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IMPACT OF DISAGGREGATED PUBLIC EXPENDITURE ON INFLATION RATE IN SELECTED AFRICAN COUNTRIES: A PANEL COINTEGRATION ANALYSIS¹

Favour Chidinma Onuoha² and George Okorie³

Abstract

ABSTRACT: The study examined the long run association between disaggregated public expenditure and inflation rate in selected African countries with data spanning 1990-2019. The study employed a panel cointegration technique and estimated the cointegrating relationship using the Fully Modified OLS (FMOLS), and Dynamic OLS (DOLS) proposed and advanced by Pedroni (1996, 2001) and Kao and Chiang (2001). The findings from the cointegration result reveal the existence of a long run equilibrium relationship among the variables. Also, the panel dynamic OLS revealed that a 1percent change in infrastructure (capital) and defense expenditures leads to about 0.56 percent and 0.27 percent incremental change in inflation rate respectively. On the other hand, expenditure on education has a positive and an insignificant relationship with inflation, while expenditure on health has an inverse but insignificant influence on inflation rate in the region within the period under study. The study recommends that public expenditure on infrastructure in the selected African countries be appropriately channeled to stimulate investment and production, thereby stabilizing prices.

KEYWORDS: Health, Infrastructure, Defense, Inflation, PFMOLS, PDOLS

JEL: H55, H54, H57, E31, C33

¹ The views expressed in the Paper are entirely those of the authors and do not necessarily reflect or suggest those of the affiliated institutions.

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1.0 INTRODUCTION

Public expenditure, which is usually classified as recurrent and capital expenditures, refers to the expenses a government incurs in the running of the affairs of a country. In the light of the increasing government obligations, which have necessitated huge public expenditures in most countries, with monetary growth effects, it has become increasingly necessary to re-examine the link between public expenditure and inflation. Because not all expenditures by government is inflationary, there is need to disaggregate public expenditure into their various components to ascertain the portion of government spending that feeds into the inflationary process.

Theoretically, inflation is fundamentally driven by the forces of demand and supply. Demand pressures arises mostly from expansionary fiscal policies such as increases in government spending and significant tax cuts which increases the propensity to spend and consume. Also, an expansionary monetary policy that increases the money supply contributes to putting an upward pressure on demand and consequently prices. In other words, a continued rise in the overall price level in the medium to long term can be linked to the sustained growth in the money supply (Romer and Romer, 1989). The realization of the adverse consequences of inflation on the economy has necessitated the priority accorded to inflation control by policy makers. One vital question in the macroeconomic strategy dialogue is what tools should be used to fight inflation. Most economic debates agree that the solution could be obtained by identifying the main drivers of the inflationary process. While it is important to identify how inflation responds to changes in total government spending, it is equally expedient to understand its relationship with each component of government expenditure. This is necessary because most of the large temporary changes in the size of government are due largely to changes in certain components of government spending some of which are more likely to be exogenous such as defense spending (Becker and Mulligan, 2003).

Also, proponents of structural theory of inflation argue that developing countries are characterized by structural imbalances, rigidities and market imperfections. While some economic sectors are characterized by inadequate supply relative to demand, others experience excess supply due to low demand. Hence, owing to the sectoral imbalances in these countries, aggregate demand-supply model of inflation becomes nearly unsuitable in explaining inflation in these economies (Solanki and Sen 2015). As such, a disaggregated and sectoral approach to the study of the dynamics of inflation in less developed countries finds support.

The broad objective of this paper is to examine the relationship between the rate of inflation and disaggregated government expenditures in selected African countries, and to identify its sources to inform policy. Specifically, the study seeks to establish the relationships between inflation rate and government expenditure on infrastructure, defense, education and health. The choice of these variables is based on the recognition by most African governments of the enormous role that infrastructure play in industrial development and economic diversification. This is complimented by expenditures that improve human capital particularly in the health and education sectors, as well as the interminable need to fight insecurity. A major concern for not including more disaggregated public expenditure variables in the model was the need to avoid double counting or multicollinearity that may arise thereof.

While several papers have been written on the impact of public expenditure on growth on the one hand and inflation on the other, very few have been written on its disaggregated form on inflation, particularly panel studies on Africa. If at all, most of the studies disaggregated public expenditure into recurrent and capital expenditures, in preference to sectoral disaggregation. Also, consensus on the direction and significance of the relationship between government expenditure and inflation has continued to generate debate in the literature (Dikeogu, 2018). It is for these reasons that this current study is motivated.

The long-run relationship between disaggregated government expenditure and inflation is examined using cointegration analysis. This methodology helps to examine the interactions between the variables under consideration (inflation, capital expenditure, defense expenditure, health expenditure, and education expenditure), taking into consideration the non-stationarity of the data; and to capture the existence of potential cointegrating links between series. In this light, the goal of our analysis is to investigate whether a stable relationship exists between inflation and disaggregated government expenditure and to explore the likely channels of transmission. This approach is in line with the study by Nguyen (2019) that used cointegration technique to analyse the relationship between government expenditure and inflation for three (3) Asian economies including India, China and Indonesia; and Habibullah *et al* (2011) for thirteen (13) less developed Asian economies.

The rest of the paper is divided into the following sections: Section 2 briefly discusses some stylized facts on the subject matter, while section 3 reviews the theoretical and empirical literature. The methodology of the study is described in section 4. Section 5 analyses the results, while section 6 concludes the paper with some policy recommendations.

2.0 INFLATION AND PUBLIC EXPENDITURE IN SELECTED AFRICAN COUNTRIES

2.1 Analysis of Inflationary Trend

The study analysed eleven (11) African countries selected from the various regions of the continent and includes Botswana, Egypt, Ethiopia, Ghana, Kenya, Mauritius, Nigeria, South Africa, Sudan, Tanzania and Tunisia. One major macroeconomic factor affecting these countries and, indeed, developing countries is high rate of inflation (inflation in most cases is in double digit). This is largely because of the deficit spending that characterizes these economies and the attendant growth in broad money supply attributable to an increase in demand without a corresponding growth in output. Starting with the 1990s, it can be seen that inflationary pressure has been volatile and persistent, at times, partly due to public sector dominance in which case low interest rates encouraged growth in government borrowing than they would under the market mechanism, at the expense of the private sector initiatives and output growth (Tables 1 and 2).

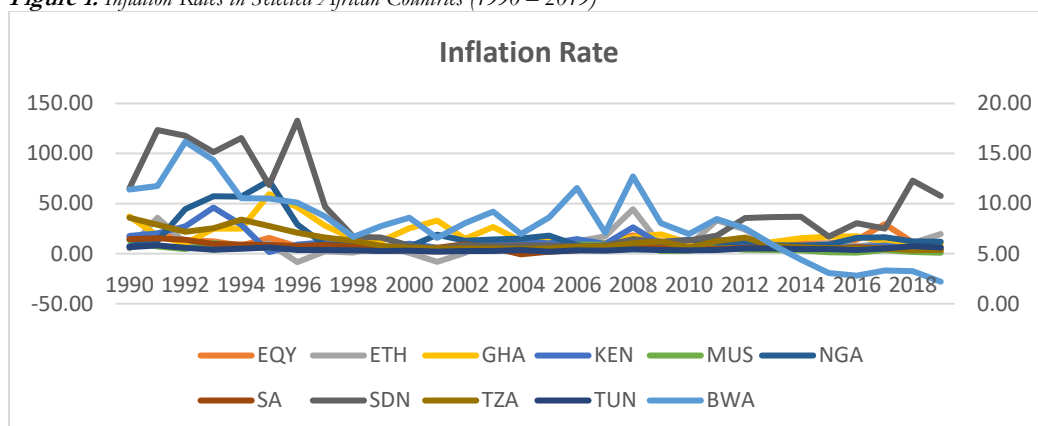
In a cross-country inflation analysis such as this, the rate of inflation that can be considered to be the desirable rate may be difficult to estimate. However, a rate of inflation higher than individual country target or benchmark rate may be seen as significant. Where a target is not set, it will largely depend on individual country's absorptive capacity. The current inflation targets in Egypt, Ghana, Kenya, Nigeria and South Africa for instance are 6-12, 6-10 (set in 2007), 2.5-7.5, 6-9 (set in 2013) and 3-6 (set in 2002) percent, respectively. Inflation in some of these countries, particularly in Ghana, Nigeria and South Africa, have exceeded their lower bounds (even the upper bound in the case of Nigeria) and gradually moving towards their upper limits.

