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**EXCHANGE RATE DETERMINATION IN NIGERIA, THE EXPERIENCE  
UNDER THE WHOLESALE DUTCH AUCTION SYSTEM (WDAS);  
2002– 2010**

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### **Abstract**

*The instability in the naira exchange rate has been a very disturbing issue for the Nigerian government. In recognition of this, various exchange reforms have been adopted to establish an acceptable value of naira over the years. The Dutch Auction System (DAS) is one the recent exchange reforms employed in Nigeria. The employment of the DAS began with the Retail Dutch Auction System (RDAS) that was employed in 1987, 1990 and 2002. The failure of DAS to establish a realistic exchange rate for the naira led to the introduction of the Wholesale Dutch Auction system (WDAS) on the 20<sup>th</sup> of February, 2006. This paper has investigated whether the switch from RDAS to WDAS has been able to establish a stable value for the naira exchange rate. It equally investigated whether there has been convergence in the various segments of the market (Interbank Foreign Exchange Market (IFEM), Bureau De change (BDC), and WDAS. The paper employs daily time series data from 20<sup>th</sup> February 2006 to 20<sup>th</sup> February, 2010. The series used to investigate stability and convergence are: Marginal rate (MR), Quantity traded (QT), Successful bid (SB), Un-Successful bid (UB), Demand (DD), Supply (SS), Highest bid rate (HB), Lowest bid rate (LB). This paper found that convergence was realised in various segments of the markets. However, volatility was still persistent in the marginal rate series and the demand series, and this constituted the continuous instability in the value of the naira. Therefore, the paper recommends that, the CBN should use monetary policy more proactively to stimulate the domestic production base of the economy so that Nigeria can import less and export more thereby reducing the excess forex demand pressure. Secondly, the CBN should create a more market determined template for foreign exchange determination by devolving more of its monopoly power of foreign exchange supply. Thirdly, CBN foreign exchange policy shift should be followed-up by timely analysis of its efficacy in yielding result.*

**Key Words:** DAS, RDAS, WDAS, Exchange rate, Foreign Exchange, SAP.

## **1. INTRODUCTION**

Since the introduction of structural adjustment program (SAP) in July 1986, the exchange rate strategy was to float the Naira and establish an institutional framework for its trading in a market determined environment. Different exchange rate systems and operational procedures have been used from that time to date which includes: the establishment of Second Tier Foreign Exchange Market in 1986; the change of the pricing method after the first two bidding from the average rate method to the marginal rate pricing; the merger of the first and second tier markets on the 2<sup>nd</sup> of July 1987; the segmentation of the market into two in 1988; Autonomous and Inter-Bank Foreign Exchange Market; the merger of the two market to form Inter-Bank Foreign Exchange Market in January 1989; introduction of a pro-rata system of foreign exchange allocation in 1993; CBN return to fixed regime in 1994; the policy reversal from regulation to guided de-regulation in 1995 ; the establishment of Autonomous Foreign Exchange Market (AFEM) in 1995 and Inter-Bank Foreign Exchange Market in 1999.

The Dutch Auction System (DAS) has been used by Less Developed Countries since the 1980s to date with the expectation that it will enthrone an efficient foreign exchange market. It was introduced in Nigeria in 1987. The Dutch auction system was developed in the Netherlands to auction goods with limited lifetime. It is known as descending price auction .The auctioneer open the bid with an initial high price and start lowering it until he gets a successful buyer. In this case, the first bidder to indicate willingness to buy is the eventual winner of the bid. The DAS has been divided in to the

Retail DAS (RDAS) and the Wholesale DAS (WDAS) (Obadan, 2006).

The RDAS was experimented in Nigeria in 1987, 1990 and February 2002. The objectives of RDAS were to determine a realistic market-determined exchange rate, conserve external reserve, eliminate wide premium between the official and parallel market and ensure stability of the Naira against the backdrop of widening premium between the parallel and official market rates and the rising demand for foreign exchange. Under this system, the CBN intervened twice-weekly and the Authorized Dealers bought foreign exchange at their bid rates. The rate that cleared the market was adopted as the ruling exchange rate for the period up to the next auction (Obadan, 2006).

Geneveisi, (1996), observed that the auction system in the experimentation of 1987 and subsequently 1990 suggested that, the exchange rate remained unstable. Further re-introduction of the RDAS in 2002 did not eliminate distortions; excessive demand pressure persisted and volatility still prevailed in the market. While Auwal,(2006) observed that, the RDAS failed to stabilize the naira exchange rate and rather engineered speculation, opportunism, sharp practices and excess demand pressure in the foreign exchange market, Akanji (2006) argued that the cumbersome process of RDAS encouraged capital flight through the banks buying foreign exchange for their customers' account.

The WDAS was introduced on the 20<sup>th</sup> of February 2006 in Nigeria against the back drop of the failure of the RDAS to achieve foreign exchange objectives of stability, reducing excessive demand for the Naira and high premium between the official and the parallel market. The WDAS is an auction system where the CBN sells the

foreign exchange to the Authorized Dealers (ADs) who bid on their own account. The ADs in turn sell the foreign exchange to End-Users at their current bid rate. The structure of the WDAS creates a dual relationship between the CBN and the ADs. The CBN assumes a monopolist status as the sole supplier of foreign exchange in the market while the buyers are few (ADs). In the reverse relationship, the CBN buys from the ADs and assumes a monopsonist status while the ADs assume an oligopolist status given that they do not collude. However, the relationship between the Authorized Dealers (AD's) and the End Users is one way such that the ADs assume an oligopolist status while End Users are many (Garba ,1997).

Based on the foregoing discussion, a common characteristic of the exchange rate policy in Nigeria is obvious; it has been 'consistently inconsistent'. Even, in all dynamics of the relationships in the various markets, one unique attribute prevails i.e. an imperfect market setting exists and efficiency of allocation of scarce resource (foreign exchange) may not be achieved under this setting. Obadan,(2006) argued that over-reliance on an imperfect market system to determine a crucial price like the foreign exchange rate has been a major cause of exchange rate depreciation. However, the market setting that characterized the relationship between Wholesaler-Retailer and Retailer-final Consumers are imperfect. To this effect, expecting an outcome that is synonymous with a perfect market (efficient resource allocation) may not be feasible. Also, the asymmetry of information could generate rent seeking behaviour given that CBN is both a regulator and a likely player in the market. Therefore, this paper is to put the current exchange rate policy (WDAS) to test. The paper specifically (i) analyzes the exchange rate spread at WDAS, (ii) analyze effects of WDAS on the stability of the

Naira exchange rate and (iii) investigates the extent of convergence of the various segment of foreign exchange market as a result of WDAS.

