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Abstract: An intriguing development since the 1990s has been that, despite the proliferation of greater exchange rate flexibility, international reserves increased substantially. Practically all the increase in reserves holding has been by developing countries, mostly concentrated in East Asia. In Nigeria, the story is not significantly different as the rising trend of reserves accumulation became quite dramatic in the 2000s. Even as the nation’s reserves holding started nosediving since 2014 in the face of economic crisis, there has been much worries by both by policymakers and even the general public. This study aims at ascertaining whether external reserves holding increases with increasing exchange rate flexibility. Moreso, demand for reserves dynamics and interventionist role of reserves are investigated using quarterly time series data spanning between 1970Q1 and 2015Q4. Econometric evidence obtained from Bayesian VAR estimation reveals that reserves holdings increase with increasing exchange rate flexibility. The study reveal that reserves accretion is substantially driven by josses and wardrobe effects. The study further reveals that optimal reserves holding significantly guard the economy against currency and financial crises. The results suggest that there is need for prudent reserves management as well as undistorted focus on the productive base of the economy to ensure sustainable growth of the economy.

Keywords: exchange rate regime, Demand for International Reserves, exchange rate stability, BVAR

I. INTRODUCTION

With the collapse of the Bretton Woods system of fixed exchange rates which lasted for nearly three decades from 1946 to 1973, exchange rate policy makers were forced into deploying varieties of exchange rate management strategies, to handle the uncertainties arising from the new floating exchange rate system. Since the volatilities arising from exchange rate floatation generally harms the economy by complicating the achievement of price stability, the central banks often intervene in the foreign exchange markets to forcefully maintain stability. The process is usually to maintain the value of own currency by buying and selling on it. To a large extent therefore it became expedient that governments or its central banks should maintain certain levels of official reserves of foreign exchange to ensure that its intervention capacity is not hampered (Obadan, 2006; Odusola, 2006). Unfortunately, interventionism has chain consequences because one policy of intervention will orchestrate distortions or problems requiring another level of interventionism to fix it. And so it was with the abandonment of the Bretton Woods system and the apparent enthronement of interventionist policies at the exchange rate management level. Many economies particularly the developing and emerging market economies, got caught up in this trap and by the mid-1990s, there was massive accumulation of foreign exchange reserves: a practice that has accelerated over the years particularly with Africa and other oil exporting countries (Aizenman & Lee, 2005; Edward, 1983).

Not surprisingly, the stance of external reserve holding has generated serious global academic debate, as different economies search for alternative strategies that will protect their economy against financial instability and stimulate economic growth. The conventional perspective sees external reserves as store of assets that central banks hold to influence their currency exchange (Aizenman & Lee, 2005; Choi & Baek, 2004). This argument will more likely hold for fixed regime as well as adjustable – peg economies. Increase in reserves holdings as a guard against capital flow volatility and financial crisis, became popular after the financial crisis of the 1990’s experienced by most Asian countries. In retrospect, the 1997–98 crises exposed hidden vulnerabilities of East Asian countries, forcing the market to update the probability of sudden stops affecting all countries. The above observations suggest that external reserve accretion can be viewed as a precautionary adjustment, reflecting the desire for self-insurance against exposure to future sudden shocks and reversals of short-term capital inflows. This implies that reserves accumulation is necessitated by deeper financial integration that is prevalent in the global economy.

This view linking the large increase in reserve holdings to deeper financial integration has in recent time, faced a well-known contender in a modern incarnation of mercantilism: international reserves accumulations triggered by concerns about export competitiveness. The explanation has been advanced by Dooley, Folkerts-Landau and Garber (2003), especially in the context of China. They interpret reserve

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accumulation as a by-product of exports promotion, which is needed to create better jobs, either by abundant labour in traditional sectors, mostly in agriculture, or through industrial sector job absorption. Whether excess reserve is held due to transactionary, precautionary, or mercantilist motive, the cost of keeping such reserves cannot be overlooked (Aizenman & Lee, 2005).

