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Responsiveness of Trade Flows to Changes in Exchange rate and Relative prices: Evidence from Nigeria

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Abstract

This paper examines the long-run and short-run impacts of exchange rate and price changes on trade flows in Nigeria using exports and imports functions. The bounds testing (ARDL) approach to cointegration is applied on a quarterly data from 1980Q1 to 2007Q4. The results indicate that in both the short-run and long-run Nigeria's trade flows are chiefly influenced by income- both domestic and foreign-, relative prices, nominal effective exchange rates and the stock of external reserves. The results also reveal that in the long-run, devaluation is more effective than relative prices in altering imports demand at both baseline and augmented models. The reverse is, however, the case for exports demand. Furthermore, the sum of the estimated price elasticities of export and import demand in Nigeria exceeds unity indicating that the Marshall-Lerner (ML) condition holds thus implying that a devalued naira might hold considerable promise as the panacea to rising trade deficits.

Keywords: Trade flows, Exchange rate, Relative prices, Autoregressive distributed lag

JEL classification: F13, F31, C32

1. Introduction

An increasingly integrated world economy has brought an admixture of both good and adverse consequences for developing countries. While international trade, especially in goods and services and capital, appears to have brightened prospects for economic growth and eventual development on the one hand, severe macroeconomic problems such as balance of payments disequilibrium, exchange rate misalignment and huge trade deficits seem to be counteracting factors on the other. From a theoretical standpoint,

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deficits resulting from trade with the rest of the world should be balanced by and equal (and opposite) amount of capital inflows. However, the global financial markets have tightened recently on account of the recession in the world economy. The foregoing coupled with the characteristic low level of financial sector in most developing countries suggests the existence of considerable difficulty in accessing the necessary offsetting capital flows when deficits arise. Hence, policymakers in these countries need to rely on the use of domestic policies- both commercial and devaluation- in order to manage the trade deficit and ensure some degree of balance within the economy.

Orcutt (1950) was the first to conjecture that trade flows of countries respond to relative price movements. This theoretical proposition, also pursued in Kreinin (1967), was however challenged by Houthakker and Magee (1969) on the grounds that the income effects neglected in the earlier studies could be equally as important[1]. Using a two-country model they showed that even with given production and prices, improvement or deterioration in the trade balance was driven largely by differences in income elasticities of their demand for imports (see, for example, Liu (1954), Junz and Rhomberg (1965), and Wilson and Takacs (1977) for further theoretical underpinnings on trade flows and relative price movement). Following this theoretical evolution, a large body of empirical literature has been developed in search of evidence on price and exchange rate impacts on trade flows among countries. These studies have used both the exchange rate and relative prices in order to investigate their combined or separate effects on trade flows.

Junz and Rhomberg (1973), in what is arguably the first empirical attempt, used data on trade flows, prices and exchange rates for thirteen industrial economies and concluded that trade flows respond in a similar fashion to changes in both prices and the exchange rate. Wilson and Takacs (1979), in contrast, employed data spanning 1957-1971 on a group of six industrial countries (Canada, France, Germany, Japan, United Kingdom and the U.S.A) in estimating export and import demand functions. They showed that trade flows were much more responsive to exchange rate variations than to price changes. Bahmani-Oskooee (1986) using data from 1971-1980[2] on a sample of seven developing countries arrives at a similar conclusion about trade flows. Although, unlike Wilson and Takacs (1979), his results show that import and export demand in these countries were more sensitive to relative prices than to exchange rate movements.

[1] In addition to this, the breakdown of the Bretton Woods system with the attendant emergence of floating exchange rate regimes altered thinking among professional economists as the possibility of reversals in the trade balance owing to foreign exchange fluctuations became an important factor in the analysis.

[2] It is noteworthy that the results from studies which used sample periods coinciding with the regime of fixed exchange rates should be interpreted with caution especially with respect to the estimated magnitude and speed of responses of trade flows to the two driving factors. See Bahmani-Oskooee (1986) and Tegene (1989) for further details on this issue.

Recent developments in both time series econometrics and expanded computational possibilities have led to a re-examination of earlier findings in the empirical literature (see, for example, Bahmani-Oskooee and Niroomand, 1998; Tegene, 1991; Bahmani-Oskooee and Brooks, 1999). Along this line, Bahmani-Oskooee and Kara (2003) investigated trade flows in nine advanced economies using stationary data within a cointegration and error-correction modelling framework. The conclusion from their study that there appears to be differential impacts on trade flows of changes in both exchange rate and relative prices seems to reject Orcutt's original opinion. In a more recent companion paper, they obtain similar results using quarterly data on a sample of twelve developing countries over the periods of 1973 to 2002. They, therefore, concluded that 'it is clear that each country demonstrates different response path to changes in the relative prices and the exchange rate' (Bahmani-Oskooee, 2008).

The present paper, therefore, attempts to fill a gap in the empirical literature, on merchandise trade flows responsiveness to exchange rate and price changes, by providing evidence[3] specific to a developing country, Nigeria. The other innovative feature of this paper is that Nigeria-specific factors, such as the level of external reserves and internal upheavals which impact on import and export demand respectively and hence on trade flows, are explicitly modeled. We estimate relative price and exchange rate response patterns of trade flows using quarterly data over the 1980 -2007 period. The rest of the paper is organized as follows. Section 2 presents some stylized facts on the Nigerian economy as well as the trade models and the estimation procedure used. This is followed by the empirical results in section 3. Finally, a summary and conclusion of the study is presented in section 4.

