A Dynamic Analysis of the Determinants of International Reserves in Nigeria

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Abstract

In this study we set out to investigate the dynamic determinants of demand for foreign exchange reserves in Nigeria. Indeed, only a few studies have been done in this area in Nigeria, especially using a dynamic specification. This study therefore is to apply the Error Correction Methodology (ECM) to determine both the short-run dynamics and the long-run relationships that exist in the demand for reserves in Nigeria. Moreover, we seek to incorporate both the traditional views and monetary approach to the study of the demand for foreign reserves function in Nigeria.

Introduction

Foreign exchange reserves have clear implications for exchange rate stability, financial markets and hence, for overall economic activity. Stakeholders have different views about reserves holding; some economists believe that foreign exchange reserves are useless and unutilized as Friedman (1953) criticized the fixed exchange rate system with the argument that it contains unutilized foreign exchange reserves. On the other hand, some economists argue that foreign exchange reserves should be there to smooth out the imbalances in balance of payments [See Kemail (2002)]

There is continuous debate about the need to hold reserves. The critics are worried about the cost of holding reserves. The cost of holding reserves is the investment that nations must forgo in order to accumulate reserves. In contrast, the supporters of reserves holding argue that the cost of reserves holding is small compared to the economic consequences of exchange rate variations. For instance, depreciation in the values of the currency, caused by either financial crisis or other internal or external shocks, may raise a country's costs of paying back debt dominated in foreign currency as well as its costs of imported items. Besides, it also creates high inflations expectations. With high levels of foreign exchange reserves, monetary authorities can purchase national currency in the foreign capital markets, which helps to maintain its value. In summary, the rationale behind reserves holding includes financing external imbalances, intervening in foreign exchange markets and providing a buffer to cushion the economy against future exigencies.

Traditionally, two explanations have been offered for the behaviour of international reserves demand through time. On one hand, the literature on the demand for international reserves had postulated that reserve movements basically respond to discrepancies between desired reserves and the amount of reserves actually held by a particular country. (See for example, Iyoha 1976; Bilson and Frenkel, 1979 and Lane and Bridge, 2001). However, an alternative explanation is offered by the simple version of the monetary approach to the balance of payments. According to the view, changes in international reserves will be related to excess demands or excess supplies of money: international reserves will increase if there is an excess demand for money and will decrease if there is an excess supply of money.

Nigeria's foreign reserves have been on the increase since after the financial crisis of the early 1980s. Reserves were at US 2836.6 dollars in 1986 and gradually rose to US 9009.1 dollars in 1994. In 2000, the level of reserves was at US 9386.1 dollars and skyrocketed (with the incipient oil windfall of the mid 2000s) to US 28,379.1 dollars in 2005 and US 53,000.4 in 2008, given that a developing country such as Nigeria may have certain peculiarities in its demand for foreign reserves function (Iyoha, 1976); it is pertinent to highlight these peculiarities in the light of the two theories in the forefront of demand for reserve behavior.

Moreover, reserves holdings matter not only for shaping exchange rate policy, but also in the context of increased interest in the subject in the face of increasing globalization of economics, integration of financial markets, and the financial and currency crises of the 1990s. So, issues related to the equilibrium of international reserves, its determinants and this departure from equilibrium are widely discussed in the debates of economic policy making.

2. Literature Review

Using cross-sectional data from 55 countries over the period of 1963 to 1967, Frenkel (1974) developed an equation in which he found a statistically significant relationship between reserve demand and average propensity to import, balance of international reserves variability and volume of imports. All coefficient estimates in the estimation were positive. He believed the relationship between import and reserve demand reflects the openness of an economy. He also found economics of scale in holding reserves in his estimation.

