THE IMPACT OF EXCHANGE RATE VOLATILITY ON THE MACRO ECONOMIC VARIABLES IN NIGERIA

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Abstract

The study analyses the impact of exchange rate volatility on Macroeconomic variables and with the help of Correlation Matrix, Ordinary Least Square (OLS) and Granger Causality test, the findings of the study shows that exchange rate volatility has a positive influence on Gross Domestic Product, Foreign Direct Investment and Trade Openness, but with negative influence on the inflationary rate in the country. It was suggested by the author, that the need country to improve their revenue base in term of increasing number of items meant for export and reduce over reliance on petroleum sector and also to reduce the importation of non essential items, so as improve their term of trade. Also increase in domestic production will reduce the problem caused by exchange rate volatility.

Keywords: Exchange rate Volatility, GDP, FDI, Trade Openness, Inflation, Correlation Matrix, OLS and Granger Causality Test

Introduction

The exchange rate is an important macroeconomic variable used as parameter for determining international competitiveness and it is being regarded as an indicator of competitiveness of any currency of any country and an inverse relationship between this competitiveness exists. To this end, lower the value of this indicator in any country, higher the competitiveness of such currency of that country will be. It becomes imperative at this junction, to distinguish between the real exchange rate and nominal exchange rate. The Nominal exchange rate (NER) is a monetary concept, which measures the relative price of the two moneys or currencies e.g Naira in relation to U.S dollar. While Real exchange rate (RER) is being regarded as real concept that measure the relative price of two tradeable goods (exports and imports) in relation to non-tradeable goods (goods and services produced

and consumed locally). But it should be noted that a relationship between two goods could be seen from the fact that change in NER causes short-run changes in RER.

Exchange rate system includes set of rules, arrangement and institutions under which nations effect payments among themselves. Traditionally, gold exchange standard, the Bretton-woods i.e. the flexible rating system is currently being used in Nigeria. The flexible exchange rate is largely determined by market mechanism i.e use of forces of demand and supply. According to Jhigan (2005), the variables that influence the exchange rate includes country's exports, imports and structural influences. If country's exports exceed imports, the demand for its currency rises and consequently, it has a positive impact on the exchange rate. On the other hand, if imports exceed exports, the desire for foreign currency rises and hence, exchange rate for such country move-up. Undoubtedly, any measure that tends to increase the volume of exports more than the rate of importation, will definitely raise the value of the domestic currency vis-à-vis other foreign currencies.

In Nigeria and indeed any developing countries, the price of foreign exchange plays a critical role in the ability of the economy to attain optimal levels in production activities. In the wake of policy change, occasioned by the introduction of structural adjustment programs (SAP) in July, 1986, led to the emergence of the flexible exchange rate as oppose to fixed exchange rate as a regime that was in place before the policy change. During the fixed exchange rate regime, the supply of foreign exchange was highly subsidized through the overvaluation of domestic currency. The essence of the policy was to maintain a relatively cheaper cost of importation of industrial raw-material and equipment, so as to sustain the policy of import substitution industrialization strategy. To further consolidate the period of the oil boom of 1970s, the government continued to sustain overvaluation of domestic currency, so as to douse the inflationary pressure arose from the monetization of the oil windfall gains through the Udoji committee known as "Udoji Awards" of 1975. But in the wake of persistent balance of payment deficit caused by the downward trend in the oil price in the international market led to the jettison of the fixed exchange rate, and emergence of flexible exchange rate through second-tier-exchange rate market (SFEM). This policy led to the downward trend in exchange rate and the impact of over valuation of the this exchange rate came with massive importation of foreign goods because they are cheaper and while exports are relatively expensive and uncompetitive at the international market and led to the importation large volumes of consumer goods and thereby worsen the country's balance of payment deficit.

Nigeria GDP Growth Rate

The GDP in Nigeria is growing at the average of 6.48% in the third quarter of 2012 over the previous quarter and going by the information provided by the National Bureau of Statistics. In the past, Nigeria GDP rate averaged about 6.8% getting to all time rise of about 8.6% in December, 2010 and a poor showing of about 4.5% was recorded in March 2009. Nigeria is being regarded as the most developed economies in sub-saharan Africa after South-Africa and hence, over 90% of the foreign trade earnings come from the petroleum industry and which eventually accounts for about 80% of the budgeted revenues. More importantly, agricultural sector still accounts for the source of revenue of about two-third of the population and over 50% of Nigerians live below the poverty line. This state of affair is largely accounted for by the high rate of corruption, mismanagement of public funds and poor state of infrastructure that are prevailing in the country and this in fact created a serious problem for future development.

