

***AN EVALUATION OF THE RE-INTRODUCED DUTCH
AUCTION SYSTEM AS A MEANS OF DETERMINING
A REALISTIC AND STABLE VALUE OF THE NAIRA***

By

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A THESIS SUBMITTED TO THE POSTGRADUATE SCHOOL IN
PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE AWARD
OF THE DEGREE OF MASTER OF SCIENCE IN ECONOMICS
DEPARTMENT OF ECONOMICS
FACULTY OF SOCIAL SCIENCE
AHMADU BELLO UNIVERSITY
ZARIA.

FEBRUARY, 2006

DECLARATION

I declare that the work in the thesis entitled “ An Evaluation of the Re-introduced Dutch Auction System as a Means of Determining a Realistic and Stable Value of the Naira” has been performed by me in the Department of Economics under the Supervision of Dr. Abdul-Ganiyu Garba and Professor Mike Kwanashie .The information derived from the literature has been duly acknowledged in the text and a list of references provided. No part of this thesis was previously presented for another degree or diploma at any university.

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CERTIFICATION

This thesis entitled “ AN EVALUATION OF THE RE-INTRODUCED DUTCH AUCTION SYSTEM AS A MEANS OF DETERMINING A REALISTIC AND STABLE VALUE OF THE NAIRA” by AUWAL Umar meets the regulations governing the award of the degree of Master of Science of Ahmadu Bello University,Zaria-Nigeria and is approved for its contribution to knowledge and literary presentation.

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ACKNOWLEDGMENTS

Alhamdulillah! First, I would like to thank my mother (*Hauwa'u*) for encouraging me to apply for the M.Sc. program at *A.B.U-Zaria* and for supporting me throughout all these years both spiritually and financially, my dad *Umar Muhammad* and My cousin Hajiya *A'isha Fada* and her husband *S.H.Adamu* for explaining the benefits and essence of a master's degree and for telling me what to expect from graduate school.

Special thanks to my co-supervisor, *Dr. Abdul-Ganiyu Garba* for showing me every facet of the world; for teaching me how to do research properly and for guiding me along as if I were his beloved son; and for having confidence in me and patience in my sluggish progress; and for showing me how little I knew on just about anything!. I would also like to thank my Minor supervisor, *Professor Mike Kwanashie* for his confidence in me and guidance.

Special thanks to my sisters *Murjanatu, A'isha* and *Maryam* and My brothers *Kabir* and *late Bashir* for taking care of my Mother during my absence in the house. I would like to thank all the graduate students whom I got to know, more specifically *Malam Auwalu Haruna* (My *Boss*) for showing me how much one can do in a day and for showing me the dark side of the world. *Jamilu Jiddan Yusuf (JJY)*, *Bello Idris Bello(Prince)*, *Muhammad Kabir Abubakar(MK)*, *Bello Abdullahi(Engr.)*, and *Musa Isa (Tailor)*, *Umar.A.Ahmed(Babana)*, *Muhammad Auwal Muhammad(MAMSY)* *Isa Maikudi*, *Sani Dandawo* , and *Asiya Hamdana* for their advice and financial support, *Josiah* and *Mallam Lawal K/Sauri* for showing me Joy, *Jahun* for demonstrating to me that "it's never too late", *Ibrahim Bakari* for sharing his thought "it doesn't have to be good, it just has to be done", for reminding me that there is a place called Mission. Thank you all!

How can I end this acknowledgment without thanking my Fiancée *Sa'adatu Muhammad Sabo* for patiently and quietly helping and supporting me to accomplish what I wanted to do? I thank you.

ABSTRACT

In 2002, the Central Bank Nigeria (CBN) re-introduced the Dutch Auction System (DAS) which was earlier introduced in 1987 and 1990 in Nigeria to eliminate distortions, speculation, opportunism and sharp practices. It appears that between 1986 and 2002 in spite of the various exchange rate management systems, the goals of efficient and stable exchange rate were elusive. This study uses data on 354 DAS sessions to evaluate the effects of the DAS in generating efficiency and stability of the values of the Naira. Trend Analysis and ADF tests were used to evaluate stochastic properties of the DAS series. Foreign exchange spreads were estimated and their trend evaluated to determine effects on efficiency. GARCH models of Demand and Marginal Price were estimated to analyze stability. The study found that the DAS series exhibited different patterns of volatility, while the DAS spread declined, the parallel exchange rate premium increased and both demand and marginal rate were volatile. Thus, the DAS seems not to have made the foreign exchange more efficient or stable. Since March, 2006 the Central Bank of Nigeria has replaced the old retail DAS in favor of the wholesale DAS for the achievement of efficiency and stability of the Naira exchange rate. However, while the exchange rate spread has declined, this seems to have been brought about by increase in supply of foreign exchange by the CBN. It is not clear if the seeming convergence in exchange rate is sustainable. The study therefore, recommends further investigation into the recent phase of the DAS, focusing on the problems of sustainability.

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CHAPTER ONE

INTRODUCTION.

The Dutch Auction System (DAS) has been used widely by developing countries in the 1980s and 1990s as part of the adjustment programme. The DAS was used as a means of allocating foreign exchange efficiently as well as for determining realistic value of national currency. Countries that have adopted the DAS to ration foreign currency and to determine realistic values of their currencies in the 1980s and 1990s include Ghana (1987) , Nigeria (1987,1990) , Uganda (January,1992-October,1993),and Ethiopia (1993).

An auction system as a rationing device is usually justified under situations of asymmetries of information such as when sellers have imperfect information about the prices buyers are willing to pay for their products (Jehle and Reny , 2001).In an exchange market situation with a Central Bank exercising monopoly powers in the market for foreign exchange, auctioning as a rationing device may appear realistic.

However, by its essence, a monopoly situation may not give rise to efficiency. The experience in Ghana , Uganda-that established exchange rate auction , which primarily engaged in transitional medium towards a unified interbank market, and to obtain a realistic exchange rates, is that the countries have some notable success ; but equally in Nigeria have experienced damaging speculative episodes and policy reversal. The rather mixed outcomes in these countries for unification and stabilization of the exchange rate were discussed in

Aron and Elbadawi, (1994). On the other hand, Ethiopia has also achieved a fairly stable depreciation from what was initially a very thin market (Aron, 1998).

In the main stream economic literature, a monopolist have an incentive to be productively efficient because its profit will be maximized when they adopt the lowest – cost method that can be used to produce whatever level of output they choose. But the monopoly will choose a level of output that is too low to achieve allocative efficiency¹, because the amount that buyers pay for the last unit of good exceeds the opportunity cost of producing it (Lipsey and Chrystal, 1996, Wonnacott and Wonnacott, 1990). Therefore monopoly is allocatively inefficient because the monopolist's price always exceeds its marginal cost. This has important policy implication for the expectation that a monopoly situation would generate a realistic or efficient exchange rate.

1.1 STATEMENT OF THE RESEARCH PROBLEM.

In 1986, Nigeria introduced the Second Tier Foreign Exchange Market (SFEM). The objectives of SFEM include: (i) to enable the Naira to find its true value(ii) to achieve a more optimal allocation of foreign exchange(iii) to gradually eliminate the parallel market (iv)and to eliminate the vices associated with the import license regime (CBN; 1986). The policy was also to encourage increase in domestic output and export revenue, curtails import and reduced exchange rate volatility. In essence, the operation of the reform policy was expected to make foreign exchange management less costly (Garba; 1997).

Since the shift to a market-determined exchange rate regime, Nigeria has used several exchange rate management strategies. The strategies include-the Second Tier Foreign Exchange Market (SFEM), 1986, the unified official market in 1987, the

¹ *That is the monopolist chooses an output at which the price charged is greater than the marginal cost which violates the conditions for allocative efficiency.*

autonomous foreign exchange market (AFEM) in 1995, and the interbank foreign exchange market (IFEM) in 1999. In 2002, the Central Bank Nigeria (CBN) re-introduced the Dutch Auction System (DAS) which was earlier introduced in 1987 and 1990 in Nigeria. According to Sanusi (2002), the Dutch Auction System (DAS) was re-introduced to eliminate distortions, speculation, opportunism and sharp practices.

It appears that between 1986 and 2002 in spite of the various exchange rate management systems, the goals of efficient and stable exchange rate were elusive. Studies have suggested several reasons for the elusiveness. Garba (1992) suggested that despite the Nigerian forex reform of 1986, a multiple exchange rate² regime prevailed in Nigeria. The persistent rise in exchange rates forced the Central Bank of Nigeria (CBN) on 5 March 1992 to “deregulate” the forex market by merging the official rates with those of the parallel market (PM) and Bureau de change (BDC). The study offered two immediate causes of the Central Bank action; (a) persistent depreciation of the Naira, as well as (b) the persistent rise in the gap between the three exchange rates.

Peterside (1993) offered that, Nigeria had operated a three tier exchange rate system—the official rate, the export proceeds exchange rate, and the free fund³. He suggested that, Nigerian forex market deviated from the competitive ideals given the persistence of the multiple exchange rate regimes and the increases in the gap between the rates. It was the persistence of deviations from the competitive market models that recommended the 1986 reforms. Obadan (1994) shows that, since the introduction of the market –based exchange rate system in 1986, the Naira exchange rate exhibited the feature of continuous

² *The multiple exchange rates has two features. First, there is no tendency towards exchange rate convergence across the segments of the forex markets. Second, the Naira/other currencies exchange has been raising since the reform began.*

³ *That is the Bureaus de change/parallel market rate*

instability reflected in a unidirectional depreciation in both the official and parallel markets. For instance, between September 1986 and October,1993 the Official exchange rate depreciated by about 93.0 percent with the exchange rate moving from ₦1.55 : \$1.00 in September 1986 to ₦21.99 : \$1.00 in October,1993.

Unlike Garba (1992), Peterside (1993) and Obadan (1994), Azam's (1991) study focuses on the parallel markets at two of Nigeria's borders: Nigeria-Niger and Nigeria - Cameroon. In the study, the market exchange rates for the Naira in the two markets were unified by arbitrage. Arbitrage and exchange rate unification were possible because there was no Central Bank intervention in the local sub-markets nor was there an effective barrier to movement of bank notes between the borders.

In spite of the insights by the studies and the failures of the DAS before, the Central Bank Nigeria expected that the DAS re-introduced on 22 July, 2002 would

- 1) minimize distortions, speculations, opportunism and sharp practices;
- 2) reduce demand for foreign exchange; and
- 3) reduce capital flight.

The expectation of the Central Bank of Nigeria does not appear to be supported by Nigerian experience with the Dutch Auction System. The divergence between experience and expectations of the Central Bank of Nigeria and the importance of the exchange rate in determining real and monetary variables makes an investigation of the recent phase of official exchange rate policy imperative.

1.2 RESEARCH OBJECTIVES.

The study has the broad objective of evaluating the effects of the DAS on the exchange rate of the Naira in terms of (1) efficiency and (2) stability. The specific objectives are:

- 1) analyze the stochastic properties of demand, supply, prices, successes and failures at the DAS.
- 2) to estimate and analyze the exchange rate spread.
- 3) to analyze the effects of the DAS on the exchange rate of the Naira.
- 4) to draw policy inferences.

1.3 JUSTIFICATION OF THE STUDY.

Getting the exchange rate right is essential for economic stability and growth in developing countries (Zhang, 2002 and Aziz and Caramazza, 1998). This is especially true for Nigeria that is heavily dependent on imports, and because of the overwhelming demand for the foreign exchange, which has caused a persistent depreciation of the Naira since the reforms in 1986 (Garba, 1997).

Though the exchange rate stability was the main objective of the introduction of Dutch auction system in 1987 and 1990 in Nigeria, but the instabilities in the auction market persisted and a realistic and a stable value of the naira was not achieved. This study is expected to evaluate the re-introduced Dutch Auction System to determine the effects on the stability of the Naira as well as the efficiency in the allocation of the Naira. The result of the study would be relevant to the success of exchange rate policy and, to the stability of macroeconomic management in Nigeria.

1.4 HYPOTHESIS/RESEARCH QUESTIONS

The optimism of the Central Bank of Nigeria appears to be based on three hypotheses. First, that the DAS would minimize distortions, speculations, opportunism and sharp practices. Second, that the DAS would reduce demand for foreign exchange. Third, the DAS would reduce capital flight. The hypotheses are claims. Therefore, empirical tests of the hypotheses are necessary to analyze the possibility of a fulfillment of the

expectations of the Central Bank Nigeria. The investigation is significant given the importance of the exchange rate to external, internal and fiscal balance. The validity of the hypothesis would have direct effects on the efficiency and stability of the exchange rate. Therefore, the three hypothesis are reduced to two hypotheses that are the central questions of this study. First, the DAS would lead to efficient or realistic value of the Naira. Second, the DAS would lead to stable value of the Naira in terms of foreign currencies.

1.5 SCOPE AND LIMITATIONS

The sample for the study is the period from July,2002 to March ,2006 for bi-weekly data, while the monthly data covered the period 2000-2004. Data of all kinds are limited to the websites.

1.6 ORGANIZATION OF THE STUDY

The study is organized as follows-chapter one is the general Introduction and it contains background to the study, Statement of the Research Problems, the Research Objectives, Justification for the Study, chapter two covers both the theoretical and empirical literature, chapter three is the presentation of the methodology while chapter four is the presentation, analysis and interpretation of the results. The summary, conclusion and recommendation are presented in chapter five. The references are to appear at the end.

CHAPTER TWO

LITERATURE REVIEW/ THEORETICAL FRAMEWORK

2.1 REVIEW OF SOME CONCEPTS

2.1.1 THE EXCHANGE RATE.

The rate of exchange is the price in local currency of one unit of foreign currency (Henderson and Pool, 1991). It is a relative price that measures the worth of a domestic currency in terms of another currency. Buying or selling foreign currency in order to profit from sudden changes in the rate of exchange is known as arbitrage. The chief demand for foreign exchange within a country comes from importers of foreign goods, purchasers of foreign securities, government agencies purchasing goods and services abroad, and travelers (<http://www.answers.com/topic/foreign-exchange>).

In order to allow for measurability economists use three separate concepts : (a) the nominal rate of exchange; the rate of exchange for any one currency as quoted against any other currency , (b) the effective exchange rate ; a measure which takes into account the fact that a particular currency varies differently against each of the other currencies , (c) the real exchange rate ; designed to measure the rate at which home goods exchange for goods from other countries, rather than the rate which the currencies themselves are traded⁴(Griffith and Wall,1995).

2.1.2 EXCHANGE RATE MANAGEMENT

⁴ It is thus essentially a measure of competitiveness.

Exchange Rate Management is the way by which a country determines how its currency should be related to the other currencies in the world (Phillips et'al, 1983). It is the operationalization of the designed policy in collaboration with other complementary measures like fiscal and monetary policies, as well as the appraisal of the system continuously to determine developments that should elicit mild policy responses towards a new policy direction. The basic objectives of the exchange rate Management is the attainment of the goals of exchange rate policy ⁵(Obaseki, 2001). Exchange rates may be managed using market and non-market devices. When the exchange rate is managed through the exchange market, it generates a market determined rates (Rybczynski, 1987). However, if managed administratively, the exchange rate tends to be fixed (Williamson, 1986). In recent times, exchange rate has been determined using auction (<http://www.cenbank.org>)

2.1.3 AUCTION

An auction is the process of buying and selling things by offering them up for bid, taking bids, and then selling the item to the highest bidder. In economic theory an auction is a method for determining the value of a commodity that has an undetermined or variable price. In some cases, there is a minimum or *reserve price*; if the bidding does not reach the minimum, there is no sale⁶. In the context of auctions, a bid is an offered price⁷. Several auction formats have emerged since the first auction occurred in Babylon in about 500 B.C (Rafaeli and Noy, 2002). There are four auction formats: English Auction, Dutch Auction,

⁵ *The goals of macroeconomic policy are controlling inflation, maintaining a stable and competitive real exchange rate, exercising fiscal prudence, and operating efficient capital market [a key link between a country and the rest of the world, both in goods and assets markets, is the exchange rate] (Dornburg and McDougall, 1976).*

⁶ *But the person who puts the item up for auction still owes a fee to the auctioneer*
(<http://en.wikipedia.org/wiki/Auction>)

⁷ <http://dictionary.cambridge.org/define.asp?key> and <http://www.etymonline.com/index.php?search>

First – price sealed- Bid Auction and Vickrey Auction(Engelbrechtsen and Carlson, 2000).

2.1.3.1 ENGLISH AUCTION

The English auction is known also as the open-outcry auction or the ascending-price auction. It is used commonly to sell art, wine and numerous other goods. According to Engelbrechtsen and Carlson, (2000), Paul Milgrom defines the English auction in the following way. "Here the auctioneer begins with the lowest acceptable price--the reserve price-- and proceeds to solicit successively higher bids from the customers until no one will increase the bid.

2.1.3.2 DUTCH AUCTION

The descending-price auction, commonly known in academic literature as the Dutch auction, uses an open format rather than a sealed-bid method. The Dutch auction was developed in the Netherlands to auction goods with a limited lifetime. It is also known as the descending- price auctions⁸, the auctioneer starts with a high initial price and progressively lowers it. The price is posted and known to all participants. The first bidder to indicate a willingness to take the object at the prevailing price is the winner (Rafaeli and Noy, 2004).

The Dutch auction is referred to as non-discriminative auction in the literature because the term Dutch auction is also widely used to describe auction where the auctioneer starts with a high price and bids the price lower while buyers have the option of buying the

⁸*Its two main ingredients are "time period" and "a descending price"*

items at any time at the current bid price. Here the winning bidders pay the price bid by the highest non-winning bidder⁹ (Shang and ling, 2004).

Recently, the Dutch Auction System is popularly used as a bidding method on internet auction sites that claim to sell everything from a new heart to diamonds (Aluko, 2004). In this format the seller places one or more identical items on sell at the same time listing a minimum required price. Bids are ranked in order of prices, then quantities and lastly time. These auctions are timed events usually lasting either hours or days. Bidders submit the number of items they want and how much their bid per item is. The final selling price in this type of Dutch auction is determined by the lowest of the winning bids¹⁰.

2.1.3.3 FIRST – PRICE SEALED- BID AUCTION

The First – Price Sealed- Bid auction has the main characteristic of not being an open- cry auction, like the English or Dutch auction. It has two different phases: a bidding phase and a resolution phase. A bidding phase is when the bids are collected; each bidder submits his bid, which is based on his own valuation. The bidder is thus totally ignorant of all the other bids that have been submitted. In the resolution phase all the bids are opened and sorted from the highest to the lowest bid. If it is only one item that is auctioned, the highest bid will be the winning bid. If multiple items of the same good are auctioned, the items are awarded to the highest bids until no more items are left. This is called a “Discriminatory sealed- bid Auction”. Since not all the bidders pay the same price (Engelbrechtsen and Carlson 2000).

2.1.3.4 VICKREY AUCTION

⁹ This is stated to create a disincentive for speculative bidding and encourage the bidders to submit bids reflecting the true value of the item being auctioned and is suggested for pricing a public utility services(http://www.Isoc.org/inet98/proceedings/3b/3b_3.htm).

¹⁰ http://www.thisdayonline.com/archieve/2002/08/17/20020817_bup10.html

William Vickrey developed the Vickrey auction¹¹ and it is also called the uniformed second – price auction. The bids are sealed and each bidder bids from his own expectation, ignorant of all the other bids. Unlike the First – Price Sealed – Bid Auction, the winning bidder will pay the price of the second highest bid, which is the same as the highest unsuccessful bid. Thus, the winner pays less than what he has bidden. For multiple units of the same item, all the winning bidders will pay the same price¹². From a seller's perspective, the Vickrey auction with second – price rule generate more income for the seller than the First – Price Sealed – Bid auction, because in Vickrey auction the bidder will adjust his bids upward, since he knows that he only needs to pay the second highest price. Therefore, the auction bids will better reflect the bidder's valuation of the item in a Vickrey auction than in a First- Price Sealed- Bid auction (Engelbrechtsen and Carlson, 2000).

