Currency depreciation and inflationary pressure vis-à-vis monetary intervention: perspectives on growth and policy implications

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Abstract

This study investigates the effects of currency depreciation, inflation, and efforts to offset depreciation through foreign exchange intervention in a sample of ten Sub-Saharan African countries considered to have had the worst performing currencies from 1990 to 2023. Using dynamic ordinary least squares and error correction estimation techniques we show that depreciation and inflation have significant negative effects on growth, which cannot be offset by central bank interventions. Gross fixed investment and trade openness help promote growth. Diagnostic tests indicate that the estimates are reliable. They are also robust to the exclusion of several explanatory variables. We find a bidirectional Granger causality between currency depreciation and growth, and strong predictive capacity of the estimated model. These findings provide support for the view that greater exchange rate flexibility does not help promote exports and growth in economies with pronounced structural weaknesses and inefficient macroeconomic policies.

Keywords: currency depreciation, inflation, foreign exchange intervention, economic growth, exchange rates, developing economies, Sub-Saharan African countries

1 INTRODUCTION

Following economic reforms that resulted in the adoption of more flexible exchange rates, most Sub-Saharan African countries have experienced persistent currency weakness over the past three decades. Central banks often intervened in the foreign exchange market in an effort to contain depreciation pressures. But with low foreign reserve buffers, interventions could at best provide only temporary relief. Sub-Saharan African countries have also experienced pronounced inflation over the past three decades, which interacted with depreciation to dampen economic growth. Failure to contain fiscal spending has likely played a key role in both currency weakness and inflation. By increasing aggregate demand, public spending has led to high imports of goods and services that generated demand for foreign currency and exerted a downward pressure on the domestic currency. High fiscal deficits required additional government borrowing and led to rising public debt, increasing sovereign risk and leading to further downward pressure on the domestic currency (Okot, Kaltenbrunner and Perez, 2022).

The effects of depreciation on growth in developing economies have been analysed extensively in academic and policy discussions. As early as the 1980s, Sub-Saharan countries had accumulated large external debts that they could not service, resulting in their exclusion from international capital markets. The IMF and the World Bank helped restructure that debt, but the crisis resurfaced in the 1990s when greater exchange rate flexibility led to currency crises with undesirable effects on trade and growth (Ojong and Bessong, 2017). One trigger for these crises was exchange rate mismanagement, notably inappropriate foreign currency interventions. This led the IMF and the World Bank to provide guidelines on intervention in foreign exchange markets (Park, 2019). The thinking behind these efforts was that the expected growth benefits of depreciation – stimulating exports, discouraging imports, increasing external competitiveness and thereby promoting growth – could only be realised when exchange rates were well managed. The possibility that depreciation could do little to encourage growth in an environment of structural and institutional rigidities and ineffective macroeconomic policies was not thoroughly considered, however.

To fill that gap, this paper aims to provide more insight on the growth effects of currency depreciation in Sub-Saharan Africa. The novelty of our study is that we consider the growth effects of depreciation together with those of inflation, and try to assess to what extent central bank interventions in the foreign exchange market help offset these effects. The study covers the period from 1990 to 2023 in a sample of ten Sub-Saharan countries listed by the World Bank (2023) as having the worst performing currencies in Africa: Angola, Burundi, Congo DR, Ghana, Kenya, Malawi, Nigeria, Rwanda, Sierra Leone and Zambia. Our main finding is that depreciation and inflation have significant negative growth effects that cannot be offset by central bank interventions, while fixed investment and trade openness help promote growth.

The remainder of the paper is structured in six sections. Section 2 reviews the literature; section 3 describes stylised facts on growth, exchange rates and inflation in Sub-Saharan Africa; section 4 provides background data analysis; section 5 outlines the empirical framework; section 6 presents the estimation results; and section 7 concludes the paper.

2 LITERATURE REVIEW

In neoclassical open economy macro models, domestic currency depreciation usually promotes trade and economic growth by helping switch domestic demand and output from imported to domestic goods (Dornbusch, 1987). The success of depreciation depends on the so-called Marshall-Lerner condition, i.e. the capacity of the domestic economy to produce and meet the additional demand for domestic goods: if the sum of absolute price elasticities of demand for exports and imports exceeds unity, currency depreciation may stimulate output through an initial increase in the price of foreign relative to home goods. This process helps divert spending from imported to domestic goods, thereby encouraging growth.

