International Journal of Economics, Commerce and Management
United Kingdom ISSN 2348 0386 Vol. 11, Issue 10, Oct 2023

https://ijecm.co.uk/

EXCHANGE RATE VOLATILITY OF OIL PRODUCING COUNTRIES IN SUB-SAHARAN AFRICAN IMPACT ON ECONOMIC GROWTH

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Abstract

The study examined how the exchange rate volatility in the oil producing countries in sub-Saharan African countries have impacted on their economic growth. The study employed the data spanning from 1980 to 2019 to empirically ascertain if exchange rate volatility of oil producing countries in Sub-Saharan African impact on Economic growth. The Pooled Fixed Effect regression approach was employed to analyse the data on Gross domestic product (captured by Economic growth) as the dependent variable, exchange rate volatility, money supply, consumer price index, trade openness, credit to private sector, foreign direct investment and gross capital formation. The results indicate that volatility in the exchange rate boosts economic growth in oil-producing SSA countries. Economic growth increases due to investor attraction from frequent exchange rate fluctuations. Money supply and credit to the private sector have a negative impact on economic growth, while foreign direct investment affects growth negatively yet is significant at the 10% level. Trade openness and consumer price index are significant to growth, with trade openness being negative and consumer price index being

positive. Gross capital formation positively influences economic growth, aligning with theories of capital as an output driver. The study concluded thatoil producing countries in sub-Saharan should adopt the most potent economic stabilization policy that would halt the constant swing, and stabilizes their exchange rates. This will make investment returns predictable for investors, led to increased domestic and foreign investments inflow, and bring about sustained development amongst oil producing countries of Sub-Saharan Africa.
Keywords: Exchange Rate Volatility, Money Supply, Trade Openness, Gross Capital Formation, FDI, Economic Growth

INTRODUCTION

In recent decades, the intricate connection between economic growth and exchange rate volatility has emerged as a central theme in macroeconomic research. Historically, this theme took center stage after the demise of the Bretton Woods system in 1971, which marked a transition from pegged to free-floating exchange rate systems. This transition ushered in substantial global currency fluctuations, commonly termed as volatility (Bala & Asemota, 2013). Such volatility bears significant consequences for critical macroeconomic indicators like interest rates and inflation. This is particularly true for developing nations, whose economies are intricately tied to international trade (Sara, 2019; Christian, 2015).

Sub-Saharan Africa, with its plethora of oil-producing nations, offers a unique perspective on this issue. Following the monetary and structural adjustments during the 1980s and 1990s, the region experienced increased exchange rate volatilities (Maehle, Teferra, & Khachatryan, 2013). Countries like Nigeria and Gabon opted to maintain pegged systems characterized by strict regulatory controls. In contrast, nations such as Uganda transitioned to more flexible systems, resulting in remarkable exchange rate fluctuations (IMF, 2015). Given the pervasive influence of exchange rate movements on the pricing of both tradeable and non-tradeable goods, it becomes imperative to discern their implications for economic policies, especially regarding stabilization and growth in Sub-Saharan Africa's oil-exporting nations (Bernal, 2015).

Before the 1970s, Sub-Saharan African countries like Nigeria boasted stable exchange rates, largely attributed to their agricultural exports (OPEC, 2021). However, the subsequent discovery and boom in crude oil trade introduced a new dimension of volatility to these economies. A pivotal turning point was the centralization of crude oil pricing, which moved from individual nation-states to the Organization of the Petroleum Exporting Countries (OPEC), rendering these economies vulnerable to external price shocks (Al Samara, 2009). This

susceptibility is vividly depicted in the fluctuations in oil prices (World Bank, 2023). When coupled with macroeconomic instabilities, such as political turmoil, the macroeconomic risk for the region amplifies. In spite of several reforms aimed at alleviating these concerns, Sub-Saharan Africa continues to wrestle with exchange rate challenges, which invariably influence its economic trajectory (Raji, 2012; Anothony & Kwame, 2008). Given the mixed findings in existing literature concerning the correlation between exchange rate volatility and economic growth, there arises an urgent call to delve deeper into this relationship, with a spotlight on the oil-rich nations of Sub-Saharan Africa.

