



## INVESTIGATING THE DETERMINANTS OF INFLATION IN LEADING ECONOMIES IN AFRICA: A PANEL DATA ANALYSIS

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**ABSTRACT:** *This paper empirically investigates the determinants of inflation in leading economies in Africa, namely Nigeria, South Africa, and Angola for the period 2001-2020. By applying the techniques of the ordinary least square (OLS) panel regression model and fixed effect model, the study finds out broad money growth, deposit interest rate, and lending interest rate positively significantly affected inflation, whereas exchange rate and exports positively affected inflation but not significantly. On the other hand, gross domestic product growth negatively affected inflation, while real interest rates and imports affected inflation negatively but not significantly.*

**KEYWORDS:** Inflation, panel regression, leading economies



## INTRODUCTION

Inflation has been for many years a subject of debate and counter-debate because of the critical role it plays in the stability of macroeconomic variables. Price stability is one of the macroeconomic variables that has been difficult to stabilise by many central banks, individuals, and organisations. However, every government, especially the Central Bank, is responsible for ensuring that its plans and programmes are not affected by unpredicted and galloping prices and that inflation is in its monetary policy framework (Amaefula, 2016). Inflation is a persistent and appreciable rise in the general price level (Bayo, 2004; Ojo, 2000), where the rise is constant, enduring and sustained, and all commodities are affected. The effects of inflation on the people and the economy at large, have motivated many researchers' interest in inflation and its determinants (Muktadir-Al-Mukit et al., 2014). Moderate inflation motivates entrepreneurs, investors, and producers (Anfofum et al, 2015). Inflation is a persistent rise in the general price level of goods and services in a nation in a particular period of time.

This present study aimed to investigate the determinants of inflation in Nigeria, South Africa, and Angola the top three growing economies in Africa. We selected eight economic variables for the study, one response (dependent) variable which is inflation and seven predictor variables which are gross domestic product growth, exchange rate, broad money growth, real interest rate, deposit interest rate, lending interest rate, imports and exports of goods and services as elicited in the studies (Ahmed et al., 2018; Cole, 1986; Gyebi & Boafo, 2013; Khan & Gill, 2010; Mohanty & John, 2015; Nurul & Tarmizi, 2018; Rizwan et al., 2018; Sahadudheen, 2012; Sahoo & Sethi, 2020).

The primary objective of this study is to ascertain the association between gross domestic product growth, exchange rate, broad money growth, real interest rate, deposit interest rate, lending interest rate, imports and exports of goods and services and inflation. The critical question of this study is as follows: is there any impact of gross domestic product growth, exchange rate, broad money growth, real interest rate, deposit interest rate, lending interest rate and imports and exports of goods and services on inflation?

Our study focused on the first three fast-growing economies in Africa – Nigeria, South Africa, and Angola according to the International Monetary Fund (IMF). We used annual data from the World Development Indicator (WDI) covering the period of twenty years (2001-2020). We applied the ordinary least square panel regression technique to analyse the data. Our findings showed that real interest rates and imports of goods and services have a negative but insignificant impact on inflation, while gross domestic product growth has a significant negative impact on inflation. In addition to this, our findings also showed that broad money growth, deposit interest rate, and lending interest rate have a positive significant impact on inflation, while exchange rate and exports of goods and services have a positive but insignificant impact on inflation. consequently, the findings showed the presence of multicollinearity because of the strong correlation existing between imports and exports, and between lending interest rate and deposit interest rate. We carefully developed four ordinary least squares (OLS) fixed panel regression models to overcome the problem of multicollinearity in the predictor variables.



The current study will contribute to the literature in the following ways. First, this study will add to the body of literature on the investigation of determinants of inflation; second, our study has a lot of consequences for monetary policymakers, academic researches, private researchers, investors, and business managers.

The rest of the paper is organised as follows: literature and theoretical review are discussed in section two. In section three, the source of data, model specification and methods are discussed, while the findings of the study and discussion are presented in section four. The last section which is five contains the conclusion, limitations, and future directions.

## LITERATURE REVIEW AND HYPOTHESES FORMATION

### Theoretical framework

Inflation is a sustained and persistent rise in the general price level of goods and services. There are many theories that tried to explain the causes of inflation and most of these theories are formulated based on the supply and demand of goods and services.

The demand-pull theory of inflation states that the persistent rise in the general price level of goods and services is caused as a result of when the aggregate demand for goods and services exceeds the aggregate supply for goods and services (Otto & Ukpere, 2016). This implies that when the total amount of money supply in the economy exceeds the supply of goods and services, then there is a higher possibility that the prices of these goods and services will rise (Ayinde et al, 2010; Jhingan, 2003).

The purchasing power parity theory states that if the price level of goods and services in two countries are persistently rising, and the domestic country is facing higher inflation compared to the other country, then the exchange rate of the domestic country relative to the other country will depreciate (Lowe, 2019). This also implies that the country with decreased exports and increased imports during inflation faces exchange rate depreciation.

Cost-push theory comes into play when there is a persistent rise in wages and other product costs. This persistent rise causes the manufacturer to transfer the rising costs to the consumers, which leads to higher prices (Undji & Kaulihowa, 2015). However, the depreciation in the exchange rate can also lead to a rise in the prices of goods and services, this is because most producers import their raw materials for production (Ahamba et al., 2020). This type of inflation is a result of the high cost of the raw materials manufacturers import and the high cost of production (Ogbokor & Sunde, 2011).

### Gross domestic product (GDP) growth and inflation

The relationship between GDP growth and inflation has been a matter of consideration and debate for a long now (Qaiser & Kasim, 2009). Many schools of thought have offered different evidence regarding the relationship between GDP growth and inflation, some are of the view that inflation is essential, while others say it is detrimental to GDP growth (Malik & Chowdhury, 2001). GDP growth is an indicator that shows whether a country's economy is rising or declining (Ellina & Yustirania, 2022).