A related argument is that by increasing the price of traded relative to home goods, domestic currency depreciation helps shift resources into traded goods production. Depreciation thus acts as a subsidy to the traded goods sector (Benigno, Converse and Fornaro, 2015). Rodrik (2008) further argued that weak domestic currencies encourage growth in developing economies by compensating for their institutional weaknesses and market failures, which often lead to underinvestment in the traded goods sector. Depreciation could also facilitate growth by stimulating competition and increasing returns to scale in production, as well as investment and saving, by redistributing income from consumers to financially constrained firms (Di Nino, Eichengreen and Sbracia, 2011; Gluzmann, Levy-Yeyati and Sturzenegger, 2012).

The structuralist view stressed, by contrast, the contractionary effects of currency depreciation on the economy. This view dates back to the early post-World War II period when Hirschman (1949) and Meade (1951) argued that the Marshall-Lerner condition may not hold in many cases: the price elasticity of exports is often low for structural reasons, so a weaker domestic currency may not stimulate exports much. Similarly, Diaz-Alejandro (1963) argued that even when depreciation does raise the profits of domestic tradable industries, their investment may not rise because they often have a high propensity to save. Bruno (1979) noted that in countries where manufacturing inputs are largely imported, the rise in the costs of production after depreciation may dominate any boost to output from improved export price competitiveness. This view was later reinforced by van Wijnbergen (1989), who advocated a guided exchange rate policy that would prevent depreciation from disrupting the economy.

Empirical studies have found support for both views. Among those that on balance found greater support for the neoclassical view, Rodrik (2008) analysed a small sample of developing countries over 1950-2004 and found evidence that depreciation supported growth in China, India, South Korea, Taiwan, Uganda and Tanzania, while in Mexico the effects were largely contractionary. Habib, Mileva and Stracca (2016) studied a panel of 150 countries over 1970-2010 and found that real depreciation raised GDP growth more significantly in developing countries than advanced economies. Huong (2019) confirmed strong expansionary effects of depreciation on growth through trade and capital investment in Vietnam using advanced econometric techniques. Han (2020) found similar effects via the foreign direct investment channel in a sample of 150 countries over 1997-2017.

Other studies on balance found greater support for the structuralist view. Bouvet, Bower and Jones (2022) analysed the effects of currency depreciation in francophone West African countries induced by IMF conditionality that exchange rate be allowed to adjust before loans could be granted. They found that only three countries experienced significant GDP growth and could control inflation resulting from depreciation within a one-year period, but the majority of countries experienced no appreciable pickup in growth over 1994-2020. The contractionary effects of depreciation on growth were also reported for Nigeria over 1981-2020 (Dada et al., 2022). Ramoni-Perazzi and Romero (2022) analysed a panel of 194 countries over 1995-2019 and established significant negative effects of currency depreciation on economic growth, attenuated to some extent by central bank interventions in the foreign exchange market. Serena and Sousa (2017) studied the effects with firm-level data, and found that depreciation led to contraction of investment and growth in firms in 36 emerging market economies over 1998-2014; the effect could be attenuated by central bank FX interventions. Lavalliere, Molina and Chaudhary (2023) found similar effects in a sample of small and medium enterprises in Lebanon.

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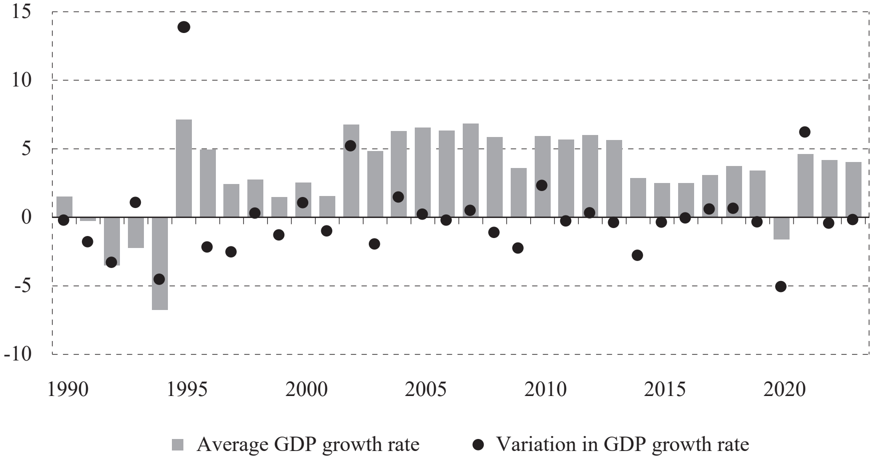
In sum, both neoclassical and structuralist theories assign currency depreciation a prominent role in open economies' growth dynamics, more so in developing than advanced economies. The primary difference is that neoclassical theory focuses on the interplay of market forces that enable depreciation to foster growth, while the structuralist theory emphasises systemic rigidities that impair market forces in developing economies and thereby result in negative effects of depreciation on growth. In the case of Sub-Saharan Africa, where currency depreciation has been persistent, the findings of existing studies on its growth impact have been mixed. Our paper contributes to that literature by looking at the concurrent impact of inflation on growth, and asking to what extent central bank interventions in foreign exchange markets can offset any negative effects of depreciation on growth.