## **2. LITERATURE REVIEW**

Various studies have been conducted in relation to convergence or divergence, stability etc of foreign exchange reforms. For instance, Kassey (1995) found out that in spite of the reform of the 1986, the naira exchange rate is still not competitively determined and the allocation of FOREX remains inconsistent with the requirements for the long-term development of the Nigerian economy. She found that the post-reform exchange rate policy has been adversely affected by government's expansive fiscal and monetary policy. Consequently government's macroeconomic policy and the character of the markets within which FOREX was traded and the linkages between them gave the naira exchange rate little chance of convergence and as a result, the possibilities for distortions in the allocation of FOREX remains very high. Geneveisi, (1996) and Obadan, (2002) in their analyses of Naira stability under the DAS, using the exchange rate stability index found the exchange rate instability index very unstable in all phases of the market and it was not uniform in the different phases of the auction system. They asserted that lack of monetary and fiscal discipline, weak domestic production, import dependent, speculative activities, over-reliance on an imperfect market system have been responsible for the instability of the Naira. Garba (1997) evaluated the possibility of exchange rate convergence through the institutional difference that segmented the market. Descriptive procedures used showed that there was no tendency towards exchange rate convergence as at December 1993

and could only be possible if the institutional barriers segmenting the markets were removed and the official market operates competitively.

In terms of convergence, Durdunoo, (2002) found that the widened premium between the official and the parallel market in Ghana was significantly reduced after the introduction of auction system. Evidence of weekly auction data from 1986-1991 studies corroborated by suggesting that convergence was achieved after six years of auction (four years retail and two years wholesale). However, Janvier, (2002) found that widening premium between the official and parallel segment between 1970 - 1998 in Burundi still prevailed and the parallel market is still thriving despite introducing foreign currency auction system in July 2000. Gray, (2005) found that the introduction of foreign exchange auction in Iraq has reduced volatility since its introduction in 2004. Auwal (2006) on the evaluation of the DAS using Nigeria data from 2002 to 2006 found different patterns of volatility in different segments of the market by considering different series. However, Akanji, (2006)) found that convergence in the Nigerian foreign exchange market was achieved after 12-13 weeks of the commencement of the WDAS considering the WDAS and interbank rates. Convergence for WDAS, interbank and Bureaux De change was achieved as at the 25th auction session. Charles (2006) found that the introduction of Wholesale Dutch Auction System (WDAS) has narrowed arbitrage premium to below 5.0 percent benchmark in Nigeria and the challenge is to sustain the convergence achieved.

### **Retail Dutch Auction System (1987, 1990, 2002)**

This section reviews the operational activities of the RDAS so that comparison can be made with the operation of the WDAS. The

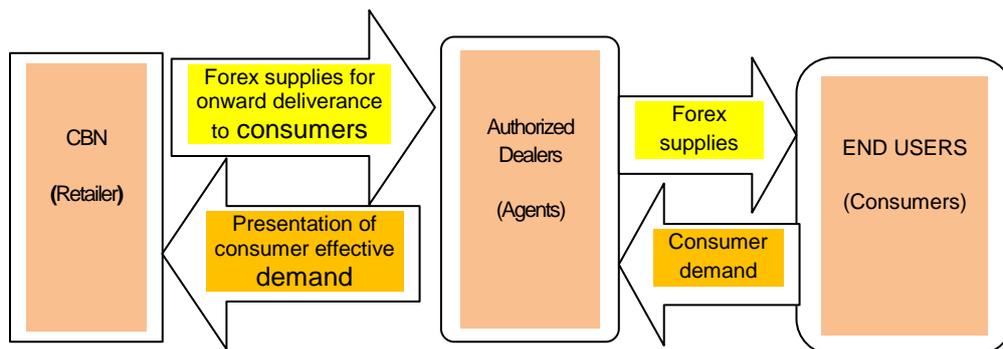
Retail Dutch Auction system was first introduced in 1987 and re-introduced in 1990 and 2002, following the failure of the other mechanism of exchange rate determination that had been implemented to achieve the specified objectives. Specifically, Retail Dutch Auction System (RDAS) was re-introduced in 2002 against the backdrop of widening premium between the parallel and official market exchange rates and the rising demand for foreign exchange (Sanni, 2006).

Under this system, CBN intervened twice weekly on Mondays and Wednesdays by announcing an amount on offer for auction by 8.30am. The authorized dealers bought foreign exchange on behalf of their customers by submitting their customers bid duly signed by two authorized signatories for any particular auction session between 9am-12.00 noon in excel format inside a diskette to CBN Abuja or Lagos office. The result of each Auction Session was announced by 1.00pm on Tuesday and Thursday and the successful Authorized Dealers had their account debited with the Naira equivalent at the current bid rate. The CBN then delivered the foreign exchange purchased by Authorized dealer within two business days after the auction i.e. T+2. Authorized dealers returned to CBN an un-utilized fund within five business days after delivery at the rate of purchase and the CBN could also purchase foreign exchange from Authorized Dealers and other participants in the market at their offer rate. The CBN delivered the Naira equivalent for US \$ bought from the banks to the bank's current account at the CBN. Equally, the banks delivered US \$ sold to CBN to the CBN special foreign exchange market account with Chase Manhattan Bank, New York. Travelex global and American express commenced the direct sales of

Traveller’s cheque to End-Users in 2002 so as to increase supply of foreign exchange (CBN Brief,2008)

The Retail Dutch Auction System (RDAS) operated for 43 months, 19 days as it was halted on the 19<sup>th</sup> February 2006 when it became obvious that it has failed to achieve its objectives.

**Structural Model of Retail Dutch Auction System**



**Figure 1:** Retail Dutch Auction flow chart

The transaction in this market is between the CBN and End Users with CBN supplying and End Users demanding. The CBN is the retailer while the End Users are the consumers. The agents don’t influence the outcome of the transaction directly as they don’t buy or sell foreign exchange but only intermediate on behalf of their customers at their request. This implies that market setting that characterized the behavior of the players is typical of a monopoly with CBN as the sole supplier of foreign exchange.

**Wholesale Dutch Auction System (WDAS) 2006**

The CBN moved to Wholesale Dutch Auction System (WDAS) on the 20<sup>th</sup> February 2006 as an improved framework for determining

the exchange rate in the foreign exchange market. Under this regime, the CBN adopted a 2 way quote (i.e. quoting the buying price and the selling price) and remained an active market participant.

The Wholesale Dutch Auction System (WDAS) session started by 8.30am and ended by 10:30am (2 hours). Authorized dealers who hitherto were not allowed to do transaction on their own account were permitted to do so. Banks bought foreign exchange for themselves and later sole to customers. Authorized dealers had to submit their bids on Mondays and Wednesdays within 8.30am – 10:30am and the result of successful and unsuccessful bid were announced by 1.00pm on the day of bidding.

The minimum amount of bidding was \$100,000 and the currency of transaction was Naira and the US\$. Also, Authorized dealers were expected to have adequate Naira cover in their current account with the CBN and were promptly debited with the naira equivalent of the foreign exchange purchased at their bid rates. The CBN normally investigated the bids to ensure they were genuine and conform to documentations and auction guidelines. The CBN effected delivery of foreign exchange purchased by each Authorized Dealers within one business day after the day of the auction result.

