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An Exposition on the Demand for Money

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Abstract

The demand for money had been known to be key to understanding the choice and effectiveness of monetary policy instruments. A detailed study of the subject was usually directed towards this ideal. In this paper, an investigation of the demand for money theory of Milton Friedman was undertaken. A clarification of the theory was deemed necessary to eliminate misconception. The data of a developing market economy, covering the period, 1971-2008, were employed to test the theory. Four different types of monetary aggregates were analyzed in the paper – currency, narrow money, quasi-money and broad money. Modern time series techniques were employed in the study. An investigation of the time series properties of the data employed was undertaken with the outcome however precluding error correction parameterization of the different models. In the alternative models, the parsimonious equations underscored the creditable performances of both the fundamental variable and relative prices at explaining the demand for monetary aggregates. Overall, the study generated important policy implications for monetary policy formulation and financial markets' dynamics in all market economies. The paper hence, theory, was a contribution to understanding the dynamics of portfolio holdings in the macroeconomy.

Keywords: general economics and teaching, time series models, demand for money, financial markets and the macroeconomy, monetary policy.

1. Introduction

Issues of demand for money and the affiliated function are of utmost importance in monetary economics. They influenced greatly, the focus and techniques of monetary policy and the degree of reliance on monetary factors in growth considerations. Accordingly, issues of form and significance of explanatory variables, stability of function, adjustment speed of actual to desired balances and the relative importance of monetary aggregates have been prominent in the theoretical, methodological and empirical literatures. Notwithstanding the voluminous literature on these issues, there remains considerable differences on the appropriate form of the money demand function especially when the horizon is extended to the long run.

The traditional Classical theory of money, according to Irvin Fisher, emphasizes income as the sole determinant of the demand for money. Although, the theory employs the full employment framework, it holds velocity and output changes constant. Hence, the emerging inferences on price level determination, demand for money and aggregate spending relate exclusively to the short run.

The Keynesian theories are in the main, generally, short run models built around the assumption of underemployment equilibrium. Usually cast in real terms, the emerging liquidity preference function is one in which real income and interest rate play crucial roles in explaining the variations in the demand for money. However, instability of function is inherent in the associated fluctuations of the income velocity.

The Monetarists' restatement of the quantity theory (see, Friedman, 1956) represents a clear understanding of long run in the context of the demand for money. A long run variable, permanent income, is prominent in the relevant demand for money function. For whatever reason, the theoretical and empirical literatures hardly referenced the Monetarists' framework in terms of its distinction between the short run and the long run. Accordingly, different versions of Friedman's demand for money theory permeate the literature.

This study conducts an empirical investigation of the Monetarists' theory of demand for money in Nigeria, deriving its springboard from a clarified exposition of Milton Friedman. No particular yardstick is used for selecting the case study country as any other market economy qualified just as well. However, the history of research into the subject of the demand for money in the country may actually provide a credible justification for her choice.

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The pioneering efforts on the subject (see e.g. Tomori, 1972; Ajayi, 1974; Teriba, 1974) have generally thumbed down the rate of interest as an insignificant explanatory variable; later investigations (see e.g. Akinnifesi and Phillips, 1978; Arize and Lott, 1985[2]; Darat, 1986; Ogiogio, 1989; Odor and Alenoghena, 2016[3]) produce results to the contrary.[4] However, this study is the first to focus exclusively on the theory and empirics of Friedman's demand for money in Nigeria.

The findings of the study summarize as follows: the estimated equations generally appeared to be reasonable fits, accounting for large proportions of total variations in different monetary aggregates. The estimates were generally robust with most variables bearing the expected signs. The models were also generally well behaved in terms of normality, serial correlation, heteroskedasticity, stability and specification.

The rest of the paper is organized as follows. The immediate section after this introduction discusses the extent and importance of money and monetary policy in reform era Nigeria in the sense of monetary dynamics. This is followed by the presentation of the clarified Friedman's theory and succeeded by the mechanics of the application of the theory to the demand for money in the case study economy. The section after this presents the results and the discussion. The final section concludes the paper.

2. Synopsis of Money Market Dynamics in Nigeria – Post 1986

The relationship between changes in money supply and the price level appears to hold tight throughout the 1980s and the 1990s. As shown in Table 1, the correspondence in the direction of changes in broad money and consumer price index appears very obvious. It would appear however that the relationship experienced some slackness since the year 2000 as price level changes no longer follow rigidly, the changes in the money supply. This development may in a sense suggest a better coordination of money supply growth in the period beginning from year 2000. It can also be a plus for the indirect monetary management style introduced in 1993.

The picture that emerges from the other indices of monetary management in Table 1 that is, growth of narrow monetary base, monetary policy rate, real interest rate, parallel market exchange rate and fiscal deficit ratios, is that of consistency with the conclusion of relatively superior monetary management in the post 1990s. It thus appears to explain the relatively more impressive growth trend of the real gross domestic product (GDP) in the period. However, the noticeable decline in the growth of net foreign assets especially, in the decade of 2000-2010, appears to be an exception.

