An Estimation of Money Demand Function Using Nigerian Data: Implication for Monetary Policy

Alex Oisaozoje Iriabije [1], **Ubong Edem Effiong** [1]

[1] *University of Uyo*
Ikpa Road, PMB 1017, Akwa Ibom State, Nigeria

DOI: 10.22178/pos.86-5

JEL Classification:
C13, C51, E41, E51, E52

Received 21.09.2022
Accepted 25.10.2022
Published online 31.10.2022

Corresponding Author:
Ubong Edem Effiong
ubongeffiong3@gmail.com

Abstract. This study estimated Nigeria's Keynesian and augmented money demand function using time series variables from 1986 through 2021. The Keynesian money demand function is estimated by considering income and interest rates as the determinants of the money demand function. In contrast, the augmented money demand function incorporates critical variables like exchange rate, income, and interest rates. With the Robust Ordinary Least Squares estimation method, the income level exerted a positive and significant effect on money demand, while interest rate put forth a negative but insignificant impact. The a priori signs of these two variables align with the Keynesian postulation that income directly correlates with the actual money demand function. At the same time, the rate of interest has an inverse relationship.

Further findings from the augmented money demand function, as reported by the autoregressive distributed lag short-run estimates, indicate that the price level and exchange rate directly and significantly affect Nigeria's current money demand function. The money demand function so estimated was reported to be stable, given the cumulative sum of squares result. A general conclusion that can be drawn from the findings is that the money demand function is income elastic but inelastic regarding interest rate, price level, and exchange rate.

Keywords: Demand for Money, Liquidity Preference, Interest Rate, Monetary Policy, Price Stability.

INTRODUCTION

Money has a wide range of applications in consumption, manufacturing, and distribution [12]. People and corporations frequently have a combination of assets and cash. Money is thus in demand because of its roles as a unit of account, a means of payment, and a store of value. “The demand for money is the amount of wealth everyone in the economy wishes to hold in the form of money balance” [21]. The Classical, Keynesian, and Post-Keynesian schools of thought take one of three main approaches to the desire for money. Although the classical economists did not formally develop the demand for money theory, Fisher's quantity theory of money has elements of this theory. Author [13] stressed the need for cash in exchanges by focusing on its velocity of circulation. He claims that the income level at full employment determines the demand for money in sales. This is predicated on Say’s Law on the idea that “supply creates its demand", given a level of income consistent with full employment. As a result, Fisher's theory of demand for money retained a constant connection with the volume of transactions, which in turn held a continuous relationship with the volume of national income. Additionally, the amount of trade in an economy at a particular time is linked to the need for money [12].

Author [23] explored the three motives for holding money (transactions demand, precautionary demand, and speculative demand) which he termed "liquidity preference" to drive home his argument on the need for cash. In transaction demand, Keynes thinks that the demand for money arises from the utilisation of money as the medium of exchange. The precautionary demand for money is to meet unforeseen necessities, while the speculative need arises from uncertainty about the monetary value of other assets that an individual can hold. John Maynard Keynes associated the transaction demand and precautionary demand depending on the income level, while the speculative market depends on the in-

terest rate. The Keynesian theory of money demand is built around a trade-off between the benefit of holding more money versus the interest cost. The higher the interest loss from having a naira of funds, the less money we expect to save. The interest rate on cash is referred to as the "own rate of interest", and the opportunity cost of holding cash is equal to the difference between the yield on other assets and the own rate [21].

From the above analogy, the Keynesian money demand function could be described as a function of two critical variables – income level and interest rate. The prediction here is that income has a direct relationship with money demand. Thus, an increase in income will increase the demand for accurate balances for the three motives for liquidity preference. An insight into Nigerian data on income and broad money reveals some exciting results about this postulation. This behaviour is reflected in Figure 1, where the value of broad money and income level are expressed in billions of naira.