2.2 EXCHANGE RATE MANAGEMENT THEORIES

2.2.1 EXCHANGE RATE REGIME

An exchange rate regime is a description of the conditions under which national governments allow exchange rates to be determined. The exchange rate regime is the way a country manages its currency in respect to foreign currencies and the foreign exchange market (Beggs et al, 1994). The currency market or foreign exchange market is the market where one currency is traded for another. It is one of the largest markets in the world. By some estimates, about \$2 trillion worth of currency changes hands every day. The basic types of exchange rate regimes are a *floating* exchange rate, where the market dictates the movements of the exchange rate, a *pegged float*, where the central bank keeps the rate from

¹¹It has been used for credit refinancing in Czechoslovakia and for foreign exchange auctions in Guinea, Nigeria, and Uganda. The U.S Treasury department is looking at this auction format for issuing national debt

¹²This price will be the highest unsuccessful bid.

deviating too far from a target band or value, and the *pegged* exchange rate, which ties the currency to another currency¹³.

2.2.2 FIXED EXCHANGE RATE SYSTEM

Under fixed exchange rates all exchange transactions takes place at the rate that is determined by the monetary authority. It may fix the exchange rate by legislation or by intervention in the currency markets. It may buy or sell currencies according to the needs of the country or may take policy decision to appreciate or depreciate the national currency (Jhingan, 2005). Under this system, countries maintained the value of their currencies in “fixed” relation to the value of some other reserve currency by standing ready to sell or by a reserve currency at constant prices (Ott, 1975). The rates are not permitted to fluctuate freely on the market or to respond to daily changes in demand and supply. Exchange variations, triggered by changes in the demand and/or supply are permitted only within the band (or spread). It’s the central banks maintain the band. In a fixed exchange rate regime, national government agree to maintain the convertibility¹⁴ of their currency at a fixed exchange rate. It meets an excess supply by running down foreign currency reserves in order to demand for the currency. Conversely, any excess demand for a currency at a fixed exchange rate is met by increasing the foreign exchange reserves and supplying that currency to the market. Since the central bank is committed to defending the fixed exchange rate at equilibrium, and the currency is convertible, the excess demand and

¹³ <http://www.answers.com/main/ntquery?>

¹⁴ *A currency in convertible if the government acting through the central bank, agrees to buy or sell as much of the currency as people wish to trade at the fixed exchange rate.*

supply will be satisfied by central bank through the use of foreign exchange reserves¹⁵ (Beggs et'al, 1994).

In a fixed exchange rate regime, a discrete official increase in the otherwise fixed par value of a currency is called a “revaluation”. On the other hand, a discrete official reduction in the otherwise fixed par value of currency is called a “devaluation”, in this case, with sluggish price adjustment, its immediate effect is to increase competitiveness and aggregate demand (Spencer, 1978). In the long run, devaluation is unlikely to have much effect. Changing one nominal variable merely leads to offsetting changes in other nominal variables. In passing on higher import prices and seeking cost-of-living wage increases, firms and workers will increase domestic prices and wages to offset the competitive advantage of devaluation. But devaluation could speed up the adjustment process when a shock requires an adjustment in competitiveness to restore internal and external balance (Beggs et'al, 1994).

FIXED EXCHANGE RATE AS A POLICY ANCHOR

The conditions under which a fixed exchange rate can be maintained impose financial constraints on monetary and fiscal policies, because it tied the hand of the authorities to enable them to maintain the balance of payment. (Krugman, 1979). Therefore, adopting a fixed exchange regime can provide an unambiguous objective “anchor” for economic policy, which helps to establish the credibility of the policy for price stability. Under fixed regimes, monetary policy must be subordinated to maintain a fixed rate. In this case, the growth rate of real output plus the world inflation rate determine the domestic money growth rate. In order to defend the fixed parity, a minimum fraction of the domestic

¹⁵ *The foreign exchange reserves are the stock of foreign currency held by the domestic central bank.*

money supply must be backed by foreign exchange reserves. So, domestic credit can not permanently exceed nominal money demand. Fiscal policy, on the other hand, which attempts to influence the aggregate demand by altering government expenditure and/or revenue (Lipsey and Christal,1996) should also be kept consistent with the fixed regime. The central bank can also resort to external borrowing to replenish reserves and sustain the fixed exchange rate. But this process can not continue permanently. The government can only borrow when it is perceived to be financially solvent¹⁶ (Zhang: 2002).

Therefore, a fixed exchange rate regime imposes fiscal discipline that requires the government's primary surpluses satisfies an inter-temporal budget constraint. The fixed exchange rate is said to be desirable also because it can serve as an anchor and help the authorities to establish credibility in pursuing non-inflationary policies ¹⁷(Aziz and Caramazza, 1998).

MONETARY POLICY UNDER FIXED EXCHANGE RATES

Monetary policy has a general influence on the economy – on output, inflation, interest rates, and other economy – wide variables (Henderson and Pool, 1991). Therefore, when price adjustment is sluggish, increases in the nominal money supply increases the real money supply in the short- run and tends to reduce domestic interest rates (Beggs et'al, 1994). It will not only lead to a reduction in interests but also to a further increase in income (Marin, 1992), With perfect capital mobility, this leads to a capital account¹⁸ outflow until the domestic money supply has been reduced to its original level and interest

¹⁶ *Meaning that the present value of the anticipated primary surplus plus seignorage is at least as large as the present value of the public sector's net debt.*

¹⁷ *Such credibility could also be gained by other means, such as announcing inflation and monetary targets, but the exchange rate is the most desirable instrument.*

¹⁸ *The records of international transactions in financial assets as in the case of balance of payments.*

rates have returned to world levels. Hence domestic policy is powerless in a fixed exchange rate regime when capital mobility is perfect (Beggs et'al, 1994).

Perfect capital mobility arises when there is no artificial barriers to the movement of financial capital and investors regard domestic and foreign securities (risk less) as perfect substitutes(Lipsey and Christal,1996). This means that the government can not fix independent target for both the money supply and the exchange rate. Under fixed exchange rates, the government has to accept the domestic money supply that makes domestic and foreign interest rates equal. (Beggs et'al, 1994).

FISCAL POLICY UNDER FIXED EXCHANGE RATES

In an open economy, capital account flows peg interest rates at world levels and prevent induced changes in interest rates. Hence, in the short-run a fiscal expansion has a larger effect in an open economy with a fixed exchange rate. In the long run, higher aggregate demand bids up prices and wages, reducing competitiveness and net export. This process will continue until internal balance¹⁹ is restored (Beggs et'al, 1994). However, this will not be a point of external balance, when the value of the balance of payment is equal to some target level because there will be a current account deficit in the long run (Lipsey and Christal, 1996).

Infact at a given exchange rate, a given level of world income and a given level of world interest rates, there is a unique fiscal policy compatible with both internal and external balance in the long run (Marin, 1992). The domestic price level can adjust to secure the level of competitiveness that makes imports equal export when the domestic economy is at full employment. Internal balance then requires that potential output Y equals domestic absorption ($C + I + G$) when interest rates are at world levels. Given

¹⁹ A country is in internal balance when aggregate demand is at the full employment level.

private sector demands for consumptions an investment, this determines the fiscal policy that the government will have to implement if the economy is to attain both internal and external balances. (Begg et'al, 1994)

2.2.2 FLEXIBLE EXCHANGE RATE SYSTEM

When government are unable to fix exchange rates by default the system becomes one of flexible rates(Henderson and Pool, 1991).Flexible exchange rates leave currencies uncontrolled and free to fluctuate according to supply and demand (Spencer, 1978). Thus it is a system whereby the exchange rate is allowed to fluctuate when a balance of payment deficit or surplus exists ; market would be cleared and the balance of payments automatically adjusted(Södersten, 1970). Under flexible exchange rates, the exchange rates fluctuates in response to changes in the supply of and demand for foreign exchange(Ott,1975 and Jhingan, 2005). If the price is free to respond to changes in supply and demand, the balance of payment equilibrium will always be maintained(Smith and Teigen,1974).

Under the flexible (floating) exchange rate regime, a fall in the market price (the exchange rate value) of a currency is called a “depreciation” of that currency, while a rise in the market price of a currency is called an” appreciation” of that currency. It is not necessary to adopt the extreme regime of pure floating. “dirty floating” describes a regime in which intervention is used to offset larger and rapid shift in supply or demand schedules in the short-run, but where the exchange rate is gradually allowed to find its equilibrium level in the long run (Begg e'tal, 1994).

MONETARY AND FISCAL POLICY UNDER FLEXIBLE EXCHANGE RATES

Under the floating exchange rate, monetary policy is a powerful short-term tool. Under a monetary target, a reduction in the money supply increases domestic interest rates

and leads to a sharp appreciation of the exchange rate, which overshoots its long run level. The fall in competitiveness, until domestic prices and wages adjust, sharply reduces aggregate demand in the short run (Zhang, 2000).

Whereas the effect of interest rate changes on the exchange rate and competitiveness makes monetary policy a more powerful tool with which to influence aggregate demand under floating exchange rates, the effect of interest rate changes on the exchange rate reduces the short-term effectiveness of fiscal policy. The fiscal expansion increases interest rates and the exchanges rate, crowding out not merely domestic consumption and investment but also net exports (Begg e'tal, 1994).

ADVANTAGES OF FLEXIBLE EXCHANGE REGIME

More flexible exchange rate regimes are said to be more desirable for developing countries that exhibit greater capital account liberalization and an integrated capital market. Allowing the exchange rate to appreciate gradually to accommodate upward pressure would be a safer way to maintain long-run economic stability. With the onset of the crisis, a flexible regime would allow large adverse shocks to be more easily deflected or absorbed than a pegged exchange rate regime. Furthermore, a flexible exchange rate could affect expectations. As market participants are made aware of the fact that they must manage the risks associated with positive and negative fluctuations. Domestic financial institutions and business would be more precautionary in foreign currency borrowing and would seek to hedge the exposure to exchange risks. Furthermore, speculative short-term capital inflows as well as the likelihood of sharp corrections would be reduced (Zhang, 2002).

2.3 APPROACHES TO EXCHANGE RATE DETERMINATION

There are basically four approaches – the Absorption, Monetary, Portfolio and Elasticity to exchange rate determination²⁰. The absorption approach emphasizes changes in real domestic income as a determinant of a nation's exchange rate. Because it treats prices as constant, all variables are real²¹. The domestic absorption fall into four categories- Consumption(c), Investment (i), government (g), and import (m), that is:

$$a = c + i + g + m \text{ _____} (2.1)$$

On the other hand, the nation's real income(y) is equivalent to the expenditures on its output:

$$y = c + i + g + x \text{ _____} (2.2)$$

The x denotes export. During the early Bretton Wood era when the absorption model was developed, investment income and unilateral transfer flows were not very important. Trade flows, therefore, determined the current account²² balances. Hence, the current account (ca) was equivalent to:

$$Ca = x - m \text{ _____} (2.3)$$

Hence, for example, if exports exceed imports ($x > m$), the nation runs a current account surplus. The absorption approach hypothesized that a nation's current account balances is determined by the difference between real income and absorption, which can be written as:

$$y - a = (c + i + g + x) - (c + i + g + m) = x - m \text{ _____} (2.4)$$

$$y - a = Ca \text{ _____} (2.5)$$

The absorption approach is helpful in understanding a nation's external performance during contraction and expansion. It can also be used to examine the changes in income affect the

²⁰ See Jhingan, M.L (1997, 2005), Ricerca (2003), Marrewijk, (2005) and <http://www.econ.upm.edu.my/>

²¹ <http://www.econ.upm.edu.my/>

²² It is the records of international flows of goods, services, and transfer payments.

value of a nation's currency in an environment of flexible foreign exchange rate. From equation (2.4), $y - a = x - m$, If real income is rising faster than absorption, then export must be increasing relative to import. Hence, the nation's currency will generally appreciate²³. The monetary approach postulates that changes in a nation's exchange rate are a monetary phenomenon- exchange rate movement result from changes in money supply and demand. In a small country model, under fixed exchange rates, the spot rate (S) is not allowed to vary, the foreign exchange requirements (FER) must vary to maintain the parity value of the spot rate, and the BOP must adjust to any monetary disequilibrium (Jhingan,1997). On the other hand, under a flexible exchange rate regime, the foreign exchange requirement component of the monetary base does not change. The spot exchange rate(s) will adjust to eliminate any monetary disequilibrium. When there is an increase in domestic currency, money supply will exceed money demand. Therefore, the domestic currency must depreciate to balance money supply and money demand (Ricerca, 2003).

The portfolio approach expands the monetary approach by including other financial assets. It postulates that the exchange value is determined by the quantities of domestic money and domestic and foreign financial securities demanded and the quantities supplied. The basic assumptions of the portfolio approach are: (1) Individuals earn interest on securities they hold, but not on money; (2) Households have no incentive to hold the foreign currency. Hence, wealth (W) is distributed across money (M) holdings, domestic bonds (B), and foreign bonds (B*). A domestic household's stock of wealth is valued in the domestic currency (Ricerca, 2003). Given a spot exchange rate (S) expressed as domestic currency unit relative to foreign currency unit, a wealth identity can be expressed as:

²³ [http://www.tau.ac.il/~razin/Trade%20Balance,%20Current%20Account%](http://www.tau.ac.il/~razin/Trade%20Balance,%20Current%20Account%20and%20Exchange%20Rate%20Determination.pdf)

$$W = M + B + SB^* \text{ _____} (2.6)$$

The portfolio approach postulates that the value of a nation's currency is determined by the quantities of these assets supplied and the quantities demanded. In contrast to the monetary approach, other financial assets are as important as domestic money. Suppose the domestic monetary authorities increase the money supply, as the domestic money supply increases, the domestic interest rate falls. With a lower interest, households are no longer satisfied with their portfolio allocation, the demand for domestic bonds falls relative to other financial assets. Households shift out of domestic bonds, they substitute into domestic money and foreign bonds. Because of the increase in demand for foreign bonds, the demand for foreign currency rises. All other things constant, the increased demand for foreign currency causes the domestic currency to depreciate (Ricerca, 2003)

The elasticity approach emphasizes price changes as a determinant of a nation's balance of payments and exchange rate. It is helpful in understanding the different outcomes that might arise from the short to long-run. The exchange rate is an important price to an economy; when a nation's currency depreciates, domestic goods become relatively cheaper and the foreign goods relatively more expensive in the global market. Hence, we would expect exports to rise and imports to decline (Marrewijk, 2005).

The elasticity approach, therefore, considers the responsiveness of imports and exports to a change in the value of a nation's currency (Jhingan, 1997). For instance, if import demand is highly elastic, a depreciation of the domestic will cause a disproportional decline in the nation's imports. In the case of elasticity of foreign exchange supply and demand, a nation's supply of foreign exchange is dependent upon (among other things) its import demand and its demand for the foreign exchange is dependent upon its export

supply. An excess supply of foreign exchange is equivalent to a current account deficit while excess demand for foreign exchange is equivalent to a current account surplus. The current account is in balance when the quantity of foreign exchange supplied and the quantity demanded are equal (Marrewijk, 2005).

2.4. THE ROLE AND INFLUENCE OF EXCHANGE RATES IN THE ECONOMY

The exchange rate links a country's macro economy to the rest of the world through the assets market and the goods market. In the goods market, the exchange rate establishes linkages between prices in the home economy and the given prices in the world market. The higher the exchange rate, other things being equal, the higher the price of foreign goods in home currency²⁴. The linkage to the goods market can be formalised in terms of the real exchange rate, R.

$$R = \frac{P}{eP^*} \text{-----} (2.7)$$

The P is the domestic price level, e is the exchange rate, and P* is the foreign price level. The R measures competitiveness by showing the number of units of foreign goods required to buy one unit of domestic goods. The choice of an exchange rate regime can influence a country's competitiveness. Under the fixed exchange rate regime, pursuing inflation policy by the government is assumed to rise domestic prices and that show real appreciation of R. Therefore inflation under the fixed exchange rate is tantamount to declining competitions; that will lead to problem of financing a growing trade deficit. This raises the question of how a country should conduct its exchange rate policy. The first answer to this is- to avoid over-valuation or a loss of competitiveness (Dornbusch and Kuenzler, 1993).

²⁴ For a given level of domestic costs and prices, a higher exchange rate makes foreign goods level competitive in the home economy and makes the home economy's goods more competitive in the rest of the world

Concerning the exchange rate, a depreciation of the exchange rate tends to raise the domestic level of price²⁵. This is because, it directly raises the prices of imported goods in the home currency, but indirectly channels also exist: domestic firm can afford to raise their prices when competitor's price rise, and in the labour market, the workers may ask for wage increases when higher import prices raise their cost of living. Thus, exchange rate movements tie in very strongly with inflation policy. In attempting to avoid inflationary impact by the governments, they risk a loss in competitiveness. Often multiple exchange rates appear to be an answer because they allow a competitive real exchange rate for some goods without risking the inflationary impact of import price increases associated with depreciation. The impact on the budget is that, a government that buys foreign exchange at a high price from exporters and sells it at low price to importers, a budget deficit is inevitable. The budget deficit, in turn, needs to be financed by higher taxes or by inflationary money creation²⁶(Dornbusch and Kuenzler, 1993).

On the other hand, the asset market also has exchange rate linkage. Domestic wealth holders must choose how to hold their wealth²⁷. The choice among assets will depend on the trade-off between risk and return. One simple rule is clear; when foreign assets yield a higher return (in home currency) than domestic assets and are no more risky, then many domestic residents will shift sooner or later (probably sooner) into foreign assets. We can express the asset market linkage in terms of a critical condition for domestic interest rates. For investment in domestic currency denominated assets to be competitive, its interest rate,

²⁵ That is, it is inflationary.

²⁶ Thus, exchange rate regimes are also linked to inflation.

²⁷ They can hold real assets or claims on real assets. They can hold domestic financial assets, such as deposits at banks or government bonds; or they can hold a range of foreign assets from the deposit banks

i , must exceed the foreign currency interest rate, i^* , Plus the expected percentage rate of home currency depreciation, δ . In symbols,

$$i = i^* + \delta \text{ _____(2.8)}$$

Therefore, the issue for exchange rate policy becomes whether and how domestic and foreign asset markets might be segmented, or how the exchange rate policy that is chosen for trade can be separated from the exchange rate relevant for calculations of asset market profitability²⁸(Dornbusch and Kuenzler, 1993).

2.5 EXCHANGE RATE MANAGEMENT IN NIGERIA.

Given the centrality of foreign exchange in international economic transactions especially in a developing country like Nigeria, the management of scarce foreign exchange has, over the years, been a significant component of national economic management (Obadan, 1994)

2.5.1 Phase One (1970-1985)

After the first major change in 1962²⁹ in the Nigerian forex the unpegged the Nigerian pound from the pound sterling, there was also a second major change that occurred in the early 1970s. During this period Nigerian currency was decimalized and changed from the pound to the naira. This time, seemingly forgetting the wisdom of autonomy, it was fixed to the U.S. dollar. When the dollar was devalued in 1973, the value of the Naira depreciated. The depreciation persisted due to the persistence in the depreciation of the dollar. Consequently, at the end of 1973, the Nigerian government

²⁸ Capital controls or dual-exchange rate systems are a potential means of achieving this end.

²⁹ The change, through the 1962 act, defined the Nigerian pound in terms of gold, which meant that Nigeria could at any time decide on whatever adjustments needed to be made in the official rate between her currency and other currencies including the pound sterling(Garba, 1997)

decided to discontinue any direct relationship between the Naira and either the pound sterling or the U.S. dollar. This led in 1974/75 to the policy of progressive appreciation of the naira enhanced by the oil boom³⁰. The exchange rate stability was the main objective of the reform. The arrangement was therefore a mechanism, for dampening the effects of external exchange rate changes on domestic prices and balance of payments (Garba, 1997).

Nigeria accumulates sizable foreign reserves arising from the oil boom from about 1973 to late 1977, which made it possible for the fixed exchange rate policy to be managed through reserve movements. Official reserve depletion helped to meet private excess demand; however, there was a reluctance to devalue when the reserve later becomes too low to support the fixed exchange rate. To curb the situation, foreign exchange from the CBN was strictly rationed and controlled through an import licensing system. The problem was that when the level of reserves increases, the Naira appreciated, but it was never allowed to depreciate when the reserve level fell. This gave an impression that a continuous drain on the official reserves could sustain the fixed exchange rate regime. Subsequently, strict exchange control measures were adopted³¹(Garba, 1997).