2. Stylized Facts on Price, Exchange Rate and Trade Flows

Merchandise trade flows in Nigeria reflect the sequence of various policies employed over time. The problems of balance of payments in the 1960s prompted the application of trade policies in the 1970s. Consequently, as expected, volume of imports decreased due to increase in import prices, which was the outcome of high tariff rates on imported goods. Coupled with this was the use of administratively determined exchange rate to ensure cheap import of raw materials for local manufacturing industries; however, the problems persisted.

The unabated problems of balance of payments, the fall in price of crude oil and the attendant economic depression, herald the introduction of Structural Adjustment Programme (SAP) in 1986. As a result, trade and exchange rate policies were liberalized. Import restrictions were reduced and export prohibition abolished. Although, the tariff structure was modified in 1995, it nonetheless remained liberalized.

[3] Studies on specific countries in Sub-Saharan Africa are at best scant. Although, Adubi and Okunmadewa (1999) focused on the effect of price changes and exchange rate volatility on agricultural trade flows.

Evidence shows that merchandise imports and exports fell considerably between 1980 and 1985. This was the period of economic recession and chronic balance of payments problems actuated by the oil price crash during the period. When the period prior to liberalization, 1980-1985, is compared to 1986-1991, the indicators of exchange rates decline over the period considered, indicating depreciation. In addition to that, the volumes of imports and exports have also increased. For example, data presented in Table 1 shows that the nominal effective exchange rate depreciated by about 81% while the exports and imports have increased by 536% and 284%, respectively for the same set of periods[4].

Table 1: Average Values and Change of some Selected Variables

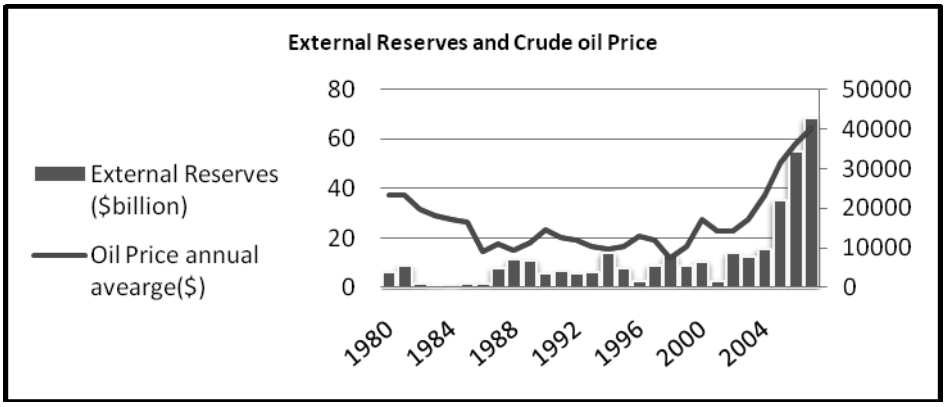
PERIOD	***NEER***	***EX***	***IM***	***IMP***	***EXPR***	***CPI***
1980:1-1985:4	7846.24	10587763333	9.8E+09	452.77	128.23	2.21
1986:1-1991:4	1475.83	67362325000	3.77E+10	95.02	81.98	6.19
1992:1-1999:4	236.22	3.9838E+11	2.56E+11	87.82	100.37	57.30
2000:1-2007:2	78.68	4.06409E+12	1.77E+12	142.78	107.62	170.32
	Percentage change of selected variables (%)					
	NEER	*EX*	*IM*	*IMP*	*EXPR*	*CPI*
1980-1985:1986-1991	-81.19	536.23	284.71	-79.01	-36.07	179.80
1986-1991:1992-1999	-83.99	491.40	578.04	-7.58	22.44	824.38
1992-1999:2000-2007	-66.69	920.15	593.15	62.58	7.22	197.25

Source: Computed from IMF's IFS 2007 CD-ROM

It should be noted that the main driver of exports volume in Nigeria is the oil exports. The increase in oil prices leads to increase in its exports and accumulation of external reserve (see Figure 1). This in turn, increases the capacity of Nigeria's imports. Thus, an investigation of trade flows in Nigeria should consider the influence of the oil sector. The external reserve surged with the boom in international crude oil market, as clearly shown in Figure 1 and 2.