Many studies have shown empirically that the relationship between GDP growth and inflation is significantly negative, while others say the relationship is negative but insignificant. For instance, Fischer (1993) examined the relationship between GDP growth and inflation by using data from 93 countries, which includes both developing and industrialised countries. The results of his findings suggested that the connection between GDP growth and inflation is negative but not significant. In another study, Khan & Senhadji (2001) examined the connection between GDP growth and inflation using an unbalanced panel data of 140 countries from 1960 to 1998, covering both industrial and developing countries, and applying the nonlinear least square estimation method. Their results showed that there is a negative and significant relationship between GDP growth and inflation. However, this present study aims to investigate the following hypothesis:

**H0:** Gross domestic product growth has a positive impact on inflation

### **Exchange rate and inflation**

For many decades now, the exchange rate has been a matter of debate of macroeconomic policies in emerging markets (Gheorghe & Ioana, 2015), and many theories have emerged to generate more debate on exchange rate. The purchasing power parity theory establishes a connection between inflation and a domestic currency against another country's currency. High inflation can threaten the exchange rate fluctuation (Okoli et al., 2016), while depreciation of the exchange rate can lead to a rise in the prices of goods and services (Okeke et al., 2022).

Many studies carried out on the effect of exchange on inflation suggested that exchange rate has a positive impact on inflation, for instance, Imimole and Enoma (2011) examined the impact of exchange rate depreciation on inflation in Nigeria, using data from 1986 to 2008, and applying autoregressive distribution lag (ARDL) cointegration method; the outcome of their findings showed that exchange rate has a positive significant impact on inflation in Nigeria. Fatukasi (2006) investigated the determinants of inflation in Nigeria from 1981 to 2003, his findings showed that the exchange rate has a positive significant impact on inflation. Another study from Uddin et al (2014) showed that the exchange rate has a positive significant impact on inflation when they examined the connection between inflation and its determinants in Bangladesh using data from 1972 to 2012, using the methods of autoregressive distributed lag (ARDL). Musa and Yousif (2018) in their study "modelling the determinants of inflation in Sudan using a generalised method of moments for the period 2000-2017", found that the exchange rate has a positive significant impact on inflation. However, this present study aims to investigate the following hypothesis

**H0:** Exchange rate has a positive impact on inflation

### **Broad money growth and inflation**

The financial association between monetary aggregates and inflation has been of great concern to researchers in the world for many years. Some of the work on broad money (money supply) can be found in the following literature: Nguyen (2015) evaluated empirically the impact of deficit financing and broad money on inflation of nine Asian countries, using data from 1985 to 2015, and by applying the methods of pooled mean group estimate and generalized method of moment (GMM); the outcome of his findings showed that broad money has a positive impact on inflation, while deficit financing has a positive sign on inflation. Diermeier and Goecke (2016) investigated the association between money supply and inflation in Eurozone using



annual data from 1970 to 2006, they applied the methods of VAR for the analysis, and their findings showed that the growth of monetary aggregates has no association with inflation. Another study by Berger & Österholm (2011) revealed that the growth of the money supply has a positive relationship with inflation. Kiganda (2014) found out that money supply has a positive affiliation with inflation when he investigated the association between money supply and inflation using data for the period 1984-202 and the method of VECM. Other studies that revealed that money supply has a positive association with inflation can be seen in Mbongo et al. (2012); Chaudhry et al. (2015); Qayyum, 2006. However, this present study aims to investigate the following hypothesis.

**H<sub>0</sub>:** Broad money growth has a positive impact on inflation

### **Real interest rate and inflation**

Real interest rate is the rate of interest a lender, an investor, or a saver receives after inflation is subtracted from the nominal interest rate, while the interest rate is just the cost imposed on the borrower. However, a low interest usually increases the borrowing power of the consumers. Inflation tends to rise once the interest rate decreases and decreases when the interest rate is high, this implies that a rise in inflation diminishes the real value of the investment. Many studies have empirically and theoretically studied the relationship between interest rates and inflation over many decades now (Amaefula, 2016). For instance, Umoru and Oseme (2013) examined the relationship between inflationary expectations and the variations in interest rates, by applying the methods of generalised method of moment (GMM) estimator. The results of the findings showed that interest rate variation has a negative significant impact on inflation expectation. Another study by Pennacchi (1991) revealed that real interest rate has a negative significant relationship with inflation. However, this present study aims to investigate the following hypothesis

**H<sub>0</sub>:** Real interest rate has a positive impact on inflation

### **Deposit interest rate and inflation**

Deposit is one of the major shares of bank financial portfolios (Youssef et al., 2022). Financial institutions face challenges especially when there is a structural change in the bank portfolio. Deposit rates differ from one financial institution to another because of some internal or external factors. However, consumers tend to increase their savings in the bank especially when there is an increase in the deposit rate. When this happens, there is a decline in the money supply. Conversely, a decrease in the deposit rate makes consumers' willingness of saving their money in the bank reduce. Orok et al. (2018) examined the association between deposit mobilisation in banks and inflation in Nigeria using data from selected banks for the period 1994-2014. They applied the techniques of ordinary least square regression for the analysis. The outcomes of their findings showed that deposit interest rate has a negative significant association with inflation, why demand and savings are significantly negatively associate with deposit time. However, this present study aims to investigate the following hypothesis:

**H<sub>0</sub>:** Deposit interest rate has a positive impact on inflation



### **Lending interest rate and inflation**

Lending is one of the functions of financial institutions through which they can influence the economy and stability of the economy. Low and restricted bank lending and as well as excessive bank lending to the unproductive sector can cause an increase in inflation (Dhungana & Pradhan, 2017), and can also increase the vulnerability of the economy towards external financial pressures. An uncontrolled bank lending to the private sector can trigger inflation, and as well undermines the efficiency of monetary policy (Debelle, 2004). Though much attention has not been given to the link between lending and inflation by researchers, we have some studies that showed that lending has a positive relationship with inflation, for instance, studies by (Antzoulatos, 1996; Ludvigson, 1999). This study aims to investigate the following hypothesis:

