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Domestic verses foreign borrowing: Does the mode of fiscal deficit financing matter for inflation in Sub-Saharan African countries?

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Abstract

The aim of this study was to analyze the relationship between fiscal deficit financing and inflation in sub-Saharan African countries and determine whether the mode of fiscal deficit financing selected in the economy matters for inflation. The panel data sourced from 45 sub-Saharan African countries from 2005 to 2020 was used for analysis with domestic and foreign borrowing as the main independent variables and the consumer price index as the dependent variable. The study used two-step GMM econometric analysis as the main econometric model with a scaling quantity analysis model to test for the relative effect of the deficit financing tools on inflation. The results show that deficit financing through foreign and domestic borrowing positively influences inflation among sub-Saharan African countries and the severity of the effect on inflation differs between the two modes of deficit financing. This is shown by the domestic borrowing's scaling quantity analysis value of 0.12 against 0.08 for the foreign borrowing. The practical implication of this study is that fiscal deficit financing is inflationary and domestic borrowing causes more inflation than foreign borrowing. Sub-Saharan African governments must therefore make efforts to reduce the fiscal deficit because of the increasing impact of the budget deficit on inflation whenever it is funded. However, foreign borrowing should be preferred to domestic borrowing because it achieves the macroeconomic goal of financing the budget deficit with a lower inflationary effect in cases where deficit financing is unavoidable.

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1. Introduction

Fiscal deficit financing can serve as a means to achieve macroeconomic goals such as enhancing economic growth and reducing inflation when used for productive activities in the economy. On the other hand, deficit finance can be the main impediment to the accomplishment of macroeconomic objectives if it is used for activities that do not increase domestic capital formation and total output. There is uncertainty in public policy as a result of an overreliance on deficit finance (Saungweme & Odhiambo, 2021). An increase in government expenditure results in a fiscal or budget deficit. The main concern remains the consequence and interrelationship between the fiscal deficit, its mode of financing and macroeconomic stability (Obinabo & Agu, 2019). Inflation is one of the perennial macroeconomic problems facing most developing countries

including sub-Saharan inclusive (Nguyen, 2015). Inflation in many countries has been known to be a monetary phenomenon. However, recent studies such as Aimola and Odhiambo (2021) which follow the fiscal theory of price level by Leeper (1991) have argued that fiscal imbalance might also play a major role in fuelling inflation especially in developing countries where financial markets are underdeveloped.

Fiscal deficits have continued to be a problem in both developing and developed countries worldwide (Ezeabasili, Mojekwu, & Herbert, 2012).The worldwide rise in fiscal deficits among developing countries has been driven by the requirement to preserve socioeconomic stability (health, education and infrastructure), foster economic growth and provide employment through the fiscal budget. In sub-Saharan African countries, political unrest, mismanagement of resources and limited tax bases are a few causes that have contributed to the surge (Heitzig, Ordu, & Senbet, 2021; Sani, Said, Ismail, & Mazlan, 2019). Several countries have become bankrupt and defaulted as a result of rising public debt brought on by ongoing fiscal deficit financing which has negatively impacted economic development, people's living conditions and social unrest. Another impact of this variable on macroeconomic stability is the rise in debt payment costs and the inability to regulate borrowing which frequently leads to excessive future borrowing (Ho, Nguyen, & Nguyen, 2021). According to Bua, Pradelli, and Presbitero (2014), the fiscal deficit in an economy is financed through various avenues such as public debt acquisition (foreign and domestic borrowing), tax collection, money creation (seigniorage) and the use of official development assistance (foreign aid). However, the most popular debt financing options among emerging nations include public borrowing from domestic lending institutions like banks (domestic borrowing) and foreign lending organisations such as the IMF, World Bank and other individual countries (foreign borrowing). Although official development assistance is also used in some countries, this mode of deficit financing is exogenously determined by the donor countries which makes it unreliable (Buryk, Bashtannyk, & Ragimov, 2019). Thus, the relative impact of deficit financing strategies on inflation in sub-Saharan African countries is assessed in this study along with the impact of fiscal deficit financing through domestic and international borrowing on inflation.

1.1. Stylized Facts on Fiscal Deficit and Inflation in Sub-Saharan Africa

This study examined a variety of stylized facts about fiscal deficit finance and inflation with the goal of illuminating their relationship. This analysis helped to support the choice of the sub-Saharan African region for investigation which is described below: Inflation in the sub-Saharan African region has persistently remained high and volatile compared to other world regions that are in the same development category. For example, from Figure 1 which presents the annual trends in consumer price indexes for different developing countries' regions, the average consumer price index for sub-Saharan Africa has predominantly remained above other regions such as Asia and Latin America over time. A challenge to social and political stability as well as the system of food security exists in the sub-Saharan region where inflation is typically close to double digits.

