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Determinants of Currency Composition of External Reserves in Nigeria: An Empirical Investigation

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This paper discusses the determinants of the currency composition of external reserves in Nigeria. The empirical analysis reveals that the main factors influencing the currency composition of external reserves in Nigeria are international trade transactions and currency compostion of external debt, while reserve adequacy aided the diversification into more currencies. Exchange and interest rates were relatively significant in the share of each currency in the reserve basket. A review of CBN's external reserves policy confirmed that vigorous diversification was embarked upon when there was remarkable increase in the level of the reserve. However, current CBN reserve management policy shows a gradual shift from diversification to liquidity as reflected in the denomination of a larger proportion of the external reserves in dollar which makes for easy settlement of external trade obligations and other foreign commitments.

I. INTRODUCTION

Central Banks hold their external reserves[1] in non-currency assets, foreign currencies and securities. The non-currency assests include gold reserve, gold tranche and Special Drawing Rights (SDRs). The currency diversification of external reserves involves the shift on the part of central banks from holding their external reserves in the traditional gold reserve assets to a basket of foreign currencies and securities. In recent times, diversification has come to be synonymous with the movement away from a few into many currencies. This multi-currency system is perceived as evolutionary in most studies on international liquidity. In considering the basket of currencies to hold, the monetary authorities of most countries are influenced by historical, economic and political fundamentals. Although a general economic objective of currency composition of reserves is investment in foreign currencies and securities by central banks to maximize returns on financial resources, the monetary authorities, more often than not, play down on the profitability

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aspects and concentrate on their liquidity needs, especially if they are experiencing balance of payments disequilibrium.

Blackman (1982) classified the main objectives of reserve management into the maintenance of value, income, liquidity, precautionary and political. Most countries would prefer to maintain their reserve assets in currencies that assure relative stability in the international foreign exchange market. The income objective is influenced by risks and returns on holding foreign currencies and securities. Liquidity assures that a reliable level of foreign exchange is maintained that will meet a nation's demand for foreign goods and services. This objective falls within transaction motive of foreign asset management, which tries to ensure a balance between outflows and inflows of foreign exchange. Precautionary motives presuppose that a country holds reserve asssets that would guide against total capital losses. Another fundamental issue usually considered by a country in her reserve currency diversification policy is the returns (income) on external reserve assets. The holding of foreign exchange reserves involves an opportunity cost with respect to the goods and services which might otherwise be imported if the reserves were immediately spent. Reserve assets should therefore yield a rate of return which will at least equal the expected utility of their immediate expenditure. Stals(1993), in a theoretical postulate, narrowed the motives of reserve management to three elements, namely, transactions demand (liquidity), precautionary demand and wealth or portfolio demand.

In Nigeria, legislation at the inception of the Central Bank of Nigeria (CBN) made it relatively impossible to diversify the reserve assets away from gold (10 per cent) and the pounds sterling (90 per cent). The dollar assets did not even qualify as part of the official reserve holdings till the amendment of the CBN Act in 1962. Consequently, in the 1960s the external reserves of the country were held predominantly in pound sterling assets thereby conforming with the arrangements of the Sterling Exchange System. The pound sterling accounted on the average for 78.4 per cent of the external reserves from 1959 through 1970 while the US dollar assets accounted for 12.5 per cent in the period.

CBN (1979) remarked that vigorous policy of diversification and portfolio management of Nigeria's international reserve was embarked upon from 1974 owing mainly to the remarkable increase in the level of reserves which further resulted in the external reserve being held in seven currencies in 1975. Also, in 1975, there was a diversion from the existing pattern of the currency composition of Nigeria's external reserve with dollar taking the lead, accounting for 41.8 per cent while sterling fell to the second position with a share of 33.1 per cent. The Deutsche mark and French franc, as new entrants in the basket, accounted for 12.5 and 3.9 per cent, respectively. By 1976, Nigeria's foreign reserves were completely diversified into several strong currencies. With the diversification, the relative share of each currency changed over the years.

Beside diversification in foreign currencies, central banks worldwide gain from the advantage of being able to invest in foreign money market bills that are highly liquid and interest earning. The CBN in its current reserve management strategies tries to place reserves in securities that are sufficiently liquid to ensure prompt and timely settlement of the country's external obligations while ensuring adequate capital appreciation. In consequence therefore, CBN's investments abroad are in the US and Japanese treasury bills, time deposits with reputable institutions like Bank for International Settlement (BIS) in Basle and AAA-rated banks such as Morgan Guaranty Trust Company, New York, in addition to securities in the US Federal Funds and Repo Markets.