These were supplemented by the establishment of the exchange control (anti-sabotage) decree of 1977, which set up tribunals to try forex offenders and the comprehensive import supervision scheme (CISS) in 1979. From 1980 to 1981, the degree of exchange control was reduced, largely due to improvement in the balance of payments brought about by positive developments in the international oil market. This policy reversal was also due to the difficulty associated with tight exchange control regulations. The

³⁰ *The Naira was pegged to a basket of the currencies of even of the Nigeria's major trading partners- United Kingdom, U.S.A, Germany, France, Japan, Switzerland and the Netherlands(Garba, 1997)*

³¹ *These exchange control measures include: reduction of consultancy and technical fees remittable to foreign consulting companies from 60% to 50%; reduction of business trips from 14 to 15 days maximum per trips; reduction of basic travel allowances to pilgrims and other travelers and so on*

relatively more liberal system of exchange controls in the early 1980s was mainly aimed at curbing rampant abuse and malpractices in the forex transaction such as over invoicing of import bills, smuggling of currencies and goods across the borders, and false documentation of import bills. The period between marked the last phase of the policy of exchange control in Nigeria. The stringent exchange control measure as in earlier periods was preceded by severe balance of payments pressures an economic stabilization act was passed in 1982 with the aim of correcting the balance of payment problems and the distortions in the domestic production and consumption pattern.. Despite the exchange control measures of the 1982 act, evidence indicates that the Nigerian external sector continued to experience problems, primarily due to developments in the international oil market that caused the price of oil to fall and forex earning to decline³².

In 1984, exchange control measures were even tighter, partly due to the growing external debt outstanding. Other restrictive measures were introduced in 1984 and 1985. This included regulatory measures such as the “Form M” registration, monitoring of import license use and matching the value of import licenses with the forex budget for imports etc. The forex was liberalized through the introduction of import licenses not valid for forex, by which imports financed through off-shore sources were allowed. The strict exchange control was maintained throughout 1985 to mid 1986 with some modifications in 1986. Exchange rate and foreign exchange management in the pre-reform period were government-determined. The formula for determining the exchange rate and foreign exchange allocation was influenced by the internal and external state of the Nigerian economy and the experience of policy makers. All the changes in policy are the consequences of these three factors (Garba, 1997).

³² See Garba, P.K. (1997) for the statistics

2.5.2 Phase Two (1986-2005)

Garba (1992, 1994) and Peterside (1993) suggested that a segmented foreign exchange market system evolved in Nigeria between 1986 and 1993. The official market in 1986 consisted of the First-tier and the Second tier³³ from September 1986. In April, 1987 the Dutch Auction System was introduced, and it used the marginal rate as the market exchange rate to July, 1987. In July, 1987 the dual exchange rate was jettisoned as the first and second tier foreign exchange segments were merged into an enlarged foreign exchange market (FEM) with a unified rate³⁴. When both markets merged to form the Foreign Exchange Market (FEM). The FEM co-existed with the parallel market and the autonomous market between December 1987 and December 1988. Subsequently, the FEM and the autonomous market merged to form the interbank foreign exchange market (IFEM) in August 1989 (CBN, 2003).

The IFEM co-existed with the forex bureaus which came into being in August 1989 and the parallel market, which preceded all the other market types. The export proceeds market (EPM) became prominent in the third phase of the evolution of the foreign exchange market. The CBN also modified the interbank procedures in December 1990 with the re-introduction of Dutch Auction System. The period 1990 to 1993 consisted of the IFEM, EPM, Forex bureaus and the parallel market. The parallel market existed throughout the period 1986 to 1993. In response to the existence of wide arbitrage premium between the official and parallel market during this period, the government in 1994 undertook a fundamental reform of the market by introducing a fixed exchange rate regime; Naira was

³³ *The first rate tier was initially reserved for diplomatic and some government transactions, while the second tier rate was for other transactions*

³⁴ *Thus, the inherent subsidy on first tier transaction was removed*

pegged³⁵ to the U.S. dollar in 1994, between 1995 to 1999 autonomous foreign exchange market (AFEM) and by October 1999 IFEM was reintroduced until July 2002 (Aluko, 2004).

On July 18, 2002, the central bank of Nigeria scrapped the 30 months old interbank foreign exchange (IFEM) in favor of the Dutch Auction System Three other submarkets – the Interbank, the bureau de change and parallel markets – continued along with the Dutch auction system. In addition to these markets, the central bank also opened its travelex Window³⁶ in mid 2002 (IMF, 2004). It is important to note that the success of reform hinges on the effectiveness of the Nigerian market system (Garba, 1997).

2.5.3 THE CURRENT DUTCH AUCTION SYSTEM

The Naira exchange rate is determined in the Foreign exchange auction market (DAS), which was established during the exchange system reform in 2002 by the Central Bank of Nigeria (CBN). The CBN offers trading and settlement services to the Authorized Dealers (AD). Trading in Naira is primarily conducted against the US Dollar between the CBN and AD through the following guidelines.

The Central Bank of Nigeria (CBN) shall intervene in the Foreign Exchange Market through the Dutch Auction System by announcing on Mondays and Wednesdays the amount on offer for each auction at 8.30 a.m. The Authorized Dealers are allowed to participate at the Auction on behalf of their customers by submitting their customers bids on Monday and Wednesday³⁷ and submit their customers' bids as per the attached format duly signed by two authorized signatories for any particular auction session between 9.00

³⁵ It was pegged at N22.0 : \$1.0 and there was direct allocation of foreign exchange to end users in order to ensure the recovery of the real sectors and hence speed up economic growth (Obadan, 1996)

³⁶ The "Traveler" window covers legitimate foreign exchange demand related to overseas travel expenses, with sales of around US\$240 million in 2003.

³⁷ The CBN reserves the right to reject bids that are deemed to be unrealistic and or/ any application that contravenes foreign exchange regulations.

a.m. and 12.00 noon of the day of the Auction. The bids should be submitted in diskette (Excel Format) to the CBN Lagos / Abuja. However, hard copies of the bids should be faxed to CBN Abuja. Under this system, the minimum bid amount by an Authorized Dealer shall be \$ 100,000.00 and the currencies of transaction shall be the Naira and United States dollar.

The CBN shall announce the result of each Auction by 1.00 p.m. on Tuesdays and Thursday. A copy of the result of the Auction may be obtained from the CBN Lagos and Abuja offices. Successful bids shall be advertised on Tuesday and Thursday, and the Authorized Dealers shall be debited at the bid rates. The Authorized Dealers shall ensure that they have adequate Naira cover on their current accounts with the CBN. The central Bank of Nigeria shall promptly debit the current accounts of bank with the Naira equivalent of the foreign exchange purchased, at the bid rates. The Central Bank of Nigeria shall deliver US Dollars sold to the banks to their *Correspondent Bank Accounts* used for IFEM transactions. The CBN shall effect delivery of foreign exchange purchased by each Authorized Dealer Within two business days³⁸ after the date of the auction result. Funds purchased from CBN at the Auction shall be used for eligible transaction only subject to stipulated documentation requirements. Such funds shall not be transferable in the inter-bank foreign exchange market.

Authorized Dealers shall return to the Central Bank of Nigeria any unutilized funds within five (5) business days after delivery, at the rate of purchase. The CBN may also purchase foreign exchange from Authorized Dealers and other participants such as oil companies, etc at their offer rates. The CBN shall deliver the Naira cover for US Dollars

³⁸ A business day is define as a day in which Banking business is carried out in Nigeria.

bought from the banks to the banks' current accounts at the CBN. The bank shall deliver US Dollars sold to CBN to the *CBN special FEM account* with Chase Manhattan Bank, New York.

The rate that clears the market shall be the prevailing exchange rate for the period. Authorized Dealers shall quote and display in their Banking Halls the buying and selling rates conspicuously. The spread between the buying and selling rates shall not exceed 1 percent³⁹.

Garba (1997) analyzed the various cost associated with the guidelines listed above ,that these institutional costs– documentation , delay ,time limit, non transferability and communication cost generated from institutional barrier to trade and exchange for the official foreign exchange market; each cost barrier generate costs to the foreign exchange market. For instance, the cost(time and money) incurred in fulfilling the requirements for obtaining foreign exchange through the official market do not necessarily lead to the satisfaction of demand for applicants. The bidding process, the transfer of foreign exchange from Central Bank of Nigeria to banks and the transfer from banks to customers lead to delay. Arbitrariness in the process complicates the process.

2.6 EMPIRICAL STUDIES OF THE DAS

Dominguez (1991) in studying the exchange rate stability and the elimination of parallel market in Bolivia⁴⁰ used the Granger causality tests and descriptive statistical techniques. The study shows that while other institutional rules didn't alter much in the course of the auction, after the first year, in which the emphasis was on unifying the dual

³⁹ *Contravention of any of the foreign exchange market regulations shall attract appropriate sanction as spelt out in the provision of relevant laws and CBN guidelines(<http://www.thisdayonline.com/achieve/>).*

⁴⁰ *Over five years from late 1985, daily retail auctions were conducted by the central bank of Bolivia, which served both to stabilize the exchange rate and virtually eliminate the parallel premium for Dollars.*

rates of exchange, the Central Bank adopted a reserve pricing rule with the objective of stabilizing the exchange rate. The reserve price was not pre-announced, but together with the authority's other policy variable, the supply to the auction, it was announced only after all the bids were submitted, and before they were unsealed. The Granger causality tests suggested that both policy instruments, the reserve price and the supply offered at each auction, were endogenously determined after 1986, and the descriptive statistical technique reveals that the market reaction tried to predict the target exchange rate. Bid spreads appear to decrease in periods where supply rules were unchanged and hence targets were more predictable: and to increase in periods when operational rules or design features altered.

Garba (1997) in evaluating the effects of post-reform monetary and fiscal policy on the stability of the exchange rate of the Naira used a descriptive procedure and shows clearly that the growth of federal deficit has positive effects on aggregate demand. By extension, the post - reform effect on demand for foreign exchange is positive because; (a) rise in internal debt service is causal to the expansion in the federal fiscal deficit and; (b) aggregate demand has positive effect on imports. Garba (1997) linked expansion in external debt service to the expansion in fiscal deficit, which in turn was linked to rises in demand for forex. The study concluded that post - reform macroeconomic shocks exerted downward pressure on supply of forex but upward pressure on demand for forex, and that the differential effects on demand and supply can explain the monotonic decline in the nominal exchange rate of the Naira.

Aron's (1998) study, characterized the rule, regimes shifts and outcomes of over four years of exchange auctions in Ethiopia⁴¹, the estimation of dynamic error correction models⁴² was used to examine policy target and learning in repeated auctions. The result of the Ethiopia' study emphasizes that, the micro-design and operation of an institution like the foreign exchange auction can have important macroeconomic consequences during liberalization. A fairly transparent design and Central Bank operational rules that can be learned by bidders in repeated auctions, have been crucial in achieving a fairly stable depreciation from what was initially a very thin market. Aron (1998) found that, fairly stable depreciation had been achieved despite large regime shifts from fiscal and other seasonality in demand, considerable trade liberalization, absorbing parallel market transactions, progressively lifting auction entry barriers, and increasing the frequency of the auction.

Xhepa's (2003) study analyzed the degree of Albania's "euroisation" and considered possible monetary policy options regarding the exchange rate using a descriptive procedure. The study showed that, the challenge for monetary authorities is to adjust the exchange rate without allowing great market fluctuations, especially when sources that sustain and protect the foreign currency market equilibrium are outside the control of monetary authorities. The study recommends the Albania's monetary authorities to be attentive to exchange rate fluctuations after priving the economy spreads exchange rate threads to other arrears.

⁴¹ *The Ethiopian economy adopted a system of consecutive foreign exchange auctions as part of a large Macro-economic adjustment programme, with a view to achieving a market- determined exchange rate, improved allocation of foreign exchange and shifting transactions form the illegal to the official market*

⁴² *Such models can capture a long-term equilibrium relationship between auction variables, adjustment to equilibrium after shocks or rules changes, and short term dynamics around equilibrium.*

Spiegel⁴³ (2003) analyzed the foreign exchange interventions' success in Japan under the conditions of near zero short-term interest rates. In measuring the foreign exchange intervention success, a descriptive procedure was used. Spiegel (2003) shows that, the exchange rate movements over the second quarter of 2003 suggest that the extensive foreign exchange intervention has had at least temporary effects, and concludes that for the first eight months of the year, there was unprecedented stability in the yen-dollar rate within the 115 - 122 yen to the dollar range. That was the narrowest trading band these currencies have exhibited since the breakdown in the Bretton woods system, indicating that the rates moved in the direction intended by the intervention activity.

Gray (2005) evaluates the objective behind the introduction of foreign exchange auction in Iraq by the Central Bank of Iraq⁴⁴. It uses a descriptive procedure and reveals that, since the beginning of 2004, the foreign exchange rate auction in Iraq has been reducing exchange rate volatility, and supporting a remarkable stable nominal exchange rate⁴⁵. This has proved to be a very powerful tool in meeting the CBI's objective of low domestic inflation⁴⁶. There is strong evidence that a stable exchange rate has helped to support price stability.

2.7 IMPLICATIONS OF THE LITERATURE FOR THIS STUDY

The Dutch Auction System has two unique characteristics, the importance of which has not been emphasized in the empirical studies. The features are (a) asymmetry of information and (b) the possibility of collusion among bidders as they learn from

⁴³ Senior Research Advisor, Department of Research, Federal Reserve Bank of San Francisco

⁴⁴ The Central Bank of Iraq (CBI) introduced a foreign exchange auction on 4 October 2003, just under a fortnight before the start of the currency exchange. The CBI has said regularly in the auction result announcements that its aim is to achieve broad exchange rate stability, in order to support domestic price stability.

⁴⁵ The Iraq economy was associated with-sharp depreciation, cutting of the supply of consumer goods, and a hike in prices for those goods still available.

⁴⁶ Formalized in the new CBI law, dated 6 March 2004.

experience. In the next Chapter on methodology for this study therefore, we shall analyze the possibilities of two types of solutions – collusive and non – collusive. We can then draw inferences for the possible behavior of series – demand, supply, price, successes, failures and so on from the possibilities of the two types of solutions. The appropriate empirical methods would then be identified.

CHAPTER THREE

METHODOLOGY

3.0 INTRODUCTION

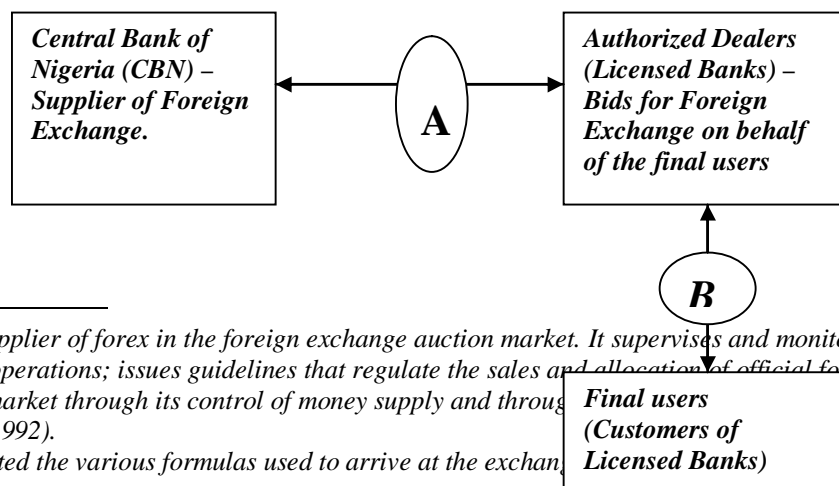
The chapter is organized into seven sections. Section one present the framework for the operation of the current Dutch Auction System (DAS) in Nigeria. Section two, the determination of exchange rates. The third section provides the methods for testing the stochastic properties of the series, these include the test of stationarity and trend analysis. The fourth section gives the method for testing the effects of DAS on efficiency and stability of the exchange rates. Again the sources of Data and the Econometrics software to be use constitutes the fifth and sixth section respectively.

3.1 THE DAS FRAMEWORK

The Central Bank of Nigeria scrapped the 30 months old inter-bank foreign exchange (IFEM) in favor of the Dutch Auction System on July 18, 2002. Along with the

Dutch auction system are other three sub-markets – the Interbank, the bureau de change and parallel markets. In addition to these markets, the Central Bank also opened its travel window (IMF, 2004). In the Dutch Auction System there are two types of transactions – the primary and secondary transactions.

The primary transactions in the Dutch Auction System (DAS) are between the CBN- a monopolist⁴⁷ and the Authorized Dealers. The Authorized dealers (ADs) are the licensed Banks. The ADs are intermediators between the final users of forex and the Central Bank of Nigeria. In the secondary market, the Authorized Dealers supply official foreign Exchange (forex) to consumers while in the primary market, they bid for Central Bank of Nigeria (CBN) supplied forex supposedly on behalf of their respective customers and based on the bids of the customers⁴⁸. In the Figure 1 below the primary market is indicated by (A) while the secondary market is indicated by (B) where the secondary transaction the submission of bids take place by the final users and allocation of foreign exchange to success bidders .The primary market on the other hand is the one in which the Dutch Auction System is used to allocate foreign exchange. The two markets are obviously linked given that Authorized Dealers actually intermediate between the monopoly (CBN) and the final users. The direct focus of the study is on the primary market.



⁴⁷ The CBN is the Sole Supplier of forex in the foreign exchange auction market. It supervises and monitors the official forex market operations; issues guidelines that regulate the sales and allocation of official forex. It influences the official market through its control of money supply and through regulation (P.K. Garba, 1992).

⁴⁸ Garba (1992) high lighted the various formulas used to arrive at the exchange rate.

Figure:.1 - The Primary (A) and Secondary (B) transaction

In the primary market, the Central Bank of Nigeria (CBN) announces on Mondays and Wednesdays the amount on offer for each auction at 8.30 a.m. The Authorized Dealers participate at the Auction on behalf of their customers by submitting their customers bids on Monday and Wednesday⁴⁹ between 9.00 a.m. and 12.00 noon of the day of the Auction. Under this system, the minimum bid amount by an Authorized Dealer is \$ 100,000.00 and the currencies of transaction are the Naira and United States dollar. The result of each Auction is released by 1.00 p.m. on Tuesdays and Thursday, and the Central Bank delivers US Dollars sold to the banks to their *Correspondent Bank Accounts* used for IFEM transactions within two business days⁵⁰, after the date of the auction result⁵¹. These mechanics of the auction indicate that it is a sequential auction process as shown in Figure 2 below.

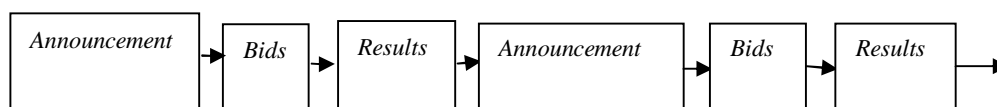


Figure 2 : The DAS cycle.

The Figure 2 above shows that, a DAS cycle begins with announcement of the quantity traded by the CBN and submission of bids by the ADs, and ends with results of the

⁴⁹ The CBN reserves the right to reject bids that are deemed to be unrealistic and or/ any application that contravenes foreign exchange regulations.

⁵⁰ A business day is define as a day in which Banking business is carried out in Nigeria.

⁵¹ <http://www.thisdayonline.com>

auction and exchange. A typical cycle lasts two days: the “Monday’s cycle” ends on Tuesday and the “Wednesday cycle” ends on Thursday. At each of the DAS cycle, the following are determined –

- 1) Marginal Rate (MR)
- 2) Quantity Traded(QT)
- 3) Successful Bid(SB)
- 4) Nonsuccessful Bid(NSB)

The other main series of the DAS cycle include:

- 1) Total Bid or Demand (D),
- 2) Supply (SS),
- 3) Highest Bid Rate (HR),
- 4) Lowest Bid Rate (LR),

From the series, Rate Spreads and Measures of Excess Demand can be generated. The rate spreads are between:

- 1) Marginal Rate and Highest Bid Rate;
- 2) Lowest Bid Rate and Highest Bid Rate;
- 3) Marginal Rate and Lowest Bid Rate;
- 4) Marginal Rate and Parallel Market Rate;
- 5) Marginal Rate and Bureau de change;
- 6) Bureau de change and Parallel Market Rate.

The spreads are given by:

$$DAS_1 = HBR - MR \text{_____} (3.1)$$

$$DAS_2 = HBR - LBR \text{_____} (3.2)$$

$$DAS_3 = MR - LBR \text{_____} (3.3)$$

$$\text{FOREX}_1 = \text{Parallel} - \text{OR} \text{_____} \quad (3.4)$$

$$\text{FOREX}_2 = \text{Parallel} - \text{BDC} \text{_____} \quad (3.5)$$

$$\text{FOREX}_3 = \text{BDC} - \text{OR} \text{_____} \quad (3.6)$$

The measures of excess demand are: demand less supply; demand less quantity traded ; quantity traded less supply.