Figure 1. Consumer price index in different developing countries' regions

The second stylized fact is that the fiscal deficit in the sub-Saharan Africa region has maintained a rising trend over time. For example, starting in 2015, the median fiscal deficit as a percentage of gross domestic product (GDP) has kept rising from 3.22% to 5.3% in 2020. The deficit has constantly been financed through domestic and foreign borrowing which has seen an increase in sovereign debt in the region from 35.1% in 2014 to 55.4% of GDP in 2019 and 63.1 in 2020 (Heitzig et al., 2021). The high fiscal deficit is also evident among individual countries such as Botswana, Ghana, Zambia and Mauritius which had average rates of 11.1%, 15.3%, 13.8% and 10.9% over the last five years (IMF, 2022).

The third stylized fact is that the fiscal deficit and inflation over time have been moving together (see Figure 2). Figure 2 show that the fiscal deficit and inflation in the sub-Saharan region have some relationships in terms of trend. The inflation peak resembles that of the median fiscal deficit over the years. For instance, the inflation rate had an upward trend from 4.3% to 5.2% in 2001 followed by a downward trend between 2002 and 2004 reaching its lowest in 2004 at 4.1% and later resuming an upward trajectory up to 10.4% in 2008.The inflation rate has decreased since the post-economic crisis of 2008, however, there have been variations with the lowest being in 2019 at 2.8% before it increased to 3.4% in 2020. This is the same trend observed in the fiscal deficit over the sampled period. For instance, between 2006 and 2009, the region experienced an expansion in fiscal deficit owing to low tax revenue due to the great economic recession of 2007 to 2009 which is anticipated to cause the rising fiscal deficit. The COVID-19 epidemic which led most African countries to implement economic stimulus measures to protect populations from the pandemic's impacts is also responsible for the increase in median fiscal deficits in 2020. These stimuli were mainly financed through public borrowing (Heitzig et al., 2021).

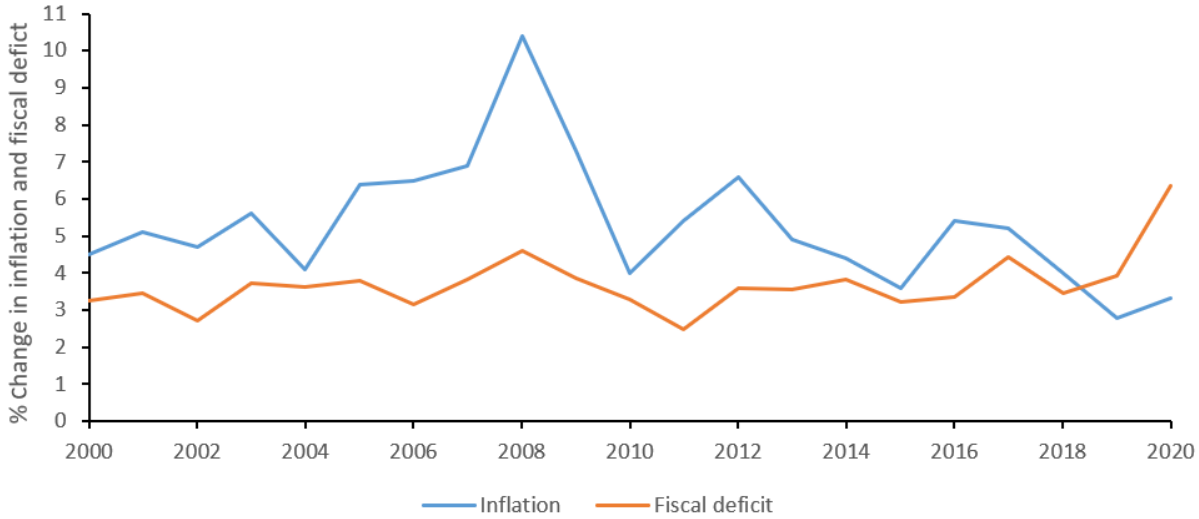

Figure 2. Median fiscal deficit and inflation in SSA region 2000-2020.
Source: Word Development Indictors, https://data.worldbank.org/ and IMF (2022).

