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The Impact of Budget Deficit on Trade Balance in Nigeria: An Empirical Analysis, 1980 - 2011

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Abstract

The paper empirically examines the impact of budget deficit on trade balance in Nigeria. The general objective is to examine the causality between budget deficit and trade balance. The specific objective is to measure the impact of budget deficit on trade balance in Nigeria using annual data as a means of determining the econometric relationship. The approach: In time series context, modern econometric techniques were used: the Augmented Dickey Fuller (ADF) Unit Root tests for stationarity, Johansen and Juselius cointegration for long term relationship and Granger causality tests were used to establish the direction of causality in the model relationships. The ordinary least square method (OLS) was used to measure the impact of budget deficit on trade balance. The findings of the study show that Granger causality test revealed a unidirectional relationship between budget deficit and trade balance in Nigeria, the

direction is from trade balance to budget deficit. Similarly, budget deficit has a positive impact on trade balance. The implication is that economic policies that will minimise budget deficit will have to be addressed through demand management such as increase in tax and a reduction in government expenditure as a means of maintaining trade balance in Nigeria for the period under study.

Key words: Budget deficit, Trade Balance, Government Expenditure, Exchange Rate

Introduction

There exist different theoretical positions on the macro-economic effects of sustained budget deficits.It can led to increase in output and employment to crowding out of domestic investment in some countries. It may lead to high and variable inflation, to debt crisis, low inflation with crowding out investment and growth, while in some countries budget deficits seem notto generate macroeconomic problem at all. Equally, persistent high budget deficits above 5% of gross domestic product (GDP) may resort to monetary accommodation by the central bank. This often leads to disequilibrium in the domestic money market. Budget deficits increase domestic spending on imported foreign goods and services, distorting the trade balance and increasing the demand for foreign exchange. This leads to depreciation of exchange rate under the floating exchange rate regime as it is practiced in Nigeria.

 In a study by Mai-Lafia (1995), using the IS – LM framework in explaining the inter linkages between the monetary and fiscal aggregates, posited that for obvious reasons, monetary policy may be less effective than fiscal policy in Nigeria due to poor financial investment habits and credit control, among others. An increase in government expenditure is expected to increase interest rates upwards, but with financial repression,the real interest rate is expected to be positively related to budget deficit, especially with the financial sector reform taking place in Nigeria.

Literature review and theoretical framework

Saleh (2003) stated that a positive association between budget deficit and trade balance can be shown in the context of a simple keynesian open economy model. In a simple open economy model gross domestic product, Y, is the sum of private consumption expenditure, C, gross private domestic investment, I, government expenditure, G, export, X, and imports, M.

$$Y = C + I + G + X - M \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots(1).$$

Other studies by Chee – Keong and Jayaraman (2008) also followed the same approach and conclude that there is a direct interaction between budget deficit and trade balance through domestic absorptionand indirectly through monetary channels. As budget deficit rises, aggregate demand would increase and domestic interest rate would also rise, and if the domestic rate is higher than the world interest rate there will be a capital inflow, resulting in the rise of real exchange rate, exports would fall and trade balance would deteriorate. Thus the modelling strategy has to incorporate both real and monetary variables. The model incorporating the real and monetary variables for the study can be stated thus:

$$Tdbn = \beta_1 + \beta_2 Mossx + \beta_3 Bdefc + \beta_4 Gdpng + \beta_5 Intrs + \beta_6 logRern + \mu \dots(2)$$

Where Tdbn = Trade balance, Mossx = Money supply, Bdefc = Budget deficit

Gdpng = Gross domestic product, Intrs = Interest rate, Rern = Real exchange rate

Augmented dickey fuller (ADF) unit root test

As a preliminary data analysis, data was first tested for Stationarity, consistency, and independence in table 1. If the data series are non - stationary, using econometric techniques can lead to misleading results given that econometric theory requires the variables to be stationary. The econometric methodology first examined the

stationarity using the Augmented Dickey Fuller (ADF) test. The test was applied to each individual series. This consists of running the variables at their level, first difference of the series with series lagged once and the option of intercept and trend. The result of the characteristics of the model showing the unit root test for each of the variables at their level and first difference is shown in Table 1.

