Exchange Rate, Inflation and the Nigerian Balance of Payment

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Abstract

This study examined the relationship between exchange rate, inflation and balance of payment in Nigeria using yearly time series data spanning from 1986 to 2015. The researchers adopted Ordinary Least Squares (OLS) multiple regression technique for analysis. The study revealed among other that the core variables (exchange rate and inflation) of this study have statistically significant negative impacts on balance of payment (the dependent variable) during the investigated period. In addition, the result showed that domestic credit, money supply and Rgdp are statistically significant drivers of balance of payment in Nigeria. Sequel to the findings, the Nigerian government, economic planners and policymakers are advised to (as a matter of urgency) make policies that will boost productivity and enhance/promote more exports of goods and services. Efforts should also be made to check the rising rate of inflation so as to restore stability to the Nigeria economy.

Keywords: Exchange Rate, Inflation rate and Balance of Payment

1.0   Introduction

Balance of payment is the record of a nation's financial transactions with the rest of the world (Krugman, 1996). A nation's balance of payment is a vital index used in measuring the strength of such country since it reveals transactions relating to payment made (for imports of goods and services) or received (for exports of goods and services), financial capital, financial transfer etc of a country for a specified period of time. Stability or equilibrium in balance of payment is one of the main macroeconomic objectives which all economies (worldwide) strive to achieve/sustain. Nigeria is a developing nation that relies heavily on importation of goods and services to meet local demands/consumptions without a strong industrial base to provide exportable industrial goods and services to match rising rate of imports. As such, the aggregate value of imports often outweighs that of exports; a situation which is expected to trigger instability/disequilibrium in the country's balance of payment.

Exchange rate simply put measures the strength of a country's currency in term of others. Nzotta (2004) defined exchange rate as the value of a currency (say Naira) in term of another (say Dollar). It is important to note that the values of a nation's imports and exports are expressed in a given currency. Also since countries all over the world use different currencies; for the purpose of having itch-free trade relationships, the need for a standard exchange rate becomes essential. Thus, the link between exchange rate and balance of payment can be seen in that light. In addition, inflation which most economics scholars defined as the persistent rise in general price level of goods and services is also expected to be linked to balance of payment. This is because, the exports and imports of all nations is a function of price. Therefore, the lower the price, the higher the nation's imports/exports and vice versa.

Nigerian economy has undergone strains and stresses in her balance of payment since the collapse of the oil boom in early 1980s and most recently is that of the collapse of the oil price in the international oil market since the mid 2015. During the oil boom period, the Nigerian export was mainly crude oil which grew steadily from 1975 and reached its peak in 1980, the import grew faster, bringing about a growth deficit in the visible trade balance. Also the production and consumption patterns that emerged from the era of the oil boom could not be sustained in the face of declining export, exchange rate and inflation resulted from the heavy borrowing by the Nigerian government. Thus, the capital account balance (of the balance of payment) is used to reduce the degree of deficit which leads to low external reserve.

Also, the inability of the industrial sector to import the required raw materials needed for production due to high cost of inputs (triggered by depreciation of exchange rate) seems responsible for sharp decline in overall output. Left unchecked, the drastic fall in output may further lead to retrenchment of workers and even complete shutdown of many industries. Therefore, worsening the position of the balance of payment (Olisadebe, 1991). Inflation is another key factor that is expected to cause changes (positive or negative) in the balance of payment; this is because price is an essential factor that influences the volume of both imports and exports. From economic theories, when the price of goods and services are relatively high, less of it will be demanded from abroad (i.e.

exports will be discourage/low) and vice versa. As such, if aggregate export falls, balance of payment is expected to be distorted.

Over the years, the Nigerian balance of payment have continued to show deteriorating trends. Since the major causes of this deterioration may include the highly volatile nature of exchange rate as well as the fast-growing rate of inflation, the researchers are optimistic there is a link among these variables (inflation, exchange rate and balance of payment). Although, numerous efforts have been made by successive governments in Nigeria to ensure stable balance of payment, the researchers will not be wrong to assert that the problems are far from being resolved. It is against this backlog that this study seeks to ascertain the relationship between exchange rate, inflation and Nigerian balance of payment using annual data that spans from 1986 to 2015.