The CBN also said that funds was transferable in the Inter-bank Foreign Exchange Market and the CBN could equally purchase foreign exchange from Authorized Dealers and other participating companies at their offer rates. The Authorized dealers were meant to quote two ways and displayed in their banking halls, the buying and selling rates conspicuously, while the spread between the buying and selling rates was not to exceed 50kobo.

Other supplementary measures introduced under the Wholesale Dutch Auction System (WDAS) in order to achieve its objectives included;

- i. Direct sales of foreign exchange to licensed BDC effective April, 2006.
- ii. Increase in Basic Travelling Allowance (BTA) from \$2,500.00 bi-annually to \$5,000.00 per quarter and Personal Travelling Allowance (PTA) from \$2,000 bi-annually to \$4,000 per quarter.
- iii. In September, 2008 purchases by licensed bureau de charge was increased from \$200,000 to \$300,000.

The WDAS was implemented using an electronic medium of transaction rather than manual communication through phone, hard copies etc. under RDAS. Hence, WDAS is an E-NOODLES (Electronic Naira/Dollars exchange rate system) i.e. a system where transactions are done electronically on line on a sound ICT platform.(CBN Brief,2008)

**Table 1: Differences between Retail and Wholesale Dutch Auction System.**

<b>RETAIL DUTCH AUCTION SYSTEM(RDAS)</b>	<b>WHOLESALE DUTCH AUCTION SYSTEM(WDAS)</b>
1. Transaction takes place between 9.00am and 12.00 noon.	Transaction takes place between 8:30am and 10:30am.
2. CBN announces amount on offer 30 minutes before bidding starts i.e. (8.30am)	No pre- bidding announcement of amount on offer.
3. Result of Auction is announced 1.00pm a day after bidding.	Result of Auction is announced 1.00pm on the day of bidding.

4. CBN effect delivery two days after transaction i.e. of foreign exchange T + 2	CBN effect delivery of foreign exchange a day after transaction i.e. T + 1
5. The transaction is essentially manual through telephone, hard copies, fax and submission of bids in diskette at CBN Abuja and Lagos.	The transaction is essentially electronically, using the E-NOODLES ICT platform.
6. Funds purchased from CBN at the auction are not transferable to the inter-bank foreign exchange market.	Funds purchased from CBN are transferable to the inter-bank foreign exchange market.
7. Authorized dealers only transact on behalf of their customers.	Authorized dealers are allowed to transact on their own account.
8. The two-way quote system was not operational.	CBN adopted the 2-way quote system.
9. Direct sales to Bureaux De Change (BDC's) was not effective.	Direct sales to BDC became effective April, 2006.
10. Basic Travelling Allowance (BTA) of \$2,500 bi-annually for end users.	Basic Travelling Allowance (BTA) was increased to \$5,000 per quarter.
11. Personal Travelling Allowance (PTA) of \$2,000 bi-annually.	Personal Travelling Allowance (PTA) increased to \$4,000 per quarter.

Source: *Compiled by the Researcher.*

The implication of the differences between retail and wholesale Dutch auction system is that the phasing out of 30 minutes pre-auction announcement of amount on offer before bidding would reduce substantially pre-bidding speculation. The release of the

results of bidding on the day of bidding is a reflection of an enhanced efficient setting as post bidding speculation time is narrowed and reduced by 24 hours. Also, the effective delivery of foreign exchange by the CBN a day after transaction is an indication of improved service delivery by the bank. The automation of the transaction platform would reduce communication cost, time wasting and enhance transparency of the bidding process. The authorized dealers' access to transact on their account, increase in BTA, PTA, direct sales to Bureaux De Change (BDC) would go a long way in increasing supply of foreign exchange in the market so as to reduce the excess demand for foreign exchange and tend towards stability of the exchange rate. Finally, the two-way quote system would reduce significantly speculation about the exchange rate spread thereby fostering the stability of the Naira exchange rate.

### **Other segments of the market**

Bureau De change was introduced in 2006. Direct sales of forex to bureau de change became effective April, 2006 in order to supply small user of foreign exchange thereby reducing the excess demand gap. The liberalization opened the market for the operations of private BDCs and Authorized Dealer BDCs. The operations of these BDCs with CBN window was basically cash operation.

### **Private Bureaux-De-Change (BDC)**

- Each licensed BDC was required, to open a Naira Current Account with an Authorized Dealer of its choice, for the purpose of buying forex.

- A Bureau-de-Change is allowed to purchase forex from the CBN through a presentation of the CBN cheque issued by their banks twice a week (Tuesdays and Thursdays).
- The Bureau-de-Change purchase equivalent amount of forex from the CBN up to a maximum limit of US\$200,000.00 twice a week.

### **Authorized Dealer Bureaux-De-Change (BDCS)**

- The Authorized Dealer applied to CBN through the WDAS window on Mondays and Wednesdays for a maximum of US\$2.0 million.
- The forex purchased by the Authorized Dealers is disbursed in cash and the BDCs in turn sell to end-users for **eligible transactions only**. Such eligible transactions include: Basic Travelling Allowance(BTA) at \$5,000 per quarter and \$20,000 per annum; Personal Travelling Allowance(PTA) at \$4,000 per quarter and \$16,000 per annum; Mortgage monthly payment; School fees abroad; Medical fees abroad; Credit Card payment; Utility bills and Life Assurance premium payment.

In an effort to ensure that liberalization get to the small end-users, in April 2006; the CBN commenced cash sales of forex to BDCs in all its 22 branches across the country. (<http://www.cenbank.org>).

## **3. METHODOLOGY**

### **Source of Data**

The data used are basically secondary. The results of the bi-weekly Dutch Auction System (WDAS) from 2002-2010 were sourced from the CBN website. Also, secondary data on monthly exchange rate in the Bureaux De Change (BDC's), RDAS/WDAS and the Inter Bank Foreign Exchange Market were sourced from the CBN website.

Finally, monthly data on net-foreign asset, foreign exchange reserve, money supply, domestic credit and exchange rate were sourced from CBN website.

### **WDAS theoretical framework**

The CBN introduced the Wholesale Dutch Auction System (WDAS) on the 20<sup>th</sup> February 2006 against the backdrop of the failure of the Retail Dutch Auction System to achieve its objectives after operating it for 43 months 19 days. The foreign exchange market has other sub-markets which include, Inter-bank Foreign Exchange Market (IFEM), Bureau De Change (BDC) and the un-official (parallel market). The structure of Wholesale Dutch Auction System (WDAS) established a two-way transaction between the CBN and Authorized Dealers (licensed banks). The Authorized Dealers are not only inter-mediators but dominant players in the market setting as they can influence demand or supply directly by trading on their own account.

The primary transaction is between a Wholesaler (CBN) and Retailers (ADs and BDCs). When CBN is selling, it assumes the status of a **monopolist** but, when it is buying it assumes the status of a **monopsonist** given that AD's and BDC's sell all their foreign exchange in the primary transaction segment of Wholesale Dutch Auction System (WDAS).

