The Long-Run Relationship between Foreign Reserves Inflows and Domestic Credit: Evidence from a Small Open Economy

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Abstract: This paper investigates whether the Balance of Payments disequilibrium is a monetary phenomenon. The money demand function was formulated and utilised in the empirical testing of the monetary approach to balance of payments in Nigeria. The study applied the Johansen cointegration test, Pantula principle and Error Correction Mechanism (ECM) estimation techniques in the determination of the long and short-run relationships between foreign reserves inflows and domestic credit. The study found that BOP is a monetary phenomenon depending on the nature of the specification of the money demand function. The study recommends that the monetary authorities should impose stringent ceilings on domestic credit as excessive borrowing could cause drastic reduction in the inflows of foreign reserves.

Keywords: Monetary Approach; Pantula Principle; Balance of Payments; Nigeria.

JEL Classification: F40; C33; E51

1. Introduction

Economies (whether small or large) interact with the rest of the world through the exchange of goods and services culminating into economic transactions. These transactions are either in form of receipts or payments made in response to imports purchased or export (tangible or non-tangible) received by the other countries or the rest of the world. These transactions are recorded annually in the Balance of Payment accounts of every economy. Due to the strategic nature of the Balance of Payment accounts to the management and administration of every economy in the world; it was stipulated as one of the traditional macroeconomic goals in Keynesian economics: attainment of balance of payment equilibrium. However, as important as the BOP is, series of questions have trailed its true nature; whether it is a monetary phenomenon or not. The origin of this debate could be traced to the surge in international macroeconomics and monetary economics; with the resultant divergence in the perspectives/approaches to the analysis of the BOP phenomenon in the economic and econometric literature. From the macroeconomic perspective, it has been posited by several macroeconomic scholars that the balance of

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payments is linked to the domestic demand for money function. This is why, it has been argued that the disequilibrium of the BOP is a monetary phenomenon; that is, it is fundamentally determined by the disequilibrium in the domestic money market. This has led to endless economy-specific search for the one description of BOP as a monetary phenomenon for both developed and less developed countries (LDCs).

Also, scholars have reached a general consensus that the new monetarism of the new international monetarists has made significant contributions to the adjustment theory and school of thought. The monetary approach emphasized the role of money in the adjustment process of the balance of payments contrary to the previous pragmatic practice where the role of money was completely ignored. Based on this microcosm, the adjustment and disequilibrium processes of the BOP are now related and associated with to either money supply or external sector money growth or both.

Hence, in this study, we formulated and applied a money demand function in exploring the role of money and of its aggregates in the adjustment process of the BOP. This has formed the thematic interest and focus of the current study. The monetary approach to BOP has formed the bedrock of our study because it has the advantage of adopting an elaborate perspective of the adjustment process of the BOP through it affinity to both demand for and supply of money functions. Furthermore, the monetary approach gives insight into the BOP adjustment process under the flexible exchange rate system. In the context of flexible exchange rate, the difference between money demand and money supply acts as a determinant of exchange rate. For instance, an increase in money supply results to the depreciation of the exchange rate while an increase in real income associated with constant nominal money supply drags the price level downwards culminating into appreciation of the exchange rate. Therefore the major objective of this study is to assess the Balance of Payments in the context of the monetary approach and to ascertain whether it is a monetary phenomenon using the case of a small open economy (Nigeria). The rest of the paper is organised as follows: Section two presents the literature review while section three focuses on the theoretical framework of the model. Section four consists of the materials and methods (data issue, model specification and estimation techniques); section five presents the analysis and evaluation of the empirical results. Section six concludes the paper.

2. Literature Review

Adouka *et al.*, (2013) conducted a study on the balance of payments in Algeria using the monetary approach for the period 1980 to 2010. The Edward model of

1989 was adopted. Terms of trade, External debts, International Reserves, Real Exchange rate, government expenditure, budget deficit and money supply were augmented into the Edward model. These variables were categorized as external and internal variables. The study applied the unit root tests, cointegration tests(Engle and Granger and Johansen); and Error Correction Mechanism (ECM estimation techniques.The long-run and short-run relationships among real exchange rates, domestic credit and international reserves were investigated. The study found that an increase in international reserves results in a relative appreciation of the exchange rate. Also, the study found a positive relationship between exchange rate and domestic credit. This means that an increase in domestic credit causes an appreciation of real exchange rate. This finding is counter-intuitive. The weaknesses of this study are that it failed to explain the reason for the converse results.

Adamu and Itsede (2009) investigated the balance of payments adjustment for the period 1975 to 2008 using panel data estimation technique involving both the within and cross-country effects for countries in the West African Monetary Zone (WAMZ). (The Gambia,Ghana,Guinea,Liberia,Nigeria and Sierra Leone).The study categorised the balance of payments disequilibrium as either temporary or fundamental. It found that a strong negative relationship exists between domestic credit and net foreign assets. The study also found that interest rate and growth rate of GDP have significant impacts on the balance of payments for the WAMZ countries.

Chaudhary and Shabbir (2004) explored the nature and implications of the specification of money demand function on the performance of the monetary approach to Balance of Payments for Pakistan. The study adopted the traditional money demand function as the benchmark for deriving the reserve-flows equation. The traditional money demand function according to this study depends on real exchange rate, real income, domestic interest rate and the rate of inflation. The study found that an increase in the allocation of domestic credit leads to a corresponding increase in foreign reserves inflows.

Leon (1987) studied the monetary approach to the balance of payment for the Jamaican economy. Annual data was used in the estimation of the nature of the relationship between domestic credit and international reserves flows. It adopted the reserve flows and sterilization models.

