



Inflationary Trends and Real Economy in Sub-Sahara Africa – A Study of Nigeria, South Africa and Ghana

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Article History

Received: 17 April 2026

Revised: 24 May 2026

Accepted: 30 May 2026

Published: 20 July 2026

To cite this article

Chinedu Sunday Jiaqponna, & *et al.* (2026). Inflationary Trends and Real Economy in Sub-Sahara Africa – A Study of Nigeria, South Africa and Ghana. *Journal of Development Economics and Finance*, Vol. 7, No. 1, pp. 207-227.

Abstract: This paper analyzed inflation rate dynamics in Sub-Saharan African countries (Nigeria, South Africa and Ghana) during the period, 1980 – 2020. The Autoregressive Distributed Lag (ARDL) model was employed due to the mixed level of integration at levels and first difference. The study found that the inflation rate had a long-run cointegrating relationship with gross domestic product. The ECM showed that inflation rate dynamics had a time-varying effect on the real economy. In the long run, it was observed that the inflation rate hindered real economic growth across Nigeria, South Africa and Ghana but it was significant for South Africa and insignificant for Nigeria and Ghana. It was also realized that the economy of Ghana adjusted rapidly to macroeconomic shocks than Nigeria and South Africa which justifies it as the fastest growing economy in the SSA region. Generally, it was found that the economies of Nigeria, South Africa and Ghana were faced with inflationary pressure, especially in the short run. Consequently, it was insinuated that the monetary authorities carefully identify the underlying causes of such inflationary pressures and apply the appropriate policy (such as monetary and fiscal policy) to curtail them to foster the domestic economic productivity of countries.

Keywords: Inflation, real economy, SSA, ARDL

1. INTRODUCTION

A well-functioning economy and the sustainability of balances depend, above all, on a smooth-running and stabilization of macroeconomic variables that sum up the overall economic structure. Hence, any form of imbalance inherent in macroeconomic variables negatively influences the general economic life of a country. Thus, maintaining a stable macroeconomic structure is a basis for sustainable economic advancement. In various macroeconomic studies, it is stated that inflation dynamics is the centermost variable underpinning macroeconomic fundamentals of developing economies and that macroeconomic downturns are often a result of inflationary pressures (Musa, 2021; Mandeya and Ho, 2021; Jiakponna, 2023; Ikwuagwu, Ariwa and Onyele, 2017). Informed by the need to establish economic stability and implementation of a timely and effective anti-inflation policy, the search for the nexus between inflation and economic performance remains crucial for governments and central banks globally. Consequently, a sound economic system and sustainable output growth largely hinge on inflation dynamics.

The interconnections between real economic output and inflation are among the most debated issues in development economics. Economic output and inflation are highly instrumental in regulating macroeconomic trends and ensuring economic stability. As discussed by economists, unchecked price levels lead to myriads of negative influences. Regardless of the stage of economic advancement, changes in prices are seen as the fundamental performance yardstick in every country. As such, problems associated with price stability and output growth must be resolved to ensure stability. Generally, price stability is explained by a moderate and sustainable rate of inflation that does not erode savings, consumption and investments decisions (Onyele, Onyekachi-Onyele and Ikwuagwu, 2024). The point here is checking inflation dynamics not to exceed certain limits that would entrench economic prosperity. Efficient management of inflation dynamics is the principal condition necessary for ensuring social and economic stability over the medium and long term. According to Abdulqadir, Chua and Mohd (2019), a country's economic, social and political structure may seriously break down if the authorities fail to effectively and efficiently halt inflationary pressures and dynamics.

Inflationary pressures make savings accumulation difficult, hinder investments, undermine consumption and discourage production. During periods of high inflation dynamics and uncertainties regarding inflationary trends, savings meant

for development projects are invested in speculative businesses for obtaining higher returns rather than entrenching real investments or production (Mandeya, Chua and Ho, 2021). This does not encourage economic prosperity as it causes real investments to shrink. Additionally, while a high rate of inflation erodes the real value of investments by reducing the level of returns, it also wears down the purchasing power of money. Thus, proper management of inflation dynamics remains an important macroeconomic factor that could potentially to a developing economy into a developed one. On the other hand, inflation dynamics do not only influence economic output but also widen the disparity between income groups by disrupting the social distribution of income that is, causing degeneration in income against fixed income groups (Amen, 2016). Generally, economies with unstable inflation rates experience lower output growth compared to those with a stable rate of inflation.

Notwithstanding the macroeconomic adjustments aimed at price stability, inflation in two leading Sub-Saharan African (SSA) economies and one of the fastest-growing economy – Nigeria, South Africa and Ghana, respectively, has persistently spiralled over the decades (see Table 1). Uncontrollable inflation rates could hamper the growth of the real economy and exacerbate the levels of poverty. This situation unveils the circumstances behind the recent inflationary pressure in these three SSA economies. It builds on prior researches which indicates that inflation dynamics are instrumental in determining financial stability and economic growth (Mandeya and Ho, 2021; Abdulqadir and Mohd, 2019; Mishchenko, Naumenkova, Mishchenko and Ivanov, 2018; Abasimi, Li, Salim and Vorlak, 2018; Aydin, Esen and Beyrak, 2016; Omotosho and Doguwa, 2015). This study aims to motive more debate by providing comparative empirical evidence of the influences of inflation rate dynamics on SSA countries – Nigeria, South Africa and Ghana. It is designed to serve as reference material for further empirical analysis on the subject matter.