**H0:** The lending rate has a positive impact on inflation

### **Imports and inflation**

Imports are transactions in goods and services between consumers of a country and the rest of the world that involves a change of ownership, that is, from non-residents to residents. The imports can affect inflation directly through the prices of imported goods or indirectly through domestic competition (Dexter, 2005). However, a rise in imports usually leads to a decrease in the exchange rate, thereby increasing inflation. Consequently, a depreciation in a country's currency makes imports very expensive and subsequently the cost of production of goods rises because of an increase in the prices of raw materials. This implies that higher imports lead to increased inflation. The dynamic association of imports and inflation has been a concern to researchers for decades now. For instance, Abidemi and Malik (2010) investigated the relationship between inflation and its determinants in Nigeria using data for the period 1970-2007. They applied the Johansen co-integration technique and error correction model for the analysis. The results revealed that imports have a positive relationship with inflation. Another study by Ulke et al (2010) also revealed that there is a positive association between imports and inflation. Munepapa and Sheefeni (2017) examined the impact of imports on inflation in Namibia, using quarterly data for the period 1991Q1 to 2013Q4. They applied the method of error correction modelling for the analysis. Their findings showed that import has a positive but not significant effect on inflation. Ofori et al (2015) examined the link between imports and inflation in Ghana using data from 1960 to 2012. Their findings revealed that import is negatively associated with inflation. Islam (2013) investigated the association between imports and inflation in Bangladesh. His findings showed that there is a positive insignificant association between imports and inflation. However, this present study aims to investigate the following hypothesis:

**H0:** Imports of goods and services have a positive impact on inflation

### **Exports and inflation**

Exports are transactions in goods and services between consumers of a country and the rest of the world that involves a change of ownership, that is, from residents to non-residents. Exports affect the prices of goods and services as well as their supplies available to domestic consumers. Exporting goods and services to other nations is another way of handling excess output



(Muktadir-Al-Mukit & Shafiullah, 2014). Moreover, an increase in exports of goods and services will lead to an appreciation of the local currency and a depreciation of the foreign currency, thereby reducing inflation. Nurul and Tarmizi (2018) examined the effect of export and import on inflation in Indonesia for the period 1990-2016, using annual data from BPS Indonesia and Bank Indonesia. They analysed their data using the techniques of ordinary least square multiple linear regression. The findings showed that exports have no impact on inflation. In another study, Sahoo and Sethi (2020) examined the relationship between exports, imports, and inflation in India using data for the period 1975-2017. They employed the methods of Johansen co-integration, variance decomposition analysis, and impulse response function for the analysis of the data. Their findings revealed that export has a positive impact on inflation. Ahmed et al (2018) examined the association between inflation and exports and imports in Pakistan. The output of their results showed that influences inflation. However, this present study aims to investigate the following hypothesis:

**H0:** Exports of goods and services have a positive impact on inflation

## Materials And Methods

### Materials

We used data from the annual report of the Central Bank of Nigeria (CBN) statistical Bulletin and World Bank Development Indicator (WDI) to test our hypotheses. The data are collected from Nigeria, South Africa, and Angola for the period 2001-2020. An equal sample size of twenty (20) was elected for Nigeria, South Africa, and Angola. We selected eight economic variables for the study, one response (dependent) variable which is inflation and seven predictor variables which are gross domestic product growth, exchange rate, broad money growth, real interest rate, deposit interest rate, lending interest rate, imports and exports of goods and services.

### Methods

We adopted the techniques of ordinary least square panel regression with a fixed effect model to ascertain the effects of the predictor variables on the inflation proxied by consumer price inflation. The variables were subjected to fixed effects regressions. The reason for this choice was that fixed effect models can control the observed heterogeneity (Hegde & Mishra, 2019) and it also allows for heteroscedasticity and serial correlation to be addressed by the standard errors (Driscoll & Kraay, 1998). We carefully developed four ordinary least square (OLS) fixed panel regression models for robust analysis and to overcome the problem of multicollinearity in the predictor variables. The ordinary least square panel regression model for the analysis of the data is given as

$$\begin{aligned}
 INF_t = & \beta_0 + \beta_1 GDP_{it} + \beta_2 EXCR_{it} + \beta_3 BMG_{it} + \beta_4 RINR_{it} + \beta_5 DINR_{it} + \beta_6 LINR_{it} \\
 & + \beta_7 IMP_{it} + \beta_8 EXP_{it} \\
 & + \varepsilon_t
 \end{aligned}
 \tag{1}$$

where  $INF_{it}$  is the consumer price inflation in year  $t$ ,  $IMP_{it}$ ,  $EXP_{it}$ ,  $BMG_{it}$ ,  $EXCR_{it}$ ,  $RINR_{it}$ ,  $DINR_{it}$ ,  $LINR_{it}$  and  $GDP_{it}$  are the predictor variables of the models that reflect the impact of consumer price inflation at time  $t$ .



## Variable description

Table 1 presents the variables used in this study and their definition

**Table 1. Variable Description**

Variable Type	Variables	Variable name	Definition
Response variable	INF	Inflation proxied by consumer prices	The sustained and continuous rise in the general price level of goods and services. Measured in percentage (%)s
Predictor variables	IMP	Imports of goods and services	These are transactions in goods and services between people of a particular country and the rest of the world that involve a change of ownership, that is, from non-residents to residents. Measured in a million US dollars.
	EXP	Exports of goods and services	These are transactions in goods and services between people of a particular country and the rest of the world that involve a change of ownership, that is, from residents to non-residents. Measured in a million US dollars.
	BMG	Broad money growth	The total sum of currency outside banks; foreign currency deposited by residents sectors other than government. Measured in percentage (%)
	RINR	Real interest rate	The rate of interest a lender, an investor, or a saver receives after allowing for inflation. Measured in percentage (%)
	DINR	Deposit interest rate	The interest commercial banks or other financial institutions pay to deposit account holders. Measured in percentage (%)
	LINR	Lending interest rate	The amount charged by lenders for a period of time. Measured in percentage (%)
	GDPR	Gross domestic product growth rate	It compares the year-over-year change in a nation's output to measure the rate at which an economy is growing. It is given in annual percentage (%)





	EXCR	Exchange rate	The rate at which a local currency is exchanged for another currency. measured per \$1
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## RESULTS AND DISCUSSION

### Summary statistics

Table 2 shows the summary statistics for the entire variables with Nigeria, South Africa, and Angola as subsamples. The total observations, the mean value, the standard deviation, the skewness (SK), and the kurtosis (KT).

