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THE EFFECTS OF TRADE LIBERALIZATION ON REAL EXCHANGE RATE: EVIDENCE FROM NIGERIA

Ayodele Jimoh*

The study examines the Nigerian data between 1960- 2000 to see what support it provides for the traditional theory of real exchange rate. Using the well-known Johansen's (1992; 1995) methods for estimating models whose variables are non-stationary but cointegrated, the study found that the decisive trade liberalization programme of 1986-87 led to about 13 per cent depreciation in the Nigerian real exchange rate and made the real rate more responsive to changes in its terms of trade. However, other less decisive changes in trade regime produced no significant changes in the real exchange rate.

1. INTRODUCTION

The conventional wisdom is that a country's equilibrium real exchange rate is determined by its economic fundamentals (i.e. some key real variables) and that the long-run value of the equilibrium real exchange rate is determined by sustainable (permanent) values of these fundamentals (Williamson, 1994; Isard and Faruqee, 1998; MacDonald, 1997; Clark and McDonald, 1999; etc.). One of the often identified economic fundamentals is the extent of trade liberalization (Dornbusch, 1974; Edwards, 1994; Khan and Ostry, 1992 and Williamson, 1994). Others are the volume of net capital inflows, the size of government expenditure, the terms of trade, real interest rate relative to that of the rest of the world, and the level of net foreign assets (Elbadawi, 1994; Edwards, 1994; and Clark and McDonald, 1999).

Since Nigeria gained its independence in 1960, it has made varying degree of attempts at trade liberalization. For most part of its colonial history, its trade was tied to the apron of and virtually restricted to the British economy and for this reason its trade regime during this period could be described as restrictive. This colonial trade regime remained in

* Department of Economics, University of Ilorin, dajimoh2003@yahoo.com.

place in the immediate post-independent years and trade restrictions were only heightened with the passage of the Exchange Control Act of 1962 (CBN, 1983: 18-50). Between1976-79, the military government of Obasanjo further escalated Nigerian trade restrictions. Between 1980 and 1982, Shagari government after initially relaxing trade restrictions, tightened the noose in 1982. However, these were not a major departure from the norm when compared to the 1976-79 restrictive trade regime or 1986-1987 trade liberalization regime. Also, the 1976-79 restrictive trade regime itself was less massive than the 1986-1987 trade liberalization regime. Hence, it can be said that it was not until 1986 that the first decisive attempt at changing the trade regime was made and this happened to a trade liberalization programme.

Specifically, in 1986, Nigeria abolished import and export licensing, reduced items on import Prohibition List from 74 to 16 and took off all the 11 items on the Export Prohibition List from that list (Rodrik, 1992; Moser, et al., 1997). Furthermore, in 1987, it abolished 30 per cent surcharge on imports and reduced the 100 per cent advanced payment in respect of import duty to 25 per cent. Between 1986 and 1987, trade tariffs were significantly reduced from an average of 33 per cent to 23 per cent and tariffs dispersions were also drastically compressed. However, by 1988, average tariff began to rise (from 23 per cent to 28 per cent) (Rodrik, 1992; Moser, et al., 1997). By 1989 through 1990, it was clear that the trade liberalization programme had been aborted as tariffs were significantly raised and Export Prohibition List reappeared (Rodrik, 1992; Moser, et al., 1997). This remained the state of affairs till 1999.

Though democratic rule was restored in 1999 and expectations were high that it would usher in trade liberalization in view of government's declaration of a commitment to major economic reforms, this was not to be as Nigeria is yet to witness trade liberalization at a level that is comparable to that recorded between 1986 and 1987. Nigeria currently has about 18 items on its Import List (FGN, 2004) and a number of items remain on its Export Prohibition List while average tariff rate is significantly higher than its 1990 level.

Thus, the Nigerian experience provides us with a rich opportunity to determine and study the effects of trade liberalization on the real exchange rate. It is therefore desirable to determine the impact of

various degrees of trade liberalization recorded in Nigeria between 1960 and 2000 on the real exchange rate to see what support it provides for the theory of real exchange rate. In particular, it is desirable to determine the impacts of massive trade liberalization of 1986-1987 (a period of two years) on the real exchange rate and whether or not the escalation of Nigerian trade restrictions during 1976-1979 (a period of four years) was responded to by its real exchange rate.