Both in absolute terms and relative to GDP, the growth of money supply was generally expansive, financed mostly through a combination of domestic and foreign components of the monetary base. Thus, deficit financing was little relied upon to finance the expansion in money supply in the period. The expansionary stance of monetary policy since the 1990s was further attested to by the generally negative trend of the changes in both the monetary policy rate and the real interest rate.

The general conclusion that emerges from this brief review is that of better policy coordination, less distortive policies and more successful monetary management since the switch to indirect management system under the economic reform process that was initiated in 1986.

3. A Clarified Friedman's Demand for Money Theory

The presentations of the Friedman's theory in Mishkin (2007) and Serletis (2007) are referenced. Demand for money is a demand for a durable asset calling forth a budget constraint and price variable(s). The budget constraint is the permanent income or the expected average long run income (Yp) which can be approximated as:[5]

$$Yp = Y_0 + \frac{Y1}{(1+r)} + \frac{Y2}{(1+r)^2} + \text{--} = \sum_{j=0}^{\infty} \frac{Yt+j}{(1+r)^j} \quad (1)$$

[2] Arize and Lott's conclusion that, for reason of low per capita income, permanent and measured income are largely the same in Nigeria appears to be unsupported by theory as the only plausible ground for this equality is price stability; even in their study, price level (though exogenously determined) is noted to be variable.

[3] There appears also to be a methodological issue with Odior and Alenoghena (2016); it seems that all series are subjected to the cointegration analysis notwithstanding their theoretical status.

[4]There has been a myriad of studies on different aspects of the demand for money including the extension within an optimization framework or general equilibrium model, of Friedman's basic tenet (though not usually credited to him) that money be treated like any other durable good and in competition with others in consumers' baskets; empirically however, two main issues has preoccupied researchers' minds (especially since the mid-1970s): the influence of interest rate or the appropriate opportunity cost variable in money demand functions, and, the stability of the demand for money function (see e.g. Goldfeld, 1976; Judd and Scadding, 1982; Hafer and Hein, 1982; Andersen, 1985; Ragan and Trehan, 1998).

[5]In generating permanent income, it is not necessary to introduce measurement in real terms into the concept beyond the initial period, as the discount rate, r, usually reflects price level changes. Thus, as measured, permanent income is the equivalence of income (e.g. gross national product) at constant prices.

Where, Y_0 is initial undiscounted permanent income, r is nominal interest rate as the discount factor, Yt + j is measured income at time t + j.

Equation (1) is transformed after some algebraic manipulations, into:[6]

$$Yp = \frac{r}{(1+r)}\sum_{j=0}^{\infty}\frac{Yt+j}{(1+r)^j} \quad (2)$$

More than one price variable is relevant to the demand for money. Apart from the return on money (r_m), there are returns, on bonds (r_b), equities (r_e) and goods (π^e – expected inflation). These others, being returns on money substitutes are expressed in relative terms to return on money. Thus, in the first instance, a functional form of the demand for money emerges as follows:

$$\frac{M}{p} = f(Yp, r_b - r_m, r_e - r_m, \pi^e - r_m) \quad (3)$$

(+) (-) (-) (-)

The signs underneath indicate the relevant partials. The return on money is not a constant because it consists of an explicit component in the return on the deposits included in the definition of money, and, a services' linked component (implicit) in the form of provision of automated teller machines in accessible locations, more tellers in the bank and automatic payment of bills. The overall return on money increases whenever these explicit and/or implicit returns rise. As a result, the differences between return on the money substitutes in equation (3) and the return on money remain relatively constant. Thus, given competitive banking system, any forces - market or administrative - causing the returns on the other assets to rise will also supply the basis for proportional rise in return on money. In this sense, the relationship between money and the other assets tends towards (that is, beyond the short run) complementarity rather than substitutability.

The submission in the latter part of the preceding paragraph is the aspect of Friedman's theory that is overlooked or ignored in the literature. It appears to be an interpretation problem. For instance, Laidler (1985, p. 57) recognizes that, a rise in the return on any asset will cause the demand for that asset to rise while the demand for the other assets will fall and this process continues until equilibrium is restored. However, he does not interpret this dynamism in terms of 'adjustment to the long run'. Hence, the resultant equilibrium is not viewed as long run even when it is understood that the theory is in respect of a capitalist economy whose money market is in initial long run equilibrium.[7]

The implication of these developments is that the relative rates of return are only relevant to demand for money in the short run. In the long run, only the permanent income influences the demand for money.[8] Thus, the following long run expression holds:

$$\frac{Md}{p} = f(Yp) \quad (4)$$

As Yp does not change much with business cycle, velocity (V) tends to vary in a predictable manner given the expression below:

$$V = \frac{Y}{f(Yp)} \quad (5)$$

When the state of velocity predictability is coupled with the relative stability of the demand for money as conditioned by the presence of permanent income, then, a change in the quantity of money produces a predictable change in aggregate spending.[9] This way, Friedman's theory becomes a restatement of the quantity theory of money.

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[6] For an insight into such manipulations, see for example, Serletis (2007).

