

# Nigeria:

## An Extension of Microeconomic Perspective of Demand for Money

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### Abstract

*The study examines the microeconomic foundation of money demand in Nigeria. It adopted weighted aggregate value of wealth to examine the problem of aggregation of monetary variables in Nigeria. Empirical analysis of the data from 1980 to 2004 using a co-integration test reveals an equilibrium behavior of money demand, wealth, composite consumer price index, and private consumption. It reinforces the fact that co-integration is purely a means to an end in analyzing the long-run relationship among variables. However, the use of simple sum aggregated variables in this study despite its being problematic yields different results. The micro attempt at aggregating these variables is therefore a probable solution to the problem at hand. The result shows that a positive impact of private consumption on money demand is negligible. On the other hand, the increase in inflation continues to pose a serious challenge to money demand, thus raising the desire to hold money. The demand for money consequently increases significantly as the wealth of few Nigerians increases.*

**Key words:** Demand for money, value of wealth, monetary variables, co-integration test., Nigeria.

## 1. Introduction

The continued interests in the area of demand for money could be attributed to its central importance to economic theory, monetary theory effectiveness, seigniorage and inflation. However, controversies have trailed the empirical results of the subject. The controversy borders on the issue of an appropriate definition of money stock, the appropriate specification of the money demand function and the opportunity cost variable, stability of money demand and the specific variable that might affect the demand for money function (Ewis and Fisher 1984; Alayande 2003).

In the literature, there are macro- and microeconomic methods provided for resolving the controversies. The macro approach has been adopted by many authors and it relies on the simple –sum monetary aggregate. However, the method has been proved to be of dubious validity because the simple sum quality index is a special case of the linear index and the price dual to the linear index is the Leontief price index. The implication of linearity is that the macro method assumes perfect substitutes among component assets forming the aggregates, and the assets are also perfect substitutes in identical ratios (Belongia 1995). There is also the problem of internal consistency of the variables used by the conventional macromethod and the variables at times do not relate in a valid manner with economic theory because little consideration is paid to the non-linear functional forms implied by demand theory. The rationalization for ignoring the implications of economic theory is the potential damage to economic theory produced by aggregation over economic agents (Barnett, Fisher and

Serletis 1992).

In addressing these pitfalls, some of the macro methods assume a linear or (log linear) function for the demand for money (Tomori 1972; Ajayi 1974; Adejugbe 1988; Jimoh 1990; Oresotu and Mordi 1992). In these series, some macro studies focus on the role of money as a buffer stock asset which absorbs unforeseen monetary shocks disturbing the balance between receipts and payments (Laidler 1985; Cuthbertson and Taylor 1989). Some have also focused on the analysis of shift or stability in the money demand function (Brunner and Meltzer 1972; Hetzel and Mehra 1989; Adam 1991; Laidler 1996). Others have applied the co-integration and error correction model for establishing a long run relationship in the money demand function (Miller 1991; Adam 1992; Teriba 1974 and 1996; Akinlo and Folorunso 1999).

In spite of all these traditional analytical approaches, some issues remain unresolved in the literature. These include an appropriate definition of money, substitutability of monetary assets, and the issue of money measurement. The application of a micro-economic foundation to address the problems becomes paramount. However, this study intends to assess money demand in Nigeria from the perspective of utility maximization.

The paper is structured into five sections with the introduction in section 1. The related literature is reviewed in Section 2 while the theoretical framework that underpins the empirical analysis including the model is presented in Section 3. The empirical results are presented and interpreted in Section 4 while the last section is the concluding remarks.

## 2. Review of Related Literature

The issue of money measurement rests on the concern of whether the analysis of money should be based on official monetary aggregates constructed by a method of simple sum aggregation or aggregation based on the postulates of economic theory. This is one problem which the macro approach is yet to resolve. This simple – sum aggregation method does not take advantage of the result of existing aggregation theories or theory consistent aggregation approaches. It does not consider the optimizing behavior of individuals and the recent development in the application of the demand theory to the study of financial institutions (Chrystal and Macdonald 1994).

