DETERMINANTS OF THE CHOICE OF THE EXCHANGE RATE REGIMES IN NIGERIA

LLOYD AHAMEFULE AMAGHIONYEODIWE
and TOKUNBO SIMBOWALE OSINUBI*

Abstract. This paper examined determinants of the choice of the exchange rate regime in Nigeria using a time series approach. Both multinomial logit and simultaneous limited-independent models were estimated using time series data from 1960 to 2000. The study found that when domestic inflation was relatively high with respect to world inflation, a fixed exchange rate regime was preferred. This serves as an anchor. Also, domestic monetary disturbances appreciated the real exchange rate and favoured a more flexible arrangement, while in the presence of real shocks the balance of payments acted as a shock absorber and a fixed regime was more likely.

I. INTRODUCTION

The formulation and conduct of Monetary and Exchange Rate Policy is an essential part of the macroeconomic policy framework in most developing countries. Low inflation and international competitiveness have become the desirable targets in these countries. The importance of monetary and exchange rate policies is renewed by the current reforms which entails among others the liberalization of the financial markets and ensuring positive balance of payments. The choice of the exchange rate regime to implement by an economy is determined by many objectives. However, once the choice is made, it is expected that the authorities concerned will adjust the fiscal and

*The authors are teaching at, respectively, Department of Economics, Faculty of the Social Sciences, University of Ibadan, Ibadan, Oyo State, Nigeria
(e-mail: lamaghionyeodiwe@yahoo.co.uk) and
Department of Economics, Faculty of the Social Sciences, University of Lagos, Akoka, Yaba, Lagos, Nigeria
(e-mail: tokunbosinubi@yahoo.co.uk).

monetary macroeconomic policies to fit the chosen exchange rate policy. Furthermore, once the choice of exchange rate regime has been made, the flexibility or independence of monetary policy will consequently be determined.

The choice of an exchange rate regime is linked, to some extent, to the attainment of specific targets set by the monetary authority. Most times, these targets are related to internal and external imbalances. Hence, a correlation between the choice of the exchange rate regime and real output, prices, and balance of payments stabilization is expected. For instance, when the aim of the monetary and fiscal policy is to stabilize the balance of payments, it is desirable to adopt a flexible exchange rate system. This will help overturn any current or capital account disequilibrium. This, notwithstanding, the degree of capital mobility and foreign reserve constraints has to be considered (that is, the Marshall-Lerner conditions).

When the aim is to stabilize domestic prices, then financial discipline has to be adhered to. It is believed by many economists that the exchange rate can be used as an anchor for financial stability since it is one price of the economy. In respect to financial discipline, a fixed exchange rate imposes a degree of financial discipline by discouraging recourse to inflationary finance (León and Oliva, 1999). On the contrary, proponents of exchange rate flexibility argue that the choice of a fixed exchange rate would only cause financial crises and consequently continuous devaluations. Lastly, when the aim is real output stabilization, the role of the exchange rate regime is largely viewed as a shock absorber. That is, the variability of real output is affected by diverse economic instability and the choice of the exchange rate regime is used to spread these effects. Therefore, the choice of which exchange rate to adopt will depend on the nature of the shocks as well as the structural characteristics of the economy such as degree of openness, degree of capital mobility, degree of wage indexation, and degree of development.

Using secondarily sourced data from 1960 to 2000, the study investigates the determinants of the choice of the exchange rate regimes in Nigeria using a time series approach. The use of this approach aims at overcoming the limitations of the cross-section approach. And like León and Oliva (1999) opined, the time series approach is based upon the assumption that the choice of a regime is better explained by the past and present evolution of the economy rather than by certain conditions at a given moment while the cross-section approach is based upon the assumption that policy makers would not change the regime until the long term benefits would exceed the cost of the switch. This would imply that there is some

inertia in regimes that will be better captured by a time series analysis. By using a time series approach, we regard the regime choice as a medium term decision that marginally depends on short span indicators.

The study is divided into five sections. Section I is the introduction while the section II contains a brief review of the literature. Section III discusses the exchange rate policy in Nigeria while section IV describes the methodology and empirical findings. Section V concludes the study.

II. BRIEF REVIEW OF THE LITERATURE

The issue of exchange rate has been prevalent in the literature. Real exchange rate is said to be a very important relative price in the economy. This is because changes in the real exchange rate influence foreign trade flows, the balance of payments, the level and structure of production, consumption and employment, the allocation of resources in the economy and domestic prices (Kiguel, 1992). Real exchange rate is perceived as an important mechanism for transmitting trade shocks to changes in the current account.