The main purpose of this paper is to investigate empirically the determinants of reserve diversification in Nigeria through multiple regression technique. The paper will continue in part II with the review of literature on currency composition of reserves. Part III will present the development of the model on currency diversification of external reserve in Nigeria. Part IV analyses the estimation results, while Part V summarizes the findings and policy issues and concludes the paper.

II. REVIEW OF LITERATURE

The advent of currency diversification of external reserves hinged on developments in the international monetary system prior to the mid 1960s. In the international monetary system, the gold pool was abandoned in 1968. By August 1971, the United States had suspended the gold convertibility of the dollar, and from July 1974 the Special Drawing Rights (SDRs) were no more valued in gold but in a "basket" of national currencies. Initial literature concentrated on the substitutability and optimality between a two-asset portfolio – gold and dollar – which were explained using the utility preference theory while the empirical tests were modeled along the line of the standard optimal portfolio theory.

Stekler and Piekarz's (1970) empirical study centered on the preferences of central banks for gold and foreign exchange. Their study revealed that the desired gold share in a reserve portfolio was influenced by the interest earnings on foreign exchange, the risk of devaluation, the adequacy of a country's reserves relative to its transaction needs, and the availability of close substitutes for official foreign exchange. They noted that central bankers like other investors try to avoid making large capital losses. This they do by divesting from currencies with greater risk of devaluation and holding more of liquid foreign assets. Their model represented the behaviour of twelve central banks using estimates derived from the equation:

$$\left(\frac{G}{R}\right)_t = \alpha_1 + \alpha_{2.1} + \left(\frac{\Delta R}{R_{t-1}}\right) + \alpha_{2.2} - \left(\frac{\Delta R_t}{R_{t-1}}\right) + \alpha_3\left(\frac{G}{R}\right)_{t-1} + \alpha_4 \frac{R}{\sqrt{M}} + \alpha_5 (\text{Risk}) + \alpha_6 (\text{EPU}) + \alpha_7 i_{US}$$

where G/R represented the observed ratio of gold, G, to total reserves; (R), rate of return on US treasury bills; (i_{US}), the risk of devaluation by a measure of the risk of dollar devaluation, the adequacy of a country's reserve for transaction purposes by a 3-year moving average ratio of imports, M, while EPU reflected political relations representing European Payments Union. Their findings indicated that beside transaction needs, most central banks prefer to hold the bulk of their external reserves in the form of gold and that there was little evidence that they could be induced to hold a large percentage in dollars by higher US interest rates or a lower risk of devaluation. The study showed the relative strength of gold as reserve asset during the period (1951 to 1966) which corresponded with the era of the gold exchange system prior to the Fund's Substitution Account arrangements of the 1970s.

Makin (1971) revealed that an earlier work on the subject by Machlup (1968)[2] opined that official dollar holdings are determined largely by political considerations, noting that central banks do not look, in the first place, at the attractiveness of reserve assets to earn higher income or returns but rather on the necessities of international financial co-operation or non-cooperation. However, this contrasted with Makin's work which concentrated on economic influences, basically risk and return, as significant variables in central banks' choice between gold and dollar assets. His empirical study was derived from the work of Donald Farrar, Haim Levy, and J.R. Hicks, using the utility function of expected rate of returns of a two-asset portfolio. The model equation was presented in the form:

$$\left(\frac{L}{G}\right)^* = \alpha + \beta_1 R_G + \beta_2 VG + \beta_3 QG + \beta_4 R_L$$

where

R_G = the return on gold,
VG = the variance of the return on gold,
QG = the skewness of the return on gold, and
R_L = the return on dollars.

He expected $\beta_1 < 0, \beta_2 > 0, \beta_3 < 0$ and $\beta_4 > 0$. The empirical tests were conducted based on data from fourteen countries with 81 observations spanning from June 1961 through March 1968. In the study, the euro-dollar interest rate was taken as a proxy for the return on dollar assets in a number of cases while the annualized forward premium of gold futures represented the return on gold. The regression

results showed high significance of the expected return on gold as a major determinant of international reserve holdings.