2.0   Review of Literature

It is important to note that the number of available related literature (on the relationship between exchange rate, inflation and balance of payment) are at the moment relatively few (most especially at the domestic/national level). It is important to note that these available studies lack unanimity in both their findings and conclusions. In this study, review of related literature was done in what follows:

In a more recent study, Imoisi (2015) examined the relationship between exchange rate variations and balance of payment position during the regulated and deregulated regimes in Nigeria using annual time series data ranging from 1960 to 2013. The researcher relied on ordinary least squares (OLS) and error correction mechanism (ECM) for data analysis. The study revealed exchange rate had more influence on the balance of payment position during the deregulated era than the regulated era. The study recommended government increase capital expenditure in order to stimulate exports through diversification of the Nigerian economy.

In Pakistan, Ahmad, Ahmed, Khoso, Palwishah & Raza (2014) investigated the impact of exchange rate on balance of payments using monthly data from January 2007 to October 2013. Using Autoregressive Distributed Lagged (ARDL) model and Granger Causality Test, the researchers observed a positive link between exchange rate and balance of payment. The study recommended government intervention in stabilizing exchange rate in order to attract more investment and improve balance of payment.

In another research based on Nigeria, Oladipupo & Onotaniyohumo (2011) studied the impact of exchange rate on balance of payment using yearly data from 1970 to 2008. The data obtained on the variables of interest were analysed using OLS, the researchers found a significant positive relationship between exchange rate and balance of payment position. The researchers recommended exchange rate depreciation and diversification of the Nigerian economy to achieve favourable balance of payment position.

Furthermore, Shafi, Hua, Idrees & Nazeer (2015) reviewed the impact of exchange rate, inflation rate and interest rate on balance of payment in a study based on India and Pakistan. The study was a comparative study in which the researchers used both OLS regression method and Analysis of Variance (ANOVA). The findings showed that inflation and exchange rate have positive impact on balance of payment while interest rate has negative effect on balance of payment in both countries.

Following the review of literature, it is important to note that:
1. Studies that have looked at the relationship between exchange rate, inflation and balance of payment remain relatively scanty both at national and international level despite the economic sensitivity of the variables.
2. To the best knowledge of the researchers, only Oladipupo & Onotaniyohumo (2011) examined the relationship between exchange rate and balance of payment between 1970 and 2008. The research work is not just limited in scope; the researchers omitted vital variables (inflation rate, domestic credit etc) that are expected to have influence on balance of payment for the period.
3. Also there is absence of consensus in literature as to the relationship between the variables of concern.

Therefore, this study seeks to fill the highlighted gaps in literature.

3.0   Data and Research Methodology/Model

Data

This study seeks to establish the relationship between exchange rate, inflation and the Nigeria balance of payment using yearly time series data ranging from 1986 to 2015. The core variables are exchange rate and inflation whereas interest rate, domestic credit, FDI, money supply, RGDP and trade openness are included as control variables. Data for RGDP, domestic credit, money supply and balance of payment were obtained from the Central Bank of Nigeria (CBN) statistical bulletin (CBN, 2016) while data for other variables incorporated were drawn from World Bank (2016).

Research Methodology/Model

To capture the objective of this study (i.e. to ascertain the relationship between exchange rate, inflation and balance of payment in Nigeria), the mathematical relationship between the explained and explanatory variables is expressed as follows:

$$Bop = f(Exr, Infr, Intr, DomCred, Fdi, M_2, Rgdp, Top) \dots\dots\dots\dots\dots.1$$

Where:

Bop is Balance of Payment

Exr is Exchange Rate

Infr is Inflation Rate

DomCred is Domestic Credit

Fdi is Foreign Direct Investment

M_2 is Money Supply

Rgdp is a Real Gross Domestic Product (a proxy for real output)