3 STYLISED FACTS

Growth in Sub-Saharan Africa over the 1990-2023 period has been characterised by remarkable fluctuations. The average GDP growth rate declined from 1.5% in 1990 to a low of -6.8% in 1994, only to rise above 7% the following year and decline again to around 2% in the second half of the 1990s (graph 1). From 2002 until 2013 growth averaged over 6% per annum and was fairly stable. From 2014 until 2019, however, the average growth rate halved to around 3%. After a brief recession in 2020 due to the Covid pandemic, the average growth rate stabilised at above 4% per annum. Variations in the annual growth rate were mostly negative, indicating the lack of sustained growth dynamism in this region over the past 34 years. This lack has been explained in most analyses by a combination of internal and external forces: exchange rate instability, rising inflation, monetary and fiscal policy ineffectiveness, persistent weakness in global markets for primary commodity exports, and spillovers from the financial distress in advanced economies.

Graph 1

Growth performance of Sub-Saharan African countries, 1990-2023

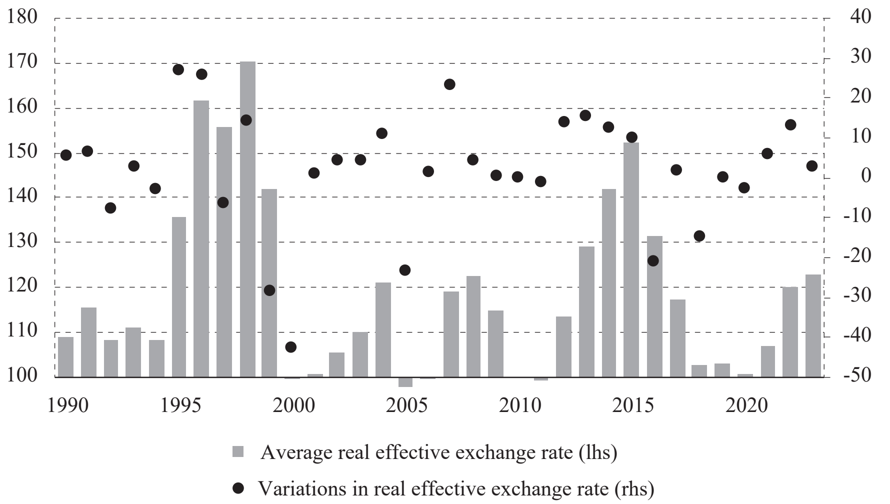


Sources: World Bank (2023); authors' estimates.

Our analysis focuses on the role of persistent currency weakness and high inflation in this disappointing growth performance. Graph 2 shows the average real effective exchange rates of the ten Sub-Saharan countries over 1990-2023; index values above 100 indicate real effective depreciation. The mid-1990s saw a massive real depreciation of nearly 60% between 1994 and 1998. Domestic currency weakness during this period can be largely attributed to the policy shift from fixed to floating exchange rates (IMF, 2023). Depreciation pressures eased in the early 2000s, but resurfaced in 2004 and 2007-9. The mid-2010s saw another bout of real depreciation, cumulating to more than 50% from 2011 to 2015. A measure of stability returned in 2018-21, but rapid depreciation resumed in 2022-23. Currency weakness in this period has been attributed to a combination of factors, including trade imbalances, decline in foreign reserves, inadequate policies and further external reforms (Kemoe, Mama and Mighri, 2023). With few exceptions, annual variations in real effective rates have been mostly positive, confirming the persistent downward pressure on the value of domestic currencies in the region. This has led the IMF and the World Bank, among other institutions, to worry about when the Sub-Saharan countries would finally be able to stabilise their exchange rates (Kubota and Calderson, 2024).