[7] This interpretation still holds even when banks are not allowed to increase the interest rate paid on deposits as they could choose to focus on improving the quality of their services. Mishkin (2003, p. 554) cites the example of the US airlines of the 1960s and 1970s that resorted to competing on quality dimension when they were prevented from reducing air fares by the regulatory authority which had earlier increased the fares across the board. The interpretation also holds in the case of a dysfunctional economy where for instance, demand for money can rise when market interest rate rises; the general rise in the demand for money would generate deflation causing an 'across the board' fall in all rates of return thereby, preserving the long run constancy of the differences between the relative rates of returns and hence, the associated demand for the linked assets.

[8] Arguments in defense of this outcome can be found in Friedman (1966).

[9] The view on velocity and aggregate spending holds in both the short and long runs even with changes in any growth driver in the case of the latter run. This is so because velocity varies in a predictable manner. Expectations of interest rate changes will play a crucial role in the short run velocity dynamics: demand for money will fall as interest rate rises in expansion causing velocity to rise while it will rise as a safety net in recession with velocity falling (see also, Friedman, 1959, p. 20). Thus, the strictly short run equivalent of equation (5) will include the incentive terms in the denominator. However, as stated earlier, velocity continues to vary predictably.

Table 1: Indicators of Money Market Dynamics in Reforms' Era Nigeria, Annual Average Change (%)[1]

Date[2]	M2[3]	CPI[4]	MBI[5]	MPR[6]	RIR.[7]	Holding of TB[8]	RER[9]	M2Y[10]	Parallel Market Exchange Rate, PMR	Net Foreign Assets, NFA.	Fiscal Deficit – GDP Ratio	Fiscal Deficit – Broad Money Ratio.	Real GDP	Internal Debt	External Debt	Capital Account
1981-1985	11.8	13.0	3.7	9.0	-37.1	32.2	-1.1	9.8	23.3	-2.8	-8.4	-22.7	-3.1	38.5	75.9	46.1
1986-1990	22.3	18.2	27.2	10.5	-50.2	13.2	35.5	16.5	15.2	127.2	-10.9	-38.0	5.9	27.5	85.8	0.9
1991-1995	36.5	31.4	59.1	-14.0	-153.3	39.6	-24.3	71.9	32.4	30.2	-6.7	-24.1	1.0	42.2	20.9	117.3
1996-2000	27.1	10.4	17.9	-1.4	-7.1	110.3	6.5	195.2	3.2	76.8	-3.3	-15.7	3.2	14.7	63.2	35.5
2000-2005	22.5	13.5	18.0.	-2.2	-15.2	7.2	-8.8	392.9	4.6	30.9	-2.8	-10.7	11.4	11.2	0.9	39.2
2005-2010	34.1	9.1	21.0	-17.7	-2.7	0.7	-5.3	1186.2	0.5	12.3	-1.7	-4.4	6.6	33.2	-7.3	29.8
1999-2007	31.4	10.3	23.2	-7.7	-0.3	26.4	1.1	387.7	6.8	53.8	-2.8	-12.0	8.3	20.7	27.3	39.2

Notes: [1] Real exchange rate and parallel market exchange rate were included in order to underscore the influence of the volatility in the foreign exchange market on developments in the money market. [2] Recession period of 1981-'85 and booming period of 1999-2007 were included for comparison. [3] Broad Money. [4] Consumer Price Index. [5] Narrow Monetary Base. [6] Monetary Policy Rate. [7] Real Interest Rate – cumulative increase. [8] Central Bank's holding of Treasury Bills. [9] Real Exchange Rate. [10] Broad Money – Income Ratio

Source: Available upon request.

4. An Application of the Theory

(4.1) Model Specification

The basic model as motivated by equation (3) could be specified as:

$$\frac{M}{p} = f\left(Yp, r_b - r_m, r_e - r_m, \pi^e - r_m, r_f - r_m, r_p - r_m\right) \quad (6)$$

(+) (-) (-) (-) (-) (-)

Where, the additional terms were, r_f and r_p representing returns on foreign deposit and foreign exchange holding respectively.[10]

The return on money varied depending on the substitute asset whose return was being considered. Thus, interest rates on different deposit types were substituted for the return on money as follows.[11] In r_b - r_m, the 3 months money market interest rate was chosen to represent return on money, r_m, while treasury bills rate was the return on bonds, r_b. In r_e - r_m, average stock price index was the proxy for return on equity, r_e, while the 6 months money market rate represented the return on money, r_m.[12] In $\pi^e - r_m$, π^e that is, expected inflation, was generated as the fitted series in a parsimonious short run inflation model[13]. The interest rate on twelve months' time deposit stood for return on money, r_m. In $r_f - r_m$, r_f was represented by short-term (3 months) foreign interest rate while r_m was the equivalent rate in the domestic economy. In $r_p - r_m$, r_p was proxy by the return in the parallel exchange rate market or simply, the parallel market exchange rate premium while the three months deposit rate of interest represented the return on money, r_m.