In recent years, Nigerians have experienced some moderate growth with the discovery of petroleum in 1958 in commercial quantity by the colonial administration, and the country has emerged as a major oil exporter and most of her reserves are located in Niger-Delta region of the country. But the country over reliance on the oil sector, which is capital intensive in nature, ignore the need to diversified the economy and probably return back to the agricultural sector from which the country derived substantial part of her revenues before the emergence of the petroleum sector in the country. But with the introduction of Structural Adjustment program, coupled with the need to allow for private participation in the economy, it is interesting to note that Non-oil sector have witnessed a tremendous growth in recent years and the sector recording about 9.1% growth rate and agricultural sector contributed about 51.1% of the non-oil sector (Mordi and Nwawudu, 2010). But it needs to emphasize that building, services, health and education equally played a critical role in the country's growth drive. The growth of the non-oil sector was driven by government reforms and the expansion of the private sector. The program of Structural Adjustment Program further entails deregulation of the economy and this impact positively on the non-oil sector and in fact, it can safely be argued that Nigeria heavy dependence on the oil sector as a major source of earnings is however, driven by the non-oil sector, most especially agricultural sectors.

Trends of Foreign Direct Investment (FDI) Inflows in Nigeria

Nigeria has been a major destination for FDI after South-Africa in the Sub-Saharan Africa and the country has the potentials in both human and material resources but its potentials in building a prosperous economy, lower poverty rate, ensure good health, sound

education and infrastructural facilities for its population needs, have seriously hampered by the fact that all productive sectors faced series of problems due to over reliance on the petroleum sector. Income distribution in the country is so skewed in favor of the few segments of the society, while 50% of the populations only have access to 8% of the national income (Sala-I-Martin and Subramaniam, 2003).

The high volume of FDI inflows into the country went to the oil and gas sectors and the economy remain a mono-culture economy and with petroleum contributed over 90% of exports (USAID, 2003). However, the efforts of the government in diversifying the economy, through promotion of the small and medium Enterprises (SME), thereby encouraging the non-oil sector activities. The introduction of SAP in 1986 terminated the hostile policies toward FDI in Nigeria, and the new Industrial policy was initiated to open-up the economy and to encourage private participation in the economic activities, and hence, it becomes imperative for foreign investors to be more interested in the Nigerian economy.

Furthermore, the industrial Development Coordinating Committee (IDCC) was set-up in 1988 and with the objective of facilitating and attracting foreign investment flows. This agency was followed-up with the abolition of Nigerian Enterprise promotion Decree of 1977 and replaced with the Nigerian Investment Promotion Commission (NIPC) Decree 16 of 1995 and the NIPC decree made it possible for foreign investors to set-up a business in Nigeria with 100% ownership. To further consolidate the FDI drive in Nigeria, government further set-up Export Processing Zone (EPZ) scheme and the essence of the scheme was to allow interested individuals and corporate organization to set-up industries and businesses within specified zones, most especially, with the objective of exporting the goods and services manufactured or produced within the zones, but 25% of such products are allowed to be sold locally.

With emergency of democratic rule in Nigeria in 1999, Nigeria developed a “Home grown” development strategies so as to change the focus of the government regarding the direction they want development to take. To this end, the government launched the National economic empowerment program strategies (NEEDS). The essence of launching the program was to change the development strategies, where government tries to withdraw from commercial activities and embrace private led-growth strategies. In this case, FDI is given vital role to play in order to kick-start development in Nigeria, and the program enables private manufacturers and servicing companies in both foreign and local firms alike to compete for both international and local markets.