Numerous studies have analyzed the relationship between fiscal deficit financing and inflation (see (Alemu, 2020; Ekinci, 2016; Fasanya, Fajobi, & Adetokunbo, 2021; Sethi, Bhujabal, Das, & Sucharita, 2019; Yien, Abdullah, & Azam, 2017)). It is still an open debate on which mode of deficit financing causes more macroeconomic instability especially inflation than the other. Most countries use a variety of different debt instruments to finance their fiscal deficits. Therefore, it is important for policymakers to know which deficit financing method leads to higher inflation as well as how much the overall debt level affects macroeconomic factors like inflation. This forms the basis of the current study. The study provides literature on deficit financing and inflation using data on disaggregated debt financing tools and goes ahead to test the relative effect of deficit financing tools on inflation. This will enable policy makers to choose a deficit financing tool with regard to an optimal deficit financing mechanism. In addition, most studies on this subject have used single country time series data for analysis. The current study used panel data from 45 sub-Saharan countries which increased the sample size. A rise in model effectiveness and predictive power precedes an increase in sample size as provided by the law of large numbers.

The rest of the study is structured as follows: section 2 covers the literature review, model specification and data is covered in section 3, section 4 covers results analysis and discussion and section 5 proves the conclusion and policy implications of the study research.

2. Literature Review

2.1. Theoretical literature

Economists have investigated channels through which fiscal deficit financing causes inflation. In this study, three major theories of inflation are explored to build up the theoretical relationship between inflation and fiscal deficit financing using deficit financing tools. These theories are: The fiscal theory of price level, the demand pull theory of inflation and the quantity theory of money.

2.2. Fiscal Theory of Price Level

The fiscal theory of price level (FTPL) was first suggested by Leeper (1991) and later extended by Leeper and Sims (1994). This theory suggests that continuous fiscal deficit financing may or may not lead to inflation, depending on how it is implemented. For instance, if the government decides to issue treasury bonds and bills

to borrow domestically to make up for revenue shortfalls, inflation would result if commercial banks and other lending institutions supported the purchase of these securities by raising customer deposits because increasing customers' deposits with commercial banks raises banks' assets and liabilities which results in the wealth effect inflationary pressure. On the other hand, if commercial banks use maturing loan proceeds to finance central government borrowing, the banks' assets and liabilities will remain unchanged if no inflation (Afful, 2021). Similarly, suppose foreign borrowing is used to finance the fiscal deficit, the result can be inflationary or deflationary depending on how the government's foreign debt is acquired. For instance, inflation will occur if the government persistently uses short-term loans to meet its financial obligations because short-term foreign loans attract high interest rates which raise the cost of debt servicing using domestic taxes and thus enhance the price level in the economy (inflation). On the other hand, if governments choose long-term and concessional loans, inflation will not occur because of the lower interest rates and better service conditions that prevent taxes from being raised in order to cover the debt (Roy & Sen, 2022).

2.3. Demand Pull Theory of Inflation

The work of John Keynes and his followers is primarily featured in the demand pull theory of inflation. This theory suggests that an anticipated increase in aggregate demand emanating from activities such as financing war using debt financing will increase price levels in the economy. Firms tend to produce more as the price level rises which increases labour demand and causes further inflation. The demand pull theory of inflation suggests that any economic measure that reduces demand can reduce economic inflation because when government expenditure declines, the aggregate demand curve responds through an inward shift to the left which leads to a decrease in the price level, assuming supply is inelastic (Helmy, 2022).

2.4. Quantity Theory of Money

The quantity theory of money suggests that an increase in the fiscal deficit causes inflation through debt monetarization which widens the monetary base given a stable money demand function in the economy. This theory used the Fisher equation to represent the relationship between the money supply and inflation making it one of the oldest theories of inflation in economics.

$$MV = PT \quad (1)$$

Where the parameters M, V, P and T represent the money supply in the economy, money velocity, economic price level (inflation) and the number of economic transactions respectively. The proponents of Fisher equation assumed that the number of transactions T remains constant over time and that money supply and velocity have no composite elements. Thus, an increase in the value of M will automatically lead to a rise in the value of P. Therefore, according to this theory, fixing fiscal imbalances through debt monetarization in the economy will cause inflation if the money demand function is unstable (Friedman, 2010).