It is worthy of note, however, that while these countries set lower and upper limits for inflation, they are not necessarily inflation targetters *per se* as defined in the literature. Only Ghana and South Africa officially practice inflation targeting amongst the selected countries.

Table 1: Inflation Rates in Selected African Countries (1990 – 2019)

Inflation Rate											
	Botswana	Egypt	Ethiopia	Ghana	Kenya	Mauritius	Nigeria	South Africa	Sudan	Tanzania	Tunisia
1990	11.40	16.76	5.15	37.26	17.78	13.49	7.36	14.32	65.16	35.83	6.55
1995	10.51	15.74	10.02	59.46	1.55	6.03	72.84	8.68	68.38	27.43	6.24
2000	8.60	2.68	0.66	25.19	9.98	4.20	6.93	5.34	8.03	5.92	2.96
2005	8.61	4.87	9.97	15.12	10.31	4.94	17.86	2.06	8.52	5.03	2.02
2010	6.95	11.27	8.15	10.71	3.96	2.93	13.72	4.06	13.25	6.20	3.34
2015	3.06	10.36	10.11	17.15	6.58	1.29	9.01	4.51	16.91	5.59	4.44
2019	2.20	1.99	19.49	9.26	6.27	0.88	11.98	4.02	57.71	3.80	6.06

Source: World Bank database and the Global Economy data base

Figure 1: Inflation Rates in Selected African Countries (1990 – 2019)

Source: World Bank database and the Global Economy data base

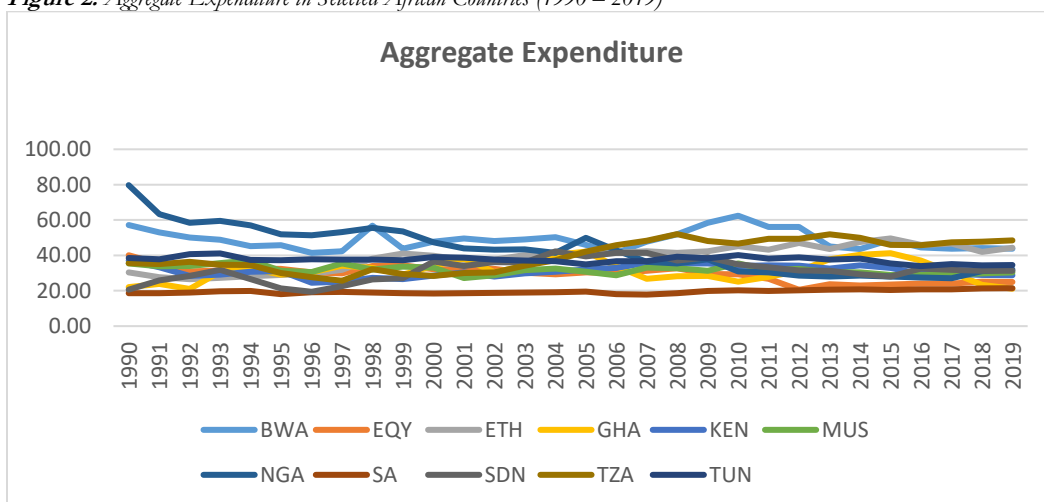
2.2 Analysis of Expenditure Trend

Examining the trend of total expenditures across the eleven (11) countries reflects a similar trend as the inflationary movements. For the purpose of this analysis, the total expenditures are derived by aggregating public spending on defense, education, health and infrastructure in each of the selected countries.

Table 2: Aggregate Expenditure in Selected African Countries (1990 – 2019)

Aggregate Expenditure (% GDP)											
	Botswana	Egypt	Ethiopia	Ghana	Kenya	Mauritius	Nigeria	South Africa	Sudan	Tanzania	Tunisia
1990	57.14	40.08	30.43	22.09	37.10	35.42	79.73	35.01	20.59	35.56	38.51
1995	45.76	32.42	28.87	29.04	31.10	31.23	51.98	32.27	21.29	30.00	37.29
2000	47.82	32.26	39.73	33.95	28.54	33.02	47.39	31.32	36.47	28.34	39.08
2005	45.95	30.40	40.61	42.12	31.99	30.76	49.96	31.62	39.51	42.06	34.97
2010	62.44	29.24	45.19	25.15	34.03	35.52	30.96	34.96	34.94	46.61	40.08
2015	48.76	23.49	49.59	41.21	32.95	28.95	28.00	35.36	28.00	45.91	35.54
2019	43.73	24.99	44.37	21.09	28.83	30.44	32.07	32.19	31.34	48.45	34.61

Source: World Bank database and the Global Economy data base

Figure 2: Aggregate Expenditure in Selected African Countries (1990 – 2019)

Source: World Bank database and the Global Economy data base

Government expenditure has oscillated phenomenally in the last ten years in most African countries. A cursory look at the chart in figure 2 suggests that in the early 1990s, expenditure as a ratio of GDP was above 15% in all countries with Nigeria having the highest of 79.73%, followed by Botswana with 57.14%; 40.08% in Egypt, 38.51% in Tunisia, 37.10% in Kenya, 35.56% in Tanzania, 35.42% in Mauritius and 35.01% in South Africa. Between 2010 and 2015, the ratio of expenditure to GDP rose from 45.19% to 49.59% in Ethiopia and 25.15% to 41.21% in Ghana, while there was a fall from 62.44% to 48.76% in Botswana, 35.52% to 28.95% in Mauritius, and 40.08% to 35.54% in Tunisia. Finally, between 2015 and 2019, expenditure-GDP ratio dropped from 49.59% to 44.37% in Ethiopia, from 41.21% to 21.09% in Ghana, and from 35.36% to 32.19% in South Africa; while it increased from 28.00% to 32.07% in Nigeria, 28.00% to 31.34% in Sudan, and from 45.91% to 48.45% in Tanzania. The foregoing analysis of inflation trends and expenditure profiles in the countries of interest shows a dynamic trend in both variables in the period under review, largely reflecting unstable macroeconomic conditions in these countries.

3.0 LITERATURE REVIEW

3.1 Theoretical Literature

The theoretical frameworks that form the basis between inflation and government expenditure relationship have remained a subject of debate between various schools of thought running from the Classical, Neo-Classical, Keynesian, and Monetarist to the Structural schools of thought. While the classical economists relate the price level directly to the quantity of money in circulation (Friedman 1969), that is the higher the money supply the higher the price level, the Neo-classical (Cambridge school) theorize that the general price level is a direct function of the increases in the demand for money in which case prices increase proportionately with money demand. The Keynesian view on the other hand is at clear variance with the neo classical approach to inflation. In the Keynesian analysis, aggregate demand is what drives inflation and this increase in aggregate demand is caused by increases in government spending, increase in investment, and cut in taxes, among others (Keynes 1936).