Trade Openness in Nigeria

Central to the structural Adjustment Program (SAP), which was introduced in 1986 in Nigeria, was the policy of trade openness according to Effiom, et al (2011), the essence of the policy was to deregulate the local economies so as to compete with the rest of the world. The cardinal objective was to ensure efficiency in resource utilization, avoid wastage, removal of continued misalignment in the foreign and domestic sectors, which led to persistent balance of payment deficits and to channel a path of economic recovery and growth. The main policy thrust involves removal of non-tariffs obstacles to imports, the rationalization and lowering of tariffs, establishment of market mechanism as a medium of foreign exchange rate determination and removal fiscal disincentives and regulatory measures that prevent exports (Agbeyegbe et al, 2004).

Trade openness appears a controversial policy in the international economics and finance. The proponents of the policy argue that the policy promotes free trade and remove obstacles that may inhibit free trade. They further believed that the policy if fully implemented, can promote economic growth of African countries. While the trade openness may not generate desire impact on long run growth of African countries. But it should be noted that application of appropriate fiscal and monetary policies, intensive financial reforms and decontrol of domestic prices and these measures are expected to raise international competitiveness and this has been the target of the present government in Nigeria.

Inflationary Pressures in Nigeria

The issue of price instability becomes a re-occurrence decimal in the macroeconomic challenges confronting the Nigeria government. The concept often referred to as inflation, and it has been a major issue in the policy decision in most of the developing countries. Jhingan, 2005, refers to inflation as a persistent and appreciable rise in the general level of prices. Generally, inflation has created a serious problem in view of the fact that it affects an economy, where her currency is characterized by a persistent fall in the value of the country's currency and rise in her exchange rate in the rest of the world. The persistent fall in the value of Nigeria's domestic currency (i.e. Naira) corresponds with the period of inflationary growth in Nigeria and this unfortunate phenomenon led to a continual falling in the standard of living of an average Nigeria. The period of the oil boom of 1970s automatically allowed for fiscal dominance by the government and coupled with series of macroeconomic imbalances during the period, witnessed an upward trend in government revenue in term of foreign exchange from the sale of crude-oil. The massive oil revenue accrued from the oil boom in 1970s coincided with the post war era in Nigeria and thereby led to the federal government massive

spending on programs of reconstruction, rehabilitation and resettlement of the areas badly affected during the Civil-war period. In addition to this, federal government further raised the public expenditure in term of increasing salaries and wage of public sector workers through the Udoji committee constituted by the federal government of Nigeria and this Udoji committee came-up with "Udoji awards" in 1975, which doubled the basic minimum wage in the public sector and this further compounded the inflationary problem in Nigeria and this in fact led to widespread protest and strike in the private sector.

The above measures increased the currency in circulation and as a result, the annual growth rate of money supply further escalated from 56.6% in January to 91.3% in April 1975 (CBN, 1982). The measures further compounded the inflationary trend in the country, but this cost push inflation further hampered production activities and expanded inflationary problem, as the increased money supply and aggregate demand was not matched by an increased in output. This structural rigidity that prevents domestic production, led to the trade liberalization of imports by the government and hence, the country witnessed massive importation of manufactured goods in view of the fall in domestic production. The rest of the paper will be divided as follows, part two will be literature reviews after the introduction, part three will entail model specification and methodology, part four will contain result estimation and analyses and part 5 will be conclusions.

Literature Review

In spite of many empirical studies that have been carried on the subject, the impact of exchange volatility of macro economic variables remains ambiguous. Many theoretical modeling studies on the effect of exchange rate volatility showed a negative relationship of exchange rate volatility on macroeconomics variables.

In Dornbusch (1989) examine the differences in RER volatility between developing and industrialized countries. He identified the fact that volatility is higher in developing countries, when comparing to industrialized countries. The author further identified three times higher volatility in developing countries than in industrialized countries, but failed to explained explicitly why such differences in volatility between the industrialized countries and developing countries exit. Bleaney (2008), in his work, he examined the adjustment of domestic prices to exchange rate movement as the reason for the existence of correlation between real exchange rate volatility and trade openness but this does not provide a satisfactory explanation for the whole phenomenon.

Olimor and Sirajiddinov (2008) in their study, they identified an inverse relationship between exchange rate volatility on both the trade outflows and inflows in Uzbekistan. They

submitted that there was a high presence of volatility in the exchange rate system after exchange rate reforms of 2001 and 2003. Aydin (2010) employed panel data examine the impact of exchange rate volatility in 182 countries from 1973-2008 and discovered different dynamics in the impact of macroeconomics fundamentals on the equilibrium real exchange rate of Sub-Saharan economies in the less advance economies.