2.5. Empirical Literature

The current study's review of the existing literature reveals mixed findings with the variables of interest showing a substantial positive, negative or even no relationship. Fasanya et al. (2021) examined whether Nigeria's deficit financing is inflationary using the consumer price index as the dependent variable and the money supply and fiscal deficit as the primary explanatory factors. The study found that among other macroeconomic variables in the country, the fiscal deficit was an important cause of change in the price level (inflation). The same findings are supported by research on public debt and inflation in Ghana by Aimola and Odhiambo (2021). This study used the ARDL model of estimation with the consumer price index as the dependent variable and gross domestic product, money supply and public debt level as the independent variables. Furthermore, in Ethiopia, Alemu (2020) examined whether fiscal deficits cause inflation and found that raising the public debt (deficit financing) causes inflation to rise when the money supply rises.

A study by Mweni, Njuguna, and Oketch (2016) examined the effect of foreign borrowing on inflation in Kenya using a simple linear regression model and found that an increase in external debt raises the price level in Kenya in regard to how individual deficit financing tools (domestic and foreign borrowing) cause inflation. Ahmad, Sheikh, and Tariq's (2012) study on the determinants of inflation in Pakistan also revealed that local or domestic debt accumulation and its servicing were the major determinants of inflation in the country throughout the research period because domestic debt was mainly financed through floating short-term debt instruments with high-interest rates, thus enhancing income by entities or institutions financing debts which causes a wealth creation inflationary effect. Similarly, Yien et al. (2017) analyzed the causality between debt, exchange rate and inflation in Malaysia. This study found that both domestic and foreign borrowing strongly cause inflation in the country using Granger causality and the Johansen cointegration tests.

Some scholars have also found that deficit financing does not cause inflation in the economy. For instance, according to Essien, Agboegbulem, Mba, and Onumonu (2016), the macroeconomic impact of public debt in Nigeria revealed that domestic and foreign debt do not influence inflation in the country. The same was also confirmed by Khieu (2021) who did a study on the budget deficits, money growth and inflation in Vietnam and found no significant relationship between inflation and the budget in the long run. The study by Khieu (2021) concluded that budget deficit did not cause inflation in Vietnam over the sampled period. In India, a study by

Ashra, Chattopadhyay, and Chaudhuri (2004) on deficit, money and price also found no relationship between budget deficit and inflation in the country.

The negative relationship between deficit financing and inflation has been revealed by studies such as Ekinci (2016) who analyzed the relationship between external debt and inflation in Turkey using a simple linear regression model. This study used the consumer and producer price indexes to measure inflation as dependent variables and external borrowing as the primary independent variable. According to Ekinci (2016), a budget deficit can only cause inflation if the acquired debt is not used for productive endeavours that broaden the economy and boost production. Otherwise, when the borrowed funds are invested in well-thought development projects, it increases economic activity and aggregate supply in the long-run, thus reducing inflation as in the case of Turkey.

3. Study Methodology

3.1. Study Variables

The annual consumer price index was used as the dependent variable while net annual domestic borrowing as a percentage of GDP and foreign borrowing as a percentage of gross national income (GNI) were the main independent variables. Other variables in the model were official development assistance inflow, annual GDP growth, foreign direct investment, capital formation, broad money supply and real interest rate.

3.2. Study Data

The data for this study was annual time series and cross-sectional sourced from the World Bank (World Development Indicators) and the IMF (World Economic Outlook). Some missing data on variables were obtained from www.tradingeconomics.com databases as well as the respective countries' central banks. All variables except domestic borrowing were obtained directly from these databases. The domestic debt data as a percentage of GDP was calculated by dividing the annual domestic debt value by the annual GDP in local currency in percentage form. The sampled period was between 2005 and 2020 for 45 sub-Saharan African countries. Although the current data may cover up to 2022, this study collected data up to 2020 because beyond this year the values of some variables of interest in the study were missing. Similarly, although there are long panels for some countries, 2005 was selected as the base year to have uniform coverage for all selected countries.

3.3. Theoretical Frameworks and Model Specification

The fiscal theory of price level which claims that inflation is a result of governmental fiscal activity serves as the basis for this study. According to Leeper (1991) and Leeper and Sims (1994),the price level in an economy is usually determined by fiscal variables such as current and future government revenue and debt. The proponents of this theory also recognize the role of monetary authority and advocate for coordination between monetary and fiscal policy due to the seigniorage revenue effect on inflation. Hence, on the econometric modeling, this study enhanced the model by Arif and Ali (2012) and specified a dynamic relationship between fiscal deficit financing and inflation as follows:

$$lnCPI_{it} = \beta_0 + \beta_1 lnCPI_{it-1} + \beta_2 DB_{it} + \beta_3 FB_{it} + \gamma_i + \delta_t + \varepsilon_{it} \quad (2)$$