Another Puzzle about excess reserve holding in emerging markets is its sustainability. Will high reserves holding be sustainable in the long run, irrespective of the exchange rate regime that an economy operates? Most literature has concentrated either in the trade-off between monetary independence and credibility implied by different exchange rate regimes, or on the insulation properties of reserve holdings in the face of monetary and real shocks, with less attention on the long run trend of reserves given a particular exchange rate regime (Cohen,1975; Ben-Bassat & Gottlieb,1992; Aizenman & Lee, 2005). But, it is imperative to understand this relation in order to enable policy makers reconcile the goal conflict inherent in the choice of exchange rate regime and desire to hold reserves.

Globalization and its concomitant effect-financial integration, has led to currency crisis. Thus, different economies of the world have experimented different types of exchange rate regimes, ranging from gold standard to Bretton wood arrangement, floating regime, managed floating, and even multiple rate regime; all in a bid to stabilize the global price of their currency. From a priori, the more stable the exchange rate, the less the quantity of reserves held, since reserves are used to intervene in the forex market to stabilize the international price of the domestic currency. Intuitively, there is going to be goal conflict if an economy desires to accumulate excess reserve and also maintain a stable exchange rate (Hee-Ryang,2009; Bird &Rajan,2002).

The phenomenal rise in the level of Nigeria’s external reserve especially between 2004 and 2013 also generated a lot of interest and debate among both the informed and uninformed members of the public on how the reserves should be managed and the sustainability of such trend. While some criticized the monetary authorities and indeed, the government for stockpiling reserves in the midst of poverty and unemployment with a call for the reserves to be injected into the economy to develop infrastructure and create employment, others opined that since the reserves accumulation was through highly volatile and unsustainable sources, the excess revenue should be saved for the future generation (Tella, 2006; Omolara, 2007; Aluko, 2006). But, in a swift of time, Tella (2006) and Omolara (2007) fears that the hitherto reserves accumulation could be unsustainable began to stare us in the face. Reserves began plummeting since 2014 and there is no doubt that recovery is still slow even after the second quarter of 2017.

In response to the sustained headsway of external reserves, the Central Bank of Nigeria (CBN) announced a full float of the Naira after its MPC meeting on 24th May, 2016. Consequently, for over 6 months following the full floating, the CBN’s intervention in the market was so low. Although free floating system was welcome by some, it soon turned out to be the beginning of around of unprecedented woes. The naira exchange rate summersaulted, being exchanged between N300 and N 500 per dollar. The gap between the official and black-market exchange rates then grew wider. This development prompted a quick return to interventionism and managed floating since, April, 2017.

The ever accelerating interest in accumulation of external reserves by a number of countries, particularly since late 1990s has contributed in reviving interest in reserve related issues. Research has focused mainly on estimating the demand for reserves for developed vis a vis developing countries, assessment of reserve adequacy and its opportunity costs and reserve- exchange rate nexus (Frenkel,1978; Frenkel & Jovanovic,1981; Abdullateef, 2010). However, the empirical investigation of the relationship between exchange rate regime and the level of reserve holding has been sidelined.

The puzzle that begs for answer is: do reserves holdings decrease with increasing exchange rate flexibility. Also the issue of long runimpact of external reserve holding on exchange rate stability is very critical. Moreover, the classification of exchange rate regimes used by most researchers seems to be misleading. For instance, a situation whereby Nigeria is considered as a floating regime economy (even though it is officially correct; but practically, it is not) may generate misleading conclusion. Also, a situation whereby groups of economies with different economic fundamentals are lumped up for estimating the country’s external reserves holdings demand function may produce biased results. Since specific country economic fundamentals may be assumed away. It is therefore worrisome to economists and policy makers to know the empirical relationship between exchange rate regimes and external reserves holding with respect to the Nigerian case.

Thus, unlike previous studies, we examined the implication of increasing exchange rate flexibility for reserves accumulations. Since realizing the desire for reserves accumulation is contingent on the exchange rate regime, it is imperative to ascertain whether (or not) external reserves increases with increasing flexibility of the exchange rate. Also, in modelling the demand for reserves function, we re-examined opportunity cost of holding reserves with interest rate differential (that is the difference between global rate and domestic rate), using the US as a representative economy instead of using domestic interest rate. The rest of the paper is organized as follows. Section two highlights the stylized facts on exchange rate and reserves accumulation in Nigeria. section three discusses the theoretical framework and empirical evidences from previous studies while section four presents the econometric modelling procedure. The empirical results of the study are presented in section five.
II. STYLIZED FACTS ON EXCHANGE RATE AND RESERVES MANAGEMENT IN NIGERIA

Nigeria is the largest African Economy as well as the largest oil producer in Africa. As a major exporter of petroleum products, Nigeria earns over 70% of its foreign exchange from oil export. Admittedly, this has made the economy vulnerable to oil price volatility. But, another source of macroeconomic instability is exchange rate variability. This is even of greater concern given that in addition to being oil dependent, the economy is also grossly import dependent. Thus, concerns about exchange rate management strategies are paramount.