Khan (2008) examined the monetary approach to balance of payments using currency substitution version of the money demand function for Pakistan with annual data spanning 1962 to 2005. The Johansen and Juselius cointegration technique was applied with results suggesting that real output, real exchange rate and domestic credit play an important long-run role in the determination of foreign reserves inflows in Pakistan.

Obadan (2012) observed that while the monetary approach to balance of payments analysis has been prominent, the findings are mixed and somewhat inconclusive. According to Obadan (2012), the estimates of the reserve-inflows perspective are more prominent with most profound empirical findings. Most of these studies such as Aghevli and Khan (1977) and Bhatia (1982) upheld the view that money is a major determinant of balance of payments disequilibrium and adjustment process (Adamu and Itsede, 2009).

Akpansung (2013) attempted a theoretical appraisal of the empirical literature on the monetary approach to Balance of payments. The review covers studies on both developed and less developed countries. The empirical studies on Australia, Malaysia, Japan, Nigeria, Panama, Spain, Sweden and the United Kingdom were reviewed. A common consensus and inference drawn from the review indicated/revealed that major disequilibrium in the BOP are often occasioned by distortions in the economy's monetary aggregates. It also lends support to the view that the demand for domestic credit can either be used to correct the BOP disequilibrium or to aggravate it.

Spanos and Taylor (1984), investigated the validity of the monetary approach to the balance of payments for the United Kingdom using quarterly data from 1965:I to 1971:IV. The study adopted the fixed exchange rates regime and specified a reserve flow equation using the real Gross Domestic Product, implicit GDP deflator, and a proxy for interest rate defined as the gross redemption return on government bonds (issued at par with 20 years maturity period). The findings of the study found somewhat support for the monetary approach to balance of payments as being a monetary phenomenon but using a reserve - flow model is more appropriate when considered in the context adjustment/or disequilibrium.

Calvo and Mendoza (1996) examined the causes of the Balance of Payments crises in Mexico with the focus on shifts in the flows of foreign capital and the expectant financial system bailout. The study evaluated the sources of the December 1994 financial crash in Mexico and attempted an investigation of the five (5) previous separate steps taken since 1945 towards restoring/resolving the BOP crises. In order to explain the nature, sources and dimension of the crises, a link between banking fragility and world capital flows was established using the classic models of BOP crises proposed by Krugman (1979) and Obstfeld (1986). Furthermore, the study used the following questions as guide towards realising the main objectives of the study; first, why did Mexico lost its accumulated foreign reserves during the crises? Second, why did the devaluation strategy adopted by Mexico undermined Mexican's investment and propelled the worst recession ever experienced by the Mexican economy? Third, why was the multiplier effects of the Mexican crash felt by almost all the economies in the World? The BOP model formulated by this study relies on a monetary transmission mechanism in which expenditures and

capital flows affect the demand (M_2). The Error Correction Mechanism (ECM) was applied in the estimation of the single-equation model of M_2 and predicted M_2.

Also, the study conducted multivariate Granger Causality test using two and four lag structures of the following variables; lagged GDP, real M_2, Interest rates, expenditures (consumption expenditure, investment expenditure and net exports), the terms of trade and exchange rate.

The study found a strong link between money and private expenditure; and the effects of the world capital markets on Mexico's M_2 was established.

Khvostova *et al.*,(2013) analysed the determinants of balance of payments changes for seventy-eight (78) countries with different exchange rates regimes(free floating, currency board, conventional fixed peg, crawling peg, currency band, managed floating) from 2006 to 2010. The modelling approach adopted by this study is after the pragmatic practices of Ross (1991), Lee and Chinn (1998), Boyd *et al*; (2001) and Gomez and Paz (2005) who applied the traditional approach to modelling the dynamics of the Balance of Payments. The variables included in the traditional approach include trade balance, price level in the country, foreign price level, volume of imports, nominal exchange rate, exports and real effective exchange rate. The study considered balance of payments as an intermediate target of monetary policy. Furthermore, the role of capital account in the evaluation of the adjustment process of the BOP was considered; and the study found two avenues in which monetary authorities would prefer to influence the establishment of BOP. In the face of negative shock of capital outflows, the monetary authorities have two alternatives; first either reduce production in response to decline in investment, or second, use external reserves to forestall the overwhelming impact of domestic demand. Regulating capital flows by using interest rate could compound the problem by producing negative consequences and escalate the problems in the financial sector. The study applied the unit root tests, structural breaks tests, and Ordinary Least Squares estimation techniques. The study found that Central Banks policies are highly influenced by the type of exchange rate regime of the country.

3. Theoretical Framework of the Model

According to Khan (2008) and more recently Obadan (2012), the Monetary Approach to Balance of Payment can be traced to the studies of David Hume (1752) and the revival of the classical price-specie-flow mechanism. However, two principal developments spurred the uncommon upsurge in the application of MABP approach. These include the research team of the University of Chicago led by Milton Friedman and the Polak-led team of the International Monetary Fund (IMF) with a special interest in proffering solution to the monetary policy crises

experienced by most central banks globally especially among the LDCs..In the late 1960s and early 1970s, Mundell (1968) and Johnson (1972a, 1972b, 1972c) contributed to and developed some essential aspects of the MABP.Since then, there has been a torrent of contributions to this important theory of the balance of payment.

Obadan (2012) identified the following assumptions of the MABP.

First is the assumption of a small and open economy that is both an international prices of goods and interest rate taker. This implies that the small open economy is an active participant in global economic transactions and relations.

Second is the assumption of perfect capital mobility and perfect currency substitution among economies involved in the global international economic relations. This assumes that the domestic and international interest rates equilibrate but only diverge at disequilibrium. The law of one price which applies here connotes that the MABP relies on efficient global markets.

Third, the MABP assumes a stable demand for money function. An addendum to this assumption is that money demand and its determinants (income, prices etc) are fixed overtime; and

Fourth is the assumption that exchange rates ensures that external reserves flows between countries in order to adjust to payment disequilibrium.

