2004	0	5.2004	0.5

This shows a significant linear connection uniting the GDP and the independent variables that influences currency devaluation. The R square is a determinant coefficient indicating that exchange rate, inflation rate and government reserve describes 99% of the variations in GDP during the period of review while other components not incorporated in the model is ascribed

to the balance of 26%. Due to the relative high R square and the significance, the model is been demonstrated to be compatibly appropriate for this analysis and prediction of the GDP.

The model estimate is $GDP_{at2010ConstantMarketPri} = 2257.07 + 0.261928 GDP_{at2010ConstantMarketPri-1} + 0.192294 ER_{-1}$. The fitted model will provide forecasts or estimates for future data points. These forecasts are been used for prediction and decision-making. The Phi value, which represents the previous component, is the auto-regressive component and the theta value, which represents the Moving average component, is the error term component.

Normality of the Residual Test

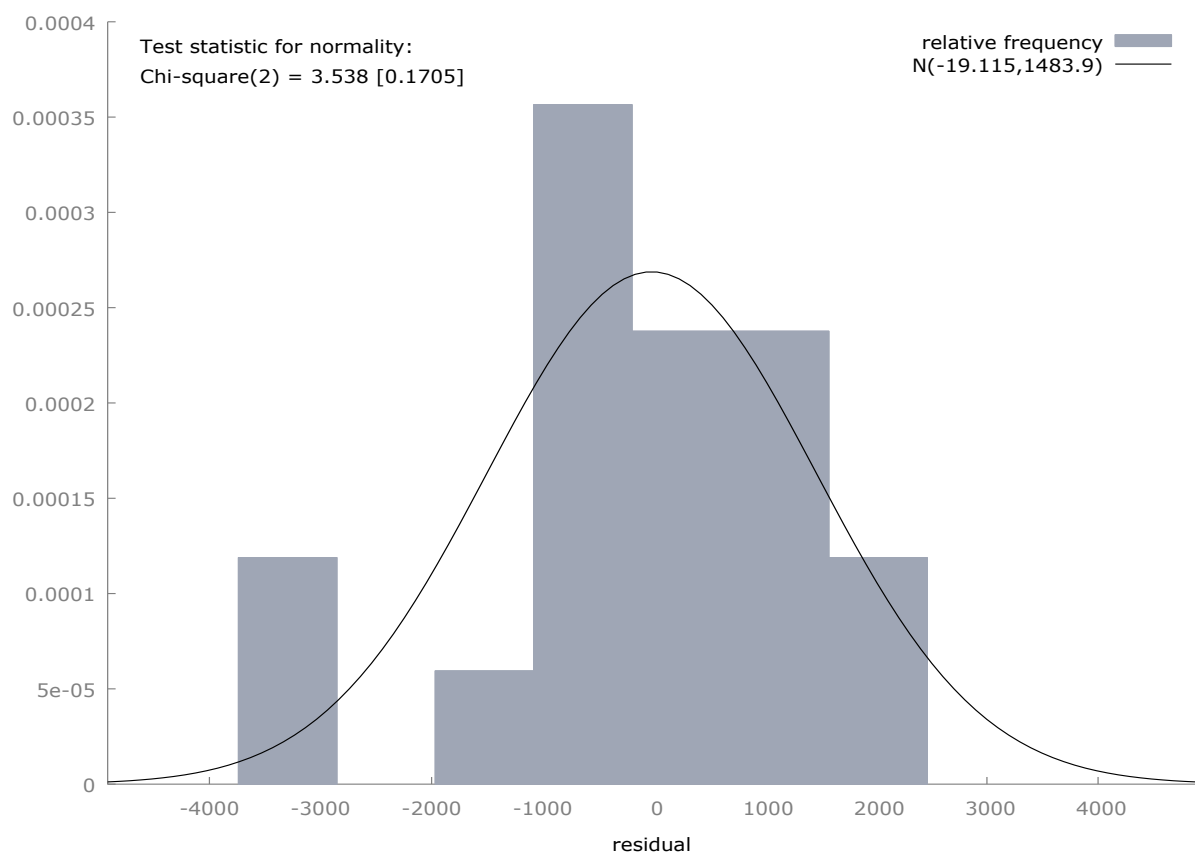


Table 6

Frequency distribution for residual, obs 2-20

number of bins = 7, mean = -19.1152, sd = 1483.94							
interval	midpt	frequency	rel.	cum.			
< -2852.8	-3295.7	2	10.53%	10.53%	***		
-2852.8 - -1967.0	-2409.9	0	0.00%	10.53%			
-1967.0 - -1081.2	-1524.1	1	5.26%	15.79%	*		
-1081.2 - -195.32	-638.24	6	31.58%	47.37%	*****		
-195.32 - 690.51	247.59	4	21.05%	68.42%	*****		
690.51 - 1576.3	1133.4	4	21.05%	89.47%	*****		
>= 1576.3	2019.3	2	10.53%	100.00%	***		
Test for null hypothesis of normal distribution:							
Chi-square(2) = 3.538 with p-value 0.17050							

Residual analysis is important for model validity. Here it shows a normality with the P-value exceed the critical threshold. This means the model is good and can generate a forecast.

4.5 Forecast

ARIMA models typically provide confidence intervals for the forecasts. These intervals give an idea of the range of uncertainty in the predictions. With a range of certainty at 95%, $z(0.025) = 1.96$

Table 7

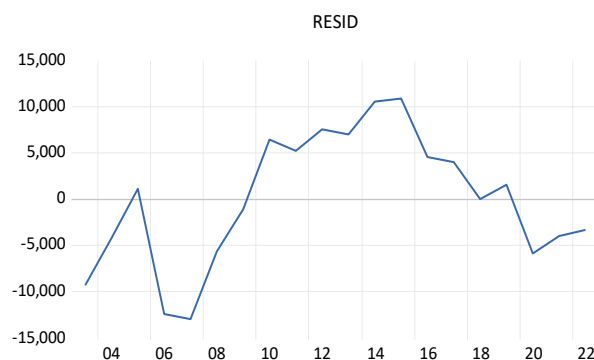
Forecast table for prediction

Obs	GDPat2010	prediction	std. error	95% interval
2003	33346.6	undefined	Undefined	
2004	36431.4	35682.5	Undefined	
2005	38777.0	39034.7	Undefined	
2006	41126.7	41007.9	Undefined	
2007	43837.4	43430.8	Undefined	
2008	46802.8	46291.5	Undefined	
2009	50564.3	49343.7	Undefined	

2010	55469.3	53450.1	Undefined	
2011	58180.3	58808.3	Undefined	
2012	60670.1	60435.6	Undefined	
2013	63942.8	63033.1	Undefined	
2014	67977.5	66640.9	Undefined	
2015	69780.7	70957.1	Undefined	
2016	68652.4	71692.7	Undefined	
2017	69205.7	69438.2	Undefined	
2018	70536.4	70971.8	Undefined	
2019	72094.1	72467.0	Undefined	
2020	70800.5	74096.3	Undefined	
2021	73382.8	71493.9	Undefined	
2022	75768.9	76088.2	Undefined	
2023	undefined	77998.4	1361.89	(75329.2, 80667.7)

This table shows the actual price of the GDP at 2010 constant market from 2003 to 2022 and the predictions from 2004 to 2023. However, they are closely related but slightly different with variations and a predicted value for 2023. This prediction is been made with a 95% confidence interval as a range of uncertainty. As seen also in the graph the GDP is been predicted to increase in 2023 and under the review period, it is predicted to have increased at some points more than the actual price. The graphical representation is in the appendix.