In log expression, equation (6) was transformed into[14]:

$$Log\left(\frac{Md}{p}\right) = \alpha_0 + \alpha_1 logYp + \alpha_2 log(r_b - r_m) + \alpha_3 log(r_e - r_m) + \alpha_4 \log(r_f - r_m) + \alpha_5 log(r_p - r_m) + \alpha_6 log(\pi^e - r_m) + \mu_t \quad (7)$$

Where, $\alpha_1 > 0;\ \alpha_2, \alpha_3, \alpha_4, \alpha_5 \text{ and } \alpha_6 < 0;\ \mu_t$ was error term, and, all others, were as defined earlier.

(4.2) Methodology and Data

The method of analysis employed was of the nature of general-to-specific that among others, encompassed an investigation of the unit root status of the data series and allowing the outcome to determine the direction of further investigation. Thus, where theoretically identified long run variables were not stationary at level (that is, they were integrated of the order of 1), a test of cointegration with the dependent variable was recommended. With cointegration, an error correction model (ECM) emerged in the residual of the static regression involving the cointegrated vector. In this study, the unit root tests were conducted according to the Augmented Dickey Fuller (ADF) and the Phillips-Perron (PP) procedures. The following features of the data employed in the analysis should be noted. First, the data were annual series from secondary sources.[15] Secondly, the permanent income series in the study was generated from nominal gross national product (GNP) as the fitted

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[10] The introduction of interest parity condition in the relative return to foreign deposit and relative return in the foreign exchange market turns the model into an open economy type. Note however that the use of actual returns instead of expected returns on foreign deposit and in the foreign exchange market presupposes perfect foresight which may be restrictive.

[11] Only the explicit return is considered in this study. A way to impute value to the implicit return is to normalize total return on money to one, subtracting the explicit return accordingly. The problem with this approach is that, unless carefully handled, it could result into disproportionately large values for the implicit returns. An alternative approach that emerges from an insight offered by project analysis, would at the least, equates the implicit return to the explicit return. A separate study appears necessary to analyze the issue exhaustively.

[12] The 6 months horizon here is predicated on the understanding that speculators in the stock market typically dealt on that basis.

[13]The arguments in the inflation function are: narrow money per capita, real gross national product, real interest rate, parallel market exchange rate premium, fiscal deficit, trade deficit and supply shock; the data employed in the inflation model are from the same source as Table 1.

[14] Expressing the price differentials in log is justified by the fact that the relevant prices (interest rates) are in percentages and not percentage growth rates when they will be the equivalent of log differences. In any case, the variations of log-transformed and untransformed series are the same. In the case of expected inflation, it was derived from series in log hence the log prefix to its differential.

[15]Available upon request.

series in a regression of time on gross national product. Thirdly, data on stock prices, that is, stock price index, as proxy for return on equity, was only available for the period, 1980-2008; values for 1971 to 1979 were obtained through extrapolation.[16] Fourthly, the foreign interest rates (3 months deposit rate) used in the study were averages of the rates for the specified periods, and of the country's major trade partners that were also notable open economies.

5. Results and Discussion

(5.1) Estimation Issues

Two major issues cropped up in the course of estimating the equations of the model. The first had to do with the generation of permanent income which was approximated as the fitted series in a regression of time on nominal GNP. Such generation implied possible parameter inefficiency as the resulting error variances were bound to be relatively larger and, the estimated variances of the estimated parameters became biased estimators of the true variance of the estimated parameters.[17] Testing for heteroskedasticity was accordingly warranted.

The second issue had to do with the problem of near singular matrix that arose during the unit root investigation involving the ADF test. Accordingly, the level test of the permanent income series (Yp) could not be conducted using the test procedure. However, the PP test produced results at all levels of testing and was relied upon for decision on the order of integration.

(5.2) Preliminary Data Analysis

The unit root tests of the data series employed in the study were presented in Table 2.

Table 2: Unit Root Tests

	Augmented Dickey –Fuller		Phillips-Perron		Remarks
Variable	Level	1st Diff.	Level	1st Diff.	
LogRM1	-0.756	-3.767	-1.279	-3.844	I(1)
	(0.819)	(0.007)	(0.628)	(0.005)	
LogRM2	-0.985	-3.312	-0.963	-3.312	I(1)
	(0.748)	(0.021)	(0.755)	(0.021)	
LogRM0	-2.375	-4.754	-1.927	-4.636	I(1)
	(0.155)	(0.000)	(0.316)	(0.000)	
logRQM	0.475	-4.511	0.399	-4.458	I(1)
	(0.983)	(0.000)	(0.980)	(0.001)	
Yp	NSM	-22.379	-7.903	N.A.	I(0)
		(0.000)	(0.000)		
$\log(r_b - r_m)$[18]	-2.894	N.A.	-2.701	N.A.	I(0)
	(0.055)		(0.083)		
$\log(r_e - r_m)$	1.502	-3.991	1.196	-4.017	I(1)
	(0.999)	(0.003)	(0.997)	(0.003)	
$\log(r_p - r_m)$	-2.134	-5.087	-2.134	-5.040	I(1)
	(0.232)	(0.000)	(0.232)	(0.000)	
$\log(r_f - r_m)$	-1.599	-6.116	-1.438	-6.895	I(1)
	(0.472)	(0.000)	(0.553)	(0.000)	
$\log(\pi^e - r_m)$	-1.846	-6.921	-1.891	-6.869	I(1)
	(0.353)	(0.000)	(0.332)	(0.000)	