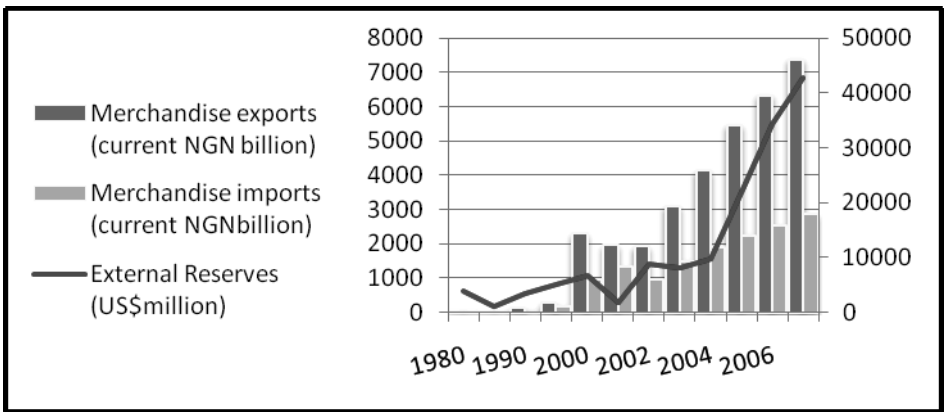
[4] Theoretically, exchange rate depreciation will lead to an increase in import prices, resulting into a fall in imports volume under the assumption that purchasing power parity. This is expected to correct the problems of balance of payments. However, the volume of trade flows has continued to increase in spite of the depreciation of exchange rate.

Figure 1: Nigeria External Reserve ($million) and Crude oil price ($US),1980-2007



Sources: (i) Central Bank of Nigeria Statistical Bulletin, Vol.18, 2007 issue.
(ii) http://www.nyse.tv/crude-oil-price-history.htm

Figure 2: Nigeria External Reserve ($million) and Trade Flows,1980-2007



Sources: (i) IMF's IFS 2007 CD-ROM
(ii) Central Bank of Nigeria Statistical Bulletin, Vol.18, 2007 issue.

3. Methodology

3.1. Data Definition and Study Scope

With the aim of investigating the relative responsiveness of trade flows to changes in prices and exchange rate in Nigeria, this study employs the Nigerian quarterly which covers the period from 1980Q1 to 2007Q4. The variables employed in this study include the following: export, world income, domestic export price, world export price, nominal exchange rate (for export demand model); and import, domestic income, domestic price level, import price, nominal exchange rate and foreign reserves (for import demand model). All variables are sourced from International Financial Statistics[5] and expressed in their natural log form[6].

3.2. Model Specification

The export demand and import demand models employed in this study specifically represent the augmented version of Bahmani-Oskooee and Kara (2003). It should be recalled that the core of this study is to compare the benchmark models of both export and import demand with those of country specific using the case of Nigeria. This is, of course, not unconnected with the findings from different empirical studies on cross country analysis where the effects of changes in exchange rate and relative prices on trade flows in each country demonstrates different response path thus signaling the importance of country specific factors especially in the developing countries (see Bahmani-Oskooee and Kara, 2003; Bahmani-Oskooee and Kara, 2008). Therefore, the following country specific export demand and import demand models for the case of Nigeria are specified thus:

Export Demand Model

$$\ln ex_t = \alpha_0 + \alpha_1 \ln yw_t + \alpha_2 \ln\left[\frac{dep}{wep}\right]_t + \alpha_3 \ln ner_t + \alpha_4 dum + \mu_t \qquad (1)$$

$$\alpha_1 > 0; \alpha_2; < 0; \alpha_3 < 0; \alpha_4 < 0$$

where

ex_t = quarterly merchandise exports expressed in naira;

yw_t = index of world income;

$[dep/wep]_t$ = the relative price of domestic exports (*dep*) compared to that of the world (*wep*);

[5] See appendix for details on data definitions and measurement.

[6] The descriptive statistics for the variables employed in both models are presented in the appendix.

ner_t = Nominal effective exchange rate;
dum = Dummy which represents the impact of domestic insurgency and conflicts especially in the oil producing regions in Nigeria. From 1980 to 1992, 0 is assigned to *dum* and from 1992 to 2007 we assigned 1[7]; and
u_t = Error term

Meanwhile, the impact of increase in the world income on Nigeria's export is hypothesized to be such that it induces exports. Therefore, an estimate of α_1 is expected to be positive. Again, given that an increase in the Nigeria's exports price relative to world price consequently leads to a decrease in the demand for Nigeria's exports. Thus, an estimate of α_2 is expected to be negative. It is also expected that an estimate of α_3 would be negative. The argument here is that with a fall in nominal effective exchange rate exports are anticipated to rise. Finally, the domestic conflicts in the oil producing regions in Nigeria are expected to be detrimental to oil production and therefore have a negative impact on oil export. Thus, an estimate of α_4 is expected to be negative.

Import demand Model

$$\ln im_t = \beta_0 + \beta_1 \ln yd_t + \beta_2 \ln\left[\frac{pm}{pd}\right]_t + \beta_3 \ln ner_t + \beta_4 \ln frs + \varepsilon_t$$
$$\beta_1 > 0; \beta_2; < 0; \beta_3 > 0; \beta_4 > 0 \qquad (2)$$

where
im_t = Quarterly merchandise imports expressed in naira;
yd_t = Quarterly domestic income expressed in naira;
$[pm/pd]_t$ = Relative prices of import (pm) compared to that of domestic goods (pd);
ner_t = Nominal effective exchange rate;
frs_t = Nigeria's foreign reserves; and
u_t = Error term

From the import demand model, the estimates of β_1, β_2, β_3 and β_4 are expected to be positive, negative, positive and positive respectively. In other words, while the propensity to import increases with increase in domestic income, relative price of import to domestic good, on the other hand, is expected to be negatively related to import demand. Furthermore, a decrease in nominal effective exchange rate dampens imports. Finally, the model postulates import demand as a positive function of foreign reserves.