Many economists have shown the important role played by real exchange in facilitating the adjustment process in low-income economies. Some of these studies include Edwards (1989, 1994), Elbadawi (1989), and Kiguel, (1992). Edwards (1989, 1994) argues that in the short run, real exchange rate responds to both real and monetary disturbances and that in the short run, inconsistently expansive macroeconomic policies will generate a situation of real exchange rate misalignment that is overvaluation. Likewise, Elbadawi and Soto (1994) illustrated that under a pegged nominal exchange rate, expansionary fiscal and monetary policy can be a cause of persistent real overvaluation. It was the conclusion of these studies that a proper alignment of the real exchange rate serves as a major determinant of economic performances. Conversely, severe macroeconomic disequilibria and balance of payment crises in the developing countries are also often cited as the direct consequence of real exchange rate misalignment (Edwards, 1989 and Dornbush, 1982). A study by the World Bank (1984) concluded that overvalued exchange rates in African countries led to dramatic collapse of the agricultural sectors. This is because overvalued exchange rates undermine overall export and agricultural performance.

Kiguel (1992) argues that the exchange rate regime has limited effect on the real exchange rate and only affects it in the short run due to rigidities in domestic prices and wages. In his study, Calvo *et al.* (1995) argued that the steady state real exchange rate is independent of (permanent) changes in

monetary policy. They opined that this result depends on the fact that there is no direct steady state link in theory between inflation and the real exchange rate so that monetary shocks are related to real exchange rate misalignment. In the long run, De Grauwe (1994) concluded that the correlation between money supply and the nominal exchange rate is relatively strong but tends to be lost in the short run.

Despite the role exchange rate play in an economy, Aghevli *et al.* (1991) stated that the choice of exchange rate regime is, however, dependent on several other factors. These factors include the objectives pursued by the policymakers, the sources of the shocks hitting the economy and the structural characteristics of the economy. The basic argument is that, whatever the objectives that determine the exchange rate regime, the authorities are presumed to adjust their domestic macroeconomic policies (especially monetary and fiscal policies) to fit the chosen exchange rate policy. The exchange rate regime consecutively determines the flexibility of the monetary policy pursued.

Various regimes have been reviewed in the literature. These include the extreme regimes (the fixed exchange rates), complexity free float and intermediate regimes (adjustable or crawling peg and target zones/crawling bands). There are a number of theoretical arguments and experiences about the relative stability of the exchange rate under these regimes. However, the choice of regime has great implications for the monetary policy of a country.

Most of the empirical studies advocated that small open economies are better served under a fixed exchange rate regime (Nnanna, 2000). In their separate studies, The World Bank (1984) and Faruqee (1995) suggested that the less diversified a country's export and production structure, the better for that economy to adopt a flexible exchange rate. Consequently, policymakers adopt a fixed exchange rate regime in the hope of gaining credibility in the fight against inflation (Nnanna, 2000). He, however, maintained that while fixed exchange rate regime may provide price stability, it undermines policy flexibility, which can have serious implications for internal and external balance.

The effect of various random shocks on the domestic economy is another major concern with respect to the choice of an exchange rate regime. Hence, Nnanna (2000) opined that the optimal regime is that which ensures macro economic stability. Generally, it is believed that when the source of macroeconomic instability is primarily endogenous, an exchange regime that has a greater degree of fixity is ideal. But if the macroeconomic instability is largely exogenous in nature, then a flexible regime is favoured.

Precisely, a fixed exchange rate regime involves the pegging of the exchange rate of the domestic currency to a reference currency. By implication, there is the tendency that monetary discretion may be lost. Thus, Nnanna (2000) opined that a fixed exchange rate regime has become increasingly hard to defend in a globalized financial market as the recent Argentine experience demonstrates. For the floating exchange rate regime, it entails that the *laissez faire* method (that is, forces of demand and supply) will be used to determine the exchange rate. A floating exchange rate regime do not only serves as a "shock absorber" for external shocks, it also allows monetary policymakers to have full discretion in the manipulation of monetary aggregates. As a result Nnanna (2000) stated that the greatest benefit of the floating regime is monetary policy independence (defined in terms of a country's ability to control its monetary aggregates and influence its domestic interest rate).

III. EXCHANGE RATE POLICY IN NIGERIA[1]

Exchange rate regimes are different systems of managing the exchange rate of a nation's currency in terms of other currencies. The major regimes are the free floating, rigidly fixed exchange rate system and the hybrid systems. The Hybrid system is the resultant variants arising from the combination of the two extreme exchange rate regimes. This is because in real life, a free floating or a rigidly fixed regime is impracticable. In general, the optimal management of the exchange rate depends on the policy makers' economic objectives, the sources of shocks to the economy, and the movement in major macroeconomic aggregates. As a result, it is difficult to define a system that might be effective and optimal at all times. When economic conditions change, the suitability of the existing system may be called to question, thereby necessitating the need for change.

While a fixed regime guarantees stability in decision-making process, a flexible system tends to be volatile and unstable, although it tends to transmit external shocks across borders. However, a floating rate does not on its own guarantee the prevention of external shock to the domestic economy. Also, floating exchange rate is not necessarily self-equilibrating, as recent experiences have shown that reserves are needed for desirable adjustments. Note that the problems associated with fixed and flexible exchange rate regimes usually prompt countries to adopt a combination of the two.