Exchange rate management is the primary responsibility of the nation’s central bank (the CBN). Since the establishment of the CBN in 1958/59, it has been committed to ensuring stable exchange. In this respect, it has experimented several exchange rate arrangements/ regimes. Exchange rate arrangements in Nigeria have transited from a fixed regime in the 1960s to a pegged regime between the 1970s and the mid-1980s and finally, to the various variants of the floating regime from 1986 with deregulation and adoption of the Structural Adjustment Programme (SAP).

On September 26, 1986 the naira was first floated in Second-tier Foreign Exchange Market (SFEM) and a dual exchange rate mechanism, a combination of the first and second exchange rate system, was introduced. Due to obvious shortcomings, the system was discarded and the two rates were merged with a single enlarged Foreign Exchange Market (FEM) on July 2, 1987 (Omolara, 2007). Within this period, exchange rate jumped from N1 for $0.89 to N4.02 for $1, representing 352% increase in the naira exchange rate. By 1995, Autonomous Foreign Exchange Market (AFEM) and Inter-Bank Foreign Exchange Market (IFEM) were introduced in 1995 and 1999 respectively. Again, the desired outcome appeared to be far from reach.

Following the failure of the variants of the flexible exchange rate mechanism (the AFEM introduced in 1995 and the IFEM in 1999) to ensure exchange rate stability, the Retail Auction System was re-introduced on July 22, 2002. The RDAS was to serve the triple purposes: reducing the parallel market premium, conserve the dwindling external reserves and achieve a realistic exchange rate for the naira. On February 20, 2006 the Wholesale Dutch Auction System (WDAS) was introduced to consolidate the gains of the Retail Dutch Auction System as well as deepen the forex in order to evolve a realistic exchange rate of the naira (Auwal, 2008; CBN 2006; Obadan, 2006). By 2008, the WDAS could not be adjudged to have satisfied the aspiration that gave birth to it. As shown in figure 2.1, naira exchange rate depreciated from N4.02 for $1 in 1987 to N8.03, N101.70 and N132.89 in 1990, 2000 and 2004 respectively. However, the periods, 2005 to 2008 witnessed naira exchange rate appreciation as the naira exchange rate appreciated from N132.89 in 2004 to N118.55 in 2008. This appreciation of the naira was viewed by many as a consequence of Paris club debt relief, reserves accretion as well as sound macroeconomic management. Unfortunately, the appreciation of the naira never reoccurred after 2008.

So, the strong determination to resolve the fluctuations of foreign exchange and restore stability made the CBN to suspend the WDAS and in 2008 reintroduced the Retail Dutch Auction System (RDAS). Again, in 2015, the CBN closed the RDAS and ordered that forthwith all demand for foreign exchange should be channeled to the Interbank Foreign Exchange Market (IFEM). By this time, the exchange rate was around N197.

Following series of events in the macro economy including oil price crash, the Central Bank of Nigeria (CBN) announced a full float of the Naira after its MPC meeting on 24th May, 2016. It immediately stopped its interventionist programme to allow the market determine the true rate of the naira. Although this policy reversal was welcome by many analyst, it soon worsened the instability of the macroeconomy. Thus, the CBN quickly reserved its stand after six months of non-intervention, thereby stepping up its interventions over the past few months (that is since April 2017). With at least some of the pent-up demand for dollars now being met by banks, the rate in the parallel market has started to return closer to the official rate.