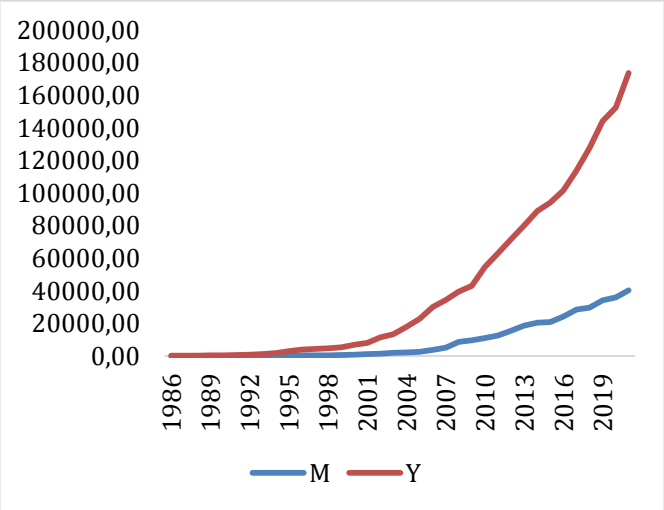

Figure 1 – Trend of Income (Y) and Money Demand (M)

From the 1980 to the 1990, the income level was below ₦20,000 billion, corresponding to a lower level of broad money within the same period. But as income level increased sharply from the early 2000 till 2021, the demand for money also rose. This depicts that both money demand and the price level move in the same direction and that an increase in income level will prompt an increase in the need for money. At the same time, a decline in income level will also exert a declining trend in demand for cash.

Since the Keynesian postulation on liquidity preference also centres on the fact that "the higher the interest loss from holding money, the less money we expect to hold" [21], it can be adduced that there is an inverse relationship between interest rate and liquidity preference. Thus, the higher interest rate will prevent individuals from holding more money, given the interest cost. This attribute can be linked to the inverse relationship between the value of the bond and the rate of interest. In a period of higher interest rates, individuals will prefer to buy bonds (since the price of bonds has declined), and the speculative demand for money will decrease (which hitherto leads to a decline in the total money demand). But as interest rate decreases, individuals will sell their bonds to take advantage of the increase in the value of bonds; hence, they hold more money. This will increase the speculative demand for money as they will have more money while waiting for the interest rate to rise.

One Can, therefore, vividly state that the role of interest rate in the Keynesian money demand function arises from the speculative demand for money which Keynes clearly stated to be a function of interest rate. However, Author [9] has added essential to Keynesian transaction's need for cash. "Keynes regarded transactions demand for money as a function of the income level, and the relationship between transaction demand and income is neither linear nor proportional". He showed that the relationship between transaction demand and income is linear and proportional. Instead, changes in income lead to less than proportionate changes in transaction demand. Further, "Keynes regarded transactions demand as predominantly interest inelastic". But [9] analysed the interest rate elasticity of the transaction's demand for money [21].

Author [35] developed a portfolio-based 'risk aversion theory of liquidity preference. This theory fixed two significant flaws in the Keynesian theory of money demand. For Keynes' liquidity preference function to work, "expectations of future interest rates have to be inelastic because people typically keep either cash or bonds" [35]. His argument was based on the idea that "the expected value of any capital gain or loss from keeping interest-bearing assets is always zero, rather than on the elasticity of predictions of future interest rates" [12]. Additionally, it clarified that a person's portfolio consisted of owning cash and bonds collectively rather than just one at a time. The demand for real money, according to

[14], is a function of wealth (permanent income), projected returns on investments, bonds, equities, and the anticipated rate of inflation [12].

Since Friedman's seminal study in 1956, researchers, policymakers, and governors have paid close attention to the money demand function. The presence of "a stable money demand function" is critical in macroeconomics since the appropriate design of monetary policy is dependent on it [37]. According to [25], "no claim in macroeconomics has attracted greater attention than the existence of "a stable demand for money function' at the aggregate economy level". The accurate money balances are related to a nominal interest rate and a gauge of current economic activity via the traditional money demand function. The monetary authority can adjust the average growth rate of money that is consistent with price stability, given the average growth rate of the economy and nominal interest rate, under the assumption that there is a strong and stable relationship between the goal variable (say, inflation) and targeted monetary aggregate [37]. However, as other nations have discovered, notably the United Kingdom, Canada, and Switzerland, economic targeting only functions if there is a strong and consistent link between the goal variables and the targeted monetary aggregates [37]. Accordingly, a weak and unstable connection will not have the desired effect on the objective variable, and the targeted total will no longer be able to convey the direction of monetary policy [30] adequately.

Different scholars have introduced other variables into the model in estimating the money demand function apart from the level of income and interest rate. Gong to Authors [15], exchange rate and consumer price index, along with revenue and interest rate, are critical in the money demand function. Authors [28] included the inflation rate, nominal exchange rate, financial depth, and the average treasury bill rate in their money demand function. Authors [12] recognised the role of the exchange rate, economic innovation, and total population as key variables along with income and interest rate in the money demand function. For Authors [1], the role of the domestic price level, expected exchange rate depreciation, and foreign interest rate is crucial variables to consider. Similar to the case of Authors [12], the role of the exchange rate and inflation rate was also considered by Authors [29] as being critical variables in the money demand function. The study of Authors [24] further thought consumer price index, exchange rate, and credit to the private sector, in addition to income and interest rate, are the determinants of money demand. In all, only Authors [36] recognised the role of stock prices on the money demand function of a country.