Note: probability in bracket.
Definitions:
NSM = Near Singular Matrix
N.A. = Not Applicable
ADF = Augmented Dickey-Fuller test

[16] In part, the need to avoid generating data for too long a period informs the restriction of the analysis to the period, 1971-2008.
[17] See e.g. (Pindyck and Rubenfeld, 1998).
[18] All rates of return are in log because they were expressed as percentages and not percentage changes that would have equated them with log differences.

PP = Phillips-Perron test
RM1 = Real narrow money
RM2 = Real broad moneys
RM0 = Real narrower money (currency only)
RQM = Real quasi-money
Others were as defined in earlier equations
Source: Computed.

The table showed that, with the exception of the permanent income series, Yp, and return on bonds relative to that on money, $r_b - r_m$, that were stationary at level, all others were I(1) series. Given that the theoretical long run variable, permanent income, was stationary at level, only short run estimates of equation (7) incorporating permanent income was recommended. Thus, at level, the permanent income contains long run information.

(5.3) Estimated Results and Interpretations

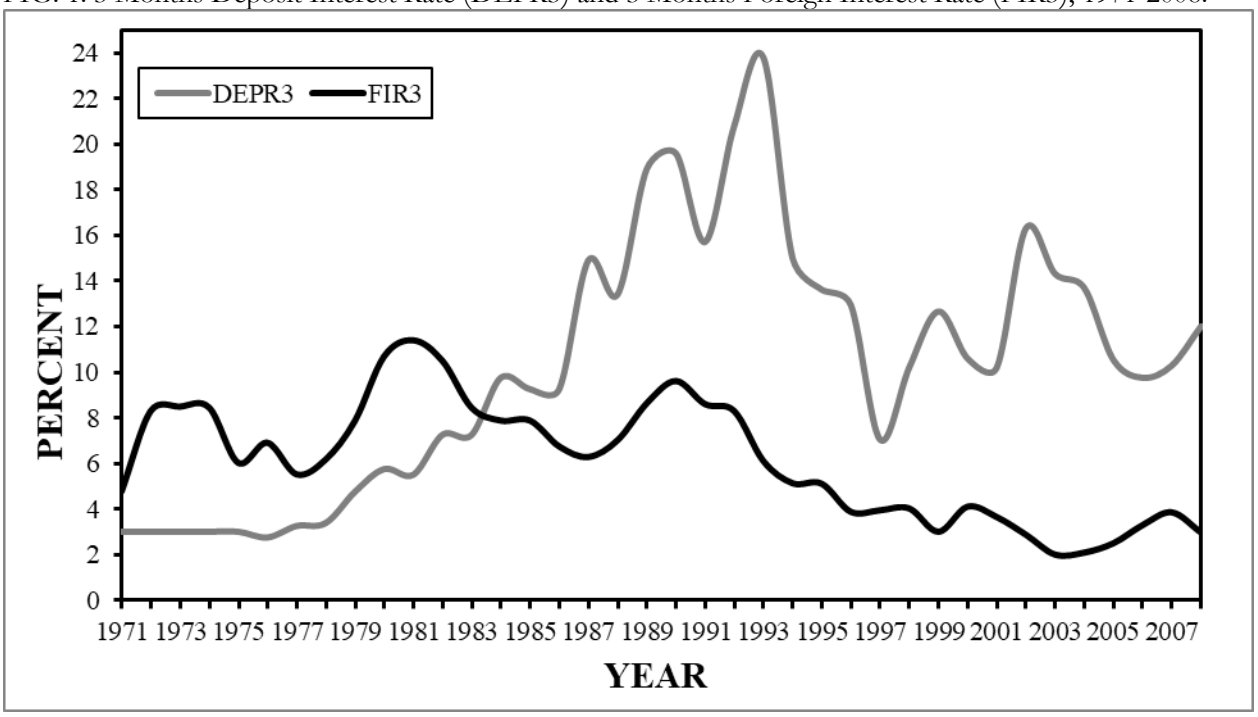
The analysis is carried out in respect of two key definitions of the real money stock, RM2 (real broad money) and RM1 (real narrow money), as well as two minor definitions, RM0 (real currency) and real Quasi-money (RQM). The presentation of the results and the associated discussions are organized as follows.

The demand for RM2

The basic parsimonious result is presented in Table 3.[19] All variables are specified according to their order of integration. The equation can be seen to have accounted for about 75 per cent of the total variations in the demand for RM2. It has a standard error of about 9 per cent and appears from the diagnostic tests to be free of serial correlation and heteroskedasticity. Except for the lag of the dependent variable and the return on foreign currency deposit relative to return on money, all variables bears the expected signs and are generally significant. The performances of the relative prices appear to be strong indications of their potent influence on real (broad) money demand in the short run. It is however noted that the variable depicting the return on foreign deposit relative to return on domestic deposit strongly and consistently suggests that, domestic deposit is generally more profitable as RM2 demand rises in response to the growth of the differential.[20] Figure 1 is quite revealing on the trends of the two prices and appears to support the observation above.