Ben-Bassat (1984) noted that Heller and Knight revealed in their earlier study that although risk and return play a role in determining the choice of currencies held, they are more important to individual investors than to central banks. However, in his study, he contented that a country's optimal reserve composition is influenced by three principal factors: the country's motive for holding foreign-currency reserve, the risk and return on the various currencies and the country's interest in maintaining international monetary stability. He further noted that for countries with floating exchange rate systems whose currencies serve as reserve assets for other central banks, their reserves are likely to be influenced by international monetary stability than for profit and loss consideration. But for most countries with pegged exchange rate regimes, and in particular developing and semi-industrialized countries, the composition of their reserve currencies depends mainly on the profit, risk and liquidity considerations. As in the previous studies, Ben-Bassat employed a portfolio-selection model. His approach also tried to minimize variance for a given level of return by using the import-currency basket, representing the transaction needs. He established that the optimal reserve portfolio would first involve identifying the combinations of reserve positions which yield the highest rate of return for a given level of risk as measured by the variance of yields. Ben-Bassat further noted that although the optimal composition of external debt was not included in his model, it did influence the solution to the optimal composition of reserve portfolio.

Horii's (1989) *a priori* expectation was that international trade and exchange rate arrangements should influence the foreign currency compostion of reserves. However, his empirical work on a group of industrial and developing countries between 1978 and 1984 invalidated this position. He noted that international trade in manufactured goods tended to be denominated in the seller's currencies for the purpose of intervening in the foreign exchange markets. Although, this was found insignificant in his study, he attributed the result to discrepancies in the "share of currencies used for trade invoicing" which might differ from the actual direction of trade flow. Horii's work ignored risk and political consideration in the currency preference of countries and also played down on the return on investments, even though he held the view that these factors are necessary. His empirical work employed the standard portfolio selection model with data on interest rates and domestic inflation. The work showed that diversification can be constrained by the levels of reserve, noting that the choice of reserve currencies by individual central bank is partly a function of the adequacy of reserve. Thus, countries with large idle balances have more scope for diverting currency holdings away from transaction needs.

Dooley et al. (1989) improved on earlier studies which relied solely on currency composition data for country groups. Their empirical analysis used individual

country data in a combined cross-country, time-series regression. The study considered a simple model that incorporated the role of the transaction costs into the traditional mean-variance approach. Their empirical model was based on the hypothesis that transaction needs are the principal determinants of the currency composition of foreign exchange reserves. Thus, their specifications placed emphasis on the currency composition of a country's trade flows and debt servicing payments in addition to the nature of its exchange rate arrangements. Trade transactions were represented by the sum of imports and exports between a country and the reserve-currency of the country. In their model, the dependent variables were the proportions of foreign exchange reserves held as instruments denominated in US dollars, pounds sterling, deutsche mark, French francs, and the yen. The explanatory variables were the exchange rate regimes and the five transaction variables representing trade with the reserve-currency countries. The data used were annual observations for each of the 19 industrial and 39 developing countries, while the empirical analysis spanned from 1976 to 1985. Their results suggested that although risk and return considerations play some role in determining a country's net foreign asset position in different currencies, the gross holdings of foreign currency components were more strongly influenced by transaction variables and exchange arrangements.

Gawronski (1990), in a similar quantitative study, analyzed the optimal currency composition of foreign debt. The study, like others, was modeled along the line of the standard optimal portfolio theory, where a "risk aversion" function and the expected yields and riskiness of each asset combine to determine the optimal porfolio choice.

III. MODEL

A review of the literature on the study indicates that the main determinants of the currency composition of external reserve were expected to be rate of returns, risk of devaluation, transaction needs/international trade, adequacy of reserves, political considerations and currency denomination of foreign debt.

III.1 Model

The model for this study was developed from the combination of the works by Stekler and Piekarz (1970), Makin (1971) and Dooley et al. (1989). It was tailored along the line of a typical linear form equation and the significance of the variables tested through regression techniques. The model assumes that:

(i) external reserves in Nigeria are held in a basket of five major convertible currencies, viz. British pound sterling, United States dollar, German deutsche mark, Japanese yen and French franc, corresponding with the currencies of

her principal trading partners. However, all other foreign currencies were grouped together.

(ii) the measurable variables for establishing the determinants of currency composition are exchange rate and interest rate which proxy, respectively, the risk of devaluation and the rate of return on investments, while exports plus imports to major trading partners measure the quantum of trade flow or transaction/liquidity motives.

(iii) reserve adequacy represents the level of reserve that could support four months of current import commitments.

(iv) political factor was based on the fact that in most of the 1960s to the mid 1970s, Nigeria's external reserves were tied to the pound sterling.

