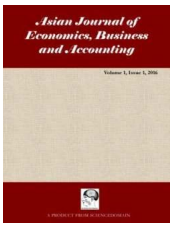

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Money Demand and Supply under Market Disequilibrium: Evidence from Nigeria

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Author's contribution

The sole author designed, analyzed and interpreted and prepared the manuscript.

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ABSTRACT

This paper argues that for economies that have structural rigidities and irregularities, the received knowledge of equilibrium in the demand and supply of money should be interrogated. The paper proposes a third variable – equilibrium bias – to test its significance. Using quarterly time series data for Nigeria from 2008Q1-2016Q2, a money demand function was estimated with the aid of Ordinary Least Square Method in a coefficients and standard errors bootstrap approach. The result found that due to structural rigidities and irregularities in the economy, the variable income though significant posted result against a priori expectation and the equilibrium bias variable was significant which justifies its use.

Keywords: Market disequilibrium; bootstrap; breakpoint unit root; structural rigidity; Nigeria.

1. INTRODUCTION

Since the appearance of Keynes' 1936 magnum opus, the concept of the demand for money continues to play a strategic role in macroeconomic theory and policy analysis. Until fairly recently, scholars had merely concentrated on estimating competing versions of the demand for money function rather than question its very concept and unravel problems posed by the intriguing interdependence between the demand for, and supply of money [1]. Moreover, the

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implications of the existence of disequilibrium in the money market, on the choice of model, measurement of variables and estimating techniques has only recently been hinted at in the literature. This has rendered obsolete past efforts at estimating the demand for money in a fixated theoretical framework [2].

This new thinking is able to bring forth a revolutionary approach in monetary analysis especially to aid the work of central banks. Accordingly, this has far reaching importance because non-normative frameworks like these give the impetus to asses and interpret the nature of the deviations of money stock in the economy from the norm [3]. More so, like the proverbial tale of the dog waggling its tail or the tail waggling the dog can be seen when identifying whether monetary developments are driven by money supply or demand is of importance when assessing its relationship with its determinants. This study is motivated because in principle, in a static setting it is imperative and very possible to properly differentiate between money demand and money supply than in dynamic models. Therefore, in this paper the validity of the demand for money concept was questioned and evidence sought. It was examined within the concept of a disequilibrium framework, which hints at possible existence of an "equilibrium bias" in current methodologies of estimating the demand for money which is a departure from the demand for money problems by Feige & Pearce [1].

The next section will review existing literature, section three will show the methods, and section four will discuss the empirical results while section five will conclude.

2. RELATED LITERATURE

What is really meant by the demand for money in the economy? Is it similar to the demand for commodities, bonds, and labour services? The problem here is caused by the rather unique role of money in an economy. Money has no significant inherent value but its use cuts down transaction cost and facilitates the process of exchange. While other goods are demanded to be consumed and in the process yielding direct utility to the consumer, money is held temporarily or for longer periods (depending on the preference of the transactors) for the purpose of facilitating the purchase of goods other than money at some future time. The quantity of money stock available at any point in time is held by firms, individuals and other transactors. The motivation for individuals to hold money may be different from that of firms. This difference in motivation raises the question of the admissibility of aggregating individual and business holdings of money into a single macroeconomic variable.

An additional problem presents itself in the measurability of the quantity of money demanded. In the theoretical literature, the concept, being part of the general equilibrium analysis a la Walras is taken to be *ex ante* or notional without any trouble being taken to consider measurability. Most econometric work on the demand for money follows *Say's Identity* in assuming permanent equilibrium in the money market, and using money stock supplied to represent quantity of money demanded which is unobservable and could be seen as an expression of the intentions of transactors in the economy. Recent empirical work on the demand for money may have erroneously been estimating the supply of money with variables intended to explain variations in quantity of money demanded if the heroic assumption of Say's Law is found to be untenable. This kind of problem is conceptually distinct from the well-known identification problem in demand and supply estimation.

One of the reasons for interest in the concept and measurement of demand for money is the possibility, first pointed out by Keynes, of a liquidity trap materializing. The interest rate is rather important in the theoretical analysis of the liquidity trap. Also implicit in the analysis is the existence of well-developed money and capital markets to permit the type of portfolio adjustments considered in the liquidity trap. For less developed countries, where interest rate is most likely to be a dormant instrument of monetary policy, money and capital markets are distinguished by their unimportance. The concept of the demand for money as well as the liquidity traps does not have the relevance and implication for monetary policy that it may have in a more developed economy.

The less developed economy is more likely to experience short-run disequilibrium in many sectors. And it is also significant to point out here that disequilibrium in the money market in the form of excess demand for money was what Keynes considered the cause of unemployment. Indeed, it is rather curious that post-Keynes empirical analysis of the demand for money conveniently ignored this disequilibrium aspect of Keynes's monetary theory. However, the acceptance of disequilibrium in the market raises

doubt about the validity of the concept of the demand for money.