Now, investigating the responsiveness of trade flows to changes in both relative price and nominal effective exchange rate entails thorough examination of dynamic adjustment nature of both export and import demand models specified above (Bahmani-Oskooee and Kara, 2008). Hence, this study shall employ the Unrestricted Error Correction Model (UECM) which follows the other of Autoregressive Distributed Lag

[7] The idea here is to capture the impact of domestic conflicts in the oil producing regions in Nigeria in our model.

(ARDL) proposed by Pesaran et al. (2001). Pesaran et al. (2001), proposed a (ARDL) bounds testing approach to investigate the existence of cointegration relationship among variables. Compared to other cointegration procedures, such as Engle and Granger (1987) and Johansen and Juselius (1990), the bounds testing approach appears to have gained popularity in recent times due to the following reasons: Both long-and short run parameters of the specified model can be estimated simultaneously. Again, the approach is applicable irrespective of the order of integration whether the variables under consideration are purely I(0), purely I(1) or fractionally integrated.

ARDL Specification of Export Demand Model

$$\Delta \ln ex_t = \alpha_0 + \alpha_1 \ln ex_{t-1} + \alpha_2 \ln yw_{t-1} + \alpha_3 \ln\left[\frac{dep}{wep}\right]_{t-1} + \alpha_4 \ln ner_{t-1} + \alpha_{5i} dum$$
$$+ \sum_{i=1}^{p} \alpha_{6i} \Delta \ln ex_{t-i} + \sum_{i=1}^{q} \alpha_{7i} \Delta \ln yw_{t-i} + \sum_{i=1}^{r} \alpha_{8i} \Delta \ln\left[\frac{dep}{wep}\right]_{t-i} + \sum_{i=1}^{s} \alpha_{9i} \Delta \ln ner_{t-i} + \mu_t \quad (3)$$

ARDL Specification of Import Demand Model

$$\Delta \ln im_t = \beta_0 + \beta_1 \ln im_{t-1} + \beta_2 \ln yd_{t-1} + \beta_3 \ln\left[\frac{pm}{pd}\right]_{t-1} + \beta_4 \ln ner_{t-1}$$
$$+ \beta_5 \ln frs_{t-1} + \sum_{i=1}^{p} \beta_{6i} \Delta \ln im_{t-i} + \sum_{i=1}^{q} \beta_{7i} \Delta \ln yd_{t-i} + \sum_{i=1}^{r} \beta_{8i} \Delta \ln\left[\frac{pm}{pd}\right]_{t-i} \quad (4)$$
$$+ \sum_{i=1}^{s} \beta_{9i} \Delta \ln ner_{t-i} + \sum_{i=1}^{v} \beta_{10i} \Delta \ln frs_{t-1} + \varepsilon_t$$

The first step in the (ARDL) bounds testing procedures is to estimate equation (3) and (4) by Ordinary Least Square method and thus conduct an F-test for the joint significance of the coefficients of the lagged level of the variables with the aim of testing for the existence of long run relationship among the variables in both equations:
For equation (3):

Ho: $\alpha_1 = \alpha_2 = \alpha_3 = \alpha_4 = \alpha_5 = 0$ against H_1: $\alpha_1 \neq \alpha_2 \neq \alpha_3 \neq \alpha_4 \neq \alpha_5 \neq 0$

For equation (4):

Ho: $\beta_1 = \beta_2 = \beta_3 = \beta_4 = \beta_5 = 0$ against H_1: $\beta_1 \neq \beta_2 \neq \beta_3 \neq \beta_4 \neq \beta_5 \neq 0$

Consequently, the computed F-statistic is then compared to the non-standard critical bounds values reported in Pesaran et al., (2001). If the computed F-statistic

exceeds the critical upper bounds value, then the null hypothesis of no cointegration is rejected. If the computed F-statistic falls below the critical lower bounds value, then the null hypothesis of no cointegration is not rejected. But when the computed F-statistic falls between the critical lower and upper bounds values, then the knowledge of integration of the variables under consideration is required, or else, no conclusion can be reached about cointegration status.

4. Empirical Results

4.1. Unit Root Testing

Tables 2 and 3 present the results of Augmented Dickey Fuller and Phillip Perron unit root tests for both export demand and import demand models[8]. As indicated in both tables, almost all variables under consideration appear to be of I(1) variables. This is evidenced in their respective probability values. The maximum order of integration of the variables under consideration in both tables appear to be I(1). The result therefore, implies that the bounds testing approach is applicable in this study since none of the variables are integrated of higher order of stationarity than I(1).

Table 2: Unit Root Tests for Export Variables

	Augmented Dickey Fuller				**Phillip Perron**			
	With Constant		With Constant & Trend		With Constant		With Constant & Trend	
Variable	Level Prob.	FD Prob.	Level Prob.	FD Prob.	Level Prob.	FD Prob.	Level Prob.	FD Prob.
Exports	0.9661	0.0000	0.0274	0.0000	0.9506	0.0000	0.0545	0.0000
World Income	0.7995	0.0000	0.0803	0.0000	0.7735	0.0000	0.1465	0.0000
Relative Price	0.0132	0.0000	0.0529	0.0004	0.0292	0.0001	0.1276	0.0009
Exchange Rate	0.7313	0.0000	0.8365	0.0000	0.7499	0.0000	0.8724	0.0000

Note: FD signifies First Difference.