In the same vein, the CBN is also saddled with the responsibility of managing the external reserves. In Nigeria, the problems of reserve management began during the periods of the First National Development Plan in 1962-1966, and the Nigerian civil, 1967 – 1970. In these periods, financing the plan and the war consumed a large portion of the country’s reserves. Also, the tempo in the foreign trade sector dropped, following the disruption of economic activities in the country. The problem became compounded immediately after the war in the wake of Federal Government effort to reconstruct and reactivate the war ravaged economy which continued to demand immense foreign exchange reserves. Because of the exigencies of this period, the CBN became committed to maintaining an adequate level of external reserve (Omolara, 2007; Obaseki, 2007).
In addition to the problem of depleting reserves, Nigeria faced a new scenario with reserve management. Following the admission to OPEC in 1973, and the oil boom of that era, the problem of reserve management switched from that of inadequacy to that of excess reserves. This remained so until 1981 when the country was hit by the global economic recession that led to a consistent decline in her external reserves (Odozi, 1986). In the light of this development economic stabilization measures involving stringent exchange control which ran from April 1982 to June 1986 (when accretion to external reserves was low as shown in figure 2.1), were introduced. By the end of 1985, it was evident that the use of stringent economic controls was ineffective in restraining external reserve depletion. To this end, exchange rate trade controls were discontinued in 1986 in the wake of SAP. However, after more than seven years of liberalization, government felt that the overall performance of the economy was unsatisfactory. This led to yet, more reforms in the foreign sector, including the re-introduction of fixed exchange rate regime in January 1994.

Overall, Nigeria’s external reserves have neither being stable nor predictable over the years. In 1992, the level stood at US$0.70 billion. It rose to US$1.30 and US$1.70 billion in 1993 and 1994 respectively. After falling by 17.70 per cent to US$1.40 billion in 1995, it rose by 192.90 per cent to US$4.10 billion in 1996. At the end of 1999, external reserves stood at US$5.50 billion (representing a 22.5% drop against the $7.10 billion level in 1998). End-of-the-year records for 2001, 2002 and 2003 were US$10.42 billion, US$7.29 billion and US$ 7.47 billion respectively. Reasons for the downward trend in reserves were the inadequacy of foreign exchange receipts, coupled with large fiscal spending and the subsequent pressure on the country’s debt obligation.

Following the huge receipts from crude oil sales, and the prudent fiscal and monetary policy stance under the NEEDS introduced in 2004, trends in the countries reserves took a dramatic upward turn. The stock of external reserves which was US$7.47 billion at the end of December 2003 increased by 127 percent to US$16.96 billion in 2004. The reserves position in 2004 could finance 18.40 months of imports. In 2005, the stock of external reserves increased further by 66.80 per cent to US$28.28 billion. The reserve position could support 19.60 months of imports. The level of reserve stood at US$42.20 billion, $49.12 billion and $42.47 in 2006, 2007 and 2009. By 2010, the reserve level had dropped to $35.88 billion. Although the following year witnessed a pick-up, the reserves began plummeting by 2014. For example, it dropped from $46 billion in 2013 to $37 billion and $31 billion in 2014 and 2015 respectively. The dwindling of the reserves was believed to have been caused by falling oil price. By the end of 2016, the reserves level was about $29 billion. Available evidence, however, indicates that reserves has picked up, howbeit slowly since March, 2017, recording about $30.3 billion in May, 2017.

III. THEORETICAL FRAMEWORK

The literature on the choice of exchange rate regime centers on the relative merits of fixed and flexible exchange rate (or any other variant of regime policy); optimality criterion, and reserves versus exchange-rate-based stabilization (Zhang,2002). The choice among exchange regimes is thought to depend on a wide range of
factors which Zhang (2002), summarized as: optimality criterion, nature of shocks to the economy and their structural characteristics. In addressing the issue of optimality, a standard criterion should be specified and applied which will be broadly based on the policy makers’ economic objectives. Here the focus will be on the relatively narrow criterion of macroeconomics stability (which includes minimizing the variance of real output, the price level or the real consumption) in the face of random transitional shocks. It is equally important to consider the nature of shocks that the economy is likely to be subjected to before determining whether the exchange rate should be fixed or flexible. The early literature demonstrated that when domestic shocks are important, the choice of exchange rate regime depends on whether these shocks are monetary or real. When domestic shock originates in the domestic money market, conventional theory indicates that a fixed exchange is more effective in stabilizing the output. A disturbance to money demand or supply would be countered by offsetting changes in the international reserves under a fixed exchange rate. Thus it would not affect the supply-demand conditions in the good market. In contrast, if domestic shocks originate in the goods market, the flexible exchange rate would be more desirable for output stability. Shocks to domestic goods demand would generate offsetting changes in foreign demand through an adjustment in the exchange rate, which would moderate the impact of the domestic shock to output. In the case of foreign nominal shocks, the early debate between the merit of fixed and flexible exchange rates favoured flexible and was built around an implicit sticky-price model. It emphasized the insulation properties of market-determined exchange rates. Faced with movements in the foreign price level, domestic prices can be stabilized by a suitable adjustment in the exchange rate (Mundell, 1962; Zhang, 2002; Friedman, 1976).