Different empirical works have tried to make up for the problems in the demand for money specification and estimation. Mulligan & Sala-i-martin [4] argued that these problems could be avoided when money demand is estimated cross-sectionally. For the problem with the choice of variables as determinants, it was Friedman [5] who first made a case for the inclusion of price level in modelling demand for money. Teriba [6] included inflation rate in his model and the empirical result justified its inclusion. Subsequently, the findings of Nwafor et al. [7] were to support the exclusion of interest rate for Nigeria. Furthermore, Essien, Onwioduokit, & Osho [8] argued that in an open economy, the external sector should not be ignored. They contended that in estimating the demand for money function, the returns on the holdings of foreign assets will be influenced by the expectations of exchange rate movements.

3. METHODOLOGY

The foundations of microeconomics provided the first analysis into how different markets can be in equilibrium (or disequilibrium). To begin with, it is important to lucidly lay down these arguments.

3.1 Disequilibrium in Money Market

Say's identity states that at all prices there is zero excess demand for money, thus implying that the money market is permanently in equilibrium [9]. Accordingly, equation (1) states

$$\sum_{} P_i S_i = \sum_{} P_i D_i \qquad (1)$$

$$D_n = S_n$$

Where

n = number of commodities
P*i* = price index
S*i* = quantity of goods supplied
D*i* = quantity of goods demanded
D_n , S_n = quantity of money demanded, supplied
Respectively; money being the n^{th} commodity

Later on, Walras [10] came up with his law which states that aggregate demand for all goods including money is permanently equal to aggregate supply, provided money is a commodity like any other. Using the same symbolism as above, equation (2) goes thus,

$$\sum_{n-1} P_i S_i = \sum_{n-1} P_i D_i \qquad (2)$$

$$D_n = S_n$$

Thus, excess demand for all goods, including money is zero, but if, following the logic of the law, money market is in equilibrium, the commodity market is also in equilibrium. As Yeager [11] has put it,

> "… and aggregate excess demand for or supply of currently produced goods and services, valued at prevailing prices, must be matched by an aggregate excess supply of or demand for all other things."

According to Walras, the money market is in equilibrium only if equilibrium is established in the non-money sector by an equilibrium Walrasian vector of prices. Therefore, in the "presence of significant and shifting (non-money) market disequilibrium", the money market itself is in disequilibrium and the whole concept of demand for money may be "treacherous" and of limited analytical usefulness [12].

When disequilibrium occurs in the money market, the effect on the price level is the exact opposite of that which would occur in the non-money sector. In goods markets, an excess demand results in rising prices, but since the exchange value of money is the reciprocal of the change value of money and hence a falling price level and vice versa for excess supply of money. But how can one determine when there exists excess supply in the money market? For this, two alternatives are conceivable.

3.2 Disequilibrium Framework

The time series on the stock of money (however defined) can be segmented into demand regime and supply regime, which correspond to the period of excess supply and excess demand respectively [13]. This is because actual exchange is determined by the short side of the market, that is

$$Q = \min (D_m , S_m) \qquad (3)$$

The basic idea here is from the model of Fair and Jaffe [13]. However, Fair and Jaffee did not face the issue of what price to use for sample separation. The price was obvious in the

application of their model to the housing market. But the question of what price to use is fundamental to the application of their model to the housing market.

In this connection the general price level would be theoretically acceptable in view of strong inter-relation between the money market and the goods market. Empirically, the use of the price level rather than interest rate (however measured) is expedient in some countries where the (official) interest rate shows little or no variability for some years. Clearly a virtually constant variable cannot be used as a basis for sample separation, theoretically also, in an economy experiencing a persistent rise in the price level due to excess supply of money, there is a strong tendency for individuals to protect themselves against the evils of inflation by investing increasingly in housing, land, and other real assets, in which case the price level rather than interest rate is the relevant criterion for sample separation. Finally, assuming that the rate of interest is variable enough to be usable for sample separation, an important question still arises as to the theoretical validity of including interest rate as an explanatory variable as well as using it as a basis for sample separation. Fair and Jaffee apparently did not face this kind of problem.

3.3 Equilibrium Framework

Thus far, the concern has been with estimation of equilibrium models of the demand for money function. But there is an important issue which seems to have been ignored in previous studies. There are two aspects of interest first, is there any reasonable or valid way of transforming a disequilibrium situation into an equilibrium one for ease of estimation? Osagie & Osayimwese [9] suggested that there is a reasonable way and offer a pragmatic approach which depends on (possibly strong) assumptions concerning 'expectations and adjustments in the monetary sector'.