2. LITERATURE REVIEW

2.1. Conceptual Framework

Inflation is the sustained increase in the general price level of goods and services in an economy. Through the cost-push theory of inflation, rising wages can fuel inflation, which will further increase the price of a property (Ho and Iye, 2018). Money supply or money stock is the total amount of monetary assets available

in an economy at a specific time. Conceding Keynes's theory, a rise in the money supply would lead to a rise in the velocity of circulation and real income, the flow of financial resources to productive ends, hence enhancing productivity in the real economy (Onyele, Ikwuagwu and Ibe, 2025). Therefore, velocity could change in response to changes in the money supply. As such, countries of the world are by no means immune to the menace of inflation.

The effects of inflation on the economy are diverse and can be both positive and negative. The undesirable effects comprise a fall in the real value of money amidst other monetary parameters over time. Irrefutably, among the macroeconomic goals which policymakers thrive to achieve is price stability. Pursuing this goal helps to avoid the cost of price fluctuations and the economic uncertainties that may arise due to price instability (Osuala and Onyeike, 2013). The linkages between inflation and growth in the real economy remain controversial, both in theoretical and empirical dispositions. A high inflation rate (for instance, double-digit inflation) creates distortions in economic activities and decisions concerning savings and investments when the tax system is not fully adjusted to inflation.

When inflation is high, currency and non-interest-bearing checking accounts are undesirable because they are constantly declining in purchasing power. Additionally, a surge in inflation can create uncertainties among people about future economic outcomes, which could hamper economic growth. First, it adds an inflation risk premium to long-term interest rates and it complicates the planning and contracting by business and labour that is so essential to capital formation and economic output (Onyele, Ikwuagwu and Opara, 2023). Second, people may devote their energies to mitigating the tax and other effects of inflation rather than to developing products and processes that would raise overall living standards (Ozekhome, 2016). Third, inflation cause difficulties to households and firms in responding to the signals emanating from market prices: therefore, when prices surge or become unstable, it may become difficult to differentiate between changes in relative prices (the cost of one item relative to another), which may require them to reallocate their spending, and changes in the overall price level, which should not induce such an adjustment (Abasimi *et al.*, 2018). The empirical evidence is pretty clear that "high" rates of inflation (say, above 10 per cent) have deleterious effects on long-term economic growth. For lower inflation rates, like those experienced most of the time in the U.S., the evidence is mixed, with some studies finding significant

effects and others finding little or no effect. Nonetheless, many economists believe it is important to aim monetary policy in inflation control (Onyele, Ikwuagwu and Onyekachi-Onyele, 2020).

To provide a comprehensive understanding of the macroeconomic dynamics and economic growth, the conceptual framework for this study was developed as displayed in Figure 1:

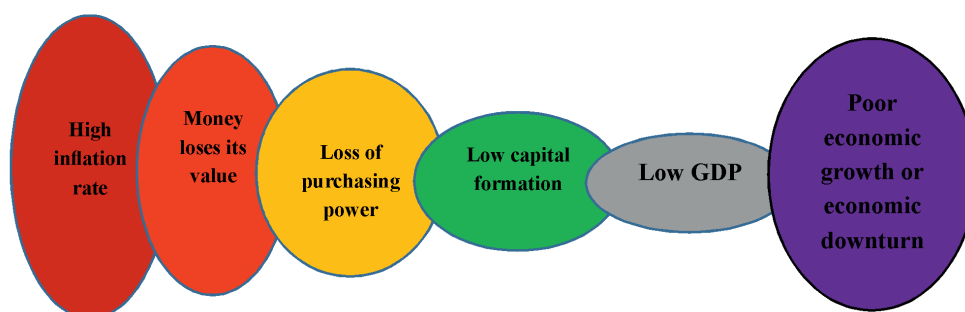


Fig. 1: Link between inflation and the real economy

2.2. SSA's Inflation Rate Dynamics: Stylized Facts

There have been questions as to why some economies grow much faster than others and the core reason for the unequal growth level as experienced between Nigeria, South Africa and Ghana. These issues have been among the major underlying economic problems still under investigation by different researchers worldwide (Abdulqadir, Chua and Mohd, 2019). From an economic perspective, a country's economy is often affected by myriads of macroeconomic variables such as exchange rate, inflation, interest rate, unemployment rate, money supply, among others. The influence of these factors on a nation's economic system varies across countries. These macroeconomic aggregates, to a large extent, dictate the macroeconomic policy a country pursues as it greatly influences inflation dynamics.

Figure 2 shows that Ghana had more inflationary pressure than Nigeria and South Africa, especially between 1980 and 1985. Inflation in the three countries has been quite volatile. This could be due to low productivity occasioned by the high cost of production in Ghana (Appienti, Ofori, Dampsey and Kusi, 2016). However, while the inflation rate in South Africa was somewhat stable, significant fluctuations were recorded in Ghana and Nigeria probably due to the economic shock shocks occasioned by changes in macroeconomic policies in these countries. Also, South