As desirable as this kind of study is, our extensive review of the relevant literature does not reveal any study on Nigeria that investigates the impact of trade liberalization on its real exchange rate (as well as its equilibrium real exchange rate) since 1960. The objective of the study is to fill this gap in our knowledge. Towards this end, the rest of this paper consists of the following: Section 2: Conceptual and Analytical Framework; Section 3: Model Specification and Methods of Estimation; Section 4: Empirical Results; and Section 5: Concluding Remarks.

2. CONCEPTUAL AND ANALYTICAL FRAMEWORK

A country's real exchange rate is defined as the relative price of its tradable goods to non-tradable ones (Sundararajan, et. al., 1999; Betts and Kehoe, 2004, etc). This is often measured by the nominal exchange rate multiplied by the ratio of foreign prices to the domestic price. The equilibrium real exchange rate is defined as the exchange rate that is consistent with both internal and external balance (Williamson, 1994; Isard and Faruqee, 1998). While it is generally agreed that the degree of trade liberalization affects the level of real exchange rate, with increased trade liberalization leading to real exchange-rate depreciation (Dornbusch, 1974; Edwards, 1994; Khan and Ostry, 1992 and Williamson, 1994), there is no agreement on how best to measure the extent of trade liberalization that has taken place in country in a given time.

A review of the literature suggests that existing measures of the extent of trade restrictions can be categorized into three, namely, outcome-based, incidence-based and event-based measures. In the outcome-based category, we have measures that use variables (flows or prices) that are affected by trade barriers to determine the extent of the severity of trade restrictions (Pritchett, 1991; and Andriamananjara and Nash, 1997). These include parallel exchange market premium and the ratio of

exports plus imports to GDP, among others. For instance, Edwards (1989) suggests that the spread between official exchange rate and the parallel market exchange rate is a good measure of the extent of the severity of trade restrictions and exchange controls. Similarly, Elbadawi (1994) suggests that the ratio of exports plus imports to GDP is a good measure of the extent of trade liberalization.

In the incidence-based category, we have measures that use average tariff level or/and counts of the incidences of non-tariff restrictions in the entire economy (Pritchett, 1991; and Andriamananjara and Nash, 1997). In the event-based category is any study that uses dummy variables to capture the effects of trade liberalization in periods when it is clear that significant trade liberalization had taken place.

However, the work of Pritchett (1991) suggests that all various existing outcome-based and incidence-based measures are poorly correlated. This may reflect the problem inherent in any attempt at developing a single measure for a multi-impact activity like trade restrictions. In the main, each of the existing measures either captures more than the effects of trade restrictions or less than it. For instance, parallel market foreign exchange premium would capture the effects of capital flow controls as well as those of trade restrictions. It is for this reason that event-based study may give a more reliable verdict. In particular, when it is possible to compliment either outcome- or incidence-based measure of trade liberalization with event-based measures and this is done, study outcome is expected to be more reliable. Fortunately, Nigeria is such a case. This informs our decision in this study to compliment an outcome-based measure (of flow variety) with an event-based measure to determine the effects of trade liberalization on real exchange rates in Nigeria.

3. MODEL SPECIFICATION AND METHOD OF ESTIMATION

In this section, we specify a model of real exchange rate to be estimated, outline the method(s) of estimation employed as well as data requirements and sources.

The Model

In specifying the model to be employed in this study, we make two simplifying assumptions with respect to the general model commonly discussed in the literature. First, we assume that the Nigerian stock of foreign assets, for most of the study period, is not significant to have any effect on its real exchange rate. Second, we assume that because of the thinness of its money market, real interest rate differentials play no significant role in the determination of its real exchange rate. These are in line with many similar studies on developing countries (Atingi-Ego and Sebudole, 2004).

Thus, in accordance with the current literature on this subject matter, we specify the equilibrium real exchange rate (ė) as a decreasing function of terms of trade (Π), a decreasing function of the ratio of net capital flows to GDP (KI/Y), an increasing function of the degree trade liberalization – often measured by the degree of openness (OPEN) - and a function of the size of government – often measured by the ratio of government expenditures to GDP - (g/Y). To this we add Trade Liberalization Dummy (LIBE) – an event-based measure - and expect *a priori* that ė would increase with LIBE. That is:

$$\dot{e} = \dot{e}(\Pi, g/Y, KI/Y, OPEN, LIBE) \ldots \quad (1)$$

where $\dot{e}_1, \dot{e}_3 < 0$, $\dot{e}_4, \dot{e}_5 > 0$ and $\dot{e}_2 \geq 0$; ($\dot{e}_i$ being the partial derivative of ė with respect to its i^{th} argument); for a more detail definition of variables in equation (1) and indeed for all other subsequent equations, see the appendix to this paper. It is worth noting that in this study we have followed the empirical literature which usually captures the effects of import and export tariffs by the sum of total imports and total exports as percentage of Gross Domestic Product (GDP). Thus, OPEN in equation (1) is a (flow type of) outcome-based measure of trade Liberalization while LIBE is an event-based measure of it.