III.1.1 Model Specification

The determinants of currency composition of reserves can be represented in the form:

1. $CRS = f(ex, i, tf, z, rs, d_1)$
2. $CRS = a_0 + a_1ex + a_2i + a_3tf + a_4z + a_5rs + a_6d_1$

where

ex = exchange rate
i = interest rates
tf = trade flow (export plus imports)
z = the currency of creditor nations (external indebtedness)
rs = reserve adequacy
d_1 = political considerations (dummy)

The *a priori* expectation is that all the variables would be positively correlated.

III.2 Methodology

The multiple regression technique in STATISTIX was employed in the estimation of the model. In doing this, the preliminary tests were based on equations 3 to 9 (Appendix 1) which revealed the major determinants of the currency composition of external reserve in Nigeria. However, the curiosity to further explain the relative strength of the currencies in the basket necessitated the secondary tests which threw more light on the effect of the independent variables on the share of each currency (equations 10 to 14). A major shortcoming of the study was the smallness of observations, especially for the currency composition of external debt.

III.3 Data and Data Sources

The study utilized annual data spanning from 1970 to 1994 totalling 25 observations. To standardize the data on exchange rate used in the regression tests, all rates were tied to the Special Drawing Rights (SDRs) as published in the International Financial Statistics (IFS). The interest rate data were specifically the treasury bill rate of foreign governments representing short-term investments by the CBN abroad. To complement the treasury bills rate in two of the countries where this rate was not available, the government bonds rate which was available for all the countries was finally adopted. The restriction of the interest rate to foreign government portfolio is in line with the CBN Act which only permits the holding of "medium and long-term securities provided they were issued by Government or otherwise guaranteed by it or they were issued by international financial institutions to which Nigeria belong." The data on interest rate were also sourced from the IFS. The international trade figures were exports to Nigeria from her trading partners (Nigeria's imports) and imports to these countries from Nigeria (Nigeria 's exports) as extracted from the Direction of Trade Statistics (DOTS). Data for the reserve composition were sourced from CBN publications. The data on the currency composition of Nigeria's external debt were obtained from the World Bank Debt Tables as published in the 1994 edition. The debt data were limited to the period 1985 – 1992 in which dissaggregated statistics were available.

IV. ESTIMATION AND ANALYSIS OF RESULTS

The adjusted R-squared statistics ranged from 0.02 to 0.95 while the degree of auto correlation as measured by the Durbin-Watson (D-W) statistics ranged from 1.13 to 2.24. The summary statistics are as presented in the text.

IV.1 Determinants of Currency Composition of Nigeria's External Reserves

Equations 3 to 9 were meant to test the effect of international trade (trade flows), interest rate, exchange rate, currency composition of external debt, reserve adequacy and political considerations on the currency composition of external reserve with a view to determining the main explanatory variables in the equations. For ease of convenience, equations 3 to 14 on which the regression analyses were based are provided in Appendix 1. The analyses of the results are presented below:

IV.1.1 International Trade

The initial result showed that the variable was insignificant with a low explanatory power of about 35 per cent. However, a disaggregation of the variables revealed

an interesting result. The result from equations 6 and 7 showed that inflows (export receipts) from international trade transactions had more influence on the reserve currency basket than import. The explanatory power of equation 6 as measured by the value of R^2 based on the export variable performed well at 73 per cent level compared with a poor 33 per cent for imports. Thus, the initial poor result for trade flow in equation 5 may be attributed to the strong offsetting effect of the import variable in the combination. On the other hand, the improvement in equation 6 (exports) is not surprising since a greater proportion of Nigeria's receipts from abroad during the period were from oil, denominated in dollar, which further made it easier to settle external commitments to other trading partner countries in that currency. The export coefficient for the United States and Japan were highly significant at 4.60 and 2.90 levels, respectively. The surprising and remarkable level of significance of the Japanese export variable in the equation reflected the relative appreciation of the yen in the international foreign exchange market during the period. This suggests that the country might have preferred the settlement of part of its export receipts in a strong yen, despite the low level of actual export to Japan. The export variable for France was also significant in the equation but had a wrong sign.