Essentially, the MABP is a theory of the overall balance of payments which rejects separate evaluation of the current and capital accounts. The overall BOP surplus is:

$$(EX - IM) + i^* I_f + Ks = \Delta R = \Delta BM - \Delta Ds \quad (1)$$

where $(EX - IM)$ is net imports, $i^* I_f$ represents investment income from overseas, (i^* is the foreign interest rate, I_f is foreign investment by residents of the domestic economy). ΔR is the change in foreign reserves while ΔDs connotes the additions to foreign exchange reserves and domestic assets which form the bedrock for monetary expansion by the banking system ΔBM. Hence both domestic and foreign assets are assumed to be perfect substitutes.

Also, the MABP assumes that the balance of payment is a monetary process that hypothesizes that the disequilibrium in the BOP is a reflection of a similar imbalance existing between domestic supply of and demand for money (see Khan, 2008).Owing to the hypothesized disequilibrium in the BOP, an automatic adjustment process is expected. Obadan (2012) aptly summarises the nature of the adjustment process. First, when money supply is greater than the demand for money, the following outcomes are expected: residents in the economy that is

experiencing the adjustment process are expected to experience an increase in their expenditure on foreign goods, financial assets and services with a deficit in the BOP that leads to a fall in foreign exchange reserves with an associated decrease in money supply that eventually culminates into money supply equilibrating the demand for money.

Second, when the demand for money is greater than the supply of money, the followings are the obvious occurrence. Residents will experience a drastic reduction in their expenditures on foreign assets, goods and services. The BOP will experience a surplus with increase in both foreign exchange reserves and money supply leading to equilibrium between the demand for and supply of money.

The model of the MABP according to Obadan (2012) and Khan (2008) relates the money demand and money supply components, the BOP and exchange rates. The demand for money component in its fundamental formulation represents a money demand function in which the demand for real money balances is assumed to be a stable but linearly homogeneous function of a number of macroeconomic factors expressed below:

$$M_d = M_d(P, Y, r) \quad (2a)$$

$$M_d = L(P, Y, r) \quad (2b)$$

With $L_p > 0, L_y > 0, L_r < 0$

Where M_d is nominal demand of money balances,

P is price level,

Y represents wealth (real income), and

r represents interest rate.

Equation (2a and 2b) mean that the demand for money is a function of prices, wealth or real income and interest rate. Prices and real income are hypothesized to be positively related to M_d .This implies that the more the income that is available in the economy, the more the money that the residents will have to purchase more goods and the higher the price level, the more the money that would be required to purchase any desired asset, good or service. Conversely, interest rate is hypothesized to be negatively related to M_d .This implies that higher interest rates lower the volume of money people hold for transactionary and precautionary purposes.

Assuming that the income velocity of money is a function of only interest rate and has invariant tendencies towards the changes in income; the demand for money balances becomes:

$$M_d = k(i)PY \quad (3)$$

Where $k(i)$ represents the inverse of velocity as a function of the interest rate and PY is defined as nominal income. If the income velocity $\left[\frac{1}{k}\right]$ is hypothesized to be insensitive to the interest rate. The Cambridge version of equation (3) is stated as:

$$M_d^* = kPY \quad (4)$$

Where k represents the ratio of the desired nominal money balances nominal income. k connotes a constant fraction showing how money demand will behave given a change in either P or Y. Equation (4) says that the demand for money is a function of price and real income. Dividing both sides of equation (4) by P gives the demand for the stock of real money balances as a stable, linearly homogeneous function of real income.

$$M_d^* = kY \quad (5)$$

The demand for money function expressed in equation (5) represents the domestic demand for money.

The second component of the MABP model represents the supply of money function in which the supply of money (M_s) is depicted as the product of the money multiplier (m) and the monetary base (B) (also known as high-powered money).

$$M_s = m.B \quad (6)$$

The monetary base has two components: the domestic component (D) consisting of domestic credit and the other component is the international component(R) which is the domestic currency value of the monetary authority's external reserves accumulation. The monetary base is expected to change as the lending capacity of commercial banks changes, in which case the increase in base money has the tendencies to expand M_s while the reduction in base money reduces the supply of money.

Hence, the base money identity is written as:

$$B = D + R \quad (7)$$

Substituting (7) into (6) above, the money supply equation can be redefined as:

$$M_s = m(D+R) \quad (8)$$

The final component of the MABP is the money market equilibrium condition often stated as:

$$M_s = M_d \quad (9)$$

Obadan (2012) critically analysed the conditions that almost always necessitate the adjustment mechanism that cause the condition in (8) above to occur. The adjustment mechanism varies with the different exchange rates regimes. Under the fixed exchange rate regime, money supply adjusts to equilibrium with money demand using the channel of international flows of money via BOP imbalances. During the flexible exchange rates regime, money demand will adjust to an equilibrium position with exogenous money supply through the channel of exchange rate changes while where the exchange rate system is flexible but with intervention from the apex bank or regulatory authorities to keep exchange rate (dirty float or managed float) at a determined level, both the exchange rate and the international money flows experience a change.

4. Materials and Methods

4.1 Source and Description of Data

Annual time series data for the Nigerian economy were used for the estimation of our models. Data were sourced from the Central Bank of Nigeria (CBN) Statistical Bulletin for various years. The study covers the period 1970 to 2012.