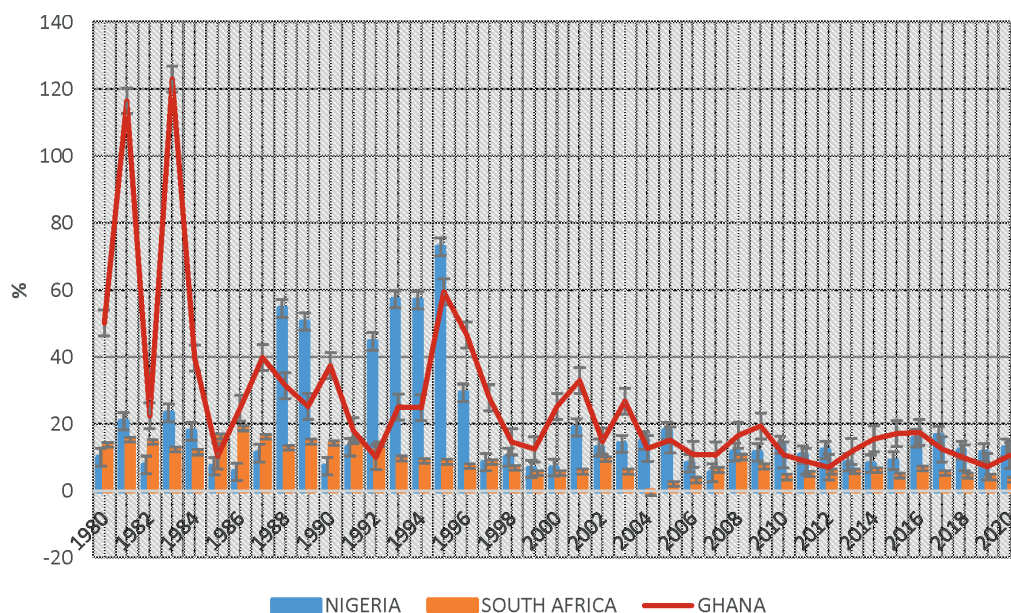


Fig. 2: Trend of inflation rate

Africa might have recorded low inflation due to the lower cost of raw materials and interest rate on borrowings when compared to Nigeria and Ghana (IMF, 2014). In 2020, the inflation rate increased in Nigeria and Ghana because both countries failed to reduce their discount rate but South Africa reduced theirs which probably allowed for an increase in production that reduced overall prices.

2.3. Theoretical Framework

In a bid to give a clearer picture of how inflation dynamics interact in the macroeconomic environment, it is essential to take a glimpse at some of the theoretical expositions. Specifically, this paper focuses on the Fischer effect and the Mundell-Tobin effect which were drawn from the endogenous growth model which states that economic prosperity depends on internal (endogenous) macroeconomic factors. Hence, the theories that underpin this study have been discussed hereafter:

The Fischer effect

This theory holds that the extent to which inflation affects output growth depends on how inflation dynamics interacts with nominal interest rate while holding real interest rate constant. Therefore, it implies that rising inflation triggers a

proportionate upsurge in nominal interest rate which then influences real economic output assuming real interest rate is kept constant.

$$i_t = r_t^e + \Pi_t^e \quad (1)$$

Where,

i_t = nominal interest rate

r_t^e = real interest rate

Π_t^e = expected inflation

Equation (1) is derived from by the following expressions;

$$(1 + i_t) = (1 + r_t^e) \cdot (1 + \Pi_t^e) \quad (2)$$

$$1 + i_t = 1 + r_t^e + \Pi_t^e + (r_t^e \cdot \Pi_t^e) \quad (3)$$

$$i_t = r_t^e + \Pi_t^e + (r_t^e \cdot \Pi_t^e) \quad (4)$$

$(r_t^e \cdot \Pi_t^e)$ is often insignificant and can be removed. Therefore, the Fischer Effect can be expressed as $(\Delta i_t = \Delta \Pi_t^e)$ which is a direct relationship between expected inflation rate and nominal interest rate. The nominal interest rate is an observable factor in the economy and is often referred to as the interest rate while the real interest rate, on the other hand is computed from the observed rate of interest and forecasted inflation. Jareño and Tolentino (2012) opined that this also means that at zero expected inflation, nominal interest rate and real interest rate are equal.

Mundell - Tobin effect

Unlike the Fischer Effect, the Mundell – Tobin Effect postulates that nominal interest rate and expected inflation has a nonlinear relationship, that is, nominal interest rate rises more than the expected rate of inflation. This was based on the assumption that fewer money balances are held by the public and more in other assets in response to high inflation. In other words, a rise in the exogenous growth of money would lead to an increase in the nominal interest rate and the velocity of money while the real interest rate would decrease. The significance of the Mundell–Tobin effect is that it seems like a deviation from the classical dichotomy. Mundell – Tobin is of the view that the real interest rate, would fall if inflation rose, meaning the overall impact would be that i did not rise in the same proportion as inflation (Musa, 2021). The reason, they said, that r falls is because higher inflation means

people would rather save than hold money: if more people are saving money then the real interest rate falls. As such, inflation increases whilst r decreases so i do not rise in the same proportion as inflation.

2.4. Empirical Review

In a comparative study, Olusegun (2021) examined and compared inflation targeting in the largest economies of Africa, that is, Nigeria and South Africa with the aid of Fully Modified Least Squares (FMOLS) from 1970 to 2016. The study showed a significant reaction of inflation to the policy rate in South Africa, but such a reaction was not experienced in Nigeria. Generally, South Africa's central bank emphasized more on inflation targeting in managing interest rates, which was not the case in Nigeria. For South Africa, there was a significant output gap but insignificant for Nigeria. The study also revealed that exchange rate, openness to trade and foreign reserves played significant roles in central bank policy in both countries. The central banks are requested to follow an eclectic path, maintaining monetary policy rules in a way that adjusts any form of disequilibrium between output, inflation, external reserves, trade openness and exchange rate.