Where $lnCPI$ is the natural logarithm of the consumer price index at level, $lnCPI_{t-1}$ is one year lagged of the consumer price index, DB is domestic borrowing and FB is foreign borrowing (main deficit financing tools). β_1, β_2 ... are parameters to be estimated, γ_i represents the country fixed effect, δ_t is the time effect and ε is the error term, i and t represents the cross-sectional index and time index respectively. Equation 2 is further modified to include other variables that are supported by the theories to have the effect on inflation, to give Equation 3. These variables served as control variables.

$$lnCPI_{it} = \beta_0 + \beta_1 lnCPI_{it-1} + \beta_2 DB_{it} + \beta_3 FB_{it} + \beta'_4 X_{it} + \gamma_i + \delta_t + \varepsilon_{it} \quad (3)$$

where X is a set of control variables among official development assistance, money supply, gross domestic product, capital formation (gross domestic investment) and real interest rate. These variables were also selected based on empirical studies by Agoba (2021) and Ho et al. (2021) who used them as the determinants of inflation in their modeling.

The lagged inflation variable presented in Equation 2 also served as a valid instrument that decomposes variation in the endogenous dependent variable, thus focusing on the variations that are uncorrelated with the error term. This reduces the problem of endogeneity which may emanate from reverse causality or simultaneity (Gretz & Malshe, 2019).

The two-step system Generalized Method of Moments (GMM) model by Blundell and Bond (1998) was the main estimation model in this study. The system GMM model was selected because of its inbuilt dynamic structures that offer robust estimates and deal with the correlation between lagged dependent variables and unit fixed effects problems while avoiding dynamic endogeneity biases that may occur in cases of variable omission (Li, Ding, Hu, & Wan, 2021). The estimation technique also applied the GMM criteria for eliminating country-specific effect problems by taking the first difference of the specified model before conducting the two-step GMM estimation technique. The two-step system GMM was also preferred to the one-step system GMM because it is more robust, asymptotically efficient and reliable for short panels where

the time period (T) is less than the number of cross-sectional units (N), (T<N) due to its ability to correct the possible problem of instrument proliferation (Roodman, 2009). The GMM model used in this study also improves other panel estimation models such as fixed effect models in the following ways: First, the model which uses lagged inflation as the independent variable provides the opportunity that the present inflation rate in this case might be influenced by shocks or earlier realisations that had an impact on past inflation rates. Second, if the past inflation rate influences current inflation, then it is possible to use a combination of lagged variables in an equation to serve as valid instruments for inflation that also account for model simultaneity (Altunbaş & Thornton, 2022).

The reliability of the estimated results was tested using Sargan-Hansen and Arellano and Bond post-estimation tests. In both cases, the null hypothesis was not to be rejected. The Sargan-Hansen test checked for the endogeneity problem with a null hypothesis of instrument over-identification while Arellano and Bond tested for first and second order autocorrelation in errors with a null hypothesis of no autocorrelation. According to Labra and Torrecillas (2018), the Arellano and Bond test for first-order error autocorrelation (AR1) could be ignored while the second order error autocorrelation (AR2) needed to be examined to determine how severe the autocorrelation problem was.

3.4. Scaling Quantity Analysis

In fact, sub-Saharan African states use a wide range of methods to fund their fiscal deficits rather than relying on one tool. In most cases, countries use different deficit financing tools simultaneously. Scaling quantity analysis was employed in order to ascertain the relative importance of each deficit financing tool used by sub-Saharan African countries on inflation. The following model leads to a scaling quantity analysis.

$$\left(\frac{S_I}{S_d}\right) \times |\beta_i| \quad (4)$$

Where S_I the standard deviation of the independent variable is, S_d represents the standard deviation of the dependent variable and $|\beta_i|$ is the absolute value of the independent variable coefficient. This simulation implies that the fiscal deficit financing tool with the highest absolute value of scaling quantity is the most inflationary and vice versa (Ubi-Abai & Ekere, 2018).