Trade Flows

CRS	=	-116.10	- 4.30*tf*FR	+	1.06*tf*GM	+	4.25*tf*JP	+	1.42*tf*U	+	5.20*tf*US
		(-0.10)	(-0.30)		(0.05)		(0.20)		(0.08)		(1.20)

R^2adj. = 0.35 DW = 1.42

Exports

CRS	=	-911.9	- 4.05*x*FR	+	1.15*x*GM	+	7.71*x*JP	+	1.93*x*UK	+	8.56*x*US
		(-0.90)	(-3.10)		(1.50)		(2.90)		(0.10)		(4.60)

R^2adj = 0.73 DW = 2.24

Imports

CRS	=	537.2	+ 1.41*m*FR	+	5.22*m*GM	+	3.88*m*JP	+	4.07*m*UK	-	6.35*m*US
		(0.50)	(1.50)		(2.10)		(0.13)		(0.01)		(-2.01)

R^2adj. = 0.33 DW = 1.13

IV.1.2 Interest and Exchange Rates

Interest rate performed poorly in the regression with an explanatory power of 45 per cent. Further examination revealed that only the share of pound sterling proved significant in equation 4. The exchange rate variable performed moderately in the equation (3) in which the yen was significant having the right sign while the Deutsche mark had a wrong sign. The result further confirms the relative strength of the yen in the international exchange market during part of the review period.

Interest Rate

$$\begin{array}{lccccccc} CRS = & -7431.8 & - 504.5iFR & - 31.8iGM & + 362.3iJP & + 818.2iUK & + 398.4iUS \\ & (-2.40) & (-0.80) & (-0.10) & (0.70) & (2.40) & (0.70) \end{array}$$

R^2 adj.= 0.45 DW = 1.59

Exchange Rate

$$\begin{array}{lccccccc} CRS = 1.63 & + 721.0exFR & - 7555.2exGM & + 37.01exJP & - 1.06exUK & - 728.3exUS \\ (0.83) & (0.70) & (-3.22) & (1.90) & (-1.40) & (-0.1) \end{array}$$

R^2adj. = 0.42 DW = 2.07

IV.1.3 Currency Composition of External Debt

The explanatory power of the currency composition of foreign debt in the model was high at 79.0 per cent. Similarly, the independent variables fared well with debts denominated in pound sterling, dollar and mark influencing the dependent variable in equation 8. In addition, the variables had the right signs.

$$\begin{array}{lccccccc} CRS = & -7.3 & - 84.2zFR & + 982.4zGM & + 1871.1zJP & + 2088.8zUK & + 584.2zUS \\ & (-1.86) & (-0.16) & (1.61) & (1.13) & (2.50) & (1.87) \end{array}$$

R^2adj. = 0.79

IV.1.4 Reserve Adequacy

The empirical test from equation 9 proved reserve adequacy highly significant with the appropriate sign and performed far better than political consideration in the model. This conformed with Horii (1986) which identified reserve adequacy as one of the determinants of reserve currency diversification. In addition, a study by CBN (1979) also noted that diversification in Nigeria really started when there was remarkable increase in the level of external reserves. The coefficient of reserve adequacy in the equation was highly significant at 3.8 level with the right sign

although the explanatory power of the equation as measured by the R^2 adjusted performed moderately at 43 per cent.

Reserve Adequacy and Political Considerations

$$\begin{array}{lcccc} CRS = & 1379.9 & + & 3137.2rs & - & 796.3d_1 \\ & (2.30) & & (3.80) & & (-0.80) \end{array}$$

$R^2adj. = 0.42 \qquad DW = 1.60$

Reserve Adequacy

$$\begin{array}{lcccc} CRS & = & 1134.9 & + & 3302.6rs \\ & & (2.20) & & (4.20) \end{array}$$

$R^2adj = 0.43 \qquad DW = 1.60$

IV.1.5 Political Considerations

The hypothesis that political consideration is significant in the model of the currency composition of externl reserve (Stekler et al. 1970) did not prove convicing in the Nigeria case (equation 9). The coefficient had negative signs and was not statistically significant for the period. This might be attributed to the period of study 1970 – 1994 in which major diversification away from the pound sterling occurred. However, since this variable intends to validate the influence of political relations on the composition of external reserve, we therefore extended the period of study to cover 1959 - 1994, corresponding to earlier year when Nigeria's currency was tied to the British pound. The outcome was an improved result. Statistically, the variable became significant although with the wrong sign. The poor explanatory power of R^2 in the first result improved to 23.0 per cent from 4.0 per cent.

$$\begin{array}{lcccc} CRS & = & 2948.5 & - & 1737.3d_{1\ (1970\text{-}1994)} \\ & & (5.14) & & (-1.41) \end{array}$$

$R^2 = 0.04 \qquad DW = 1.04$

$$\begin{array}{lcccc} CRS & = & 2946.9 & - & 2274.2\ d_{1\ (1959\text{-}1994)} \\ & & (6.40) & & (-3.30) \end{array}$$

$R^2 = 0.23 \qquad DW = 1.5$

V. FINDINGS, POLICY ISSUES AND CONCLUSION

V.1 Findings

The study tested the effect of the explanatory variables on the currency composition of Nigeria's external reserves. The findings included that:

(i) on the aggregate, international trade transaction, represented here by export, fared best in the set of equations with a high explanatory power (R^2adj. = 0.73) having three significant variables in the equation.