On the other hand, the secondary transaction is between Retailers (ADs, BDCs) and final consumers (End Users). The Retailers assume the status of an **oligopolist** given that collusive behaviour is ruled-out otherwise, they will be a **monopolist**.

The CBN request authorized dealers to submit their bids on Mondays and Wednesdays between the opening of the session at 8:30am to closing time 10:30am. The CBN reserves the right to

reject the bids that are deemed to be unrealistic or failed to conform to trading guideline. The minimum bid amount by an Authorized Dealer should be \$100,000.00 and the currencies of transaction should be the Naira and the \$US. The CBN announces the result of each Auction by 1.00pm on the day of the auction. The CBN promptly debit the current account of Authorized Dealers and thereafter, delivers the foreign exchange to their correspondent bank account used for IFEM 24 hours after the end of the transaction (CBN Brief,2008).

### The Structural Model Of WDAS in Nigeria

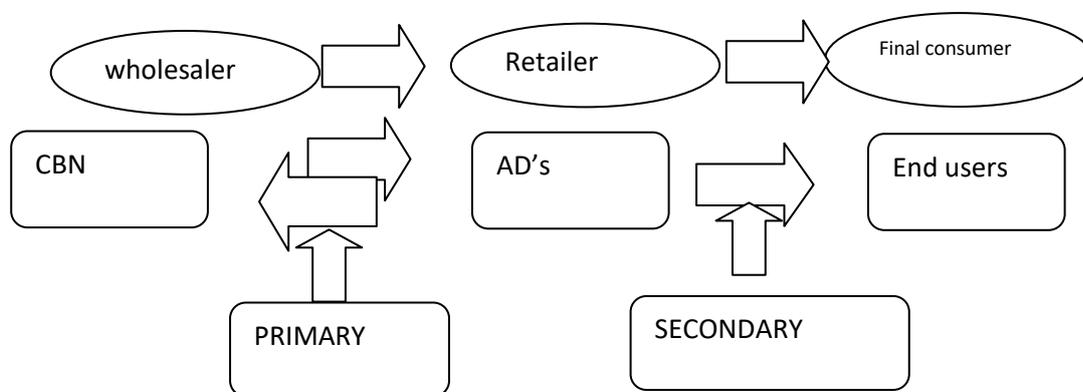


Figure 3: Wholesale Dutch Auction System flow chart.

Source: Constructed by the Researcher.

The result of every Wholesale Dutch Auction session generates the following indices;

- i. Marginal rate (MR)
- ii. Quantity traded (QT)
- iii. Successful bid (SB)
- iv. Un-Successful bid (UB)

- v. Demand (DD)
- vi. Supply (SS)
- vii. Highest bid rate (HB)
- viii. Lowest bid rate (LB)

**Measures of Spread:** From the indices above, rate spread and measures of excess demand can be generated.

$$WDAS_1 = HB - MR$$

$$WDAS_2 = HB - LB$$

$$WDAS_3 = MR - LB$$

$$FOREX_1 = IFEM - BDC$$

$$FOREX_2 = WDAS - BDC$$

$$FOREX_3 = WDAS - IFEM.$$

Also, excess demand can be captured by the following.

$$ED_1 = \text{Demand} - \text{Sold}$$

$$ED_2 = \text{Demand} - \text{Amount traded}$$

$$ED_3 = \text{Amount Traded} - \text{supply}$$

### **Determination of Exchange Rate under WDAS**

This study shows how exchange rate is determined under Wholesale Dutch Auction System (WDAS) given the structural differences it has institutionalized in comparison to Retail Dutch Auction System (RDAS). According to the procedure, the operators in the market are to submit their bids in a two-way quote during the trading session (8:30am – 10:30am) on Mondays and Wednesdays. The CBN evaluates their bids with utmost confidentiality to determine the acceptability or otherwise of bids submitted for approval.

Thereafter, CBN determines the ruling rate using the marginal pricing method. However, the marginal rate lies between the highest

and lowest bid rates. The result of the auction is released at 1.00pm on the day of auction and successful bidders are notified and their current accounts with CBN promptly debited. The CBN consequently effect delivery of foreign exchange within the next 24 hours of releasing the bid result. There are two types of solution that can emerge from the Wholesale Dutch Auction System (WDAS).

### **Non-Collusive Solution**

If the ADs compete the bid rates band (highest bid – lowest bid) might be too wide and unstable thereby creating some positive premium for lowest bidders and negative premium for the highest bidders (typical of a price war). The CBN would be in position to wield full monopoly power if the ADs don't collude but its traditional mandate of maximizing social welfare by maintaining a sound macro-economic environment may have this opportunity thwarted.

### **Collusive Solution**

If the ADs collude, a bilateral monopoly market setting would evolve in the primary segment of the Wholesale Dutch Auction System (WDAS) and the likely outcome will be that the marginal rate determined will fall between the *monopolist* and *monopsonist* price. Also, the bid rates band would become widened and in this situation, one would expect the marginal rate to be unstable.

However if the ADs collude in the secondary segment of the market, a monopoly situation will arise. Given that ADs are being driven by profit motive, the exploitation of full monopoly power will become their goal and this implies higher rates for end user and a widened premium. Hence, exchange rate will be unstable.

### Exchange Rate Spread and Convergence

The trend analysis and descriptive statistics have been used to determine whether convergence of the submarkets (WDAS, IFEM, and BDC) in the foreign exchange has been achieved under Wholesale Dutch Auction System or not and whether the convergence had been sustained throughout the Wholesale Dutch Auction System.

### GARCH Model (Estimation Technique)

The Generalized Autoregressive Conditional Heteroscedasticity Model was used by Engel (1982); Bollarslev (1986); and Auwal (2006) to study volatility of stock prices, inflation and exchange rate respectively. This model would be used to investigate volatility on marginal rate and demand under the WDAS.

The GARCH model is specified as thus:

$$Y_t = x_t Y + E_t \dots\dots\dots \text{eqn 1 - mean eqn.}$$

$$\sigma_t^2 = \alpha + \beta E_{t-1}^2 + \Pi \sigma_{t-1}^2 \dots\dots\dots \text{eqn 2 .conditional variance eqn.}$$

The mean equation is a function of an exogenous variable ( $X_t Y$ ) and an error term  $E_t$ . While the conditional variance is a function of mean ( $\alpha$ ), the ARCH term ( $\beta E_{t-1}^2$ ) and the GARCH term ( $\Pi \sigma_{t-1}^2$ ).

$$DDt = \alpha_0 + \alpha_1 MR_{t-1} + \alpha_2 DD_{t-1} + \alpha_3 SB_{t-1} + E_t \dots\dots\dots \text{eqn 3}$$

$$\sigma_t^2 = \beta_1 + \beta_2 E_{t-1}^2 + \lambda \sigma_{t-1}^2 \dots\dots\dots \text{eqn 4}$$

$$MR_t = \Pi_0 + \lambda_1 D_t + \lambda_2 MR_{t-1} + \mu_t \dots\dots\dots \text{eqn 5}$$

$$\sigma_t^2 = \beta_1 + \beta_2 E_{t-1}^2 + \lambda \sigma_{t-1}^2 \dots\dots\dots \text{eqn 6}$$

### Expected Signs

$\alpha_1 < 0$ ,  $\alpha_2 > 0$  and  $\alpha_3 < 0$

$\lambda_1 < 0$  and  $\lambda_2 > 0$ .