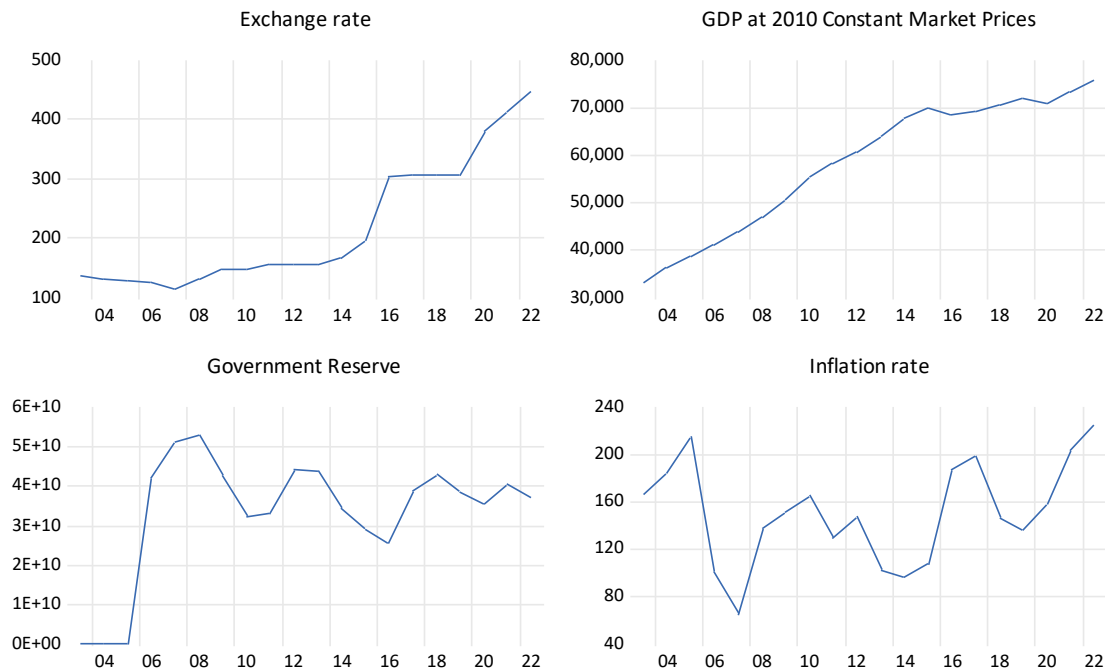
Graph 1



Having a regression line aims at minimizing the sums of the residual, and as shown in the graph1, at the point where the effect of currency devaluation as represented by the variables is

high shows a negative residual while it depicts a positive when the effects is predicted to be low.

Graph 2.



Graph 2 clearly shows the movement of all the variables over the years (2003-2022). It indicates that as the year advances the exchange rate gradually increases, the GDP swiftly increases as well and the government reserve started low but grew rapidly despite the slopes at some points but remained consistent while the inflation rate had the most unsteady movement.

4.6 Investigation of other relationships

Time series analysis often shows a correlational relationship, but not necessarily causality. Using methods like Granger causality can help determine potential causal relationships between the variables. Correlation and regression relationships do not necessarily mean the presence of causality,

4.6.1 Short-run causal relationships

This presents the causal relationship between two variables on a short run using the **Granger causality**, the null hypothesis is no Granger causality.

GDP and Exchange rate: To find out how many trial observations to include and for GDP difference and exchange rate difference only one past observation is required from the model parameters as seen below using the VAR lag selection

Table 8

VAR system, maximum lag order 2

The asterisks below indicate the best (that is, minimized) values of the respective information criteria, AIC = Akaike criterion,

BIC = Schwarz Bayesian criterion and HQC = Hannan-Quinn criterion.

lags	loglik	p(LR)	AIC	BIC	HQC
1	-222.94315		26.934488*	27.228563*	26.963719*
2	-222.20491	0.83080	27.318225	27.808351	27.366945

Now to check for Granger causality, using the vector auto-regression

VAR system, lag order 1

OLS estimates, observations 2005-2022 (T = 18)

Log-likelihood = -235.59071

Determinant of covariance matrix = 8.0069584e+008

AIC = 26.8434, BIC = 27.1402, HQC = 26.8843

Portmanteau test: LB(4) = 15.6595, df = 12 [0.2073]

Table 9

Equation 1: d_GDPat2010ConstantMarketPri

Heteroskedasticity-robust standard errors, variant HC1

	<i>Coefficient</i>	<i>Std. Error</i>	<i>t-ratio</i>	<i>p-value</i>	
const	894.886	915.909	0.9770	0.3440	
d_GDPat2010Cons	0.528605	0.295396	1.789	0.0937	*
d_Exchangerate_1	7.47341	13.5525	0.5514	0.5895	
Mean dependent var	2185.421		S.D. dependent var	1590.493	
Sum squared resid	34382520		S.E. of regression	1513.991	
R-squared	0.200487		Adjusted R-squared	0.093885	
F(2, 15)	2.087677		P-value(F)	0.158529	
rho	0.062099		Durbin-Watson	1.874767	

F-tests of zero restrictions:

All lags of d_GDPat2010ConstantMarketPriF(1, 15) = 3.2022 [0.0937]

All lags of d_Exchangerate F(1, 15) = 0.30409 [0.5895]

All vars, lag 1 F(2, 15) = 2.0877 [0.1585]

Table 10

Equation 2: d_Exchangerate

Heteroskedasticity-robust standard errors, variant HC1

	<i>Coefficient</i>	<i>Std. Error</i>	<i>t-ratio</i>	<i>p-value</i>	
const	16.3334	16.9912	0.9613	0.3517	
d_GDPat2010Cons	-0.000456370	0.00437407	-0.1043	0.9183	
d_Exchangerate_1	0.146374	0.324665	0.4508	0.6585	
Mean dependent var	17.56667		S.D. dependent var	30.18873	
Sum squared resid	15075.17		S.E. of regression	31.70191	
R-squared	0.026976		Adjusted R-squared	-0.102761	
F(2, 15)	0.280412		P-value(F)	0.759346	
Rho	-0.015934		Durbin-Watson	1.993522	

F-tests of zero restrictions:

All lags of d_GDPat2010ConstantMarketPriF(1, 15) = 0.010886 [0.9183]

All lags of d_Exchangerate F(1, 15) = 0.20326 [0.6585]

All vars, lag 1 F(2, 15) = 0.28041 [0.7593]

Interpretations: The P-value (F) 0.158529 in the GDP Granger and the P-value (F) 0.759346 in the Exchange rate Grangers both exceeds the critical threshold which proves that the hypothesis is null and both variables do not Granger cause each other that means no Granger causality. The Durbin-Watson non-autocorrelation is close to 2 for both variables (Durbin-Watson 1.874767 for GDP and Durbin-Watson 1.993522 for exchange rate) which indicates it is not positive or negative. The Portmanteau test: LB(4) = 15.6595, df = 12 [0.2073] for serial correlation with a null hypothesis of no serial correlation as shown in p-value [0.2073] above the critical value.

GDP and Inflation rate:

Table 11

VAR system, maximum lag order 2

The asterisks below indicate the best (that is, minimized) values of the respective information criteria, AIC = Akaike criterion,

BIC = Schwarz Bayesian criterion and HQC = Hannan-Quinn criterion.

lags	loglik	p(LR)	AIC	BIC	HQC
1	-236.34562		28.511249*	28.805325*	28.540481*
2	-234.00634	0.32190	28.706628	29.196753	28.755347

The VAR lag Selection indicates only one past observation difference is required.

To check for Causality using the vector Auto-regression

VAR system, lag order 1

OLS estimates, observations 2005-2022 (T = 18)

Log-likelihood = -249.4681

Determinant of covariance matrix = 3.7421414e+009

AIC = 28.3853, BIC = 28.6821, HQC = 28.4263

Portmanteau test: LB(4) = 15.3613, df = 12 [0.2223]

Table 12

Equation 1: d_GDPat2010ConstantMarketPri

Heteroskedasticity-robust standard errors, variant HC1

	<i>Coefficient</i>	<i>Std. Error</i>	<i>t-ratio</i>	<i>p-value</i>	
const	1213.02	666.336	1.820	0.0887	*
d_GDPat2010Cons	0.436502	0.221250	1.973	0.0672	*
d_Inflationrate_1	0.745365	4.61053	0.1617	0.8737	
Mean dependent var	2185.421		S.D. dependent var	1590.493	
Sum squared resid	34823098		S.E. of regression	1523.660	
R-squared	0.190242		Adjusted R-squared	0.082274	
F(2, 15)	2.067655		P-value(F)	0.161034	
rho	0.026144		Durbin-Watson	1.946231	

F-tests of zero restrictions:

All lags of d_GDPat2010ConstantMarketPriF(1, 15) = 3.8923 [0.0672]

All lags of d_Inflationrate F(1, 15) = 0.026136 [0.8737]

All vars, lag 1 F(2, 15) = 2.0677 [0.1610]

Table 13

Equation 2: d_Inflationrate

Heteroskedasticity-robust standard errors, variant HC1

	<i>Coefficient</i>	<i>Std. Error</i>	<i>t-ratio</i>	<i>p-value</i>	
const	9.59822	16.1701	0.5936	0.5616	
d_GDPat2010Cons	-0.00331509	0.00478447	-0.6929	0.4990	
d_Inflationrate_1	0.0146323	0.195411	0.07488	0.9413	
Mean dependent var	2.254444		S.D. dependent var	46.42580	
Sum squared resid	36126.50		S.E. of regression	49.07579	
R-squared	0.014042		Adjusted R-squared	-0.117419	
F(2, 15)	0.282266		P-value(F)	0.757991	
rho	0.010123		Durbin-Watson	1.944394	