Arize et al (2000) in their study, they examine the RER volatility on the exports of 13 less developed countries with quarterly data series for the period 1973-1996. They employed Johansen's Multivariate procedure and Error Correction Model to investigate the both the long-run relationship and short-run dynamics explicitly, their result shows a significant negative effect of volatility on export flows. While Broda, (2004) investigate with the help of panel data of 75 countries for the period of 1973-1996, employing VAR model. The findings show the presence of substantial shocks to terms of trade and real GDP in the short-term. The result further confirms the negative shocks, resulting in larger exchange rate changes in countries that adopted flexible exchange rate.

Yoon, (2009) shows that the real exchange rate demonstrate different patterns of behavior depending on the exchange rate regime in place. His findings show evidence that real exchange rate series behave as stationary processes during the fixed exchange rate regime. But he acknowledged the fact that, more stationary episodes are found in the gold standard and the Bretton-Woods periods.

Accam (1997), while examining the exchange rate volatility and FDI flows in some selected 20 least developed countries, using OLS estimation, and employing standard deviation as a proxy for instability in exchange rate volatility, the result shows a significant negative relationship between exchange rate uncertainty and FDI flows for the period. Agodo (1978), using 33 U.S private manufacturing firms', having 46 investments in Africa and the findings of the research shows that domestic market size, raw-material endowment, presence of infrastructural facilities and relative political stability were the drivers of FDI rather than exchange rate volatility.

Cushman (1985) in his study, they discovered higher exchange rate volatility accounts for FDI flows from U.S to Canada, France, Germany, and Japan. However, Barrel and Pain (1996) employed a dummy foreign exchange rate controls in a profit-maximizing regression model confirmed that expected appreciation in dollar temporarily postponed U.S outward FDI flows within the period under consideration.

Froot and Stein (1991), they believed that level of the exchange rate may exact some influence on FDI flows, since depreciation of the relative wealth of foreigners, thereby make

it more attractive for the foreign investors to invest in the host country and more so, they can acquire assets in the host countries cheaper than their home country. Hence, devaluation of the host country's currency promotes FDI flows into the host country.

Blonigen (1997) employed data on the Japanese for the period 1975-1992, he believed that acquisition of FDI in U.S economy within the period under consideration was largely influenced by exchange rate that are favorable to Japanese and this includes acquiring specific assets in foreign currency that can bring about returns in another currency.

Devereux and Engel (2003) emphasized that a flexible exchange rate gives room for the adjustment of relative price, when prices are sluggish, while Engel and Rogers (2001) on their part, analyze the border effects on relative prices for a sample of 55 European countries from 1981 to 1997 and concluded that exchange rate volatility accounts for parts of deviations in those prices.

Chen (2004) in his study, explain that an increase in price rigidity in the event of the uncertainty caused by exchange rate volatility (i.e. firms becomes unwilling to change their prices due to the possibility of later reversion to exchange rate). Apart from this, volatility would account for much of inability of Purchasing Power parity (PPP) in cross-country analyze and decrease the speed of mean adjustment towards PPP. By testing for speed of convergence, the author discovered a positive significant coefficient for exchange rate volatility i.e higher exchange rate volatility, the stickier the prices are.

Model Specification and Methodology

In literature, series of factors have been identified as having bearing on macroeconomic variables in Nigeria. But we are going to examine the impact of exchange rate volatility on the selected macroeconomic variables. The following econometric models based on the simple regression equations have been formulated:

$$GDP = \beta_1 + \beta_2 EXHV \text{----------} 1$$

$$FDI = \beta_1 + \beta_2\ EXHV \text{----------} 2$$

$$TO = \beta_1 + \beta_2 EXHV \text{----------} 3$$

$$INF = \beta_1 + \beta_2 EXHV \text{----------} 4$$

The above notations represent as follows:

GDP = Gross Domestic Product in Nigeria

FDI = Inflows of Foreign Direct Investment in Nigeria

TO = Trade Openness of Nigeria, represented by ratio of exports to imports i.e exports/imports

EXHV = Exchange rate Volatility in Nigeria.