#### 4. RESULTS AND DISCUSSIONS

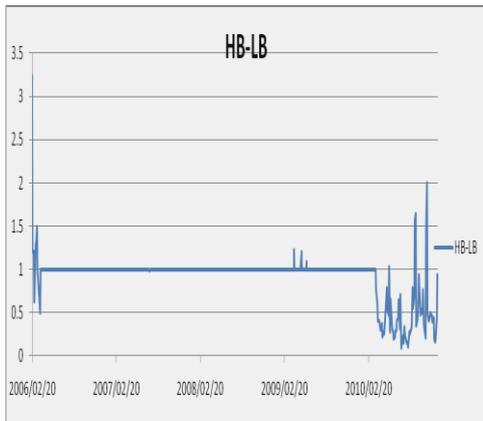
Table 1 shows the DAS spread using the mean and standard deviation. The spreads exhibit one pattern for both mean and standard deviation. The mean and standard deviation for highest bid-lowest bid, highest bid-marginal rate and marginal rate-lowest bid are lower under the WDAS than RDAS phase of the auction. This implies that volatility was more in the Retail phase of the auction than Wholesale.

Table 1: DAS spread mean and standard deviations.

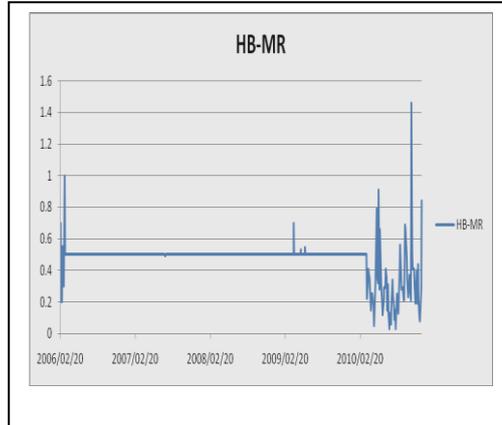
<b>SPREAD</b>	<b>MEAN</b>	<b>STANDARD DEVIATION</b>
HB-LB(WDAS)	0.928	0.26
HB-LB(RDAS)	2.283	1.76
HB-LB(DAS)	1.491	1.33
HB-MR(WDAS)	0.47	0.11
HB-MR(RDAS)	1.77	1.61
HB-MR(DAS)	1.01	1.21
MR-LB(WDAS)	0.45	0.19
MR-LB(RDAS)	0.5	1
MR-LB(DAS)	0.47	0.66

**Source:** Computed by the Researcher.

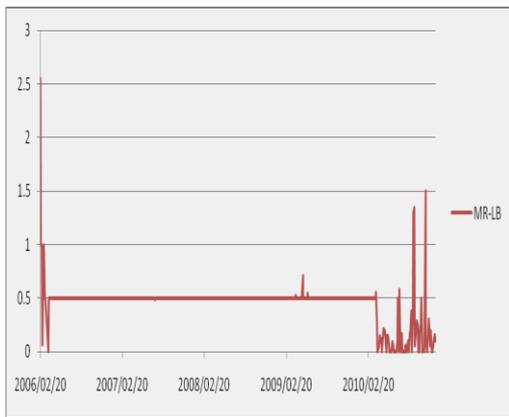
Figures 1 to 4 illustrate the spread of the series under the WDAS from 2006 to 2010



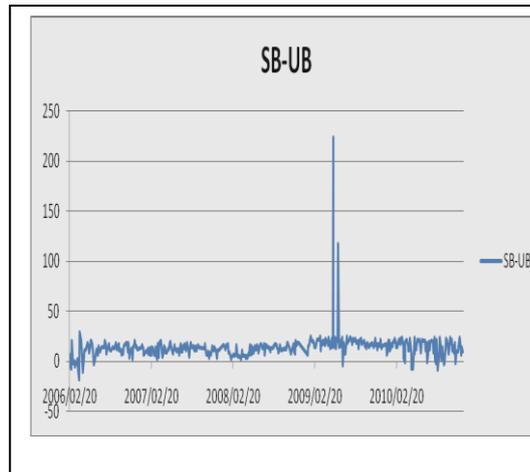
**Figure 1:** Highest bids-Lowest bids spread series for WDAS.



**Figure 2:** Highest bids-Marginal rate spread series for WDAS series.



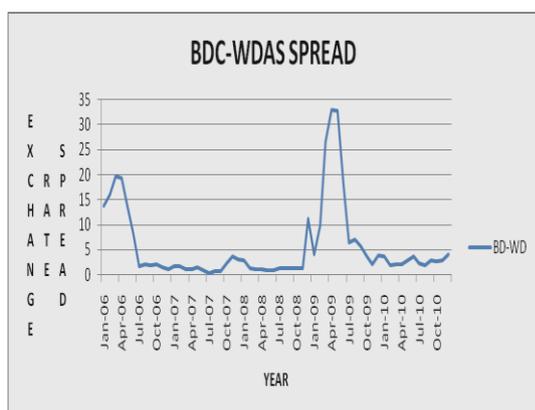
**Figure 3:** Marginal rate-Lowest bids rates spread series for WDAS.



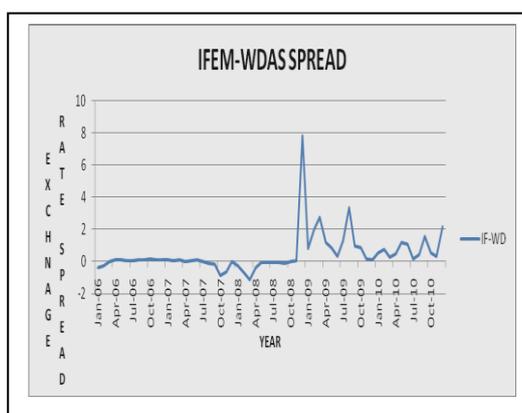
**Figure 4:** Successful – Unsuccessful bid spread series for WDAS.

The HB-LB, HB-MR and MR-LB spread exhibit similar patterns during the WDAS. At the inception of WDAS the spread narrowed down and stabilized for most of the period between February 2006 to February 2010 and became more turbulent for the rest of the period of 2010. The fluctuation of the spread for successful and unsuccessful bid is a reflection of high speculative tendencies among the Authorized Dealers. Also, it can be explained by non-conformity to trading guidelines as this is a reason for rejecting a bid.