As Calvo (1998) noted, desire to accumulated external reserves could be another important consideration for choosing a given exchange rate regime. This is because economic theory holds that optimal reserves balance the macroeconomic adjustment costs incurred in the absence of reserves with the opportunity cost of holding reserves. This theory is referred to as the buffer stock model (BSM). The BSM which was first developed by Miller and Orr (1966) and popularized by Frenkel and Jovanovic (1981) predicts that average reserves depend negatively on adjustment costs, the opportunity cost of reserves and exchange rate flexibility; and positively on GDP and on reserve volatility, driven frequently by the underlying volatility of international trade.

The BSM otherwise known as inventory model has been remarkably successful in explaining international reserve holding in the post – World War II period. The model postulates that the monetary authority will choose an initial level of reserve holding that minimizes its total expected costs. The model identifies two costs incurred by the monetary authority. The first is the opportunity cost of holding reserves. The second is the adjustment cost that is incurred whenever reserves reach some lower bound (Aizeman & Lee, 2005; Edward 1983; Frenkel & Jovanovic, 1981).

The two costs are interrelated since a higher stock of reserves reduces the probability of having to adjust and thus reduce the expected cost of adjustment, but this benefit comes at the cost of higher forgone earnings. Optimal reserve management involves finding the cost minimizing level of reserves to acquire once reserves have reached their lower bound. Of course, the basic idea in inventory management models is to optimize the trade-off between flow holding costs and fixed restocking costs. Miller and Orr (1966) were the first to model desired money holdings in a stochastic inventory – theoretic framework. Frenkel and Jovanovic (1981) applied this inventory theoretic approach to external reserve management.

From a priori, it follows that since different exchange rate regimes have different adjustment costs, the reserve holding will not be the same in both cases. While this prediction is theoretically true (Edward, 1983, Aizenman & Lee, 2005), its empirical validity is still inconclusive (Aizeman & Marion 2002, 2004, Choi & Baek, 2004).

IV. DATA AND ECONOMETRIC PROCEDURE

Following Obi and Clement (2016), Flood and Marion (2002) and Aizenman and Lee (2005), we develop three vector autoregressive (VAR) models as follows:-

Demand for Reserves Function

To model external reserves demand function, we specify a BVAR model such that the vector of the first differences of \( n \) endogenous variables, \( y_t \), is determined as follows:

\[
x_t = \alpha_0 + \hat{\Lambda}_t \Pi + \sum_{j=4}^{j} \Pi_j x_{t-j} + \varepsilon_t (4.1)
\]

With \( \varepsilon_t \sim^{ind} (0, \sum) \), \( x_t = (res_{i_t}, gdp_{i_t}, trop_{i_t}, fopen_{i_t}, r^{UR}_{NG}, r^{vol}_{exp}) \), \( i = 1,2,3,..N \) variables and \( j=1,2,3,...J \) lags

Where:
Demand for Reserves and its determinants

Demand for reserves equation was estimated conditional on quarterly period lag of 1, 2 and 3. The results of the three models are presented and critically discussed in this section. Table 5.1 shows that international reserves accumulation can be explained by GDP, financial openness, interest rate differentials as proxy for opportunity cost of holding reserves, trade

<table>
<thead>
<tr>
<th>Variables</th>
<th>(1)</th>
<th>(2)</th>
<th>(3)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
<td>-0.9812***</td>
<td>(-1.935)***</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(2.743)</td>
<td>(0.378)</td>
<td></td>
</tr>
</tbody>
</table>

V. ECONOMETRIC RESULTS

The results of the three models specified in section 4 are presented and critically discussed in this section. Table 5.1: Demand for Reserves and its Determinants for three quarters