It should be noted that different methods have been identified in literature to estimate foreign exchange rate volatility. In the work of Anderton and Skudely (2001), quarterly variance of the weekly nominal exchange rate is used to measure exchange rate volatility. While Zubair and Jega (2008), use standard deviation of each series through their samples are used to measure the exchange rate volatility. More so, Gujarati (2003) measure in exchange rate volatility in term of mean-adjusted and the squared deviation of variance of each series in a sample. For the purpose of this paper, Gujarati (2003) will be used to measure exchange rate volatility.

The apa ori expectations are that exchange rate volatility will positively influence both the GDP and trade openness. Volatility in the exchange rate is expected to increase GDP because both the exporters and importers will try to take advantage of this and hence, the demand for goods will rise. Exchange rate volatility will also impact positively on trade openness, because of the tendency to encourage exports and make it more competitive in international market and at the same time reducing the volume of imports. Moreover, it is also expected that exchange rate volatility will negatively influence FDI and unstable exchange rate will discourage the inflow of FDI into that country.

For the purpose of analysis, we will first analyze the relationship between exchange rate volatility and other macroeconomic variables through correlation matrix and then, we move to conduct unit root tests using both Augmented Dickey Fuller (ADF) and Phillip Pheron (PP) and then we run the regression using Ordinary least Square (OLS) and conducting Granger causality test to test the short run dynamics. The Data will be sourced from Central bank of Nigeria's Statistical Bulletin, National Bureau of Statistics and United Nation Handbook of Statistics. The period of research covered the period 1980 to 2010.

Result and Analysis of the Estimates

Table 1: Correlation Matrix

Variables	**EXHV**	**FDI**	**GDP**	**INF**	**TO**
EXHV	1.00000				
FDI	0.747262	1.00000			
GDP	0.847170		1.00000		
		0.934410			
INF	-0.181840	-	-0.194172	1.00000	
		0.030588			
TO	0.335460		0.326651	-0.060947	1.00000
		0.365472			

The above correlation matrix shows the relationship between exchange rate volatility and other macroeconomic variables under consideration. The above shows a positive

relationship between exchange rate volatility and other variables except inflationary rate will shows negative relationship with the exchange rate volatility.

Table 2a: ADF Unit Root Test (Trend & Intercept)

Variables	ADF statistics	Critical Values	Level of Sig	order of integ
EXHV	-5.162914	-4.309824	1%	1(1)
FDI	-5.335688	-4.309824	1%	1(1)
GDP	-13.53152	-4.323979	1%	1(2)
INF	-5.111842	-4.309824	1%	1(1)
TO	-3.613970	-3.568379	5%	1(0)

The above is the ADF Unit Root test for the variables and they are all stationary at different level of significance and order of integrations. For example, EXHV, FDI, and INF were stationary at first different, TO is stationary at level, but GDP is stationary at level. Furthermore, EXHV, FDI GDP, and INF at 1% level of significant, while the TO is stationary at 5% level of significant

Table 2b: PP Unit Test (Trend & Intercept)

Variables	PP statistics	Critical Values	Level of Sig	order of integ
EXHV	-5.162914	-4.309824	1%	1(1)
FDI	-5.312656	-4.309824	1%	1(1)
GDP	-5.059366	-4.309824	1%	1(1)
INF	-6.918926	-4.309824	1%	1(1)
TO	-3.582424	-3.568379	5%	1(0)

The stationary test is further reinforced with Phillip Pheron Unit Root test to ascertain the level of significance and the order of integration of the above variables. The PP unit root test shows that EXHV, FDI, GDP and INF were stationary at first difference and 1% level of significance. While TO is stationary at level, but with 5% level of sign

Table 3a OLS Estimation of the equations 1-4

Estimation of Regression equation 1

Dependant Variable GDP

Explanatory	Variable	Coefficient	Std Error	t-Statistic
Constant	-913791	1165918	-0.783753	
EXHV	126927	14782.30	8.586428	
R-squared	0.717698			
Adjusted R-squared	0.707963			
F-statistic	73.72675			
Prob. F (statistic)	0.00000			
Durbin Watson	0.266812			

The above regression show regression table shows a relationship between the Exchange rate volatility and GDP. The association between the variable is positive and equally significant at the 1% level of significance and is in line with the result in the exchange volatility and macroeconomic variables in Pakistan by Iqbal Mahmood et al (2001).