Table 1: ADF Unit Root Test Results

Variable	Levels	First Difference
Tdbn	-2.213862	-5.432538***
Bdefc	-1.179844	-4.985170***
Rerng	-1.178844	-6.438804***
Intrs	-2.621529	-4.953701***
Mossx	-1.787549	-3.404371***
Gdpng	-2.321856	-4.830669***

Source: Eviews output for equation 2. Three asterisks (***) indicates that the variable is statistically significant at 1% level.

The results of the Augmented Dickey Fuller unit root test, as reported in Table 1, indicate that trade balance variable is non – stationary at level I(0),but became stationary at first difference I(1). Budget deficit was also tested for stationarity and it was non – stationary at level but stationarity was achieved after taking the first difference of the data I(1) at 1% level of significance. Real exchange rate was tested for stationarity using the Augmented Dickey fuller test and it was non – stationary at level I(0) but stationarity was achieved after taking the first difference of the data I(1) at 1% level of significance. Money supply variable in the model was tested for Stationarity and the data was non – stationary at level I(0) but stationarity was achieved after taking the first difference I(1) of the data. The ADF test was also

conducted on the gross domestic product data and was stationary at first difference with a statistical value of -4.830669*** that is significant at 1% level of confidence.

Johansen cointegration test

Before applying the cointegration technique, the variables were first tested to determine the order of integration of each variable. The Augmented Dickey Fuller unit root test was used to determine the order of integration. The result shows that all the variables under consideration are non-stationary at their level, but the variables were stationary at first difference. The variables are therefore integrated of order 1. The Johansen (1988) and Johansen and Julius (1990) technique of cointegration was then applied. The Johansen's technique is a multivariate generalisation of the Dickey Fuller test. The maximum likelihood ratio procedure tests how many of the cointegration vectors are significant, that is, what rank the cointegration matrix has for the variables under the study. The Johansen method uses two test statistics for the number of cointegrating vectors: the maximum Eigenvalue and the likelihood ratio test statistics. According to Johansen (1990), the choice of lag length is important, the lag length for the variables was based on Akaike Information Criterion (AIC) and the optimal lag length was 1.

The results of the cointegration technique were as shown in Table 2.

In Table 2, the Johansen cointgration model shows the existence of a long run relationship between trade balance, money supply, interest rate, real exchange rate, budget deficit, and domestic output in the model. Trade balance has Eigenvalue of 0.787516, the likelihood ratio of 121.5296. Money supply has Eigenvalue of 0.720493, the likelihood ratio of 78.16068 and statistically significant at 5% level of significance. Real exchange rate has Eigenvalue of 0.579441, the likelihood ratio of 42.46834 and statistically significant at 5% level of significance.

Table 2: Johansen Maximum Likelihood Cointegration Test Result for the Stochastic matrix (TDBN MOSSX RERNG INTRS BDEFC GDPNG).
Lags interval: 1 to 1

Eigenvalue	Likelihood Ratio	5 Percent Critical Value	1 Percent Critical Value	Hypothesized No. of CE(s)
0.787516	121.5296	94.15	103.18	None **
0.720493	78.16068	68.52	76.07	At most 1 **
0.579441	42.46834	47.21	54.46	At most 2
0.301564	18.21559	29.68	35.65	At most 3
0.245489	8.166040	15.41	20.04	At most 4
0.009909	0.278835	3.76	6.65	At most 5

Source: Eviews output for equation 2. Two asterisks (**) indicates a rejection of null hypothesis at 5% significant level

The parameters, which are long run elasticities of the cointegrating vector of the long run trade balance functions, are presented on Table 3.

Table3: Normalised Cointegration Test

Tdbn	Mossx	Rerng	Intrs	Bdefc	Gdpng	C
1.00000	-1.32088	2.41886	0.90683	0.08657	0.04606	- 4.1152
	(0.1256)	(0.4560)	(0.6851)	(0.0676)	(0.3411)	

Log likelihood 115.4587

Source: Eviews output for equation 2

The cointegrationcoefficients for money supply from the computation was -1.320880, while the coefficient for real exchange rate for the period was 2.418863. The estimated regression coefficients for interest rate and gross domestic product were 0.906831 and 0.046061 respectively. The result shows that there is a positive relationship between trade balance and budget deficit in Nigeria. The estimated coefficient of budget deficit was 0.086577. This suggests that a unit

increase in trade imbalance between Nigeria and its partners will increase budget deficit by 8.6%.