To determine the effects of 1976- 1979 trade restrictions and 1986-1987 trade liberalization on the Nigerian real exchange rate, we have treated LIBE in equation (1) as a vector of two variables, namely, LIB dummy variable (to measure the event of 1986-1987 trade liberalization) and

RES dummy variable (to measure the event of 1976-1979 trade restrictions)[1]. Thus, equation (1) becomes:

$$\dot{e} = \dot{e}(\Pi, g/Y, KI/Y, OPEN, LIB, RES) \ldots \quad (2)$$

If the traditional theory of real exchange rate is supported by the Nigerian data, it is expected that the coefficient of RES will be negative while that of LIB is positive.

Real Exchange Rate and Equilibrium Real Exchange Rate

While the four variables (the last three variables being measures of one variable) identified in equation (2) above are the fundamental variables that determine equilibrium real exchange rate, the works of Edwards (1989, 1994) and Elbadawi (1994) have shown that fiscal and monetary policies that deviate from their sustainable levels in the short run cause the actual real exchange rate (e) to deviate from ė. Similarly, the nominal exchange rate (E) was shown by Elbadawi (1994) to have some inertia on e in the short run. Consequently, e is modeled as having a mean reversion in ė. Therefore,

$$\Delta e = \alpha\{\dot{e}_t - e_{t-1}\} - \Phi_1\{S_t - S_t^*\} + \Phi_2\{E_t - E_{t-1}\} \ldots\ldots \quad (3)$$

where S_t is a vector of shocks (policy variables, e.g. money supply) and S_t^* is a vector of shocks consistent with equilibrium real exchange rate (i.e. ė); E is nominal exchange rate as defined before.

[1] One may be tempted to say that the periods of 1986-1987 (with two data points) and 1976-1979 (with 4 data points) give us too few observations to yield reliable estimates for the coefficients of the two dummy variables - LIB and RES - but we should not yield to this temptation. This is because when investigating the stability or otherwise of parameters of a model, the dummy-variable method employed here is particularly very suitable for cases when the size of the sub-sample being investigated is small (including when it is just one data point). All that one needs do, when in doubt, is to first conduct Chow's (1960) *predictive test* – which avoids small sample-size problems - to establish the existence or otherwise of a change in the value(s) of the parameter(s) of the model in the sub-sample being investigated and thereafter use dummy variables (including those containing just one data point) to determine where, specifically, the break occurred and the magnitude of the change (for a detailed description of these procedures, see Maddala, 2002:314). All these steps have been taken in this study to ensure the validity of our methods and results.

The implication of equation (3) is that the dynamic behaviour of e can be modelled as a function of the fundamental variables in equation (2), monetary shocks (M_2) and nominal exchange rate in the previous period (E_{t-1}). That is:

$$e = e (\Pi, g/Y, KI/Y, OPEN, LIB, RES, M_2, E_{t-1}) \ldots\ldots (4)$$

In order to determine whether or not RES and LIB affect the structural parameters (i.e. Π, g/Y, KI/Y, OPEN, M_2, and E_{t-1}) – their effects may not be limited to the intercept parameter alone – we have included interaction variables, (Π)*RES, (g/Y)*RES, (KI/Y)*RES, (M_2)*RES, (E_{t-1})*RES, (Π)*LIB, (g/Y)* LIB , (KI/Y)* LIB , (M_2)* LIB and (E_{t-1})* LIB and retained any that is found to be statistically significant.

Methods of Estimation

We use the Johnasen and Juselius (1992) cointegration methods to estimate both ė as in equation (2) and e as in equation (4) and this was implemented using E-View software. Specifically, we first determined the order of integration of each of the variables in the model and proceeded to determine if they are cointegrated if they have unit roots. Thereafter, we estimate equations (2) and the associated Vector Error-Correction Model (VECM) which is formulated on the basis of equation (4). After trying alternative functional forms, it was discovered that log-functional performed better than any other.