Table3b: Estimation of Regression Equation 2
Dependent Variable FDI

Explanatory	**Variable**	**Coefficient**	**Std Error**	**t-Statisti**
Constant	518.0376	395.1168	1.311100	
EXHV	30.33591	5.009561	6.055602	
R-squared	0.558400			
Adjusted R-squared	0.543173			
F-statistic	36.67032			
Prob. F (statistic)	0.00001			
Durbin Watson	0.483168			

The relationship between exchange volatility and FDI is positive but not significant. The study shows that the response to exchange rate volatility by the foreign investors were not quite impressive but positive.

Table 3c: Estimation of Regression 3
Dependent Variable Trade Openness (TO)

Explanatory	**Variable**	**Coefficient**	**Std Error**	**t-Statistic**
Constant	1.556969	0.118055	0.0651	
EXHV	0.002870	0.001497	0.0000	
R-squared	0.112534			
Adjusted R-squared	0.081931			
F-statistic	3.677294			
Prob. F (statistic)	0.065055			
Durbin Watson	1.221925			

More so, the relationship between exchange rate volatility and trade openness. The relationship is also positive but not significant and shows that the country exports drive did respond adequately to the exchange rate volatility.

Table3d: Estimation of Regression 4
Dependent Variable INF

Explanatory	**Variable**	**Coefficient**	**Std Error**	**t-Statis**
Constant	22.30678	5.133010	4.345750	
EXHV	-0.064809	0.065080	0.995839	
R-squared	0.033066			
Adjusted R-squared	-0.000277			
F-statistic	.991695			
Prob. F (statistic)	0.327566			
Durbin Watson	0.723955			

Expectedly, inflationary rate shows a negative relationship with exchange rate volatility and depreciation of the domestic currency and hence, exact influence on general prices and hence, inflation become imperative in view of exchange rate volatility.

Table 4: Pairwise Causality Tests
Pairwise Granger Causality Tests
Date: 01/13/13 Time: 17:03
Sample: 1980 2010
Lags: 1

Null Hypothesis:	Obs	F-Statistic	Prob.
FDI does not Granger Cause EXHV	30	0.07358	0.7883
EXHV does not Granger Cause FDI		4.17153	0.0510
GDP does not Granger Cause EXHV	30	0.06639	0.7986
EXHV does not Granger Cause GDP		15.5488	0.0005
INF does not Granger Cause EXHV	30	0.09440	0.7610
EXHV does not Granger Cause INF		0.31222	0.5809
TO does not Granger Cause EXHV	30	2.32177	0.1392
EXHV does not Granger Cause TO		1.73770	0.1985

The above Granger Causality result between exchange rate volatility and GDP shows a unidirectional causality that moves from exchange rate volatility in GDP and further confirm that exchange rate volatility exact positive influence on the country's GDP at 5% level of significance. In the same vein, unidirectional causality was equally observed in the relationship between exchange rate volatility and FDI i.e. the former exact positive influence on the latter at 1% level of significance. But in the case of inflationary rate the influence of exchange rate volatility is not significant in the short-run. But in the exchange rate volatility and trade openness, the bidirectional causality is observed, but move heavily from trade openness to exchange rate volatility.

Conclusion

The study analyses the impact of exchange rate volatility on the macro-economic variables in Nigeria. The positive influence of exchange rate volatility on Gross Domestic Product, Foreign Direct Investment and Trade Openness need to be consolidated by the government through the provision of the enabling environment that will gear toward improving the export base of the country and at same time reduce over reliance on the foreign importation of local raw-material in the manufacturing sector so as benefit more in exchange rate volatility in the country, in term improving the term of trade balance. More so, the over reliance on petroleum sector as the sole income earner for the country, will not augur well for the country and it becomes imperative for the country to diversify their revenue base. In addition to this, the country need to improve their local production of commodities, so as to solve problems emanated from the inflationary pressure occasioned by the exchange rate volatility and since exchange rate volatility has negative influence.

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