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<table>
<thead>
<tr>
<th></th>
<th>(\beta)</th>
<th>(S.E.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reserves Holding ((\Delta res)_{t-4})</td>
<td>0.665***</td>
<td>(0.165)</td>
</tr>
<tr>
<td>Financial openness ((fopen)_{t-4})</td>
<td>0.323***</td>
<td>(0.07951)</td>
</tr>
<tr>
<td>((GDP)_{t-4})</td>
<td>0.1929**</td>
<td>(0.0931)</td>
</tr>
<tr>
<td>Interest rate differential(r_{US,NG}^{t-4})</td>
<td>-0.824**</td>
<td>(0.439)</td>
</tr>
<tr>
<td>Export((exp)_{t-4})</td>
<td>0.710**</td>
<td>(0.346)</td>
</tr>
<tr>
<td>Trade openness ((trop)_{t-4})</td>
<td>-0.153***</td>
<td>(0.032)</td>
</tr>
<tr>
<td>Reserves volatility ((rvol)_{t-4})</td>
<td>0.195***</td>
<td>(0.032)</td>
</tr>
<tr>
<td>Obs</td>
<td>184</td>
<td>184</td>
</tr>
</tbody>
</table>
| Robustness check                           | \(R^2 = 0.95\) S.E. = 0.19 \(\chi^2\) \(g\) Likelihood Ratio = -37.34 | \(R^2 = 0.91\) S.E. = 0.25 \(\chi^2\) \(g\) Likelihood Ratio = -27.04 | \(R^2 = 0.89\) S.E. = 0.51 Log Likelihood Ratio = -33.01

***, ** and * indicates significant at 1% and 5% respectively

Openness, export, and volatility of reserves conditional of their lagged values. Financial openness which measures the openness of Nigerian economy to capital and portfolio flow is both positive and statistically significant for first and second lag. This implies that the more open an economy is to capital flow, the more reserves it tends to hold. The significance of financial openness variable corroborates Aizenman and Crichton (2006) view on the impact of capital mobility on reserves holding. GDP, as a measure of the size of a country, is also positively related to reserves holdings and significant also for first and second lag. This means that bigger economies will require more reserves than smaller economies. One variable whose impact on reserves has generated much debate is the opportunity cost of holding reserves. This result shows that opportunity cost of holding reserves is negatively related to reserves accumulation. That is, higher opportunity cost of holding reserves reduces the tendency to accumulate reserves. Interest rate differential which is used as a proxy for the opportunity cost of holding reserves is statistically significant for first and third lags. The result obtained corroborates Abdullateef and Waheed (2010) and Adams and Leonce(2007) for some selected African countries. According to them, the demand for international reserves in Africa is determined mainly by export, GDP growth and opportunity cost of holding reserves. Choi and Baek (2004) found interest rate to be insignificant in estimating demand for reserves function. Table 1 also shows that the more open an economy is to external trade, the more the chances to face external shock, and the more its demand for reserves could be. More openness also implies that the economy will need to keep more of both transactionary and precautionary reserves. While transactionary reserves is held to meet the need for international transaction, precautionary reserves is held to mitigate against external shock. Also the more open an economy is, the more the level of reserves it is expected to generate from international transaction, ceteris paribus. In an earlier study, Flood and Marion (2002), using marginal propensity to import as a measure of trade openness found trade openness to be significant for developed countries. Reserves volatility is only at the third lag. This finding suggests that demand for reserves responds to reserves volatility with lag period of about three quarters. Export is also found to be a significant determinant of demand for reserves. This may not be surprising since one of the most important source of reserves accumulation is crude oil export earnings, a major component of Nigerian export. Table 4.1 also suggests that changes in export immediately translate to changes in reserves holding. The intercept coefficient is negative and significant at 1%. This is the mean value of reserve when the effect of all the variables in the function is held constant. The negative sign of the intercept may not be unconnected with the
fact that reserves a form of national saving. This means that when foreign exchange earnings are low, the stock of reserves can be dis-saved.