LITERATURE REVIEW

The impact of exchange rate volatility on economic growth is evaluated by Ramoni-Perazzi & Romero (2022) using a panel of 194 nations over the years 1995–2019. In addition to some control variables, such as the degree of economic openness and financial development, investment, government spending, and the anticipated level of education, they turn to dynamic panel data models, taking the exchange rate volatility estimated based on GARCH models as an explanatory variable. Economies are categorized based on how corrupt their governments are. The estimations are produced using both the Difference and System Generalized Method of Moments. The results repeatedly demonstrate that exchange rate volatility has a large negative impact on economic growth, which decreases as the financial system matures. The effect of volatility is lessened in high-corruption nations, which may be due to the fact that these nations are accustomed to managing the economic instability brought on by poor levels of governance and have already factored this cost into their prices.

Aye & Harris (2019) tried to examine real exchange rate volatility and income distribution between capital and labour in South Africa. The study utilized time series data and applied the VAR likewise symmetric and asymmetric effects. Findings from the study shows that labour share in income is not been affect by exchange rate volatility thus, exchange rate volatility is positively related to labour income. The findings also revealed that the effect of a greater increase in exchange rate volatility is much higher than when exchange rate volatility is on a decline making it possible or certain control variables as GDP and investment to change in sharp response to a fall in income which is followed by an increased in the price for investment. The study however recommended that a low exchange rate volatility is advisable in such an economy where investment is within its peak so as to boost income and attain economic growth.

Khomo (2018) empirically looked at how exchange rate volatility and misalignment affect economic activity in South Africa. The study utilized time series data and applied the non- linear autoregressive distribution lag (NARDL). It was found by the study that exchange rate volatility

as measured using the GARCH estimation technique have less contributions to economic activity proxy by GDP, this is for the reason in the study that exchange rate behaviour is not aligned with potentials in attaining increased growth in the economy. It was recommended by the study that in order to stimulate growth through investment drive exchange rate conditions in the economy should be given a proper attention that can attract investors into the economy thereby increasing output.

Pino, Tas, & Sharam (2016) used time series data and multiple regression based on OLS technique to show the effects of exchange rate volatility on exports in East Asia. The study utilized time series and applied the error correction model (ECM) and the variance decomposition (VD) all allied to ascertain the joint influence of the model both within the short- and long-term periods. The study found empirically that there is an increased change in exchange rate volatility which has a significant effect to the response of export for the various economics under considerations, findings from the variance decomposition indicate that innovation brought by exchange rate volatility has less effect on the pattern of export in the various economies. However, the study recommended that policy change geared towards the minimization of the harmful effect of exchange rate changes and export should be encouraged by the government of the various countries within the study.

Yildiz, Ide, & Malik (2016) tried to examine in Turkey whether economic growth is being affected by exchange rate volatility. The study utilized time series data and applied the Engle-Granger two step estimation method (EGM) and the ARCH family models, it was found by the study that all the variables, correlations exist between them. It was also shown by the study that exchange rate volatility impacts economic growth in a positive manner crossing out its relationship also, again that capital inflows into the country attracts greater investment drive with the elastic exchange rate policy in operation. The study therefore recommended among others that improving investment drive in the country will reducing the dependency in the country and therefore a policy aimed at inflation targeting should also be in place as an intervention ground as to reduced disruptive impact of exchange rate volatility over price stability in the country.

Gunther (2014) empirically examined the impact of exchange rate volatility on growth in Emerging Europe and East Asia by using time series unbalanced cross country panel model for 17 Emerging European countries and 9 East Asian countries. Generalized least square fixed effect (GLS) estimation techniques was adopted by the study. The study found that exchange rate volatility on economic growth has a negative effect in both East Asia and Emerging Europe. It was therefore recommended that emerging economies in Europe move towards attaining increased stability in exchange rate as against a high volatility exchange rate that is much essential for increased growth.

Wandede (2014) analyzed Kenya`s real exchange rate volatility and economic growth. Thus using time series data and descriptive statistics, the study found that exchange rate volatility has a positive significant with economic growth though not affected by the growth rate of GDP in Kenya in the same magnitude, this can be related to the dividend appreciation of the local currency of over 30% increase as against the dollars which enable a total investment approach within the economy. However, the study recommended that since currency devaluation accounted for a rapid increase in the economy which in turn increase export, there should also be a striking balance between appreciation of currency and devaluation in the future.