According to the Keynesian school, public spending will stimulate aggregate demand which further stimulates economic activities with a multiplier effect on growth. While many studies have revealed that public spending is positively related to economic growth, increases in public spending may lead as well to excess liquidity in the economy with the attendant increase in domestic prices. The Keynesian notion of demand pull inflation, a condition in which excess aggregate demand over supply pushes up the general price level, is based on the postulation that the economy operates below full employment of which increases in aggregate public investment expenditure leads to increases in aggregate demand expenditure up to the point where full employment of resources is reached, beyond which further increases in expenditure creates inflationary pressure. Therefore, additional public investment expenditure over and above the economy's capacity to accommodate such expenditure based on the attainment of full employment equilibrium will create an environment of excess demand over the economy's capacity to increase output, creating what has come to be known as inflationary gap. In other words, since inflation is a function of excess demand, prices remain stable until full employment is reached in which case government investment expenditure leads to price distortions.

While stating that public expenditure acts to stabilize the economy, Keynes (1936) argued that employment and output remained below their potential rate on account of inadequate aggregate demand. As such, increasing total demand could lead to increase in output and employment thereby returning the economy to its full employment potential.

During a recession, Keynes argued that rather than balancing its budget, the government should increase its spending, reduce taxes, and shift its budget towards a deficit. According to Keynes, higher levels of government spending would directly increase total demand. Furthermore, lowering households' income taxes increases their disposable incomes which would further stimulate total demand. Hence to cure a recession, the Keynesian school prescribes a larger public expenditure. On the other hand, if the economy is experiencing inflation in the course of an economic boom, the Keynesian school called for fiscal tightening to address excess demand. As such, reductions in government expenditure, higher taxes, and surplus spending rather than deficit could help fight inflation. In all, the Keynesians disagreed with the notion of a balanced budget, arguing that economic situations should drive fiscal policy measures. In other words, fiscal policy could be applied in such a way as to smooth the unevenness in the business cycle. However, this is not as easy as advocated, as the efficacy of fiscal policy tools in stabilizing the economy depends on proper timing of fiscal interventions, and proper coordination between fiscal and monetary policies.

Monetarists see inflation as the outcome of excessive monetary growth that results when the money supply expands beyond the capacity of the economy to generate output. As such, inflation rate at any given time is the result of current and previous episodes of monetary expansion. Monetarists reject

nonmonetary explanations of inflation such as those that attribute inflation to factors such as, government fiscal expenditures, autonomous private expenditure, demand pull and cost-push effects, among others. They argue that without excessive monetary growth such nonmonetary-induced increases in the prices of some goods would be offset by declines in the prices of other goods, leaving unchanged the average price level. The conclusion reached by modern monetarists is that increases in money supply will have no effect on real output and employment in the long term but will serve merely to raise the price level, while arguing that over time, market forces will naturally settle the economy in a full employment environment.

There is also a generally acclaimed belief that inflation is not always caused by demand-pull and or cost push factors particularly in less developed countries. This has led to the emergence of the structuralist theory of inflation. Proponents of this school explain that inflation in less developed countries is the direct outcome of structural imbalances in these countries, including ambitious development plans aimed at developing critical sectors and infrastructure in those economies (Solanki and Sen 2015).

The new version of the Phillips Curve, in which unemployment rate is replaced with the output gap as a measure of total demand relative to supply, shows that output depends not only on labor inputs, but also on capital inputs. The excess capacity generated by these factors of production raises potential output, widens the output gap and reduces the pressure on domestic prices (IMF 1989). This goes to suggest that government expenditure on capital formation may in the long run work to reduce inflation.

3.2 Empirical Literature

Attari and Javed (2013) explored the link between inflation, disaggregated government expenditure and economic growth in Pakistan using data from 1980 to 2010. Applying the ARDL approach, Johansen cointegration and Granger causality tools, the results show that there is a long run relationship between the variables, suggesting that government expenditure yields positive externalities and linkages. The analysis reveals that while inflation rate does not affect economic growth in the short run, government expenditure does. The causality test indicates a unidirectional causality between economic growth and inflation and economic growth and government expenditure. There is however, no discernable causality between government expenditure and inflation.

Oniore and Obumneke (2015) investigated the relationship between public expenditure growth and inflation in Nigeria with time series data covering the period 1981 to 2012. The study employed the Johansen cointegration and Granger causality tests and the result reveals the existence of a long run relationship among the variables. However, the findings showed that there is no statistical relationship between government expenditure and inflation in Nigeria.

In a study by Ezirim and Ofurum (2003) on the relationship between public expenditure growth and inflation in developed and less developed countries, they find that public expenditure growth significantly and positively affect inflation in Kenya, the United Kingdom and the United States of America, but not in Nigeria.

Alavirad (2003) examined the effect of inflation on government revenue and expenditure in the Islamic Republic of Iran with quarterly data spanning 1981:1 to 1997:1. The study employs simultaneous equation - three-stage least squares estimation techniques and finds that government expenditure increases in a situation of inflationary condition.

Han and Mulligan (2008) reviews the connection between inflation and the size of government by matching theory with empirical evidence. They established that a strong empirical relationship exists between inflation and government size particularly during wartime. Their findings show that inflation

was high during most of British and American wartime periods and low in post-war periods. Their results also show that continually high spending on non-defense goods appears to be mildly negatively associated with inflation while spending on defense items is more strongly positively correlated. In addition, the report noted that there has been a slight increase in inflation with the size of government over time, which is unrelated to defense spending.

In their study on the causality among economic growth, public expenditure and inflation rate in Nigeria between 1970 and 2010, Olaiya *et al.*, (2012) found that a long run relation exists among the variables. While a bi-directional causality exists between government expenditures and economic growth in the short and long run, a unidirectional causality from government expenditure and economic growth to inflation rate was established for the short run. Their result suggests that inflation in Nigeria is influenced by government spending and economic growth.

Dikeogu (2018) modeled the impact of public expenditure on inflation in Nigeria from 1980 to 2017. The study disaggregated government expenditure into capital and recurrent expenditures, while exchange rate and money supply were included as control variables. The result of the Auto Regressive Distributed Lag (ARDL) model shows that capital and recurrent expenditures exert negative impact on inflation with that of recurrent, insignificant. On the other hand, money supply has a positive impact on inflation, while the relationship with exchange rate is positive and insignificant.

Using the Bayesian econometric approach, Mehrara and Sujoudi (2015) modeled the link between inflation rate, money supply and government spending in Iran during the period 1959-2010. The result infers that monetary growth, economic growth, previous inflation rate, excess liquidity, and energy prices have significant positive effect on inflation. Amongst the explanatory variables, money supply growth exerted the strongest impact on inflation. The result indicates that government spending, GDP growth and the exchange rate had insignificant effect on inflation. The author recommends the intensification of monetary policy in the control of inflation.

Inflationary expectations are more effective in causing short run inflation. The nonlinear relationship between inflation and government spending in Iran, using quarterly data over the period of 1990-2013 was examined by Mehrara *et al.*, (2016). Using Smooth Transition Regression Model, their study reveals that in a contractionary regime, government expenditure exerts low impact on inflation and possibly encourages economic growth. In an expansionary regime, however, increases in money supply fuels inflation rather than increasing production. Hence, monetary and fiscal policies remain veritable tools in the control of inflation and stimulating demand in either regime.

Ogbonna (2014) analyses the correlation between the size of government and developments in consumer price index in Nigeria, during the period 1981-2013, using the co-integration and vector error correction model (VECM) methods. The results indicate the existence of a long run equilibrium relationship between government size in Nigeria and consumer price index. The results further suggest that the consumer price index in Nigeria depends on its preceding values or public expectations of inflation.

Ezirim *et al.* (2008) investigates the relationship between growth in public expenditure and inflation in the United States using co-integration analysis and Granger Causality test from 1970 – 2002. The results indicate a co-integrating relationship, implying a long-run equilibrium relationship between inflation and public expenditure. Additionally, the paper identified a bi-causal relationship between the two variables, which suggests that while public expenditure growth could aggravate inflationary pressures in the US, such inflationary trend also considerably influences public expenditure. The study concludes that public expenditure growth is positively correlated with inflationary pressures in the US.