The micro foundation method involves the application of the demand system to demand for money. It either uses the disaggregated general equilibrium modeling or simple form of aggregation over goods and economic agents. This enables us to study the response of optimizing private agents by testing for the existence of both the postulated aggregate goods and aggregate economic agents while determining the demand for financial services. Besides, this provides the means for solving some salient issues of financial asset substitutability, the private sector income and wealth elasticities of demand for real and financial assets, the role of relative prices in determining portfolio composition and monetary aggregation in the empirical analysis of demand for money (Beyer 1998; Ericsson 1998; Ewing and Payne 1999; Coenen and Vega 2001; Felmingham and Zhung 2001). Even with this micro demand perspective, it is still difficult to justify summing together

monetary assets that have different and varying yields (Barnett, Fisher and Serletis 1992). Incidentally, there is enough evidence that assets which are usually combined in money measures are not perfect substitutes (Belongia 1995).

Chrystal and Macdonald (1994) among others noted that the micro foundation method provides a means for resolving the issue of “money measurement” by using two alternatives. The first is to restrict attention to a very narrow definition of money which only needs non-interest bearing components, while the second is to construct an index number of monetary aggregates which could in principle, capture the transaction services yielded by a broad range of financial assets. The common indices are the divisia index and the currency equivalent index (Barnett and Liu 2000). This attempt makes it easier to deal with issues relating to the definition and substitutability of money assets.

The micro foundation method is broadly based on utility theory. In the framework, the representative consumer’s utility function is assumed to be weakly separable with respect to monetary services and other consumption goods. Thus, the consumer allocates the selected expenditure on the user cost of monetary assets (Ewis and Fisher 1984; Barnett et al. 1992; Fisher and Fleissing 1994).

Besides, properly weighted monetary aggregates are most informative in explaining general economic activities especially when they come from data that are consistent with the axiom of utility maximization. This has been missing in most studies and this work aims at bridging such gap.

According to Barnett, Fisher and Serletis

(1992) and Belongia and Chalfant (1991), the micro method is able to take account of the different degree of “moneyness” possessed by the various monetary assets. The approach can also provide quantitative estimates of the degree of substitutability of monetary assets for money (Alayande 2003; Odama 1974; Ogun 1974).

Alayande (2003) further reiterates the superiority of an expenditure-based variable over a production-based variable. It was found that the choice of inappropriate proxy as scale variable could account for the different misconceptions on the issue of money demand in Nigeria.

### 3. Theoretical Framework and the Model

The study is based on the theory that permits exact aggregation of market demands as if they were the outcome of decisions of rational representative consumers (Deaton and Muelbauer 1980; Varian 1983; Chi 2006). Here, the preference of representative consumers is represented by a cost function, which defines minimum expenditure necessary to attain specific utility level at given prices'. Therefore, if 'u' represents utility and 'p' represents prices, one class of exactly aggregate cost function can be represented as:

$$\ln c(u,p)=(1-u)\ln\{l(p)\}+u\ln\{m(p)\} \quad (1)$$

Where u lies between zero (subsistence) and one (bliss); l(p) and m(p) can thus be regarded as the costs of subsistence and bliss respectively. For the cost function to be flexible, it must have enough parameters so that

at any single point, its derivatives

$$\frac{\partial c}{\partial p_i}, \frac{\partial c}{\partial u}, \frac{\partial^2 c}{\partial p_i \partial p_j}, \frac{\partial^2 c}{\partial u \partial p_i} \text{ and } \frac{\partial^2 c}{\partial u^2}$$

can be set equal to those of an arbitrary cost function. By taking the specific functional forms of log l(p) and log m(p) and applying the second order Taylor approximation to the cost function in (1), we obtain:

$$\log l(p) = \alpha_0 + \sum_i \alpha_i \ln p_i + \frac{1}{2} \sum_i \sum_j \theta_{ij} \ln p_i \ln p_j \quad (2)$$

$$\log m(p) = \log l(p) + \beta_0 \gamma_k P_k^{\beta_k} \quad (3)$$

By substitution of the expressions for l(p) and m(p) into the cost function in (1), we have

$$\ln c(u,p) = \alpha_0 + \sum_i \alpha_i \ln p_i + \frac{1}{2} \sum_i \sum_j \theta_{ij} \ln p_i \ln p_j + u \beta_0 \gamma_k P_k^{\beta_k} \quad (4)$$