F-tests of zero restrictions:

All lags of d_GDPat2010ConstantMarketPriF(1, 15) = 0.48009 [0.4990]

All lags of d_Inflationrate F(1, 15) = 0.0056069 [0.9413]

All vars, lag 1 F(2, 15) = 0.28227 [0.7580]

Interpretations: The P-value (F) 0.158529 in the GDP Granger and the P-value (F) 0.757991 in the Inflation rate Grangers both exceeds the critical threshold which proves that the hypothesis is null and both variables do not Granger cause each other that means no Granger causality. The Durbin-Watson non-autocorrelation is close to 2 for both variables (Durbin-Watson 1.874767 for GDP and Durbin-Watson 1.944394 for inflation rate) which indicates it is not positive or negative. Portmanteau test: LB(4) = 15.3613, df = 12 [0.2223] for serial correlation with a null hypothesis of no serial correlation as shown in p-value [0.2223] above the critical value

GDP and Government reserve

Table 14

VAR system, maximum lag order 2

The asterisks below indicate the best (that is, minimized) values of the respective information criteria, AIC = Akaike criterion,

BIC = Schwarz Bayesian criterion and HQC = Hannan-Quinn criterion.

lags	loglik	p(LR)	AIC	BIC	HQC
1	-565.33553		67.215945*	67.510020*	67.245177*
2	-563.80446	0.54748	67.506408	67.996533	67.555127

The VAR lag Selection, indicates only one past observation difference is required.

Check for Causality using the vector Auto-regression

VAR system, lag order 1

OLS estimates, observations 2005-2022 (T = 18)

Log-likelihood = -597.57105

Determinant of covariance matrix = 2.3485927e+026

AIC = 67.0634, BIC = 67.3602, HQC = 67.1044

Portmanteau test: LB(4) = 11.0636, df = 12 [0.5235]

Table 15

Equation 1: d_GDPat2010ConstantMarketPri

Heteroskedasticity-robust standard errors, variant HC1

	<i>Coefficient</i>	<i>Std. Error</i>	<i>t-ratio</i>	<i>p-value</i>	
const	1123.90	739.312	1.520	0.1493	
d_GDPat2010Cons	0.454071	0.231963	1.958	0.0692	*
d_GovernmentReser	2.29055e-08	1.12244e-08	2.041	0.0593	*
Mean dependent var	2185.421		S.D. dependent var	1590.493	
Sum squared resid	33560102		S.E. of regression	1495.774	
R-squared	0.219611		Adjusted R-squared	0.115559	
F(2, 15)	2.464653		P-value(F)	0.118712	
rho	-0.025699		Durbin-Watson	2.050418	

F-tests of zero restrictions:

All lags of d_GDPat2010ConstantMarketPri F(1, 15) = 3.8319 [0.0692]

All lags of d_GovernmentReserve F(1, 15) = 4.1644 [0.0593]

All vars, lag 1 F(2, 15) = 2.4647 [0.1187]

Table 16

Equation 2: d_GovernmentReserve

Heteroskedasticity-robust standard errors, variant HC1

	<i>Coefficient</i>	<i>Std. Error</i>	<i>t-ratio</i>	<i>p-value</i>	
const	6.05215e+09	3.19111e+09	1.897	0.0773	*
d_GDPat2010Cons	-1.94178e+06	803956	-2.415	0.0289	**
d_GovernmentReser	0.145187	0.0452942	3.205	0.0059	***
Mean dependent var	2.06e+09		S.D. dependent var	1.22e+10	
Sum squared resid	2.27e+21		S.E. of regression	1.23e+10	
R-squared	0.096014		Adjusted R-squared	-0.024517	
F(2, 15)	6.609088		P-value(F)	0.008744	
Rho	0.109828		Durbin-Watson	1.770966	

F-tests of zero restrictions:

All lags of d_GDPat2010ConstantMarketPriF(1, 15) = 5.8336 [0.0289]

All lags of d_GovernmentReserveF(1, 15) = 10.275 [0.0059]

All vars, lag 1 F(2, 15) = 6.6091 [0.0087]

Interpretation: The P-value (F) 0.158529 in the GDP Granger and the P-value (F) 0.008744 in the Government reserve Grangers both exceeds the critical threshold which proves that the hypothesis is null and both variables do not Granger cause each other that means no Granger causality. The Durbin-Watson non-autocorrelation is close to 2 for both variables (Durbin-Watson 1.874767 for GDP and Durbin-Watson 1.770966 for Government reserve) which indicates it is not positive or negative. Portmanteau test: LB(4) = 11.0636, df = 12 [0.5235] for serial correlation with a null hypothesis of no serial correlation as shown in p-value [0.5235] above the critical value.

4.6.2 Long-run relationship:

Here the variables are been used at non-stationary levels. The Engle Granger co-integration analysis is been used to study the persistent connection among the non-stationary series over an extended period with the residual of the co-integrating regression as stationary.

GDP and exchange rate : Step 1: testing for a unit root in GDPat2010ConstantMarketPri

Table 17

Augmented Dickey-Fuller test for GDPat2010ConstantMarketPri

Testing down from 1 lags, criterion AIC

Sample size 19, Unit-root null hypothesis: $\alpha = 1$

Test with constant	Exchange rate	GDPconstant Market
Test statistic: tau_c(1)	1.39929	-2.37281
Asymptotic p-value	0.9991	0.1496
Test without constant	Testing for a unit root in uhat	
Test statistic: tau_c(1)	-1.97671	
Asymptotic p-value	0.5402	

Step 3: cointegrating regression

Table 18

Cointegrating regression -

OLS, using observations 2003-2022 (T = 20)

Dependent variable: GDPat2010ConstantMarketPri

	<i>Coefficient</i>	<i>Std. Error</i>	<i>t-ratio</i>	<i>p-value</i>	
const	36296.6	4611.27	7.871	3.09e-07	***
Exchangerate	101.199	19.0478	5.313	4.74e-05	***
Mean dependent var	58367.38		S.D. dependent var	13962.46	
Sum squared resid	1.44e+09		S.E. of regression	8951.422	
R-squared	0.610615		Adjusted R-squared	0.588983	
Log-likelihood	-209.3165		Akaike criterion	422.6330	
Schwarz criterion	424.6245		Hannan-Quinn	423.0218	
rho	0.796391		Durbin-Watson	0.226785	

A co-integrating relationship is supported through the following ways:

- (a) Acceptance of the unchallenged unit-root hypothesis for the individual variables
- (b) Rejection of the unit-root hypothesis derived from the cointegrating regression for the residuals (uhat).

GDP and Inflation rate: Step 1: testing for a unit root in GDPat2010ConstantMarketPri

Table 19

Augmented Dickey-Fuller test for GDPat2010ConstantMarketPri

Testing down from 1 lags, criterion AIC

Sample size 19, Unit-root null hypothesis: $\alpha = 1$

Test with constant	Inflation rate	GDPconstant Market
Test statistic: tau_c(1)	-3.23613	-2.37281
Asymptotic p-value	0.01802	0.1496
Test without constant	Testing for a unit root in uhat	
Test statistic: tau_c(1)	-1.27114	
Asymptotic p-value	0.8396	

Step 3: co-integrating regression

Table 20

Co-integrating regression -

OLS, using observations 2003-2022 (T = 20)

Dependent variable: GDPat2010ConstantMarketPri

	<i>Coefficient</i>	<i>Std. Error</i>	<i>t-ratio</i>	<i>p-value</i>	
const	52550.7	11875.7	4.425	0.0003	***
Inflationrate	38.4431	75.6126	0.5084	0.6173	
Mean dependent var	58367.38		S.D. dependent var	13962.46	
Sum squared resid	3.65e+09		S.E. of regression	14243.16	
R-squared	0.014157		Adjusted R-squared	-0.040612	
Log-likelihood	-218.6058		Akaike criterion	441.2116	
Schwarz criterion	443.2031		Hannan-Quinn	441.6004	
rho	0.905722		Durbin-Watson	0.055759	

A co-integrating relationship is supported through the following ways:

- (a) Acceptance of the unchallenged unit-root hypothesis for the individual variables
- (b) Rejection of the unit-root hypothesis derived from the cointegrating regression for the residuals (uhat).