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[1]This section borrows substantially from the Central Bank of Nigeria Brief (1998).

The hybrid system, which is a combination of the fixed and flexible regimes, is of different forms namely:

Adjustable Peg System: This system is based on an assumed par value that defines upper and lower limits of fluctuation from a central exchange rate. Although such upper and lower levels are defined, they can be altered as the balance of payments position changes. Destabilizing speculation may also affect exchange rate stability, necessitating the alteration of the limits.

Crawling Peg System: The crawling peg or the system of "sliding or gliding parities" was developed to avoid the problem of relatively large par value changes to correct external imbalances and destabilizing speculation. Under this system, the authorities can undertake programmed or step-devaluation instead of a once and for all approach to alter the par value so as to restore external balance.

Managed Float: The managed float involves some form of official intervention to smooth the path of exchange rate when it overshoots the desired level. This is contrary to the pure float that allows the market forces of demand and supply to dictate the movements in the exchange rate. For the managed float to operate in the system successfully there must be a large pool of reserves to draw from, whenever necessary. An insufficient reserve is a major constraint to the successful operation of the managed float variant and has often resulted in the specification of bounds within which the managed float system should operate. The advantage is that it is relatively stable as in a fixed system.

Consequently, the main objectives of exchange rate policy in Nigeria are to preserve the international value of the domestic currency, maintain a favourable external reserves position, and ensure external balance without compromising the need for internal balance and the overall goal of macroeconomic stability (CBN, 1998). The exchange rate policy pursued at any particular point in time is positively correlated with the intended objectives to be achieved by the authorities. In a fixed exchange rate regime, the authorities, in many instances at an overvalued level, fix the rate. This is to attain some perceived objectives such as stabilizing the inflation rate through cheap imports. The rate could also be fixed at an undervalued level as part of policy mix of export drive.

However, since the authorities do not normally respond quickly enough to economic fundamentals, as would the market, the rate sooner than later becomes unrealistic. This usually happens when the expected tight stance of monetary and fiscal policies that should support the fixed exchange a rate

does not materialized. Invariably, the authorities end up exhausting all available reserves, inflation soars while a parallel market emerges and blossoms. Eventually, the rate is devalued to bring it in line with economic fundamentals.

In a floating regime, the determination of the exchange rate is left to market forces. The slippages in monetary and fiscal policies are reflected in exchange rate changes. Under a managed exchange rate regime, the exchange rate is adjusted to compensate, often belatedly, for changes in some fundamentals such as inflation, the terms of trade and some other perceived factors.

STRUCTURE OF NIGERIA'S FOREIGN EXCHANGE MARKET

The Nigerian foreign exchange market is made up of three major segments, the official, autonomous (made up of the inter-bank and bureaux de change) and the parallel markets. The various segments of the market evolved over time and emerged due to developments in the economy that warranted their debut.

The official foreign exchange market, the largest and predominant segments of the market, has remained one and has been in place through the period of trade and exchange controls when the 1962 Exchange Control Act held sway: the official foreign exchange market has also metamorphosized over the years. Since the institution of a regime of exchange and trade liberation in 1986, the market has witnessed tremendous changes. From the Second-tier Foreign Market (SFEM) in September 1986 to the unified official market in 1987 when exchange rate for public sector transactions was aligned with the commercial exchange rate, up to 1995 when the Autonomous Foreign Exchange Market (AFEM) for the direct allocation of foreign exchange to end-users by the Central Bank of Nigeria (CBN) was established; the official market has evolved from a single to a dual exchange rate system. During this time, the market operates two exchange rate systems, a fixed exchange rate for priority public sector transactions and a market-based exchange rate for private sector and other non-priority public sector transactions through the autonomous foreign exchange market segment.

The inter-bank market for free funds or privately sourced foreign exchange was not apparent when foreign exchange was centralized in the CBN through the 1962 Exchange Control Act. However, the market came into life and became vibrant with the introduction of the Second-tier foreign Exchange Market and the permission granted to the banks by the CBN to

effect foreign exchange dealings among themselves. The sharp practices that emanated from the system, in the form of round-tripping of funds leading to persistent instability in the exchange rate, informed the merger of the official Foreign Exchange Market and the Inter-bank market in 1989 into an enlarged inter-bank Foreign Exchange Market (IFEM). Thus, the inter-bank market was outlawed. The bureaux de change were established with the abolition of the inter-bank market in 1989 to afford access to small users of foreign exchange and enlarge the officially recognized foreign exchange market. Exchange rates in the bureaux de change are market determined. With the introduction of the AFEM in 1995, the banks were once more allowed to engage in inter-bank dealings with only privately sourced foreign exchange.