Equation (4) puts the problem can be simply put as follows:

$$D_{mt} \neq S_{mt} \quad (4)$$

As previously argued the money market does not necessarily need to be assumed to always be in equilibrium as equation 4 suggests. Going forward, first it may be assumed that adjustment is made by either holders of money or monetary authorities. Where adjustment is undertaken by holders of money, it can be postulated that the quantity of money demanded in period *t* is equal to the supply of money in period *t*-1. That is, full adjustment of demand for money to supply of money occurs in one year in equation (5).

$$D_{mt} = S_{mt-1} \quad (5)$$

Admittedly, this may be too restrictive an assumption. Where, alternatively, it is the monetary authority that adjusts to what it believes to be the equilibrium quantity of money demanded, also assuming full adjustment in one period as given in the equation (6) below.

$$D_{mt} = S_{mt+1} \quad (6)$$

Again, this may be an oversimplification, but possibly a worthwhile one.

Second, previous estimations have assumed 'period equilibrium' in spite of strong evidence pointing to its absence. Therefore, there is an 'equilibrium bias' in previous estimations, the statistical significance of which should be tested. Finally, the next problem is to generate a series for the explanatory variable inclusive of an equilibrium bias. For the case of Nigeria, full adjustment is assume in one period by holders of money in the economy knowing fully well the huge impact of high powered money from oil receipt and its subsequent sterilisation, such a series can be defined as

$$S_{mt} - D_{mt} \equiv S_{mt} - S_{mt-1} = B_t \quad (7)$$

The new variable, B_t is then included among whatever variables are believed to determine the demand for money. Bitrus [14] argued for the non-inclusion of interest rate in the demand for money function for Nigeria due to its lack of variability reason being its underdeveloped and structurally rigid financial system. Therefore for the purpose of estimation, the static model will be tested for statistical significance. Equation (8) is as follows;

$$\text{Log } D_{mt} = a_0 + a_1 \log Y_t + a_2 \log CPI_t + a_3 \log B_t + u_t \quad (8)$$

Where;

Log D_M = money demand (M2, broad money)
Log Y = GDP
Log CPI = Consumer Price Index
Log B = equilibrium bias

The data source is quarterly time series data from Central Bank of Nigeria statistical bulletin from 2008Q1-2016Q2. EViews econometric software will be used for the analysis. Due to the small sample size, the regressors coefficients and standard errors were bootstrap using random resampling of 10,000 bootstrap samples to correct for the model's lack of asymptotic properties.

4. ANALYSIS AND DISCUSSION

To avoid the incidence of spurious regression, first the stationarity of the variables will be checked. It has become the norm to take cognizance of structural breaks in time series data as standard unit root tests are known to fail to reject the unit root null hypothesis when it is in fact incorrect due to bias inferences. For this analysis, the technique of Perron breakpoint unit root test was employed as it is more flexible than the Zivot and Andrews test because it allows for a break under both the null and alternative hypotheses. For trend and intercept series inspection, a graph of the variables is shown in Fig. 1 in the appendix.

The results from Table 1 show that apart from the variables DM and CPI, all other variables were stationary at level. However, after first difference the non-stationary variables became stationary. Consequently, the bootstrap multivariate correlation can be estimated, its result presented in Table 2 and its CUSUM test result presented in Fig. 2 in the appendix.

It is clear from the results above that the determinants explain 93% of variations in the regressand, the results show no presence of autocorrelation and the overall model is significant at 1% level. Furthermore, Y (income) and CPI both registered negative relationship with DM (money demand) at 1% levels while B, the equilibrium bias variable was statistically significant at 1% level. The significance of the equilibrium bias variable proves that the assumption for the estimated money demand function holds. Since the chosen model assumed that the demand for money adjustment is made by holders of money (non-monetary authority), this is the reason why for Nigeria which is a petrodollar (mono product) dependent economy, the variable income went against a priori expectation as the monetary authority continually sterilises 'perceived' excess liquidity after printing and sharing the Naira equivalent of oil receipts, interest rates remains high and money demand will continue to reduce. This means that 10% increase in income reduces money demand in the economy by 0.2%.