**Exchange Flexibility and external Reserves Accumulation**

The second model set up to ascertain whether (or not) reserves holding increases with increasing exchange rate flexibility is presented in table 5.2. The result shows that both the intercept (represented by dum 1) and the slope (represented by dum 2) of the demand for reserves function

**Table 5.2: Exchange Flexibility and external Reserves Accumulation**

<table>
<thead>
<tr>
<th>Variables</th>
<th>Parameters (standard error)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
<td>6.923*** (0.833)</td>
</tr>
<tr>
<td>reserves(res)</td>
<td>0.480 (0.112)</td>
</tr>
<tr>
<td>Exchange rate(exh)</td>
<td>0.709*** (0.213)</td>
</tr>
<tr>
<td>Change in intercept due to regime shift(Dum 1)</td>
<td>0.710** (0.413)</td>
</tr>
<tr>
<td>Change in slope due to regime shift(Dum 2)</td>
<td>0.016** (0.007)</td>
</tr>
<tr>
<td>Obs</td>
<td>184</td>
</tr>
</tbody>
</table>

**Robustness check**

Adjusted $R^2 = 0.95$  
$S.E. = 0.698$  
Log likelihood Ratio = -36.51  
$F$-statistic = 180.19

**Table 5.3: Impact of Reserves on Exchange Rate Stability**

<table>
<thead>
<tr>
<th>Variables</th>
<th>Parameters (standard error)</th>
<th>Parameters (standard error)</th>
</tr>
</thead>
<tbody>
<tr>
<td>First regression</td>
<td>Second regression</td>
<td></td>
</tr>
<tr>
<td>Intercept</td>
<td>0.1594*** (0.0965)</td>
<td></td>
</tr>
<tr>
<td>Changes in reserves (Ares)</td>
<td>-2.585*** (0.149)</td>
<td>0.9415*** (0.192)</td>
</tr>
<tr>
<td>Net export (nx)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Oil price (oip)</td>
<td></td>
<td>0.079** (0.030)</td>
</tr>
<tr>
<td>Financial Stress index(fins)</td>
<td></td>
<td>0.04*** (0.001)</td>
</tr>
<tr>
<td>Robustness check</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
| Adjusted $R^2 = 0.81$  
Log likelihood Ratio = -74.59  
$F$-statistic = 200.19 | Adjusted $R^2 = 0.60$  
$S.E. = 0.698$  
Log likelihood Ratio = -18.64  
$F$-statistic = 121.19 |
change significantly as the economy moves from fixed to managed floating regime. Both dummies are significant and positive, implying an upward shift in the demand for reserves function as the economy moves from fixed to floating regime. The result also reveals that the more flexible the exchange rate, the more likely it will be to currency crisis. Also if regime flexibility increases by 1%, the reserves holding might increase by 0.71%, ceteris paribus. Exchange rate also entered the regression function with the expected positive sign and is found to be statistically significant. This implies that exchange rate devaluation has the tendency of increasing the reserves holding. This is not surprising since economic theory predicts that devaluation leads to increased export which by extension will lead to increase in reserves accumulation, at least in the short run. The intercept term is significant, confirming our earlier conclusion that the reserves function has an intercept. This implies that reserves accumulation depends also on noneconomic factors. The possible explanation for this result is that under hard pegs – monetary authorities should hold reserves more for the transactional motive, but less for the precautionary motive since they are less subject to speculative attacks. As capital account liberalization progresses with greater capital mobility, the latter motive becomes the more important factor for the country’s reserve. Since under more flexible exchange rate regime countries keep more precautionary reserves so as to insure the economy against external shocks, the sum of transactionary and precautionary reserves increases with increasing exchange rate flexibility. Following Kousoyiannis (1979), the reserves will be expressed as: \[ Res_t = \beta_0 + \beta_{dum1} + \beta_{dum2} + \beta_{exh} \quad Exh_t \] for the period of floating regime. That is, \[ Res_{t-j} = (6.923 + 0.711) + (0.016 + 0.710)Exh_{t-j} \]

Impact of Reserves on Exchange rate Stability

Table 5.3 presents the regression results for the impact of reserves on exchange rate stability. Two regression estimations were implemented. The first was estimated without oil price and financial stress index while the second was estimated with both variables. The regression result summarized in table 5.3 shows that exchange rate is a negative function of reserves, indicating that exchange rate appreciates with increase in reserves. Stability check shows that the exchange rate of the naira is more stable with the first regression than with the second. This reinforces the theory of intervention: international reserves are used to manage and therefore stabilize the nominal exchange rate. Net export is found to be statistically insignificant. This may be interpreted to mean that net export does not play any significant role in explaining changes in exchange rate. The VAR result however reveals that exchange rate has significant impact on the level of net export. The result in appendix B shows that net export is not only a positive function of the nominal exchange rate but also significant at both 5% and 1%. This is quite intuitive since exchange rate devaluation tends to increase export and reduce import, thereby increasing the net export. The result obtained also reveals that the lagged value of exchange rate also helps to explain the current rate. This may be due to the fact that the monetary authority manages the exchange rate within certain limits or bound within which it is to fluctuate.