This study aligns with the model of [34] by incorporating the exchange rate, the price level, and the exchange rate into the Keynesian money demand function for Nigeria. The estimation follows the total ordinary least squares and the autoregressive distributed lag (ARDL) approach, which aids in estimating both the short-run and long-run money demand functions. The study also tries to detect the stability of the money demand function in Nigeria to ascertain the potency of monetary policy on target variable(s). The study covers the period 1986 through 2021. It is intended to indicate the elasticity of the money demand function and how monetary policy can be channelled appropriately to achieve the desired effect on the quantity of money in circulation within the Nigerian economy to achieve price stability.

Review of related literature

Several empirical studies have been conducted to estimate the money demand function with diverse approaches being utilised. Authors [15] aimed to assess Author [10]'s money demand function with the aid of data from 1988-1998 for twenty-seven (27) countries using static and dynamic fixed effects approaches. The study's outcome further validates Cagan's theory as it revealed that interest rate negatively affected money demand, while the income level put forth a positive effect. Additionally, the estimated income elasticity of money demand was estimated to be 0.18. The study concluded that the estimated elasticity is far less than Cagan's theory suggested.

Authors [20] estimated India's money demand function using monthly and annual data from 1976 to 2007 using co-integration analysis and the dynamic OLS estimation approach. The study's result revealed that co-integration exists among accurate money balances, interest rates, and output when the money demand is expressed in terms of M_1 and M_2, but absent when expressed in M_3. The result from the dynamic OLS revealed a consistency in the sign of the interest rate and income as they relate to money

demand. The effect was significant when estimating the M_1 and M_2 functions. Thus, income exerts a positive and considerable influence on the M_1 and M_2 money demand function, while interest rate exerts a negative effect.

Analysing the money demand function for the case of Malawi was the core concern of the Authors [28] using monthly data from 1985 to 2010. Their findings revealed that co-integration exists with income and interest rates, both negatively affecting money demand. In contrast, the exchange rate, financial depth, and treasury bill rate exerted a positive impact. In the short-run, a similar effect exists, with financial innovation, exchange rate movements and lagged money supply displaying causality with money demand.

Authors [12] made an effort to assess the variables influencing Pakistan's actual money demand function. The study is based on an analysis of time series data from 1972 to 2011. The study used an autoregressive distributed lag (ARDL) framework and a bound testing technique to co-integration to estimate the money demand function. The study's conclusions showed that while factors like deposit and exchange rates are negatively connected to the current demand for money, real GDP, financial innovation, and the overall population positively affected the basic need for money. The study has implications for monetary policy that Pakistan's monetary authorities should consider to increase economic and commercial activity in the country.

Likewise, Authors [1] looked at how the monetary authority controls actual cash balances by manipulating the money supply. The study's empirical analysis used co-integration and vector error correction model testing. The co-integration test showed a long-run equilibrium link. In the long term, it was found that the influence of interest rates, inflation rates, and trade openness on money demand is negative. Still, the impact of gross capital formation, the exchange rate, and government spending are favourable in Nigeria.

Author [32] attempted to estimate Ghana's money demand function using data from 1991 to 2011. The data analysed using the ARDL approach in the M1, M2, and M3 money demand functions, co-integration exists, and income puts forth a negative effect. At the same time, interest rate positively impacts the money demand functions. These findings negate the conventional a priori expectation of the slope coefficient of the respective variables. Further, the result reported the instability of the country's M_1 and M_2 money demand functions. However, the actual money function for M3 was regarded as stable compared to M_1 and M_2 in Ghana.

The study of Author [36] was geared towards estimating the money demand function for Turkey, plus ascertaining the stability of such a process. Data which covered the period of 1970 to 2013 was analysed using co-integration and dynamic regression analysis. The study revealed a cointegrating relationship with income, yielding a positive and significant effect on money demand. In contrast, the impact of interest rate was reported to be inverse. The result further revealed that the narrow money demand is stable as the cumulative sum of squares plot portrayed.