### From Nigeria perspective

From Table 2, the consumer prices inflation gives a mean value of 12.39% and a standard deviation of 3.47%, with skewness and kurtosis of -0.028 and -0.248 respectively, which indicates that the consumer price inflation distribution is negatively skewed and playkurtic; (2) the gross domestic product growth gives a mean value of 5.32% and a standard deviation of 3.91%, with skewness and kurtosis of 0.234 and 1.343 respectively, implying that the gross domestic product growth distribution is positively skewed and playkurtic; (3) the exchange rate gives a mean value of 182.41 per a \$1 and a standard deviation of 77.47 per a \$1, with skewness and kurtosis of 1.234 and 0.071 respectively, implying that exchange rate distribution is positively skewed and playkurtic; (4) the broad money growth gives a mean value of 21.14% and a standard deviation of 19.42%, with skewness and kurtosis of 2.229 and 6.916 respectively, implying that the broad money growth distribution is positively skewed and leptokurtic; (5) the real interest rate gives a mean value of 6.35% and a standard deviation of 5.74%, with skewness and kurtosis of -0.176 and 0.234 respectively, implying that real interest rate distribution is negatively skewed and playkurtic; (6) the deposit interest rate gives a mean value of 10.13% and a standard deviation of 3.19%, with skewness and kurtosis of 0.401 and -0.0263 respectively, implying that the deposit interest rate distribution is positively skewed and playkurtic; (7) the lending interest rate gives a mean value of 17.74% and a standard deviation of 2.66%, with skewness and kurtosis of 1.407 and 2.238 respectively, implying that the lending interest rate distribution is positively skewed and playkurtic; (8) the imports of goods and services gives a mean value of \$56.17 billion and a standard deviation of \$26.21 billion, with skewness and kurtosis of -0.136 and -1.125 respectively, implying that the imports of goods and services distribution is negatively skewed and playkurtic; (9) the exports of goods and services gives a mean value of \$60.77 billion and a standard deviation of \$26.08 billion, with skewness and kurtosis of 0.036 and -0.962 respectively, implying that the exports of goods and services distribution is positively skewed and playkurtic.

### From South Africa perspective

From Table 2, the consumer prices inflation gives a mean value of 5.19% and a standard deviation of 2.38%, with skewness and kurtosis of -0.179 and 1.627 respectively, which indicates that the consumer price inflation distribution is negatively skewed and playkurtic; (2) the gross domestic product growth gives a mean value of 2.16% and a standard deviation of



2.69%, with skewness and kurtosis of -1.611 and 4.310 respectively, implying that the gross domestic product growth distribution is negatively skewed and leptokurtic; (3) the exchange rate gives a mean value of 9.92 per a \$1 and a standard deviation of 3.16 per a \$1, with skewness and kurtosis of 0.701 and -0.845 respectively, implying that exchange rate distribution is positively skewed and playkurtic; (4) the broad money growth gives a mean value of 11.32% and a standard deviation of 6.64%, with skewness and kurtosis of 0.664 and -0.864 respectively, implying that the broad money growth distribution is positively skewed and playkurtic; (5) the real interest rate gives a mean value of 4.33% and a standard deviation of 1.50%, with skewness and kurtosis of 0.700 and 0.491 respectively, implying that real interest rate distribution is positively skewed and playkurtic; (6) the deposit interest rate gives a mean value of 7.34% and a standard deviation of 1.89%, with skewness and kurtosis of 0.890 and -0.008 respectively, implying that the deposit interest rate distribution is positively skewed and playkurtic; (7) the lending interest rate gives a mean value of 11.06% and a standard deviation of 2.35%, with skewness and kurtosis of 0.784 and -0.387 respectively, implying that the lending interest rate distribution is positively skewed and playkurtic; (8) the imports of goods and services gives a mean value of \$88.63 billion and a standard deviation of \$28.94 billion, with skewness and kurtosis of -0.806 and -0.275 respectively, implying that the imports of goods and services distribution is negatively skewed and playkurtic; (9) the exports of goods and services give a mean value of \$89.08 billion and a standard deviation of \$26.98 billion, with skewness and kurtosis of -0.827 and -0.306 respectively, implying that the exports of goods and services distribution are negatively skewed and playkurtic.

### **For Angola perspective**

From Table 2, the consumer prices inflation gives a mean value of 33.09% and a standard deviation of 39.56%, with skewness and kurtosis of 2.181 and 4.059 respectively, which indicates that the consumer price inflation distribution is positively skewed and leptokurtic; (2) the gross domestic product growth gives a mean value of 5.09% and a standard deviation of 6.05%, with skewness and kurtosis of 0.168 and -1.018 respectively, implying that the gross domestic product growth distribution is positively skewed and playkurtic; (3) the exchange rate gives a mean value of 137.20 per a \$1 and a standard deviation of 128.93 per a \$1, with skewness and kurtosis of 2.595 and 7.196 respectively, implying that exchange rate distribution is positively skewed and leptokurtic; (4) the broad money growth gives a mean value of 45.52% and a standard deviation of 46.90%, with skewness and kurtosis of 1.594 and 1.955 respectively, implying that the broad money growth distribution is positively skewed and playkurtic; (5) the real interest rate gives a mean value of 4.41% and a standard deviation of 16.57%, with skewness and kurtosis of 0.249 and 1.084 respectively, implying that real interest rate distribution is positively skewed and playkurtic; (6) the deposit interest rate gives a mean value of 12.05% and a standard deviation of 13.53%, with skewness and kurtosis of 2.208 and 4.068 respectively, implying that the deposit interest rate distribution is positively skewed and leptokurtic; (7) the lending interest rate gives a mean value of 35.16% and a standard deviation of 31.85%, with skewness and kurtosis of 1.347 and -0.027 respectively, implying that the lending interest rate distribution is positively skewed and playkurtic; (8) the imports of goods and services gives a mean value of \$24.78 billion and a standard deviation of \$15.53 billion, with skewness and kurtosis of 0.400 and -1.595 respectively, implying that the imports of goods and services distribution is positively skewed and playkurtic; (9) the exports of goods and services gives a mean value of \$35.05 billion and a standard deviation of \$21.69 billion, with



skewness and kurtosis of 0.398 and -1.280 respectively, implying that the exports of goods and services distribution is positively skewed and leptokurtic.