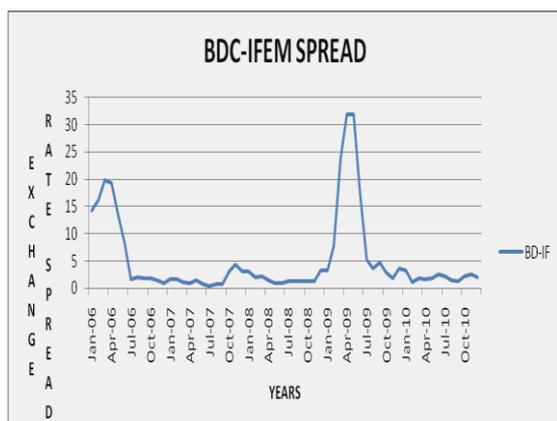
Figures 5 to 7 show the spread in different segments of the market under the WDAS



**Figure 5:** Bureau De Change-WDAS rates spread series.



**Figure 6:** IFEM- DAS rates.



**Figure 7:** Bureau De Change- IFEM rates spread series.

The oscillations of the BDC-WDAS spread suggest that the rate was not stable with either of the rate appreciating or depreciating. After the inception of the WDAS, the spread since narrowed down around July 2006 up till around January 2009 when it widened creating an arbitrage seeking opportunity for speculators as premium reached over N30.00. In August 2009, the premium narrowed to below N4.00 per Dollar and had remained around so up till December 2010.

The IFEM-WDAS rate was merely zero and negative at some time since the introduction of WDAS in 2006 up till January 2009 which indicate a high degree of convergence between the two rates. Afterwards it widened creating a premium of around N8.00 which later became lower around N2.00 as at December 2010. The graphs above show that the convergence of the sub-markets of exchange rate under WDAS did not translate to stability of the rates nor did it prevent the depreciation of the exchange rate of the Naira against the Dollar in the period under review. Also the wide spread between the

BDC and IFEM (over N30 per Dollar) between January 2009 and August 2009 would have created huge opportunity for arbitrage between the two segment of the market which would have frustrated the attempt to attain stability of the Naira. This random swing is not unconnected with the turbulent of the macroeconomic space.

One could equally deduced from the graphs that since the start of the WDAS in 2006, the earlier convergence witnessed had been sustained but for a transient hike of BDC rate around January 2009 to August 2009 which has been re-converged. In effect, there is a convergence of the BDC, IFEM and WDAS rate of the foreign exchange segment of the market.

Figures 8 to 14: The market trends of the various series.

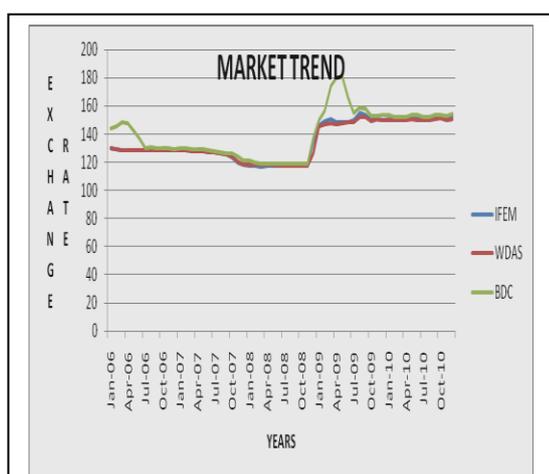


Figure 8: Market trend series WDAS.

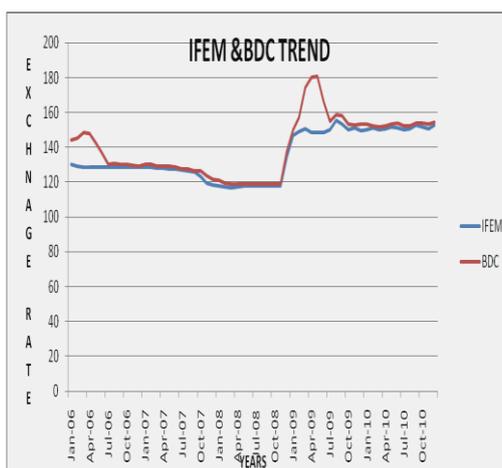
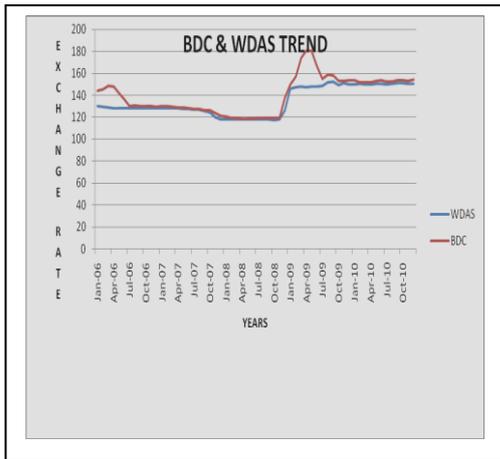
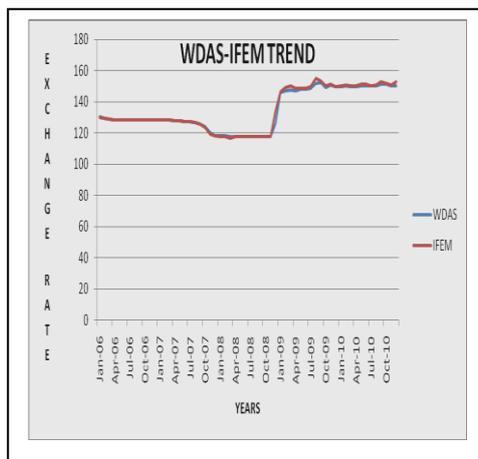


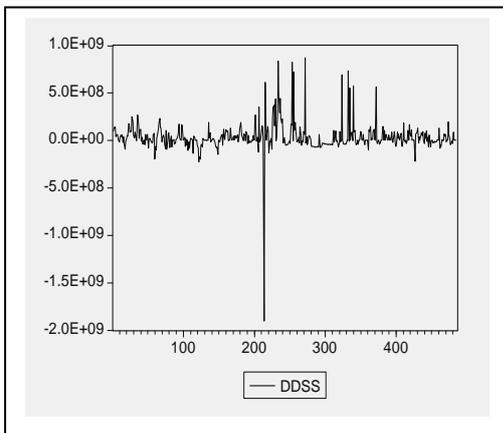
Figure 9: IFEM and Bureau de Change trend series.



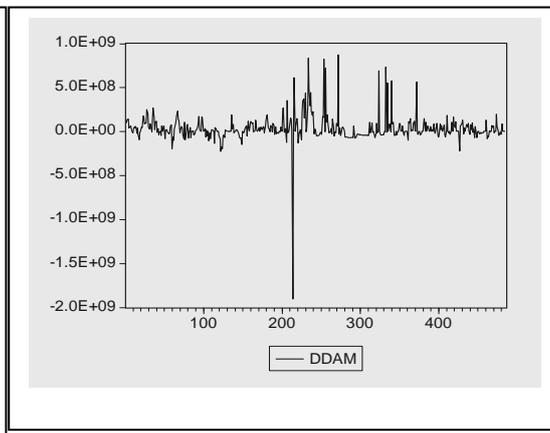
**Figure 10:** Bureau de Change and WDAS series trend.