4.2 Specification of Model.

From the theoretical framework, the model representing the first component of MABP is specified as:

$$M_d = \beta_0 + \beta_1 RGDP_t + \beta_2 ITR_t + \beta_3 RPL_t + \beta_4 REER_t + \Sigma_t \quad (10)$$

$\beta_1, \beta_3, \beta_4 > 0.\ \beta_2 < 0$

Where M_d (money balances), $RGDP_t$ (wealth or real income), ITR_t (domestic interest rate), RPL_t (real price level) and $REER_t$ (real exchange rate) are similar to M_d, P, Y and r in model (2) above but represents the logarithm of nominal money balances, domestic interest rate, price level, real income and real exchange rate in equation (10). Σ_t represents the stochastic term. Equation (10) similar to equation (2) because it hypothesizes that real money balances are positively related

to real income being an increasing function of real income. Domestic interest rate (ITR_t) being the opportunity cost of holding money relative to financial assets is expected to be negatively related to real money balances. $REER_t$ is expected to be positively related to nominal money balances. Obadan (2012), Khan (2008) and, Arango and Nadiri (1981) have argued that a depreciation of the domestic currency is expected to increase the financial worth of foreign financial assets held by domestic or resident portfolio holder if they perceive this to mean an increase in their wealth. This would eventually increase the demand for money. Hence an increase in real exchange rate is hypothesized to increase the demand for money. But if the exchange rate depreciation occurs in a debtor country such as Nigeria, the Naira value of wealth is expected to decrease and this is expected to reduce the demand for money. Therefore, exchange rate is hypothesized to be negative (see Khan and Sajjid, 2005 and Khan, 2008).

The second component of the MABP can be expressed mathematically in terms of money supply as:

$$M_s = P_t + FRS_t + DMc_t \tag{11}$$

Equation (11) expresses money supply as equal to the sum of prices, foreign reserves and domestic credit to the economy. This also expresses money supply as consisting of external (foreign reserves) and domestic (credit to the domestic economy) components. In equation (11), M_s, P, FRS and DMc represent the logarithm of base money, price level, foreign reserves and credit to the domestic economy and are written in real terms. From equation (11), we obtain the foreign reserves function as: $FRS_t = M_s - P_t - DMc_t$. Assuming that the equilibrium condition holds such that $M_d = M_s$ then,

$$FRS_t = M_d - P_t - DMc_t \tag{12}$$

Substituting equation (2) into equation (12) akin to Khan (2008) and, Otane and Sassanpour (1988), we obtain:

$$FRS_t = L(Y_t, r_t, -DMc_t) \tag{13}$$

Equation (13) can be written in an econometric form for foreign reserves as:

$$FRS_t = \phi_0 + \phi_1 RGDP_t + \phi_2 ITR_t + \phi_3 REER_t - \phi_4 DMc_t + \Sigma_t \tag{14}$$

$$\phi_1, \phi_3 > 0;\ \phi_2, \phi_4 < 0$$

Equation (13) implicitly expresses two conditions that relate money demand, credit to the domestic economy and foreign reserves inflows. First; if money demand exceeds credit to the domestic economy then foreign reserves is expected to be positive. Second, if the credit to the domestic economy is greater than the demand for money then foreign reserves is hypothesized to be negative.

4.4. Estimation Technique

4.4.1 Unit Root Test

Recent advances in econometrics have noted that testing and ascertaining the unit root and order of integration of time series data is a pre-condition for obtaining reliable and consistent results (Gujarati, 2011 for instance).Fuller (1976) and, Dickey and Fuller (1979,1980) developed a parametric test for the determination of the stationarity and order of integration of time series data. Dickey and Fuller (1980) adopted three basic types of models in the process of testing for the stationarity of variables in a model.

The first model:

$$X_t = \phi X_{t-1} + \varepsilon_t \tag{15}$$

consists of models without intercept or trend.

The second model:

$$X_t = \phi X_{t-1} + \alpha + \varepsilon_t \tag{16}$$

comprises of models with intercept without Trend.

The third model

$$X_t = \alpha + \beta_t + \phi X_{t-1} + + \varepsilon_t \tag{17}$$

consists of models with intercept and trend. The hypotheses are stated in consonance with the three models above as:

$H_0 : \phi = 1$: This implies that the series is non-stationary connoting the presence of a unit root.

$H_1 : |\phi| < 1$: This implies that the series is stationary depicting the absence of unit root.

The null hypothesis states that the series is non –stationary and as a result has a unit root.

The alternative hypothesis states that the series in its absolute value is stationary and as such unit root is absent.

If the null hypothesis holds, we fail to reject the null hypothesis but if the null hypothesis is violated, we do not reject the alternative hypothesis. The null hypothesis is usually tested using the three models above but starting from the third equation (17) to the first equation (15).

4.2.2 Pantula Principle

The determination of the long-run relationship using the Johansen cointegration test is not adequate in itself. The Johansen cointegration test uses three (3) most accepted models: model 2, model 3 and model 4 respectively. Of the three (3) models, there is need to select the most suitable and appropriate. This selection is done using the Pantula principle. The Pantula principle is described in some reasonable details below in table (1). Our model contains five(5) series: FRS,RGDP,PSC,REER and ITR.Therefore, $n=5$. There are five (5) trace-test statistics and five (5) maximum Eigen value-test statistics for each of the models. Using the trace-test statistics, there are $tr_{i,j}$ estimated trace statistics with i representing model i and $i=3$ for model 2, 3 and 4 respectively. r represents the cointegrating vectors. The implementation of the Pantula principle starts by evaluating model 2 row one with $r=0$, that is, using trace statistic ($tr_{2,0}$). If the trace statistic ($tr_{2,0}$) exceeds its critical value. Then proceed to model 3 using $r=0$ for trace statistics($tr_{3,0}$).If the trace statistics($tr_{3,0}$) exceeds its critical value; continue with the other model and with other rows until you get to model whose trace statistics does not exceed its critical value. This model is selected using the trace statistic of that row. This is the rudimental description of the Pantula principle of cointegration best model selection.