Where  $\alpha_i$ ,  $\beta_i$  and  $\theta_{ij}$  are the parameters to be estimated. The derivative of the cost function with respect to prices using shepherd's Lemma gives us the Hicksian demand functions.

$$\frac{\partial \ln c(u,p)}{\partial \ln p_i} = \frac{P_i q_i}{c(u,p)} = w_i \quad (5)$$

Here,  $w_i$  = wealth share of good i. Therefore, a logarithm differentiation of (4) thus gives wealth shares as a function of prices and utility as:

$$w_i = \alpha_i + \sum_j \theta_{ij} \ln p_j + \beta_i u \beta_0 \gamma_k P_k^{\beta_k} \quad (6)$$

$$\theta_{ij} = \frac{1}{2} (\theta_{ij} + \theta_{ji}) \quad (7)$$

Under the assumption of utility maximization, the total expenditure (E) is equal to cost

c(u,p). Hence if we substitute E for c(u,p) in the cost functions and solve for u as a function of E and P, we get the indirect utility function. If the indirect utility is used to substitute for u in the wealth share equation in (6), the wealth share will be expressed as a function of prices, p and total spending E. Hence we obtain the Marshallian demand equations for the AIDS in the wealth share form as:

$$W_i = \alpha_i + \sum_j \theta_{ij} \ln P_j + \beta_i \ln \left( \frac{E}{P^*} \right) \quad (8)$$

where  $P^*$  = Price index defined by:

$$\ln P^* = \alpha_0 + \sum_k \alpha_k \ln P_k + \frac{1}{2} \sum_j \sum_k \theta_{jk} \ln P_j \ln P_k \quad (9)$$

The restrictions on the parameters of equation (6) in addition to equation (9) imply restrictions on the parameters of the share equation (8). This may be represented by:

$$\sum_{i=1}^n \alpha_i = 1; \sum_{i=1}^n \beta_i = 0; \sum_{i=1}^n \theta_{ij} = 0 \quad (10)$$

$$\sum_j \theta_j = 0 \quad (11)$$

$$\theta_{ij} = \theta_{ji} \quad (12)$$

Condition (10) is the adding up restrictions which derives from the definition of wealth shares and total spending E that the sum of the shares over all nth goods adds up to total expenditure. If equation (10) to (12) hold, then equation (8) represents a system of demand function equations which add up to total expenditure ( $\sum w_i = 1$ ). This is homogenous of degree zero in prices and total expenditure taken together which also satisfies Slutsky symmetric conditions (the compensated cross price effects are equal).

In order to model money demand, we introduced money directly into the indirect utility function which was used to substitute

for wealth share equation in (6). By so doing, we obtained our tested empirical model for the study:

Where Md = Narrow money demand (M1)

$P^*$  = Composite Consumer Price Index

C = Private Consumption

$$Md = \alpha_0 + \alpha_1 \ln W + \alpha_2 \ln P^* + \alpha_3 \ln C \quad (13)$$

W = Wealth.

And are parameters of the model estimated. Wealth is obtained through simple aggregation of treasury bills, commercial papers, bankers' acceptances, total fixed assets and savings.

For the purpose of meaningful regression analysis, the orders of integration of the variables were determined using the Augmented Dickey Fuller and Phillips Perron tests. The model for both tests is specified as:

$$y_t = y_{t-1} + \sum_t \quad (14)$$

$$\sum_t = \rho \sum_{t-1} + u_t \quad (15)$$

where u with noise variable is:

$$\Delta y_t = \rho \sum_{t-1} + u_t \quad (16)$$

The fact that variables are co-integrated implies that there is an adjustment process that prevents errors in the long-run relationship from becoming larger and larger. It also showed that co-integrated series has an error correction presentation, suggesting that co-integration is a necessary condition for an error correction model. We employed an error correction dynamic specification of the form:

$$\Delta Md_t = \alpha_0 + \alpha_1 L(\Delta z) + \alpha_2 u_{t-1} \quad (17)$$

### 4. Empirical Results and Interpretation

This section begins with unit order of in-

<sup>1</sup>Our cost function is specified on the basis of two assumptions; (1) That the cost function is concave and homogenous of degree one in prices and increasing utility (2) The cost function is also assumed to be continuous and increasing in all prices and that the first and second derivatives with respect to prices exist.

tegration test and is followed by Johansen Co-integration test and short– run regression analysis.