Top is Trade Openness (measure as import plus export divided by RGDP)

The econometric form of Equation 1 is specified as follows:

$$Bop_t = \beta_0 + \beta_1 Exr_t + \beta_2 Infr_t + \beta_3 Intr_t + \beta_4 DomCred_t + \beta_5 Fdi_t + \beta_6 M2_t + \beta_7 Rgdp_t + \beta_8 Top_t + \mu_t \dots\dots\dots\dots\dots\dots...2$$

Where β_0 is the constant term, β_1 to β_8 are the coefficients of the explanatory variables and μ_t is the error/stochastic term while all other variables remain as earlier defined. following the recommendation of Gujarati & Porter (2009), all variables not in percentage in Equation 2 are logged. Thus, Equation 2 is re-specified as:

$$LgBop_t = \beta_0 + \beta_1 LgExr_t + \beta_2 Infr_t + \beta_3 Intr_t + \beta_4 LgDomCred_t + \beta_5 LgFdi_t + \beta_6 LgM2_t + \beta_7 LgRgdp_t + \beta_8 LgTop_t + \mu_t \dots\dots\dots 3$$

Equation 3 is therefore estimated using Ordinary Least Squares (OLS) regression technique to capture the afore-mentioned objective of the study.

4.0 Results and Interpretation
4.1 Stationarity Test

As a pre-condition for the avoidance of spurious regression, stationarity test was conducted for all the variables listed in the model. This test is expected to help determine whether or not the mean value as well as variance of these variables do not vary over time. The popular Augmented Dickey-Fuller (ADF) test was employed in this study. The null hypothesis is stated as follows:

$$H_O: \delta = 0 \; or \; \rho = 1 \; \text{(i.e. the variables are non-stationary)}$$

Decision Rule

At the more conventional 5% level of significance, the null hypothesis will be rejected if the ADF statistics is negative and greater than the Mackinnon critical value (i.e. if the ADF statistics is more negative than the Mackinnon critical value at 5% level of significance).

Table 1: Stationarity Test Result for Variables in the Model (Equation 3)

Variable	Mackinnon Critical Value at Level	PP Test Statistics at Level	Mackinnon Critical Value after 1st difference	PP Test Statistics after first difference	Order of Integration
LgBop	-2.967767	-2.542269	-1.953381	-9.136200	I(1)
LgExr	-3.574244	-2.300531	-3.580623	-6.785230	I(1)
Infr	-3.574244	-3.176656	-3.580623	-6.110784	I(1)
Intr	-3.574244	-3.873968	-	-	I(0)
LgDomcred	-3.574244	-2.921602	-3.580623	-11.93549	I(1)
LgFdi	-3.574244	-3.320020	-3.580623	-10.16862	I(1)
LgM2	-3.574244	-0.552006	-3.580623	-3.776158	I(1)
LgRgdp	-3.574244	-2.099176	-3.580623	-5.201097	I(1)
LgTop	-3.574244	-3.334940	-3.580623	-10.66407	I(1)

Source: Author's computation (see appendix A)

The above (Table 1) revealed that expect interest rate (Intr) which is stationary at level, all other variables (i.e. LgBop, LgExr, Infr, LgDomCred, LgFdi, LgM2, LgRgdp and LgTop) became stationary after first differencing at 5 percent level of significance.

4.2 Test of Cointegration

The conventional econometrics wisdom has it that when the dependent variable shares same order of integration (i.e. integrated of order one) with at least one of the explanatory variables in the model, it is enough suspicion to suspect co-integration. As such, co-integration test to determine whether this shared order of integration is a mere coincidence or an evidence of long-run relationship between these variables becomes essential. Since the unit root test result for the variables listed in the model of this study revealed that the dependent variable (LgBop)

is of the same order of integration as at least one of the associated explanatory variables. The table below contains the result of the co-integration tests conducted using the Johansen Co-integration Test which is more appropriate particularly when there are more than one explanatory variable in the equation having same order of integration as the dependent variable (Gujarati & Porter, 2009).