Table 1. Cointegration Model Selection using the Pantula Principle

H_0: r	n – r	Model 2	Model 3	Model 4
0	5	$tr_{2,0}$	$tr_{3,0}$	$tr_{4,0}$
1	4	$tr_{2,1}$	$tr_{3,1}$	$\rightarrow tr_{4,1}$
2	3	$tr_{2,2}$	$\rightarrow tr_{3,2}$	$\rightarrow tr_{4,2}$
3	2	$\rightarrow tr_{2,3}$	$\rightarrow tr_{3,3}$	$\rightarrow tr_{4,3}$
4	1	$\rightarrow tr_{2,4}$	$\rightarrow tr_{3,4}$	$\rightarrow tr_{4,4}$

4.4.3 Johansen Cointegration and Error Correction Mechanism (ECM)

4.4.3.1 Johansen Cointegration

Several methods for testing for cointegration have been proposed and applied in the econometric literature. But in this study, we are interested in the Johansen cointegration test. Cointegration test is conducted in this study because Granger (1986) observed that:

"A test for cointegration can be considered or thought of as a pre-test to avoid spurious regression" Granger (1986, p. 226).

While unit root test is a pre-cointegration test; cointegration is a pre-ECM test (as it is a necessary condition for the application of ECM).Also, it is appropriate to differentiate the tests for unit root from the test for cointegration. As Dickey, Jansen and Thornton (1991) aptly observed:

"*Tests for unit roots are performed on univariate (i.e. single) time series. In contrast, cointegration deals with the relationship among a group of variables, where (unconditionally) each has a unit root*". Dickey, Jansen and Thornton (1991, p. 59)

This means that unit root tests are usually always performed on individual time series while cointegration tests are applied on a group of variables or series. The Johansen cointegration test is unique because its application requires that the number of cointegrating vectors be detected using the trace statistic. Hence, the statement of null and alternative hypotheses are required. The null and alternative hypotheses are:

$H_0 : r = 0$: The null hypothesis states that there are at most r cointegrating vectors.

$H_A : r = k - 1$: The alternative hypothesis states that there are at least r cointegrating vectors.

The rule of thumb for the rejection of the null hypothesis which connotes the non-rejection of the alternative hypothesis is: If the trace statistic is lower (in value) than the critical values at a chosen significance level, we do not reject the null hypothesis BUT otherwise, we reject the null hypothesis. However, in line with the hypothesis, the following steps are required for the estimation of the long-run relationship:

Step One: Test the hypothesis that the number of cointegrating vectors is strictly zero, implying that $r = 0$.

Step Two: Test the hypothesis that the number of cointegrating vectors is strictly equal to unity which implies that $r = 1$.

Final Step: Test the hypothesis that the number of cointegrating vectors is strictly k coefficient minus unity, that is, $r = k - 1$.

Inferences relating to the number of cointegrating vectors are drawn based on the hypothesis and the steps outlined above.

The Johansen cointegration test is adopted in this study because the test is adjudged to be superior to other tests (such as the Engle - Granger cointegration test), because it has the requisite/desirable statistical properties. Assumption of Johansen cointegration test: It is assumed that the system is integrated of order one (I(1)). A major advantage of the Johansen cointegration test is that if there are variables that are integrated of order two (I(2)), provision is made for their transformation. The difference operator ∐ =1-L, or L=1-∐ is used to transform the variables that are integrated of order two to order one. After transforming the model using L=1-∐ , a lag is lost resulting to K-1 lags (where K represents the lags on each variable). The Johansen and Juselius procedure is based on a maximum likelihood estimation of the ECM (Dhliwayo, 1996)

$$\Delta X_t = \lambda_0 + \mu_i \Delta X_{t-1} + ... + \mu_{k-1} \Delta X_{t-k-1} + \pi x_{t-1} + \varepsilon_t \qquad (18)$$

X_t is defined as $(nX1)$ of vector I(1) variables, λ represents an n-dimensional vector of parameters (μ_1,... μ_{k-1}). π are (nxn) matrices of parameters. ε_t is defined as an $(nX1)$ vectors of stochastic error term.

The major focus of this study is the investigation of the long and short-run relationships between foreign reserves and domestic credit. The information about the long and the short-run equilibrium is found in the error-correction term and the cointegration analysis (Engle and Granger , 1987; Engle and Yoo, 1987; and Banerjee *et al.* , 1993).

4.4.3.2 Error Correction Mechanism (ECM) Estimation Technique

According to Sjo (2008), a *prori* information can be used to estimate an error correction mechanism first and then proceed to include it in an equation of variables in their first differences. Generally, this is specified as;

$$\Delta X_{it} = \beta_0 + \sum_{i=1}^{k} \gamma_{1,i} \Delta x_{i,t-i} + ... + \sum_{i=1}^{k} \gamma_{n,i} \Delta x_{n,t-1} + \theta \varepsilon_{t-1} + u_t \qquad (19)$$

In the above ECM general equation, the error term(ε_{t-1}) can be used as error correction mechanism. If these are *n* variables involved in the ECM, the lag length selection is done so that u_t in the above equation in $\text{NID}(0,\sigma^2)$ stochastic term. Specifically, the ECM above can be written as:

$$\Delta FRS_t = \beta_0 + \sum_{i=1}^{k-1} \delta_{1,i} \Delta FRS_{t-1} + \sum_{i=0}^{k-1} \delta_{2,i} \Delta RGDP_{t-1} + \sum_{i=0}^{k-1} \delta_{3,i} \Delta ITR_{t-1} + \sum_{i=0}^{k-1} \delta_{4,i} \Delta PSC_{t-1} + \sum_{i=0}^{k-1} \delta_{5,i} \Delta REER_{t-1} + \theta \varepsilon_{t-i} + u_t$$

(20)

In both the general and specific forms of the ECM above, $\sqcup$ represents the first difference operator; θ represents the speed of adjustment towards long-run equilibrium as suggested in Sjo (2008); ε_{t-1} represents the lagged value of the error correction and u_t is as previously defined.