In addition, Nyahokwe & Ncwadi (2013) examined the impact of effect of exchange rate volatility on South African exports the study adopted the use of vector error correction model. Findings from the study showed that exchange rate volatility is sensitive in deciding exports conditions in South African, such that the impact of export in the economic is mainly measured by exchange rate volatility. The study recommended that a variable exchange rate regime should be in operation that can influence export advancements and enhance the growth of the economy.

Dickson & Andrew(2013) conducted a study of the effect of exchange rate volatility and trade imports in Nigeria. The study adopted the use of Error Correction Model (ECM) technique. Findings emanating from the study showed that exchange rate volatility is said to have a positive relationship with trade (Export and Import) but shows no impact in explaining the variation of trade inflows and outflow into the country. The study recommended that trade volume of import of foreign goods should be reduced while export should be enhanced and promoted.

Musila & Al-Zyoud (2012) explored the relationship that exists between exchange rate volatility and international trade flows in selected countries in Sub-Saharan African countries. The study adopted the use of annual data in over 42 selected countries within the region. Findings from the study showed that there is a negative significant impact between trade inflows and exchange rate volatility within the region the use of the gravity model was used to exact this impact. The study recommended that countries within the region should adopt exchange rate policy that has trade parity inclusive in the attempt of attaining economic growth.

Ekanayake, Thayer, & Plante (2012) investigated the impact of exchange rate volatility on South Africa's trade flows. The study applied the ARDL-ECM method to conduct the analysis. The findings from the study show that there is a negative impact between exchange volatility and variations in trade (Import and Exports), this however, showed that interdependency in imports will impede economic development in SA. The study recommended

that external reserve should be informed to enhance the tempo of trade flow and increase economic growth with the country thus keeping exchange rate at an observable pace that can influence trade flows with the economy.

Gap in Literature

Several academic studies have been conducted to explore the correlation between exchange rate volatility and economic growth. However, a noticeable dearth of comprehensive scholarly inquiry exists, specifically for oil-producing nations in the Sub-Saharan African region. The magnitude of this difference is noteworthy, considering the distinctive socio-economic and political contexts of these countries, which are closely linked to their economies reliant on oil. There is a noticeable absence of comprehensive studies that investigate the complex effects of exchange rate variations in these particular circumstances, taking into account both internal and external forces.

RESEARCH METHODOLOGY

The theoretical framework that inspired the study is anchored on the Mundell- Fleming model which is an extension of the IS-LM curve. It can be regarded as an upgrade of the IS-LM curve as it tried to incorporate external factors in the study of the economy. It adjusted the normal Keynesian IS-LM model to incorporate an open economy influenced by outside credit, real shocks and other external economic activities in the macroeconomic level. The focus of the model is an open economy, majorly on the interactions exhibited by some macroeconomic variables such as interest rate, exchange rate, GDP price and how they relate to each other in the economy. Another major argument of the model is the impossible trinity which argued that an economy cannot simultaneously maintain a fixed exchange rate and independent monetary policy.

Ex-post-facto approach was used in this study's research design. This ex-post facto approach was chosen because no attempt will be made to change the pertinent independent variables; only secondary data will be used. The relationship between economic variables or the effect of one or more variables on her variables is established by ex post facto research. Ordinary Least Square (OLS) approaches, often known as the conventional linear regression model, served as the foundation for the researcher's multiple regression study.

The study utilizes the Pooled Fixed Effect (FE) model. The motivations for the use of pooled fixed effect model in handling the study`s research question is that it is efficient and consistent in the case of correlation between the unobserved heterogeneity and a time-varying dependent variable.