### Summary statistics for the panel data

Table 3 shows the summary statistics for the panel data. The total observations, the mean value, the standard deviation, the skewness, and the kurtosis.

From Table 3, the consumer prices inflation gives a mean value of 16.88% and a standard deviation of 25.53%, with skewness and kurtosis of 4.003 and 16.979 respectively, which indicates that the consumer price inflation distribution is positively skewed and leptokurtic; (2) the gross domestic product growth gives a mean value of 4.19% and a standard deviation of 4.60%, with skewness and kurtosis of 0.403 and 0.422 respectively, implying that the gross domestic product growth distribution is positively skewed and leptokurtic; (3) the exchange rate gives a mean value of 109.84 per a \$1 and a standard deviation of 112.75 per a \$1, with skewness and kurtosis of 1.758 and 4.238 respectively, implying that exchange rate distribution is positively skewed and leptokurtic; (4) the broad money growth gives a mean value of 25.99% and a standard deviation of 32.47%, with skewness and kurtosis of 2.809 and 8.729 respectively, implying that the broad money growth distribution is positively skewed and leptokurtic; (5) the real interest rate gives a mean value of 5.03% and a standard deviation of 10.03%, with skewness and kurtosis of 0.200 and 5.823 respectively, implying that real interest rate distribution is positively skewed and leptokurtic; (6) the deposit interest rate gives a mean value of 9.84% and a standard deviation of 8.20%, with skewness and kurtosis of 3.709 and 15.411 respectively, implying that the deposit interest rate distribution is positively skewed and leptokurtic; (7) the lending interest rate gives a mean value of 21.32% and a standard deviation of 20.88%, with skewness and kurtosis of 3.029 and 8.152 respectively, implying that the lending interest rate distribution is positively skewed and leptokurtic; (8) the imports of goods and services gives a mean value of \$56.52 billion and a standard deviation of \$35.49 billion, with skewness and kurtosis of 0.296 and -1.141 respectively, implying that the imports of goods and services distribution are positively skewed and leptokurtic; (9) the exports of goods and services gives a mean value of \$61.63 billion and a standard deviation of \$33.17 billion, with skewness and kurtosis of 0.112 and -1.128 respectively, implying that the exports of goods and services distribution are positively skewed and leptokurtic.

### Correlation analysis

Table 4 reports the correlation matrix in this study. The empirical results showed that a strong negative relationship exists between exports of goods and services and imports of goods and services, in addition, a strong negative relationship also exists between lending interest rate and deposit interest rate, thus, this relationship is a result of the presence of multicollinearity. Consequently, Table 4 showed that gross domestic product growth, real interest rate, and imports of goods and services have a positive relationship with consumer price inflation; exchange rate, broad money growth, deposit interest rate, lending interest rate, and exports of goods and services have a positive relationship with consumer price inflation, but the relationship between consumer price inflation with the exchange rate and exports is insignificant.

**Table 2. Summary statistics for the countries**

	Obs.	<b>Nigeria</b>				<b>South Africa</b>				<b>Angola</b>			
		Mean	Std. Deviation	SK	KT	Mean	Std. Deviation	SK	KT	Mean	Std. Deviation	SK	KT
INF	20	12.39	3.47	-0.028	-0.248	5.19	2.38	-0.179	1.627	33.07	39.56	2.181	4.059
GDPR	20	5.32	3.91	0.234	1.343	2.16	2.69	-1.611	4.310	5.09	6.05	0.168	-1.018
EXCR	20	182.41	77.47	1.234	0.071	9.92	3.16	0.701	-0.845	137.20	128.93	2.595	7.196
BMG	20	21.14	19.42	2.229	6.916	11.32	6.64	0.664	-0.864	45.52	46.90	1.594	1.955
RINR	20	6.35	5.74	-0.176	0.234	4.33	1.50	0.700	0.491	4.41	16.57	0.249	1.084
DINR	20	10.13	3.19	0.401	-0.263	7.34	1.89	0.890	-0.008	12.05	13.53	2.208	4.068
LINR	20	17.74	2.66	1.407	2.238	11.06	2.35	0.784	-0.387	35.16	31.85	1.347	-0.027
IMP	20	56.17	26.21	-0.136	-1.125	88.63	28.94	-0.806	-0.275	24.78	15.53	0.400	-1.595
EXP	20	60.77	26.08	0.036	-0.961	89.08	26.98	-0.827	-0.306	35.05	21.69	0.398	-1.280

**Table 3. Summary statistics for the panel data**

	Obs.	Min.	Max.	Mean	Std. Deviation	Skewness	Kurtosis
INF	60	-0.7	152.6	16.88	25.53	4.003	16.979
GDPR	60	-6.3	15.3	4.19	4.60	0.403	0.422
EXCR	60	6.36	578.26	109.84	112.75	1.758	4.238
BMG	60	-0.8	163.0	25.99	32.47	2.809	8.729
RINR	60	-33.6	39.0	5.03	10.03	0.200	5.823
DINR	60	3.1	48.7	9.84	8.20	3.709	15.411
LINR	60	7.7	97.3	21.32	20.88	3.029	8.152
IMP	60	6.70	123.43	56.52	35.49	0.296	-1.141
EXP	60	6.74	126.91	61.63	33.17	0.112	-1.128

**Table 4. Correlation Matrix of the panel data**

	INF	GDPR	EXCR	BMG	RINR	DINR	LINR	IMP	EXP
INF	1.000								
GDPR	-0.578	1.000							
EXCR	0.020	0.236	1.000						
BMG	0.322	-0.177	-0.008	1.000					
RINR	-0.180	-0.225	0.097	0.174	1.000				
DINR	0.513	-0.076	0.176	-	0.297	1.000			
				0.333					
LINR	0.643	-0.016	-0.004	-	-0.348	-0.637	1.000		
				0.233					
IMP	-0.054	0.326	-0.039	0.258	-0.226	-0.311	0.029	1.000	
EXP	0.006	-0.264	0.229	-	0.236	0.297	0.089	-0.916	1.000
				0.212					

## Main Findings

This section assesses the impact of gross domestic product growth, exchange rate, board money growth, real interest rate, deposit interest rate, lending interest rate, imports of goods and services, and exports of goods and services on consumer price inflation.