The specific form of the ECM postulates that as the growth rate of real income increases, it will necessarily lead to the improvement of the Balance of Payment position of the economy. Also, the change in real exchange rate is hypothesized to enlarge foreign reserves through the increase in money demand.

5. Empirical Results

The empirical results presented below include the results of the unit root test, Pantula principle, Johansen cointegration test and error correction mechanism.

5.1 Order of Integration/Unit Root Test

The results of the ADF unit root / order of integration test are reported below in table 2.The ADF statistic were compared with the Mackinnon critical values at the 1 percent, 5 percent and at the conservative 10 percent level of significance. The result of the comparison of the ADF statistic with Mackinnon critical values shows that all the series (FRS,RGDP,PSC,REER and ITR) were non-stationary at levels; which implies that we do not reject the null hypothesis of the presence of unit root or non-stationarity at levels. However, the null hypothesis was rejected for these series at first difference except for two of the series (PSC and REER). The results show that all the series are not integrated of order zero at levels but are integrated of order one (I(1)) and order two (I(2)) respectively. We therefore proceed to test for the long-run relationship among the variables using the Johansen cointegration test.

Table 2. Order of Integration Tests of the Series

Series	ADF LEVEL		ADF FIRST DIFFERENCE		ADF SECOND DIFFERENCE		Order Of integration
	Intercept	Intercept / Trend	Intercept	Intercept / trend	Intercept	Intercept / trend	
LFRS	-0.1731	-1.7228	-3.7851*	-3.7413**	-	-	I(1)
LRGDP	-1.2154	-0.3268	-5.5711*	-5.6826*	-	-	I(1)
LPSC	-0.8154	-2.0870	-2.4853	-2.4801	-4.4272*	-4.4638*	I(2)
REER	-1.5484	-1.2730	-2.6626***	-2.8496	-4.6706*	-4.5864*	I(2)
ITR	-0.2043	-1.1631	-3.3270**	-3.7692*	-	-	I(1)

Source: Author's Calculation.

NOTE: * , ** and *** connote 1 , 5 and 10 percent significance levels.

5.2 The Pantula Principle:Test of the cointegration Models

Table 3. The Pantula Principle Test Results for Model 2, 3 and 4

r	n – r	Model 2	Model 3	Model 4
0	5	122.6835	107.0305	126.1172
1	4	64.3757	56.1049	75.1915
2	3	33.3340*	27.7069	46.1655
3	2	12.7160	7.3541	24.8980
4	1	4.5987	0.2698	6.9820

Source: Author's Calculation

NOTE: Trace statistic values are reported for each model

From Table 3 that shows the results of the Pantula principle test, we compared the trace statistics for the three models with their respective critical values. This is to enable us to choose which of the three models is more appropriate. We started with the smallest number of cointegrating vectors **r = 0**, we checked whether the trace statistic for model 2 rejects the null hypothesis. It was found to be yes. So we proceeded to the next model 3 and model 4; we found that both model 3 and 4 rejected the null hypotheses also. At **r = 2**, we found that the Pantula principle holds for model two because its trace statistic was less than the 5% critical value (reported in this study).

5.3 Cointegration Tests

Table 4. Results of the Cointegration Tests

Hypothesized No. of CE(s)	Eigen Values	Trace Statistics	5% Critical Values	1% Critical Values
None**	0.8200	122.6835	76.07	84.45
At most 1**	0.5988	64.3757	53.12	60.16
At most 2	0.4547	33.3340	34.91	41.07
At most 3	0.2124	12.7160	19.96	24.60
At most 4	0.1265	4.5987	9.45	12.97

Source: Author's Calculations

NOTE :*(**) denotes rejection of the hypothesis at 5 percent (1 percent) significance level. Trace statistics indicates two cointegrating equations at 5 percent level of significance.

We reported the results of the cointegration tests of equation 2 based on the **Pantula** principle. For $r = 0$ (none), the trace statistic (122.684) is greater than the critical values at both 1 and 5 percent significance levels. Thus, we reject the null hypothesis that there are at most r cointegrating vectors or equations. This is **step one**.

Second Step; for $r \leq 1$ (at most 1), the trace statistic (64.3757) is greater than the critical value (53.12) at 5 percent level of significance and (60.16) at 1 percent level of significance. Hence, we reject the null hypothesis that there are at most $r = 1$ cointegrating vectors or equations.

Third Step: For $r \leq 2$ (at most 2), the trace statistic (33.3340) is less than the critical values (34.91 and 41.07) at both 5 and 1 percent levels of significance respectively. In this case, we do not fail to reject the alternative hypothesis (we do not reject the null hypothesis).The result of this third step applies to $r \leq 3$ (at most 3) and $r \leq 4$ (at most 4) respectively. The results shown in table 3 above indicated that there are 2 cointegrating equations. This implies that there is a long-run relationship among FRS, RGDP, PSC, REER and ITR.

5.4 Results of the Error Correction Mechanism

The results of the ECM are presented below in table (5) and (6) respectively.

Table 5. Results of the Error Correction Mechanism(FRS as Dependent Variable)

Variable	Coefficient	Standard Errors	t -Statistics	Probability
C	0.458	0.418	2.0962	0.012
FRS(-1)	0.0619	0.2330	0.2657	0.793
ITR	-0.6054	0.2083	3.6410	0.003
LRGDP	0.3840	0.3074	2.8483	0.008
LPSC	-0.0402	1.918	4.0172	0.001
REER	3.1001	0.0741	2.1391	0.012
ECM(-1)	-0.3780	0.6230	3.2103	0.0032
$R^2 = 0.42$	$Adj.R^2 = 0.38$	$D.W. = 1.96$	$\Pr ob = 0.000$	

The coefficient of real Gross Domestic Product (GDP) had a positive and statistically significant sign. This deserves some explanation because the relationship between real GDP and foreign reserves is linked to money demand, domestic currency (the naira) and the Nigerian exports. The positive sign of the coefficient of real GDP signifies that as real GDP grows, the domestic currency appreciates through the expansion in the demand for money; the multiplier effects of the appreciation of the domestic currency is reflected or shown in the expansion of foreign reserves and exports.