Further, the quality of pooled FE estimation depends on extent of variation of regressors over time, since the estimation uses the time differences. In the pooled FE model, all invariant variables are eliminated and it imposes time independent effects for each entity that are possibly correlated with the regressors (Greene, 2010). Therefore, modelling the OLS estimable functional form how exchange rate volatility impact on economic growth in Oil producing countries in sub-Saharan African. Consequently, the level variables of the OLS mathematical specification of the model can be given as:

$$LRGDP_t = \beta 0 + \beta 1 lnEXVOL_t + \beta 2 lnMS_t + \beta 3 lnCPI_t + \beta 4 lnTOP_t + \beta 5 lnCPS_t + \beta 6 lnFDI_t + \beta 7 lnGCF_t \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (1)$$

Where;

GDP= Gross domestic product (captured by Economic growth)

EXVOL= Exchange rate volatility (captured by GARCH (1,1)

MS= Money supply

CPI= Consumer price index

TOP= Trade openness

CPS= Credit to private sector

FDI = foreign direct investment

GCF= gross capital formation

Furthermore, the econometric specification of the model is given as:

$$LRGDP_t = \beta 0 + \beta 1 lnEXVOL_t + \beta 2 lnMS_t + \beta 3 lnCPI_t + \beta 4 lnTOP_t + \beta 5 lnCPS_t + \beta 6 lnFDI_t + \beta 7 lnGCF_t + \mu_t \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (2)$$

Where; all the variables remained as defined above

μ_t= the disturbance term.

The Pooled fixed effect model is specified as follows;

$$F_{it} = \varphi + X`it\alpha_{it} + \beta_i + \varepsilon_{it} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (3)$$

Where; Fit is the dependent variable (economic growth), $X`it$ is a k-vector of regressors (EXVOL, MS, TOP, CPS,FDI,GCF.MS), ε_{it} are the error terms for i=1,2,….., M countries observed for dated periods, t=1,2,…., T. The φ parameter represents the overall constant in the model, while the β represent country-specific fixed effect. The individual coefficients are estimated together with the vector of coefficients, α.

It is important to note that the volatilities of exchange was measured using the GARCH model before the pooled fixed effect model was applied. Further, Hausman specification test was conducted in order to validate whether the pooled fixed effects specification is appropriate

for the analysis otherwise, pooled random effect model would have been utilised by the study to capture objective one.

The data used in this research is annual time series data spanning from 1980 to 2019 for each country and were sourced from both World development Indicator and OPEC statistical bulletin (2021).

RESULTS

In order to sole objective one (1) that is (to ascertain if exchange rate volatility of Oil producing countries in Sub-Saharan African impact on Economic growth), this study, after measuring exchange rate volatilities using GARCH (1, 1), looked at the pooled fixed effect and pooled random effect model. However, in order to select the appropriate model that explains objective one, the study adopted the Hausman selection test. Hence, Table shows the results of the pooled OLS.

Table 1 Pooled OLS result

lgdp |	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
VOL |	.0000179	8.55e-06	2.09	0.039	9.60e-07	.0000348
lms |	1.693938	.4917186	3.44	0.001	.720611	2.667265
lfdi|	-.1589635	.0641727	-2.48	0.015	-.2859894	-.0319375
lgcf |	.1290174	.0856872	1.51	0.135	-.0405951	.29863
lcps|	-.4788102	.2760322	-1.73	0.085	-1.025199	.0675786
TOP |	.0339596	.0031695	10.71	0.000	.0276858	.0402335
CPI |	.001296	.0018899	0.69	0.494	-.002445	.005037
_cons |	-1.118775	1.924488	-0.58	0.562	-4.928181	2.690632

R^2= 0.67 Adj R^2= 0.65 F= 36.86, 0.000, No of Obs= 131

Table 1 indicates exchange volatility is positive and significant to economic growth amongst the selected oil producing countries in SSA at 5 percent level of significance. Hence, a sudden change in exchange rate will cause economic growth to increase by 1 percent. Money supply shows to be highly significant to economic growth at both 1% and 5%. Based on this a unit change in money supply will cause economic growth proxy by GDP to increase by 16%. Foreign direct investment proves to be a good measure of economic growth as accounted by the pooled OLS estimated results as FDI has a negative impact to economic growth by 15%. Hence, a rapid change in FDI will cause economic growth to reduce by 15%. Gross capital formation accounts for the role of capital stock in the entire model. However, from the pooled OLS results capital is positive but has no

impact on economic growth at all level of significance. Thus, capita stock increases economic growth tends to reduces in the same direction at 12 percent.