Similarly, Oke and Onyokwonu (2021) examined the nexus between inflation, exchange rate and sectoral output in Nigeria. A multivariate cointegration technique was applied for the analysis. Results showed that inflation with a depreciating exchange rate exerted contractionary affected output of the industrial, agricultural, and trade sectors in Nigeria. However, inflation did not exert a significant influence on the service, building and construction sectors. The threshold of inflation for Nigeria was found to be 9 per cent. Thus, policies of inflation anchoring might be meaningful to Nigeria if the exchange rate is stable and the core economic sectors are well developed.

Again, using yearly data from 1986 to 2020, Idris (2021) investigated the linkages between inflation, unemployment on the economic growth of Nigeria. The study approached the data analysis with the OLS technique. Findings indicated that rising unemployment significantly diminished domestic production while inflation caused an increasing effect. Hence, the need to formulate policies that would encourage self-employment and cut down the cost of doing business was recommended.

Also, Ngalawa and Ngalawa (2020) revealed that an understanding of the inflation-output trade-off was essential for the achievement of price stability. In South Africa, the nature of this relationship is not known. Estimation of inflation-

expectations using the difference GMM on quarterly data for the period 2000 Q3 to 2015 Q1 revealed a concave asymmetric Philip curve in South Africa's. In line with the Lucas Critique, a novel Keynesian dynamic stochastic general equilibrium model for South African was formulated. Simulation results showed that low demand shocks reduced output and inflation while increased demand shocks of similar magnitude led to a low increase in inflation and a larger acceleration in output which confirmed the inflation-output concave asymmetric relationship earlier found. Phillip's curve concavity implied decreasing sensitivity of inflation to economic growth, suggesting that any given variation in inflation required an increasingly larger output adjustment.

In a similar study, Johnson, Onakoya and Akeju (2018) examined the significance of macroeconomic aggregates on national income between 1975 and 2015. The study deployed the VECM technique for its analysis. The findings revealed that inflation negatively influenced economic growth. There was positive economic growth amid rising exchange rate, interest rate and unemployment. There was no short-run association among the variables. Hinging on the findings, proper economic diversification alongside inflation targeting should be prioritized by policymakers.

Mavikela, Mhaka and Phiri (2018) investigated the relationship between inflation and economic growth for South Africa and Ghana using quarterly empirical data collected from 2001 to 2016 applied to the quantile regression method. For the sample estimates, it was indicated that inflation was positively related to GDP in Ghana amid high inflation whilst inflation in South Africa exerted adverse effects at high inflation. However, during the post-crisis period, it was shown that inflation triggered negative effects for both countries with inflation exerting its least adverse influence for Ghana and moderately for South Africa.

In Ghana, Abasimi *et al.* (2018) investigated the dynamics of inflation, exchange rate, money growth and interest rates in Ghana between 1990 and 2017. The ARDL and ECM were used because of the observed mixed level of integration at levels and first difference. The results portrayed that money supply has no strong impact on inflation rate dynamics in the short and long run. Hence, it is insinuated that the Bank of Ghana should maintain moderate and stable economic growth ensuring rigorous macroeconomic policies for key economic units to act in complacency.

Also, Gatawa, Abdulgafar and Olarinde (2017) investigated the impact of money supply and inflation rate on economic growth in Nigeria. The study covered the

period 1973 to 2013. The study employed the Granger-causality test and Vector error correction mechanism (VECM) technique to analyze the data collected. Findings from the study showed that broad money supply and interest rate had a negative and insignificant impact on economic growth in Nigeria in the short run while inflation rate had a positive and insignificant impact on economic growth in Nigeria in the short run. In the long run, the study showed that inflation rate and interest rate had a negative and significant impact on economic growth in Nigeria while broad money supply had a positive and significant impact on economic growth in Nigeria. Furthermore, the Granger-causality test showed that there was no causality between gross domestic product and broad money supply, inflation rate and interest rate.

In a study, Okonkwo and Chigbu (2016) investigated the impact of inflation and exchange rate on manufacturing output in Nigeria from 1981 to 2013. The findings of the study revealed that a shock on inflation rate harmed manufacturing capacity utilization in the short run, but in the long run, began to exact positive impact on manufacturing capacity utilization in Nigeria. Variations in the foreign exchange rate are caused by inflation in the short run and manufacturing capacity utilization in the long run, while variation in inflation rate is mostly caused by manufacturing capacity utilization. Also, the study concluded that the inflation rate causes manufacturing capacity utilization in Nigeria.

In another study, Ozekhome (2016) empirically examined inflation, investment and economic growth nexus in Nigeria, employing the neoclassical growth model and data from 1980 to 2014. In particular, the results showed evidence of a non-linear relationship with two thresholds (6 per cent and 12 per cent) between inflation and economic growth. Inflation below the first threshold affects economic growth positively and insignificantly. At a moderate rate, inflation exerted a negative effect and a marginal impact of higher inflation on economic growth diminished but remained significantly negative. The results further indicated a non-linear relationship between these two variables with only one threshold at 7 per cent. Below the threshold level, inflation had a positive but insignificant impact, while it had a significant but negative influence above the threshold. Therefore, it was desirable to keep the inflation below 6 per cent (first threshold) through sound macroeconomic policies (both monetary and fiscal).