Table 5 shows how the gross domestic product growth, exchange rate, board money growth, real interest rate, deposit interest rate, lending interest rate, imports of goods and services, and exports of goods and services influence consumer price inflation. For robust analysis, however, to avoid omission bias, four OLS panel regression models were used. Model 1 contains six predictor variables (GDPR, BMG, RINR, DINR, LINR, and IMP); model 2 contains seven predictor variables (GDPR, EXCR, RINR, DINR, LINR, IMP and EXP); model 3 contains seven predictor variables (GDPR, EXCR, BMG, RINR, DINR, LINR and EXP); and model 4 contains seven predictor variables (GDPR, EXCR, BMG, RINR, DINR, LINR, and IMP). The OLS panel regression models for the analysis are written as



$$INF_t = \beta_0 + \beta_1 GDP_{it} + \beta_2 BMG_{it} + \beta_3 RINR_{it} + \beta_4 DINR_{it} + \beta_5 LINR_{it} + \beta_6 IMP_{it} + \varepsilon_t \quad (2)$$

$$INF_t = \beta_0 + \beta_1 GDP_{it} + \beta_2 EXCR_{it} + \beta_3 RINR_{it} + \beta_4 DINR_{it} + \beta_5 LINR_{it} + \beta_6 IMP_{it} + \beta_7 EXP_{it} + \varepsilon_t \quad (3)$$

$$INF_t = \beta_0 + \beta_1 GDP_{it} + \beta_2 EXCR_{it} + \beta_3 BMG_{it} + \beta_4 RINR_{it} + \beta_5 DINR_{it} + \beta_6 LINR_{it} + \beta_7 EXP_{it} + \varepsilon_t \quad (4)$$

$$INF_t = \beta_0 + \beta_1 GDP_{it} + \beta_2 EXCR_{it} + \beta_3 BMG_{it} + \beta_4 RINR_{it} + \beta_5 DINR_{it} + \beta_6 LINR_{it} + \beta_7 IMP_{it} + \varepsilon_t \quad (5)$$

The empirical results of the four OLS panel regression models showed consistency. In model 1, the R-square is 0.926 and the F-value is 109.989; in model 2, the R-square is 0.917 and the F-value is 82.194; while in model 3, the R-square is 0.925 and the F-value is 92.248; and in model 4, the R-square is 0.926 and the F-value is 92.535. Thus the values of the R-squares obtained from using the panel regression models all lie within the range 0.9 and 1, which implies that the models are indeed good fits to the data.

Consequently, in Table 5, the findings showed that board money growth, deposit interest rate, and lending interest rate have a positive significant impact on consumer price inflation, while exchange rate and exports of goods and services have a positive but insignificant impact on consumer price inflation. On the other hand, gross domestic product growth has a negative significant impact on consumer price inflation, meanwhile, real interest rate and imports of goods and services have a negative but insignificant impact on consumer price inflation.

**Table 5. OLS Panel regression estimation**

	Model	Model 2	Model 3	Model 4
Variable	Fixed effect	Fixed effect	Fixed effect	Fixed effect
GDP	0.000*** (-5.670)	0.000*** (-4.498)	0.000*** (-5.262)	0.000*** (-5.285)
EXCR		0.875 (0.158)	0.896 (0.131)	0.889 (0.140)
BMG	0.014** (2.536)		0.011** (2.636)	0.015** (2.517)
RINR	0.171 (-1.386)	0.100 (-1.677)	0.156 (-1.439)	0.178 (-1.366)
DINR	0.000*** (4.557)	0.000*** (5.147)	0.000*** (4.402)	0.000*** (4.501)
LINR	0.000*** (6.134)	0.000*** (6.449)	0.000*** (6.056)	0.000*** (6.071)
IMP	0.301 (-1.044)	0.321 (-1.001)		0.389 (-0.868)
EXP		0.587 (0.546)	0.896 (0.131)	
Constant	0.319 (-1.005)	0.447 (-0.766)	0.491 (-0.694)	0.406 (-0.839)
Observations	60	60	60	60



R-square	0.926	0.917	0.925	0.926
F-test	109.989	82.194	92.248	92.535

Note: t statistic in parentheses

\*\*\* $p < 0.01$  and \*\* $p < 0.05$  means significant at 1% and 5% level of significance respectively

## DISCUSSION OF FINDINGS

Table 2 explores the association between the predictor variables and the consumer price inflation in Nigeria, South Africa, and in Angola for the period 2001-2020. The study uses descriptive statistics to show the country that has the variable with the highest mean value. From Table 2, Angola has the highest mean consumer price inflation (33.09%), mean deposit interest rate (12.05%), and highest mean lending interest rate (35.16%) compared to Nigeria and South Africa; Nigeria has the highest mean gross domestic product growth (5.32%), mean broad money growth (21.14%), and highest mean real interest rate (6.35%) compared to South Africa and Angola, and it experienced depreciation in its currency due to its exchange rate value compared to Angola and South Africa; South Africa has the highest mean imports of goods and services (\$88.63 billion) and highest mean exports of goods and services (\$89.08 billion) compared to Nigeria and Angola.

Moreover, the results in Table 5 showed that broad money growth, deposit interest rate, and lending interest rate have a positive significant impact on consumer price inflation, while exchange rate and exports of goods and services have a positive but insignificant impact on consumer price inflation. The results also showed that gross domestic product growth has a significant negative impact on consumer price inflation, while real interest rates and imports of goods and services have a negative but insignificant impact on consumer price inflation. Consequently, the result of the real interest rate is in line with (Lowe, 2019; Umoru & Oseme, 2013); the result of the exchange rate is consistent with (Lowe, 2019); the result of the gross domestic product growth is similar to (Kirimu, 2014; Okhiria & Saliu, 2008).