These results however show a total contrast theory as capital remains an important variable for output. Credit to private sector is negative but significant to economic growth at 10 percent level of significant. Trade openness is positive and significant to GDP at 1% level of significance such that a change in trade is followed by a proportional change in economic growth by 1 percent. Consumer price index is negative and has no impact on economic growth among the selected oil producing countries in SSA. The R-squared of 67% shows a good fit. Furthermore, the F statistics of the pooled OLS revealed that all the variables employed are significant at five percent level of significance.

Table 2 Summary Results of the Pooled Fixed Effect Model for Objective 1

lgdp |	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
VOL |	2.31e-06	3.38e-06	0.68	0.496	-4.39e-06	9.01e-06
lms |	-.0265586	.2308259	-0.12	0.909	-.4836171	.4304998
lfdi |	-.0225681	.025565	-0.88	0.379	-.0731894	.0280532
lgcf |	.6285903	.074387	8.45	0.000	.4812965	.775884
lcps |	-.0666288	.1123396	-0.59	0.554	-.2890724	.1558149
TOP |	-.0063322	.0022157	-2.86	0.005	-.0107195	-.0019448
CPI |	.0026653	.0008879	3.00	0.003	.0009071	.0044235
_cons |	-6.436366	1.490711	-4.32	0.000	-9.388123	-3.484609

sigma_u| 1.9701519
sigma_e| .28080605
rho | .98008963 (fraction of variance due to u_i)

F test that all u_i=0: F(4, 119) = 179.08 Prob > F = 0.0000 corr(u_i, Xb) = -0.6737

Corr(u_i_Xb) shows that the errors, ui, are correlated with the regressors in the fixed effects model. In addition, the F-test indicates that all the coefficients in the model are statistically different from zero. The reason for this is that, the probability of F, Prob > F= 0.000, is < 0.05. Therefore, the model is good and as such has a good fit.

Further, the intra-class correlations (rho) show that about 98.00% of the variance are due to difference across panels (that is across oil producing countries in Sub-Saharan Africa).

Table 3 Summary Results of the Pooled Random Effect Model for Objective 1

lgdp |	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
lVOL |	.0627663	.0384548	1.63	0.103	-.0126038	.1381364
lms |	1.807489	.4933214	3.66	0.000	.8405971	2.774381
lfdi|	-.1539602	.0651808	-2.36	0.018	-.2817122	-.0262083
lgcf |	.1063865	.0901856	1.18	0.238	-.0703741	.283147
lcps |	-.568712	.2775848	-2.05	0.040	-1.112768	-.0246558
TOP |	.0336843	.0031896	10.56	0.000	.0274327	.0399359
CPI |	.0017168	.0020789	0.83	0.409	-.0023578	.0057914
_cons |	-.9865541	1.962661	-0.50	0.615	-4.833299	2.86019
sigma_u |	0					
sigma_e|	.27985369					
rho |	0 (fraction of variance due to u_i)					

corr(u_i, X) = 0 Wald chi2(7) =252.92 Prob > chi^2 =0.0000

Table 3 indicates that's the errors, u_i are uncorrelated with the regressors, X in the random effects model (that is; corr(u_i, X) = 0). The Wald chi^2 test shows that all the coefficients in the model are statistically different from zero (that is Wald $chi^2(7)$ =252.92 hence, indicating that it is statistically significant) further, the probability of Chi^2 test in the model. This therefore, implies that the model is good and as a result, has a good fit. However, the intra-class correlation (rho) showed that about 0% of the variance is due to difference across oil producing SSA countries.

The study at this juncture, utilizes the Hausman selection test in order to select the appropriate model (that is between pooled fixed and random effect model) to be interpreted. As a result of this, this study summarily presents the Hausman selection test as given in Table 4.

Table 4 Summary Results of the Hausman Model Selection Test

	---- Coefficients ----		
|	(b)	(B)	(b-B)
|	fixed	random	Difference
lVOL |	-.0180076	.0627663	-.0807739
lms |	-.0381086	1.807489	-1.845598
lfdi |	-.0283861	-.1539602	.1255742
lgcf |	.6351217	.1063865	.5287352
lcps |	-.047267	-.568712	.521445
TOP |	-.0069873	.0336843	-.0406717
CPI |	.0021311	.0017168	.0004143

$chi^2(7)$ = (b-B)'[(V_b-V_B)^(-1)](b-B) =271.96 Prob>chi^2 =0.0000

From the summary results of the Hausman test conducted on the two models, given in Table 4, it can be deciphered that Prob>chi^2 =0.0000 < 0.05).This indicates that the Hausman test is statistically significant and as such, the study adopts the pooled fixed effect model as the best model that best ascertain how exchange rate volatility in oil producing countries in SSA impact economic growth. Therefore, the pooled fixed effect model is consistent and efficient under H1 that the preferred model is pooled fixed effects model. Hence, the study resorts to the pooled fixed effect model for results interpretations and other tests. For a look at the significance levels of both the pooled random and fixed effect models at a glance, the study therefore, presents bothmodels is simultaneously as can be seen in Table 5.