V. POLICY IMPLICATION, CONCLUSION AND RECOMMENDATION

The aim of this study is to provide a comprehensive response to the question as to whether reserves holding increases with increasing exchange rate flexibility as well as what determines a country’s reserve demand for reserves. The optimal use of a nation’s external reserve to stimulate desirable macroeconomic performance has also been debatable within the Nigerian context. This study’s contributions to the debates predicated on the evidence derived from the econometric analysis presented in the preceding sections are as follows. First, reserves holding increases with exchange rate flexibility conditional on institutional efficiency. Second, the factors that determines the level of foreign reserves holding are GDP, export, capital mobility, opportunity cost of holding reserves and openness of the economy. Third, reserves accumulation is largely driven by josses effect and inertia behavior (or wardrobe effect). Fourth, reserves holding plays a critical role for exchange rate stability.

Accordingly, optimal reserves balance the macroeconomic adjustment costs incurred in the absence of reserves with the opportunity cost of holding reserves (see Frenkel & Jovanovic, 1981). The buffer stock model predicts that average reserves depend negatively on adjustment costs, the opportunity cost of reserves, and exchange rate flexibility; and positively on GDP and on reserve volatility, driven frequently by the underlying volatility of international trade. Overall, the literature of the 1980s supported these predictions (see Frenkel, 1983; Edwards, 1983; Flood & Marion, 2002). While useful, the buffer stock model has limited capacity to account for the recent development in hoarding international reserves – the greater flexibility of the exchange rates exhibited in recent decades should work in the direction of reducing reserve hoarding, in contrast to the trends reported in this study. Contrary, however to the buffer stock model, we found that more reserves are held during flexible regime than during fixed regime. That is, as an economy becomes more flexible in terms of exchange rate regimes, it accumulates more reserves.

Reserves hoarding is reinforced by such non-economic factors as josses effect. This is the tendency to accumulate reserves so as to be like other economies that are piling up reserves. This tendency defies every economic consideration and can be sustained in the face of high adjustment and opportunity cost. Similarly,
Inertia behavior or wardrobe effect could be another non-economic factor that explains motive for holding reserves. That is, the tendency to sustain the existing trend in reserves holdings even when the opportunity cost is high and domestic economic conditions do not warrant that. The wardrobe effect is reinforced by the desire to maintain the status quo or even surpass it.

It should be noted that on the matter of insurance in the face of disturbances, the role of the government is irreplaceable because of the economies of scale and externalities that exist from creating a pool, instead of leaving coverage decisions to the judgment of each individual agent. This is valid even when there is potentially a moral hazard problem. It is true that self-insurance through reserve accumulation could be considered a second-best solution, even when the dilemma of composition is ignored. The importance of self-insurance makes it possible to understand the relevance of the openness of the economy, both on the real and financial side as a determinant of reserve accumulation. The monetary authority should therefore endeavour to maintain above the bench mark reserves stock for precautionary purposes since dependence on the reserves pool system managed by the IMF is often plagued by colossal uncertainty.

Furthermore, the significance of the opportunity cost of holding reserves brings into focus the goal conflict inherent in attainment of macroeconomic objectives: holding of excess reserves has increasing opportunity cost, while holding of less reserves has high adjustment cost. The monetary authority should therefore evolve an efficient reserves management framework that will ensure that reserves is not kept as idle balance. The need to turn stocks of reserves to high-return yielding assets, in itself, necessitates that a robust risk management framework for the investment of the nation’s reserves should be developed and operationalized.

Although there are rational non-economic reasons to keep reserves, this agenda should not supplant the macroeconomic objective of economic stability. For instance, arising reserves accompanied by rising prices and falling employment level is disastrous. It is therefore recommended that policies, which would focus on the enhancement of the internal economy, especially the stability of the economy, should be pursued instead of a mere crusade for foreign reserves arising from Josses effect.

VI. REFERENCE


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