[8] The essence of testing for the stationarity properties of the variables under consideration is because the (ARDL) bounds testing approach to cointegration as proposed by Pesaran et al (2001) becomes applicable only in the presence of a I(0) or I(1) variables. Thus, the assumption of bounds testing will collapse in the presence of I(2) variables.

Table 3: Unit Root Tests for Import Variables

	Augmented Dickey Fuller				Phillip Perron			
	With Constant		With Constant & Trend		With Constant		With Constant & Trend	
Variable	Level Prob.	FD Prob.	Level Prob.	FD Prob.	Level Prob.	FD Prob.	Level Prob.	FD Prob.
Imports	0.9616	0.0007	0.0628	0.0041	0.8983	0.0000	0.3702	0.0000
Domestic Income	0.9487	0.0133	0.6050	0.0121	0.9992	0.0001	0.0009	0.0006
Relative Price	0.8883	0.0000	0.2033	0.0000	0.9318	0.0000	0.4116	0.0000
Exchange Rate	0.7313	0.0000	0.8365	0.0000	0.7499	0.0000	0.8724	0.0000
Foreign Reserves	0.6667	0.0000	0.0446	0.0000	0.0354	0.0000	0.0824	0.0000

Note: FD signifies first difference

Table 4 depicts the results of the cointegration status of the models employed in this study. The results show that there are long run relationships in the models. For instance, both benchmark and augmented export models exhibit long run relationship when the vectors of variables are normalized on exports. A similar outcome is obtained in both import models. As clearly elucidated in Table 5, the long-run merchandise exports from Nigeria are largely driven by expansion or contraction in economic activity in trading partners. This view is supported by our finding that an increase of one percent in foreign income should lead to about 2 percent increase in Nigeria's exports to the rest of the world[9]. The results from both models- benchmark and augmented- are quantitatively and qualitatively similar. The nominal effective exchange rate (*neer*) carries the expected negative sign in both models. In theory, devaluation/depreciation of exchange rates is expected to result in a surge in export demand. The export elasticities of *neer* are -1.08 and -1.19 in the benchmark and augmented models, respectively. The policy implication here is that with a 10 percent depreciation in naira, exports in both models increase by about 10 and 12 percent respectively. This is as a result of the fact that with depreciation in naira, domestic export becomes relatively cheaper compared with world export leading to increased demand for Nigeria's exports.

[9] This is much in line with the findings of Agolli (2004) and Vika (2006) in the case of Albania, though their estimates of elasticity are in the 6-7 percent range.

Table 4: Cointegration Test

Equation	F-Calculated	Lower Bound I(0)	Upper Bound I(1)	Outcome
Export	6.22	3.23	4.35	Cointegrated
Import (benchmark)	5.04	3.23	4.35	Cointegrated
Import (Augmented)	3.53	2.45	3.52	Cointegrated

Note: The asymptotic critical value bounds for both export and import models are obtained from Table C1 (iii) case III: Unrestricted intercept and no trend (Pesaran *et al*., 2001). For k = 3 and 4 (in the augmented import model) lower bound I(0) = 3.23 and upper bound I(1) = 4.35 at 5% significance level, while lower bound I(0) = 2.45 and upper bound I(1) = 3.52 at 10% significance level (for k =4). The lag structure was selected based on the Akaike Information Criterion; * Denotes the rejection of the null hypothesis at 1 (5%) significance level

Table 5: Long run Export Demand Model

	Benchmark Model			Country Augmented model		
Variables	**Coefficient**	**t-Statistic**	**Prob. Value**	**Coefficient**	**t-Statistic**	**Prob. Value**
lnyw	2.085813	3.169458	0.0020*	1.925479	2.889880	0.0047*
ln[dep/wep]	1.168849	5.356905	0.0000*	1.271752	5.520905	0.0000*
lnneer	-1.081470	-15.01823	0.0000*	-1.186380	-11.21629	0.0000*
dum	-------	-------	-------	-0.331054	-1.349717	0.1800
constant	23.47035	7.027008	0.0000*	25.02667	7.106792	0.0000*

Note: * represents 1 percent level of significance

However, against the received wisdom which posits that a rise in domestic export price relative to world export price should discourage exports, Nigeria's export price relative to world export price has a positive effect on exports. The result here seems counterintuitive. This stems from the fact that Nigeria's major export item is oil. Favourable price realisations in the global oil markets, ceteris paribus, should culminate in higher exports from Nigeria. Hence, Nigeria's export is seen to be quite elastic to relative price movements as revealed by elasticity estimates of 1.17 and 1.27 in our benchmark and augmented export models (see Table 5). These estimates comport with the 1.12 reported for Korea in Bahmani-Oskooee and Kara (2008). It is interesting to note that although our dummy for domestic conflicts in the augmented long-run model appears

insignificant at the conventional levels, but has the expected negative sign. This implies that internal frictions[10] have a dampening effect on exports.