Estimation of the structural model

The macroeconomic model of the study of the budget deficit and trade balance is made up of five disaggregated regression equations. The equations are estimated and the results of the first model is presented in Table 4

Table 4 Results of Regression model 1
Dependent Variable is Tdbn

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	1.485250	0.358702	-4.140627	0.0003
MOSSX	1.187675	0.064904	18.29905	0.0000

R-squared	0.820298	Mean dependent var	4.992817
Adjusted R-squared	0.817550	S.D. dependent var	1.121127
S.E. of regression	0.321922	Akaike info criterion	0.633329
Sum squared resid	3.005387	Schwarz criterion	0.725844
Log likelihood	-7.816592	Hannan-Quinn criter.	0.663486
F-statistic	334.8552	Durbin-Watson stat	1.557293
Prob(F-statistic)	0.000000		

Source: Eviews 7 output for equation 2

As shown in Table 4, the estimates indicate that the regression coefficient of money supply was 1.187675, suggesting that the variable money supply is an important component of the relationship between budget deficit and trade balance in Nigeria within the period of study. The Durbin Watson of the estimated model is 1.557293. This shows the absence of autocorrelation in the function, compared with the Durbin Watson that is less than 1.00 that shows the presence of autocerrelation. The coefficient of determination $R^2 = 0.82$ is significant. It shows that money supply explain 82% of the

performance of the trade balance. The relationship between money supply and trade balance is positive. The adjusted coefficient of determination is 0.81 meaning that money supply accounts for 81% of the model.

Table 5. Model 2 Regression Results
Dependent Variable is Tdbn

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	1.659861	0.745969	0.884569	0.3839
MOSSX	1.880765	0.069397	15.28546	0.0000
RERNG	-0.683739	0.215800	-3.168389	0.0037
R-squared	0.911332	Mean dependent var		4.992817
Adjusted R-squared	0.907141	S.D. dependent var		1.121127
S.E. of regression	0.281085	Akaike info criterion		0.391445
Sum squared resid	2.212244	Schwarz criterion		0.530218
Log likelihood	-3.067404	Hannan-Quinn criter.		0.436682
F-statistic	224.6306	Durbin-Watson stat		1.583159
Prob(F-statistic)	0.000000			

Source: Eviews 7 output for equation 2

The introduction of the second variable into the disaggregated regression model shows an improvement in the functional parameters. As shown in table 5, the real exchange rate has the right negative sign; the Durbin Watson improved slightly from 1.557293 to 1.583159 with the introduction of real exchange rate in the equation system when compared with the model in table 4. The coefficient of multiple determination also improved from the 0.82 to 0.91. This indicates that the introduction of the real exchange rate increased the explanatory power of the model. It means money supply and real exchange rate explain 91% of the performance in trade balance. The adjusted

coefficient of determination also improved from 0.81 to 0.90. The Akaike information Criterion and the Schwarz Criterion are within acceptable limits. The standard error of both variables is low and it shows that the variables under study are correctly specified.

Table 6. Regression model 3 Results
Dependent Variable is Tdbn

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	2.683225	1.037360	2.586590	0.0154
MOSSX	1.919255	0.065289	15.61150	0.0000
RERNG	-1.087297	0.251245	-4.327633	0.0002
INTRS	-0.872261	0.337636	-2.583437	0.0155
R-squared	0.942960	Mean dependent var		4.992817
Adjusted R-squared	0.937733	S.D. dependent var		1.121127
S.E. of regression	0.256312	Akaike info criterion		0.235068
Sum squared resid	1.773782	Schwarz criterion		0.420099
Log likelihood	0.356444	Hannan-Quinn criter.		0.295383
F-statistic	182.3257	Durbin-Watson stat		1.648324
Prob(F-statistic)	0.000000			

Source: Eviews 7 output for equation 2

The model 3 shows the introduction of interest rate into the system of equations. As shown in table 6, there is a positive relationship between trade balance and interest rate. The coefficient of interest rate has the right negative sign. There is an inverse relationship between trade balance and interest rate in Nigeria within the period under study. The coefficient of determination improved from 0.91 to 0.94, similarly the adjusted coefficient of determination increased from 0.90 to 0.93. It shows that money supply, real exchange rate and interest rate explain 94% of the performance of trade balance. The Durbin

Watson statistics also improved from 1.58 to 1.64 as more variables are added into the function.