Data Measurement

As is common in the literature, e - the real exchange rate (RER) - is measured as the effective nominal exchange rate adjusted for effective relative prices of the domestic economy and those of its trading partners. In more precise term, RER is:

$$RER_t = E_t P_t^* / P_t$$

Where RER_t is RER at time t; P_t is domestic price index at time t, P_t^* is effective (weighted) price indices of major trading partners at time t - a measure of foreign price index. In other words,

$$P_t^* = \Sigma P_{it}^* W_{it}; \quad i = 1, 2, \ldots n$$
$$E_t = \Sigma W_{it} E_{it}; \quad i = 1, 2, \ldots n$$

Where W_{it} = trade weight assigned to the i^{th} trading partner at time t – measured as the sum of total imports (M_i) from and exports (X_i) to the i^{th} trading partner divided by the total imports from and exports to all the n selected major trading partners; and E_{it} = indexed domestic-currency value of the currency of i^{th} trading partner at time t (i.e. the direct quote), n = 17 OECD countries that account for over 75 percent of Nigeria total trade during the study period.

It is worth noting that unlike many of the existing studies, our W_{it} is not the average for the study period but time-varying weights. Furthermore, in this study, as is common in the empirical literature, we have measured OPEN by the sum of total imports and total exports as percentage of Gross Domestic Product (GDP). Also, event-based measures RES and LIB are dummy variables. RES takes the values of ones in 1976-1979 and zeroes otherwise while LIB takes the values of ones in 1986-1987 and zeroes otherwise. Similarly, we have included another dummy variable – OIL - to account for a possible shift in the intercept parameter. OIL takes the values of ones in 1974- 2000 and zeroes otherwise and is expected to account for the fact that it was only after 1973 that oil displaced agriculture as an important foreign exchange earner. As such, it is expected that between 1960 and 1973, the world prices for Nigerian agricultural exports would be important determinants of the Nigerian terms of trade. Therefore, by using oil prices to proxy the Nigerian terms of trade throughout the study period - 1960 and 2000 - we expect some shift in the intercept as from 1974.

Data Sources

Data on P_i^* (trading partners' consumers' price indices), M_i, X_i, and Ei were obtained from International Monetary Funds' International Statistics (IFS) (various issues). Similarly data on Nigerians consumers' price index (CPI), its government expenditures, its real/nominal income, and net direct investments (KI) were obtained from IFS and Central Bank of Nigeria's Statistical Bulletin (various issues). The export price index (P_X^*), measured by the crude oil price index, and import price index

(P_M^*), measured by the price index of industrial countries manufactured exports, were also obtained from IFS (Various issues).

4. EMPIRICAL RESULTS

Table 1 presents the results of stationarity tests on the logarithms of variables in the model using Augmented Dickey Fuller (ADF) test framework (Dickey and Fuller, 1979; 1981). The results show that the logarithms of all the variables in the model are integrated of order one. Consequently a regression model involving those variables in their level forms will not be appropriate except they are cointegrated. To determine the appropriate model, a co-integration test is required and therefore performed.

Table 1: ADF Unit Root Test for Stationarity

Log. of Variables	Levels	First Difference
OPEN	-1.8326	-5.1433
Terms of Trade (Π)	-1.5521	-4.1643
Government Expenditures (g/Y)	-0.8053	-5.3607
Capital Inflow (KI/Y)	-1.0847	-4.7625
M_2	0.5234	-6.2438
Nominal Exchange Rate (E)	1.8233	-3.2902
Real Effective Exchange Rate (REER)	-1.5229	-5.8488
5% Critical Value[1]	-2.9378	-2.9399

Note: 1. MacKinnon Critical Values for the rejection of the hypothesis of unit root.

Table 2: The Result of Testing for Co-integration among ln [REER], ln [Π], ln [g/Y], ln[OPEN] and ln[KI/Y] Where r is the Number of Cointegrating Vectors.

Null	Alternative r	Trace Test Value	5% Critical Value
0	1	40.414	29.68*
$R \leq 1$	2	8.864	15.41
$R \leq 2$	3	0.584	3.76

Notes: 1. * implies that Null hypothesis is rejected at 5% confidence level and therefore there is only one co-integrating vector.
2. ln[g/Y] and ln[KI/Y] were found to be insignificant and therefore excluded from the search for cointegration vectors.