The parallel market for foreign exchange has been in existence from the exchange control era. The disparity in exchange rates was even greater in some of the periods before Nigeria's economic reforms. The renewed interest in the market is found on the quest for windfall gains associated with the instability and upward pressures that the market generates occasionally. The parallel market is a residual market as it accommodates spillover demands from other sources. It has been established that scarcity in the official sector and bureaucratic procedures necessitates the growth and development of the parallel market. Although transactions through it are limited and small, its speculative tendencies when well monitored and built into the general framework for foreign exchange and exchange rate management world result in a more effective and efficient system. In any foreign exchange management framework, whether in developed or developing economies, speculation, arbitrage, hedging, and portfolio switching are important elements in gauging the health and development of the foreign exchange market and, by extension the financial system.

EXCHANGE RATE REGIMES IN NIGERIA

Exchange rate regimes applied in Nigeria have traversed two main mechanisms namely: the fixed and flexible regimes. Between 1960 and 1986, the fixed exchange rate system was in operation. The inability of the system to achieved the major objectives of exchange rate policy led to the reversal of policy in September 1986 with the floatation of the Naira under the Structural Adjustment Programme (SAP). The flexible system continued until January 1994 when the fixed exchange rate system was reintroduced with the pegging of the naira relative to the United States' dollar. In 1995, the exchange rate mechanism was deregulated with the adoption of the Autonomous Foreign Exchange Market (AFEM).

Fixed Exchanged Rate System Era

From 1962 to 1973, the Nigerian currency was pegged to the pound sterling on a 1:1 ratio before the latter was devalued by 10%. Thereafter, the currency was allowed to move independently of the sterling. Also, the Naira was appreciated progressively to source imports cheaply to implement development projects. This enhanced the reliance on imports, which eventually led to the depletion of external reserves. By 1981, there was a gradual depreciation of the naira against the United States' dollar and/or the pound sterling based on whichever, was stronger. This gradual depreciation policy, however, could not sufficiently reverse the sustained pressure on the external sector.

In 1978, the CBN applied the basket-of-currencies approach as a guide in determining the exchange rate movement. The exchange rare during this periods was determined by the relative strengthen of the currencies of the country's trading partners and the volume of trade with such countries. Weights were assigned to countries' currencies with the dollar and sterling dominating in the exchange rate calculation.

The Dual Exchange Rate System Era

With the introduction of the Structural Adjustment Programme (SAP) in 1986, a flexible exchange rate mechanism was adopted with the floating of the naira in the Second-tier system; the exchange rate was largely determined by market forces. Although these forces were expected to produce a clearing price as the basis for the allocation of foreign exchange, the monetary authorities still had the power to intervene in the market when necessary. Such intervention depends on the state of the balance of payments, the rate of inflation, domestic liquidity, and the employment situation. Within the basic framework of market determination of the naira exchange rate, various methods have been applied and some adjustments carried out to fine-tune the system.

At the commencement of the SFEM, a dual exchange rate for the allocation of foreign exchange was adopted. Pre-SFEM or transitional transactions, debt service payments, contributions to international organizations, and expenses of Nigerian embassies were excluded from the SFEM and settled at the first-tier rate. The second-tier rate was determined by auction at the SFEM. At the first two sessions of the SFEM, the average of successful bids of authorized dealers was used to determine the exchange rate. Allocations were made to banks on pre-determined quota basis. Owing to the downward trend of the nominal exchange rate, the average pricing method was abandoned in the auction and the marginal rate was adopted.

Under this method, the last successful bid determined the clearing price, which was also the ruling rate. However, the method did not succeed in entrenching professional discipline in the system as the biddings appeared unrelated to market situations. As such, the Dutch Auction System (DAS) was adopted in April 1987, with an aim of introducing professionalism. Under the DAS, individual bank bid rates were used to allocate foreign exchange. The system, however, created the problem of multiplicity of rates, which resulted in the further depreciation of the naira.

The Unified Exchange Rate System

In July 1987, the first and second-tier markets were merged into an enlarged Foreign Exchange Market (FEM). Under FEM all transactions were subjected to market forces. The merger increased demand pressures and contributed to the persistent depreciation of the naira between July and November 1987. In 1988, the inter-bank market where banks were allowed to transact official foreign exchange business among themselves was separated from the official market. Subsequently, an autonomous market for privately sourced foreign exchange emerged with its interdependent rates. The autonomous market rates depreciated continuously, necessitating its subsequent merger with the FEM to form the Inter-bank Foreign Exchange Market (IFEM) in January 1989. The exchange rate in this market premium was reduced substantially.