Table 7 Regression model 4
Dependent Variable is Tdbn

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	2.171484	2.587211	0.839314	0.4089
MOSSX	1.959343	0.113421	8.810944	0.0000
INTRS	-0.857289	0.350634	-2.444968	0.0216
RERNG	-1.110626	0.277536	-4.001742	0.0005
GDPNG	0.061252	0.282693	0.216673	0.8302

R-squared	0.953045	Mean dependent var	4.992817
Adjusted R-squared	0.945821	S.D. dependent var	1.121127
S.E. of regression	0.260959	Akaike info criterion	0.297780
Sum squared resid	1.770584	Schwarz criterion	0.529068
Log likelihood	0.384407	Hannan-Quinn criter.	0.373174
F-statistic	131.9292	Durbin-Watson stat	1.691055
Prob(F-statistic)	0.000000		

Source: Eviews 7 output for equation 2

Regression Model 4 shows the introduction of gross domestic product into the system of equation of trade balance as the dependent variable while money supply, interest rate, exchange rate and gross domestic product were explanatory variables. As presented in table 7, the coefficient of the gross domestic product is positive 0.061252. It means that gross domestic product is positively related to trade balance in Nigeria within the period of study. It also means that an increase in domestic income will lead to increase in trade balance in Nigeria. The result shows an improvement in the explanatory power of the model where the coefficient of determination (R^2) explains

about 95% of the equation system in the model. The adjusted coefficient of determination ($\hat{R}^2$) also improved and it accounts for 94% of the model. The Durbin Watson statistics also increased from 1.67 to 1.69. This shows the absence of autocorrelation in the model.

Table 8. Regression Model 5 Results
Dependent Variable is Tdbn

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	2.256912	2.602423	0.867235	0.3941
MOSSX	1.989245	0.114611	8.631342	0.0000
INTRS	-0.809915	0.356744	-2.270295	0.0321
RERNG	-1.124718	0.279447	-4.024803	0.0005
GDPNG	0.072028	0.284424	0.253242	0.8022
BDEFC	0.042849	0.049990	-0.857137	0.3995
R-squared	0.964385	Mean dependent var		4.992817
Adjusted R-squared	0.955262	S.D. dependent var		1.121127
S.E. of regression	0.262300	Akaike info criterion		0.333332
Sum squared resid	1.720037	Schwarz criterion		0.610878
Log likelihood	0.833347	Hannan-Quinn criter.		0.423806
F-statistic	104.6133	Durbin-Watson stat		1.739173
Prob(F-statistic)	0.000000			

Source: Eviews 7 output for equation 2

As shown in table 8, the complete introduction of the variables into the model shows that budget deficit coefficient is 0.042849. The result shows that a unit change in trade balance will lead to 4% change in budget deficit in Nigeria. This shows that budget deficit has a positive relationship with trade balance in Nigeria. The coefficient of determination for the model shows a positive strong relationship between the variables under study as it increased from 0.95 to 0.96,

that is, the variables under study explain 96% of the performance of trade balance in Nigeria. The R^2 value of 0.96 shows that all variations in trade balance can be explained by the explanatory variables. In other words, 96% of the changes in trade balance can be explained by the parameters specified in the model. The Durbin Watson statistics (1.73) indicates that there is absence of serial autocorrelation in the model. The standard error 1.720 illustrates that the parameter estimates i.e explanatory variables are jointly significant and explain the variation in trade balance, the dependent variable in the model.

Conclusion

The implication of the estimated model results is that the more the external sector is in deficit the more the domestic government budget gravitates towards a deficit position. This is because evidence from the study shows that the performance of the government budget is dependent on the external sector - trade balance. The Nigeria economy depend so much on oil revenue which is volatile and subject to the vagaries of international oligopolistic competition, this therefore requires diversification of the economy.

Foreign sector performance has been identified as one of the sources of budget deficit in Nigeria as in many developing countries, foreign shocks are a source of fiscal instability due to the fluctuation in export prices that characterise commodity exports of Nigeria and many other developing countries. The changes in export prices affect the government directly through the profits of state owned corporations like the Nigeria National Petroleum Corporation. The effect of external shock also affects taxes on profits or on exports. The quantitative impact of the export price shock on government accounts depends on the tax and property structure, the amount exported and the magnitude of the price shock. Nigeria is one of the developing countries that depend on oil as its primary source of revenue earnings. Export price volatility often affect terms of trade. If the foreign trade structure is diversified allowing for more private sector participation

and export of a variety of commodities, it will reduce the volatility of external sector earnings.

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