Iyoha (1976) presented a rigorously derived disequilibrium lag model for estimating the demand for international reserves in less developed countries. He tested the model with data from 29 LDCs in 1970, using expected earnings, an instability of export receipts index, the degree of openness, the return on reserves and two lagged values of reserves as explanatory variables. He found statistical significance for all the variables. Particularly, he found that the opportunity cost variable had a high explanatory power. The result showed that a 10 percent increase in the opportunity cost of holding reserves will trigger a 9 percent reduction in the level of reserves held. He therefore concluded that the monetary authorities of LDCs behaved rationally in reserves management

Using quarterly data from 1980 to 1994, Huang (1995) found China had a low average propensity to import and thus had a closed economy. He also found variability was not significant in his empirical model. Also according to his research, international reserve holdings in China had a negative relationship to imports tested on a quarterly basis. He gave a possible reason that it was because most of the China's foreign exchange was kept as reserves, and would flow in the opposite direction as imports. He also showed that China had negative diseconomies of scale. When it came to reserve holdings, he believed this situation was logical as in payment from export was larger than out payment from imports. His model also gave an indication that there was a rapid response from the authorities when there were deviations from the desired level of reserves.

Khan and Ahmed (2005) used a co-integration-error correction framework to analyze Pakistan's reserve demand using the quarterly data over the period 1982:1-2002-2 and found that there exists a stable long-run reserve demand function. In the period of analysis, Pakistan's long-run reserves policy appeared to have been guided by the foreign trade (Imports), uncertainty (variation in the balance of payment) and the opportunity cost of holding reserves (money market rate). These three variables were considered central to the theory of optimal reserves theory. Their results confirmed that variations in the balance of payments and imports affected reserves positively while reserves vary inversely with its opportunity cost and all the relationships are significant in this study

For Nigeria, Abdullateef and Waheed (2010) carried out a study involving the determinants of foreign exchange reserves holding data covering the period 1986 to 2007. Evidence from the estimated model showed that growth in reserve is not influenced by the opportunity cost of reserves but by other determinants such as exchange rate stability and current account variability. They therefore recommended that Nigerian government need to reconsider her reserve management strategies as the result shows that reserves holding by this country cannot be justified by its opportunity cost, strategies with a broader economic development policy framework should be aimed at maximizing the gains from oil export revenues by utilizing more of these resources to boost domestic investment.

3. Model and Methodology

The exant literature identifies a range of variables that may influence reserve holdings. We concentrate on incorporating the leading traditional theory model of reserves behaviour. We take a broad approach and attempt to include a large number of these potential determinants in the empirical work.

These are: output (GDP), temporary balance of payments disequilibrium-proxied by trade balance (TDB), this can also be viewed as external volatility exchange rate (EXRT); and external debt (EXDT) variables. Trade openness is an obvious candidate. Reserves are the financing option of last resort in covering import demands, providing a natural link between trade balance and reserve levels. External volatility provides a prudential motive to hold reserves. Volatility is measured as the growth rate of export revenues. The exchange rate is a measure of relative prices. Finally, we consider an external debt indicator which is pertinent for a developing country. Total external debt is taken since it indicates the nation's debt burden.

The model is then specified as:

RES = f (GDP, OPN, ΔEXP, FD, EXRT, EXDT).

In econometric form,

$$RES = \alpha_0 + \alpha_1 GDP + \alpha_3 TDB + \alpha_5 EXRT + \alpha_6 EXDT + u$$

The error correction methodology is used for the estimation of the model. This is in order to be able to obtain short-run dynamic relationship between the variables. The result is expected to indicate the negative relationship between reserves and all the explanatory variables.

4. Presentation of Results

The Augmented Dickey Fuller (ADF) test was conducted on the differenced values of the variables. Table 1 presents result of ADF test by taking into consideration the trend variables and without trend variables in the regression. The results obtained provide strong evidence that all the times series in their levels are non-stationary; all variables had a unit root in their levels and are stationary in their first difference. This can be seen in the result presented in the table. Each of the ADF statistics is greater than the 95% critical value.

Table 1: Result of the ADF Unit Root Test (First Difference) Estimation period 1981 Q1 to 2009 Q4

Variables	ADF Statistics	Critical value	Order of Integration
RES	-6.178	-2.88	I(1)
NGDP	-12.105	-2.887	I(1)
EXRT	-7.008	-2.88	I(1)
TDB	-8.806	-2.88	I(1)
XDEBT	-3.471	-2.88	I(1)