4. Empirical Analysis, Results and Discussion

4.1. Descriptive Characteristics of Our Sampled Data

The characteristics of the variables under consideration are presented in Table 1. According to Table 1, the dependent variable (consumer price index) has a maximum value of 557.2, minimum value of -72.7 and standard deviation of 25.5 implying that there are differences in inflation rates among sub-Saharan countries. The independent variables characteristics have foreign and domestic borrowing with minimum values of 0.46 and -36.4, maximum values of 497.9 and 142.6 and standard deviations of 38.8 and 22.2 respectively. Other variables also follow the same trend of having a large standard deviation and a large difference between the minimum and maximum values implying weak stability as well as heterogeneity in the data sample. The dynamic GMM model by Blundell and Bond (1998) is therefore an appropriate model for analysis because it simultaneously accounts for random and fixed effects.

Table 1. Descriptive statistics

Variable name	Indicator	Observations	Mean	Std. dev.	Min.	Max.
Consumer price index	CPI	693	8.3	25.5	-72.7	557.2
Official development assistance	ODA	673	8.1	8.7	0.01	92.1
Foreign borrowing	FB	717	42.3	38.9	.46	497.9
Gross domestic product	GDP	709	4.4	4.6	-36.4	20.7
Domestic borrowing	DB	683	25.5	22.2	-23.2	142.6
Capital formation	CPF	702	23.4	10.5	-3.9	79.4
Money supply	M2	682	32.9	22.2	4.6	163.8
Real interest rate	RIR	597	8.2	11.1	-79.8	65
Exchange rate	EXR	699	713.5	1396.7	0.9	9829.9

4.2. Panel Test for Cross-Sectional Dependence

The Pesaran Cross-sectional Dependency (CD) test was used to test for cross-sectional dependence of errors or residuals across countries. The test provides a null hypothesis of no cross-sectional dependency across residuals and an alternative hypothesis of cross-sectional dependency across individuals or countries (Alsayed, 2022). This study fails to reject the null hypothesis as expected with a Cross-sectional Dependency (CD) test statics of 0.53 and a probability value of 0.6 implying the errors are cross-sectional independent across countries (see Table 2).

Table 2. Pesaran CD test results

H0: Errors are weakly cross-sectional dependent.
CD = 0.53
p-value = 0.60

4.3. Panel Multi-Collinearity Test

The test for multicollinearity among explanatory variables was conducted using the variance inflation factor (VIF). This test is usually essential because it makes the estimated parameters a precise estimator of the population parameter. The rule of thumb states that when estimated VIF surpasses >10, there is a serious multicollinearity concern(Curto & Pinto, 2011). According to Table 3, this study found a variance inflation factor range of between 1.04 and 1.46 with a mean of 1.22 implying that there is no severe multicollinearity problem. The variables under consideration can be used in multiple linear models without influencing each other's test power.

Table 3. Panel multi-collinearity tests

Variable	VIF	1/VIF
l.lnCPI	1.08	0.93
ODA	1.46	0.69
FB	1.46	0.67
RIR	1.14	0.88
CPF	1.06	0.94
GDP	1.08	0.92
dDB	1.36	0.74
dM2	1.20	0.84
dEXR	1.04	0.96
Mean VIF	1.22	0.82

4.4. System GMM Estimation Results

The estimated result for this study is presented in Table 4. The analysis used the natural logarithm of the consumer price index at the level as the dependent variable and domestic borrowing and foreign borrowing as the main predictor variables. Other variables in the model were: one-year lagged inflation level, official development assistance inflow, capital formation, real interest rate, money supply and GDP growth. This set of variables served as control variables controlling the effect of previous inflation on the current inflation level in the economy, country-specific effects and money market dynamics. The estimation model also detected that one-year lagged inflation and money supply are endogenous hence being used as variables in the GMM style while exchange rate, capital formation, GDP growth and real interest rate are exogenous which are used as instruments in the IV style.

Table 4. Two-step system GMM estimation results

Variable name	Model 1	Model 2
Consumer price index(-1)	0.35***	0.37***
	(0.00)	(0.00)
Domestic borrowing (d)	0.14**	0.14**
	(0.01)	(0.06)
Foreign borrowing	0.05**	0.06***
	(0.04)	(0.00)
Official development assistance	0.07***	0.07***
	(0.00)	(0.00)
Capital formation	-0.02**	-0.02***
	(0.01)	(0.00)
Real interest rate	-0.018*	-0.02*
	(0.06)	(0.053)
Money supply (d)	-	0.07
		(0.54)
Gross domestic product	0.05*	0.07**
	(0.06)	(0.01)
AR(2) test	0.35	0.39
Sagan test	0.61	0.53

Note: ***, ** and * denote 1%, 5% and 10% significance levels respectively.
Natural log of consumer price index is the dependent variable.