(ii) the share of individual currencies in the external reserve composition has been influenced by exchange rate, interest rate, trade flows, and currency denomination of foreign debts.

(iii) in specific terms, the exchange rate factor best explained the share of US dollar and Japanese yen in the basket with the right signs while the German mark had a wrong sign. Interest rate variable influenced positively the share of the pound sterling and the US dollar while wrong sign was obtained for the Deutsche mark (Appendix II).

(iv) the inference from the regression on the exchange rate reflects the relative strengths of the Japanese yen, the US dollar and the Deutsche mark during the period.

(v) other determinants included currency composition of foreign debt which had an adjusted R^2 of 0.79 but with two significant variables, and reserve adequacy with a high level of significance of 4.20. Political considerations was insignificant in the regression which showed that although Nigeria remained within the pound sterling system in the 1960s and mid 1970s, decisions on the composition of the reserve assets by the CBN were influenced mostly by economic considerations.

V.2 Policy Issues

Policy issues derivable from the study are two-fold. The first centers on the significance of the currency composition of foreign debts in the model and the implication on the continued denomination of a relatively high proportion of Nigeria's external debt in US dollar, bearing in mind the instability in recent years of this currency in the international foreign exchange market. The effect would be translated into increased debt stock for the country. This calls for a renegotiation of the currency denomination of our external debts or a diversification into more stable currencies.

Second, if reserve adequacy proved relatively significant in the regression result, then beside meeting the liquidity needs for foreign goods and services, it is imperative for government to always set aside the surpluses arising from improved oil prices for investment in income earning foreign securities to further increase

the value of the country's external assets. An effective portfolio management plan for deployment of such inflows should be articulated by the CBN which, if necessary, should be backed by legislation. The CBN should be free to determine which currency and foreign securities are best to invest in, to hedge against currency and interest rate risks.

V.3 Conclusion

Although there are procedures for determining the currency composition of external reserves in Nigeria, so far, no extensive work has been done to ascertain the determinants empirically. This paper therefore tried to bridge the existing gap. The paper has identified that the decision of central banks to hold a particular currency in their external reserve may be influenced by the rate of return on investment, risk of devaluation, international trade and relations, currency of creditor countries, reserve adequacy, and political considerations. In the case of Nigeria, though most of these variables proved significant in the regression analysis, the best explanatory variable was trade flow, reflecting the liquidity needs in settling international transactions.

Finally, the existence of statistically significant coefficients makes the empirical test meaningful in elucidating the determinants of currency composition of external reserves in general and particularly, the case of Nigeria.

Table 1
Currency Composition of Nigeria's External Reserve
(in percentage)