- 1) $E_1 = \text{demand} - \text{supply}$
- 2) $E_2 = \text{demand} - \text{quantity traded}$
- 3) $E_3 = \text{quantity traded} - \text{supply}$

It is reasonable to suppose that successive cycle are somewhat related since both the CBN, and AD’s/customers may adjust their behavior to outcomes of previous bids. Consequently the series may contain autoregressive processes (AR).The general autoregressive model for a series X_t that is AR(P) is :

$$x_t = f(x_{t-1}, x_{t-2}, \dots, x_{t-p}) \text{_____} \quad (3.7)$$

and the specific AR form is given as:

$$x_t = \alpha_1 + \lambda_1 x_{t-1} + \lambda_2 x_{t-2} + \dots + \lambda_p x_{t-p} + \epsilon_t \text{_____} \quad (3.8)$$

The exact lag length and pattern of lags is an empirical matter.

3.2 DETERMINATION OF EXCHANGE RATES

The study requires analysis of how marginal rate is determined. Once the marginal rate is determined, the quantity traded, successful and non-successful applicants are also determined. Given that the DAS comprise one seller and many buyers, the monopoly market model shall be used in modeling the exchange rate market. The market has two sets of agents: the CBN and Authorized Dealers (Ads).The CBN manages the quantity traded and allows the market to determine marginal prices. The CBN announces the quantity

traded on Mondays and Wednesdays at 8:00 a.m and the ADs submits their bids between 9.00 a.m. and 12.00 noon of the day of the Auction the bids are added cumulatively and the marginal rate for that session is determined where quantity traded is equals to total demand. The quantity traded may not be the amount that was announced by the CBN. In other words, at the marginal rate E_3 (quantity traded – supply) may not always be equal to zero. This implies that the CBN could determine the marginal rate.

The bids submitted by the ADs depend on the announced quantity traded by the CBN. It is in line with this sequential process (see Figure 2 above) that the players (CBN and AD's) may be adaptive in their bidding behavior towards the achievement of their goals as they acquire experience in the auction market. Therefore, two types of solution are possible over the course of operation of the DAS: the non-collusive solution (NCS) and the collusive solution (CS).

NON-COLLUSIVE SOLUTION

The time between the announcement of the quantity that will be traded by the CBN and the submission of bids by the ADs and the lack of experience at the early stages of the DAS may prevent AD's from colluding. Thus, the spreads between the highest and lowest bids, may be wide and demand may be unstable as AD's are sensitive to successes and failures. The CBN under a non – collusive solution can still determine the MR by influencing E_3 .

COLLUSIVE SOLUTION

Given that the market is essentially a monopoly, the experience acquired by the ADs may be used to collude in their bidding strategy. If this happens, the spreads between the highest and lowest bids are likely to be closer and demand may be more stable. This may lead to the conclusion that the DAS is leading to efficiency in determination of MR

and stability in demand. It is important therefore, to go beyond the DAS spreads(HBR – MR and HBR – LBR) to analyze the forex spreads(Parallel – OR, Parallel –BDC,BDC – OR) to evaluate the impact of DAS on the efficiency and stability of the exchange rate.

The demand and price may be autoregressive and the sampling covariance may be heteroscedastic given the possibilities of transition from non – collusive to collusive equilibriums. The possible behavior of the series recommend the Autoregressive Conditional Heteroscedastic(ARCH) and Generalized Autoregressive Conditional Heteroscedastic(GARCH) in modeling demand and prices.

3.3 ANALYSIS OF STOCHASTIC PROPERTIES OF SERIES

3.3.1 MAIN SERIES AND GENERATED SERIES

From the DAS framework in section 3.1, there are two sets of series:

- 1) Series determined in the market: MR, QT, SB, NSB; and
- 2) Primary series: Total Bids(D), Supply(S), Highest Bid Rate(HBR), and Lowest Bid Rate(LBR).

In all therefore, there are eight DAS series. In addition to the DAS series, six generated series – the DAS spread (DAS_1 , DAS_2 and DAS_3) and forex spread ($Forex_2$, $Forex_2$ and $Forex_3$) – are given in equations 3.1 – 3.6.

3.3.2 TEST FOR STATIONARITY AND TREND ANALYSIS

The Augmented Dickey Fuller test of stationarity will be used to test for stationarity of each of the eight series of the DAS. In addition, descriptive statistics (mean, std

deviation) would be used to analyze trend of series. The exercise is expected a first check on heteroscedasticity.

3.4 EFFECTS OF DAS ON EFFICIENCY AND STABILITY OF THE EXCHANGE RATE

The re-introduction of the DAS was intended to (a) enhance efficiency (minimizes distortion, speculation, opportunism and sharp practices) and (b) stabilize the exchange rate by reducing demand. It follows therefore, that analysis can focus on analysis of the exchange rate and demand. The first stage of analysis therefore, computes and analyses the exchange rate spread while the second uses GARCH modeling to analyze the marginal rate and demand.

3.4.1 EXCHANGE RATE SPREADS

Equation 3.1 – 3.3 show the DAS spread. The Analysis in section 3.2 indicates earlier that the DAS spread would be larger in the earlier stages of the DAS and become smaller at the later stages. Therefore, analysis of the trends of the spread is to assess empirically, the prediction. To avoid errors of interpretation, we also analyze the forex spreads to determine if the trend of the forex spread is consistent with that of the DAS spreads. Consistency implies increasing efficiency and stability and vice versa.

3.4.2 THE ARCH AND GARCH ANALYSIS

The Autoregressive Conditional Heteroscedastic (*ARCH*) model and the Generalized Autoregressive Conditional Heteroscedastic (*GARCH*) model have been used since Engel (1982) to analyze the financial market variables such as the stock market price,

interest rates indices or currency exchange rates⁵². The general form of the ARCH is GARCH. The GARCH (1,1) model is :

$$Y_t = x_t \gamma + \varepsilon_t \text{-----} (3.9)$$

$$\sigma_t^2 = w + \alpha \varepsilon_{t-1}^2 + \beta \sigma_{t-1}^2 \text{-----} (3.10)$$

Equation (3.9) is the Mean equation showing that Y_t is a function of two components – (1) the exogenous variables and (2) an error term. Since σ_t^2 is the one-period ahead forecast variance based on past information, it is called the conditional variance. The conditional variance equation specified in (3.10) is a function of three terms: (a) the mean , w ; (b) the ARCH term, ε_{t-1}^2 ; (c) the GARCH term, σ_{t-1}^2 .The two terms are explaining the news about volatility from the previous period and the last period’s forecast variance respectively. Using GARCH(1,1) specifications, the demand and marginal rate models are:

$$D_t = \alpha_0 + \alpha_1 MR_{t-1} + \alpha_2 D_{t-1} + \alpha_3 RS_{t-1} + \varepsilon_t \text{-----} (3.11)$$

$$\sigma_t^2 = \beta_1 + \beta_2 \varepsilon_{t-1}^2 + \lambda_1 \sigma_{t-1}^2 \text{-----} (3.12)$$

$$MR_t = f(D_t, MR_{t-1}) \text{-----} (3.13)$$

$$MR_t = \pi_0 + \pi_1 D_t + \pi_2 MR_{t-1} + \mu_t \text{-----} (3.14)$$

$$\sigma_t^2 = \beta_1 + \beta_2 \varepsilon_{t-1}^2 + \lambda_1 \sigma_{t-1}^2 \text{-----} (3.15)$$

The demand and marginal rate model are autoregressive. In addition, demand at time t is explained also, by marginal rate at time t - 1 and rate of success at time t – 1. The expected signs of the coefficients for demand are as follows:

⁵² <http://www.mathworks.com/access/helpdesk/help/toolbox/garch/>

$$\alpha_1 < 0; \alpha_2 > 0 \text{ and } \alpha_3 < 0$$

The marginal rate equation apart from a one period lag of the marginal rate is explained also by current demand. The expected signs are:

$$\pi_1 > 0 \text{ and } \pi_2 < 0$$

3.4 SOURCES OF DATA:

The bi – weekly data on all the eight Dutch Auction System (2002-06) variables included in the models in this study are posted on the websites of the Central Bank of Nigeria (<http://www.cenbank.org>). Data on monthly rates on Parallel, Bureau De Change and Official rates are sourced from [http:// - www.nigeriabusinessinfo.com](http://www.nigeriabusinessinfo.com), www.nigerianmuse.com, www.citibank.com, www.thisdayonline.com internet websites.

3.5 ECONOMETRIC SOFTWARE

The EViews⁵³ software is used because it provides a comprehensive set of estimation and testing procedures for ARCH and GARCH models as well as the trend analysis and the Stationarity test.

⁵³ windows software program from quantitative micro-software, Irvine, California.

CHAPTER FOUR

PRESENTATION, ANALYSIS AND INTERPRETATION OF RESULTS

4.0 OVERVIEW OF THE CHAPTER

In this Chapter, the first section presents and analyzes the results on the stochastic properties of series. The second section presents and analyzes results on the effect of Dutch Auction System on the Efficiency and stability of the Exchange Rate.

4.1 STOCHASTIC PROPERTIES OF SERIES

The main results presented in this section are:

- 1) graph of the eight DAS series(Figures 4.1a – 4.8a) and their residuals(Figure 4.1b – 4.8b)
- 2) descriptive statistics(Table 4.1)
- 3) test of stationarity(Table 4.2)

Sub- section 4.1.1 analyses the trend using the Standard deviations while sub – section 4.1.2 analyses the results of the test of Stationarity.

4.1.1 Trend Analysis

The results are based on data on the 354 sessions of DAS. For each of the series, two distinct phases (A and B) were determined from observation of the graphs of the series. Table 4.1 and 4.2 show that the eight series have similar turning points for the series. The phases for each series are :

- 1) A = 1st – 128th DAS session.
- 2) B = 129th – 354th DAS session.

Table 4.1 when the standard deviations are compared, two patterns could be observed. The first patterns has three cases – demand, successful bid (SB) and nonsuccessful bid (NSB), in which the standard deviation in phase A(51.74) is greater than that of phase B(29.69). Figure 4.1a and 4.1b shows that demand was more volatile in period A than in period B. The high volatility in demand may be attributed by the lack of experience in bidding process during phase A by the Authorized Dealers .This is supported by the higher rate of failure⁵⁴ in phase A (29%) compared to phase B(11%).

TABLE 4.1: SUMMARY OF THE DESCRIPTIVE STATISTICS

Variable	Sample	Mean	Std. Dev
Demand	A(1-128)	137.67	51.74
	B(129-354)	99.50	29.68
	A+B(1-354)	113.30	43.15
Supply	A(1-128)	94.14	31
	B(129-354)	97.37	32.85
	A+B(1-354)	96.20	32.18
Quantity traded	A(1-128)	87.85	13.10
	B(129-354)	93.39	17.93

⁵⁴ The rate of failure is determined by the ratio of NSB to SB plus NSB.

	A+B(1-354)	91.42	16.53
Marginal rate	A(1-128)	127.60	1.49
	B(129-354)	132.43	2.31
	A+B(1-354)	130.68	3.10
Highest bid rate	A(1-128)	129.90	2.27
	B(129-354)	133.85	2.83
	A+B(1-354)	132.43	3.25
Lowest bid rate	A(1-128)	127.59	1.50
	B(129-354)	131.64	2.56
	A+B(1-354)	130.17	2.96
Successful bid	A(1-128)	721.72	232.91
	B(129-354)	556.65	198.61
	A+B(1-354)	615.44	225.48
Nonsuccessful bid	A(1-128)	296	298.22
	B(129-354)	67.08	92.54
	A+B(1-354)	148.84	221.72

SOURCES : <http://www.cenbank.org>

Both Successful bids and Nonsuccessful bids exhibit similar patterns as demand as could be seen in Table 4.1 and Figures 4.2a , and 4.2b (Successful bids) and 4.3a and 4.3b (Nonsuccessful bids)

Figure 4.1 a: Demand for forex at DAS

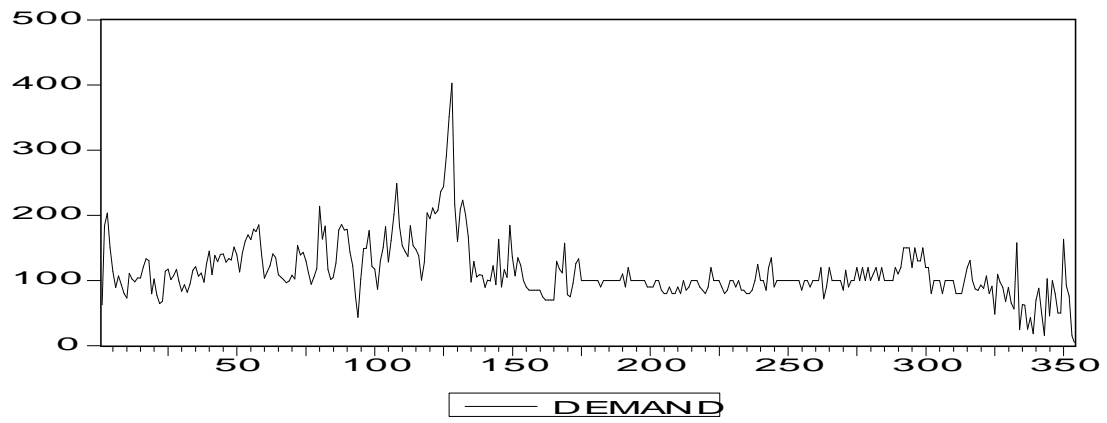


Figure 4.1 b: Residuals for Demand at DAS

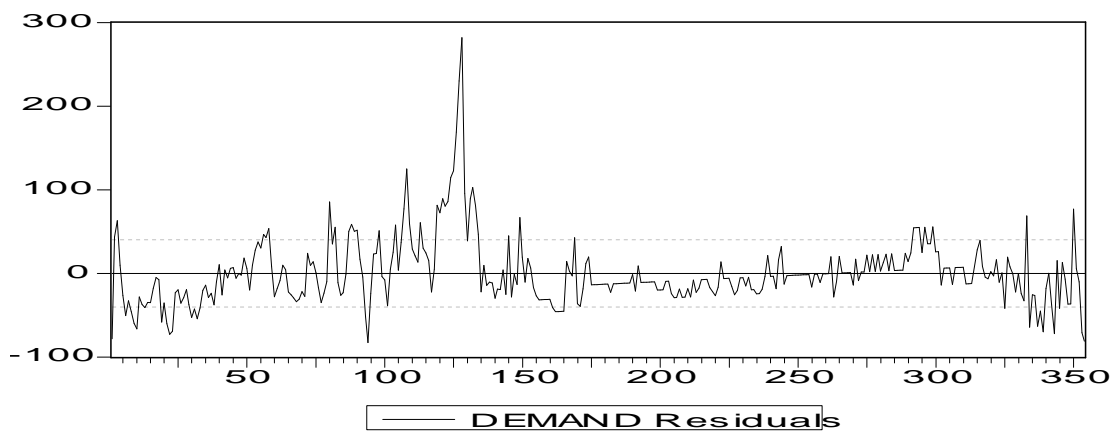


Figure 4.2a: Success Bid at DAS

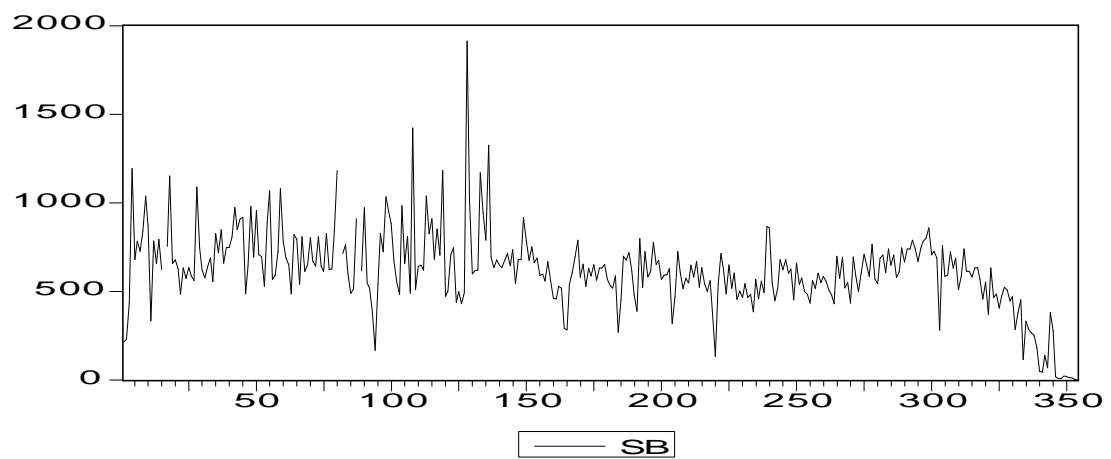


Figure 4.2b: Residuals for Success Bid at DAS

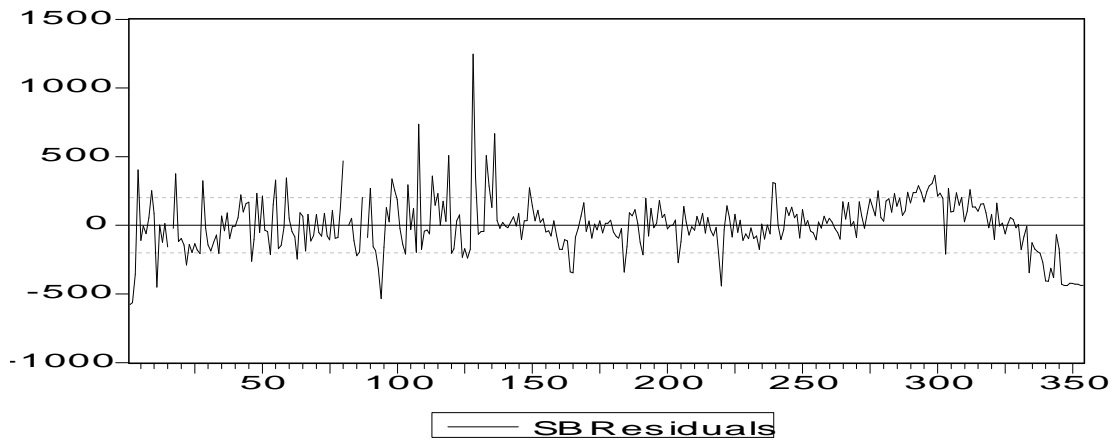


Figure 4.3a: Non success Bid at DAS

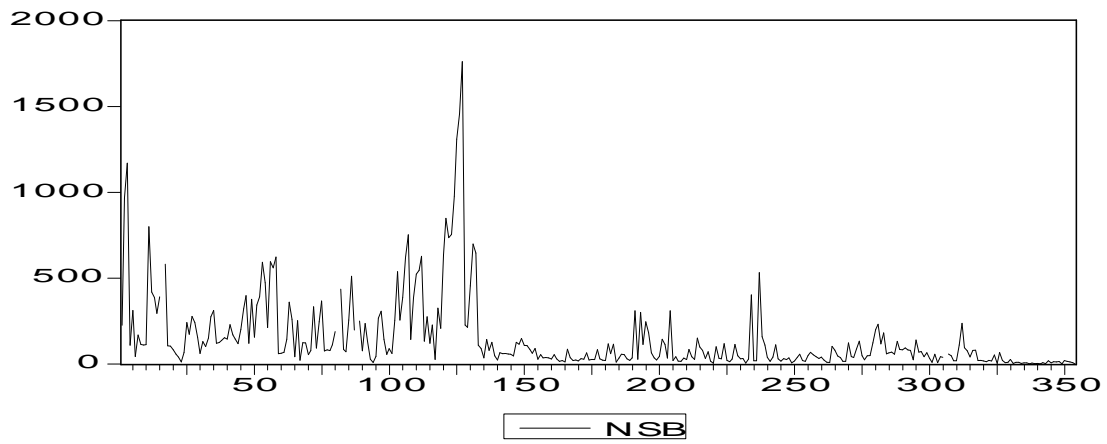
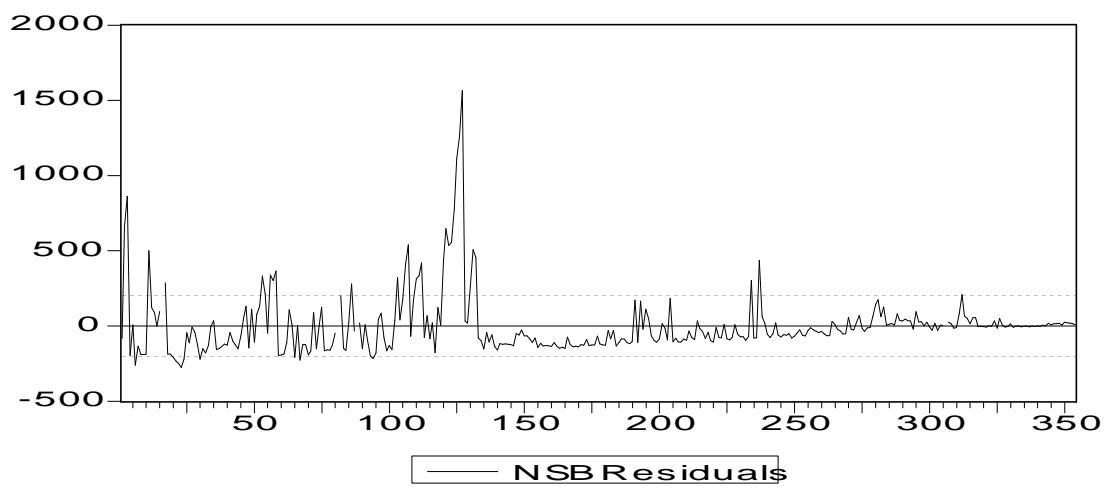


Figure 4.3b: Residual for Success Bid at DAS



The second pattern observed from the standard deviations in Table 4.1 is that the supply (SS), quantity traded(QT), marginal rate (MR), high bid rate (HBR) and low bid rate (LBR) have higher standard deviation in phase A period than in phase B period. This may be attributable to the CBN’s efforts to stabilize the MR by adjusting the supply. Figure 4.4a and 4.4b (Supply) and 4.5a and 4.5b (Quantity Traded) could be observed to be more unstable than the Marginal Rate (Figure 4.6a and 4.6b).