## CONCLUSION, LIMITATIONS, AND FUTURE DIRECTIONS

The effects of gross domestic product growth rate, exchange rate, broad money growth, real interest rate, deposit interest rate, lending interest rate, imports and exports of goods and services have been investigated, using annual time series from the top three economies in Africa – Nigeria, South Africa, and Angola from 2001 to 2020. This present research adopted the technique of ordinary least square panel regression with a fixed effect to investigate the influence of the predictor variables on inflation. The outcomes of Table 2 showed that exports and imports of goods and services are strongly correlated, meanwhile, on the other hand, lending interest rate and deposit interest rate are highly correlated, which means there is evidence of multicollinearity. To overcome the problem of multicollinearity, four different OLS panel regression models were carefully developed. Furthermore, Table 5 revealed that real interest rates and imports of goods and services have a negative significant impact on inflation, while gross domestic product growth has a negative but insignificant impact on inflation. In addition to this, broad money growth, deposit interest rate, and lending interest rate have a



positive significant impact on inflation, meanwhile, exchange rate and exports of goods and services have a positive but insignificant impact on inflation. However, this present study has a lot of consequences for monetary policymakers, academic researches, private researchers, investors, and business managers. Our study also helps to add to the literature on the determinants of inflation. This present study has the following limitations, which will initiate further research on it. First, our sample size was small, so future studies should focus on large samples which could help in having a wide explanation of the traditional data. Second, our study focused on three out of the five fast-growing economies in Africa, so future studies should look at the five fast-growing economies in Africa. Finally, the present study only focused on the fixed effect regression model; future studies should employ the techniques of the random effect regression model, GMM method, and other econometric techniques for the analysis.

## REFERENCES

- Abidemi, O., & Malik, S. (2010). Analysis of inflation and its determinant in Nigeria. *Pakistan Journal of Social Sciences*, 7(2), 97-100.
- Ahamba, K. O., Obi, K. O., Durueke, C. N., Onoja, J. E., Okoro, D. C., & Nwuzor, C. V. (2020). Macroeconomic determinants of inflation in Nigeria: An application of autoregressive distributed lag bounds testing technique. *International Journal of Development Research*, 10(02), 33827-22837.
- Ahmed, R. R., Ghauri, S. P., Vveinhardt, J., & Streimikiene, D. (2018). An empirical analysis of export, import, and inflation: A case of Pakistan. *Romanian Journal of Economic Forecasting*, 21(3), 1149-1177.
- Amaefula, C.G. (2016). Long-run relationship between interest rate and inflation: Evidence from Nigeria. *IOSR Journal of Economics and Finance (IOSR-JEF)*, 7(3), 24-28.
- Anfofum, A. A., Afang, H. A., & Danpome, M. G. (2015). Analysis of the main determinants of inflation in Nigeria. *Research Journal of Finance and Accounting*, 6(2), 144-155.
- Antzoulatos, A. (1996). Consumer credit and consumption forecasts. *International Journal of Forecasting*, 12(4), 439-453.
- Ayinde, O. E., Olatunji, G. B., Omotesho, O.A., & Ayinde, K. (2010). Determinants of inflation in Nigeria: A cointegration approach. Contributed paper presented at the Joint 3<sup>rd</sup> Africa Association of Agricultural Economists (AAAE) and 8<sup>th</sup> Agricultura Economist Association of South Africa (AEASA) Conference, Cape Town, 19-23<sup>rd</sup> September.
- Bayo, F. (2004). Determinants of inflation in Nigeria: an empirical analysis. *International Journal of Humanities and Social Science*, 1(18), 262-271.
- Berger, H. & Österholm, P. (2011). Does money growth granger cause inflation in the Euro area? Evidence from out-of-sample forecasts using Bayesian VARs. *Economic Record*, 87(276): 45-60.
- Chaudhry, I.S., Farooq, R. I. F., & Murtaza, G. (2015). Monetary policy and its inflationary pressure in Pakistan. *Pakistan Economic and Social Review*, 53(2), 251-268.
- Cole, J. H. (1986). Imports and domestic inflation in Latin America. *Studies in Economics and Finance*, 10, 72-78.





- Debelle, G. (2004). Household debt and macroeconomy. *BIS Quarterly Review*, 51-64.
- Dexter, A. S., Levi, M. D., & Nault, B. R. (2005). International trade and the connection between excess demand and inflation. *Review of International Economics*, 13(4), 699-708.
- Dhungana, N. T., & Pradhan, R. S. (2017). Effect of bank lending on inflation in Nepal. *Journal of Advanced Academic Research (JAAR)*, 4(II), 27-43.
- Diermeier, M., & Goecke, H. (2016). Money supply and inflation in Europe: Is there still a connection? (No. 17/2016E). IW Policy Paper.
- Ellina, N. F., & Yustirania, S. (2022). Effect analysis of inflation, exports and imports on economic growth in Indonesia. *Journal of Humanities, Social Sciences and Business (JHSSB)*, 2(1), 32-46.
- Fatukasi, B. (2006). Determinants of inflation in Nigeria: An empirical analysis. *International Journal of Humanities and Social Sciences*, 1(18), 262-271.
- Fischer, S. (1993). The role of macroeconomic factors in growth. *Journal of Monetary Economics*, 32, 485-512.
- Gheorghe, M., & Ioana, M. Z. (2015). Interest rate, exchange rate and inflation in Romania, correlate and interconnection. *Journal of Public Administration, Finance and Law*, 8, 146-160.
- Gyebi, F., & Bofo, G. K. (2013). Macroeconomic determinants of inflation in Ghana from 1990-2009. *International Journal of Business and Social Research*, 3(6), 81-93.
- Imimole, B., & Enoma, A. (2011). Exchange rate depreciation and inflation in Nigeria (1986-2008). *Business and Economics Journal*, 2011, BEJ-28.
- Islam, M. A. (2013). Impact of inflation on import: An empirical study. *International Journal of Economics, Finance and Management Sciences*, 1(6), 299-309.
- Khan, R. E. A., & Gill, A. R. (2010). Determinants of inflation: A case of Pakistan (1970-2007). *Journal of Economics*, 1(1), 45-51.
- Khan, M. S., & Senhadji, A. S. (2001). Threshold effects in the relationship between inflation and growth. *IMF Staff Papers, International Monetary Fund*, 48, 1-21.
- Kiganda, E. O. (2014). Relationship between inflation and money supply in Kenya. *Journal of Social Economics*, 2(2), 63-83.
- Kirimi, W. N. (2014). *Determinant of inflation in Kenya*, School of Economics of the University of Nairobi, 34-43.
- Lowe, A. B. (2019). The impact of exchange rate on inflation: A case study of the Gambia (1978-2016). *European Scientific Journal*, 15(10), 261-277.
- Ludvigson, S. (1999). Consumption and credit: A model of time-varying liquidity constraint. *The Review of Economics and Statistics*, 81(3), 434-447.
- Malik, G., & Chowdhury, A. (2001). Inflation and economic growth: Evidence from South Asian countries. *Asian Pacific Development Journal*, 8, 123-135.
- Mbongo, J. E., Mutasa, F., & Msigwa, R. E. (2014). The effects of money supply on inflation in Tanzania. *Economics*, 3(2), 19-26.
- Mohanty, D., & John, J. (2015). Determinants of inflation in India. *Journal of Asian Economics*, 36, 86-96.
- Muktadir-Al-Mukit, D., Shafiullah, A. Z. M., & Ahmed, M. R. (2014). Inflation led import or import led inflation: Evidence from Bangladesh. *Asian Business Review*, 2(4), 1-11.
- Muktadir-Al-Mukit, D., Shafiullah, A. Z. M., & Ahmed, M. R. (2014). Exports, imports and inflation: A study on Bangladesh. *Amity Global Business Review*, 46-55.