GDP and Government reserve: Step 1: testing for a unit root in GDPat2010ConstantMarketPri

Table 21

Augmented Dickey-Fuller test for GDPat2010ConstantMarketPri

Testing down from 1 lags, criterion AIC

Sample size 19, Unit-root null hypothesis: $\alpha = 1$

Test with constant	Government Reserve	GDPconstant Market
Test statistic: tau_c(1)	-3.88082	-2.37281
Asymptotic p-value	0.00219	0.1496
Test without constant	Testing for a unit root in uhat	
Test statistic: tau_c(1)	-0.94386	
Asymptotic p-value	0.00219	

Step 3: cointegrating regression

Table 22

Cointegrating regression -

OLS, using observations 2003-2022 (T = 20)

Dependent variable: GDPat2010ConstantMarketPri

	<i>Coefficient</i>	<i>Std. Error</i>	<i>t-ratio</i>	<i>p-value</i>	
const	44818.1	6786.39	6.604	3.35e-06	***
Inflationrate	4.07646e-07	1.85330e-07	2.200	0.0411	**
Mean dependent var	58367.38		S.D. dependent var	13962.46	
Sum squared resid	2.92e+09		S.E. of regression	12735.30	
R-squared	0.211842		Adjusted R-squared	0.168056	
Log-likelihood	-216.3678		Akaike criterion	436.7356	
Schwarz criterion	438.7271		Hannan-Quinn	437.1244	
rho	0.921852		Durbin-Watson	0.183676	

A co-integrating relationship is supported through the following ways:

- (a) Acceptance of the unchallenged unit-root hypothesis for the individual variables
- (b) Rejection of the unit-root hypothesis derived from the cointegrating regression for the residuals (uhat).

Interpretation: The statistics show that the rejection of the unit root hypothesis for all the variables is because it is non-stationary and so has a P-value less than the critical value. In addition, the Unit root hypothesis for the residual is not been dismissed because the p-value of the variables exchange rate, inflation rate and Government reserve are greater than the critical

value respectfully Therefore, both the response and controlled variables has no continual relationship.

4.7 Investigation of Structural Breakpoints (diagnostic test)

Within the time series, structural changes or breakpoints can occur, which can significantly influence the behaviour of the variables. Changes in government policies, significant political changes, fiscal measures, economic crises, or central bank interventions can lead to structural breaks in macroeconomic indicators such as inflation rates, government reserves, or exchange rates. Using the ordinary lease square to run the Chow test, the data structure is been confirmed if it remains the same or if there are structural breakpoints. The null hypothesis is that the parameters are stable while the alternate hypothesis indicates otherwise.

Exchange rate

Table 23

Augmented regression for Chow test

OLS, using observations 2004-2022 (T = 19)

Dependent variable: d_GDPat2010ConstantMarketPri

HAC standard errors, bandwidth 2, Bartlett kernel

	<i>Coefficient</i>	<i>Std. Error</i>	<i>t-ratio</i>	<i>p-value</i>	
const	2977.08	222.624	13.37	9.71e-010	***
d_Exchangerate	28.2233	7.82648	3.606	0.0026	***
splitdum	-510.030	753.440	-0.6769	0.5088	
sd_d_Exchangerate	-60.8596	12.0294	-5.059	0.0001	***
Mean dependent var	2232.754		S.D. dependent var	1559.390	
Sum squared resid	19680946		S.E. of regression	1145.453	
R-squared	0.550361		Adjusted R-squared	0.460433	
F(3, 15)	36.53618		P-value(F)	3.89e-07	
Log-likelihood	-158.5417		Akaike criterion	325.0834	
Schwarz criterion	328.8611		Hannan-Quinn	325.7227	
rho	0.312285		Durbin-Watson	1.350625	

Chow test for a structural break at observation 2013

Chi-square(2) = 74.1356 with p-value 0.0000,F-form: F(2, 15) = 37.0678 with p-value

0.0000, Quandt likelihood ratio test for structural break at an unknown point,with 15 percent

trimming: The maximum Wald test = 85.9504 occurs at observation 2009, Asymptotic p-value = 8.81553e-018 for chi-square(2) = 85.9504

Inflation rate

Table 24

Augmented regression for Chow test
 OLS, using observations 2004-2022 (T = 19)
 Dependent variable: d_GDPat2010ConstantMarketPri
 HAC standard errors, bandwidth 2, Bartlett kernel

	<i>Coefficient</i>	<i>Std. Error</i>	<i>t-ratio</i>	<i>p-value</i>	
const	3046.19	253.335	12.02	4.20e-09	***
d_Inflationrate	4.54494	1.59069	2.857	0.0120	**
splitdum	-1369.76	601.217	-2.278	0.0378	**
sd_d_Inflationra~	-25.8201	9.47567	-2.725	0.0157	**
Mean dependent var	2232.754		S.D. dependent var	1559.390	
Sum squared resid	26015413		S.E. of regression	1316.951	
R-squared	0.405641		Adjusted R-squared	0.286770	
F(3, 15)	7.110275		P-value(F)	0.003395	
Log-likelihood	-161.1926		Akaike criterion	330.3851	
Schwarz criterion	334.1629		Hannan-Quinn	331.0245	
rho	0.140641		Durbin-Watson	1.681198	

Chow test for structural break at observation 2013

Chi-square(2) = 20.2856 with p-value 0.0000

F-form: F(2, 15) = 10.1428 with p-value 0.0016

Government reserve

Table 25

Augmented regression for Chow test
 OLS, using observations 2004-2022 (T = 19)
 Dependent variable: d_GDPat2010ConstantMarketPri

	<i>Coefficient</i>	<i>Std. Error</i>	<i>t-ratio</i>	<i>p-value</i>	
const	3195.48	493.654	6.473	1.05e-05	***

d_GovernmentRese~	-3.25037e-08	3.15061e-08	-1.032	0.3186	
splitdum	-1721.65	666.454	-2.583	0.0208	**
sd_d_GovernmentR	-1.83050e-08	7.93032e-08	-0.2308	0.8206	
Mean dependent var	2232.754		S.D. dependent var	1559.390	
Sum squared resid	29669959		S.E. of regression	1406.413	
R-squared	0.322148		Adjusted R-squared	0.186578	
F(3, 15)	2.376242		P-value(F)	0.110868	
Log-likelihood	-162.4413		Akaike criterion	332.8826	
Schwarz criterion	336.6603		Hannan-Quinn	333.5219	
rho	0.019194		Durbin-Watson	1.943562	

Chow test for a structural break at observation 2013

Chi-square(2) = 6.75484 with p-value 0.0341

F-form: F(2, 15) = 3.37742 with p-value 0.0615

Interpretation; For the exchange rate and the inflation rate, the p-value does not support the null hypothesis; it is less than the critical value because it is 0.0000, which means that the data is not stable and there are structural breakpoints in them. The Government reserves also has a p-value of 0.0341, which falls below the critical threshold also. Therefore, the test indicates that all the variables' data and structure are not stable and they are been influenced by significant changes as mentioned above.

To check if the stability of the constant term in the regression analysis. The parameters are stable is the null hypothesis while alternate is that they are not stable.

CUSUM test for stability of parameters : mean of scaled residuals = -673.505

sigmahat = 1485.76, Cumulative sum of standardized residuals

(*' denotes a value beyond the 95% confidence boundary)

Table 26

2006	-0.352
2007	-0.309
2008	-0.169
2009	0.292

2010	1.282
2011	0.918
2012	0.673
2013	0.710
2014	1.040
2015	-0.007
2016	-2.791
2017	-4.022
2018	-4.793
2019	-5.526
2020	-8.031
2021	-7.749
2022	-7.706

Harvey-Collier $t(16) = -1.86903$ with p-value 0.08004

The p-value of 0.08004 for the constant parameters exceeds the critical value, indicating stability in the parameters of the constant and supporting the null hypothesis. This is further illustrated in the graphical representation provided in Graph 6 of the appendix.

4.8 Examination of Interaction Effects

The interaction effect is visible if a particular variable's impact on the dependent determines the level or values of another variable. It shows the influence the relationship between two or more variables has on the dependent variable. This examination of interaction effects between the variables is been conducted using the ordinary lease square.