The long run variable, Yp, is generally correctly signed and significant. The diagnostic tests generally indicate a well behaved model.[21]

FIG. 1: 3 Months Deposit Interest Rate (DEPR3) and 3 Months Foreign Interest Rate (FIR3), 1971-2008.



[19] All the overparameterized models as well as the data employed can be obtained from the author.
[20] The result in Table 3 gives the initial inkling in this regard.
[21] The instances of model instability in the study generally disappear under a 5% highest benchmark for unit root test.

Table 3: Demand for Real Broad Money - RM2

Dependent Variable: Δlogrm2
Method: Least Squares
Sample (adjusted): 1975 2008
Included observations: 34 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
Δlogrm2(-2)	-0.392	0.145	-2.707	0.014
Yp(-1)	43.691	9.636	4.533	0.000
Yp(-2)	-63.602	14.790	-4.300	0.000
Yp(-3)	21.311	5.401	3.945	0.000
log(rb – rm)	0.271	0.109	2.487	0.022
log(rb – rm)(-3)	-0.333	0.137	-2.434	0.025
Δlog(re – rm)(-1)	-0.253	0.065	-3.873	0.001
Δlog(re – rm)(-3)	-0.289	0.075	-3.815	0.001
Δlog(rp – rm)(-1)	-0.055	0.022	-2.342	0.025
Δlog(rp – rm)(-2)	0.028	0.024	1.174	0.255
Δlog(rp – rm)(-3)	0.057	0.024	2.389	0.028
Δlog(rf – rm)(-1)	0.251	0.072	3.468	0.002
Δlog(rf – rm)(-2)	0.166	0.080	2.073	0.052
Δlog(rf – rm)(-3)	0.145	0.088	1.634	0.119
Δlog(π^e – rm)(-2)	-0.218	0.113	-1.920	0.070
C	-9.129	1.601	-5.700	0.000
R-squared	0.865			
Adjusted R-squared	0.753			

Diagnostic Tests

Test	LM Version	F Version
Normality	1.245(0.536)	Not Applicable
Serial Correlation:		
BG[1] (2)	0.083(0.958)	F(2, 16) = 0.019(0.980)
(3)	5.823(0.120)	F(3, 15) = 1.033(0.406)
Heteroskedasticity:		
BPG[1]	7.866(0.929)	F(15, 18) = 0.361(0.974)
ARCH (Chi. Sq. 1)	0.785(0.375)	F(1, 31) = 0.756(0.391)
" (" " 3)	1.831(0.608)	F(3, 27) = 0.565(0.642)
Ramsey RESET (1)	1.816(0.177)	F(1, 17) = 0.933(0.347)
Recursive Residuals	Generally stable (minus 1992)[1]	

Source: Computed

The demand for RM1

Unlike RM2 with different deposit components and thus could experience intra-aggregate movement following a change in the relevant incentives, RM1 would show clearly the effect of the opportunity cost variables on the demand for money. The parsimonious result on RM1 demand is presented in Table 4. Three variables are shown as incorrectly signed – the lag of money demand, the return on bonds relative to return on money, and, the return on foreign currency deposit relative to return on money. The case of the bond's rate and return on money differential (r_b - r_m) is quite revealing as it suggests that Central Bank's open market operations (OMO), specifically, open market sales, may have had little impact on currency and transaction deposit holdings in the country. The aggregate holdings of these assets rise with new issues of treasury bills.

Table 4: Demand for Real Narrow Money – RM1

Dependent Variable: Δlogrm1
Method: Least Squares
Sample (adjusted): 1975 2008
Included observations: 34 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
Δlogrm1(-3)	-0.223	0.129	-1.722	0.102
Yp	12.755	3.407	3.742	0.001
Yp(-2)	-20.780	6.558	-3.168	0.005
Yp(-3)	8.947	3.323	2.692	0.014
log(rb – rm)(-1)	0.386	0.126	3.062	0.006
log(rb – rm)(-3)	-0.227	0.125	-1.817	0.085
Δlog(re – rm)	0.152	0.063	2.403	0.027
Δlog(re – rm)(-1)	-0.224	0.075	-2.971	0.008
Δlog(re – rm)(-2)	0.230	0.084	2.720	0.014
Δlog(re – rm)(-3)	-0.175	0.082	-2.125	0.047
Δlog(rp – rm)(-1)	-0.070	0.023	-3.001	0□ 007
Δlog(rf – rm)(-1)	0.337	0.079	4.225	0.000
Δlog(π^e – rm)(-1)	-0.279	0.133	-2.097	0.050
Δlog(π^e – rm)(-2)	-0.290	0.131	-2.211	0.040
Δlog(π^e – rm)(-3)	0.159	0.136	1.171	0.256
C	-6.181	1.179	-5.242	0.000
R-squared	0.873			
Adjusted R-squared	0.768			