The estimation results presented reveal that foreign and domestic borrowing (deficit financing tools) positively and significantly influence inflation in sub-Saharan African countries. These variables are statistically significant without lags, implying that the current levels of fiscal deficit financing influence current inflation in the region and that the relationship between the variables is monotonic. The study results also show that lagged inflation, official development assistance inflow (ODA) and GDP growth have a positive and significant effect on inflation. In contrast, capital formation and real interest rates have negative and significant effects on inflation.

The GMM estimation results provided in Table 4 are valid as justified by the Arellano-Bond test for first and second order serial autocorrelation and the Sargan-Hansen test for the endogeneity phenomenon. The two tests failed to reject the individual null hypothesis at all significant levels as expected with the Arellano-Bond test for serial correlation (AR (2)) having a p-value of 0.396 > 0.05 and the Sargan-Hansen test having a p-value of 0.534 > 0.05 in model 2. This means that all hypotheses regarding over-identification of instruments are valid and have no issue with second order serial correlation.

Empirically, the findings of this study support the work of scholars such as Bolarinwaa and Olubiyi (2018), Arif and Ali (2012) and Parsad and Inaba (2021) who also found a positive relationship between fiscal deficit financing and inflation. Regarding other variables such as lagged inflation, foreign aid inflow and GDP growth, the current study's findings are consistent with those of researchers such as Umaru and Zubairu (2012); Nguyen (2015); Arif and Ali (2012) and Moreira (2013). The current study also supports the empirical work of Aimola and Odhiambo (2021) who found a negative relationship between capital formation, the real interest rate and inflation in Nigeria. In practice, inflation is a result of deficit financing in developing countries which borrow to pay for government consumption expenditures such as reducing hunger, paying civil servant salaries and transfer payments. Similarly, GDP growth causes inflation because as the economy grows, households' incomes increase, thus accelerating aggregate demand which in turn raises the price level. On the other hand, an increase in private investment increases the output of a country, availing more goods for consumption and thus lowering the price level (inflation). Similarly, an increase in the interest rate stimulates saving which lowers households' consumption expenditure bundle and aggregate demand, thus, putting downward pressure on the price level (Aimola & Odhiambo, 2021).

4.5. The Relative Effect of Deficit Financing Tools on Inflation

This study used scaling quantity analysis techniques to test for the relative influence of the deficit financing tools on inflation in addition to assess the relationship between deficit financing instruments and inflation. The results are shown in Table 5. According to the scaling quantity analysis estimation, this study found that domestic borrowing causes more inflation than foreign borrowing as implied by the scaling quantity value of 0.12 for domestic borrowing against 0.08 for foreign borrowing. Domestic borrowing causes more inflation because it crowds out private investment whenever it is acquired, thus reducing domestic production (supply) from the private sector. Secondly, domestic borrowing is usually realized through governments floating short-term debt instruments such as treasury bills and bonds which attract high interest. This increases the income of the security holders, thus resulting in wealth-effect inflationary pressure in the economy (Ahmad et al., 2012). Similarly, foreign debt, particularly from international monetary organisations like the IMF and the World Bank tends to come with predefined limitations on use which minimises wastage and accounts for the low inflationary effect of borrowing from abroad. The IMF and World Bank also provide capacity building, policy support and concessional loans at a relatively low interest rate especially to low-income countries which minimizes the adverse effect on macroeconomic stability, especially inflation (Thomson, Kentikelenis, & Stubbs, 2017).

Table 5. Scaling quantity analysis

CPI (Inflation) S_d	25.48	-	-
Variable	S_i	$\lvert\beta_i\rvert$	$(S_I/S_d) \times \lvert\beta_i\rvert$
Foreign borrowing	38.83	0.059	0.08
Domestic borrowing	22.23	0.142	0.12

Note: × Represent the multiplication operator.
Source: Regression analysis and descriptive statistics results.

4.6. Robustness Analysis

This study draws particular attention to the fact that several robustness checks are employed to test the quality and consistency of the results. First, the use of system GMM analysis with two estimation models, in each case, the second model adds control variables to the equation (see model 2 in Tables 4, 6 and 7). The consistency of the results by checking whether the results changed by adding more variables to the model. Second, sub-Saharan African countries were sub-divided into two groups: middle and low-income countries and analyzed independently, the results are as shown in Tables 6 and 7 in the Appendix. The sub-group results are similar to the whole sample analysis in Table 4 in terms of coefficient signs, size and significance level confirming that the study results are highly robust.