Table 27

Model 14: OLS, using observations 2004-2022 (T = 19)

Dependent variable: d_GDPat2010ConstantMarketPri

	<i>Coefficient</i>	<i>Std. Error</i>	<i>t-ratio</i>	<i>p-value</i>	
const	2985.07	312.628	9.548	<0.0001	***
d_Exchangerate	-40.8440	10.6655	-3.830	0.0016	***
d_Inflationrate	0.983785	8.17092	0.1204	0.9058	
d_GovernmentReser	-4.32999e-08	2.73451e-08	-1.583	0.1342	
Mean dependent var	2232.754		S.D. dependent var	1559.390	

Sum squared resid	19179861		S.E. of regression	1130.777
R-squared	0.561809		Adjusted R-squared	0.474171
F(3, 15)	6.410552		P-value(F)	0.005210
Log-likelihood	-158.2967		Akaike criterion	324.5934
Schwarz criterion	328.3711		Hannan-Quinn	325.2327
rho	0.368743		Durbin-Watson	1.255723

This table shows the interaction effects between the variables indicating the influence of the independent variables (exchange rate, inflation rate and government reserve) on the dependent variable (GDP). It proves to have a significant connection allying the independent variables with the dependent variable. It demonstrates that both the exchange rate and government reserve positively impact the gross domestic product, whereas the inflation rate exerts a negative influence.

5. SUMMARY AND CONCLUSIONS

In Summary, a descriptive statistics was been conducted on the data of exchange rates, inflation rates, and gross domestic product which are obtained from both the National Bureau of Statistics Central Bank of Nigeria and statistical bulletin and government reserve within the scope of 2003 to 2022 to clarify if the information would fit a normal distribution or not. In this case, the skewness and kurtosis of a normal distribution are close to zero, which means there is a likelihood of a deviation from a normal distribution. This warrants performing a normality test, which indicates that the data adheres to a normal distribution. Additionally, an Augmented Dickey-Fuller first difference was conducted to examine the variables non-staticity. This implies that differencing the original time series data once has made it stationary, which is often a prerequisite for using certain time series models or performing statistical analyses.

The Univariate time series auto-regressive integrated model (ARIMA) was conducted, Both The Auto and partial autocorrelation function plots are employed to assist in identifying the appropriate lag order (p and q) for the model. These plots revealed how many previous findings influence the current impression. The model shows a significant linear connection uniting the GDP and the independent variables that influence currency devaluation. The R square is a determinant coefficient indicating that exchange rate, inflation rate and government reserve describe 99% of the variations in GDP during the period of review while other components not incorporated in the model are been ascribed to the balance of 26%. Due to the relatively high R square and the significance, the model is been demonstrated to be compatibly appropriate for this analysis and prediction of the GDP.

For a test of the model volatility, a residual analysis was conducted, The assessment demonstrates that normality was observed, as indicated by a P-value exceeding the critical value therefore the model was been used to generate a forecast. This forecast shows the actual price of the GDP at 2010 Constant Market from 2003 to 2022 and the predictions from 2004 to 2023. However, they are closely related but slightly different with variations and a predicted value for 2023 with a 95% confidence interval as a range of uncertainty.

Other relationships were been investigated, the Granger causality to test for short-run causal relationships between variables using the vector Auto-regression after the VAR lag Selection, indicates only one past observation difference is required. All variables have p-values that surpass the critical value, confirming the null hypothesis. Thus, neither variable demonstrates Granger causality, suggesting the absence of a causal relationship between them.

The Durbin-Watson non-autocorrelation is close to 2 for all which indicates it is not positive or negative. The Portmanteau test for serial correlation proves a null hypothesis of no serial correlation as shown in p-value [0.2073] above the critical value. A long-run relationship was also been conducted using the Engle-Granger co-integration analysis and the variables at non-stationary. The analysis reveals that when the residual of the co-integrating regression attained stationarity, there was no evident of continual alliance connecting the response and controlled variables.

Diagnostic test to investigate structural breakpoints was been conducted, using the ordinary least square to run the Chow test and the test indicates that all the variables' data and structure are not stable and have been influenced by significant changes. A CUSUM test for the stability of parameters was been conducted to check for stability of the constant term in the regression analysis, which shows the parameters of the constant as stable and null hypothesis is been proven. Finally, an interaction effect examination was conducted using the ordinary least square method and it shows that the independent variable has a strong effect on the dependent.

Conclusively, it is important to note that the research questions raised in the course of this study as follows; “Does exchange rate, inflation rate and government reserve (which represent currency devaluations) relate positively or negatively to economic growth? Which of the three variables impacts more significantly the economy of Nigeria in the scope of the study?” have been answered as summarised above, clearly indicating that exchange rate and government reserve relate positively to economic growth while the inflation rate relates negatively during the review period. This means in Nigeria, currency devaluation relates more positively to the country's development of its economy contrary to Todaro (1982) and Udo, et al. (2018) who opined that currency devaluation aggravates a nation's problem of balance of payment and trade, which means is destructive to the development of the economy. However, it also has some negative effects and that is where some recommendations below become necessary.

5.1 CONSIDERATIONS

It is no doubt that the reduction in the value of the naira is a crucial economic problem in Nigeria, and this devaluation affects the exchange and inflation rate as well as the government reserve which consequently impact the economy significantly. Therefore, the government should consider the revaluation of the currency not to only boost the economy but also to reinstate the value at the international level as follows:

- Reduction of external debt: when the government reduces debt to external bodies, then it can have more funds as external reserves in foreign currency, which can encourage investors with its stability of exchange rate and boost the economy.
- Policy Implementation; There should be policies implemented for the rise and improvement of the productive capacity in every sector of the economy, particularly the export sector, by the government and policymakers with a consistent monetary and fiscal policy.

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APPENDIX

Normality Test

Test for normality of Inflation rate:

Doornik-Hansen test = 0.0833115, with p-value 0.9592

Shapiro-Wilk W = 0.97891, with p-value 0.919259

Lilliefors test = 0.0911873, with p-value $\approx$ 0.96

Jarque-Bera test = 0.505124, with p-value 0.776808

Test for normality of Exchange rate:

Doornik-Hansen test = 11.5946, with p-value 0.00303572

Shapiro-Wilk W = 0.80652, with p-value 0.00108251

Lilliefors test = 0.280564, with p-value $\approx$ 0

Jarque-Bera test = 3.00286, with p-value 0.22281

Test for normality of Government Reserve:

Doornik-Hansen test = 11.3696, with p-value 0.00339729

Shapiro-Wilk W = 0.80818, with p-value 0.00114709

Lilliefors test = 0.227477, with p-value $\approx$ 0.01

Jarque-Bera test = 5.56458, with p-value 0.0618966

Test for normality of GDPat2010ConstantMarketPri:

Doornik-Hansen test = 6.56294, with p-value 0.037573

Shapiro-Wilk W = 0.893634, with p-value 0.0313813

Lilliefors test = 0.204362, with p-value $\approx$ 0.03

Jarque-Bera test = 2.06282, with p-value 0.356504

Augmented Dickey-Fuller test for stationarity

Augmented Dickey-Fuller test for d_GDPat2010ConstantMarketPri

Testing down from 7 lags, criterion AIC, Sample size 11, Unit-root null hypothesis: $a = 1$

Test with constants

Including 7 lags of $(1-L)d_GDPat2010ConstantMarketPri$

Model: $(1-L)y = b_0 + (a-1)*y(-1) + \dots + e$

Estimated value of $(a - 1)$: -3.03552

Test statistic: $\tau_c(1) = -1.86635$

Asymptotic p-value 0.3486

1st-order autocorrelation coeff. For e: -0.488

Lagged differences: $F(7, 2) = 1.803$ [0.4024]

With a constant and trend

Including 7 lags of (1-L)d_GDPat2010ConstantMarketPri

Model: $(1-L)y = b_0 + b_1*t + (a-1)*y(-1) + \dots + e$

Estimated value of (a - 1): -3.17728

Test statistic: $\tau_{ct}(1) = -1.58818$

Asymptotic p-value 0.798

1st-order autocorrelation coeff. for e: -0.618

Lagged differences: $F(7, 1) = 1.195$ [0.6093]

Augmented Dickey-Fuller test for d_ Exchange rate

Testing down from 7 lags, criterion AIC, Sample size 11, Unit-root null hypothesis: $a = 1$

Test with constants

Including 7 lags of (1-L)d_ Exchange rate

Model: $(1-L)y = b_0 + (a-1)*y(-1) + \dots + e$

Estimated value of (a - 1): 3.17622

Test statistic: $\tau_c(1) = 2.39201$

Asymptotic p-value 1

1st-order autocorrelation coeff. for e: -0.252

Lagged differences: $F(7, 2) = 2.724$ [0.2947]