Table-1: Phillips Perron Test2

Variable	Level	1st Difference	2nd Difference	Decision/Integration Order
Md	-1.517622	-2.274063	-4.759777	I(2)
W	-0.541340	-4.596824	-	I(2)
CPI	-3.759548	-	-	I(1)
C	-0.266680	-3.303525	-	I(1)

Source: Authors' Computation.

**Note:** The 5% critical value for Phillips Perron statistic is approximately -2.99 for levels; 3.00 for first difference and -3.01 for second difference. They were computed from Mackinnon (1996).

Table-2: Johansen's Co-integration Test

Null	Hypothesis Alternative	Maximum Eigen Value		Trace Test Statistic	
		Statistic	Critical value at 5%	Statistic	Critical value at 5%
R=0	R=1	104.1935	27.07	197.6282	47.21
R≤1	R=2	51.30088	20.97	93.43469	29.68
R≤2	R=3	28.16203	14.07	42.13382	15.41
R≤3	R=3	13.97179	3.76	13.97179	3.76

Source: Authors' Computation.

Table-3: Short-run Regression Result

Variable	Coefficient	T-ratio
C	7.870682	15.47527
Wt	0.233616	2.252926
CPIt	0.000419	10.44045
Ct	0.035632	0.388837

Durbin Watson Statistic= 0.816695

R2 = 0.985445

Adj.R2 = 0.983365

F Statistic = 505.6172

Source: Authors' Computation.

The Phillips Perron test reveals that the composite price index in Nigeria is stationary at level while private consumption and

the aggregated wealth are stationary at first difference. Money demand is only stationary after second difference. A linear combination of the four variables using Johansen's test of co-integration reveals long run relationship among the variables. Both maximum Eigenvalue and Trace tests show four co-integrating vectors in the model3. This implies that all the variables converge at equilibrium. The variables that sum up the wealth value to attain this interesting result are the treasury bills, savings commercial papers and banks acceptances. The interesting result of the co-integration is in line with the findings of Teriba (1992) and Oresotu and Mordi (1992).

In the short run, wealth, private consumption and consumer price index exhibit a positive relationship with the money demand. While both coefficients of wealth and consumer price index are statistically significant, that of consumption is insignificant and negligible. The coefficient signs of wealth and consumption are in line with a – priori expectation but that of the consumer price index is not. This can be adduced from the fact that the country experiences stagflation. As inflation rises, unemployment rises likewise and income falls, so also money supply and then money demand.

The study further discovers that the demand for money is insensitive to interest rate in Nigeria and as such generates unpredictable velocity of money in circulation thus suggesting no clear linkage between aggregate spending and money supply. Invariably, the Central Bank of Nigeria could not determine the actual volume of money in circulation and for so many years faced with ineffective monetary policies. It is therefore imperative for

CBN to take more cognizances of wealth and consumer price indices as stable measurement of demand for money function in other to determine the volume of money in circulation. By so doing, the demand for money function would have been determined from microeconomic perspective rather than from the traditional macroeconomic perspective as the former is more realistic in the case of Nigeria.

Finally, the results show good fit, and are significant overall. The Durbin Watson statistic shows positive autocorrelation despite long run attainment of the variables, which suggests no spurious regression.

### Concluding Remarks

The nature of aggregation of monetary variables determines the results on money demand analysis. However, a simple sum aggregation is faulty. This implies that money demand remains an empirical issue. From the empirical evidence discussed, aggregation of wealth value as one of the determinants of money demand seems to be appropriate, when total fixed assets in the economy

are excluded.

Co-integration analysis in economic research is not an end but only a means to an end. The study reveals that it is actually one requiring test and retest exercises. Definitive and more accurate approaches need to be sought out. Adopting the logarithm of monetary variables and analyzing without the logarithm exhibits different co-integration results.

Lack of internal stability in the Nigerian economy still affects money demand. It is imperative that money should be regarded as a commodity for which satisfaction wealth holders will struggle to maximize from time to time. On this note, the fluctuations in demand for money can be predicted in the monetary policy formulation or evaluation as against the macroeconomic foundations of demand for money.

The government of the day must closely examine the problem of inflation and unemployment in the country among other issues. In addition, it should also ensure that all leakages from the monetary system are blocked.

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