Table 1. Perron breakpoint unit root test

Variables	Levels				1st difference	
	Log(DM)	Log(Y)	Log (CPI)	B	D(Log(DM))	D(Log(CPI))
	Intercept + trend	Intercept + trend	Intercept + trend	Intercept	Intercept + trend	Intercept + trend
t-Statistics	-4.609114	-9.182837	-1.818630	-5.755851	-7.845198	-6.038236
5% critical value	-5.59	-5.59	-5.59	-5.23	-5.59	-5.59
Chosen lag length	0	0	4	2	1	0
Chosen breakpoint	2013Q3	2009Q4	2011Q2	2014Q3	2013Q3	2014Q4

Table 2. Bootstrap correlation result

Variable	Coefficient	Std. Error	t-Statistic
C	0.291110	0.130747	2.226510**
LOG(Y)	-0.017275	0.007763	-2.225247**
D(LOG(CPI))	-0.127256	0.191590	-0.664210
B	6.88E-08	4.67E-09	14.73429*
R-squared	0.93		
F-statistic	133.7		
Durbin-Watson stat	2.06		

Note: (*) Significant at 1%, (**) Significant at 5%, Bootstrapped coefficient estimates and standard errors, r = 10,000

Though insignificant, CPI elasticity (hereafter inflation rate) posted its correct a priori expectation which means that holders of money are prone to defend their wages/cash balances by switching consumption to less expensive goods/services or better still reduce consumption all together which is the reason for the indirect relationship. Therefore, 10% increase in inflation rate reduces demand for money by 1.3%.

5. CONCLUSION

The main concern of this paper was to raise certain conceptual issues in the demand for money function. This was motivated by the fact that in spite of the amount of theoretical work to-date on the subject, the issue of disequilibrium in the money market has not received adequate attention. Thus there remains a fair amount of conceptual and empirical ambiguities in the literature.

This paper has highlighted an approach to the modelling and estimation of demand for money function in a disequilibrium framework. The method of sample separation into demand and supply regimes was based on the work of Fair and Jaffee which has its genealogy in the theory of demand for durable goods, emphasizing the stock property. However, this paper has added further assumptions to make the Fair-Jaffee scheme better suited to the estimation of demand for money function under albeit special conditions. Finally, the assumption of equilibrium in the existing literature was tested for statistical significance by introducing a variable denoting equilibrium bias which was found to be significant and the results highlighted the structural irregularity prevailing in the economy.

COMPETING INTERESTS

Author has declared that no competing interests exist.

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APPENDIX

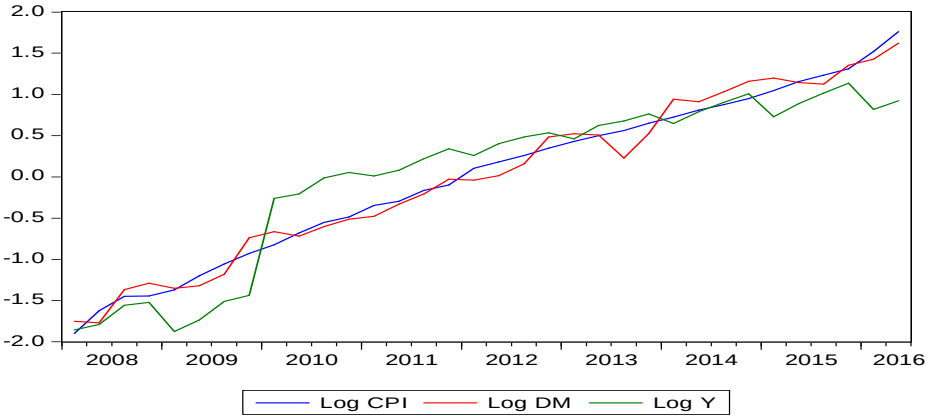

Fig. 1. Graph showing normalised data of the variables

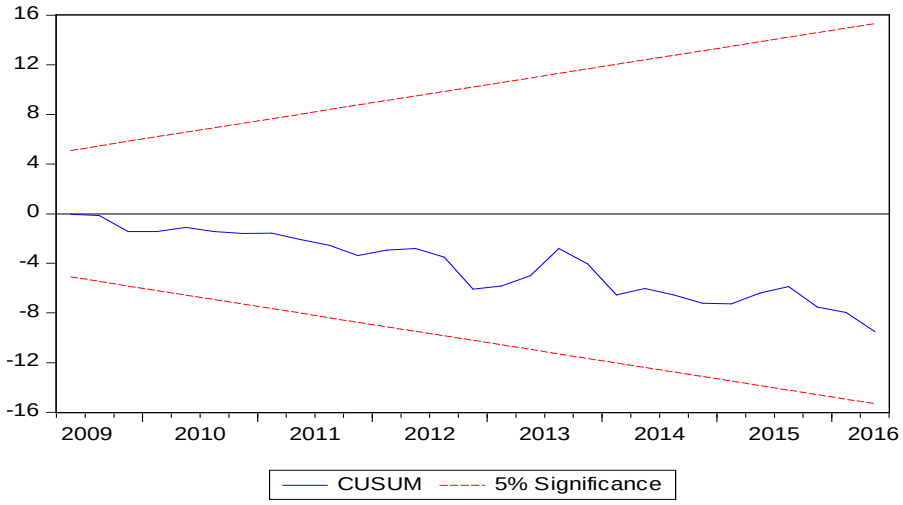

Fig. 2. CUSUM test result

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