Graph 2

Real effective exchange rates of Sub-Saharan African countries, 1990-2023
2000 = 100

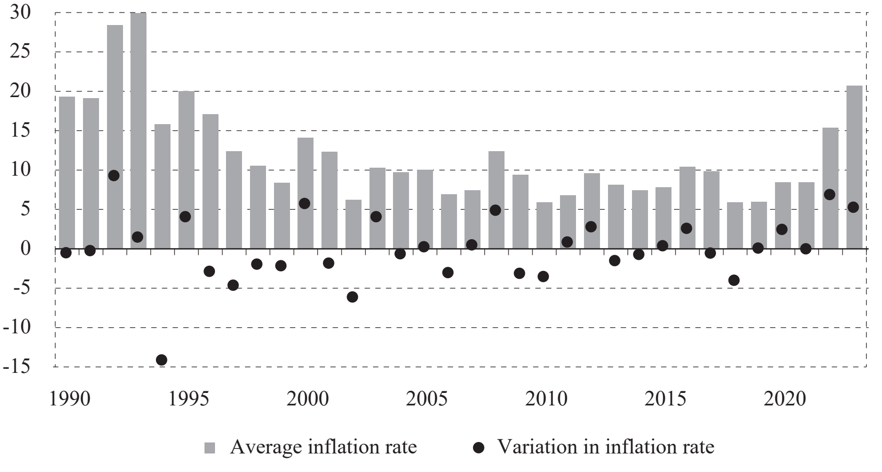


Sources: Federal Reserve Bank of St. Louis (2024); OECD (2023); authors' estimates.

Real depreciation has been accompanied by high inflation, averaging over 20% per year from 1990 to 1996, and about 10% from 1997 to 2021 (graph 3). Like elsewhere around the world, the pandemic led to a surge in inflation in 2022-23. The annual variations show the patchy record of bringing down inflation from the mid-1990s to the early 2020s: many years saw disinflation, but such efforts could not be sustained and average inflation often rebounded in subsequent years. In addition to currency weakness, persistent inflationary pressures have been attributed to supply shocks in agriculture, high production costs, and fiscal expansion (Nguyen et al., 2017).

Graph 3

Inflation rates in Sub-Saharan African countries, 1990-2023



Sources: World Bank (2023); authors' estimates.

4 EMPIRICAL FRAMEWORK

A regression equation of GDP growth as explained by currency depreciation, inflation, central bank FX interventions, and other explanatory variables can be specified as follows:

$$EG_{it} = f[CDP_{it}, INF_{it}, C^{F}_{it} MON_{it}, KAP_{it}, TRD_{it}] \quad (1)$$

$$EG_{it} = \alpha_0 + \sum_{j=1}^{6} \alpha_j X_{it} + \omega_i + \tau_t + \mu_{it} \quad (2)$$

where EG_{it} is the growth rate of GDP in country i in year t; CDP_{it} is the change in the real effective exchange rate (an increase indicates depreciation); INF_{it} is the rate of inflation; C^{F}_{it} is an interaction term between depreciation and inflation rates; MON_{it} is the size of central bank FX interventions (central bank gross sales of foreign currencies in the interbank FX market as a share of official foreign reserves); KAP_{it} is gross fixed capital formation as a share of GDP; TRD_{it} is a measure of trade openness (exports plus imports as a share of GDP); and X_{it} in equation (2) is a vector of the five exogenous variables. ω_i, τ_t, and μ_{it} are vectors of country fixed effects, time fixed effects, and random error terms, respectively. The signs of coefficients α_j that need to be estimated are *a priori* uncertain.

The data sample consists of annual observations for the ten Sub-Saharan African countries noted above over the period 1990-2023. Data sources for the variables are the World Bank's *Open Database* (GDP growth and inflation), *World Development Indicators* (gross fixed capital formation and trade openness), St. Louis Federal Reserve Bank's *FED statistics* and OECD Statistics (for real effective exchange rates), and central bank and national statistical databases (for central bank foreign exchange sales and foreign reserves). Foreign exchange sales are calculated from the annual data series on central bank weekly interventions via auctions and direct sales in individual countries' interbank markets.

Equation (2) can be transformed into a dynamic ordinary least squares (DOLS) model:

$$EG_{it} = \partial_0 + \sum_{j=1}^{6} \partial_j X_{it} + \Delta \sum_{j=1}^{6} \sum_{k=(-1,+1)}^{6} \pi_j X_{it-k} + \omega_i + \tau_t + \mu_{it} \tag{3}$$

where Δ is the first difference operator, and ∂_j are long-run coefficients of exogenous variables that need to be estimated. First differences are included to control for time-invariant, country-specific factors. The leads and lags are introduced to address potential issues with autocorrelation and endogeneity of variables.