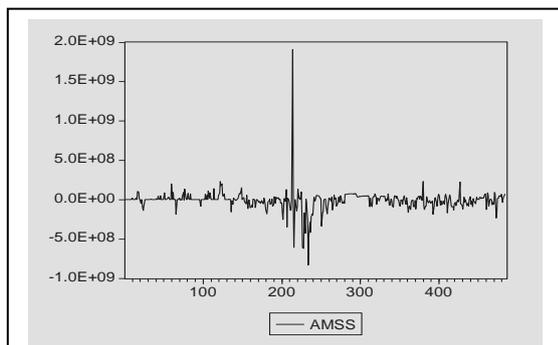
**Figure 11:** WDAS and IFEM series trend.



**Figure 12:** Demand-Sold(WDAS)



**Figure 13:** Demand-Amount (WDAS)



**Figure 14:** Amount-Sold(WDAS)

Figures 8 to 11 show trend of the series for various segments of the market. The trends have similar patterns which demonstrated some level of convergence in the difference segment of the market. However, figures 12 to 14 show that excess demand volatility still persists under the Wholesale Dutch Auction System. In other words, the Wholesale Dutch Auction System has not eliminated excess demand pressure that existed under the Retail Dutch Auction System. The oscillation showed that excess demand had been largely positive with a bit of negative trend thereby driving the force for the depreciation of the naira.

**Table 2:** Mean and standard deviation of the DAS series.

VARIABLE	MEAN	STANDARD DEVIATION
AMOUNT OFFERED(WDAS) In million \$	145.738	127.23
AMOUNT OFFERED(RDAS) In million \$	937.675	444.168
AMOUNT OFFERED(DAS) In million \$	124.415	106.88
SOLD(WDAS) In million \$	159.549	131.831
SOLD(RDAS) In million \$	974.784	309.78
SOLD(DAS) In million \$	133.755	107.161

DEMAND(WDAS) In million \$	178.918	157.481
DEMAND(RDAS) In million \$	113.275	431.424
DEMAND(DAS) In million \$	151.64	127.679
HIGHEST BID(WDAS)	134.39	13.36
HIGHEST BID(RDAS)	132.56	3.199
HIGHEST BID(DAS)	133.63	10.45
LOWEST BID(WDAS)	133.46	13.46
LOWEST BID(RDAS)	130.28	2.94
LOWEST BID(DAS)	132.14	10.57
MARGINAL RATE(WDAS)	133.92	13.4
MARGINAL RATE(RDAS)	130.79	3.096
MARGINAL RATE(DAS)	132.62	10.54
SUCCESSFUL BID(WDAS)	16.34	11.78
SUCCESSFUL BID(RDAS)	632.7	206.811
SUCCESSFUL BID(DAS)	272.4	331.96
UN-SUCCESSFUL BID(WDAS)	2.2	3.36
UN-SUCCESSFUL BID(RDAS)	151.7	223.55
UN-SUCCESSFUL BID(DAS)	64.33	161.61

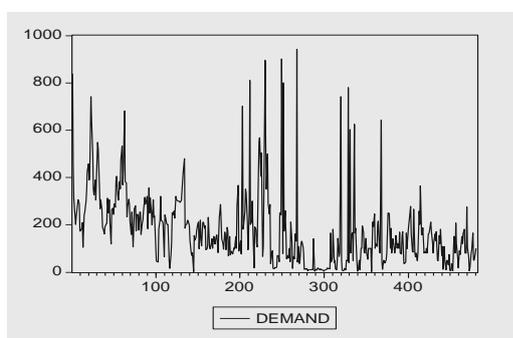
**Source:** *Computed by the Researcher.*

When standard deviations are compared in the two Phases (RDAS and WDAS) two pattern can be observed. The first pattern has five cases: Amount offered, Quantity sold, Quantity demanded, Successful and Unsuccessful bids all have higher standard deviation in the retail phase than in the wholesale phase of the auction system. This shows that demand was more volatile under Retail auction than in Wholesale auction which is not unconnected with the inexperience of the Authorized Dealers in the bidding process. Also, couple with the fact that the bidding process was largely manually done as at then and this cast doubt on the potent efficiency and transparency of the system. Furthermore, the higher standard deviation of successful bid and unsuccessful bid in the Retail phase of the auction is an

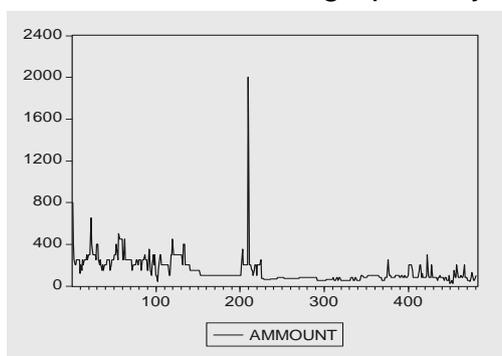
indication that speculative tendencies were higher in the Retail phase than in the Wholesale phase.

The second pattern has three cases: Highest bid, lowest bid and marginal rate. Standard deviations were higher under the Wholesale than in the Retail phase of the auction which showed that the rates were more unstable in the wholesale than in the retail which is not unconnected with the depreciation of the naira under the Wholesale as evident in the higher mean of the rates and coupled with the global economic meltdown and its consequent challenges.

Figures 15 to 24 demonstrated the series in the WDAS graphically.



**Figure 15:** Amount Offered series at WDAS.



**Figure 16:** Demand for WDAS series.

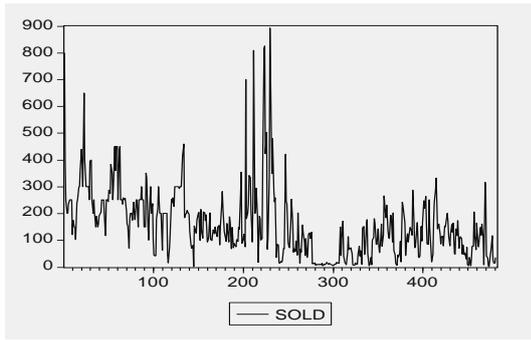


Figure 17: Quantity sold for WDAS series.

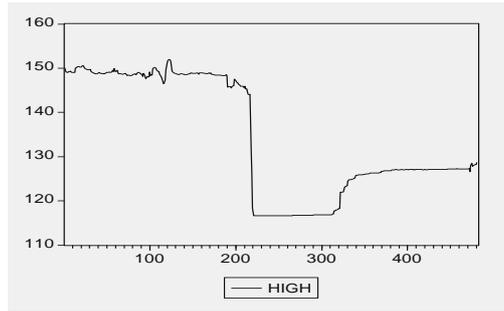


Figure 8: Highest bid rate for WDAS series.