Figure 4.4a: Supply of forex at DAS

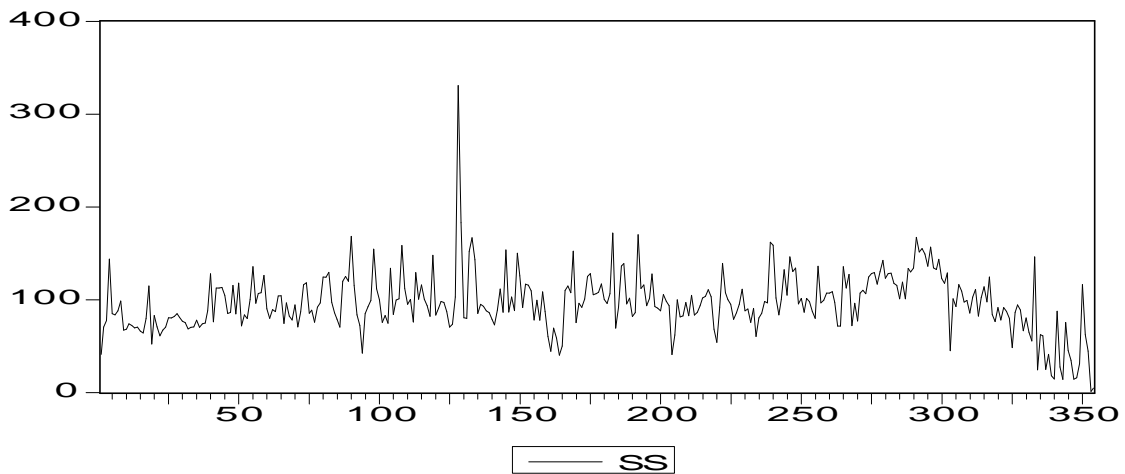


Figure 4.4b: Residuals for Supply of forex at DAS

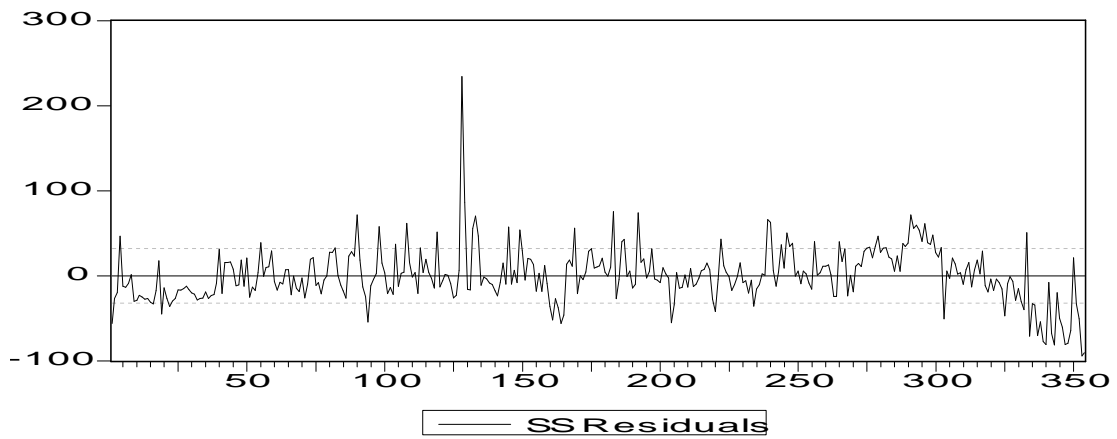


Figure 4.5a: Qty of forex traded at DAS

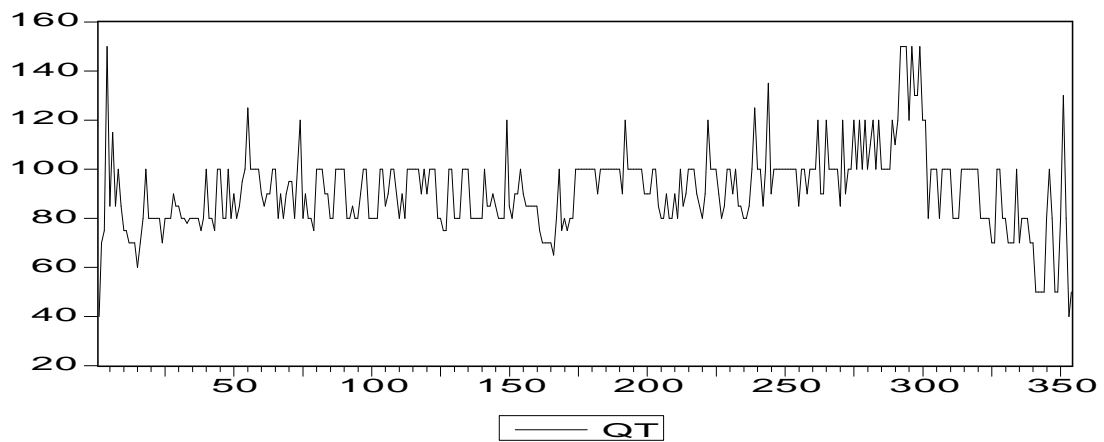


Figure 4.5b: Residuals for Qty traded at DAS

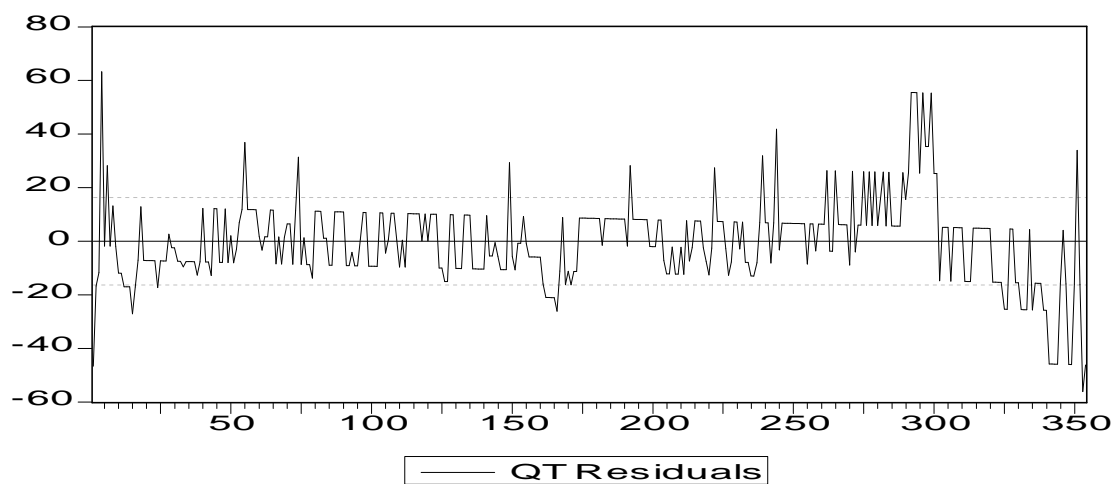


Figure 4.6a:Marginal rate atDAS

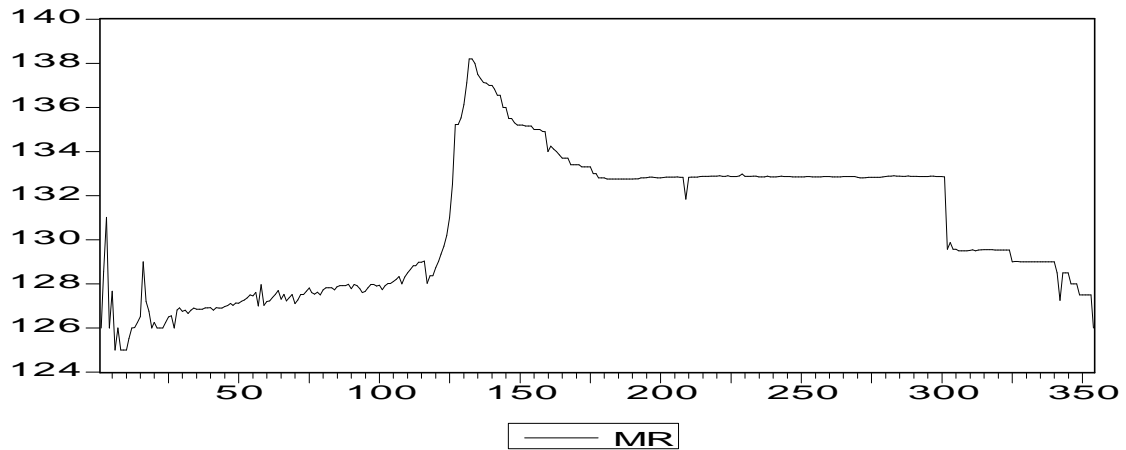


Figure 4.6b:Residuals for Marginal rate at DAS

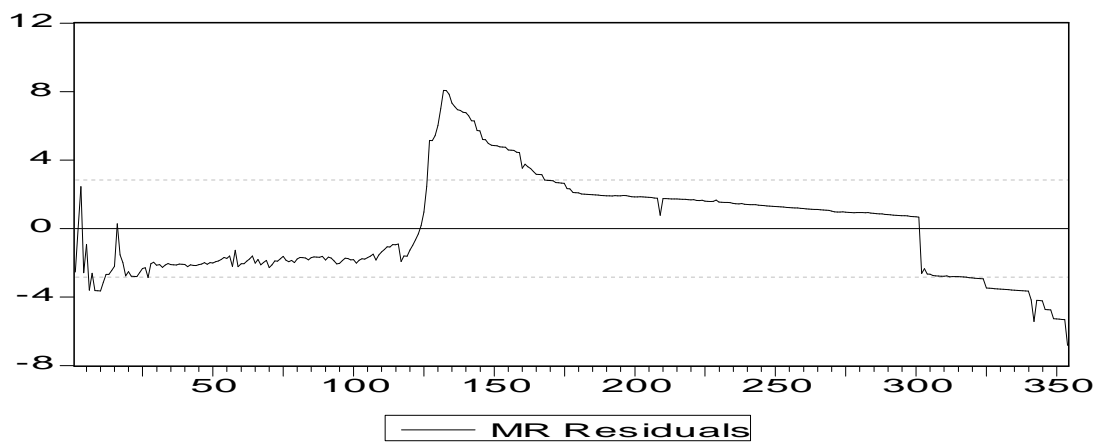


Table 4.1 and Figure 4.6a and 4.6b (Marginal Rate) , 4.7a and 4.7b(Highest Bid Rate) and 4.8a and 4.8b (Lowest Bid Rate) exhibit similar patterns – higher levels in phase B relative to phase A.

Figure 4.7a: Highest bid rate at DAS

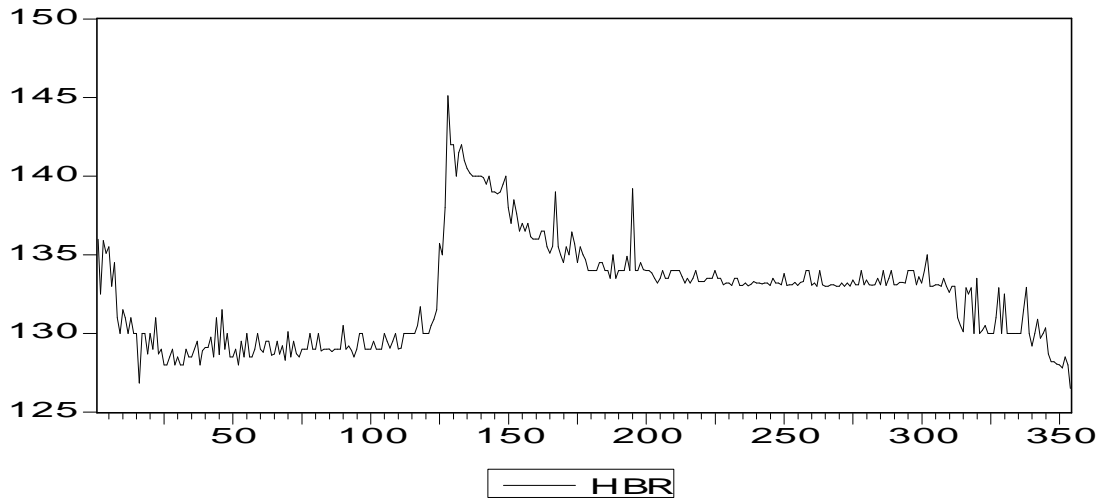


Figure 4.7b: Residuals for Highest bid rate at DAS

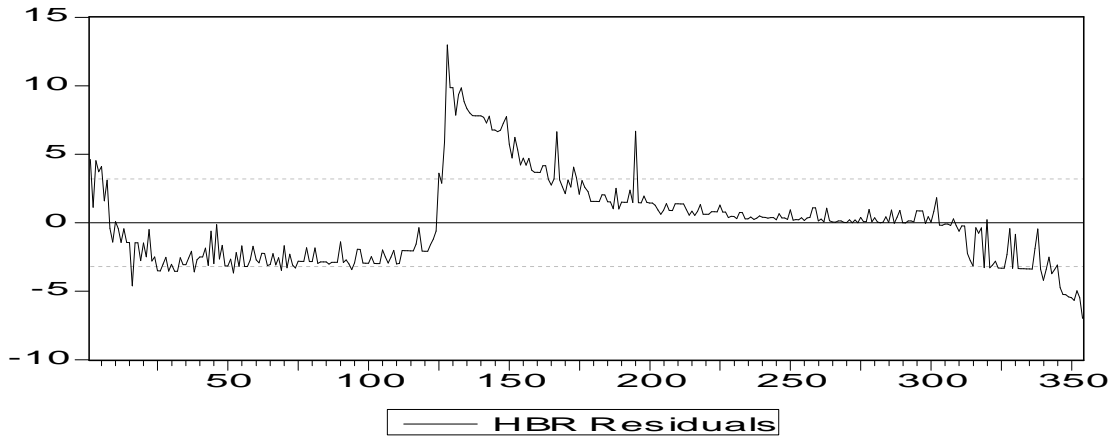
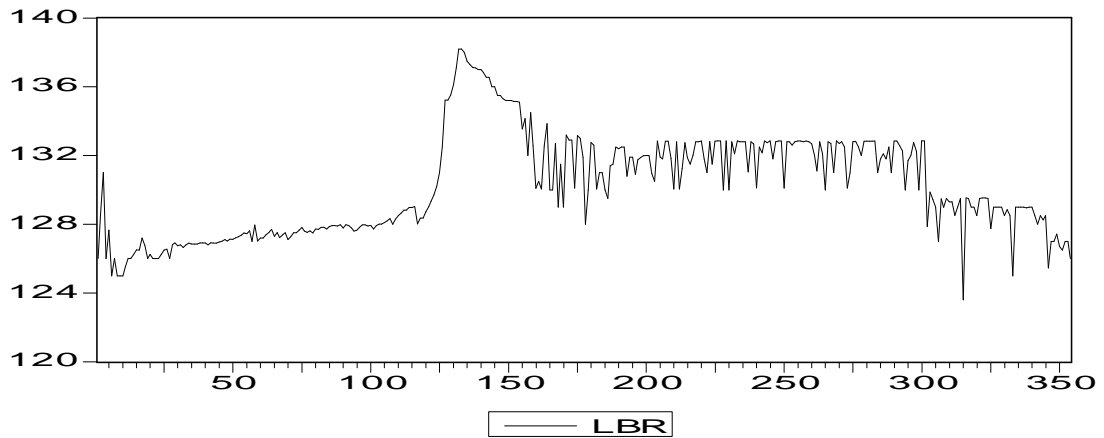
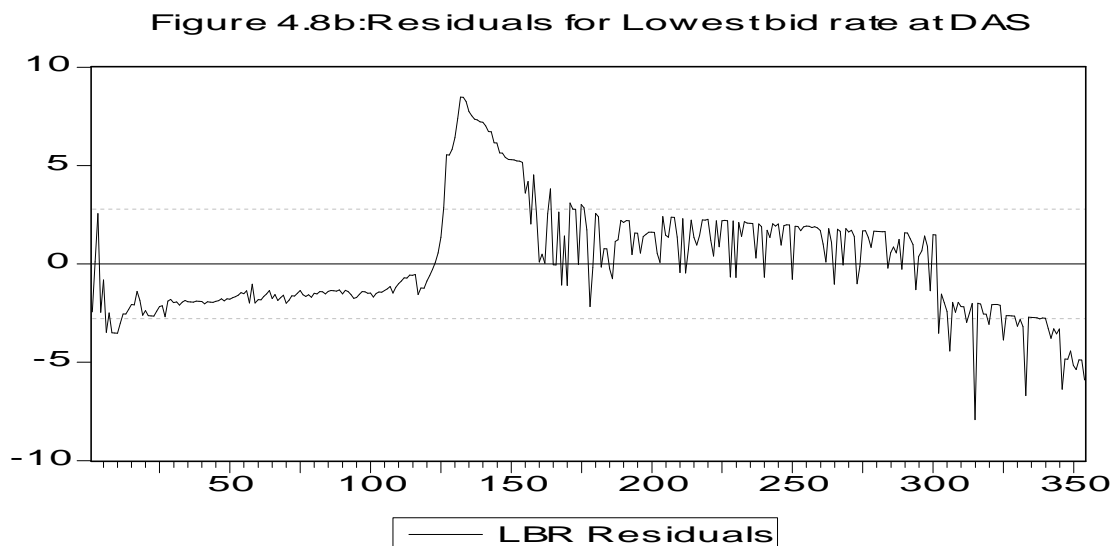


Figure 4.8a: Lowest bid rate at DAS





4.1.2 TEST OF STATIONARITY

The result of the test of stationarity are presented in Table 4.2 below and it reveals two patterns. In the first pattern, indicated by five cases, the ADF – test of stationarity is sensitive to data; the quantity data – demand(DD), supply(SS), quantity traded(QT), successful bid (SB) and nonsuccessful bid(NSB). In these series, the data becomes either stationary in the phase A period and non stationary in phase B or vice versa.

The second pattern, the series are nonstationary in all phases. This patterns has three cases: marginal rate(MR), highest bid rate(HBR) and lowest bid rate(LBR). Taking the marginal rate for instance, It is non - stationary in the phase A because it is sensitive to demand, but as the bidding process continues, it becomes obvious that the CBN has to adjust the supply in order to accommodate stability of the exchange rate, and that is when the marginal rate becomes sensitive to the supply.

The first pattern where the results of the ADF test for unit root is sensitive to data suggest that the test is not robust. In the second pattern, the results shows that the mean and variance of the exchange rate are sensitive to time.

TABLE 4.2 :STATIONARITY TEST.