The coefficient of interest rate (ITR) is negative but with very strong impact (0.60) on foreign reserves inflows. The negative sign implies that as interest rate increases foreign reserves inflows reduces. This simply portrays interest rate as a major determinant of foreign reserves inflows in Nigeria.The results presented in table (5) shows that the coefficient of domestic credit is -0.040 instead of -1.00.This means that the coefficient is not close to unity as posited by the monetary approach to BOP. The implication of this is that the expansion of domestic credit was an important determinant of the worsening BOP condition in Nigeria. This finding corroborates the results of Nyong and Johnson (1995) for the Nigerian economy and Khan (2008) for Pakistan. The negative sign of the coefficient of domestic credit (-0.040) connotes the existence of inverse relationship between foreign reserves inflows and domestic credit. The coefficient (-0.040) suggests that a rise in domestic credit would lead to outflow or decline of foreign reserves by about 4 percent in the long-run. This implies that although domestic credit policies are fundamental to the design of foreign reserves accumulation in Nigeria, its long-run effect is very weak. This is simply an indication of the weakness of monetary policies in the control and regulation of the demand for and supply of money in Nigeria.

Table 6. Results of the Error Correction Mechanism(PSC as Dependent Variable)

Variable	Coefficient	Standard Errors	t -Statistics	Probability
C	**0.816**	**0.0438**	**5.2863**	**0.000**
LPSC(-1)	**0.890**	**0.604**	**0.432**	**0.217**
FRS	**-0.320**	0.0216	2.463	0.019
ECM(-1)	**-0.194**	0.6230	0.2103	0.320
$R^2 = 0.35$ $Adj.R^2 = 0.30$ $\Pr ob = 0.004$ $D.W = 1.89$				

Source: Author's Computation

The results shown in table (6) indicated that all the variables had the expected signs (thus satisfying one of the fundamental test of robustness). The coefficient of the error-correction term is negative but statistically insignificant; which implies that about 20 percent of the disequilibrium of the previous period is adjusted and eliminated within the current period. The statistical insignificance of the coefficient of the error-correction term is an indication that there is no two-way causality between foreign reserves inflows and domestic credit. This implicitly suggests the existence of one way long-run causal linkage from domestic credit to foreign reserves.

5.5 Model Selection Criteria

Two versions of the error correction mechanism were specified and estimated in this study. There is need to select the most appropriate model. Model one was specified with FRS as dependent variable while model two was specified with PSC as the dependent variable (see table 7 below).

Table 7. Model Selection Criteria

Statistical Criteria	Model One	Model Two	Decision
$AdjustedR^2$	$Adj.R^2 = 0.38$	$Adj.R^2 = 0.30$	Model one has the highest adjusted R^2
AIC	-7.2240	-0.6143	Model one has the lower AIC
SC	-5.3022	-0.1132	Model one has the lower SC

Source: Author's Computation

NOTE: AIC denotes Akaike's Information Criteria while SC represents Schwartz Criteria

Using the above statistical criteria, the model with the highest adjusted R2 and lower AIC and SC values is adjudged the better specified model. From the statistical criteria shown in table 7 above, model one is selected as better specified.

6. Conclusion and Policy Implications

This study investigated the long and short-run relationships between foreign reserves inflows and domestic credit in a small open economy like Nigeria over the period 1970 to 2012. The major objective of the study is to determine whether the balance of payments disequilibrium is a monetary process; that is, to assess the theory of MABP and its implications for Nigeria. The money demand function was specified and estimated using the Johansen cointegration test, Pantula principle and error correction mechanism. These were applied as the major econometric techniques in the estimation of the long and short-run relationships between foreign reserves inflows and domestic credit. We found that the monetary approach to the balance of payments holds for Nigeria and a one-way long-run causal linkage exists/ runs from domestic credit to foreign reserves. This implies that domestic credit is a key determinant of the inflow of foreign reserves in Nigeria. Also, our results indicated that domestic credit is weakly and negatively related to foreign reserves inflows in Nigeria. This finding is important for the design and effective implementation of monetary policy in Nigeria. Since the expansion of domestic credit has a reducing effect on the inflows of foreign reserves, the monetary authorities should regulate domestic credit by imposing restrictions / ceiling on it.

Furthermore, our results showed that real GDP is positively related to the inflows of foreign reserves. This implies that the balance of payments is not entirely a monetary phenomenon as posited by most studies. Interest rate was found to be negatively related to the inflows of foreign reserves. This finding is a major validation of one of the assumptions of the MABP.

7. References

Adamu, P.A. & Itsede, O.C. (2009). Balance of Payments Adjustment: The West African Monetary Zone Experience. *Journal of Monetary and Economic Integration*, 10(2), pp. 100-116.

Adouka, L.; Boucheta, Y.; Chenini A., Belonimoune, A. & Kerbouche, M. (2013). The Monetary Approach to Balance of Payments and Exchange Rate Equilibrium Determination with an Empirical Application to the Case of Algeria. *International Business Research Journal*, 6 (4), pp. 114-129.

Akpansung, A. (2013). A Review of Empirical Literature on Balance of Payments as a Monetary Phenomenon. *Journal of Emerging Trends in Economics and Management Sciences (JETEMS)*, 4(2), pp. 124-132.