The exchange rate under IFEM was determined through one or more of the following methods: marginal rate pricing, average rate pricing, highest and lowest bids, weighted average pricing, average of successful bids and consideration of developments in the exchange rate of major international currencies. To further reduce exchange rate instability, the CBN modified the inter-bank procedures in December 1990 when the DAS was re-introduced. In August 1991, the modal weighted average method of exchange rate determination was introduced. Under the new system, the rates tending towards the mode were applied to determine the market exchange rate. This method was designed to reduce wide fluctuations in the exchange rate.

Completely Deregulated Exchange Rate System

The parallel market premium was becoming increasingly high, reaching 79.2% in February 1992, compared with 20.0% in 1990 and 35.5% in 1991, as against the conventional limit of 5.0%. As a result of the persistent instability in the foreign exchange market, the CBN adopted a completely deregulated system of foreign exchange trading on March 5, 1992. Under the new arrangement, the CBN bought and sold foreign exchange actively in the

market and was also expected to supply in full all requests for foreign exchange made by the authorized dealers. The aim of this new mechanism was to narrow the parallel market premium and enhance the operational and allocative efficiency of the foreign exchange market. In pursuance of these objectives, the CBN adjusted its effective rate upward on March 5, 1992. The upward adjustment of the official exchange rate reduced the parallel market premium. For a limited period, the parallel market premium declined gradually while effective demand by banks for foreign exchange fell short of the supply. However, as a result of renewed demand pressures and speculative activities, the parallel market premium started to widen again. In 1993, the naira exchange rate was administered at N21.9960 to the dollar throughout the latter part of the year. However, the rates in the parallel market and the bureaux de change almost doubled the rate at the official market.

Reintroduction of the Fixed Exchange Rate System

Given the ailing nature of the economy and the need for its recovery as well as the role of an appropriate exchange rate in the recovery bid, new broad policies to stabilize and shore-up the value of the Naira were delineated by the Federal Government in 1994. And among other policy measures, the naira exchange rate was retained at N 21.9960 to the United States' dollar. The policy stance in 1994 was aimed at instilling sanity into the foreign exchange market and encouraging increased activities in the productive sectors of the economy. It was also expected that complementary monetary policy could reduce the cost of funds to the manufacturing sector, thereby enhancing domestic production and dampening inflation.

Apart from outlawing foreign exchange dealings in the parallel market, the bureaux de change operators became buying agents of the CBN. Designated banks acted as agents of the Central Bank in the remittance of foreign exchange. Agencies of government that earn foreign exchange in the course of their operations were mandated to surrender such funds to the Central Bank. A foreign exchange allocation committee, comprising representatives of the Central Bank, the Federal Government, and the organized private sector, was constituted early in 1994 to supervise the allocation of foreign exchange to designated sectors (agriculture, manufacturing, finished goods and services) on agreed percentages. Allocations were made to the beneficiaries through authorized dealers who bid on their behalf after making proper documentation and depositing the naira cover of such bids with the CBN.

The Dual Exchange Rate Regime

In 1995, the policy of dual exchange rates was introduced. This was response to the apparent adverse effects of the fixed exchange rate on non-oil exports, the productive sectors of the economy, and the bureaux de change. In 1994, the naira depreciated substantially in the parallel market. In order to stem these negative developments and to achieve efficient allocation and utilization of scarce resources, an Autonomous Foreign Exchange Market (AFEM) for trading in privately sourced foreign exchange was introduced in 1995, while the fixed exchange rate was reserved for selective public sector use. The exchange rates in AFEM were determined largely through market forces. The policy allows for Central Bank's intervention in the market in order to stabilize the rate and ensure movement towards equilibrium. The Bank sells foreign exchange to end-users through designated banks. The designated banks are not expected to add margins to the intervention exchange rate in excess of the commission on turnover as indicated in the banker's tariff. However, the utilization of funds is expected to be fully documented and unutilized funds returned to the Central Bank within a specified period. Official funds disbursed through AFEM are not eligible for inter-bank transactions. However, autonomous funds were freely traded in the inter-bank market under the AFEM.

The exchange rate system introduced in 1995 resulted in a fairly stable exchange rate leading to its retention in 1996. In 1997, the policy thrust of guided deregulation through the AFEM was retained with some adjustments. Current account transactions were further liberalized. Although the dual exchange rate system was retained in 1998, its operation was modified. Unlike in the past, all ministries and parastatals are to source their foreign exchange requirements from the AFEM. Thus, most of the transactions are now conducted at the AFEM. Consequently, the fixed official exchange rate is applicable to only a small proportion of foreign exchange transactions. As such, the unification of the dual exchange rates looks almost accomplished.