With a constant and trend

Including 7 lags of (1-L)d_ Exchange rate

Model: $(1-L)y = b_0 + b_1*t + (a-1)*y(-1) + \dots + e$

Estimated value of (a - 1): -2.09708

Test statistic: $\tau_{ct}(1) = -0.335503$

Asymptotic p-value 0.9897

1st-order autocorrelation coeff. for e: -0.604

Lagged differences: $F(7, 1) = 2.264$ [0.4724]

Augmented Dickey-Fuller test for d inflation rate

Testing down from 7 lags, criterion AIC

Sample size 11

Unit-root null hypothesis: $\alpha = 1$

Test with constant

Including 7 lags of $(1-L)d_{\text{Inflation rate}}$

Model: $(1-L)y = b_0 + (\alpha-1)y(-1) + \dots + e$

Estimated value of $(\alpha - 1)$: 0.778342

Test statistic: $\tau_c(1) = 0.292484$

Asymptotic p-value 0.978

1st-order autocorrelation coeff. for e : -0.537

Lagged differences: $F(7, 2) = 1.663$ [0.4260]

With constant and trend

Including 5 lags of $(1-L)d_{\text{Inflation rate}}$

Model: $(1-L)y = b_0 + b_1t + (\alpha-1)y(-1) + \dots + e$

Estimated value of $(\alpha - 1)$: -5.71232

Test statistic: $\tau_{ct}(1) = -6.1645$

Asymptotic p-value 4.542e-07

1st-order autocorrelation coeff. for e : -0.032

Lagged differences: $F(5, 5) = 8.009$ [0.0197]

Augmented Dickey-Fuller test for $d_{\text{Government Reserve}}$

Testing down from 7 lags, criterion AIC, Sample size 16, Unit-root null hypothesis: $\alpha = 1$

Test with constant

Including 2 lags of $(1-L)d_{\text{Government Reserve}}$

Model: $(1-L)y = b_0 + (\alpha-1)y(-1) + \dots + e$

Estimated value of $(\alpha - 1)$: -1.22357

Test statistic: $\tau_c(1) = -6.11833$

Asymptotic p-value 6.187e-08

1st-order autocorrelation coeff. for e : -0.145

Lagged differences: $F(2, 12) = 3.764$ [0.0539]

With constant and trend

Including 7 lags of (1-L)d_ Government Reserve

Model: $(1-L)y = b_0 + b_1*t + (a-1)*y(-1) + \dots + e$

Estimated value of $(a - 1)$: -10.5202

Test statistic: $\tau_{ct}(1) = -129.088$

Asymptotic p-value 0.0001

1st-order autocorrelation coeff. for e: -0.234

Lagged differences: $F(7, 1) = 7105.838$ [0.0091]

Autocorrelation

Autocorrelation function for GDPat2010ConstantMarketPri

***, **, * indicate significance at the 1%, 5%, 10% levels

Using standard error $1/T^{0.5}$

LAG	ACF	PACF	Q-stat. [p-value]
1	0.8559 ***	0.8559 ***	16.9656 [0.000]
2	0.7152 ***	-0.0652	29.4681 [0.000]
3	0.5788 ***	-0.0657	38.1375 [0.000]
4	0.4273 *	-0.1428	43.1587 [0.000]

Autocorrelation function for Exchange rate

***, **, * indicate significance at the 1%, 5%, 10% levels

using standard error $1/T^{0.5}$

LAG	ACF	PACF	Q-stat. [p-value]
1	0.8170 ***	0.8170 ***	15.4575 [0.000]
2	0.6361 ***	-0.0944	25.3482 [0.000]
3	0.4701 **	-0.0653	31.0684 [0.000]
4	0.3785 *	0.1136	35.0078 [0.000]

Autocorrelation function for Inflation rate

***, **, * indicate significance at the 1%, 5%, 10% levels

using standard error $1/T^{0.5}$

LAG	ACF	PACF	Q-stat. [p-value]
1	0.3977 *	0.3977 *	3.6623 [0.056]
2	-0.2103	-0.4377 *	4.7437 [0.093]
3	-0.2935	0.0012	6.9735 [0.073]
4	0.0089	0.1237	6.9757 [0.137]

Autocorrelation function for Government Reserve

***, **, * indicate significance at the 1%, 5%, 10% levels

using standard error $1/T^{0.5}$

LAG	ACF	PACF	Q-stat. [p-value]
1	0.6074 ***	0.6074 ***	8.5444 [0.003]
2	0.1006	-0.4253 *	8.7917 [0.012]
3	-0.3164	-0.2808	11.3826 [0.010]
4	-0.2611	0.3444	13.2568 [0.010]

Long Run relationship

GDP and exchange rate : Step 1: testing for a unit root in GDPat2010ConstantMarketPri

Augmented Dickey-Fuller test for GDPat2010ConstantMarketPri

Testing down from 1 lags, criterion AIC, Sample size 19, Unit-root null hypothesis: $a = 1$

Test with constant

Including 0 lags of $(1-L)$ GDPat2010ConstantMarketPri

Model: $(1-L)y = b_0 + (a-1)y(-1) + e$

Estimated value of $(a - 1)$: -0.0567167

Test statistic: $\tau_c(1) = -2.37281$

Asymptotic p-value 0.1496

1st-order autocorrelation coeff. for e: 0.283

Step 2: testing for a unit root in Exchange rate

Augmented Dickey-Fuller test for Exchange rate

Testing down from 1 lag, criterion AIC

Sample size 19

Unit-root null hypothesis: $a = 1$

Test with constant

Including 0 lags of (1-L) Exchange rate

Model: $(1-L)y = b_0 + (a-1)*y(-1) + e$

Estimated value of $(a - 1)$: 0.0999048

Test statistic: $\tau_c(1) = 1.39929$

Asymptotic p-value 0.9991

1st-order autocorrelation coeff. for e: -0.012

Step 4: testing for a unit root in uhat

Augmented Dickey-Fuller test for uhat

Testing down from 1 lags, criterion AIC, Sample size 19, Unit-root null hypothesis: $a = 1$

Test without constant

Including 0 lags of (1-L)uhat

Model: $(1-L)y = (a-1)*y(-1) + e$

Estimated value of $(a - 1)$: -0.203609

Test statistic: $\tau_c(2) = -1.97671$

Asymptotic p-value 0.5402

1st-order autocorrelation coeff. for e: 0.259

There is evidence for a co-integrating relationship if:

- (a) The unit-root hypothesis is not rejected for the individual variables, and
- (b) The unit-root hypothesis is rejected for the residuals (uhat) from the cointegrating regression.

GDP and Inflation rate: Step 1: testing for a unit root in GDPat2010ConstantMarketPri

Augmented Dickey-Fuller test for GDPat2010ConstantMarketPri

Testing down from 1 lags, criterion AIC, Sample size 19, Unit-root null hypothesis: $a = 1$

Test with constant

Including 0 lags of (1-L) GDPat2010ConstantMarketPri

Model: $(1-L)y = b_0 + (a-1)*y(-1) + e$

Estimated value of $(a - 1)$: -0.0567167

Test statistic: $\tau_c(1) = -2.37281$

Asymptotic p-value 0.1496

1st-order autocorrelation coeff. for e: 0.283

Step 2: testing for a unit root in Inflation rate

Augmented Dickey-Fuller test for Inflation rate

Testing down from 1 lags, criterion AIC, Sample size 18, Unit-root null hypothesis: $a = 1$

Test with constant

Including one lag of $(1-L)$ Inflation rate

Model: $(1-L)y = b_0 + (a-1)*y(-1) + \dots + e$

Estimated value of $(a - 1)$: -0.897612

Test statistic: $\tau_c(1) = -3.23613$

Asymptotic p-value 0.01802

1st-order autocorrelation coeff. for e: -0.093

Step 4: testing for a unit root in uhat

Augmented Dickey-Fuller test for uhat

Testing down from 1 lags, criterion AIC, Sample size 18, Unit-root null hypothesis: $a = 1$

Test without constant

Including one lag of $(1-L)$ uhat

Model: $(1-L)y = (a-1)*y(-1) + \dots + e$

Estimated value of $(a - 1)$: -0.0682873

Test statistic: $\tau_c(2) = -1.27114$

Asymptotic p-value 0.8396

1st-order autocorrelation coeff. for e: 0.036

There is evidence for a co-integrating relationship if:

- (a) The unit-root hypothesis is not rejected for the individual variables, and
- (b) The unit-root hypothesis is rejected for the residuals (uhat) from the

Co-integrating regression.