Equation (3) describes a long-run equilibrium relationship between economic growth and the set of selected explanatory variables. It is a specification dating back to Stock and Watson (1993) that is commonly used to analyse long-run relationships between endogenous and exogenous variables. We complement it with an error-correction model that describes short-run growth adjustment to shocks in explanatory variables:

$$EG_{it} = \beta_0 + \sum_{j=1}^{6} \beta_j Z_{it-1} + \omega_i + \tau_t + \mu_{it} \tag{4}$$

$$\Delta EG_{it} = \beta_0 + \sum_{j=1}^{6} \beta_j Z_{it-1} + \Delta \sum_{j=7}^{12} \beta_j Z_{it-1} + \theta EC_{it-1} + \tau_t + \mu_{it} \tag{5}$$

where Z_{it} is a vector of lagged exogenous variables with coefficients β_j (j = 1,…,6); Z_{it-1} is a vector of lagged exogenous variables in first differences with coefficients β_j (j = 7,…,12), and EC_{it} is an error-correction term with adjustment coefficient θ.

We perform standard preliminary tests to check that all variables in the model are stationary and co-integrated. The stationary tests are complemented with three unit-root tests: the Levin-Lin-Chu (LLC), Im-Pesaran-Shin (IPS), and Hadri (HD) tests. Co-integration between variables is assessed using Pedroni, Kao, and Westerlund tests as applied for instance in Andrei, Mieila and Panait (2017) and Taghizadeh-Hesary et al. (2019). Structural stability of the model is tested by employing the maximum likelihood technique proposed by Yu, Jong and Lee (2008), followed by a test of prediction capacity using the procedure adopted by Kuo (2016).

5 PRELIMINARY ASSESSMENT OF VARIABLES

5.1 DESCRIPTIVE STATISTICS

The average annual growth rate for the ten countries in the sample over 1990-2023 was a moderate 3.3%, with a minimum of -6.4% and a maximum of 7.8%. The high standard deviation and kurtosis indicate significant fluctuations in growth rates across countries and over time. The average real effective exchange rate index indicates significant real depreciation of nearly 12% per year.[1] It fluctuated between 1% and 77% relative to the base year (2010 = 100), which highlights pronounced currency instability. The average inflation rate was also very high, 13% per annum, ranging from 5.5% to over 31%. Central banks sold on average close to 23% of their reserves in the FX market each year to limit the weakening of domestic currency. The size of FX interventions was relatively stable across the sample. Gross fixed investment averaged 18% of GDP per annum and was also stable. Sub-Saharan African countries are quite open, with an average share of exports and imports in GDP of 62%. This points to a relatively high potential to generate foreign currency, which unfortunately has yet to realise, hence domestic currencies remain weak.

TABLE 1
Descriptive statistics[1]

Variable	Mean	Median	Max	Min	Std. dev.	Skewness	Kurtosis
Real GDP growth[2]	3.3	6.7	7.8	-6.6	5.8	-1.60	3.36
REER index[2]	111.5	126.2	176.9	101.2	19.7	0.92	4.07
Inflation rate[2]	13.1	7.2	31.3	5.5	6.2	2.40	3.93
Central bank FX sales[3]	22.8	16.1	41.4	14.7	3.1	0.83	2.52
Gross investment[4]	17.9	14.7	21.6	12.1	2.9	0.96	2.96
Trade openness[4]	62.3	29.7	71.2	27.2	17.6	1.21	3.62

[1]The sample includes 340 annual observations for ten Sub-Saharan countries over 1990-2023. [2]2010 = 100. [3]In percent of total international reserves of central bank. [4]In percent of GDP.

Source: Authors' calculations.

5.2 PANEL UNIT ROOT AND COINTEGRATION TESTS

The panel unit root tests indicated that economic growth and gross investment were stationary in levels, and all other variables were stationary in first differences (table 2). By rejecting the null hypothesis that the variables are non-stationary, the tests suggest that the six model variables are suitable for DOLS and ECM estimation.

The Pedroni, Kao and Westerlund panel cointegration tests further confirmed that the model variables were co-integrated, i.e. they tend to converge to their long-run equilibrium values after being temporarily disturbed by exogenous shocks. The test statistics shown in table 2 are all estimated to be statistically significant at the 5% level. This indicates that the panel ECM can be used to estimate the dynamic relationship between growth and the selected five explanatory variables.

[1] Averages for the REER index and inflation in table 1 are slightly different from those shown in graphs 2 and 3 because the former were calculated for all 340 observations, while the latter were, for easier interpretation of regional trends, first averaged over individual countries and then over all the ten countries for a given year.