IV. ECONOMETRIC ANALYSIS

THE BASIC MODEL

The model for this study flows closely from those of León and Oliva (1999). The model is a multinomial qualitative response model. This was used since the choice of the exchange rate regime is of a discrete form. The model also have a dependent variable y_i, such that:

$y_t = 0$ if the country has a fixed exchange rate regime at time t

$y_t = 1$ if the country has a managed exchange rate regime at time t

$y_t = 2$ if the country has a flexible exchange rate regime at time t

In line with the above definition, the study, using a time series approach, investigates the determinants of the choice of exchange rate regime. From the literature, some of the variables that affect the decision of a specific exchange rate system include:

- Monetary shocks (MS), defined as the 12-months-average standard deviation of the residuals from an ARMA (3-6, 1) specification for the seasonally adjusted percentage change of money (M1). To avoid simultaneity problems, the paper considered the one-period lagged MS as an explanatory variable. The fitted ARMA was obtained using an iterative cycle of identification, estimation, and diagnostic checking of the variable.

- Real shocks (RS), defined as the 12-months-average standard deviation of the residuals from an ARMA (1, 1) specification for the percentage change in manufacturing production. The fitted ARMA was obtained using an iterative cycle of identification, estimation, and diagnostic checking of the variable.

- Inflation differential (ID), defined as the difference between domestic and international inflation. International inflation was based on the definition from the IFS, IMF.

- Foreign reserves constraints (FR), defined as the average change in international reserves during the previous 12 months.

- Openness (OPEN), defined as the ratio of trade (exports plus imports) divided by manufacturing production (The manufacturing production index is used as a proxy for total output).

The exchange rate regime equation thus, takes the form:

$$y_t = f(ID_t, FR_t, OPEN_t, MS_{t-1}, RS_t) \qquad (1)$$

From the specification above, the major rationale for considering a given exchange rate regime is related to the shocks that affect output variability and subsequently make the economy unstable, while the restrictions for a fixed exchange rate system comes from the balance of payments side. In addition, the purchasing power of parity and the fact that the nominal exchange rate can be used as an anchor are implicit with the incorporation of

the inflation differential variable. A structural characteristic of the economy, common in the exchange rate regime literature, is captured by the openness variable.

The econometric estimation of equation (1) requires a definition of the probabilities of choosing any of the three alternatives in a binary form:

$$\text{Log} (P_j / P_{2t}) = \beta X_t + u_t \tag{2}$$

With: $j = 0, 1$ and $t = 1, \dots N$. As usual, X_t represents a matrix of independent variables and β a vector of coefficients. Assuming a logistic cumulative distribution for the error term:

$$P_{2t} = 1 / (1 + \exp (\beta'X_t) + \exp (\beta'X_t)) \tag{3}$$

$$P_{jt} = \exp (\beta'X_t) / (1 + \exp (\beta'X_t) + \exp (\beta'X_t)) \tag{3.1}$$

The estimation requires the maximization, with respect to β of the likelihood function:

$$L = \prod_{t \in \theta_0} P_{0t} \prod_{t \in \theta_1} P_{1t} \prod_{t \in \theta_2} P_{2t} \tag{4}$$

here $\theta_j = \{$the jth response is observed$\}$ with $j = 0, 1, 2$. The results from the multinomial logit estimation are summarized in the Table 1.

The result shows that most of the variables were significant in explaining the choice of the exchange rate regime, given the value of their t-statistics. More so, the value of the Madalla's peudo-R square, which was 61, suggests that the regression has an apposite fit. With respect to the predicted outcomes, 71% of the cases are correctly predicted as a fixed exchange rate regime. The accuracy rate for the managed exchange rate regime was 68% while that of the flexible exchange rate regime was exactly 72% of the cases.

Furthermore, to recover the estimates and t-statistics for the fixed against the managed exchange rate regime choice, the variance-covariance coefficient matrix was derived. This was done using the specification below:

$$\text{Log} (P_{0t} / P_{2t}) - \text{Log} (P_{1t} / P_{2t}) = \text{Log} (P_{0t} / P_{1t})$$

From the table, inflation differential (ID) coefficient estimate was significant relative to the flexible exchange rate regime. Also, the slope of the estimates indicates that the bigger the inflation differential the greater the probability of a using or operating a less flexible exchange rate regime. This implies that Nigeria tend to use the flexible exchange rate to stabilize prices especially when it was inherent that relative to international inflation, domestic inflation remains high.

TABLE 1

Multinomial Logit Estimation: Fixed and Managed versus Flexible

Variable	Compare	Estimate	T-Value
Constant	0/2 1/2	−9.18 −1.23	−3.41* −0.71
Inflation differential (ID)	0/2 1/2	0.91 0.98	3.01* 3.11*
Foreign reserves constraint (FR)	0/2 1/2	0.00 −0.01	−0.26 −1.96**
Openness (OPEN)	0/2 1/2	8.35 −3.42	5.01* −2.08*
Monetary shock 1 lag (MS(−1))	0/2 1/2	−1.08 −0.11	−3.92* −1.01
Real shock (RS)	0/2 1/2	1.42 1.31	3.84* 4.02*

Observed and Predicted Outcomes

Observed	Predicted			
	Reg = 0	Reg = 1	Reg = 2	Total
Reg = 0	71	21	9	101
Reg = 1	8	68	11	87
Reg = 2	0	6	76	82
Total	79	95	96	270