GDP and Government reserve

Step 1: testing for a unit root in GDPat2010ConstantMarketPri

Augmented Dickey-Fuller test for GDPat2010ConstantMarketPri

Testing down from 1 lags, criterion AIC, Sample size 19, Unit-root null hypothesis: $a = 1$

Test with constant

Including 0 lags of (1-L) GDPat2010ConstantMarketPri

Model: $(1-L)y = b_0 + (a-1)*y(-1) + e$

Estimated value of $(a - 1)$: -0.0567167

Test statistic: $\tau_c(1) = -2.37281$

Asymptotic p-value 0.1496

1st-order autocorrelation coeff. for e: 0.283

Step 2: testing for a unit root in Government Reserve

Augmented Dickey-Fuller test for Government Reserve

Testing down from 1 lags, criterion AIC, Sample size 18, Unit-root null hypothesis: $a = 1$

Test with constant

Including one lag of (1-L)GovernmentReserve

Model: $(1-L)y = b_0 + (a-1)*y(-1) + \dots + e$

Estimated value of $(a - 1)$: -0.602325

Test statistic: $\tau_c(1) = -3.88082$

Asymptotic p-value 0.00219

1st-order autocorrelation coeff. for e: -0.438

Step 4: testing for a unit root in uhat

Augmented Dickey-Fuller test for uhat

Testing down from 1 lags, criterion AIC

Sample size 18, Unit-root null hypothesis: $a = 1$

Test without constant

Including one lag of (1-L)uhat

Model: $(1-L)y = (a-1)*y(-1) + \dots + e$

Estimated value of $(a - 1)$: -0.103344

Test statistic: $\tau_c(2) = -0.94386$

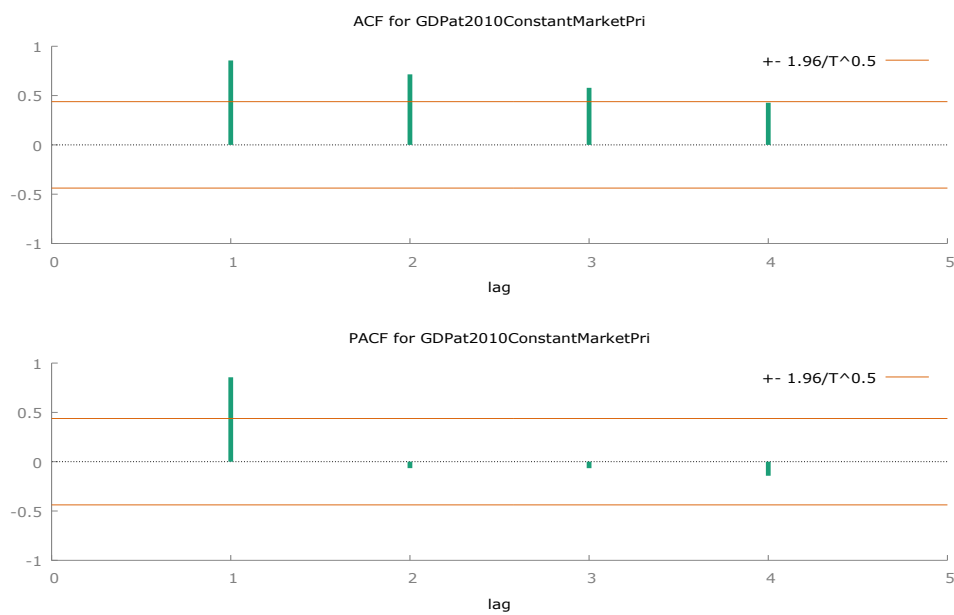
Asymptotic p-value 0.9113

1st-order autocorrelation coeff. for e: 0.074

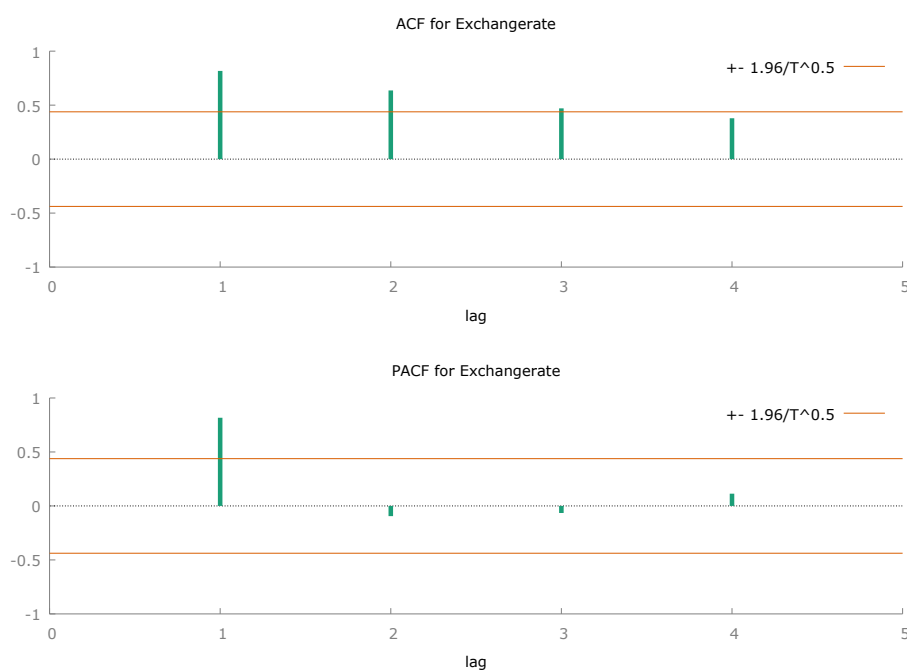
There is evidence for a cointegrating relationship if:

- (a) The unit-root hypothesis is not rejected for the individual variables, and
- (b) the unit-root hypothesis is rejected for the residuals (uhat) from the cointegrating regression.

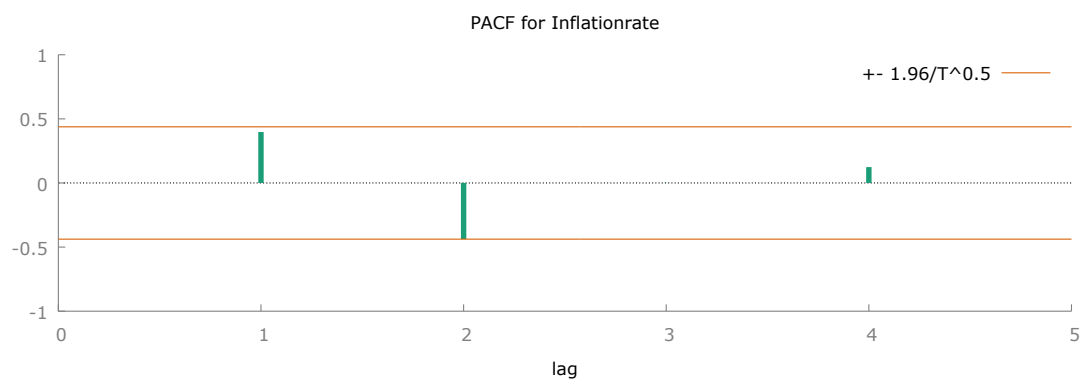
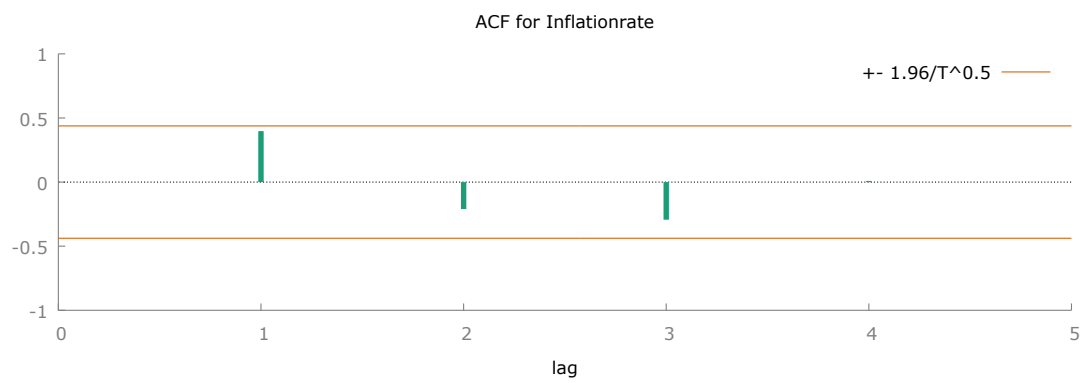
Graph 1