Since the ADF tests shows that the data are characterized as (1) or unit process, we proceed and adopt the Engle and Granger (1987) two step methodology. If the variable is co-integrated, then the residual from the co-integrating equation must be integrated to the other zero (stationary). The economic interpretation of co-integration is that if two or more variables are linked to form an equilibrium relationship spacing the long-run even though the series themselves in the short-run deviate from equilibrium, they will move closer in the long-run equilibrium. A non-stationary variable might have a long run relationship with other non-stationary variables and this does not create a spurious regression if the deviation of this long-run relationship is stationary. It implies that these variables are co-integrated. The result of the co-integration test is summarized in table 2

Table 2: Results of Engle and Granger Residual Based Co-integration Test

Variables	ADF Statistics	Critical value
ECT	-2.839	-4.870

From Table 2 using the Engle and Granger co-integration procedure, the null hypothesis of no co-integration is accepted at the 5% significance level. This is shown from the fact that in absolute values, the ADF statistic is less than the 95% critical ADF value. This again implies that the residual are non-stationary. Thus, the variables are not co-integrated and therefore a long-run relationship may exist between reserves and the regressors.

However, even though the co-integration test failed, we can still estimate the short-run dynamic representation of foreign reserves. This would however only be limited to the short-run because deviations from equilibrium in the short-run might not be restored to equilibrium in the long-run. The regression results for demand for external reserves model is presented below. The reserves demand model contains four independent variables

Table 3: Regressive Result of Demand for Reserves in Nigeria (ECM).

Variables	Coefficient	T-Ratio
dRES (-1)	-0.323	-3.374
dNDGP	-0.0002	-0.200
dNGDP(-1)	-0.002	-1.516
d EXRT	-58.350	-1.664

D EXRT (-1)	-61.197	-1.682
XDEBT	-0.325	-1.469
TDB	0.007	4.526
INPT	804.22	0.848
ECM (-1)	-0.152	-2.190

$R^2 = 0.396$ $R^2 = 0.32$

F(8,105) = 8.29 dw-Statistics = 1.99

The result shows that all the coefficients of the variables are correctly signed in line with appropriate determination. The coefficients of income and exchange rate agree with the absorption and elasticities approach to BOP determination. However, only the coefficient of trade balance (proxied by foreign trade variability) is significant at the one percent level. This shows that in the short-run, only the desire to smooth out trade unpredictable and temporary imbalances in international payments determines the demand for foreign exchange reserves in Nigeria. An increase in the desire to smooth out the temporary imbalance causes the accumulation of foreign exchange reserves to rise.

The negative coefficient of the lagged reserves variables again underscores the persistence of instability in the reserves position. It shows that any disequilibrating movements in the short-run will persist in the long run. This is what has already been established in the lack of co-integration in the variables. The coefficient of the error correction term is negative and significantly different from zero. It shows that a very long period is needed for adjustment to equilibrium to be achieved following any disturbance in the system.

The goodness of fit of the model is quite impressive, even though the R-squared value is low, suggesting that the model only explains about 39.6% of the behavior of reserves in the short-run, the F-statistic value is significant at the 5 percent level. This means that a significant dynamic relationship exists between the dependent variable and all the independent variables combined. The Durbin-Watson statistics is approximately 2, and shows the absence of serial correlation in the model

5. CONCLUSION AND RECOMMENDATIONS

This model has investigated the determinants for demand for foreign exchange reserves in Nigeria using an error correction methodology. In this context, it was found that a stable long-run reserves demand function in the case of Nigeria does not exist, when only the traditional determinants variables are used. In the period of analysis, any temporary disturbance in the system persists for a long time. This result is rather incompatible with previous works especially in other developing countries (Iyoha, 1976, Khan and Ahmed, 2005).

In addition, in the short-run, reserves movements were found to be driven by the trade balances which represent short-term BOP disequilibrium. Thus, the most important short-term determinant of reserves are the desire to smooth this disequilibrium.

Keeping in view the foregoing findings, some recommendations are given with regard to the reserves holding behavior of the Nigeria Economy. Firstly since our results have confirmed that variations in the balance of payments are the primary cause of reserves holdings in the short-run, authorities should minimize the imbalances in the international account by taking other measures such as enhancing exports by ensuring quality and competitiveness, attracting foreign direct investment by providing friendly domestic environment will go a long way in reducing the need for holding reserves and take appropriate steps in restructuring reserves economics performances.

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