Table 3: Estimated Cointegration Vector (Johansen Method)

variables	coefficients	T –Values
Constant	-6.481	--
Ln [Π]	-1.116*	-8.340
Ln [OPEN]	1.099*	5.773
Ln[g/Y]	--	--
Ln [KI/Y]	--	--

(*) Implies coefficient is significant at 5%.

Table 2 presents the result of Johansen's (1992; 1995) co-integration test. It shows that there is one unique co-integration vector (i.e. equation). In particular, it shows that co-integration exists only among ln(REER), ln(Π) and ln(OPEN). The corresponding co-integration coefficients are presented in Table 3. This co-integrating equation represents the equilibrium relationship among the variables. In particular, it shows that a 10 per cent increase in the terms of trade (Π) – an improvement - will at the equilibrium, lead to about 11 per cent appreciation in the real effective exchange rate and that this effect is statistically significant. Similarly, this result shows that a 10 per cent increase in the degree of openness (OPEN) will lead to about 11 per cent depreciation in the real effective exchange rate. The government expenditure and the capital flow variables turn out to be statistically insignificant. This result for government expenditures, suggests that government expenditures are more or less evenly spread on tradable and non-tradable goods. The insignificance of capital flow variable may be as a result of tight capital controls that were in place in Nigeria for most part of the period covered by this study. As a result, significant part of capital flows does not pass through the official channels and therefore escape official recording.

Table 4a presents estimates of parameters in the vector error-correction model of order 1 – VEC(1) - corresponding to equation (4). The result suggests that the adjustment coefficient is about -0.311 (i.e. about 31 per cent). It also shows that nominal exchange rate in the previous period exercises some significant influence on RER in the short run. However, Money stock (lnM2) does not come out significant. Table 4b presents the results for a more efficient model - VEC(0) - corresponding to the same equation (4) as it drops insignificant lagged variables in the model

reported in Table 4a. The estimated parameters have analogous interpretation to the result in Table 4a.

Table 4a: Estimates of Parameters in the Vector Error-Correction Model – VEC(1) (Dependent variable is Δln[REER]

variables	coefficients	T – Values
Constant	-0.221*	-2.994
$\Delta \ln[REER]_{t-1}$	-0.039	-0.218
$\Delta Ln[\Pi]_{t-1}$	0.170	1.477
$\Delta Ln[OPEN]_{t-1}$	0.1069	0.427
$\Delta Ln[g/Y]_{t-1}$	--	--
ΔLn [KI/Y]	--	--
ECM_{t-1}	-0.311*	-3.519
Δln[E]	0.747*	6.403
Δln[M2]	--	--
OIL	0.166	1.683
LIB	6.580*	2.059
RES	-0.051	-0.647
Ln[Π]*SAP	-8.080	-1.786

Other Statistics:
R^2 = 0.838; Adjusted R^2 = 0.788; Log Likelihood = 26.933.
(*) Implies coefficient is significant at 5%.

Table 4c presents OLS estimates for the parsimonious error-correction model associated with the same model reported in Table 4a. The results show that the estimated equation is with desirable statistical properties and well behaved. Being the most efficient model, our analysis and inferences shall be based on estimates in this table. The result suggests that the adjustment coefficient is -0.312. Further, the result shows that the estimated coefficient of LIB is 12.840 and this is statistically significant. This implies that the trade liberalization of 1986-9187 directly led to about 13 per cent depreciation in the Nigerian real exchange rate. Furthermore, the coefficient of -16.778 for the interaction variable (Ln[Π]*SAP) – the terms of trade – implies that the trade Liberalization programme of that period increased the size of the terms of trade coefficient by about 17 per cent. Consequently, the real exchange rate became more responsive to changes in terms of trade. Thus, given that the Nigerian terms of trade actually worsened in 1986, trade liberation of that period decisively led to a depreciation of the Nigerian real exchange rate.

Table 4b: Estimates of Parameters in the Error-Correction Model – VEC(0) (Dependent variable is Δln[REER]

variables	coefficients	T – Values
Constant	-0.177*	-2.629
ΔECM_{t-1}	-0.272*	-3.135
Δln[E]	0.700*	6.761
Δln[M2]	--	--
OIL	0.123	1.322
LIB	8.763*	3.580
RES	-0.024	-0.314
Ln[Π]*SAP	-11.164*	-3.325

Other Statistics:
R^2 = 0.817; Adjusted R^2 = 0.784; Log Likelihood = 69.860
(*) Implies coefficient is significant at 5%.