Diagnostic Tests

Test	LM Version	F Version
Normality	0.609(0.737)	Not Applicable
Serial Correlation:		
BG(2)	2.817(0.244)	F(2, 16) = 0.722(0.500)
(3)	9.721(0.021)	F(3, 15) = 2.001(0.157)
Heteroskedasticity:		
BPG	13.495(0.564)	F(15, 18) = 0.789(0.674)
ARCH (Ch. Sq. 1)	0.062(0.802)	F(1, 31) = 0.058(0.809)
" (" " 3)	1.487(0.685)	F(3, 27) = 0.453(0.716)
Ramsey RESET (1)	4.056(0.044)	F(1, 17) = 2.154(0.160)
Recursive Residuals	Quite stable (minus 1991, 1992, 2004 & 2006)	

Source: Computed

All other variables bear the expected signs and are mostly significant. Again, the influence of relative prices on the demand for real balances in the economy is generally underscored. Overall, the model appeared a reasonable fit explaining over 76 per cent of the variations in RM1 demand with a standard error of about 9 per cent. The diagnostic tests generally indicate a well behaved model. However, there is evidence of model instability in some years.

The demand for RM0

The parsimonious model is presented in Table 5. The explanatory variables are mostly correctly signed and significant. The performances of the bond's rate – money return differential, parallel market return – money return differential and the foreign currency deposit return – money return differential suggest that their growth only sometimes cause the demand for money to fall. In a way, this might be a reflection of the size of the segment of the money market that could be deemed sophisticated. The model explains about 72 per cent of the total

variations in real currency demand in the economy. It has a standard error of about 9 per cent. The diagnostics suggest a generally well behaved model.

Table 5: Demand for Real Narrower Money Balances – RM0

Dependent Variable: Δlogrm0
Method: Least Squares
Sample (adjusted): 1975 2008
Included observations: 34 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
Δlogrm0(-2)	0.662	0.222	2.975	0.012
Δlogrm0(-3)	-0.779	0.273	-2.852	0.015
Yp	-24.459	11.491	-2.128	0.056
Yp	91.996	35.729	2.574	0.025
Yp(-2)	-88.632	33.920	-2.612	0.024
Yp(-3)	22.650	9.509	2.381	0.036
log(rb – rm)	0.245	0.141	1.733	0.110
log(rb – rm)(-1)	0.465	0.154	3.009	0.011
log(rb – rm)(-3)	-1.117	0.307	-3.627	0.004
Δlog(re – rm)	0.255	0.107	2.373	0.037
Δlog(re – rm)(-2)	-0.578	0.212	-2.728	0.019
Δlog(rp – rm)	0.093	0.052	1.785	0.101
Δlog(rp – rm)(-1)	-0.042	0.030	-1.380	0.194
Δlog(rp – rm)(-2)	0.084	0.037	2.239	0.046
Δlog(rp – rm)(-3)	0.072	0.038	1.909	0.082
Δlog(rf – rm)(-1)	0.238	0.096	2.467	0.031
Δlog(rf – rm)(-2)	0.397	0.109	3.619	0.004
Δlog(rf – rm)(-3)	-0.511	0.167	-3.050	0.011
$\Delta\log(\pi^e - rm)$	-0.351	0.256	-1.369	0.198
$\Delta\log(\pi^e - rm)(-1)$	-0.521	0.147	-3.546	0.004
$\Delta\log(\pi^e - rm)(-2)$	-0.215	0.151	-1.428	0.180
$\Delta\log(\pi^e - rm)(-4)$	0.303	0.150	2.018	0.068
C	-10.074	3.034	-3.320	0.006
R-squared	0.906			
Adjusted R-squared	0.718			

Diagnostic Tests

Test	LM Version	F Version
Normality	6.324(0.042)	N.A.
Serial Correlation		
BG (Ch. Sq. 2)	3.986(0.136)	F(2, 9) = 0.597(0.570)
" (" " 3)	5.995(0.111)	F(3, 8) = 0.570(0.649)
Heteroscedasticity		
BPG	23.479(0.375)	F(22, 11) = 1.115(0.441)
ARCH (Ch. Sq. 1)	0.387(0.533)	F(1, 31) = 0.368(0.548)
" (" " 3)	1.704(0.635)	F(3, 27) = 0.523(0.669)
Ramsey RESET (1)	0.787(0.374)	F(1, 10) = 0.234(0.638)
Recursive Residuals	Stable (minus 2001)	

Source: Computed

The demand for RQM

The parsimonious model of the demand for real quasi-money balances is presented in Table 6. The inconsistent but significant coefficient of the return on foreign currency deposit relative to that on money carries an important implication for portfolio holdings in the country. Depending on if quasi-money included foreign currency deposits, the result would suggest that the holding of such deposits occasionally rises with increases in

the relevant relative price differential. The result also adduces success to open market operations in altering the level of quasi-money as it translates into bank reserves. In addition, it suggests strongly that the Nigerian public often substitutes the holding of equity for quasi-money when the price of equity rise relative to return on money (quasi-money deposits).