Table 2
Panel unit root and cointegration test

Variable	Panel unit root test					
	Level			First difference		
	LLC	IPS	HD	LLC	IPS	HD
EG	3.02*	2.97*	0.99*	–	–	–
CDP	0.96	1.12	2.85	2.93*	2.99*	1.01*
INF	1.02	0.86	2.76	2.89*	3.04*	0.97*
MON	0.88	1.01	3.13	3.33*	3.10*	0.89*
KAP	2.99*	2.55*	1.06*	–	–	–
TRD	0.98	1.03	3.10	3.02*	2.91*	104*

Test	Panel cointegration test							
	Statistic							
	Var	Rho	PP	ADF	Gt	Ga	Pt	Pa
Pedroni	-7.05*	-6.23*	-8.08*	-5.54*	–	–	–	–
Kao	-5.48*	-4.96*	-9.31*	-6.03*	–	–	–	–
Westerlund	–	–	–	–	-11.07*	-5.97*	-7.99*	5.91*

* *Variable is stationary.*

Note: The sample includes 340 annual observations for ten Sub-Saharan African countries over 1990-2023. LLC = Levin-Lin-Chu test; IPS = Im-Pesaran-Shin test; HD = Hadri test. For LLC and IPS tests, larger statistics indicate more stationary variables. In HD test, smaller statistics indicate more stationary variables. Var = cointegration rank statistic; Rho = stationarity statistic; PP = Phillips-Perron test statistic for co-integration; ADF = Augmented Dickey Fuller test statistic for co-integration; Gt and Ga = Westerlund test statistics for cointegration; Pt and Pa = Westerlund test statistics for adjustment speed in cointegration.

Source: Authors' calculations.

6 ESTIMATION RESULTS

6.1 DYNAMIC ORDINARY LEAST SQUARES (DOLS) ESTIMATION

Estimates of the DOLS model after controlling for country and time specific effects are shown in table 3. The estimation was done by entering the indices of variables in log form. Currency depreciation had a statistically significant negative impact on growth. The estimated coefficient suggests that a 1% real depreciation, other things being equal, depressed GDP growth rate on average by 0.61%. In other words, the average annual growth rate in the sample would have been 5.4% instead of 4.2%, other things being equal, if domestic currencies in Sub-Saharan Africa had been stable instead of depreciating. Inflation also had a significant negative impact on growth: a 1% higher inflation depressed the real GDP growth rate of the countries in the sample by 0.52%. The average annual growth rate would thus have been 6.3%, other things equal, if domestic prices had been stable. The interaction between currency depreciation and inflation compounded these effects – the two variables had appreciable negative synergistic effects on growth.

Table 3
DOLS long-run estimation results
Endogenous variable: Real GDP growth (EG)

Exogenous variables	**Coefficient**	**SEE**	**t-statistic**	**Prob.**
Intercept	2.43**	0.266	9.14	0.001
REER change (CDP)	-0.61*	0.158	-3.84	0.011
Inflation rate (INF)	-0.52*	0.228	-2.28	0.014
REER and inflation interaction (C^F)	-0.74**	0.106	6.97	0.003
Cent.bk FX sales (MON)	0.32	0.233	1.37	0.142
Gross investment (KAP)	0.66*	0.166	3.96	0.009
Trade openness (TRD)	0.51*	0.225	2.26	0.011
ΔCDP_{-1}	-0.55*	0.228	2.41	0.014
ΔINF_{-1}	-0.46*	0.234	-1.96	0.027
ΔC^F_{-1}	-0.67*	0.167	-3.99	0.008
ΔMON_{-1}	0.37	0.263	1.39	0.122
ΔKAP_{-1}	0.58*	0.195	2.97	0.019
ΔTRD_{-1}	0.22	0.209	1.05	0.184
ΔCDP_{+1}	-0.51*	0.227	-2.22	0.017
ΔINF_{+1}	-0.49*	0.246	-1.99	0.021
ΔC^F_{+1}	-0.53*	0.235	-2.25	0.012
ΔMON_{+1}	0.39	0.274	1.42	0.129
ΔKAP_{+1}	0.50	0.420	1.19	0.151
ΔTRD_{+1}	0.26	0.234	1.11	0.163
Adjusted R^2 = 0.88; F-statistic = 14.26; Durbin's h = -1.96; log likelihood = 57.81				

Phillips-Perron unit root test on DOLS residuals

Residual series	**Drift**	**Drift with trend**
Level	-5.04	-6.13
First difference	-9.86	-11.02
Critical value = -7.96		

** Significant at 5% level, **significant at 1% level.*
The sample includes 340 annual observations for ten Sub-Saharan African countries over 1990-2023.
Source: Authors' estimates.

Central bank interventions in the foreign exchange market had positive but statistically insignificant effects on growth, which suggests that they could not effectively contain the negative growth effects of depreciation and inflation.

Gross fixed capital formation and trade openness were positively correlated with growth, helping to offset partly the adverse effects of depreciation and inflation. The estimated coefficients suggest that a 1% rise in capital formation and trade openness were associated with 0.66% and 0.51% higher growth rates, respectively, thus providing cushioning effects against the adverse effects of depreciation and inflation on growth.