Magazzino (2011), for the countries of the Mediterranean region, assesses the connection between government expenditure and inflation during 1970 - 2009 periods. Employing a time-series estimation technique, the study identified a long-run relationship between public expenditure growth and inflation for Portugal alone. Granger causality tests results confirmed a uni-directional short-run causation emanating from government expenditure to inflation for Cyprus, Malta and Spain; bi-directional causality, for Italy; and uni-directional causality arising from inflation to public expenditure for France.

Ruzima and Veerachamy (2015), explores how government expenditure, imports, foreign direct investment, population growth, and agricultural output affect inflation in Rwanda for the period of 1970 to 2013. Employing the Ordinary Least Squares (OLS) estimation technique, they find that government spending has a negative impact on inflation which is not statistically significant.

In Tanzania, Laryea and Sumaila (2001) adopts the Error Correction Model (ECM) to study the short and long run causes of inflation. The exercise used data running from 1992:1 to 1998:4. The empirical result reveals that while in the short run inflation is influenced by money supply and economic growth, it is determined by the domestic exchange rate in the long run. The study concluded that since inflation in Tanzania is a monetary phenomenon, the government should use both monetary and fiscal policies to tame inflation.

Pekarski (2010) modelled the link between public sector deficits and inflation in high inflation economies. The main finding is that increases in recurrent expenditure lead to extreme inflation in these countries. Another finding of the study is that variations in different items of the budget balance sheet may have different magnitude effects on inflation.

The foregoing review of the empirical literature shows that the issue of government expenditure and inflation has remained in the front burner of empirical studies. However, the disaggregated approach to government expenditure and inflation is fairly scanty. A good number of the previous studies essentially analysed the relationship between public expenditure and inflation in its aggregate form or majorly in its recurrent and capital configurations. Also, panel data approach to the study, using the Fully Modified OLS (FMOLS) and Dynamic OLS (DOLS) techniques on the selected African countries to the best of our knowledge is non-existent. In order to fill this gap, this study disaggregates government expenditures into its sectorial forms and employed panel analysis to test how individual components of government expenditure influence inflation.

We support our estimation technique and justify some of our variables with the following array of studies particularly regional studies that have previously employed similar methodologies.

Table 3: Summary of other Empirical Literature

	Authors	Country/region	Period	Key variables	Method/analytical framework
1	Oghole and Momodu (2015)	Nigeria	1970-2011	Government expenditure and inflation rate	Johansen cointegration test and Granger causality test
2	Oyerinde (2019)	Nigeria	1980 - 2017	Total expenditure, CPI, exchange rate and M2	Johansen co-integration test, ECM and granger causality
3	Nguyen (2019)	India, China and Indonesia	1970 - 2010	Government spending and inflation rate	Cointegration and VECM
4	Narayan <i>et al.</i> , (2019)	Fiji	1970 - 2004	CPI, fiscal deficit and M1	ARDL, FMOLS, and DOLS
5	Maurya and Singh (2017)	India	1981 - 2012	Inflation, public expenditure and GDP	FMOLS and DOLS
6	Ayobami and Olalekan (2020)	Nigeria	1981 - 2018	Inflation, expenditure, GDP and exchange rate	GMM
7	Habibullah <i>et al.</i> (2011)	13 Asian LDCs	1950-1999	CPI, budget deficit and M2	Cointegration and ECM
8	Nwakoby <i>et al.</i> (2016)	Nigeria	1981-2015	Inflation and fiscal deficits	Johansen co-integration test, ECM and granger causality
9	Makochekanwa (2008)	Zimbabwe	1980 - 2005	CPI, deficit budget, GDP and exchange rate	Cointegration and parsimonious ECM

4.0 METHOD OF DATA ANALYSIS

4.1 Model specification

The study is aimed at examining the relationship between consumer price index (CPI) and disaggregated government expenditures in selected African countries. The disaggregated government expenditures include; infrastructural expenditure which is proxied by capital expenditure (CAPEX), defense expenditure (DEXP), health expenditure (HEXP) and education expenditure (EDEXP); while controlling for the model with exchange rate (EXR) which has been established to be a major cause of inflation (Mehrra, and Sujoudi, 2015; Dikeogu, 2018; Momodu, 2015 and Makochekanwa (2008).

The study employs a panel cointegration technique and estimated the cointegrating relationship using Panel Fully Modified Ordinary Least Squares (PFMOLS) and Panel Dynamic Ordinary Least Squares (PDOLS) methods proposed and developed by Pedroni (1996, 2001) and Kao and Chiang (2001). Consequently, cross-sectional dependence and panel unit root test were all conducted to analyze the data. Hence, the general form of the model is specified as:

$$CPI = F(CAPEX, DEXP, HEXP, EDEXP, EXR) \quad (1)$$

Equation 1 states that inflation rate (measured by CPI) is a function of capital, defense, health, and education expenditures, as well as exchange rate. Building on the works of Magazzino (2011) and Olaiya, *et al*, (2012) we exploit the cross sectional and time series dimension of our data by using panel data estimation techniques. The linear functional form of the model becomes:

$$CPI_{it} = \beta_0 + \beta_1 CAPEX_{it} + \beta_2 DEXP_{it} + \beta_3 HEXP_{it} + \beta_4 EDEXP_{it} + \beta_5 EXR_{it} + \mu_{it} \quad (2)$$

Transforming equation (2) into a log form, we have:

$$\ln CPI_{it} = \beta_0 + \beta_1 \ln CAPEX_{it} + \beta_2 \ln DEXP_{it} + \beta_3 \ln HEXP_{it} + \beta_4 \ln EDEXP_{it} + \beta_5 \ln EXR_{it} + \varepsilon_{it} \quad (3)$$

Where:

CPI_i = consumer price index (for inflation rate)

$CAPEX$ = Capital expenditure

$DEXP$ = defense expenditure

$HEXP$ = health expenditure

$EDEXP$ = expenditure on education

EXR = exchange rate

\ln = the natural logarithm of the variables

β_0 = intercept

$\beta_1 - \beta_5$ = coefficients of the explanatory variables to be estimated.

ε_{it} and μ_{it} are the stochastic terms

i denotes the country ($i=1, y, \dots, 11$) and t denotes the time period ($t=1990, y, 2019$).

By *a priori*, $\beta_1, \beta_2, \beta_3, \beta_4, \beta_5 > 0$ which means the explanatory variables are expected to cause inflation.

4.2 Estimation Techniques

The models specified above are estimated using the panel cointegration analysis of Pedroni test, panel fully modified OLS and panel dynamic OLS.

4.2.1 Heterogeneous Panel Cointegration

According to Granger (1981), non-stationary data which become stationary after first differencing will be tested for long run relationship using cointegration estimation technique. But the Engle and Granger (1987) approach involve a simple two-step and as such suffer from several problems, prompting the study to adopt the panel cointegration tests developed by Pedroni (2004), which enables i.) The use of panel data, ii) overcomes problem of small samples, and iii) allows for heterogeneity in the slopes and intercepts of the cointegrating equation.

Pedroni's tests based on the estimated residuals can be expressed in a long-run model as below:

$$y_{it} = \alpha_i + \sum_{j=1}^m \beta_{ji} x_{jit} + \varepsilon_{it}, \quad (4)$$

Where, $\varepsilon_{it} = \rho_i \varepsilon_{i(t-1)} + w_{it}$ which are the estimated residuals from the panel regression. The seven statistics are assumed to be normally distributed and the null hypothesis is that $\rho_i = \text{unity}$ (that is no cointegration). Rejection of the null hypothesis entails the existence of a long run relationship among the variables and thus, a more explicit modeling approach (PFMOLS and PDOLS developed by Kao *et al* (1999) would be employed to test for a long run relationship.