Years	Gold & IMF Tranche	SDRs	Pound sterling	US dollar	Deutsche mark	French franc	Canadian dollar	Japanese yen	Swiss franc	Belgian franc	Dutch guilder	Others	Total
1959	0.0	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0
1960	0.0	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0
1961	9.3	0.0	81.1	9.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0
1962	9.2	0.0	80.4	10.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0
1963	11.0	0.0	81.0	8.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0
1964	9.1	0.0	82.0	8.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0
1965	8.6	0.0	80.6	10.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0
1966	9.9	0.0	72.3	17.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0
1967	19.6	0.0	60.2	20.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0
1968	18.6	0.0	61.2	20.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0
1969	23.9	0.0	66.3	9.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0
1970	15.4	0.0	75.4	9.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0
1971	7.9	7.9	73.9	10.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0
1972	9.6	13.4	54.0	23.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0
1973	10.7	9.5	59.1	20.4	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0
1974	1.1	1.1	57.6	38.8	1.3	0.1	0.0	0.0	0.0	0.0	0.0	0.0	100.0
1975	1.2	1.2	33.1	41.8	12.5	3.9	3.4	2.1	0.8	0.0	0.0	0.0	100.0
1976	1.4	1.7	14.7	20.9	26.6	6.0	15.0	7.3	1.5	3.5	1.4	0.0	100.0
1977	1.3	2.2	16.5	15.8	30.5	4.0	12.7	9.2	1.9	3.9	1.4	0.6	100.0
1978	27.1	4.6	14.0	14.6	14.8	5.0	2.1	4.5	0.0	9.2	1.8	2.3	100.0
1979	2.7	2.6	4.9	25.3	37.1	7.7	2.0	5.8	6.4	0.3	2.8	2.4	100.0
1980	2.6	3.6	22.0	23.5	22.8	6.8	1.4	9.1	6.8	0.8	0.6	0.0	100.0
1981	10.0	11.3	15.1	19.7	13.2	4.5	2.1	9.6	9.4	1.5	2.7	0.9	100.0
1982	1.8	2.7	18.8	39.0	6.3	13.3	1.0	0.5	12.8	3.1	0.7	0.0	100.0
1983	2.4	10.2	17.3	33.9	5.4	1.1	0.9	0.3	23.4	3.8	1.3	0.0	100.0
1984	6.5	0.5	16.6	51.2	6.9	0.2	0.6	0.0	12.4	1.8	2.0	1.3	100.0
1985	1.1	0.5	7.1	58.2	6.2	9.3	0.6	1.3	12.5	0.4	1.9	0.9	100.0
1986	0.5	0.0	4.9	76.2	5.4	3.5	0.3	0.0	3.3	0.2	3.4	2.3	100.0
1987	0.4	0.0	9.1	69.2	5.0	8.0	0.2	0.0	2.7	0.4	2.5	2.5	100.0
1988	0.5	0.0	5.8	66.6	9.1	5.0	0.2	0.0	3.4	0.6	3.7	5.1	100.0
1989	0.2	0.0	21.9	67.3	2.9	5.8	0.0	0.0	0.4	0.1	0.3	1.1	100.0
1990	0.1	0.0	42.5	50.4	0.4	5.6	0.0	0.1	0.0	0.0	0.0	0.9	100.0
1991	0.1	0.0	3.9	91.1	1.4	3.0	0.0	0.1	0.1	0.0	0.0	0.3	100.0
1992	0.2	0.0	1.1	52.6	26.9	13.4	0.1	1.2	3.7	0.1	0.0	0.7	100.0
1993	0.0	0.0	6.3	54.8	10.6	21.5	0.1	1.5	3.3	0.1	0.1	1.7	100.0
1994	0.0	0.0	1.2	71.8	13.2	9.8	0.1	1.1	1.2	0.1	0.1	1.4	100.0

Source: CBN Publications

APPENDIX 1

In line with the works of Stekler and Piekarz (1970), Makin (1971), and Dooley et al. (1989) the model takes the form:

$$2.\ CRS = a_0 + a_1 ex + a_2 i + a_3 tf + a_4 z + a_5 rs + a_6 d_1$$

where

ex = exchange rate
i = interest rate
tf = trade flow (export plus imports)
z = the currency of creditor nations
rs = reserve adequacy
d_1 = political consideration

Testing the effect of the main independent variables on the currency composition of external reserve, we used the following equations.

3. CRS = f (*ex*FR, *ex*GM, *ex*JP, *ex*UK, *ex*US)
4. CRS = f (*i*FR, *i*GM, *i*JP, *i*UK, *i*US)
5. CRS = f(*tf*Fr, *tf*GM, *tf*JP, *tf*UK, *tf*US)
6. CRS = f(*x*FR, *x*GM, *x*JP, *x*UK, *x*US)
7. CRS = f(*m*Fr, *m*GM, *m*JP, *m*UK, *m*US)
8. CRS = f(zFR, zGM, zJP, zUK, zUS)

The superscripts on the independent variables depict the trade partner countries. Thus, FR, GM, JP, UK and US represent France, Germany, Japan, United Kingdom and United States, respectively. Also, introducing reserve adequacy and political considerations to the model we had:

$$9.\ CRS = f(rs, d_1)$$

To ascertain the relative strength of the share of each currency on total reserve, a series of functional relationship and equations derived from 2 were tested differently represented by equations 10 – 14.