Again, Amen (2016) examined the relationship between inflation and key macroeconomic variables such as money supply, interest rate, exchange rate, and

GDP in Ghana. Data of these macroeconomic aggregates spanned from January 1990 to December 2014. The study used the Augmented Dickey-Fuller (ADF) technique; the Granger Causality Test Technique, the Autoregressive Distributed Lag (ARDL) cointegration Technique, and the ECM of the ARDL model to test for the presence of a short and long-run association between the model variables. From the study, it was established that there existed a significant long-run and short-run relationship between inflation rate and money supply; this confirmed the monetarist theory which says "inflation is everywhere a monetary problem", interest rate, exchange rate and GDP. The Granger-causality test showed that there was a unidirectional causal relationship running from inflation rate to money supply, a unidirectional causality from interest rate to inflation. The results also suggested a non-directional causality between exchange rate and inflation rate and bidirectional causality between GDP and inflation rate.

Analyzing the threshold of inflation dynamics in Nigeria, Omotosho and Doguwa (2015) employed three (3) GARCH family to show the dynamics of Nigeria's inflation between 1996 and 2011. Of the models, the asymmetric TGARCH (1,1) provided an appropriate paradigm for explaining the dynamics of headline inflation in Nigeria, while the symmetric GARCH (1,1) was found to be sufficient for food CPI. Firstly, the model outcomes indicated high persistence parameters for the core and food CPI, implying that the impacts of inflation shocks on their volatilities faded away very slowly. However, the impact of inflation shocks on headline inflation dynamics died out rather quickly. The paper found that periods of high inflation were connected with periods of government policy change, shocks to food inflation and lack of monetary and fiscal policies coordination.

Again, Osei (2014) investigated the factors affecting the dynamics of inflation in Ghana. The study indicated that the core determinants of inflation dynamics were exchange rate, food prices, inflation persistence, price expectation and prices of petroleum products. Inflation had a weak effect on inflation. Anchoring inflation expectations and exchange rate misalignment were prominent policy measures used by the authorities in a bid to maintain price stability.

3. METHODOLOGY

This paper used annual time series data from 1980 to 2020 sourced from the World Development Indicators (WDI), Fred Reserve Economic Data (FRED) and Central

Bank of Nigeria (CBN) Statistical Bulletin. The variables considered in the model include the gross domestic product (as the dependent variable) which is used as a proxy for the real economy of sampled SSA countries (Nigeria, South Africa and Ghana) while exchange rate, inflation, discount rate and the unemployment rate were adopted as the explanatory variables (used as a proxy for macroeconomic dynamics). The autoregressive distributed lag model (ARDL) approach was adopted for the estimation to show the short and long-run dynamics of the model. The ARDL approach was adopted because the variables had a mixed level of integration at both level and first difference, that is, $I(0)$ and $I(1)$. The econometric approach allows for flexibility in attaching various lag lengths to different variables included in the model (Pesaran, Shin and Smith, 2001). The shows that the ARDL model has a reparameterization mechanism to cointegration of non-stationary variables and an error correction mechanism (ECM). Following the work of Abasimi, Li, Salim and Vorlak (2018) that showed that inflation interacts with other macroeconomic aggregates to influence the real economy, this study then controlled for the exchange rate, discount rate and unemployment rate. The ARDL model for bounds test is specified thus:

$$\Delta GDP_t = \delta_o + \sum_{i=1}^p \delta_1 \Delta GDP_{t-i} + \sum_{i=0}^p \delta_2 IFR_{t-i} + \sum_{i=0}^p \delta_3 EXR_{t-i} + \sum_{i=0}^p \delta_4 DCR_{t-i} + \sum_{i=0}^p \delta_5 UPR_{t-i} + \beta_1 IFR_{t-1} + \beta_2 EXR_{t-1} + \beta_3 DCR_{t-1} + \beta_4 UPR_{t-1} + \mu_t \quad (5)$$

Where, GDP is gross domestic product, IFR represents inflation rate, EXR is exchange rate, DCR is the discount rate, UPR denotes unemployment rate, μ_t is the “noise” term which is serially independent. $\beta_1 - \beta_6$ are the long run elasticities.

After estimating equation (6), an F - statistic on the null hypothesis was carried out to know whether the parameters IFR_{t-i} , EXR_{t-i} , DCR_{t-i} , UPR_{t-i} which have long run effects are statistically significant. If the variables are statistically significant and cointegrated, then an unrestricted error correction model (ECM) is used to estimate the given long run relationships among them.

To capture the short run dynamics, the model (Eq. 5) is further stretch to incorporate the model variables as specified in (Eq. 6);

$$\Delta GDP_t = \delta_o + \sum_{i=1}^p \delta_1 \Delta GDP_{t-i} + \sum_{i=0}^p \delta_2 IFR_{t-i} + \sum_{i=0}^p \delta_3 EXR_{t-i} + \sum_{i=0}^p \delta_4 DCR_{t-i} + \sum_{i=0}^p \delta_5 UPR_{t-i} + \theta_{ecm} m_{t-i} + \mu_t \quad (6)$$

Where, δ_0 = Constant, $\delta_1 - \delta_6$ = short-run elasticities, ecm_{t-i} = error correction term lagged for one period and Δ = First difference operator.