−2 Log Likelihood for full model 105.32
Percent Correctly Predicted 72.10
Madalla's pseudo R-square 0.61

Note: *significant at 1% level

   **significant at 5% level

Similar to the findings of Fischer (1976) and Aizenman and Frenkel (1982), the effect of the disturbances show clear-cut results which ever the choice is. This signifies the probability that the monetary authorities preferred a more flexible exchange rate regime when monetary shocks (MS) dominate. It is important to at this stage to note that a loss on the purchasing power of the domestic currency could be more obvious before the presence

of monetary shocks, thus the regime tend to be less interfering. More so, inasmuch as the monetary shocks could be caused by changes in the flow of international reserves, there could be some degree of collinearity. In the face of domestic real shocks (RS), the choice of a fixed exchange rate regime becomes apparent. This is evident given the positive slope of the estimate as well as the fact that it was significant when all the three regimes are compared against each other. Consequently, it can also be argued that the probability of a less flexible exchange rate regime is greater when there are capital controls. Though this may be controversial, a further empirical test could be carried out to ascertain whether it is true or not.

It is important to point out that the effect of inflation differential and monetary shocks have the opposite sign on the exchange rate regime when comparing both fixed and managed against flexible. This can be linked to the relationship between inflation differential, the monetary shock and the exchange rate regime in Nigeria. Over time as the inflation differential increases, the role of the exchange rate as a nominal anchor, moving the latter to a regime with higher degree of intervention in order to control balance of payments crises and shock variability due to capital flows, becomes essential. The occurrences in the 1980s partially confirms this, this is because in the early 1980s, despite the increase in inflation and the shocks that existed, Nigeria still maintained a fixed exchange rate regime, this was in existence until 1986 when the Structural Adjustment Programme (SAP) ushered in a flexible exchange rate regime.

With respect to foreign reserves (FR), the change was significant only when comparing managed and flexible exchange rate regimes. It also had a negative slope that implies that incessant change in foreign reserves demands a more flexible exchange rate regime to avoid balance of payments crisis or a severe monetization. But this also depends on whether the country loses or gains more reserves. For the fixed and managed regimes it was not significant. The degree of openness (OPEN), though had a vague estimate, was significant. In terms of comparison between fixed and flexible exchange rate regimes, the estimation shows evidence of a direct relationship between openness and a fixed regime. This means that the regime was used to aid the channeling abroad of domestic shocks. However, when the managed and flexible regimes are compared together, a more flexible system was opted for, this was to enhance the insulating properties of the exchange rate regime.

The Haussman test was also performed to verify whether the independence of irrelevant alternatives is a problem for the multinomial estimation. The Haussman's S statistic is defined as:

$$S = (\beta_d - \beta_c)^1 (V_d - V_c)^{-1} (\beta_d - \beta_c) \qquad (5)$$

with a Chi-squared distribution and $V_c - V_d$ degrees of freedom.

Where β_c is the vector of coefficients from the full choice set (that is, multinomial), β_d is the vector of coefficients from the restricted choice set (*i.e.* binomial), V_c and V_d are their respective variance-covariance matrices.

Based on regressions from Table 1, the value of the S statistic was equal to 235.18, allowing for the rejection of the null hypothesis of dependence of irrelevant alternatives.

THE SIMULTANEOUS EQUATION MODEL

In our bid to avoid simultaneity between the exchange rate regimes and the monetary shocks, a simultaneous limited-dependent model was estimated. This assumes that a number of economic variables (including the monetary shocks) determine the exchange rate regime. Subsequently, this variable, in turn, acts as one of the determinants of the monetary shocks. However, given the nature of the variables involved, one of the endogenous variables (exchange rate regime) is limited, while the other (monetary shock) is continuous. Thus the estimation of the model differs from standard simultaneous models. Based on equation (1), the complete structural simultaneous equation model is specified, in line with the study of León and Oliva (1999), as:

$$\text{Log} (P_{1t} / P_{2t}) = \gamma_1 \, MS_t + \beta_1 \, X_{1t} + u_{1t} \qquad (6)$$

$$MS_t = \gamma_2 \, y_t + \beta_2 \, X_{2t} + v_{2t}$$

The reduce form of the model is:

$$\text{Log} (P_{1t} / P_{2t}) = \pi_1 \, X_t + u_{1t} \qquad (7)$$

$$MS_t = \pi_2 \, X_t + v_{2t}$$

where X_t includes all the exogenous variables in X_{1t} and X_{2t}.