Durbin's h and log-likelihood statistics indicate minimal serial correlation, and thus suggest that estimates are reliable and highly unlikely to be spurious. The Phillips-Perron test of residuals further confirms that all variables have a unit root. The drift statistics are statistically insignificant in levels but significant in first differences, so the null hypothesis of non-stationary residuals can be rejected.

6.2 ERROR-CORRECTION MODEL (ECM) ESTIMATION

Table 4 reports coefficient estimates from the error-correction model. The long-run coefficients on currency depreciation (CDP_{-1}), inflation (INF_{-1}), and their interaction are all negative and statistically significant at the 5% level or higher. They are slightly larger in size than the DOLS estimates, confirming the strong negative effect of unstable exchange rates and high inflation on growth. The estimated coefficient on central bank FX interventions is positive and statistically insignificant, suggesting that they were ineffective in offsetting the negative growth effects of currency depreciation and inflation. Coefficient estimates on gross investment and trade openness are positive, statistically significant, and similar in size to those obtained from the DOLS estimates. Reflecting high year-to-year volatility of growth, the estimated long-run coefficient on lagged growth is not statistically significant.

Among the short-run coefficient estimates, only those on currency depreciation (ΔCDP_{-1}) and its interaction with inflation (ΔC^{F}_{-1}) are significant, with the expected negative sign. The error-correction term (EC_{-1}) is likewise negative and statistically insignificant, suggesting that adjustment to the long-run steady state after a temporary disturbance is relatively slow.

The regression diagnostics indicate a robust goodness of fit (the Pearson statistic is significant at the 5% level), reliable and consistent estimates (the Sargan AR(1) and AR(2) statistics fall within the critical range of p-values), and optimality of the one-lag structure (based on the Akaike criterion).

Long run coefficient estimates can be useful for policy analysis if they are structurally stable. To check this property, we split the sample into two sub-periods using the structural break test of Yu et al. (2008). The test identified a break in 2007, a year before the onset of the Global Financial Crisis (GFC), which led to economic downturn in most African countries. However, the test statistics (structural break parameter rho, normalised bias statistic, standard deviation, and root mean square error) indicated insignificant variation between the two subperiods. In addition, maximum likelihood estimates of coefficients in the DOLS specification were not statistically significant for either the entire period or the pre- and post-GFC subperiods. The long-run estimates in table 3 can thus be considered suitable for policy analysis.

Table 4
ECM estimation results
Endogenous variable: ΔEG

Exogenous variables	Coefficient	SEE	t-statistic	Prob.
Intercept	2.74**	0.25	10.96	0.001
CDP_{-1}	-0.64*	0.17	-3.69	0.010
INF_{-1}	-0.56*	0.21	-2.59	0.021
C^F_{-1}	-0.79**	0.11	-7.17	0.008
MON_{-1}	0.28	0.27	1.01	0.119
KAP_{-1}	0.62*	0.17	3.63	0.012
TRD_{-1}	0.53*	0.23	2.29	0.013
EG_{-1}	0.33	0.25	1.28	0.094
ΔCDP_{-1}	-0.57*	0.21	-2.62	0.020
ΔINF_{-1}	-0.39	0.28	-1.37	0.073
ΔC^F_{-1}	-0.55*	0.22	-2.51	0.023
ΔMON_{-1}	0.14	0.19	0.73	0.116
ΔKAP_{-1}	0.28	0.24	1.16	0.102
ΔTRD_{-1}	0.17	0.19	0.86	0.139
ΔEG_{-1}	0.22	0.23	0.97	0.131
EC_{-1}	-0.29	0.24	-1.21	0.097
Pearson test = 2.08*, Sargan test = 4.97, AR(1) correlation test = 2.02, AR(2) correlation test = 1.99, Akaike criterion = 12.03				

*Note: * significant at 5 percent, **significant at 1 percent.*
Source: Authors' estimates.

We further tested the predictive capacity of the DOLS model by estimating it for the first subperiod and validating it for the second. Specifically, we evaluated the prediction errors in the two subperiods: for the prediction capacity to be considered strong, prediction errors in the two sub-periods should be negligible (Kuo, 2016). The values of prediction errors are reported in table 5: they are all negligible and less than unity, which suggests that the model possesses strong prediction capacity and can be relied upon to forecast growth in this sample of countries.

Table 5
Prediction errors

Measures of prediction error	Subperiod 1 (1990-2007)	Subperiod 2 (2008-2023)
MAE	0.122	0.129
MAPE	0.799	0.901
RMSE	0.130	0.126
Theil-T	0.007	0.008

Note: The test is based on the dynamic ordinary least squares (DOLS) model.
MAE = mean absolute error; MAPE = mean absolute prediction error; RMSE = root mean square error; Theil-T = Theil's coefficient of inequality.
Source: Authors' estimates.