Variable	Sample	ADF-Test (Level)	Critical Value(5%)	Stationary/ Non-stationary
Demand	A(1-128)	0.4915	-2.8851	<i>Not-stationary</i>
	B(129-354)	-5.0149	-2.8747	<i>Stationary</i>
	A+B(1-354)	-3.3878	-2.8700	<i>Stationary</i>
Supply	A(1-128)	-3.0738	-2.8857	<i>Stationary</i>
	B(129-354)	-2.5122	-2.8747	<i>Not-stationary</i>
	A+B(1-354)	-3.9970	-2.8700	<i>Stationary</i>
Quantity Traded	A(1-128)	-4.2366	-2.8849	<i>Stationary</i>
	B(129-354)	-2.3675	-2.8747	<i>Not-stationary</i>
	A+B(1-354)	-3.6645	-2.8700	<i>Stationary</i>
Marginal Rate	A(1-128)	1.4718	-2.8849	<i>Not-stationary</i>
	B(129-354)	-0.5761	-2.8747	<i>Not-stationary</i>
	A+B(1-354)	-1.3932	-2.8700	<i>Not-stationary</i>
Highest Bid Rate	A(1-128)	0.3121	-2.8849	<i>Not-stationary</i>
	B(129-354)	-1.7425	-2.8747	<i>Not-stationary</i>
	A+B(1-354)	-1.7632	-2.8700	<i>Not-stationary</i>
Lowest Bid Rate	A(1-128)	-1.6927	-2.8889	<i>Not-stationary</i>
	B(129-354)	-1.7954	-2.8747	<i>Not-stationary</i>
	A+B(1-354)	-1.5282	-2.8700	<i>Not-stationary</i>
Sucessful Bid	A(1-128)	-5.1170	-2.8889	<i>Stationary</i>
	B(129-354)	-1.6056	-2.8747	<i>Not-stationary</i>
	A+B(1-354)	-2.4153	-2.8704	<i>Not-stationary</i>
NonSuc-	A(1-128)	-2.2478	-2.8889	<i>Not-stationary</i>

<i>cessful</i>	B(129-354)	-7.1918	-2.8750	<i>Stationary</i>
<i>Bid</i>	A+B(1-354)	-3.8513	-2.8706	<i>Stationary</i>

SOURCES : <http://www.cenbank.org>

4.2 EFFECTS OF DAS ON EXCHANGE RATE

4.2.1 EXCHANGE RATE SPREADS

The two spreads computed are the DAS and FOREX spreads.

DAS SPREADS

Table 4.3 below shows the three DAS Spreads: Highest – Lowest(DAS₁); Highest – Marginal (DAS₂); and Marginal - Lowest (DAS₃). The Table 4.3 below shows that the three DAS spread are more concentrated in Phase A than in Phase B. As seen in Figures 4.9 and 4.10 DAS₁ and DAS₂ rates appear to move towards convergence in Phase B. Table 4.3 shows that a mean DAS₂ spread of ₦2.302 in Phase A falling to ₦1.426 in DAS₂, ₦2.349 to ₦2.217 and ₦3.005 to ₦0.791 in DAS₁ and DAS₃ respectively.

TABLE 4.3: DESCRIPTIVE STATISTICS RESULT FOR THE SPREADS

<i>Spread</i>	<i>Sample</i>	<i>Mean</i>	<i>Std. Dev</i>
<i>DAS₁</i>	A (1-128)	2.349	1.91
	B (129-354)	2.217	1.673
<i>DAS₂</i>	A (1-128)	2.302	1.932
	B (129-354)	1.426	1.307
<i>DAS₃</i>	A (1-128)	3.005	19.47
	B (129-354)	0.791	1.15

SOURCES : <http://www.cenbank.org>

Figure 4.9: Highest - Lowest Rate Spread

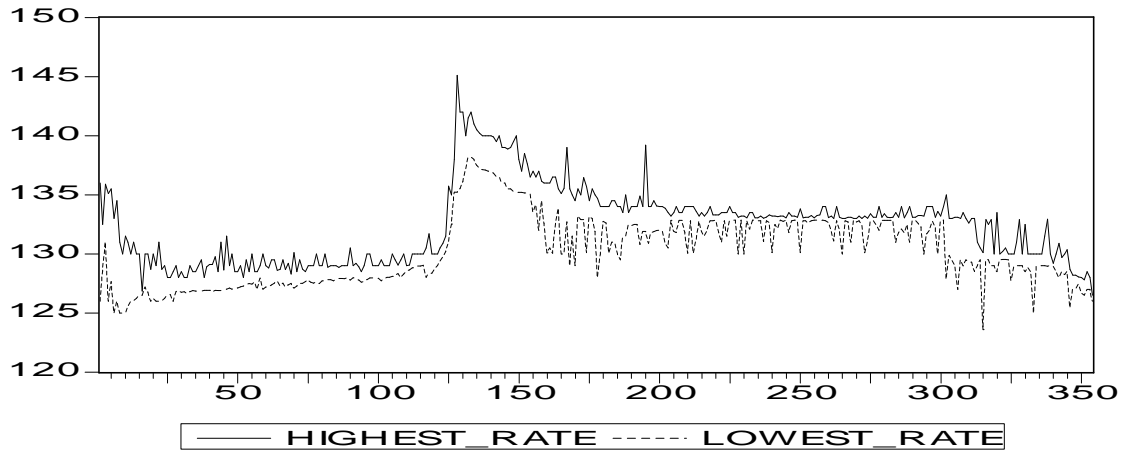


Figure 4.10: Highest - Marginal Rate Spread

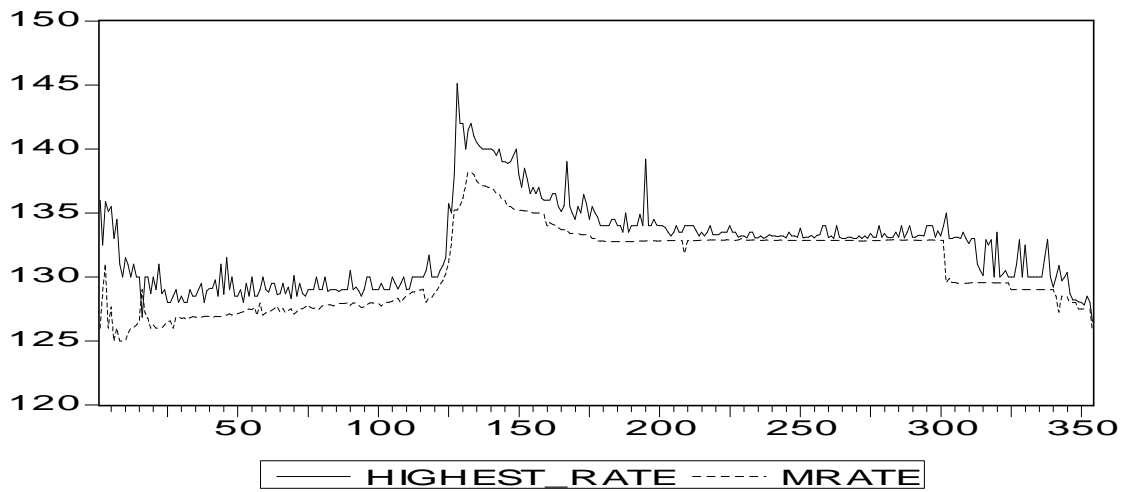
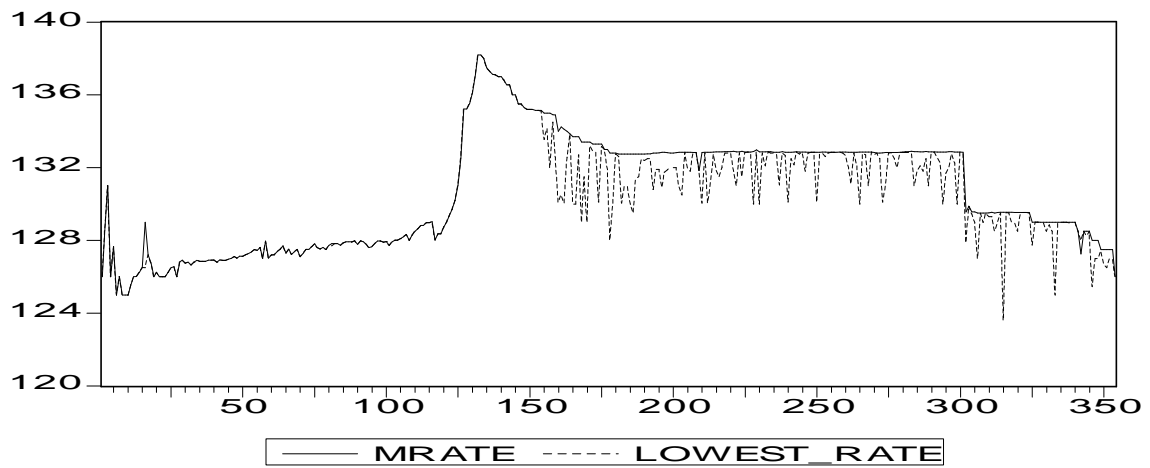


Figure 4.11: Marginal - Lowest Rate Spread



FOREIGN EXCHANGE RATES SPREADS

Table 4.4 below shows the three FOREX spreads: Bureau de change – Official (FOREX₁); Parallel – Official (FOREX₂); and Parallel – Bureau de change (FOREX₃) during the IFEM and DAS period. The table shows that the spread is more dispersed in the IFEM period than in the DAS period. Further, while the spread between BDC and Parallel closed in the DAS spread, the spreads between Parallel and DAS(FOREX₂) and BDC and DAS(FOREX₁) increased marginally. Table 4.4: thus suggests that the foreign exchange market was not becoming more convergent. Figure 4.12, 4.13 and 4.14 below shows the spread between the Official rate and Bureau De Change, Official rate and the parallel market, and Bureau de change rate and the Parallel rate respectively. The Figures LIKE Table 4.4. indicates that FOREX₁ and FOREX₂ Did not approach zero in the DAS period.

From Table 4.3, it was observed that the spread between the Highest –Lowest and Highest –Marginal were closing. However given the trend of FOREX₁ and FOREX₂ seems This shows that there may be speculative activities by market operators in a bid to take advantage of the parallel market premium through collusive behavior.

TABLE 4.4 : FOREIGN EXCHANGE RATE SPREADS(IFEM - DAS)

<i>Spread</i>	IFEM		DAS	
	Mean	Std. Dev.	Mean	Std. Dev.
FOREX₁	11.21	6.98	11.5	1.65
FOREX₂	11.21	6.96	11.91	1.57
FOREX₃	0.90	1.51	0.34	0.87

SOURCES: <http://www.cenbank.org>, www.nigeriabusinessinfo.com, www.nigerianmuse.com, www.citibank.com, www.thisdayonline.com

Figure 4.12:Official-Bureau de change Rate Spread

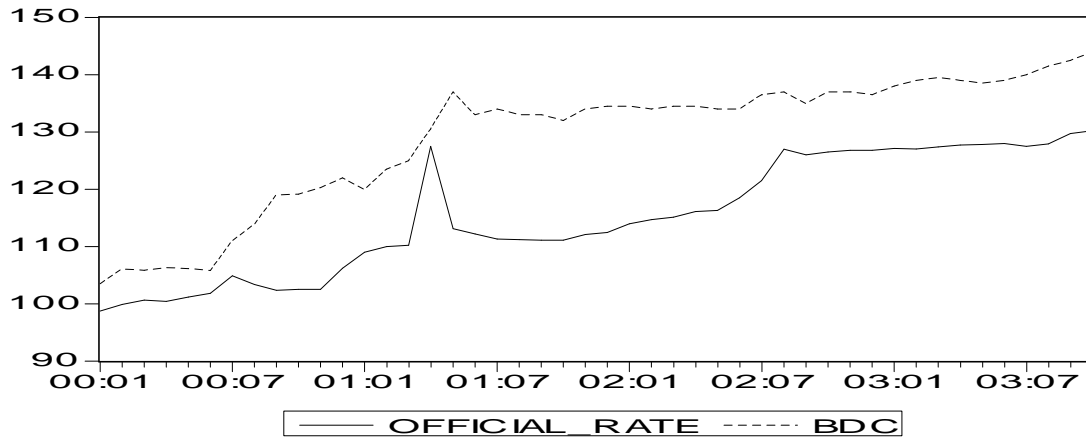


Figure 4.13:Official - Parallel Rate Spread

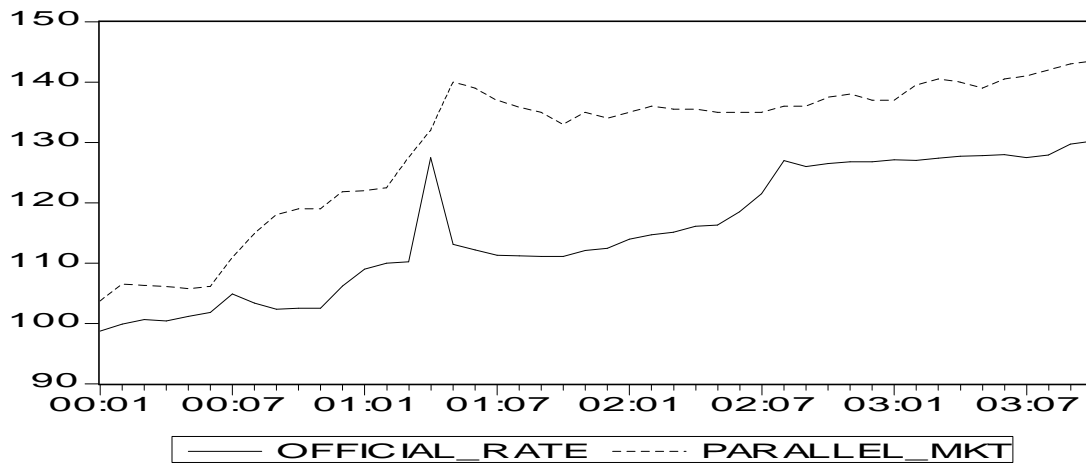
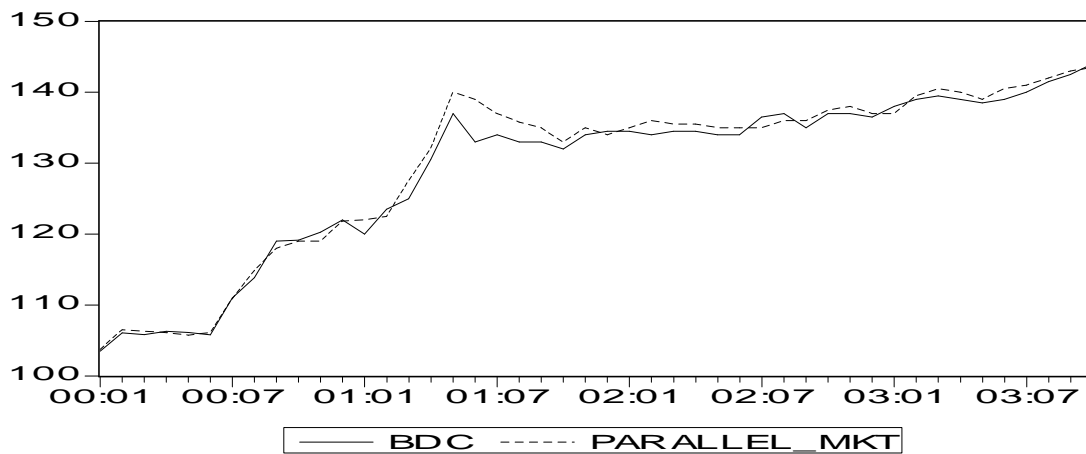


Figure 4.14:Bureau de change - Parallel Rate Spread



4.2.2 STABILITY OF THE EXCHANGE RATE

ARCH and GARCH Model Estimation

THE DEMAND MODEL

The estimated GARCH (1, 1) model for demand is given below:

$$D_t = 162.562 - 0.948MR_{t-1} + 0.659D_{t-1} - 0.42RS_{t-1} \quad (4.1)$$

(3.648) (-2924) (17.67) (0.605)

$$\sigma_t^2 = 64.759 + 0.366\varepsilon_{t-1}^2 + 0.588\sigma_{t-1}^2 \quad (4.2)$$

(3.524) (4.248) (8.287)

$$R^2 = 0.556, \quad S.E = 28.98, \quad DW = 1.87, \quad \text{Log likelihood} = 1612.128$$

The ARCH and GARCH coefficients are statistically significance. The model shows that the sum of the ARCH and GARCH coefficients, $\alpha + \beta$ (0.37 + 0.59) is close to one, indicating that volatility is not persistent. This suggests that DAS may not have eliminated distortions in demand for foreign exchange, but the volatility is not persistent. The result for tests of stationarity indicated that in phase B, demand was stationary though, it was non – stationary in phase A.

MARGINAL RATE MODEL

The estimated GARCH (1, 1) model for the Marginal Rate is given below:

$$MR_t = 0.439 + 0.002D_t + 0.995MR_{t-1} \quad (4.3)$$

(0.402) (5.939) (117.97)

$$\sigma_{t-1}^2 = 0.439 + 0.133\varepsilon_{t-1}^2 + 0.692\sigma_{t-1}^2 \quad (4.4)$$

(19.79) (6.82) (50.4)

$$R^2 = 0.9719, \quad S.E = 0.521, \quad DW = 2.514, \quad \text{Log likelihood} = 121.88$$

The coefficients on the ARCH and GARCH terms are significant. The ARCH and GARCH coefficients, $\alpha + \beta$ (0.13 – 0.69) is close to one. This also indicates that volatility is not persistent.

CHAPTER FIVE

5.1 SUMMARY OF MAJOR FINDINGS

The study evaluated the Dutch Auction System (DAS) as a means of determining a realistic and stable value of the Nigerian Naira. The objective of the study is to evaluate the effects of the DAS on the exchange rate of the Naira in terms of (1) efficiency and (2) stability from July 22, 2002 to March 27, 2006.

Firstly, the study used the stationarity test and descriptive procedure for the analysis of the trend of the DAS series and foreign exchange spreads to analyze impact of DAS on efficiency. Secondly, the Generalized Autoregressive Conditional Heteroscedasticity (GARCH) models for demand and Marginal Rate were estimated to deduced DAS impact on stability. The main findings are:

- 1) The Quantity series are stationary in one phase and non – stationary in the other.
This implies that the ADF is a robust.
- 2) The price series are non – stationary implying conditional means and conditional variances are sensitive to time.
- 3) DAS spread are convergent
- 4) The parallel market premium increased from 4.27 under IFEM to 7.21 under DAS.
- 5) The GARCH model for demand and marginal price indicate that the conditional variances of the series are heteroscedastic. However, the volatility for both demand and marginal price are not persistent.

5.2 CONCLUSION

The findings suggest that the DAS has not eliminated distortion, speculation, opportunism, sharp practices and excessive demand pressure in the foreign exchange market. It becomes obvious from the findings that there is collusive behavior on the side of

the Authorized Dealers in the bidding process. This tells us that the effects of the DAS on the exchange rate of the Naira in terms on efficiency were not achieved. The contributory factor may be their speculative activities by market operators in a bid to take advantage of the parallel market premium. The study concludes that the problems of exchange rate volatility, excessive demand pressure in the foreign exchange market still persist. This may explained why the Central Bank of Nigeria modified the DAS format from the retail DAS to wholesale DAS in March, 2006. The exchange rate spread (official – parallel) appear to have narrowed. However, it is not clear if the narrowing would be sustainable.

5.3 RECOMMENDATION

Based on the above findings that the retail DAS with Central Bank of Nigeria as monopoly would not provide efficient or stable exchange rate, the study offers four main suggestions. First, the CBN should encourage the emergence of more suppliers. Two, policy shift should be preceded by analysis. Third, studies should investigate the likely problem of sustainability under the whole sale DAS. Finally, the CBN should ensure availability of information on wholesale DAS for operators and researchers.