- Munepapa, M., & Sheefeni, J. P. (2017). The impact of import on inflation in Namibia. *European Journal of Business, Economics and Accountancy*, 5(2), 43-51.
- Musa, A. M. A., & Yousif, F. M. K. (2018). Modelling the determinants of inflation in Sudan using a generalised method of moments for the period 2000-2017. *International Journal Information Research and Review*, 05(02), 5154-5165.
- Nguyen, V. B. (2015). Effects of fiscal deficit and money M2 supply on inflation: Evidence from selected economies of Asia. *Journal of Economics, Finance and Administrative Science*, 20(38), 49-53.
- Nurul, U., & Tarmizi, A. (2018). The effect of export and import on inflation in Indonesia period 1990-2016. *Journal of Maliksussaleh Public Economics*, 1(2), 60-64.
- Ofori, A., Adjei, M. K. R., & Asuamah, S. Y. (2015). Modelling the link between inflation and import in Ghana. *Journal of Empirical Economics*, 4(1), 49-62.
- Ogbokor, C.A., & Sunde, T. (2011). Is Namibia's inflation and its determinants import driven? An econometric investigation, [Electronic version]. *Journal of Development Alternative and Area Studies*, 30(1,2), 1-14.
- Ojo, M.O. (2000). The role of the autonomy of the Central Bank of Nigeria in promoting macroeconomic stability. *Central Bank of Nigeria Economic and Financial Review*, 38(1), 23-44.
- Okeke, C.C., Ohazulume, C.G., & Emerenini, F. (2022). The determinants of inflation in Nigeria. *African Journal of Economics and Sustainable Development*, 5(3), 54-72.
- Okhiria, O., & Saliu, T. S. (2008). *Exchange rate variation and inflation in Nigeria (1970-2007)*, School of Technology and Society. Skovde, 41-48.
- Okoli, T. T., Mbah, S. A., & Agu, O. C. (2016). Exchange rate volatility and inflation: The Nigerian experience. *Journal of Economics and Sustainable Development*, 7(10), 6-15.
- Orok, A. B., Okoi, I. O., & Essien, A. (2018). Inflation and deposit mobilisation in deposit money banks – The Nigerian perspective. *International Journal of Public Administration and Management Research (IJPAMR)*, 4(4), 109-121.
- Pennacchi, G. (1991). Identifying the dynamics of real interest rate and inflation: Evidence using survey data. *Review of Financial Studies*, 4(1), 53-86.
- Qayyum, A. (2006). Money, inflation, and growth in Pakistan. *Pakistan Development Review*, 45(2), 203-213.
- Quaiser, M., & Kasim, M. (2009). Non-linearity between inflation rate and GDP growth rate in Malaysia. *Economics Bulletin*, 28(3), 1555-1569.
- Rizwan, R. A., Saghir, P. G., & Dalia, S. (2018). An empirical analysis of export, import, and inflation: A case of Pakistan. *Romanian Journal of Economic Forecasting*, XXI(3), 117-130.
- Sahadudheen, I. (2012). A cointegration and error correction approach to the determinants of inflation in India. *International Journal of Economic Research*, 3(1), 105-112.
- Sahoo, M., & Sethi, N. (2020). The dynamic relationship between export, import and inflation: Empirical evidence from India. *The Indian Economic Journal*, 1-18.  
Doi:10.1177/0019466220935552
- Uddin, S., Chowdhury, N. M., & Hossain, M. A. (2014). Determinants of inflation in Bangladesh: An econometric investigation. *Journal of World Economic Research*, 3(6), 83-94.



- 
- Uke, V., & Ergun, U. (2011). Econometric analysis of import and inflation relationship in Turkey between 1995 and 2010. *Journal of Economic and Social Studies*, 1(2), 69-86.
- Umoru, D., & Oseme, A. S. (2013). Inflation expectations and interest rate variation in Nigeria: An econometric assessment of the evidence. *International Journal of Development and Economic Sustainability*, 1(2), 1-12.
- Undji, V. J., & Kaulihowa, T. (2015). Determinants of inflation in Namibia: A co-integration approach. *Journal of Business Management Dynamics*, 5(1), 1-6.
- Youssef, A. M. M., Mansi, A. L. M., & Tamer, M. H. S. (2022). The impact of interest rates and inflation rates on deposits behaviour of banks: The case of Egypt. *The Academic Journal of Contemporary Commercial Research*, 2(1), 55-80.