10. PDS/CRS = $f(ex, i, tf_{UK}, Z_{UK})$
11. USD/CRS = $f(ex, i, tf_{US}, Z_{UK})$
12. GDM/CRS = $f(ex, i, tf_{GM}, Z_{GM})$
13. JYN/CRS = $f(ex, i, tf_{JN}, Z_{JN})$
14. FFR/CRS = $f(ex, i, tf_{FR}, Z_{FR})$

It is expected from the theoretical standpoint that all the coefficients of the equations would be positive. Although, according to Dooley et al., some signs of the model are subject to ambiguity especially in the trade flows.

APPENDIX II

EFFECT OF THE INDEPENDENT VARIABLES ON THE SHARE OF THE INDIVIDUAL CURRENCIES

The results from equations 10 to 14 are presented below as a further test of the relative strength of each currency to total reserve.

Summary Statistics: Relative Strength of Each Currency to Total Reserve

PDS/CRS	=	252.60	+	57.00ex	+	27.60i	–	3.50tf	– 6.30z
		(–2.70)		(1.02)		(4.52)		(–3.08)	(–0.26)
				R^2adj. = 0.76					
USD/CRS	=	148.74	–	9.86ex	+	5.00i	–	1.98tf	– 1.64z
		(0.47)		(–0.06)		(0.04)		(–0.27)	(–0.30)
				R^2adj. = -0.95					
USD/CRS*	=	–225.4	+	180.4ex	+	8.86i	–	6.38tf	
		(–3.85)		(4.64)		(3.20)		(–3.30)	
				R^2adj. = 0.46					
GDM/CRS	=	252.62	–	35.80ex	–	15.05i	+	2.66tf	– 6.69z
		(5.47)		(-2.94)		(–5.35)		(5.51)	(–6.33)
				R^2adj. = 0.86					
JYN/CRS	=	–8.17	+	3.61ex	–	1.90i	+	3.83tf	+ 1.89z
		(–3.15)		(3.45)		(–1.56)		(1.93)	(0.85)
				R^2adj. = 0.78					
FFR/CRS	=	45.05	–	3.82ex	–	1.42i	+	6.14tf	– 4.78z
		(0.29)		(–0.26)		(–0.31)		(0.61)	(–0.19)
				R^2adj. = 0.83					
FFR/CRS*	=	1.87	+	4.36ex	–	3.05i	+	1.76tf	
		(0.31)		(0.62)		(–0.44)		(1.17)	
				R^2adj. = 0.02					

The t-statistics are in brackets below their respective coefficient estimates.

NOTES

1. Reserves are savings from foreign exchange transactions by a country during a given period. They represent part of a country's external assets which the monetary authorities have control over and are made readily available to settle international transactions and for intervention purposes in the foreign market to finance shortfalls in supply.

2. See F. Machlup, *Remaking the International Monetary System: The Rio Agreement and Beyond*, Baltimore, 1968.

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private investment deeply. Fourth, the debt overhang, through its implied tax on future output and the accompanying credit constraints in international capital markets, also depressed investment.

The central place of private investment revival to growth resurgence is certainly not in dispute. Successful adjustment policies must engender greater productive investment so that national income and employment can recover. But despite a decade of deep-seated economic reforms, the record of private investment recovery has been poor. To paraphrase Serven and Solimano (1992a:96)

> ". . . in many countries, macroeconomic adjustment has not improved the response of private investment. Even when substantial progress has been made in correcting imbalances and restoring profitability often through drastic cuts in real wages, the effect on private investment has been weak and slow to appear. Many of these issues are difficult to explain in the context of conventional investment theories."

This disappointing trend in private investment has spurred debate and interest in the determinants of private investment in developing countries leading to the adumbration of alternative theories reflecting societal peculiarities and paradigmatic conjectures (World Bank, 1990; Greene and Villanueva, 1991; Serven and Solimano, 1992a,b)

For Nigeria, there is a near complete absence of studies devoted explicitly to the exploration of the determinants of private investment. This is due perhaps to the chronic dearth of private investment statistics or, in general, their problematic nature. Recently, however, the World Bank, under its "Trends in Private Investment in Developing Countries" series, has been publishing in a systematic fashion private investment data for several developing countries.

This, coupled with the unimpressive private investment rates, makes it opportune to *empirically investigate* the determinants of private investment for Nigeria. In doing this, in addition to traditional determinants such as public investment and credit availability, we introduce other variables such as economic instability, external shocks and foreign exchange constraints.

This report is organised as follows: Section II highlights the evolution of private investment in Nigeria. Section III reviews related works, while Section IV outlines our model. Section V presents and discusses estimation results and Section VI offers some policy advice and concludes the paper.