Table 2: Summary of Johansen Cointegration Test Result for the Model (Equation 3)

Model	Number of Cointegrating Equation(s)	Trace Statistics	Critical Value at 5%	P-Value
Equation 3	None*	483.6982	197.3709	0.0001
	At Most 5	44.78059	47.85613	0.0945
	At Most 7	8.302541	15.49471	0.4336

Source: Author's computation (see appendix B)

Decision Rule: the null hypothesis is to be rejected when the P-value is less than 5 percent (i.e. reject H_o: if P-value < 0.05). From Table 2, looking at Equation 3), for "None", the H_o: "There is no co-integrating equation" will be rejected since the P-value of 0.0001 is less than 0.05. For at most 5, the H_o:" there is at most five co-integrating equations" cannot be rejected (i.e. there is co-integration) since the P-value of 0.0945 is greater than 0.05. The same treatment applies to the hypothesis that there is "at most seven co-integrating equations" since the P-value of 0.4336 is greater than 0.05 (i.e. there is co-integration).

The presence of co-integration (as shown in Table 2) suggests the existence of a longrun relationship between the dependent and the associated explanatory variables. Thus, the need to estimate error correction model (ECM) to reveal the shortrun adjustment of the cointegrated variables towards their equilibrium values become mandatory. The ECM is a short-run model that explains how the long-run error of a model is corrected in the short-run. Gujarati & Porter (2009) explained that ECM provides the medium for the reconciliation of the short-run behaviour of an economic variable with its long-run behaviour. The ECM result (see appendix C for details) revealed a negative and statistically significant coefficient (-0.019308). This simply implies that about 1.93 percent of the short-run disequilibrium between the dependent variable and independent variables will be taken care of within the space of one year.

4.3   Regression Result and Interpretation

Following the explanation of Gujarati and Porter (2009), since the co-integration test result established the existence of long-run relationship between the dependent and independent variables of this study, the estimation of our model (equation 3) will not produce a spurious but a consistent and reliable result. Presented below is the result of the regression:

Table 3: Regression Result for Equation 3

Dependent Variable: LgBop

Variable	Coefficient	Std Error	t-Stat at 5%	Prob.
Constant	1.405976	0.552778	2.543474	0.0162
LgExr	-2.217188	0.839353	-2.641544	0.0153
Infr	-0.058492	0.017216	-3.397546	0.0102
Intr	-0.126695	0.092047	-1.376413	0.0832
LgDomcred	3.312873	0.758578	4.367215	0.0091
LgFdi	0.266662	0.545100	0.489197	0.6298
LgM2	-2.601738	1.069230	-2.433282	0.0168
LgRgdp	3.530666	1.552327	2.274435	0.0178
LgTop	-0.898632	1.524414	-0.589494	0.5618

R-Squared	0.894521
Adjusted R-Squared	0.856243
Durbin-Watson Stat.	2.845993
F-Stat.	76.15003
Prob (F-Statistics)	0.000000

Source: Author's computation (see appendix D)

It is important to note that the decision as to the significance or otherwise of any variable listed in the models depends on the use of 2-t rule of thumb as well as the corresponding probability value (P-value) of the variable. The above table contains the regression result capturing the first and second objectives of this study. It shows that the core variables (exchange rate and inflation) are statistically significant. This is a good sign since it means that the listed said variables significantly explain the changes in the dependent variable (LgBop).

Constant

The constant or intercept term (1.405976) is positive and statistically significant looking at its t-statistics and associated P-value (2.543474 and 0.0162). The intercept is expected to help predict the value of the dependent

variable (LgBop) when all listed core and explanatory variables are assumed zero (0).

Exchange Rate

The result revealed that the coefficient of this variable is negative and statistically significant (looking at the t-statistics of -2.641544 and its corresponding P-value of 0.0153 which is less than 0.05). This however implies that a one percent increase in exchange rate will on the average set-back balance of payment by approximately 2.2 percent holding all other variables constant. This result agrees with a priori expectation since exchange rate appreciation (in theory) will reduce exports thus reducing overall receivable payments from abroad.