Among several estimators proposed to test for long run relationship in the presence of cointegration, [such as OLS, Fully Modified OLS (FMOLS), dynamic OLS (DOLS), and Pooled Mean Group (PMG)], it has been established that DOLS estimator outperforms OLS and FMOLS which exhibit small sample bias (Kao and Chiang, 2001). Also the FMOLS and DOLS are specifically used to test the long-run cointegrating vector, for non-stationary panels by correcting the standard pooled OLS for serial correlation and endogeneity of regressors present in long-run relationship.

4.2.2 Fully Modified OLS in Heterogeneous Cointegrated Panels

Pedroni (1996, 2001) suggested the use of FMOLS in panel cointegration analysis. Emphasis has been laid on the problem of heterogeneity with differences in means among the individuals and differences in individual responses to short-run disturbances from cointegrating equilibrium as the main reasons for concern in estimating dynamic cointegrated panels (Pedroni, 2001). Thus, PFMOLS regression is specified as:

$$\begin{aligned} Y_{it} &= \alpha_i + \beta X_{it} + \mu_{it} \\ X_{it} &= X_{it-1} + \varepsilon_{it} \end{aligned} \quad (5)$$

where $\varepsilon_{it} = (\mu_{it}, \varepsilon_{it})'$ being the vector error process is stationary with asymptotic covariance matrix Ω_i , X_i , Y_t are the variables which cointegrate for each member of the panel with cointegrating vector β when Y_{it} is integrated of order one. The terms α_{1i} , α_{2i} allow either variable to exhibit idiosyncratic nonzero drifts for individual members of the panel.

4.2.3 Dynamic OLS in Heterogeneous Cointegrated Panels

Kao and Chiang (2001) extended the Dynamic OLS (DOLS) estimator to panel models by developing finite sample properties of the OLS, DOLS, and Pedroni's fully modified OLS (FMOLS). By specification, we have:

$$Y_{it} = \beta_i' X_{it} + \sum_{j=-q}^q \zeta_{ij} \Delta X_{it+j} + \gamma_{1i}' D_{it} + \varepsilon_{it} \quad (6)$$

Where, $D_i, i = \{1, 2, 3\}$ is a vector of deterministic terms, indicating whether the process has

- a) no constant term and time trend,
- b) a constant term and no time trend, or
- c) a constant term and time trend,

Y = dependent variable,

X = independent variables and

q = number of lags adopted with typical information criterion.

It was concluded that the DOLS outperforms both the OLS and FMOLS estimators in finite samples in terms of unbiased estimation based on Monte Carlo simulations. It equally controls for endogeneity in a model thereby providing a robust correction for endogeneity in the explanatory variables. *A priori*, all the explanatory variables are expected to have direct relationship with inflation rates. Finally, Stata 15 is used to estimate our models.

4.3 Sources of Data and Measurement of Variables

The study's sample period and countries are based on annual data availability, ranging from 1990 to 2019, selected as classified by the World Bank. Hence, the work makes use of a balanced panel data of eleven African countries, which includes Botswana, Egypt, Ethiopia, Ghana, Kenya, Mauritius, Nigeria, South Africa, Sudan, Tanzania and Tunisia.

The study considered panel data series on CPI, defense expenditure, capital expenditure (as a proxy for infrastructural expenditure), health expenditure and education expenditure with the exchange rate as the control variable, which were sourced from the World Bank database and the global economy data base.

4.3.1 Definition of Variables

Inflation rate can be defined as the continuous rise in the general level of prices or in the cost of goods and services which in our study is measured by the percentage change in the consumer price index (*CPI*) or by the average growth rates of the *CPI* (Han and Mulligan, 2008).

Capital expenditure (*CAPEX*) comprises outlays on additions to the fixed assets of the economy including net changes in the level of inventories. Fixed assets include land improvements (fences, ditches, drains, and so on); plant, machinery, and equipment purchases; and the construction of roads, railways, and the like, including schools, offices, hospitals, private residential dwellings, and commercial and industrial buildings. Inventories are stocks of goods held by firms to meet temporary or unexpected fluctuations in production or sales, and "work in progress." According to the 1993 SNA, net acquisitions of valuables are also considered capital formation. *CAPEX* is measured in US Dollar as a percentage of the country's GDP.

Defense expenditure (*DEXP*) measured in the U.S. dollar is military expenditure as a percentage of gross domestic product and comprising expenses made on peacekeeping, armed forces and all kinds of defense projects.

Health expenditure (*HEXP*) is government spending on total health care such as drug procurement, building of hospitals, spending on health education and training, research and development measured in U.S. dollar as a percentage of the gross domestic product (GDP).

Education expenditure (*EDEXP*) is the government spending on education such as transfers, scholarships, building of schools, among others and this is measured in U.S. dollar as a percentage of GDP.

Exchange rate (*EXR*) refers to the official exchange rate, calculated as an annual average based on monthly averages of local currency units relative to the U.S. dollar.

The explanatory variables are *a priori* expected to have a positive relationship with inflation, implying that all the coefficients attached to variables (that is, $\beta_1 - \beta_5$ in equation (3) above) are expected to have positive signs.

4.4 Analysis of Correlation Coefficients

To explore the relationship between inflation and disaggregated public expenditure in the eleven (11) countries selected for this study, the correlation coefficients were computed on a country-by-country basis. This is done to clearly bring out the magnitude and direction of the relationship in the individual countries, as aggregating the data across countries could conceal this information.

Analysis of the correlation coefficients shows a high and positive correlation between capital expenditure and inflation rate in Mauritius at 0.66. In Nigeria, a positive and moderate correlation exists between capital expenditure and inflation rate at 0.42. The relationship is high but negative in Sudan which has a correlation coefficient of -0.62 percent.

Defense expenditure on the other hand has a high and positive correlation with inflation rate in South Africa and Tanzania at 0.79 and 0.74, respectively. The relationship is moderate and positive at 0.54 in Botswana, 0.48 in Tunisia, and 0.45 in Kenya and Mauritius, apiece. This is not surprising as expenditure on national security could rise without a corresponding increase in output (CBN 2010).

Health expenditure shows a high, albeit; negative correlation coefficients in Mauritius at -0.71. The relationship is moderate but also negative in Egypt (-0.58), Ghana (-0.51), South Africa (-0.40), Kenya (-0.30), and Sudan and Tanzania (-0.55 apiece), (see Appendix 1).

Finally, education is positively and highly correlated with inflation rate at about 0.60 in Botswana and 0.58 in Sudan, while there exists a negative correlation coefficient of about -0.64 in Mauritius, -0.67 in Tanzania, -0.51 in Egypt, -0.33 in Tunisia and -0.30 in Kenya.

While the negative correlation coefficients between inflation rate and public expenditures observed in health and education sectors in some of the countries may question their accuracy in determining the movement in inflation rates, it is not in doubt that these sectors have wallowed in abject decay in most African countries over the years despite increases in budgetary allocations, which suggests a possible misappropriation of those funds (Appendix 1). Nevertheless, Solanki and Sen (2015) found some negative correlation coefficients between inflation and government expenditure and growth for India.

5.0 EMPIRICAL RESULTS AND DISCUSSION OF FINDINGS

5.1 Cross Sectional Dependency and Unit Root Test

The study employs Breusch-Pagan LM (Breusch and Pagan, 1980), Pesaran scaled LM (Pesaran, 2004), and Baltagi *et al* bias-corrected scaled LM (Baltagi *et al*, 2012) tests which are the most frequently used in the literature to test for the existence of cross-sectional dependency in the panel dataset. The result is presented in Table 4 and all the LM results show that there is the existence of cross-sectional dependence at the 1% level of significance for the variables. The implication is that the second-generation panel unit root tests are expected to supply more accurate information. Therefore, we proceeded further to employ unit root tests which allow for cross-sectional dependence. The results of the panel unit root tests presented in Table 5 reveal that all the variables are integrated of the first order, that is, I(1). This evidence of first order integration of all the variables informed testing for cointegration among the variables in the respective models.