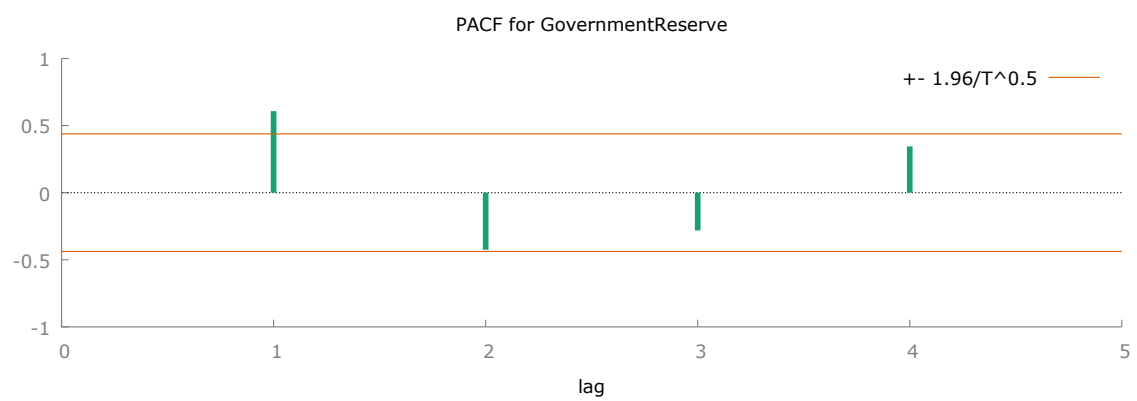
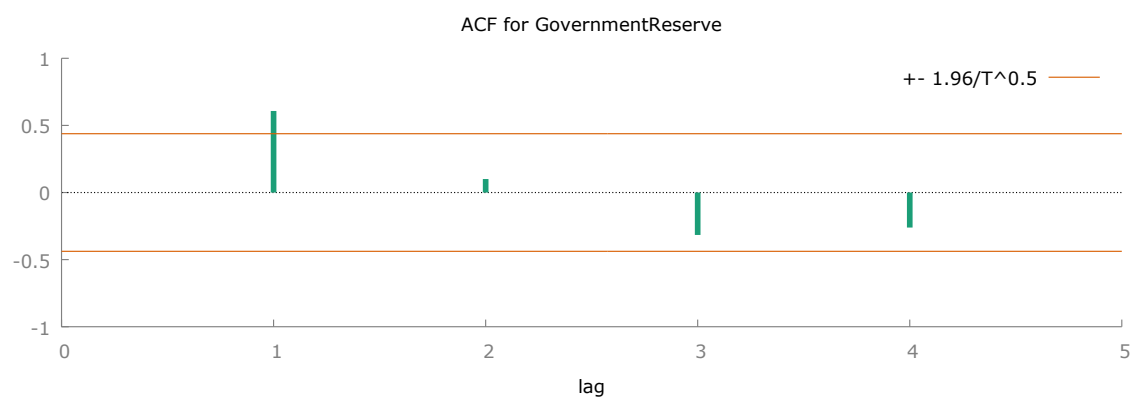
Graph 2



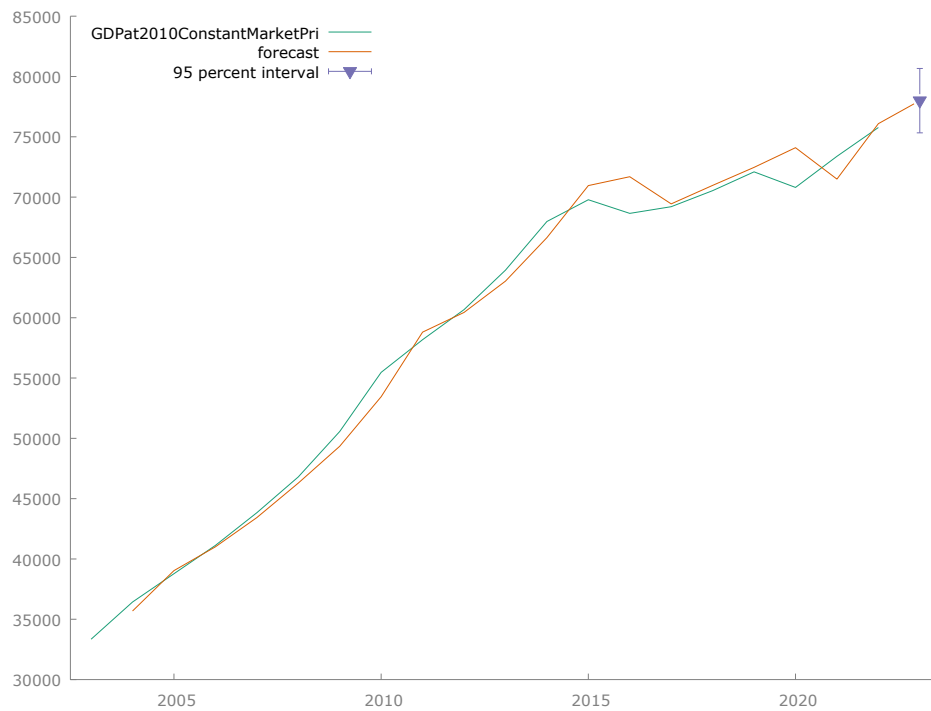
Graph3



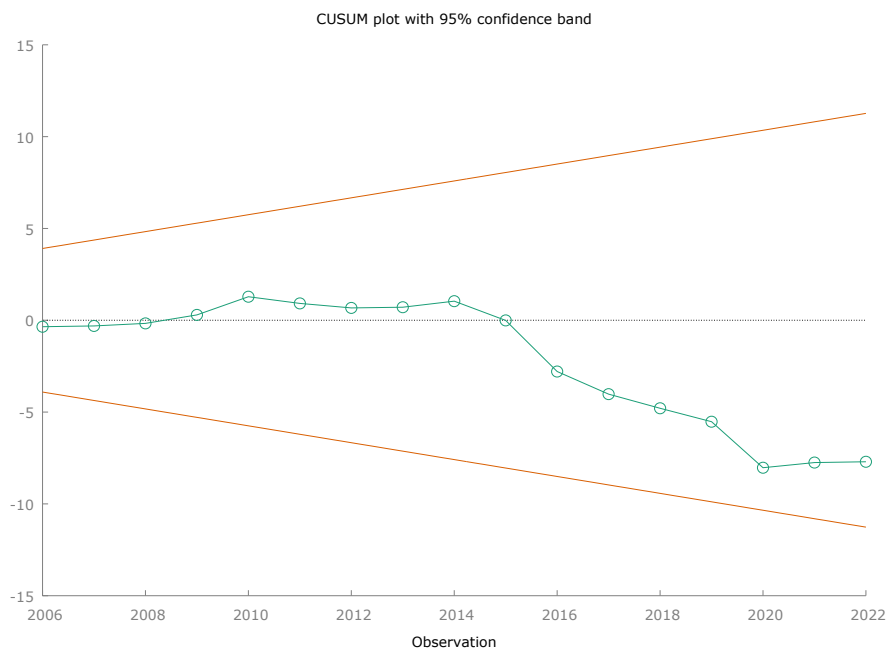
Graph 4



Graph 5



Graph 6



Statistical Data

Tyear	Period	GDP at 2010 Constant Market Prices	Exchange rate	Inflation rate	Government Reserve
2003	Annual	33346.62	136.5	167.2	1065093
2004	Annual	36431.37	132.35	184.6	2478620
2005	Annual	38777.01	128.5	214.2	3835433
2006	Annual	41126.68	126.5	100.5	42298111631
2007	Annual	43837.39	116.3	65	51333152496
2008	Annual	46802.76	130.75	138.3	52823044779
2009	Annual	50564.26	147.6	151.1	42409433657
2010	Annual	55469.35	148.67	165.1	32347493828
2011	Annual	58180.35	156.2	130.2	32915095193
2012	Annual	60670.05	155.27	146.9	44178395481
2013	Annual	63942.85	155.2	102.2	43610514240
2014	Annual	67977.46	167.5	96.7	34468621681
2015	Annual	69780.69	196.5	108.12	29069779152
2016	Annual	68652.43	304.5	187.5	25843598926
2017	Annual	69205.69	305.5	198.57	38765961445
2018	Annual	70536.35	306.5	145.75	43116863593
2019	Annual	72094.09	306.5	136.7	38595257596
2020	Annual	70800.54	379.5	158.51	35373915213
2021	Annual	73382.77	412.99	203.81	40520531730
2022	Annual	75768.95	448.55	225.18	37082778138

Sourced. Central bank of Nigeria <https://www.cbn.gov.ng/rates/>