The two-stage least square estimation technique was adopted in estimating the model. This was in line with the method suggested by Nelson and Olson (1974) and applied to exchange rate regimes by Savvides (1990). Just like León and Oliva (1999), we first estimated the reduced form of the model by applying maximum likelihood to each equation in (7), from where we obtained the instruments $y_t^{\wedge}$ and $MS_t^{\wedge}$. Later the corresponding instrument replaced the endogenous variables on the right hand side of the structural model, and then the parameters of the model in equation (6) were

estimated by applying maximum likelihood to each equation individually. The result is presented in Tables 2 and 3.

TABLE 2

Simultaneous Equations Model: Fixed and Crawling versus Flexible

Continuous variable: Monetary shock (MS) Variable	Estimate	T-Value
Constant	−0.71	−2.06*
Inflation differential (ID)	0.04	1.02
Foreign reserves constraint (FR)	0.00	−1.41
Openness (OPEN)	0.68	2.11*
Monetary shock 1 lag (MS(−1))	1.03	5.15*
Predicted exchange rate regime (yE)	0.31	1.89***
Real shock (RS)	0.13	2.81*
R^2	0.89	
Durbin Watson	1.97	
F-Statistics	204.01	

Note: *significant at 1% level

***significant at 10% level

Table 2 shows that on the overall, the model was significant. This is manifest given the value of the F-statistics, which were 204.01. Also, the value of the coefficient of determination (R^2), which is 0.89 shows that all the explanatory variables can explain 89% of the changes in the use of the various exchange rate regimes. Moreover, the value of the Durbin Watson statistics, which stood at 1.97, indicates the absence of autocorrelation in the model.

The forecasted exchange rate regime (yE) in the MS equation had a positive slope and was significant at 10% level while the coefficient for the forecasted monetary shock (MSE) in the limited dependent variable equation had a negative slope for all the compared regimes but was only significant at 5% for the fixed versus flexible exchange rate regimes. This result was similar to those obtained earlier when the lag of MS was used to eliminate the problem of simultaneity.

TABLE 3

Simultaneous Equations Model: Fixed and Crawling versus Flexible

Limited dependant variable: Exchange rate regime (y) Variable	Compare	Estimate	T-Value
Constant	0/2	−14.01	4.01*
	1/2	−1.02	−1.04
Inflation differential (ID)	0/2	1.01	3.31*
	1/2	0.71	3.14*
Foreign reserves constraint (FR)	0/2	0.00	−0.73
	1/2	−0.01	−3.14*
Openness (OPEN)	0/2	8.01	5.62*
	1/2	−5.13	−2.24*
Predicted monetary shock (MSE)	0/2	−1.41	−5.02
	1/2	−0.22	−1.01
Real shock (RS)	0/2	1.54	3.91*
	½	1.33	4.22*

Observed and Predicted Outcomes

Observed	Predicted			
	Reg = 0	Reg = 1	Reg = 2	Total
Reg = 0	78	6	4	88
Reg = 1	4	38	16	58
Reg = 2	2	26	63	91
Total	84	70	83	237

−2.00 Log Likelihood for full model 165.24
Percent Correctly Predicted 85.04
Madalla's pseudo R-square 0.73

Note: *significant at 1% level.

The result, like our earlier findings in this paper, also shows that most of all of the variables help to explain the choice of the exchange rate regime. This can be seen from the value of their t-statistics. The model had an appropriate fit given the value of the Madalla's peudo-R square. Concerning the predicted outcomes, 78% of the cases are correctly predicted as a fixed exchange rate regime. The prediction accuracy rate was 38% for the

managed exchange rate regime while that of the flexible exchange rate regime was 63%.

The simultaneous equation approach seems to be more accurate in estimating the probability of alternative exchange rate regimes. But it has a main limitation in that the statistical properties of polychotomous simultaneous equations models are not well known (León and Oliva, 1999). The standard deviation thus, obtained cannot be used to perform tests on the estimated coefficients because the asymptotic covariance matrix for the multinomial logit cannot be computed. Hence, León and Oliva (1999) warned that the results obtained using the simultaneous equation model have to be taken with caution.

V. CONCLUSION

The study investigated the determinants of exchange rate regimes in Nigeria using a time series analysis. A set of variables that helped to explain the choice of the exchange rate regime was investigated. The empirical results showed that different variables ranging from characteristics of the economy (degree of openness) and macroeconomic performance (inflation differential, change in foreign reserves) to real and monetary shocks help to explain the choice of exchange rate regime at different periods of time. The result showed that fixed exchange rate regime could be chosen as an anchor when domestic inflation was relatively high with respect to world inflation.

Also, the empirical results indicates that domestic monetary disturbances appreciated the real exchange rate and favoured a more flexible arrangement, while in the presence of real shocks the balance of payments acted as a shock absorber and a fixed regime was more likely. This was evident in Nigeria in the early 1980s, though at that period the Naira seemed to be overvalued. However, it is necessary to recall that the estimates are in terms of probabilities and therefore interpretation of the results have to be done with caution. More so, the multinomial analysis was more relevant than the binary choice model as reflected in the result.

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