Table 4: Results of Cross-Sectional Dependence Test

	INFL	LnCAPEX	LnDEXP	LnHEXP	LnEDEXP	LnEXR
Breusch-Pagan LM	276.03***	340.47***	527.32***	473.71***	373.96***	1366.30***
Pesaran scaled LM	18.28***	23.89***	40.15***	35.49***	26.80***	113.18***
Bias-corrected scaled LM	18.08***	23.68***	39.95***	35.28***	26.60***	112.97***
Pesaran CD	11.97***	0.81***	14.01***	7.75***	-2.19	36.29***

Note: Null hypothesis: No cross-section dependence. Levels of significance: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Source: Author's Computation using Eviews 10

Table 5: Results of Panel Unit Root Test (LLC, Breit and IPS)

Vaibles	At Level			At First Difference			Remark
	LLC	Breit	IPS	LLC	Breit	IPS	
LNCPI	-1.358 (0.0873) *	-0.9191 (0.1790)	-3.0218 (0.0013) ***	-11.3350 (0.0000) ***	-7.7610 (0.0000) ***	-15.8054 (0.0000) ***	I(1)
LNCAPEX	0.0759 (0.5302)	-1.9801 (0.0238)	-1.2466 (0.1063)	-9.4400 (0.0000) ***	-4.6374 (0.0000) ***	-11.6304 (0.0000) ***	I(1)
LNDEXP	1.82125 (0.9657)	-1.3696 (0.0854)	-1.35543 (0.0876) *	-6.7582 (0.0000) ***	-6.4418 (0.0000) ***	-6.4418 (0.0000) ***	I(1)
LNHEXP	0.6713 (0.7490)	3.86730 (0.9999)	1.03413 (0.8495)	-7.28159 (0.0000) ***	-7.0036 (0.0000) ***	-10.824 (0.0000) ***	I(1)
LNEDEXP	0.69761 (0.7573)	1.25985 (0.8961)	0.05548 (0.5221)	-9.34134 (0.0000) ***	-10.225 (0.0000) ***	-12.861 (0.0000) ***	I(1)
LNEXR	1.15285 0.8755	-1.3839 0.0832 *	-1.70389 0.0442 **	-4.2126 (0.0000) ***	-4.2361 (0.0000) ***	-6.3654 (0.0000) ***	I(1)

Note: *Significant at 10%, **Significant at 5%, and ***Significant at 1%.

Source: Authors Computations

5.2 Results of Cointegration Analysis

We applied the Pedroni panel cointegration test based on three cases (no trend, trend and intercept and no trend or intercept), with the null hypothesis of no cointegration among variables. The result is presented in Table 6 and the findings reveal that the majority of between and within dimension statistics show a rejection of the null hypothesis of no-cointegration at the 1% and 5% level of significance. Hence the result further indicates the existence of long run equilibrium relationship between inflation and expenditure variables.

Table 6: Panel Cointegration Test Result

Pedroni residual cointegration test with no deterministic trend assumption

Alternative hypothesis: common AR coefs. (within-dimension)

	<u>Statistic</u>	<u>Prob.</u>	<u>Weighted</u>	
			<u>Statistic</u>	<u>Prob.</u>
Panel v-Statistic	-1.387412	0.9173	-1.789994	0.9633
Panel rho-Statistic	-0.951008	0.1708	-1.763821	0.0389
Panel PP-Statistic	-4.576128	0.0000	-6.709235	0.0000
Panel ADF-Statistic	-4.62875	0.0000	-7.529706	0.0000

Alternative hypothesis: individual AR coefs. (between-dimension)

	<u>Statistic</u>	<u>Prob.</u>
Group rho-Statistic	-0.194836	0.4228
Group PP-Statistic	-6.946368	0.0000
Group ADF-Statistic	-8.661567	0.0000

Pedroni residual cointegration test with deterministic intercept and trend assumption

Alternative hypothesis: common AR coefs. (within-dimension)

	<u>Statistic</u>	<u>Prob.</u>	<u>Weighted</u>	
			<u>Statistic</u>	<u>Prob.</u>
Panel v-Statistic	-2.991004	0.9986	-3.805687	0.9999
Panel rho-Statistic	-0.810351	0.2089	-0.431578	0.3330
Panel PP-Statistic	-8.155942	0.0000	-6.897816	0.0000
Panel ADF-Statistic	-56.62179	0.0000	-7.758607	0.0000

Alternative hypothesis: individual AR coefs. (between-dimension)

	<u>Statistic</u>	<u>Prob.</u>
Group rho-Statistic	1.378102	0.9159
Group PP-Statistic	-6.066452	0.0000
Group ADF-Statistic	-10.13142	0.0000

Pedroni residual cointegration test with no deterministic intercept or trend

Alternative hypothesis: common AR coefs. (within-dimension)

	<u>Statistic</u>	<u>Prob.</u>	<u>Weighted</u>	
			<u>Statistic</u>	<u>Prob.</u>
Panel v-Statistic	0.079767	0.4682	-0.474194	0.6823
Panel rho-Statistic	-2.242506	0.0125	-2.975563	0.0015
Panel PP-Statistic	-5.711147	0.0000	-7.436093	0.0000
Panel ADF-Statistic	-5.766167	0.0000	-8.223654	0.0000

Alternative hypothesis: individual AR coefs. (between-dimension)

	<u>Statistic</u>	<u>Prob.</u>
Group rho-Statistic	-1.698844	0.0447
Group PP-Statistic	-8.391195	0.0000
Group ADF-Statistic	-10.24858	0.0000

Pedroni (2004) cointegration tests

Notes: Null hypothesis: No cointegration, lag selection: Automatic AIC with a max lag of 5.

***designate the significance at 1% level, **designate the significance at 5% level while *designate the significance at 10% level.

Source: Author's computation

5.3 Estimation of Cointegrating Relationship

After confirming the presence of a long run relationship via Pedroni cointegration tests, the study estimates the cointegrating relationship between inflation and public expenditure variables using panel fully modified OLS (PFMOLS) and panel dynamic OLS (PDOLS) estimators. Pooled weighted versions of the FMOLS and DOLS estimators were employed in both cases of PFMOLS and PDOLS. The weighted estimation accounts for heterogeneity by using cross-section specific estimates of the conditional long-run residual variances to reweight the moments for each cross-section when computing the pooled DOLS estimator. These results are presented in Table 7. However, estimates of the short-run relationships and lagged variables were suppressed. The results of the PDOLS which was preferred (based on Monte Carlo simulations), reveal the existence of a statistically significant long-run cointegrating relationships between expenditure on infrastructure (*capex*) and inflation rate (*pi*), between expenditure on defense (*dexp*) and inflation rate and between exchange rate (*exr*) and inflation rate. While capital expenditure (*capex*), defense expenditure (*dexp*), education expenditure (*edexp*) and exchange rate (*exr*) are positively related to inflation, health expenditure (*hexp*) has negative but insignificant relationship with inflation.

Table 7: Result of Cointegrating Relationship**Panel data analysis of long-run output elasticities.**

	FMOLS		DOLS	
	Coefficient	t-Statistic	Coefficient	t-Statistic
Log of capital expenditure	0.496***	18.13245	0.551***	3.444351
log of defense expenditure	-0.377***	-41.5806	0.270***	2.924452
log of health expenditure	-0.288***	-18.4706	-0.205	-0.882
log of education expenditure	-0.219***	-7.72889	0.010	0.045052
log of exchange rate	-0.371***	-24.5203	0.116**	1.998334
R-squared	0.4124		0.7432	
Adjusted R-squared	0.382823		0.3836	
S.E. of regression	0.659614		0.6531	
Long-run variance	0.301292		0.2378	

Notes: PFMOLS and PDOLS are panel fully modified and panel dynamic ordinary least square methods, respectively. *, **, *** denote the significance level at 10%, 5%, and 1%, respectively.