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APPENDIX A :DAS RECORD FROM 22 JULY, 2002 TO 27 MARCH, 2006

<i>Date</i>	<i>Session</i>	<i>Qty traded (\$M)</i>	<i>Demand (\$M)</i>	<i>Supply (\$M)</i>	<i>Highest rate (N/\$1)</i>	<i>Lowest rate (N/\$1)</i>	<i>Marginal rate (N/\$1)</i>	<i>Succe-ssful appl.</i>	<i>Unsuc-cessful app.</i>	<i>Number of banks</i>
7/22/2002	1	40	62.64	41.05	135.99	126	126	216	225	
7/24/2002	2	70	184.15	70.42	132.5	128.55	128.55	229	968	
7/29/2002	3	75	203.48	77.49	135.9	131.011	131.01	434	1169	
7/31/2002	4	150	150.05	143.7	135.1	126	126	1193	109	
8/5/2002	5	85	113.84	85.02	135.5	127.66	127.66	679	311	
8/7/2002	6	115	89.36	83.61	133	125	125	784	43	
8/12/2002	7	85	107.02	88.15	134.5	126	126	726	168	
8/14/2002	8	100	93.92	98.49	131	125	125	841	113	
9/19/2002	9	85	79.8	67.25	130	125	125	1037	110	
8/21/2002	10	75	73.08	68.27	131.5	125	125	870	112	
8/26/2002	11	75	110.98	74.1	131	125.51	125.51	334	799	
8/28/2002	12	70	102	72.21	130	126	126	785	419	
9/2/2002	13	70	98.03	69.56	131	126.01	126.01	657	386	
9/4/2002	14	70	103.99	70.55	130	126.25	126.25	794	295	
9/9/2002	15	60	103.66	66.09	130	126.51	126.51	622	391	
9/11/2002	16	70	120.54	64.04	126.85		129			
9/17/2002	17	80	133.43	79.66	130	127.2	127.2	755	581	
9/18/2002	18	100	130.67	114.82	130	126.76	126.76	1152	106	
9/23/2002	19	80	79.76	52.33	128.7	126	126	657	104	
9/25/2002	20	80	102.44	82.94	130	126.25	126.25	678	82	
9/30/2002	21	80	77.49	70.67	129	126	126	628	56	
10/3/2002	22	80	64.58	61.08	131	126	126	484	40	
10/7/2002	23	80	68.17	67.27	128.7	126	126	632	12	
10/9/2002	24	70	114.17	70.5	129	126.25	126.25	573	67	
10/14/2002	25	80	117.53	80.55	128	126.5	126.5	635	241	
10/16/2002	26	80	101.23	80.32	128	126.55	126.55	588	173	
10/21/2002	27	80	107.73	81.96	128.5	126	126	561	277	
10/23/2002	28	90	117.21	84.94	129	126.81	126.81	1090	241	
10/28/2002	29	85	98.96	81	128	126.91	126.91	745	154	
10/30/2002	30	85	83.52	76.86	128.5	126.75	126.75	621	61	
11/4/2002	31	80	93.56	75.38	128	126.8	126.8	577	130	
11/6/2002	32	80	81.73	68.64	128	126.65	126.65	639	101	
11/11/2002	33	78	94.38	70.38	129	126.8	126.8	690	150	
11/13/2002	34	80	115.43	70.74	128.5	126.9	126.9	555	275	
11/18/2002	35	80	121.29	78.02	128.5	126.85	126.85	827	312	
11/20/2002	36	80	106.5	70.3	129	126.85	126.85	718	120	
11/25/2002	37	80	111.33	73.93	129.5	126.85	126.85	848	125	
11/27/2002	38	75	97.33	74.9	128	126.91	126.91	659	137	

12/2/2002	39	80	124.74	88.1	128.9	126.91	126.91	748	153
12/9/2002	40	100	145.22	127.9	129.1	126.91	126.92	748	145
11-Dec	41	80	108.87	76.13	129.11	126.8	126.8	808	229
12/16/2002	42	80	138.51	112.67	129.76	126.92	126.92	974	170
12/18/2002	43	75	128.85	112.54	128.5	126.9	126.9	849	145
12/23/2002	44	100	140.04	113.37	131	126.9	126.9	909	118
1/6/2003	45	100	140.87	104.78	128.65	126.97	126.97	918	201
1/8/2003	46	80	128.04	85.13	131.5	127.01	127.01	486	321
1/13/2003	47	80	133.57	86.36	129	127.11	127.11	645	398
1/15/2003	48	100	131.39	115.52	130	127.02	127.02	979	120
1/20/2003	49	80	151.56	84.71	128.5	127.13	127.13	693	376
1/22/2003	50	90	139.26	117.84	128.5	127.12	127.12	957	156
1/27/2003	51	80	113.05	71.8	129	127.21	127.21	707	343
1/29/2003	52	85	142.69	83.64	128	127.27	127.27	696	391
2/3/2003	53	95	160.43	79.76	129.5	127.36	127.36	528	592
2/5/2003	54	100	170.16	100.43	128.5	127.5	127.5	890	473
2/10/2003	55	125	162.65	135.74	130	127.45	127.45	1068	212
2/17/2003	56	100	178.76	96.26	128.5	127.61	127.61	568	596
2/19/2003	57	100	175.05	106.7	128.5	127	127	591	560
2/24/2003	58	100	185.45	107.59	129	127.96	127.96	723	622
2/26/2003	59	100	139.69	126.21	130	127.02	127.02	1080	60
3/3/2003	60	90	103.58	90.14	129	127.2	127.2	782	62
3/5/2003	61	85	113.39	79.97	128.8	127.2	127.22	688	68
3/10/2003	62	90	122.55	89.28	129.5	127.38	127.38	649	144
3/12/2003	63	90	140.86	87.18	129.5	127.52	127.52	486	360
3/17/2003	64	100	135.42	103.99	128.61	127.7	127.7	821	260
3/19/2003	65	100	108.63	104.2	128.7	127.3	127.3	795	42
3/24/2003	66	80	104.92	74.49	129.5	127.52	127.52	541	252
3/26/2003	67	90	101.17	96.54	128.68	127.22	127.22	808	22
3/31/2003	68	80	96.52	82.3	129.21	127.37	127.37	612	124
4/2/2003	69	90	99.33	78.21	128.3	127.51	127.51	650	123
4/7/2003	70	95	108.22	94.34	130.1	127.111	127.1	803	54
4/9/2003	71	95	102.38	70.69	128.5	127.27	127.27	671	78
4/14/2003	72	80	153.79	87.02	129.5	127.51	127.51	643	333
4/16/2003	73	100	139.1	116.15	128.71	127.51	127.51	808	92
4/23/2003	74	120	143.36	118.21	128.5	127.66	127.66	642	246
4/28/2003	75	80	129.76	85.51	129	127.81	127.81	613	366
4/30/2003	76	90	112.36	88.75	129	127.6	127.6	827	76
5/5/2003	77	80	94.08	75.67	129	127.53	127.53	622	82
5/7/2003	78	80	105.31	91.9	130	127.62	127.62	627	78
5/13/2003	79	75	118.69	96.54	129	127.5	127.5	841	111
5/19/2003	80	100	213.91	124.51	129	127.72	127.72	1183	189
5/21/2003	81	100	163.6	124.24	130		127.82		

5/27/2003	82	100	183.4	129.52	128.88	127.82	127.82	714	436
5/28/2003	83	90	116.87	97.3	129	127.82	127.82	762	84
6/2/2003	84	90	101.68	85.83	129	127.72	127.72	598	71
6/4/2003	85	80	104.5	78.99	129.01	127.86	127.86	488	256
6/9/2003	86	80	126.7	70.54	128.85	127.92	127.92	514	511
6/11/2003	87	100	177.41	119.76	129	127.92	127.92	911	197
6/16/2003	88	100	186	125.05	129		127.92		
6/18/2003	89	100	177.41	119.76	129	127.98	127.98	616	250
6/23/2003	90	100	178.63	168.33	130.5	127.78	127.78	973	77
6/25/2003	91	80	143.66	115.25	129	127.98	127.97	547	235
6/30/2003	92	80	122.32	83.66	129.2	127.92	127.92	518	130
7/2/2003	93	85	74.57	72.16	128.91	127.78	127.78	383	27
7/5/2003	94	80	43.42	42.46	128.5	127.6	127.6	167	8
7/9/2003	95	80	101.98	84.95	129	127.65	127.65	539	44
7/14/2003	96	90	149.11	92.53	130	127.82	127.82	827	267
7/16/2003	97	100	149.64	99.31	130	127.97	127.97	723	307
7/21/2003	98	100	176.76	154.51	129	127.97	127.97	1034	144
7/23/2003	99	80	121.69	111.7	129	127.9	127.9	948	55
7/28/2003	100	80	117.48	99.95	129	127.93	127.93	884	89
7/30/2003	101	80	86.6	75.63	129.5	127.73	127.73	670	61
8/4/2003	102	80	130.1	82.96	129	127.92	127.92	553	252
8/6/2003	103	100	150.3	74.68	129	128.01	128.01	482	538
8/11/2003	104	100	182.58	133.85	129	128.01	128.01	984	256
8/13/2003	105	85	128.34	84.19	130	128.1	128.1	657	388
8/18/2003	106	90	161.65	99.64	129.5	128.2	128.2	810	620
8/20/2003	107	100	201.47	100.89	129.06	128.33	128.33	491	752
8/25/2003	108	100	249.04	158.34	129.5	128	128	1422	143
8/27/2003	109	90	183.25	112.25	130	128.3	128.3	510	386
9/1/2003	110	80	152.98	95.15	129.01	128.5	128.5	641	523
9/3/2003	111	90	144.56	100.36	129.06	128.65	128.65	648	545
9/9/2003	112	80	136.89	75.91	130	128.82	128.82	620	627
9/10/2003	113	100	184.04	129.33	130	128.82	128.82	1039	132
9/15/2003	114	100	153.26	100.48	130	128.98	128.98	826	275
9/17/2003	115	100	147.52	115.88	130	128.98	128.98	910	120
9/22/2003	116	100	138.05	100.6	130	129.03	129.03	680	226
9/24/2003	117	100	100.55	93.6	130.5	128.02	128.02	853	26
9/29/2003	118	90	127.58	82.07	131.7	128.36	128.36	704	325
10/6/2003	119	100	203.87	147.95	130	128.36	128.36	1183	208
10/8/2003	120	90	194.74	83.38	130	128.73	128.73	471	636
10/13/2003	121	100	211.5	90.84	130	129.02	129.02	502	848
10/15/2003	122	100	202.31	98.06	130.5	129.35	129.35	705	735
10/20/2003	123	100	207.59	97.08	130.9	129.71	129.71	747	755
10/22/2003	124	80	236.3	87.25	131.5	130.2	130.2	437	977

10/27/2003	125	80	244.14	70.55	135.73	131.01	131.01	499	1309	
10/29/2003	126	75	290.32	73.5	135	132.52	132.52	430	1456	
11/3/2003	127	75	351.24	102.9	138	135.22	135.22	493	1761	
11/5/2003	128	100	402.82	330.77	145.11	135.22	135.22	1913	226	
11/10/2003	129	100	216.55	182.97	142	135.52	135.52	1015	213	
11/12/2003	130	80	159.56	80.61	142	136.12	136.12	599	455	
11/17/2003	131	80	209.64	79.97	140	137.11	137.11	618	699	
11/19/2003	132	80	223.21	152.15	141.5	138.2	138.2	618	646	
11/26/2003	133	100	201.24	166.74	142	138.2	138.2	1169	109	
12/1/2003	134	100	166.85	143.2	141	138	138	946	90	
12/3/2003	135	100	97.78	85.26	140.5	137.5	137.5	789	35	
12/8/2003	136	80	129.24	95.05	140.2	137.3	137.3	1325	143	
12/10/2003	137	80	105.33	92.88	140	137.13	137.13	693	79	
12/15/2003	138	80	109.08	87.97	140	137.1	137.1	634	126	
12/17/2003	138	80	107.9	86.17	140	137	137	677	48	
12/22/2003	140	80	89.45	78.73	140	137	137	647	23	
1/5/2004	141	100	100.33	72.92	139.9	136.83	136.83	635	65	
1/7/2004	142	85	99.35	88.67	139.5	136.55	136.55	675	60	
1/12/2004	143	85	122.8	111.43	140	136.55	136.55	713	61	
1/14/2004	144	90	93.51	86.53	139	136	136	645	58	
1/19/2004	145	85	163.11	153.64	139	136	136	735	56	
1/21/2004	146	80	90.02	86.71	138.88	135.5	135.5	544	46	
1/26/2004	147	80	116.74	102.91	139	135.5	135.5	680	126	
1/28/2004	148	80	104.72	88.3	139.5	135.3	135.3	680	115	
2/4/2004	149	120	184.61	150.12	140	135.2	135.2	918	148	
2/9/2004	150	85	136.95	125.82	138	135.2	135.2	788	108	
2/11/2004	151	80	107.02	91.49	137	135.2	135.2	675	107	
2/16/2004	152	90	135.06	116.85	138.5	135.15	135.15	751	85	
2/18/2004	153	90	123.59	115.67	137.6	135.15	135.15	662	62	
2/23/2004	154	100	100	109.49	136.5	135.1	135.15	688	90	67
2/25/2004	155	90	90	78.26	137	133.55	135	590	27	64
3/1/2004	156	85	85	99.35	136.5	134.15	135	598	54	63
3/3/2004	157	85	85	78.05	137	132	135	559	35	60
3/8/2004	158	85	85	108.43	136.15	134.5	134.91	668	37	53
3/10/2004	159	85	85	87.42	136	132.56	134.9	559	35	57
3/15/2004	160	85	85	60.39	136	130.09	134	460	29	51
3/17/2004	161	75	75	44.38	136	130.5	134.24	457	54	55
3/22/2004	162	70	70	69.44	136.5	130.05	134.11	528	30	60
3/24/2004	162	70	70	58.73	136.5	132.56	134	518	15	58
3/29/2004	164	70	70	40.14	135.5	133.85	133.85	291	20	38
3/31/2004	165	70	70	50.08	135.11	130	133.7	282	12	40
4/5/2004	166	65	129.55	109.88	135.55	130	133.7	542	86	61
4/7/2004	167	80	117.47	114.7	139	132.7	133.7	606	36	61

4/14/2004	168	100	111.76	107.51	135.5	129	133.4	694	20	62
4/19/2004	169	75	157.34	152.35	135	131.5	133.4	789	23	58
4/21/2004	170	80	78.23	75.25	134.5	129	133.4	580	17	56
4/26/2004	171	75	75	96.26	135.5	133.2	133.4	654	31	66
4/28/2004	172	80	95.63	91.78	135	132.9	133.3	528	27	61
5/3/2004	173	80	125.83	100.78	136.45	132.9	133.3	630	64	60
5/5/2004	174	100	133.44	125.02	135.7	130.1	133.3	587	23	60
5/10/2004	175	100	100	128.2	134.5	133.16	133.3	651	26	56
5/12/2004	176	100	100	105.38	135.5	133	133	563	25	60
5/17/2004	177	100	100	106.55	135	131.9	133	632	83	64
5/19/2004	178	100	100	107.94	134.7	128	132.8	631	30	59
5/24/2004	179	100	100	116.98	134	130	132.8	652	22	63
5/26/2004	180	100	100	100.43	134	132.76	132.8	566	20	61
5/31/2004	181	100	100	95.87	134	132.6	132.75	532	117	53
6/3/2004	182	90	90	106.46	134	130.05	132.75	519	60	63
6/7/2004	183	100	100	171.73	134.5	131	132.75	588	115	65
6/9/2004	184	100	100	69.32	134.5	131	132.75	269	11	31
6/14/2004	185	100	100	91.72	134	130	132.75	453	34	59
6/16/2004	186	100	100	136.22	134	129.5	132.75	699	56	65
6/21/2004	187	100	100	138.97	133.5	131.4	132.75	676	54	64
6/23/2004	188	100	100	95.47	135	131.5	132.75	719	30	68
2/29/2004	189	100	100	101.64	133.5	132.5	132.75	616	21	63
6/30/2004	190	100	110	81.85	134	132.4	132.75	478	35	58
7/5/2004	191	90	90	86.12	134	132.5	132.76	388	309	65
7/7/2004	192	120	120	170.09	134	132.5	132.76	798	27	66
7/31/2004	193	100	100	112.07	134.9	130.8	132.8	523	300	66
7/14/2004	194	100	100	115.94	134	131.9	132.8	724	114	64
7/19/2004	195	100	100	93.52	139.21	131.9	132.81	581	246	65
7/21/2004	196	100	100	101.34	134	130.9	132.84	612	182	62
7/26/2004	197	100	100	127.77	134	131.75	132.84	777	64	60
7/28/2004	198	100	100	92.55	134.5	131.88	132.82	652	35	61
8/2/2004	199	90	90	90.87	134.05	131.99	132.8	675	23	51
8/4/2004	200	90	90	88.03	134	132	132.8	567	44	53
8/9/2004	201	90	90	105.54	134	132	132.82	591	144	61
8/11/2004	202	100	100	98.33	133.85	130.95	132.84	594	114	57
8/17/2004	203	100	100	93.6	133.5	130.5	132.84	629	34	60
8/18/2004	204	85	85	40.94	133.2	132.84	132.84	318	309	40
8/23/2004	205	80	80	61.85	133.5	131.9	132.84	469	20	43
8/25/2004	206	80	80	99.9	134	131.8	132.85	725	42	56
8/30/2004	207	90	90	81.41	133.5	132.83	132.83	609	16	54
9/1/2004	208	80	80	82.55	133.5	132.83	132.83	515	15	53
9/6/2004	209	80	80	96.97	134	131.84	131.84	574	34	55
9/8/2004	210	90	90	82.76	134	130.05	132.83	548	25	51

9/13/2004	211	80	80	104.62	134	132.8	132.84	648	85	55
9/15/2004	212	100	100	83.45	134	130.05	132.84	581	42	55
9/20/2004	213	85	85	86.2	133.6	131.25	132.84	668	26	57
9/22/2004	214	90	90	93.49	133.2	132.75	132.86	523	150	59
9/28/2004	215	100	100	101.97	133.5	131.88	132.87	635	99	63
9/30/2004	216	100	100	103.53	133.2	131.5	132.87	543	79	54
10/5/2004	217	100	100	110.95	133.5	132	132.87	500	32	56
10/7/2004	218	90	90	103.13	134	132.8	132.88	561	71	61
10/12/2004	219	85	85	68.4	133.3	132.8	132.88	372	16	30
10/13/2004	220	80	80	54.03	133.3	132.85	132.88	133	4	27
10/18/2004	221	90	90	91.95	133.3	131.8	132.9	539	100	57
10/20/2004	222	120	120	139.04	133.5	131	132.87	714	33	55
10/25/2004	223	100	100	107.6	133.5	132.81	132.87	629	30	61
10/27/2004	224	100	100	100.12	133.5	131.5	132.9	485	118	70
11/1/2004	225	100	100	95.117	134	132.83	132.86	649	21	59
11/3/2004	226	90	90	78.74	133.5	132.86	132.86	517	13	52
11/8/2004	227	80	80	85.8	133.5	132.85	132.86	604	28	50
11/11/2004	228	85	85	95.05	133.1	130	132.89	455	113	50
11/15/2004	229	100	100	111.19	133.2	132.86	132.98	502	47	50
11/17/2004	230	100	100	88	133.2	130	132.87	466	30	52
11/22/2004	231	90	90	90.08	133.05	132.8	132.87	544	32	52
11/24/2004	232	100	100	75.62	133.5	132.1	132.87	465	5	49
11/29/2004	233	85	85	90.76	133.5	132.86	132.88	483	29	54
12/1/2004	234	85	85	60.33	133.05	132.8	132.88	384	402	46
12/6/2004	235	80	80	80.4	133.05	132.8	132.85	568	18	51
12/8/2004	236	80	80	85.41	133.2	132.8	132.85	458	18	52
12/13/2004	237	85	85	98.14	133.02	131.05	132.85	558	532	56
12/15/2004	238	100	100	96.54	133.12	132.8	132.88	493	158	62
12/20/2004	239	125	125	162.06	133.3	132.67	132.85	866	110	54
1/5/2005	240	100	100	158.71	133.2	130.11	132.85	859	39	65
1/10/2005	241	100	100	101.93	133.2	132.5	132.85	552	15	52
1/12/2005	242	85	85	83.68	133.15	132.15	132.86	447	40	42
1/17/2005	243	100	119.28	100.3	133.2	132.85	132.88	519	111	55
1/25/2005	244	135	135	132.39	133.2	132.75	132.86	680	30	
1/26/2005	245	90	90	105.02	133.05	132.86	132.86	621	16	56
2/1/2005	246	100	100	146.16	133.5	131.8	132.86	680	31	58
2/7/2005	247	100	100	130.45	133.2	132.8	132.85	602	25	56
2/8/2005	248	100	100	134.01	133.2	132.85	132.85	626	35	63
2/9/2005	249	100	100	95.48	133.1	132.85	132.85	453	6	53
2/14/2005	250	100	100	101.42	133.8	130.1	132.85	659	17	60
2/16/2005	251	100	100	86.43	133.05	132.8	132.85	540	39	58
2/21/2005	252	100	100	101.44	133.1	132.8	132.86	576	57	57