Inflation Rate

Rate of inflation is found to be statistically significant and negatively related to the dependent variable (LgBop). The coefficient, t-statistics and P-value are -0.058492, -3.397546 and 0.0102 respectively. From the result, one can explain that a unit rise in inflation rate is expected on the average to reduce LgBop by about 0.06 percent while keeping all other variables constant. This finding is also in line with the a priori expectation. A rising inflation rate reduces overall national output which in turn drastic trigger fall in export.

Interest Rate

The t-statistics and P-value of -1.376413 and 0.0832 respectively revealed that interest rate is a statistically insignificant variable in this analysis. Although, the negative sign of its coefficient follow a priori expectation because a rising interest rate discourages investment; this will in the longrun negatively affect output, exports and balance of payment. The negative sign carried by this variable implies a negative relationship with the dependent variable of the study. However, it is important to note that no much economic meaning can be deduced from it since the variable is not statistically significant in this model.

Domestic Credit

The coefficient of this variable as obvious in Table 4.2 (above) is 3.312873; the t-statistics and P-value are 4.367215 and 0.0091 respectively. Since (based on both the t-statistics and P-value) this variable is statistically significant, a percentage rise in domestic credit is expected to improve the dependent variable (LgBop) by about 3.3 percent (on the average) holding all other variables unchanged/fixed. Note that the positive sign carried by this variable is expected; rising and available domestic credit is expected to be channelled into productive activities which will boost output and improve balance of payment in the longrun.

Foreign Direct Investment

The coefficient of this variable carries a positive sign thus depicting a positive relationship between it (LgFdi) and the dependent variable (LgBop). This implies that Nigerian balance of payment would have been reaping immensely from growing influx of FDI but for the t-statistics (0.489197) as well as the P-value (0.6298) that shows that the variable is statistically insignificant therefore such conclusion would be rash. It is worthy of note that the sign (positive) of the variable however does not contradict a priori expectation.

Money Supply

The sign of the coefficient of money supply (0.034545) revealed negative relationship with the dependent variable (LgBop). The t-statistics and P-value of -2.433282 and 0.0168 show that the variable is statistically significant in the model. Therefore, a percent rise in money supply is expected to worsen balance of payment by about 2.6 percent on the average holding other variables fixed. This is in line with theory since uncontrolled rising money supply is expected to trigger inflation thus having negative effect on LgBop.

Real Gross Domestic Product (i.e. Real Output)

One can deduce from the t-statistics and P-value of this variable that it is statistically significant as well as having a positive relationship (looking at the sign of its coefficient) with the dependent variable (LgBop). The coefficient, t-statistics and P-value are 3.530666, 2.274435 and 0.0178 respectively therefore, it suffices to say a one percent increase in real output (Lggdp) is expected to improve balance of payment by approximately 3.5 percent on the average assuming all other variables are held fixed. This is in agreement with a priori expectation since rising real national output will make more available for export which in turn is expected to better balance of payment and vice versa in the longrun.

Trade Openness

Based on the sign of the coefficient of this variable, it is surprisingly depicting a negative relationship with balance of payment (the dependent variable). Summarily, it means as trade openness rises, the dependent variable (LgBop) worsens. In theory, openness of a nation to trade is expected to better balance of payment position. However, there is no point to dwell too much in pain over explaining this result since the t-statistics and P-value (-0.589494 and 0.5618) already revealed that the variable is not statistically significant in the model.

Coefficient of Determination (or R-Squared)

This explains the proportion of the variability in the dependent (LgBop) variable that is explained by the core and control variables. The result above revealed that R^2 is 0.894521. This implies that the explanatory variables explained about 89 percent of the variations in the dependent variable in the model. The R^2-adjusted take into consideration the sample size.

F-Statistics (F-test)

This test enables us to determine whether or not the entire regression model result is statistically significant. The decision rule is to reject the null hypothesis (that the regression model is not statistically significant) if Prob (F-stat) is less than 5 percent. From the above table, the value of the F-stat is 76.15003 while Prob (F-stat) is 0.0000 (i.e. less than 0.05). Therefore, it is rational to reject the null hypothesis and conclude that the regression model is statistically significant.