Source: Author's Computation

5.4 DISCUSSION OF FINDINGS

We conducted cointegration analysis for eleven African countries using panel dynamic OLS (PDOLS) method developed by Pedroni (2004) and panel fully modified OLS (PFMOLS) technique developed by Kao and Chiang (2001). The findings of the Pedroni cointegration tests reveal the presence of cointegrating relationship among the variables which accords with the findings of Olaiya *et al*, 2012; Magazzino, 2011; Ogbonna, 2014; Ezirim *et al*, 2008; Oniore and Obumneke, 2015 and Everton *et al*, 2012. However, the results of the PDOLS being preferred indicate that there is a statistically significant long-run cointegrating relationship between expenditure on infrastructure (*CAPEX*) and inflation rate and between expenditure on defense (*DEXP*) and inflation rate in Africa during the period of study. For the PDOLS estimates, the coefficients are 0.551, 0.270, and 0.010, which means that a 1% change in *Incapex*, *Indexp*, and *Inedexp* will bring about 0.55%, 0.27% and 0.01% incremental change in inflation rate respectively. The positive relationship between *CAPEX* and inflation is in line with the findings of Everton *et al*, (2012) but contrary to the findings of Ruzima and Veerachamy, (2015) Mehrara and Sujoudi, (2015). On the other hand, a 1% change in *Inbexp* leads to about 0.21% decrease in inflation rate for the selected African countries during the period under review. Also, the positive relationship between defense expenditure and inflation rate is in line with the outcome of Han and Mulligan (2008) who found a positive and statistically significant influence of *DEXP* on inflation in Britain.

6.0 SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

The core objective of this research work is to determine the effect of disaggregated public expenditure on inflation rate in selected African countries with panel data from 1990 to 2019. The study employed a panel cointegration method and estimated cointegrating relationships using panel fully modified OLS (PFMOLS) and panel dynamic OLS (PDOLS) proposed and developed by Pedroni (1996, 2001) and Kao and Chiang (2001). The findings from the cointegration result show that there is a long run equilibrium relationship existing among the variables. To further ascertain the extent of the long run

impact of the explanatory variables on the dependent variable, the panel dynamic OLS revealed that a 1% change in capital expenditure, and defense expenditures lead to about 0.55%, and 0.27% incremental change in inflation rate, respectively. The study also finds that expenditure on education has positive and insignificant relationship with inflation, while expenditure on health has an inverse but insignificant influence on inflation rate in the selected countries during the period of study.

In conclusion, the study has revealed that infrastructure (proxied by capital expenditure) and defense expenditures cause inflation. This means that they are inflationary in nature and thus supports the auxiliary hypothesis of Becker and Mulligan (2003) that defense spending is “exogenous”.

Based on these findings, the study recommends the need for respective governments in Africa, especially those countries selected for this study, to ensure appropriate channeling of expenditure to infrastructural development in such a way as not to overheat the economy (this could be done by issuing infrastructure bonds which withdraws liquidity from the system and subsequently uses same in a gradual manner for infrastructure financing) as well as in education and health (human capital development), in order to stimulate investment and production thereby stabilizing prices. As these requires enormous amount of resources, there is need for private sector support and foreign direct investments to augment government's effort at spurring non-inflationary growth in key sectors. Private sector financing allows the spreading and sequencing of the project cost for infrastructure over a longer period of time, in line with the projected benefits. The government should also reduce non-essential budgetary expenditure on defense which does not generate increases in goods and services.

REFERENCES:

- Attari, M. I. J., & Javed, A. Y. (2013). Inflation, economic growth and government expenditure of Pakistan: 1980-2010, *Procedia Economics and Finance*, 5, 58-67.
- Alavirad A (2003). The effect of inflation on government revenue and expenditure: The case of the Islamic Republic of Iran. *OPEC Review*. 27(4): 331-341.
- Ayobami, O. T., & Olalekan, Y. D. (2020). Fiscal-Monetary Policy Interactions and Macroeconomic Performance in a Small Open Economy: A GMM Approach. *Growth*, 7(1), 1-12.
- Baltagi, B. H., Feng, Q., & Kao, C. (2012). A Lagrange Multiplier test for cross-sectional dependence in a fixed effects panel data model. *Journal of Econometrics*, 170(1), 164-177.
- Banerjee, A., Marcellino, M., & Osbat, C. (2001). Testing for PPP: Should we use panel methods? mimeo. *European University Institute*.
- Becker, G. S., & Mulligan, C. B. (2003). Deadweight costs and the size of government. *The Journal of Law and Economics*, 46(2), 293-340.
- Breitung J. (2000). The local power of some unit root tests for panel data. *Advanced Econometrics*, 15, 161-77.
- Breusch, T. S., & Pagan, A. R. (1980). The Lagrange multiplier test and its applications to model specification in econometrics. *The Review of Economic Studies*, 47(1), 239-253
- Central Bank of Nigeria (2010), Inflation. *Education in Economics Series*. Research Department. No. 1
- Choi, I. (2006). Combination unit root tests for cross-sectionally correlated panels. *Econometric Theory and Practice: Frontiers of Analysis and Applied Research: Essays in Honor of Peter C. B. Phillips*. Cambridge University Press, 11, 311-333
- Dikeogu, C.C. (2018), Public spending and inflation in Nigeria, *International Journal of Advanced Academic Research*, Vol. 4, Issue 12
- Engle, R F. & Granger, C. W. J. (1987). *Co-integration and error correction: Representation, estimation and testing*. *Econometrica*, 55, 251-276.
- Everton, D., Vincent, N. E., & Wilson E. H. (2012). On the relationship between fiscal deficits and inflation: econometric evidence for Nigeria. *Economics and Finance Review*, 2(7), 17 – 30,
- Ezirim, B.C, Ofurum CO (2003). Public expenditure growth and inflation in developed and less developed countries. *Nigerian Business and Social Review*, 2(1), 75-94.
- Ezirim, B.C., Muoghalu, M., & Elike, U. (2008). Inflation versus public expenditure growth in the US: An empirical investigation. *North American Journal of Finance and Banking Research*, 2(2).
- Friedman, M (1969). The optimum quantity of money and other essays. Chicago: Aldine. pp. 1-50.
- Granger, C. W. J. (1981). Some properties of time series data and their use in econometric model specification. *Journal of Econometrics*, 16, 121-30.
- Habibullah, M. S., Cheah, C. K., & Baharom, A. H. (2011). Budget deficits and inflation in thirteen Asian developing countries. *International Journal of Business and Social Science*, 2(9).
- Han, S. & Mulligan, C.B. (2008). Inflation and the size of government. *Federal Reserve Bank of St. Louis Review*, 90(3): 245-67.
- Im, K. S., & Pesaran, M. H. (2003). On the panel unit root tests using nonlinear instrumental Variables
- International Monetary Fund (1989). A systems approach to estimating the natural rate of unemployment and potential output for the United States. *IMF Staff Papers*, Vol 37, No. 2
- Kao, C.; Chiang, M.H.; Chen, B. (1999): An application of estimation and inference in panel cointegration. *Oxf. Bull. Econ. Stat.*, 61, 691–709
- Kao, C., & Chiang, M. H. (2001). On the estimation and inference of a cointegrated regression in panel data. In *Nonstationary panels, panel cointegration, and dynamic panels* (pp. 179-222). Emerald Group Publishing Limited.
- Keynes, J. M. (1936). The general theory of employment, interest and money, published by Harcourt, Brace and Company, and printed in the U.S.A. by the Polygraphic Company of America, New York; First Published: Macmillan Cambridge University Press.
- Laryea, S.A. and Sumaila, U.R. (2001), “Determinants of inflation in Tanzania”, WP No.12.