4. RESULTS AND DISCUSSIONS

One of the issues associated with time series analysis is that data are often have mixed levels of stationarity and may lead to spurious regression estimates. Consequently, the Augmented Dickey-Fuller (ADF) approach to ascertain the stationarity of data (unit root testing) was applied as presented in Table 1:

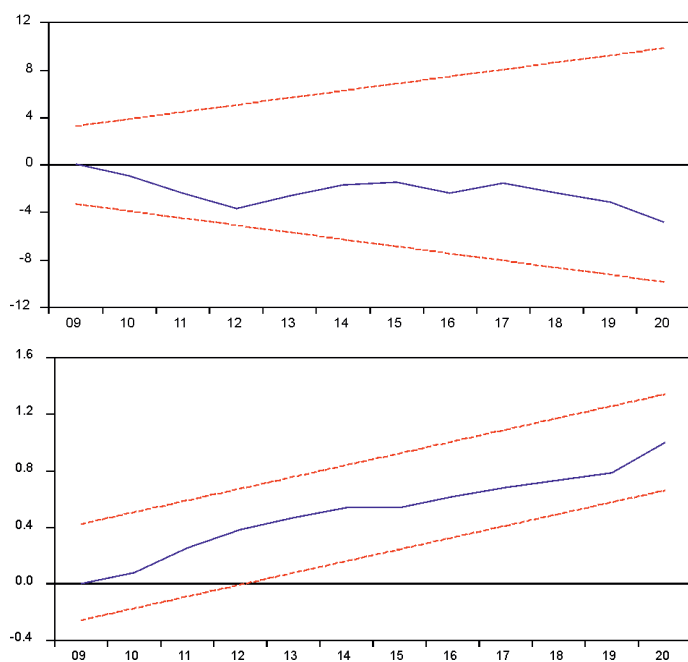
Table 1: Unit Root Test (ADF)

Variables	Nigeria			South Africa			Ghana		
	<i>I</i> (0)	<i>I</i> (1)	Order	<i>I</i> (0)	<i>I</i> (1)	Order	<i>I</i> (0)	<i>I</i> (1)	Order
GDP	-1.72644 {0.7186}	-3.58249 {0.0442}	I(1)	-0.58566 {0.9743}	4.50773 {0.0016}	I(1)	-3.34616 {0.0776}	-3.65128 {0.0415}	I(1)
IFR	-3.76497 {0.0295}	--	I(0)	-2.85991 {0.1858}	-5.38196 {0.0005}	I(1)	-6.66960 {0.0000}	--	I(0)
EXR	-0.00570 {0.9950}	-4.61772 {0.0035}	I(1)	-2.26299 {0.4432}	-4.65771 {0.0031}	I(1)	-2.59445 {0.2865}	-4.09459 {0.0134}	I(1)
DCR	-3.16336 {0.1063}	-8.70285 {0.0000}	I(1)	-4.59750 {0.0038}	--	I(0)	-1.76334 {0.7036}	-5.54556 {0.0003}	I(1)
UPR	-2.84781 {0.1909}	-4.71211 {0.0027}	I(1)	-1.88953 {0.6413}	-4.78840 {0.0022}	I(1)	-2.59871 {0.2830}	-4.37038 {0.0067}	I(1)
Test critical values:									
1%		-4.21187							
5%		-3.52976							

Source: Author's computations using EViews 10.0

Note: Figures in { } represents the p-values of the ADF t-Statistics

The ADF results portrays that GDP, EXR and UPR were stationary at first difference, that is, I(1) while INFR was stationary at I(0) for Nigeria and Ghana but stationary at I(1) for South Africa. DCR was stationary at I(0) for South Africa but stationary at I(0) for Nigeria and Ghana. Therefore, due to the mixed level of stationarity, the ARDL model was found suitable for the estimation.