2/23/2005	253	100	100	98.01	133.1	132.6	132.86	499	20	54
2/28/2005	254	100	100	87.41	133.25	132.8	132.85	484	15	47
3/3/2005	255	85	85	80	133.05	132.85	132.85	433	50	54
3/7/2005	256	100	100	136.06	133.25	132.85	132.85	562	68	54
3/9/2005	257	100	100	96.57	133.3	132.8	132.85	516	53	55
3/14/2005	258	90	90	99.45	134	132.85	132.86	602	42	51
3/16/2005	259	100	100	107.14	134	132.8	132.86	549	32	57
3/21/2005	260	100	100	107.03	133.06	132.68	132.86	584	40	58
3/24/2005	261	100	100	108.67	133.2	132	132.85	555	22	50
3/30/2005	262	120	120	97.06	133	131.1	132.85	508	9	47
4/4/2005	263	90	71.9	71.6	134	132.8	132.85	477	8	42
4/6/2005	264	90	90	71.51	133.1	132.1	132.85	430	102	48
4/11/2005	265	120	120	135.73	133	130	132.86	699	80	58
4/13/2005	266	100	100	112.57	133	132.8	132.86	573	46	52
4/18/2005	267	100	100	127.29	133.1	132.7	132.86	693	36	59
4/22/2005	268	100	100	72.02	133.1	131	132.86	520	15	49
4/25/2005	269	100	100	96.22	133	132.86	132.86	551	15	56
4/27/2005	270	85	85	77.04	133	132.7	132.83	434	123	51
5/5/2005	271	120	115.69	107.05	133.2	132.8	132.8	694	43	55
5/9/2005	272	90	90	110.29	133	132.5	132.8	591	38	51
5/11/2005	273	100	100	106.57	133.2	130.1	132.81	499	87	54
5/16/2005	274	100	100	124.48	133.01	131	132.83	607	133	61
5/18/2005	275	120	120	128.15	133.4	132.8	132.83	710	48	54
5/23/2005	276	100	100	129.33	133.1	132.82	132.83	653	24	54
5/25/2005	277	120	120	116.8	133.1	132.5	132.83	585	48	48
6/2/2005	278	100	100	130.22	134	132	132.83	766	49	57
6/6/2005	279	120	120	142.33	133.1	132.83	132.85	571	123	55
6/8/2005	280	100	100	123.18	133.4	132.83	132.86	543	201	59
6/13/2005	281	110	110	128.11	133.1	132.83	132.88	689	231	55
6/15/2005	282	120	120	128.69	133.06	132.83	132.88	705	117	57
6/20/2005	283	100	100	117.59	133.1	132.85	132.9	606	181	52
6/22/2005	284	120	120	115.45	133.5	131	132.88	740	59	58
6/27/2005	285	100	100	101.02	133.1	131.8	132.88	647	64	61
6/29/2005	286	100	100	118.89	134	132.1	132.87	705	69	59
7/4/2005	287	100	100	101	133.05	131.8	132.87	578	57	55
7/6/2005	288	100	100	133.73	133.5	132.5	132.89	611	131	54
7/11/2005	289	120	120	130.02	134	131	132.87	746	85	56
7/13/2005	290	110	110	134.09	133.1	132.85	132.87	666	82	57
7/18/2005	291	120	120	167.28	133.1	132.85	132.87	740	93	59
7/20/2005	292	150	150	151.41	133.25	132.57	132.86	739	81	53
7/25/2005	293	150	150	155.19	133.25	132.28	132.86	789	79	58
7/27/2005	294	150	150	149.14	133.2	130	132.86	741	24	58
8/1/2005	295	120	120	135.99	134	131.7	132.86	668	139	56
8/3/2005	296	150	150	156.76	134	132	132.88	744	69	54
8/8/2005	297	130	130	134.43	134	132.76	132.88	783	72	54
8/12/2005	298	130	130	132.48	133.1	132.25	132.86	800	42	56
8/16/2005	299	150	150	143.52	133.6	130	132.86	858	65	56
8/17/2005	300	120	120	122.93	133.2	132.86	132.86	706	32	57

8/22/2005	301	120	120	117.64	134	132.85	132.85	727	10	60
8/29/2005	302	80	80	128.84	135	127.87	129.57	689	56	55
8/29/2005	303	100	100	45.01	133	129.87	129.87	281	7	28
9/5/2005	304	100	100	101.07	133	129.45	129.57	759	42	54
9/6/2005	305	100	100	92.57	133.1	129	129.57	586	39	50
9/7/2005	306	80	80	116.4	133.1	127	129.5	590		51
9/12/2005	307	100	100	109.4	133	129.48	129.5	723	58	55
9/14/2005	308	100	100	97.46	133.5	128.99	129.5	631	47	49
9/20/2005	309	100	100	99.18	133	129.5	129.5	687	18	56
9/21/2005	310	100	100	85.58	132.61	129.3	129.51	509	19	52
9/26/2005	311	80	80	102.67	133	129.3	129.54	585	110	55
9/28/2005	312	80	80	111.18	133	128.51	129.5	740	237	54
10/5/2005	313	80	80	82.35	131	129	129.53	613	95	42
10/11/2005	314	100	100	102.22	130.5	129.5	129.54	613	77	42
10/13/2005	315	100	119.96	113.89	130.1	123.6	129.55	581	41	53
10/17/2005	316	100	130.99	97.68	132.9	129.53	129.55	632	79	45
10/24/2005	317	100	100	124.51	132.5	129.5	129.55	634	80	50
10/26/2005	318	100	87.03	84.02	132.9	129	129.55	567	20	46
10/31/2005	319	100	84.88	76.37	130	129	129.53	456	21	37
11/7/2005	320	100	93.15	91.65	133.5	128.5	129.53	552	17	40
11/9/2005	321	80	87.91	78.16	130	129.5	129.53	369	13	31
11/15/2005	322	80	107.05	91.62	130.2	129.53	129.53	632	21	41
11/16/2005	323	80	80	87.3	130.5	129.53	129.53	465	17	33
11/21/2005	324	80	91.12	79.93	130	129.5	129.53	485	52	35
11/23/2005	325	70	48.49	48.45	130	127.75	129	406	3	33
11/28/2005	326	70	109.57	86.31	130	129	129.01	473	67	38
11/30/2005	327	100	97.73	94.5	131	129	129.01	523	21	36
12/5/2005	328	100	89.38	88.85	132.9	129	129	508	7	36
12/7/2005	329	80	67.48	66.6	130	129	129	446	10	32
12/12/2005	330	80	89.39	80.27	132.5	128.5	129	470	26	30
12/14/2005	331	70	65.29	65.1	130	128.85	129	285	3	25
12/19/2005	332	70	56.38	55.53	130	128.5	129	380	9	31
12/21/2005	333	70	157.85	146.1	130	125	129	452	10	36
1/4/2006	334	100	24.5	24.44	130	129	129	115	3	16
1/9/2006	335	70	63.2	62.47	130	129	129	332	6	18
1/16/2006	336	80	62.2	61.1	130	129	129	285	6	16
1/18/2006	337	80	25.2	25	131.5	129	129	264	1	13
1/23/2006	338	80	43.3	41.2	132.93	128.95	129	253	5	15
1/25/2006	339	70	18.2	18.1	130	129	129	185	2	12
1/30/2006	340	70	70	14.53	129.2	129	129	48	3	8
2/1/2006	341	50	88	87.62	130	128.5	128.5	44	1	7
2/6/2006	342	50	50	27.47	130.9	128	127.25	139	7	10
2/8/2006	343	50	15.39	14.04	129.7	128.5	128.5	69	2	8
2/13/2006	344	50	102.67	75.51	130	128.25	128.5	381	18	20
2/15/2006	345	80	45.53	45.39	130.35	128.5	128.5	276	6	13
2/20/2006	346	100	100	34.76	128.7	125.45	128	19	13	21
2/22/2006	347	80	80	14.4	128.2	127	128	7	12	13
2/27/2006	348	50	50	16	128.2	127	128	7	14	15
3/1/2006	349	50	50	30.93	128.05	127.43	127.5	22	1	14
3/6/2006	350	80	163.33	116.33	128	126.7	127.5	20	20	25
3/8/2006	351	130	91.79	62.29	127.8	126.5	127.5	13	15	17

3/13/2006	352	80	75.98	44.71	128.5	127	127.5	12	12	15
3/15/2006	353	40	15.1	1.1	128	127	127.5	2	7	6
3/27/2006	354	50	4.79	4.79	126.5	126	126	2	0	2

SOURCE : www.cenbank.org

APPENDIX-B : Stationarity test For 1 – 128, 129 – 354 and 1-354 Periods Respectively
Demand

ADF Test Statistic	0.491459	1% Critical Value*	-3.4843
		5% Critical Value	-2.8849
		10% Critical Value	-2.5791

*MacKinnon critical values for rejection of hypothesis of a unit root.

ADF Test Statistic	-5.014884	1% Critical Value*	-3.4613
		5% Critical Value	-2.8747
		10% Critical Value	-2.5737

*MacKinnon critical values for rejection of hypothesis of a unit root.

ADF Test Statistic	-3.387809	1% Critical Value*	-3.4510
		5% Critical Value	-2.8700
		10% Critical Value	-2.5713

*MacKinnon critical values for rejection of hypothesis of a unit root.

Supply

ADF Test Statistic	-3.073807	1% Critical Value*	-3.4843
		5% Critical Value	-2.8849
		10% Critical Value	-2.5791

*MacKinnon critical values for rejection of hypothesis of a unit root.

ADF Test Statistic	-2.512248	1% Critical Value*	-3.4613
		5% Critical Value	-2.8747
		10% Critical Value	-2.5737

*MacKinnon critical values for rejection of hypothesis of a unit root.

ADF Test Statistic	-3.997039	1% Critical Value*	-3.4510
		5% Critical Value	-2.8700
		10% Critical Value	-2.5713

*MacKinnon critical values for rejection of hypothesis of a unit root.

Quantity traded

ADF Test Statistic	-4.236582	1% Critical Value*	-3.4843
		5% Critical Value	-2.8849
		10% Critical Value	-2.5791

*MacKinnon critical values for rejection of hypothesis of a unit root.

ADF Test Statistic	-2.367497	1% Critical Value*	-3.4613
		5% Critical Value	-2.8747
		10% Critical Value	-2.5737

*MacKinnon critical values for rejection of hypothesis of a unit root.

ADF Test Statistic	-3.664487	1% Critical Value*	-3.4510
		5% Critical Value	-2.8700
		10% Critical Value	-2.5713

*MacKinnon critical values for rejection of hypothesis of a unit root.

Marginal Rate

ADF Test Statistic	1.471835	1% Critical Value*	-3.4843
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		5% Critical Value	-2.8849
		10% Critical Value	-2.5791
<hr/>			
*MacKinnon critical values for rejection of hypothesis of a unit root.			
ADF Test Statistic	-0.576078	1% Critical Value*	-3.4613
		5% Critical Value	-2.8747
		10% Critical Value	-2.5737
<hr/>			
*MacKinnon critical values for rejection of hypothesis of a unit root.			
ADF Test Statistic	-1.393217	1% Critical Value*	-3.4510
		5% Critical Value	-2.8700
		10% Critical Value	-2.5713
<hr/>			
*MacKinnon critical values for rejection of hypothesis of a unit root.			
High Bid Rate			
ADF Test Statistic	0.312121	1% Critical Value*	-3.4843
		5% Critical Value	-2.8849
		10% Critical Value	-2.5791
<hr/>			
*MacKinnon critical values for rejection of hypothesis of a unit root.			
ADF Test Statistic	-1.742539	1% Critical Value*	-3.4613
		5% Critical Value	-2.8747
		10% Critical Value	-2.5737
<hr/>			
*MacKinnon critical values for rejection of hypothesis of a unit root.			
ADF Test Statistic	-1.763233	1% Critical Value*	-3.4510
		5% Critical Value	-2.8700
		10% Critical Value	-2.5713
<hr/>			
*MacKinnon critical values for rejection of hypothesis of a unit root.			
Low Bid Rate			
ADF Test Statistic	1.692652	1% Critical Value*	-3.4934
		5% Critical Value	-2.8889
		10% Critical Value	-2.5812
<hr/>			
*MacKinnon critical values for rejection of hypothesis of a unit root.			
ADF Test Statistic	-1.795385	1% Critical Value*	-3.4613
		5% Critical Value	-2.8747
		10% Critical Value	-2.5737
<hr/>			
*MacKinnon critical values for rejection of hypothesis of a unit root.			
ADF Test Statistic	-1.528378	1% Critical Value*	-3.4520
		5% Critical Value	-2.8704
		10% Critical Value	-2.5715
<hr/>			
*MacKinnon critical values for rejection of hypothesis of a unit root.			
Success Bid			
ADF Test Statistic	-5.116965	1% Critical Value*	-3.4934
		5% Critical Value	-2.8889
		10% Critical Value	-2.5812
<hr/>			
*MacKinnon critical values for rejection of hypothesis of a unit root.			
ADF Test Statistic	-1.605617	1% Critical Value*	-3.4613
		5% Critical Value	-2.8747
		10% Critical Value	-2.5737
<hr/>			
*MacKinnon critical values for rejection of hypothesis of a unit root.			
ADF Test Statistic	-2.415321	1% Critical Value*	-3.4520

5% Critical Value	-2.8704
10% Critical Value	-2.5715

*MacKinnon critical values for rejection of hypothesis of a unit root.

Non – success Bid

ADF Test Statistic	-2.247804	1% Critical Value*	-3.4934
		5% Critical Value	-2.8889
		10% Critical Value	-2.5812

*MacKinnon critical values for rejection of hypothesis of a unit root.

ADF Test Statistic	-7.191824	1% Critical Value*	-3.4621
		5% Critical Value	-2.8750
		10% Critical Value	-2.5739

*MacKinnon critical values for rejection of hypothesis of a unit root.

ADF Test Statistic	-3.851318	1% Critical Value*	-3.4523
		5% Critical Value	-2.8706
		10% Critical Value	-2.5716

*MacKinnon critical values for rejection of hypothesis of a unit root.

APPENDIX -C: OUTPUT FOR ARCH AND GARCH MODELS

Dependent Variable: DD

Method: ML - ARCH

Date: 12/01/06 Time: 12:21

Sample(adjusted): 2 354

Included observations: 353 after adjusting endpoints

Convergence achieved after 35 iterations

	Coefficient	Std. Error	z-Statistic	Prob.
C	162.5621	44.56766	3.647535	0.0003
MR(-1)	-0.946200	0.323580	-2.924157	0.0035
DD(-1)	0.659111	0.037306	17.66785	0.0000
RS(-1)	-0.420083	0.694220	-0.605115	0.5451

Variance Equation

C	64.75897	18.37213	3.524849	0.0004
ARCH(1)	0.365853	0.086119	4.248235	0.0000
GARCH(1)	0.588334	0.070991	8.287457	0.0000

R-squared	0.555898	Mean dependent var	113.4463
Adjusted R-squared	0.548197	S.D. dependent var	43.12856
S.E. of regression	28.98941	Akaike info criterion	9.173529
Sum squared resid	290773.5	Schwarz criterion	9.250202
Log likelihood	-1612.128	F-statistic	72.18352
Durbin-Watson stat	1.871628	Prob(F-statistic)	0.000000

Dependent Variable: MR

Method: ML - ARCH

Date: 12/01/06 Time: 12:26

Sample(adjusted): 2 354

Included observations: 353 after adjusting endpoints

Convergence not achieved after 100 iterations

	Coefficient	Std. Error	z-Statistic	Prob.
C	0.438709	1.091752	0.401840	0.6878
DD	0.002307	0.000388	5.939239	0.0000

MR(-1)	0.994518	0.008431	117.9663	0.0000
Variance Equation				
C	0.024355	0.001230	19.79342	0.0000
ARCH(1)	0.133391	0.019546	6.824390	0.0000
GARCH(1)	0.692404	0.013724	50.45169	0.0000
R-squared	0.971939	Mean dependent var	130.6954	
Adjusted R-squared	0.971535	S.D. dependent var	3.088427	
S.E. of regression	0.521068	Akaike info criterion	0.724516	
Sum squared resid	94.21459	Schwarz criterion	0.790235	
Log likelihood	-121.8771	F-statistic	2403.796	
Durbin-Watson stat	2.514230	Prob(F-statistic)	0.000000	

APPENDIX :D - SPREAD BETWEEN PARALLEL, BUREAU DE CHANGE AND OFFICIAL RATE.

<i>Monthly Foreign Exchange Rates:200 – 2003 (₹/\$1)</i>						
<i>Month</i>	<i>Official Rate(OR)</i>	<i>Bureau De Change(BDC)</i>	<i>Parallel Market Rate(PM)</i>	<i>PM- OR</i>	<i>BDC - OR</i>	<i>PM - BDC</i>
JAN,2000	98.73	103.5	103.75	5.02	4.77	0.25
FEB,2000	99.89	106.07	106.5	6.61	6.18	0.43
MAR,2000	100.65	105.83	106.3	5.65	5.18	0.47
APRIL,2000	100.4	106.3	106.1	5.7	5.9	-0.2
MAY,2000	101.17	106.13	105.75	4.58	4.96	-0.38
JUNE,2000	101.83	105.79	106.13	4.3	3.96	0.34
JULY,2000	104.9	111	110.9	6	6.1	-0.1
AUG,2000	103.36	113.87	114.87	11.51	10.51	1
SEPT,2000	102.36	119	118	15.64	16.64	-1
OCT,2000	102.52	119.14	119	16.48	16.62	-0.14
NOV,2000	102.52	120.28	119	16.48	17.76	-1.28
DEC,2000	106.19	122	121.83	15.64	15.81	-0.17
JAN,2001	109	120	122	13	11	2
FEB,2001	110	123.5	122.5	12.5	13.5	-1
MAR,2001	110.2	125	127.5	17.3	14.8	2.5
APRIL,2001	127.5	130.5	132	4.5	3	1.5
MAY,2001	113.1	137	140	26.9	23.9	3
JUNE,2001	112.2	133	139	26.8	20.8	6
JULY,2001	111.3	134	137	25.7	22.7	3
AUG,2001	111.2	133	135.8	24.6	21.8	2.8
SEPT,2001	111.1	133	135	23.9	21.9	2
OCT,2001	111.1	132	133	21.9	20.9	1
NOV,2001	112.1	134	135	22.9	21.9	1
DEC,2001	112.45	134.5	134	21.55	22.05	-0.5
JAN,2002	113.95	134.5	135	21.05	20.55	0.5
FEB,2002	114.7	134	136	21.3	19.3	2
MAR,2002	115.1	134.5	135.5	20.4	19.4	1
APRIL,2002	116.1	134.5	135.5	19.4	18.4	1
MAY,2002	116.3	134	135	18.7	17.7	1
JUNE,2002	118.5	134	135	16.5	15.5	1
JULY,2002	121.5	136.5	135	13.5	15	-1.5
AUG,2002	127	137	136	9	10	-1
SEPT,2002	126	135	136	10	9	1
OCT,2002	126.5	137	137.5	11	10.5	0.5

NOV,2002	126.8	137	138	11.2	10.2	1
DEC,2002	126.8	136.5	137	10.2	9.7	0.5
JAN,2003	127.12	138	137	9.88	10.88	-1
FEB,2003	127.02	139	139.5	12.48	11.98	0.5
MAR,2003	127.37	139.5	140.5	13.13	12.13	1
APRIL,2003	127.72	139	140	12.28	11.28	1
MAY,2003	127.82	138.5	139	11.18	10.68	0.5
JUNE,2003	127.98	139	140.5	12.52	11.02	1.5
JULY,2003	127.47	140	141	13.53	12.53	1
AUG,2003	127.9	141.5	142	14.1	13.6	0.5
SEPT,2003	129.73	142.5	143	13.27	12.77	0.5
OCT,2003	130.2	144	143.5	13.3	13.8	-0.5
NOV,2003	136.5		147.2	10.7		
DEC,2003	137.3		142.1	4.8		

SOURCE: <http://www.nigeriabusinessinfo.com/forex.htm>