- Levin, A., Lin, C. F., & Chu, C. S. J. (2002). Unit root tests in panel data: Asymptotic and finite-sample properties. *Journal of econometrics*, 108(1), 1-24.
- Magazzino, C. (2011). The nexus between public expenditure and inflation in the Mediterranean countries. *Theoretical and Practical Research in Economic Fields (TPREF)*, (1 (3)), 94-107.
- Makochekanwa, A. (2008). The impact of a budget deficit on inflation in Zimbabwe. Maurya, R., & Singh, B. P. (2017). Nexus of Economic Growth, Inflation and Public Expenditure in India. *Indian Journal of Economics and Development*, 13(1), 165-170.
- Mehrara, M., & Sujoudi, A. (2015). The relationship between money, government spending and inflation in the Iranian economy. *International Letters of Social and Humanistic Sciences*, 51, 89-94.
- Mehrara, M., Soufiani, M. B., & Rezaei, S. (2016). The impact of government spending on inflation through the inflationary environment, STR approach. *World Scientific News*, 37, 153-167.
- Narayan, P. K., Narayan, S., & Prasad, A. D. (2019). Modelling the relationship between budget deficits, money supply and inflation in Fiji.
- Nguyen, T. D. (2019). Impact of Government Spending on Inflation in Asian Emerging Economies: Evidence from India, China, and Indonesia. *The Singapore Economic Review*, 64(05), 1171-1200.
- Nwakoby, C., Okaro, C. S. O., & Ananwude, A. (2016). Fiscal deficit and inflation in an oil rich exporting country: Evidence from Nigeria. *Journal of Policy and Development Studies*, 10(3).
- Ogbole O., Momodu, A. A. (2015). Government Expenditure and Inflation Rate in Nigeria: An Empirical Analyses of Pairwise Causal Relationship. *Research Journal of Finance and Accounting*, .6(15), 36-41.
- Ogbonna, B. C. (2014). Inflation dynamics and government size in Nigeria. *International Journal of Economics, Commerce and Management*, 2(12), 1-12.
- Olaiya, S.A, Nwosa, P.I and Amassoma D. (2012). "A trivariate causality test among economic Growth, government expenditure and inflation rate: Evidence from Nigeria." *Research Journal of Finance and Accounting* Vol. 3 No 1. Pp 65-73.
- Oniore, J.O and Obumneke, E. (2015). Public expenditure growth and inflation in Nigeria: The Causality Approach. *SSRG International Journal of Economics and Management Studies*, 2(2):1-6
- Oyerinde, A. A. (2019). An Assessment of the Nexus Between Government Expenditure and Inflation in Nigeria. *Folia Oeconomica Stetinensia*, 19(2), 102-116.
- Pedroni, P. (1996). Fully modified OLS for heterogeneous cointegrated panels and the case of purchasing power parity. *Manuscript, Department of Economics, Indiana University*, 1-45.
- Pedroni, P. (2001). Fully modified OLS for heterogeneous cointegrated panels. In *Nonstationary panels, panel cointegration, and sdynamic panels* (pp. 93-130). Emerald Group Publishing Limited.
- Pedroni, P. (2004). Panel cointegration: Asymptotic and finite sample properties of pooled time series tests with an application to the PPP hypothesis. *Economic Theory*. 20: 597–625.
- Pekarski, S. (2010), Budget deficits and inflation feedback, Structural Change and Economic Dynamics.
- Pesaran, H. M. (2004). General diagnostic tests for cross-sectional dependence in panels. *University of Cambridge, Cambridge Working Papers in Economics*, 435.
- Pesaran, M. H. (2007). A simple panel unit root test in the presence of cross-section dependence. *Journal of Applied Econometrics*, 22(2): 265-312.
- Romer, C. D., & Romer, D. H. (1989). Does monetary policy matter? A new test in the spirit of Friedman and Schwartz. *NBER macroeconomics annual*, 4, 121-170.
- Ruzima, M., and P. Veerachamy (2015). A study on determinants of inflation in Rwanda. *International Journal of Management and Development Studies*, 4(4): 390-401
- Solanki, M.K and Sen, V. (2015), Public expenditure, economic growth and inflation. Allied Publishers PVT. New Delhi, India

APPENDICES

Appendix I: Correlation Analysis between Inflation and Disaggregated Public Expenditures in Selected African Countries

Botswana	INFL	CAPEX	DEXP	HEXP	EDEXP
INFL	1				
CAPEX	-0.00318	1			
DEXP	0.542017	-0.06241	1		
HEXP	-0.02023	0.50438	-0.08145	1	
EDEXP	0.595773	0.06387	0.413455	0.202	1

Egypt	INFL	CAPEX	DEXP	HEXP	EDEXP
INFL	1				
CAPEX	0.15989	1			
DEXP	-0.109	0.637	1		
HEXP	-0.57508	-0.31014	0.104	1	
EDEXP	-0.5049	0.3322	0.7421	0.546	1

Ethiopia	INFL	CAPEX	DEXP	HEXP	EDEXP
INFL	1				
CAPEX	0.22472	1			
DEXP	-0.24534	-0.691	1		
HEXP	-0.12032	-0.6666	0.43099	1	
EDEXP	0.14788	0.64406	-0.351	-0.19746	1

Ghana	INFL	CAPEX	DEXP	HEXP	EDEXP
INFL	1				
CAPEX	0.1473	1			
DEXP	-0.2038	0.13365	1		
HEXP	-0.5051	0.13393	0.429871	1	
EDEXP	0.14316	-0.0146	0.1493	-0.06812	1

Kenya	INFL	CAPEX	DEXP	HEXP	EDEXP
INFL	1				
CAPEX	0.00271	1			
DEXP	0.449898	0.42161	1		
HEXP	-0.2989	0.11861	-0.30707	1	
EDEXP	0.33667	0.13084	0.3753	0.4249	1

Mauritius	INFL	CAPEX	DEXP	HEXP	EDEXP
INFL	1				
CAPEX	0.65818	1			
DEXP	0.451045	0.65339	1		
HEXP	-0.7098	-0.8359	-0.76341	1	
EDEXP	-0.6347	-0.74985	-0.5097	0.74262	1

Nigeria	INFL	CAPEX	DEXP	HEXP	EDEXP
INFL	1				
CAPEX	0.416077	1			
DEXP	0.24224	0.573824	1		
HEXP	0.148481	0.19828	-0.05604	1	
EDEXP	-0.12094	0.4478	0.3105	0.103	1

South Africa	INFL	CAPEX	DEXP	HEXP	EDEXP
INFL	1				
CAPEX	-0.01608	1			
DEXP	0.79251	-0.2765	1		
HEXP	-0.3982	0.1757	-0.53	1	
EDEXP	0.0349	0.0321	-0.0761	0.5897	1

Sudan	INFL	CAPEX	DEXP	HEXP	EDEXP
INFL	1				
CAPEX	-0.6244	1			
DEXP	-0.196	0.48056	1		
HEXP	-0.5509	0.3217	0.04901	1	
EDEXP	0.58536	-0.49073	-0.4393	-0.4633	1

Tanzania	INFL	CAPEX	DEXP	HEXP	EDEXP
INFL	1				
CAPEX	-0.25	1			
DEXP	0.7421	-0.7271	1		
HEXP	-0.55145	0.3074	-0.4103	1	
EDEXP	-0.67154	0.7278	-0.95	0.4434	1

Tunisia	INFL	CAPEX	DEXP	HEXP	EDEXP
INFL	1				
CAPEX	-0.0979	1			
DEXP	0.4792	-0.4367	1		
HEXP	0.051	-0.81252	0.18161	1	
EDEXP	-0.32685	-0.258	-0.27644	0.11936	1