Figures 3: Denote the CUSUM and CUSUM Sum of Squares for Nigeria

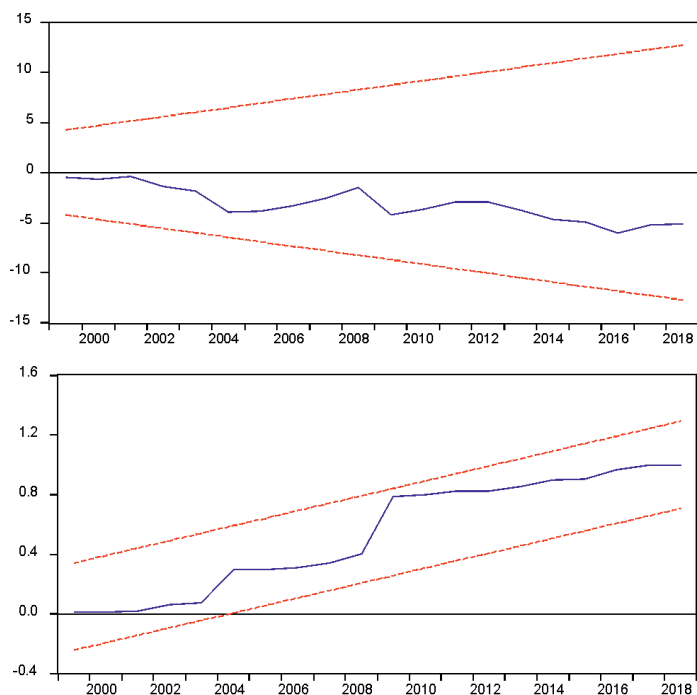


Figure 4: Denote the CUSUM and CUSUM Sum of Squares for South Africa

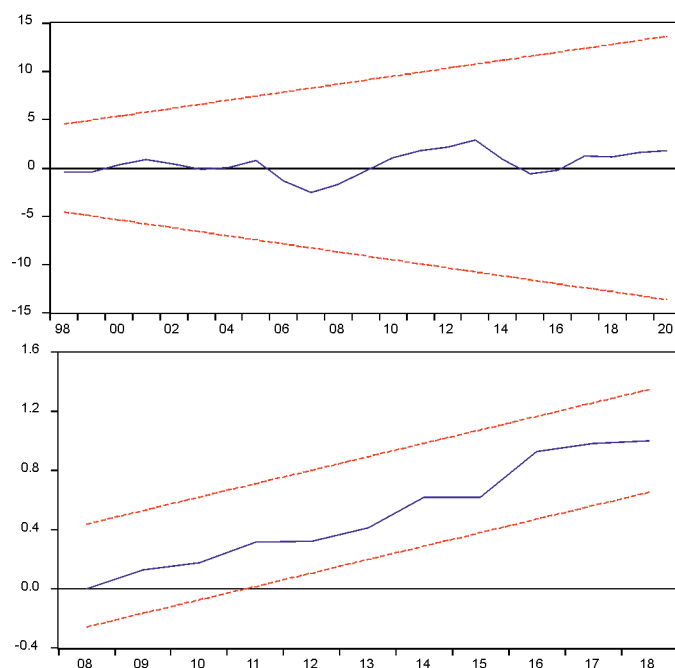


Figure 5: Denote the CUSUM and CUSUM Sum of Squares for Ghana's model

To ascertain whether the models for serial correlation, the Breusch Godfrey Serial Correlation LM Test was carried out. Table 2 shows the results for the Breusch Godfrey test for serial correlation. Since the probability values were greater than 5% significance level, the null hypothesis of no serial correlation was accepted and conclude that the model and perhaps the data has no serious serial correlation. Also, there was no evidence of heteroscedasticity and the error terms were also proved to be normally distributed.

Table 2: Diagnostic test results

Breusch-Godfrey Serial Correlation LM Test				
Nigeria	F-statistic	0.600024	Prob.	0.5674
South Africa	F-statistic	0.030390	Prob.	0.9701
Ghana	F-statistic	2.003313	Prob.	0.1717
Heteroskedasticity Test: Breusch-Pagan-Godfrey				
Nigeria	F-statistic	2.355702	Prob.	0.0620
South Africa	F-statistic	1.649537	Prob.	0.0936
Ghana	F-statistic	0.912275	Prob.	0.5803

Normality Test				
Nigeria	Jarque-Bera	0.7186	Prob.	0.6982
South Africa	Jarque-Bera	4.8239	Prob.	0.0896
Ghana	Jarque-Bera	1.3187	Prob.	0.5172

Source: Author's computations using EViews 10.0

In other to ensure that the models are cointegrated, the ARDL bound test was employed. The results obtained from the ARDL bound test are displayed in Table 3. The F-statistic across the three models has higher F-statistic values than the upper bound critical values at 5% level, giving a significant reason to conclude that a long run relationship exist among the model variables. The ECM were further applied to obtain the short and long run estimates.

The result of the regression in Table 4 revealed that the overall estimated model is good as it has an Adjusted R-squared of 0.802654, 0.804341 and 0.853870. It implies that about 80%, 80% and 85% of the total variation in GDP (dependent variable) can be collectively explained by IFR, EXR, DCR and UPR (independent variables) while the remaining unexplained variations were due to other variables not included in the model (error term). Similarly, the F- statistic value of 119.1586 and probability (F-statistic) of 0.000000, 0.000008 and 0.000000 showed that the overall model was statistically significant at 5% level of significance. This implies that IFR alongside EXR, DCR and UPR collectively exert significant impact on the real economy of SSA countries.

Table 3: ARDL bounds testing results for cointegration

Country	F-statistic	Conclusion
Nigeria	4.890816	Model variables are cointegrated
South Africa	4.288392	Model variables are cointegrated
Ghana	18.07325	Model variables are cointegrated
Level of significance	I(0)	I(1)
10%	2.2000	3.0900
5%	2.5600	3.4900
1%	3.2900	4.3700

Source: Author's computations using EViews 10.0

Having established that the variables under consideration are cointegrated, the long run estimates of the ARDL were generated as presented in Table 4:

Table 4: Long-run estimates

	Nigeria		South Africa		Ghana	
Variables	Coefficient	Prob.	Coefficient	Prob.	Coefficient	Prob.
IFR(-1)	-0.030187	{0.9314}	-4.480976	{0.0013}	-0.006622	{0.6810}
EXR(-1)	-0.457028	{0.0424}	-11.03284	{0.0014}	-3.064687	{0.0003}
DCR(-1)	-0.595201	{0.0114}	-0.264056	{0.8029}	-0.242080	{0.0064}
UPR(-1)	2.846516	{0.2014}	-0.377797	{0.7366}	-0.435486	{0.0309}