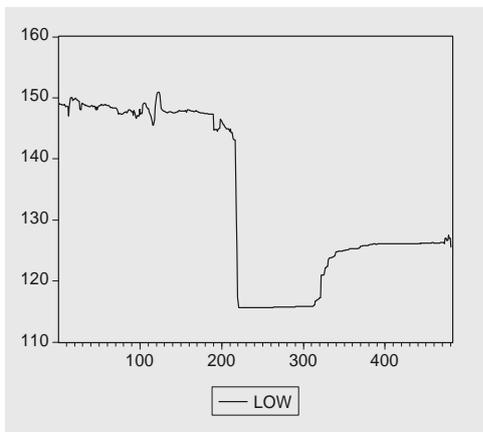


Figure 19: Lowest bid series for WDAS.

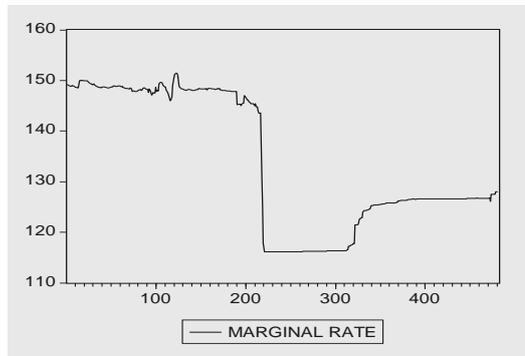
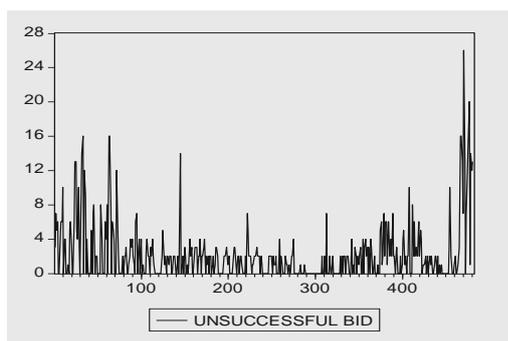
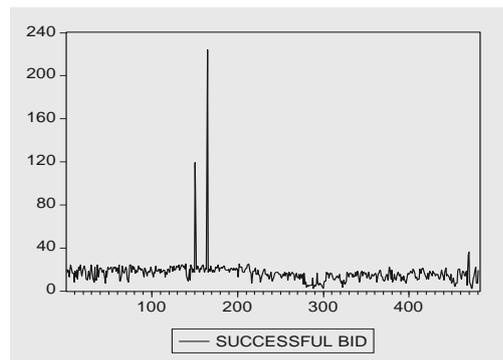


Figure 20: Marginal rate series for WDAS.



**Figure 21:** Successful bid series for WDAS



**Figure 22:** Unsuccessful bid for WDAS series.

The plot of the series exhibited two patterns; in the first phase, the marginal rate, highest bid and lowest bid follow similar trend which indicate that the rates have a band wagon movement. In the second phase, The Demand, Amount offered, Sold, Successful and Unsuccessful bid exhibit remarkable volatility in their trend plot. This implies instability and high speculative tendencies.

### Stability of the Exchange Rate

The following estimated model investigated volatility on marginal rate and demand under the WDAS.

#### Marginal Rate Model(WDAS)

$$MR_t = 0.338 - 4.45E-6D_t + 0.99MR_{t-1} \dots\dots\dots \text{eqn 28}$$

$$(1.77) \quad (-0.0038) \quad (74.4)$$

$$\sigma^2_t = 0.415 + 0.15\varepsilon^2_{t-1} + 0.6\sigma^2_{t-1} \dots\dots\dots \text{eqn 29}$$

$$(2.24) \quad (1.20) \quad (3.44)$$

**Marginal Rate Model(DAS)**

$$MR_t = 0.379 - 1.02E-10D_t + 0.99MR_{t-1}$$

.....eqn 30

$$\sigma_t^2 = 0.31 + 0.15\varepsilon_{t-1}^2 + 0.6\sigma_{t-1}^2$$

.....eqn 31

(2.89)      (2.90)      (4.56)

**Demand Model**

$$DD_t = 30.25 - 4.31 MR_{t-1} + 0.74DD_{t-1} + 0.16SB_{t-1} + \varepsilon_t$$

.....eqn 30

$$\sigma_t^2 = 241 + 0.16 \varepsilon_{t-1}^2 + 0.83\sigma_{t-1}^2$$

.....eqn31

(1.29    (1.88)      (11.49)

The sum of the ARCH and GARCH co-efficient ( $\alpha+\beta$ ) in the above three equations are close to one indicating volatility clustering was persistent. This implies that the introduction of WDAS has not eliminated volatility of demand in the foreign exchange market which in turn has effect on the volatility of exchange rate. This outcome is consistent with (Auwal, 2006), who found persistent volatility for both demand and marginal rate model under the Retail Dutch Auction System. The result is also in corroboration with Charles,(2006) and Obadan,(2006) who found that the exchange rate was unstable under the Retail Dutch Auction System.

**Summary**

The outcome of the study suggests that WDAS has not eliminated excess demand pressure, speculative practices and distortion. To this effect, exchange rate remains volatile under WDAS phase of the auction. The switch from Retail to Wholesale had no impact on the exchange rate. Perhaps, this explains why exchange rate remains unstable under WDAS as well. The introduction of WDAS has led to a sustained convergence of the rates among the

various segments of the market. This may be due to introduction of direct sales to BDC, allowing the transfer of forex bought at the auction to the IFEM and increase in BTA and PTA from \$2,500.00 and \$2,000.00 per annum to \$5,000.00 and \$4,000.00 per quarter.

Quantity demand, successful and unsuccessful bids, all have higher standard deviations in Retail than in Wholesale phase of the auction. This implies that demand was more volatile in the retail phase than in the wholesale. Also, higher standard deviation of successful and unsuccessful bids in the Retail phase indicates that speculative tendencies were higher in the Retail than in the Wholesale phase of the auction. The higher standard deviation of highest bids, lowest bids and marginal rate in the wholesale than in the Retail phase indicates that the rates were more volatile in the Wholesale than in the Retail phase. The spread of the market rates had higher mean and standard deviation in the Retail than in the Wholesale phase which indicates that speculative tendencies were higher under the Retail than in the Wholesale.

### **Recommendation**

Based on the findings of the study, the following recommendations are made; firstly, the CBN should use monetary policy more proactively to stimulate the domestic production base of the economy so that Nigeria can import less and export more thereby reducing the excess forex demand pressure that affects the stability of the Naira. Secondly, the CBN should create a more market determined template for foreign exchange determination by devolving more of its monopoly power of foreign exchange supply. Thirdly, CBN foreign exchange policy shift should be followed-up by timely analysis of its efficacy in yielding result.

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