The short-run dynamics of the export demand models for Nigeria is presented in Table 6. Our results show that both the domestic conflicts dummy and the lagged relative export price are significant. Hence, internal upheavals seem to have a muffled effect on export in the short run. The estimate of exports price relative to world export price has the expected negative sign in the short-run. A 10 percent increase in the relative price results in about 7.3 and 7.1 percent reduction in exports in the benchmark and country augmented models in that order. The sign of the coefficient of the nominal effective exchange rate is the same as in the long-run models but the magnitude of the short-run coefficients are one-fifths lower, in absolute values, than the long-run estimates across models.

The error correction terms in both export models are negative and highly significant. This further strengthens the cointegration results obtained from the prior bounds testing (ARDL) procedure. Theoretically, the estimated coefficient of the error correction term should lie within an interval of zero and one. Thus, the larger the magnitude of this coefficient is, the faster the speed of adjustment toward the long-run equilibrium. In our models, any deviations from the static equilibrium are corrected at a rate of about 10 percent in each quarter.

Table 6: Parsimonious Export Demand Error Correction Model

	Benchmark Model			**Country Augmented model**		
Variables	**Coefficient**	**t-Statistic**	**Prob. Value**	**Coefficient**	**t-Statistic**	**Prob. Value**
Δln[ex(-1)]	0.230444	2.538837	0.0126	0.225275	2.497338	0.0141
Δln[dep/wep]	-0.735650	-2.384610	0.0189	-0.713092	-2.317840	0.0224
Δln[dep/wep(-1)]	0.412596	1.335338	0.1847	0.394005	1.278676	0.2039
Δln[neer]	-0.276308	-1.850233	0.0671***	-0.276099	-1.857209	0.0661***
dum	-------	-------	-------	-0.2011	-1.298173	0.23011
ecm(-1)	-0.096411	-2.726752	0.0075*	-0.102730	-2.903882	0.0045*
constant	0.030424	1.515940	0.1326	0.030679	1.535883	0.1276

Note*:* *(***) represents 1(10) percent level of significance respectively

[10] The crisis in the country's Niger Delta region with its attendant oil and gas production disruptions as well as civil unrests following the annulment of the June 12, 1993 presidential elections, in our view, are key among other factors that have precipitated internal chaos in Nigeria.

Table 7: Long run Import Demand Model

	Benchmark Model			Country Augmented model		
Variables	**Coefficient**	**t-Statistic**	**Prob. Value**	**Coefficient**	**t-Statistic**	**Prob. Value**
yd	3.735911	11.43417	0.0000*	3.826748	7.353784	0.0000*
[pm/pd]	0.333477	3.535468	0.0006*	0.3156633	3.471611	0.0008*
neer	-0.929012	-6.784788	0.0000*	-0.884118	-6.853680	0.0000*
frs	-------	-------	-------	-0.286678	1.717724	0.0888***
frs(-1)	-------	--------	-------	0.308991	1.85566	0.0663***
constant	-65.48910	-7.372926	0.0000*	-68.24145	-5.105837	0.0000*

Note*:* * (***) represents 1 (10) percent level of significance.

In a similar fashion, Table 7 presents results of the long-run import demand models. Our elasticity estimates indicate that in the long-run the major determinants of Nigeria's import demand are domestic income, import price relative to domestic price level, the nominal effective exchange rate and foreign reserves. It is also pertinent to note that, in our augmented model, both foreign reserves and its one-period lag are significant at the conventional levels. An increase of 10 percent in real domestic income leads to a rise of about 38 percent in Nigeria's demand for foreign goods. This seems to be obvious on account of the important contribution of imports to offsetting domestic shortage of consumer durables as well as provision of inputs into production processes.

Table 8: Parsimonious Import Demand Error Correction Model

	Benchmark Model			Country Augmented model		
Variables	**Coefficient**	**t-Statistic**	**Prob. Value**	**Coefficient**	**t-Statistic**	**Prob. Value**
Δln[im(-1)]	0.293385	3.397198	0.0010*	0.327240	3.860055	0.0002*
Δln[yd]	0.794067	0.896212	0.3723	0.944616	1.220970	0.2249
Δln[pm/pd]	0.118866	1.134718	0.2592	0.138046	1.355144	0.1784
Δln[pm/pd(-3)]	0.178349	1.848182	0.0675***	0.192033	1.150352	0.2271
Δln[neer]	-0.389061	-3.863312	0.0002*	-0.349938	-3.583399	0.0005*
Δln[frs]	-------	-------	-------	-0.128542	-2.257945	0.0261**
ecm(-1)	-0.112640	-3.052779	0.0029*	-0.122900	-3.565835	0.0006*
constant	0.032348	1.999402	0.0483**	0.029606	2.012055	0.0469**

Note: *, ** and *** represent 1, 5 and 10 percent level of significance, respectively.

Digging further, Tables 7 and 8 show that import demand is inelastic to relative prices in both the long-run and the short-run. This pattern is repeated in the augmented

model as evident from the elasticity values of 0.32 and 0.13 in the long- and short-run respectively[11]. This appears to be a reflection of low substitutability between domestically produced goods and imported ones. Much of consumer goods and productive inputs are imported owing to marked declines in manufacturing capacity utilization in Nigeria. Thus, even with a decline in local prices the demand for imports falls disproportionately as most imported goods do not have competitive domestic substitutes.