Table 5 Summary Results of the Pooled Random and Pooled Fixed Effect Models

Variables	Random Effect	Fixed Effect
Exchange Rate volatility	0.062 (0.103)	-0.1807 (0.260)
Money Supply	1.807 (0.000)	-0.0381 (0.869)
Foreign Direct Investment	-0.1539 (0.018)	-0.0283 (0.07)
Credit to Private sector	-0.5687 (0.040)	-0.042 (0.678)
Trade Openness	0.3368 (0.000)	-0.0069 (0.002
Consumer Price Index	0.0017 (0.409)	0.0021 (0.022)
Gross Capital Formation	0.0163 (0.238)	0.6351 (0.000)

Note: *p<0.05, **p<0.01; ***p<0.10 shows the level of significance

The results of the pooled fixed effect model presented in Table 2 and 4 indicate that when there is a rise in volatility in exchange rate by one-dollar, economic growth in oil producing SSA countries would increase significantly by about USD 0.062 million. This result is not surprising since it is expected for exchange rate to frequently fluctuate. In this instance, though, economic growth accelerates with more investors because of the exchange rate's propensity to fluctuate. At 1%, 5%, or 10% significance, the exchange rate is positive but has no appreciable effect on economic growth.

Money supply from the pooled fixed effect is positive but not statistically significant to economic growth at all levels. Thus, a unit change in money supply will cause economic growth to reduce by 3 percent within the selected countries. This shows that money supply to the economy is not adequate to drive positive gains to economic growth amongst oil producing countries in SSA. Foreign direct investment in the selected oil producing countries in SSA has a negative relationship with economic growth although FDI has a significant impact on economic growth at 10% level of significance. However, a possible change in foreign direct investment will

cause economic growth to decrease by 2 percent. This case shows that FDI amongst the selected countries is low to attract possible investment that will increase economic growth.

Credit to private sector is both negative and has no significant impact on economic growth at all levels such that a 1% increase in credit to private sector will lead to a possible decrease in economic growth by 4%. This shows that credit facilities is securely low and thus cannot contribute to economic growth within the selected countries. Trade openness from the pooled fixed effect is negative but statistically significant to economic growth at 1%, 5% and 10% level of significant. This further shows that as when there is a change in trade economic growth tends to be negative by 6% this again proves that trade in the selected region is related low in relation to export and import variations at this the strength of trade cannot influence economic growth positively. Consumer price index from the results is both positive and significant to growth showing a large variant of impact at 1% and 5% level of significance. Thus, at a point where inflation is changing economic growth is affected positively by 2%. From the pooled fixed effect, the gross capital formation is positive and statistically significant to growth at all level of significance this result shows that capital from this result confines with theory that capital in an input for output. Thus, when capital changes it bring a positive contribution to growth of the economy by 6%.

CONCLUSION

The frequent volatility in exchange rate among SSA countries as witnessed over the few decades ago on the aggregate, have no significant effect on the economic growth of oil producing countries in the SSA, specifically. This finding seems to suggest that contrary to speculation and findings from previous studies from individual specific SSA countries, that there may be implicit factors that absorb and offset the effects of the volatile exchange rate among oil producing SSA countries. Furthermore, the high volatility of exchange rate in these economies can make the economies highly unpredictable for investors and those who are risk-averse would redirect their investments to other countries with relatively stable economy, where they can predict market outcome. Hence, exchange rate volatility does not deteriorate the GDP performance of the oil producing SSA countries. The need to examine how some country-specific exchange rate volatility expose oil producing sub-Saharan countries to exchange rate volatilities in the region also motivated the choice of this research through the use of high frequency data to measure volatility.

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