6.3 ROBUSTNESS CHECKS AND CAUSALITY ANALYSIS

We checked the robustness of estimates in tables 3 and 4 by excluding some explanatory variables, following Matemilola, Bany-Ariffin and Azman-Saini (2012). In the DOLS model, we excluded the interaction term between currency depreciation and inflation and obtained the same pattern of coefficient signs and statistical significance as in table 3. In the ECM model, we excluded gross investment and trade openness, and likewise obtained the same pattern of coefficient signs and statistical significance, as well as parameter estimates of similar size, as in table 4.[2]

To further assess the direction of association between economic growth and exogenous variables, we conducted pairwise causality test. Table 5 reports the results of tests for bidirectional and unidirectional causalities. The F-statistics for the first pair of variables suggest a bidirectional causality between economic growth and currency depreciation, with depreciation having a somewhat stronger impact on growth than the other way around. The F-statistics for the second pair of variables suggest a unidirectional and significantly larger causality between inflation and growth than the other way around. There is also a unidirectional relationship between economic growth and central bank FX interventions, gross investment and economic growth, while bidirectional relationship exists between growth and trade openness. These results are not surprising. One would not expect the FX interventions to have a lasting impact on growth, but stronger growth on the other hand helps replenish foreign reserves and central bank's intervention capacity. Similarly, investment is expected to lead to higher growth, but not necessarily vice versa. The bidirectional causality between growth and trade openness largely conforms to economic intuition.

Table 6
Pairwise Granger causality tests

Direction of causality	F-statistic	Prob.	Causality status
CDP → EG	9.21	0.0002	Bidirectional
EG → CDP	8.70	0.0004	
INF → EG	8.11	0.0005	Unidirectional
EG → INF	1.39	0.2940	
MON → EG	2.91	0.1020	Unidirectional
EG → MON	7.88	0.0012	
KAP → EG	9.03	0.0003	Unidirectional
EG → KAP	2.31	0.1140	
TRD → EG	9.50	0.0002	Bidirectional
EG → TRD	7.07	0.0016	

Source: Authors' estimates.

The negative effects of currency depreciation on growth in this study are different from those obtained by Rodrik (2008), Habib, Mileva and Stracca (2016), Huong

[2] Details of these robustness checks are available from the authors upon request.

(2019), and Han (2020), who found depreciation to have a positive effect on growth in the long run. We also show that the negative effects hold even if the central bank intervenes to limit rising exchange rate, a structuralist policy channel that was not considered in the past studies of Serena and Sousa (2017), Dada et al. (2022), and Ramoni-Perazzi and Romero (2022), although they also found negative effect of depreciation on growth. The high adjusted R^2 indicates that even with this limited set of exogenous variables the model could account for 88 percent of the large variation in Sub-Saharan countries' economic growth.

7 CONCLUSION

This study has shown that the Sub-Saharan African countries have been unable to benefit from the improved price competitiveness of their exports that greater exchange rate flexibility was expected to generate. The reasons may include inelastic supply, high import dependency of exports, shocks in global demand for primary exports, high cost of capital, weak fixed investment (Kandil and Mirzaie, 2003), as well as the general failure to control inflation (Bandaogo, 2021). The adverse effect of depreciation supports the structuralist view of exchange rate flexibility (van Wijnbergen, 1989), and suggests that economies in Sub-Saharan Africa remain burdened by pronounced structural rigidities and market imperfections that prevent depreciation from fostering trade and growth.

Central bank intervention in foreign exchange markets could not ameliorate the negative effects of depreciation and inflation on growth. This may partly reflect limited reserves at the disposal of the central bank, and partly the limitations of intervention to offset currency weakness in economies with weak fundamentals. That said, the perceived inability of central banks in African countries adequately to deploy monetary policy measures to manage depreciation and inflation, which has raised concerns in the IMF and the World Bank, has played a role as well.

A key policy implication of these findings is the need for structural reforms to enable the Sub-Saharan economies to exploit their potential by raising exports and reducing imports on a sustained basis. Strong positive growth effects of gross fixed investment and trade openness confirm the need for such a policy orientation. A more restrained fiscal policy would certainly contribute to these efforts as well, by reducing domestic and import demand pressures and pressures on public debt financing, as well as by releasing resources for fixed investment. Likewise, a more effective monetary policy would help reduce inflation and improve domestic price competitiveness.

Disclosure statement
The authors have no conflict of interest to declare.

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