Source: Author's computations using EViews 10.0

From the long-run coefficients in Table 4, it is evident that inflation negatively influenced GDP in the three countries, but was significant in South Africa. In the short run, Nigeria and Ghana experienced the negative and significant effect of inflation, but in South Africa, it was found to be positive and insignificant. Comparing the long-run and short-run results, it is evident that the effect of inflation on GDP in Nigeria, South Africa and Ghana varied with time. This implies that in the long run, rising inflation may be unfavourable to production in the Sub-Saharan region but stronger in affecting GDP in South Africa than Nigeria and Ghana. This supports the notion that a high rate of inflation reduces the purchasing power of money and thus increases the cost of production which automatically leads to lower GDP in Sub-Sahara Africa. This finding supported the empirical works of Olusegun (2021); Oke and Onyokwonu (2021); Ngalawa and Ngalawa (2020); Ahiakpor and Akapare (2014) that an increase in the inflation rate could discourage domestic production in the long run. Also, Ozekhome (2016); Omotosho and Doguwa (2015) found that an inflation rate beyond the optimal threshold hinders economic prosperity. In Sub Saharan Africa (SSA) countries, the inflationary pressure arises from huge budget deficits, hence lack of investible funds and low GDP growth (Ahmed & Sabo, 2011). On the other hand, Mavikela, Mhaka and Phiri (2018); Gatawa, Abdulgafar and Olarinde (2017); Osei (2014) observed that inflation did not hinder economic prosperity in SSA countries.

The focus of the error correction mechanism (ECM) is to study the pressure of the long run equilibrium and short-run dynamics and the *a priori* is that error-correction coefficients, which examines the adjustment from shock, are expected to be statistically significant, negatively signed, and have a sizable range of values which has to be between zero and one (Enders, 2010). Table 5 presents the results of the ECM:

The error correction coefficient (ECM), estimated at -0.071678, -0.228091 and -0.848074 are highly significant and negative as expected, which shows the speed of adjustment to equilibrium. The ECM reveals that approximately 7.17%, 22.81% and 84.81% deviation of GDP from its long-run level is adjusted in one year for Nigeria, South Africa and Ghana, respectively. These highly significant ECM further confirmed the existence of a stable long-run relationship between EXR, IFR, DCR, UPR and GDP in Nigeria. However, based on the coefficient of the ECM, the adjustment mechanism was relatively slow in Nigeria and South Africa, but rapid in Ghana. This could imply that macroeconomic instability lasts longer in Nigeria and South Africa.

Table 5: Error correction mechanism (ECM)

<i>Variables</i>	<i>NIGERIA</i>		<i>SOUTH AFRICA</i>		<i>GHANA</i>	
	<i>Coeff.</i>	<i>P-value</i>	<i>Coeff.</i>	<i>P-value</i>	<i>Coeff.</i>	<i>P-value</i>
ECM(-1)	-0.071678	0.0000**	-0.228091	0.0000**	-0.848074	0.0012**
D(IFR)	-0.313604	0.0037**	0.392616	0.7130	-0.071577	0.0418*
D(IFR(-1))	-0.073261	0.3800	0.380172	0.7505	0.457071	0.0001**
D(IFR(-2))	-0.053498	0.5466	2.390129	0.0652	-0.194246	0.0038**
D(IFR(-3))	-0.394479	0.0012**	-2.570181	0.0128*	0.165433	0.0021**
D(EXR)	-0.475049	0.0001**	-7.892940	0.0033**	0.845261	0.2367
D(EXR(-1))	0.423838	0.0011**	11.42432	0.0007**	-0.225820	0.7930
D(EXR(-2))	0.596775	0.0001**	5.307370	0.0685	5.846035	0.0000**
D(EXR(-3))	0.595201	0.0008**	11.81913	0.0009**	4.532498	0.0001**
D(EXR(-4))	--	--	7.906757	0.0263*	5.844076	0.0000**
D(DCR)	-1.839075	0.0007**	1.892718	0.0206*	-0.405438	0.0049**
D(DCR(-1))	-0.266653	0.4730	--	--	-0.059472	0.6404
D(DCR(-2))	0.659841	0.0965	--	--	-0.101941	0.4119
D(DCR(-3))	0.887439	0.0274**	--	--	0.173744	0.1981
D(DCR(-4))					-0.270152	0.0561
D(UPR)	2.277132	0.0065**	-4.649378	0.0000**	-0.562353	0.0089**
D(UPR(-1))	-1.648997	0.0238*	1.843530	0.0698	1.001961	0.0000**
D(UPR(-2))	-0.742410	0.2712	--	--	0.275733	0.2387
D(UPR(-3))	-2.284789	0.0047**	--	--	0.613738	0.0021**
R-sq.	0.906809		0.871424		0.912322	
Adj. R-sq.	0.802654		0.804341		0.853870	
F-stat.	619.1687		9.371615		26.36230	
Prob. (F-stat.)	0.000000		0.000008		0.000000	
Durbin-Watson	2.339577		1.785857		2.449570	

Source: Author's computations using EViews 10.0

Key: ** denote significance @ 1% level and * denote significance @ 5% level

5. CONCLUSION AND RECOMMENDATION

This paper investigated and compared inflation rate dynamics in Nigeria, South Africa and Ghana (SSA countries) using the econometric procedure of ARDL bounds testing for the period 1981 to 2020. The results derived from the analysis showed that inflation has a time-varying effect on the selected SSA real economies but generally hindered economic growth in the long run, especially in South Africa. This confirms that, though inflation does not affect the SSA economies at the same time and in the same magnitude, it has a long run bearing on their economies. Also, the time-varying effects as observed in the ECM presents evidence of a non-linear relationship between inflation and economic growth in SSA economies over the long term. Based on these findings, the study insinuates that the monetary authorities should carefully identify the underlying causes of such inflation rate dynamics and apply the appropriate policy (such as monetary and fiscal policy) to curtail them and maintain a moderate and stable inflation rate that would foster real economic productivity of the SSA countries.

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