5. Conclusion and Policy Implication

The current study sought to empirically analyze the relationship between fiscal deficit financing and inflation in sub-Saharan African countries and determine whether the mode of fiscal deficit financing selected in the country matters to the inflation rate. A sample of 45 sub-Saharan countries was studied for 15 years from 2005 to 2020 to achieve the objectives. The current study used a two-step GMM estimation model to determine the relationship between domestic and foreign borrowing and inflation. The estimated results presented in Table 4 reveal that domestic and foreign borrowing have a positive and significant effect on inflation. The same is confirmed by the sub-group analysis results in Tables 6 and 7 in the Appendix. These results imply that fiscal deficit financing among sub-Saharan African countries is inflationary. The current study also analyze the relative effect of fiscal deficit financing on inflation. In this analysis, a scaling quantity analysis technique was employed and the results are presented in Table 5. The analysis reveals that domestic borrowing is more inflationary than foreign borrowing as indicated by the absolute scaling quantity value of 0.12> 0.08. Therefore, on the basis of these arguments, this study comes to the conclusion that financing fiscal deficits cause inflation in sub-Saharan African countries with the severity of the inflationary effect varying according to the manner of financing chosen.

The results of this study highlight the necessity for fiscal deficit control through effective fiscal policies that decrease resource waste while limiting government spending to reduce the requirement for financing fiscal deficits. Second, the study recommends that authorities and policy makers in the SSA region reduce the domestic share of public debt in favor of foreign debt because domestic borrowing has a relatively higher inflationary effect in the region. In this case, sub-Saharan African governments should consider covering the budget through foreign borrowing especially long-term and concessional loans to ensure the achievement of macroeconomic stability at a low cost to society, since this tool is less inflationary. Third, this study found that an increase in capital formation (domestic investment) reduces inflation. The current study recommends the exploration of private investment avenues such as private-public partnerships to stimulate macroeconomic stability. Last, governments should develop institutions that foster transparency and reduce corruption by holding the government accountable to reduce resource wastage and the fiscal imbalance problems in the region.

5.1. Suggestions for Further Studies

The current study analyzed the relationship between deficit financing and inflation using of deficit financing tools as the main independent variables. The variable selection was inspired by studies such as Ho et al. (2021) and Aimola and Odhiambo (2021) which put forward that the mode of fiscal deficit financing should be of more concern when analysing inflation than the absolute level of fiscal deficit in the case of developing countries. Futures researchers are encouraged to use more deficit financing tools in addition to the ones used in this study and also determine the optimal deficit level below which deficit financing stimulates the achievement of macroeconomic goals such as lowering inflation.

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Appendix

Table 6. Two-step system GMM for the 20 low income countries in sub-Saharan Africa.

Variable name	Model 1	Model 2
ln.conumer price index(-1)	0.31**	0.38***
	(0.000)	(0.000)
Domestic borrowing (d)	0.02**	0.03**
	(0.00)	(0.05)
Foreign borrowing	0.01*	0.01*
	(0.057)	(0.073)
Official development assistance	0.05***	0.06***
	(0.00)	(0.00)
Capital formation	0.02**	0.01
	(0.01)	(0.35)
Real interest rate	0.03***	0.02**
	(0.00)	(0.00)
Gross domestic product	-	0.03**
		(0.03)
Exchange rate (d)	-	0.01***
		(0.00)
AR(2) test	0.11	0.25
Sagan test	0.51	0.81

Note: ***, ** and * denote 1%, 5% and 10% significance levels respectively.

Table 7. Two-step system GMM for the 24 middle-income countries sub-Saharan Africa.

Variable name	Model 1	Model 2
ln.conumer price index(-1)	0.35**	0.45***
	(0.01)	(0.00)
Domestic borrowing (d)	0.14***	0.27***
	(0.00)	(0.00)
Foreign borrowing	0.01**	0.013**
	(0.03)	(0.01)
Official development assistance	0.03	0.02
	(0.19)	(0.17)
Capital formation	-0.0271**	-0.034***
	(0.01)	(0.00)
Real interest rate	-0.030**	-0.04**
	(0.04)	(0.01)
Gross domestic product	-	0.04*
		(0.09)
Exchange rate (d)	-	0.01
		(0.23)
Money supply (d)	-	0.12***
		(0.00)
AR(2) test	0.46	0.29
Sagan test	0.21	0.46

Note: ***, ** and * denote 1%, 5% and 10% significance levels respectively.