Arango, S. & Nadiri, M. (1981). Demand for Money in Open Economies. *Journal of Monetary Economics*, 7, pp. 69-83.

Banerjee, A.; Dolado, J.; Galbraith, W. & Hendry, D.F. (1993). *Co-Integration, Error-Correction, and the Econometric Analysis of Non-stationary Data*. Oxford: Oxford University Press.

Boyd, D.; Caporale, G.M. & Smith, R. (2001). Real Exchange Rate, Effects on the Balance of Trade: Cointegration and the Marshall -Lerner Condition. *International Journal of Finance and economics*, 6, pp. 187-200.

Calvo, G.A. & Mendoza, E.G. (1996). Mexico's Balance-of -Payment Crises" A Chronicle of a Death Foretold. *Journal of International Economics*, 41, pp. 235-264.

Chaudhary, M.A. & Shabbir, G. (2004). The Impact of Domestic Credit Deficit and Changing Exchange Regimes on Foreign Reserves in Pakistan. *Pakistan Economic and Social Review*, XLII (1&2), pp. 1-20.

Dhliwayo, R. (1996). The Balance of Payments As a Monetary Phenomenon: An Econometric Study of Zimbabwe's Experience. *African Economic Research Consortium (AERC) Research Paper* No.46.

Dickey, D.A. & Fuller, W.A. (1979). Distribution of the Estimators for Autoregressive Time Series with a Unit Root. *Journal of the American Statistical Association*, 74, pp. 427-431.

Engle,R.F.& B.S.Yoo (1987).Forecasting and Testing in Cointegrated Systems, *Journal of Econometrics*, 35, pp. 143-159.

Engle, R.F. & C.W.J (1987). Cointegration and Error Correction Representation, Estimation and Testing, *Econometrica*, 55, pp. 251-276.

Fuller, W.A. (1976). *Introduction to Statistical Time Series*. New York: John Wiley.

Gomez, F. & Paz, L. (2005). Can Real Exchange rate Devaluation improve the trade Balance? The 1990-1998 Brazilian Case. *Applied Economic Letters* 12, pp. 525-528.

Johnson, H.G. (1972a). The Monetary Approach to Balance of Payments Theory. *Journal of Financial and Quantitative Analysis*, 7, pp. 1555-1572.

Johnson, H.G. (1972b). Elasticity, Absorption, Keynesian Multiplier, Keynesian Policy and Monetary Approaches to Devaluation Theory: A Simple Geometric Exposition. *American Economic Review*, 6, pp. 448-452.

Johnson, H.G. (1972c). The Monetary Approach to the Balance of Payments Theory, in H.G.Johnson (eds.). *Further Essay in Monetary Economics*. London: Allen and Unwin.

Khan, M.A. (2008). Long-run and Short-run Dynamics of Foreign Reserves and Domestic Credit in Pakistan. *International Journal of Applied Econometrics and Quantitative Studies*, 5(1), pp. 61-84.

Khan, M.A. & Sajiid, M.Z. (2005). The Exchange Rate and Monetary Dynamics in Pakistan: An Autoregressive Distributed Lag(ARDL) Approach, *The Lahore Journal of Economics*, 10 (2), pp. 87-99.

Khvostova, L.; Larin, A.; Novak, A. & Shulgin, A. (2013). The Balance of Payment Dynamics in the period of Crises. *The Macro theme Review* 2(7), pp. 82-103.

Krugman, P. (1979). A Model of Balance of Payment Crises. *Journal of Money-Credit and Banking*, U, pp. 311-325.

Lee, J. & Chinn, M.D. (1998). The Current Account and the real Exchange Rate: A structural VAR Analysis of Major Currencies. NBER.

Leon, H. (1988). A Monetary Approach to Balance of Payments: A Simple Test of Jamaican Data, *Social and Economic Studies*, 37(4), pp. 1-37.

Mundell, R.A. (1968). *International Economics*, New York: Macmillan.

Obadan, M.I. (2012). *Foreign Exchange Market and The Balance of Payments: Elements, Policies and the Nigerian Experience*. Benin-city: Goldlink Publishers.

Obstfeld, M. (1986). Rational and Self-fulfilling Balance of Payments Crises. *American Economic Review*, 76, pp. 72-81.

Otani, I. & Sassanpour, C. (1988). Financial, Exchange Rate, and Wage Policies in Simgapore, 1979-1986, *IMF Staff Papers* ,35(3), pp. 474-494.

Pokorny, M. (1987). *Introduction to Econometrics*, Blackwell, England: Oxford University Press.

Polak, J.J. (1957). Monetary Analysis of Income Formation and Payments Problems, *IMF Staff Papers*, 6, pp. 1-50.

Polak, J.J. & Argy, V. (1971). Credit Policy and the Balance of Payments, *IMF Staff Papers***,** 18, March.

Rodrik, D. (2010). The End of an Era in Finance. Project Syndicate. http://www.projectsyndicate. org/commentary/rodrik41/English.

Sjo, B. (2008*). Testing for Unit Roots and Cointegration*. Mimeo.

Spanos, A. & Taylor, M. (1984). *The Monetary Approach to the Balance of Payments: A Critical Appraisal of Some Empirical Evidence from United Kingdom*. Birchbeck College, University of London.

Végh, C. A. (2011). *Open Economy Macroeconomics in Developing Countries*. Forthcoming in MIT Press.

Wooldridge, J. (2003). *Introductory Econometrics: A Modern Approach*, 2nd edition. Ohio: Thomson/South-Western.

Zecher, J. R. (1978). Monetary Equilibrium and International Reserve - Flows in Australia. In: Frenkel, J. A. & Johnson, H. G., (eds.). The *Monetary Approach to the Balance of Payments*, London: George Allen & Unwin.