5.0   Summary of Findings, Conclusion and Recommendation
5.1   Summary of Findings

This study seeks to investigate the relationship between inflation, exchange rate and balance of payment in Nigeria between 1986 and 2015 incorporating exchange rate and inflation rate as core variables while interest rate, domestic credit, FDI, money supply, real output (using RGDP as a proxy) and trade openness are listed as control variables. In addition, this study also seeks to establish the possible ways of improving the Nigerian Balance of payment position

The researchers found that the core variables (exchange rate and inflation rate) were statistically significant and have an inverse relationship with the dependent variable (LgBop) of this study. Therefore, it suits to say that exchange rate and inflation rate are strong drivers of LgBop in Nigeria albeit negative drivers. These negative signs carried by the core variables are in agreement with theoretical expectations since exchange rate appreciation and rising inflation rate will drastically fall in export and overall output respectively and in turn balance of payment. Note that three of the control variables (domestic credit, money supply and real output) modelled were also found to be statistically significant; while domestic credit and real output were observed to be positively related to balance of payment, money supply was negatively associated to it.

Out of interest rate, FDI and trade openness (other control variables) that were observed to be statistically insignificant in the model; the coefficients of interest rate and FDI carried negative and positive signs respectively (in accordance with a priori expectation) while trade openness came out with negative sign contrary to theoretical expectation. Although this variable is not significant (considering the t-statistics and P-value), carrying a negative sign can be best explained to mean that the Nigerian economy is not reaping desirably from openness of her economy to foreign investors. Finally, since exchange rate, inflation rate, domestic credit, money supply and real output are drivers of LgBop, the researchers are optimist these variables can be manipulated and control to promote and expand productive activities in Nigeria so as to put the balance of payment in desirable position.

5.2   Conclusion

Following the failure of previous attempts by the Nigerian government to checkmate the rapidly growing inflation rate and unstable exchange rate as well as its associated socio-economic predicaments in the country; in this study, the researchers made an attempt to establish the relationship between exchange rate, inflation rate and balance of payment in Nigeria. Among what can be deduced from these findings are: that the current exchange rate policy is not desirable for expansion of productivity and boosting of exports; that the Nigerian inflation rate is too high and it is discouraging both domestic and foreign investors; that the Nigerian monetary policies are not yet in the right position since funds injected seem not to be used for investment and that there is need to make more economically affordable loans and credits available for potential local investors.

From the findings, it suffices to conclude that the Nigerian government should take urgent steps to attend to the issues raised so as to boost productivity and enhance or promote more exports of goods and services. Although the attention of the researcher focused principally on the behaviour of the afore-mentioned core variables of the study, the researcher cannot keep mum as to the surprise sign (negative) with which trade openness appeared in the model. The only feasible explanation that can be adduced to this rarely behaviour is that the Nigerian economy is not yet reaping any economic advantage of opening up her economy. As such efforts should be put in place to also address this problem so that the total output and overall performance of Nigerian economy can be bettered.

5.3   Recommendation

Sequel to the findings of this study, the following recommendations are made:
1. The Nigerian government should embark on policies capable of checking the rising rate of inflation in the country.
2. Policies capable of directly controlling and proper management of supply/injection of funds into the economy should be ensured. All funds injected should be tailored towards expansion of output.
3. The government should also consider exchange rate depreciation policy since it is expected to assist in expanding output and boosting more exports of goods and services.
4. The Nigerian government as well as private sector should thrive harder to invest in education and skill

acquisition programmes. This will improve the quality of labour which will in turn positively exert productivity.

5. The Nigerian government should also invest more in the area of infrastructural facilities as this will create the much needed enabling environment for various economic activities.

6. Finally, it is crystal clear that the Nigerian government still needs to spend more to ensure more credit facilities are made available at low interest for potential domestic investors

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