Similarly, the table suggests that the restrictive trade regime of 1975-1976 was not major enough to lead to a significant real exchange-rate appreciation because though its estimated coefficient has the expected sign, it is not statistically significant.

Table 4c: OLS Estimates of Parameters in Parsimonious Error-Correction Model (Dependent variable is Δln[REER]

variables	coefficients	T – Values
Constant	-0.200*	-2.944
ECM_{t-1}	-0.312*	-3.317
Δ Ln [OPEN]	0.531*	3.198
Δ Ln[Π]	-0.256*	-2.050
Δln[E]	0.374*	2.729
LIB	12.840*	4.311
RES	-0.127	-1.576
Ln[Π]*SAP	-16.778*	-4.108
OIL	0.233*	2.222

Other Statistics:
R^2 = 0.863; Adjusted R^2 = 0.828; DW = 1.919;
F = 24.434; Log Likelihood = 31.450
(*) Implies coefficient is significant at 5%.

5. CONCLUDING REMARKS

This study examines the Nigerian data between 1960- 2000 to see what support it provides for the traditional theory of real exchange rate. Using the well-known Johansen's (1992; 1995) methods for estimating models whose variables are non-stationary but cointegrated, the study found that the decisive trade liberalization programme of 1986-87 led to about 13 per cent depreciation in the Nigerian real exchange rate and made the real rate more responsive to changes in its terms of trade by about 17 per cent. Because trade liberalization is often associated with economic cooperation among economies and indeed with globalization, the result of this study has some implications for how these events should be pursued. However, because the overall benefits of economic cooperation among economies and indeed of globalization, are numerous and often outweigh its costs – like the associated real exchange rate depreciation – economic cooperation and globalization should be allowed to progress for the benefits of the concerned economies.

APPENDIX

VARIABLES IN THE MODEL – Definitions and Measurement

ė = Equilibrium effective real exchange rate
Π = Terms of trade (defined as export price index divided by import price index)
P_X^* = Export price index (measured by the indexed dollar price of crude oil)
P_M^* = Import price index (measured by the price index of industrial countries' manufactured exports)
KI = Net capital flows
Y = Gross domestic product (GDP)
KI/Y = Net capital flows as a ratio of GDP
OPEN= Degree of openness (an outcome-based measure of the extent of trade liberalization); measured by the sum of total imports and exports as percentage of GDP
g = Total government expenditures
g/Y = Size of government (measured by the ratio of government expenditures to GDP)
LIBE = A vector of two variables consisting of LIB and RES dummy variables
LIB = A dummy variable (to measure the event of 1986-1987 trade liberalization); it takes the values of ones in 1986-1987 and zeroes otherwise.
RES = A dummy variable (to measure the event of 1976-1979 trade restrictions); takes the values of ones in 1976-1979 and zeroes otherwise
E = Effective nominal exchange rate
E_t = Effective nominal exchange rate at time t
E_{t-1} = Effective nominal exchange rate at time t-1
S_t = A vector of shocks (policy variables, e.g. money supply)
S_t^* = A vector of shocks consistent with equilibrium real exchange rate
$ė_t$ = Equilibrium effective real exchange rate at time t
e_{t-1} = Actual effective real exchange rate at time t-1
Δe = Change in actual effective real exchange rate
M_2 = Monetary shocks measured by broad money supply M_2

P_t^* = Foreign price index (measured by trade-weighted price indices of major trading partners at time t)

P_{it} = Foreign price index (CPI) of the i^{th} trading partner at time t

P_t = Domestic Price index at time t (measured by the Consumers' Price Index)

M_i = Total imports by the domestic economy from the i^{th} trading partner

X_i = Total exports by the domestic economy to the i^{th} trading partner

W_{it} = Trade weight assigned to the i^{th} trading partner at time t – measured as the sum of M_i and X_i divided by the sum of total imports (M) from and total exports (X) to all the n (n = 17) selected major trading partners (OECD countries)

E_{it} = indexed domestic-currency value of the currency of i^{th} trading partner at time t (i.e. the direct quote)

M = Total imports by the domestic economy from all the 17 trading partners

X = Total exports by the domestic economy to all the 17 trading partners

OIL = A dummy variable; it takes the values of ones in 1974- 2000 and zeroes otherwise

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