Effective exchange rate variations are found to have significant effect on Nigeria's demand for foreign goods. This elasticity is close to unity in both long-run models. A one-for-one response of import demand to the nominal effective exchange rate is, however, not supported by our models in the short-run. Thus, policymakers in Nigeria may have to consider exchange rate policies as a long-run fix to the problem of growth in foreign goods demand. In the short-run, imports will be indispensable in the Nigerian economy, against the background of genuine developmental needs. This creates a crucial role for alternative demand management policies of which fiscal and monetary policies have a pivotal role.

The results in Table 7 show that, in the long-run, the foreign reserves have a significant and a positive net impact on Nigeria's import demand. The short-run results in Table 8 reveal that foreign reserves are also significant in explaining Nigeria's import demand pattern although the elasticity, in absolute terms, is about one-half of the long-run coefficients. Also, the error correction term conforms to expectations as regard sign and significance. The magnitude of 0.12, in the augmented model, implies that following a divergence from equilibrium, nearly 12 percent of adjustment takes place in the current period[12]. In sum, merchandise import volume in Nigeria is related to domestic income, movements in relative consumer prices, foreign reserves, exchange rate fluctuations as well as corrections to disequilibrium.

We now turn to the Marshall-Lerner (ML) condition which states that currency devaluations can be effective if the sum of long-run price elasticities of import and export demand exceed unity in absolute value provided that the trade balance -which is assumed to be equal the current account balance- is zero initially. The results show that the corresponding trade flows price elasticities for Nigeria are 0.33 and 1.17, respectively. The sum is evidently greater than 1. The augmented model also supports the ML condition for Nigeria with an elasticity sum of about 1.60. This, from a policy perspective, could be a pointer to the effectiveness of naira devaluation as a tool for addressing problems of external trade deficits.

Having estimated the elasticity coefficients for export demand and import demand, this study proceeds to investigating the econometric reliability of these estimates by employing batteries of diagnostic statistics with the overall aim of making this study more

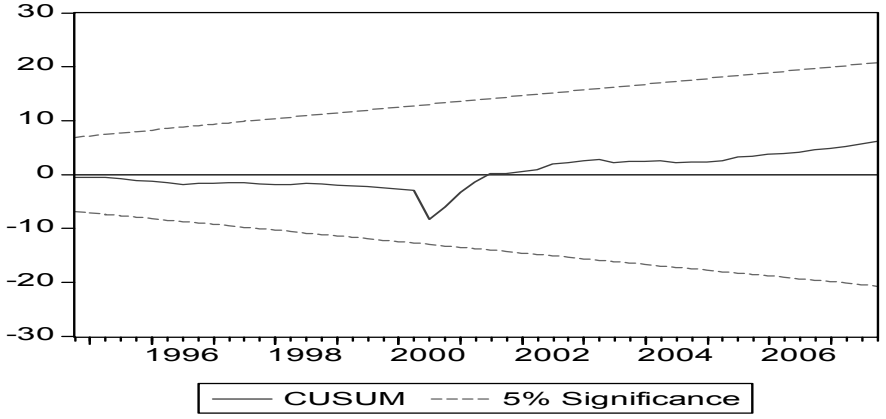
[11] The coefficient of relative import price is however insignificant in the short-run although its third period (in quarters) lag is correctly signed and statistically significant with coefficients of 0.17 and 0.19 in both parsimonious models in Table 8.

[12] This is in sharp contrast to the findings of Bahmani-Oskooee and Kara (2008). They reported estimates of 0.54, 0.55,0.61, and 0.76 for Isreal, Phillipines,Turkey, and Pakistan, respectively.

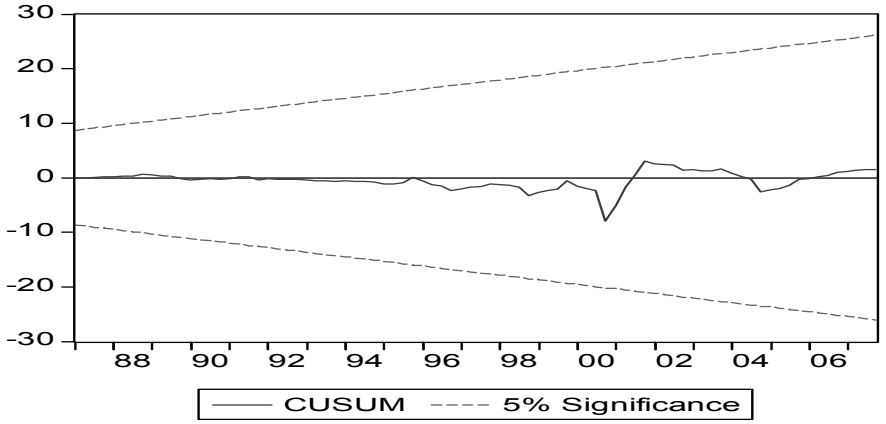
robust. As portrayed in Table 11, the following tests are conducted on both models: Residual normality, ARCH (LM) and White heteroscedasticity. Though the condition of normal distribution of residuals in export demand and import demand models appear not to be satisfied, however, both models pass the ARCH (LM) and white heteroscedasticity tests.