Table 6: Demand for Real Quasi-Money - RQM

Dependent Variable: Δlogrqm
Method: Least Squares
Sample (adjusted): 1975 2008
Included observations: 34 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
Δlogrqm(-1)	-0.459	0.151	-3.044	0.008
Δlogrqm(-2)	-0.461	0.146	-3.138	0.006
Δlogrqm(-3)	-0.750	0.166	-4.513	0.000
Yp	15.467	3.833	4.034	0.001
Yp(-1)	-17.812	4.710	-3.781	0.001
$Yp(-3)$	2.770	0.975	2.839	0.012
log(rb – rm)(-2)	0.295	0.107	2.757	0.014
log(rb – rm)(-3)	-0.303	0.100	-3.011	0.008
Δlog(re – rm)	0.355	0.089	3.968	0.001
Δlog(re – rm)(-1)	-0.194	0.083	-2.316	0.035
Δlog(rp – rm)	0.094	0.056	1.679	0.113
Δlog(rp – rm)(-1)	-0.151	0.052	-2.894	0.011
Δlog(rp – rm)(-3)	-0.231	0.064	-3.603	0.002
Δlog(rf – rm)	-2.261	0.858	-2.633	0.018
Δlog(rf – rm)(-2)	1.960	0.912	2.148	0.048
Δlog(π^e – rm)	3.405	1.099	3.097	0.007
Δlog(π^e – rm)(-1)	1.895	0.583	3.245	0.005
Δlog(π^e – rm)(-2)	1.335	0.876	1.523	0.148
C	-2.400	0.706	-3.399	0.004
R-squared	0.861			
Adjusted R-squared	0.696			

Diagnostic Tests

Test	LM Version	F Version
Normality	5.519(0.063)	N.A.
Serial Correlation		
BG (Ch. Sq. 2)	0.506(0.776)	F(2, 13) = 0.098(0.907)
" (" " 3)	3.038(0.385)	F(3, 12) = 0.392(0.760)
Heteroskedasticity		
BPG	14. 890(0.669)	F(18, 15) = 0.649(0.809)
ARCH (Ch. Sq. 1)	0.111(0.738)	F(1, 31) = 0.104(0.748)
" (" " 3)	1.107(0.775)	F(3, 27) = 0.333(0.801)
Ramsey RESET (1)	0.722(0.395)	F(1, 14) = 0.300(0.592)
Recursive Residuals	Stable (minus 1997)	

Source: Computed

The equation appears a good fit explaining about 70 per cent of the total variations in quasi-money. It has a standard error of about 7 per cent and appears to be free of serial correlation. It also appears to be stable and generally well behaved.

6. Conclusions

This study clarified Friedman's theory of money, and tested it empirically using the data of a developing market economy. The demand for four real monetary aggregates that is, RM0, RM1, RQM and RM2 were analyzed. Permanent income was prominent in the analysis. The time series properties of the data were investigated leading to conclusions on the order of integration of the data series. With permanent income integrated at level, a short run parameterization of the model incorporating the permanent income was all that was

permitted. The estimated equations generally appeared to be reasonable fits, accounting for large proportions of the total variations in the different dependent variables. The estimates were generally robust with most variables bearing the expected signs. The performances of the relative prices in the equations clearly underscored their potent influence on the demand for money in the short run.

There were two particular results worthy of emphasis. First, open market operations in the country in part increased real currency demand and in part succeeded in altering the level of bank reserves via quasi-money. The observed currency effect suggested that the monetary authorities might have been performing its underwriting role frequently. This is clearly an issue for policy intervention; in particular, there appears to be the need for increased campaign to enlighten the Nigerian public on open market operations in order to increase the patronage of treasury securities. As the empirical evidence on the United States suggested (see Friedman, 1959, p. 19), bonds (though, corporate) and money were credible substitutes in the portfolio of investors, hence no efforts should be spared in ensuring efficient functioning of the money market. Secondly, under the quasi-money model, there was the finding that, the demand for foreign currency rose occasionally with increases in the relevant relative price differential. Given that foreign currency deposit was a component of quasi-money in the relevant period, this outcome would appear to be in accord with the *a priori* expectation.

In conclusion, the result of this study was generally a major support for Friedman's demand for money theory as clarified. It suggested clearly that the theory was indeed a respectable thesis on understanding the dynamics of portfolio holdings in the macroeconomy. Although, the empirical aspect of the study focused on Nigeria, the theory and findings have implications for monetary policy formulation and financial markets' dynamics in every market economy.

This study could be extended in at least three ways. First, for purposes of comparison with the results reported in this paper, more recent data (perhaps of different frequency, say quarterly series) could be employed to test the Friedman's thesis as clarified. Second, as pointed out in the paper, a limitation of the study was its exclusive focus on explicit returns, hence, future studies could contribute to knowledge by also accommodating implicit returns. Finally, cross-country regressions, perhaps panel analysis, could be undertaken to check if the results replicated for countries at similar levels of development.

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