Graph 1 and Graph 2 depict the cumulative test which is based on the cumulative sum of the recursive residuals. The essence of this test is to find the parameter stability or consistency in both the export demand and import demand equations. The straight lines in the graphs represent critical bounds at 5% significance level. As evident from the graphs, it can be affirmed that the parameter estimates from both equations (export demand and import demand) display patterns of overall stability during the period covered.

Graph 1: Plot of Cumulative Sum of Recursive Residuals for the Export Equation



Graph 2: Plot of Cumulative Sum of Recursive Residuals for the Import Equation



5. Conclusion and Summary

Most of the previous studies that examined the responsiveness of trade flows to changes in income, relative prices and the exchange rate have used non-stationary data (Bahmani-Oskooee and Kara, 2008) and have delved more into the cross-sectional dimensions of the issue. This paper fills the lacunae not only by providing evidence specific to Nigeria but also by augmenting the now standard model formulations in the literature via the inclusion of a dummy capturing the influence of domestic upheavals and the level of foreign reserves in the export and import demand models respectively. We find that in both the short- and long-run Nigeria's trade flows are chiefly influenced by income- both domestic and foreign-, relative prices, nominal effective exchange rates and the stock of external reserves. The results also reveal that in the long-run, devaluation is more effective than relative prices in altering imports demand at both baseline and augmented models. The reverse is however the case for export supply function. Augmenting the benchmark model, albeit interesting, did not change in any significant way the conclusions arising from our result. This goes to further buttress the need, expressed by Bahmani-Oskooee and Kara (2003; 2008), for an in-depth analysis of the responsiveness of trade flows to its key determinants on a country specific basis. Furthermore, the sum of the estimated price elasticities of export and import demand in Nigeria exceeds unity indicating that the ML condition holds thus implying that a devalued naira might hold considerable promise as the panacea to rising trade deficits.

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Appendix

Table 9: Export Demand Model-Variables Descriptive Statistics

	Export	Foreign Income	Relative Prices	Exchange Rate
Mean	26.04331	4.466880	-0.030717	6.202868
Median	26.10113	4.535600	-0.090371	5.736518
Maximum	29.68023	4.741901	0.902397	9.102079
Minimum	22.74714	3.938275	-0.540321	4.180522
Std. Dev.	2.252057	0.204170	0.288450	1.765019
Skewness	0.065658	-0.814900	1.311553	0.523902
Kurtosis	1.713012	2.656017	4.992025	1.815170
Jarque-Bera	7.810054	12.94801	50.62796	11.67468
Probability	0.020140	0.001543	0.000000	0.002917
Sum	2916.851	500.2906	-3.440252	694.7213
Sum Sq. Dev.	562.9653	4.627064	9.235586	345.7974
Observations	112	112	112	112

Table 10: Import Demand Model-Variables Descriptive Statistics

	Import	Domestic Income	Relative Price	Exchange Rate	Foreign Reserves
Mean	25.57286	25.75008	1.872713	6.202868	8.257291
Median	25.70328	25.75379	0.990425	5.736518	8.340845
Maximum	28.72159	26.35078	5.737651	9.102079	10.60357
Minimum	22.48730	25.29559	-0.569764	4.180522	6.241876
Std. Dev.	2.021629	0.289485	2.150181	1.765019	1.163757
Skewness	0.065333	0.253288	0.647392	0.523902	0.308949
Kurtosis	1.612350	2.119876	1.921212	1.815170	2.070638
Jarque-Bera	9.065678	4.812439	13.25451	11.67468	5.812392
Probability	0.010750	0.090155	0.001324	0.002917	0.054683
Sum	2864.160	2884.009	209.7439	694.7213	924.8166
Sum Sq.Dev.	453.6554	9.301980	513.1840	345.7974	150.3306
Observations	112	112	112	112	112

Diagnostic tests

Table 11: Diagnostic Statistics Report

	EXPORT MODEL	IMPORT MODEL
Adj. R^2	0.93	0.96
F-Statistics	527 (0.0000)	794.66 (0.000)
Normality Test [χ^2_N]	9.1255(0.00)	12.88 (0.000)
ARCH (LM) [χ^2_{ARCH}]	1.39466 (0.15431)	1.170 (0.3193)
White Hetero. Test [χ^2_H]	2.375 (0.10769)	0.4619 (0.9893)

Table 12: Variable Definitions

Variables	Definition
Export	Merchandise export measured in local currency unit.
Export Price	Export quantum/quantity index (2000 = 100)
Import	Merchandise import measured in local currency unit
Import Price	Import quantum/quantity index (2000 = 100)
World Export Price	World export price index (2000 = 100)
Domestic Price	Consumer price index (2000 = 100)
World Income	Industrial production index from industrial countries (2000 =100)
Domestic Income	Real gross domestic product in local currency unit
Exchange Rates	Nominal effective exchange rate index (2000 = 100)
Foreign Reserves	Foreign reserves excluding gold
Dummy	Dummy which represents the impact of domestic conflicts especially in the oil producing regions in Nigeria. From 1980 to 1992, 0 is assigned to *dum* and from 1992 to 2007 we assigned 1.