Authors [35] (2018) re-examined the broad money demand function plus its stability in Nigeria using data from the first quarter of 1985 to the fourth quarter of 2016. The data was analysed using the ARDL approach, and findings revealed that a long-run stable relationship exists amid money demand and its determinants (income, stock prices, foreign interest rates, and real exchange rate). Also, the effect of the stock market in the estimated long-run money demand function is positive and significant. This portrays a rising trend in the size and influence of the economy's financial institutions (financialisation).

The study of Authors [38] was geared towards examining the impact and stability of money demand in Cambodia. With data from 1996 to 2016, which was analysed using the ARDL approach, the result revealed a long-run stable relationship amid money supply and identified variables (real income, inflation rate and nominal exchange rate). Further empirical development indicated that domestic currency depreciation shrinks the demand for money in Cambodia.

Authors [31] explored the behaviour of the money demand function in Nigeria towards executing monetary policy. The study used data from the first quarter of 2010 to the second quarter of 2018 and analysed using the ARDL approach. Findings from the survey showcased that the effect of income, exchange rate, and financial innovation on money demand is positive. In contrast, the treasury bill rate and income lag exerted a negative impact. Further, the evidence of the established long-run relationship shows that only financial innovation exerted a significant influ-

ence. The implication of the significance of treasury bill rate connotes that an increase in treasury bill rate will prompt individuals to hold money more for transaction demand rather than substituting the domestic currency with foreign ones.

Authors [24] estimated the current intermediate money demand and fundamental broad money demand functions with a focus on the South African economy using data from the first quarter of 1990 to the fourth quarter of 2019. The money demand functions, estimated using the method of autoregressive distributed lag (ARD), were observed to have a cointegrating relationship with variables of interest (inflation rate, interest rate, exchange rate, real GDP, and credit to the private sector). The effect of credit to the private sector on both actual intermediate money demand and fundamental broad money demand functions exhibited significant positive long-term results. Further, inflation and exchange rate were observed to have a negative and significant effect, while income and interest rates were favourable.

Authors [29] used quarterly data from 1981-Q1 to 2018-Q4 to estimate a broad money demand function. The co-integration test was conducted using the autoregressive distributed lag/bounds test model. The empirical findings demonstrate that public money demand, income, interest, actual exchange rates, and inflation rates are all cointegrated throughout the time under consideration. Real GDP, inflation, and exchange rates were shown to have positive and substantial effects on actual money demand, whereas interest rates had a negative and significant impact. The empirical results showed that the velocity of money in the economy is predictable. As a result, a target for the money supply might be used to control levels of income and prices.

Authors [34] recently explored the money demand function for Sub-Saharan Africa (SSA) from 1980 to 2017. The study utilised the 'Panel Homogeneous Autoregressive Distributed Lag (PH-ARDL)', Panel Co-Integration Tests (P-CIT), and Dumitrescu and Hurlin Panel Causality Test (DH-PCT). While the co-integration test supported evidence of a long-run relationship within the model, the DH-PCT reported a bidirectional causality between money demand and the variables of interest (income, interest rate, price level, and exchange rate). Within the SSA, the study revealed that the core variable influencing money demand is the price level, which calls for price stabilisation policies within the region.

This study will incorporate crucial variables like income, interest rate, price level, and exchange rate in estimating the money demand function for Nigeria from 1986 to 2021. The study will also ascertain the stability of the money demand function over the years since it is crucial in measuring how monetary policy will be potent in targeting goal variables.

METHODOLOGY

Theoretical Framework

The theoretical framework for this study follows the conventional money demand function, where the money demand is expressed as a function of income and interest rate. Following the Keynesian analysis, the money demand function is derived from the three motives for holding money. These motives are:

Transaction Demand. According to Keynes, "the transaction demand for money arises from the lack of synchronisation between receipts and disbursement, implying that one is not likely to be paid at the exact instance one needs to make payment" [21]. So between pay cheques, one keeps money around to purchase goods and services. The transaction demand for cash varies positively (directly) with the income level (output). The higher the income (outcome) level of an individual or society, the greater the demand for transactional balance and vice versa. This relationship can be portrayed as:

$$M_t^d = f(Y) \text{ and } {}^{dM_t^d}/_{dY} > 0. \quad (1)$$

where M_t^d is the transaction demand for money; Y is the income (output) level.

Keynes thinks that the transactions demand for money is proportional to the level of income hence:

$$M_t^d = \delta Y \quad (2)$$

where δ is the proportion of the total income spent on transaction demand, note that $\delta > 0$ in this regard aligns with the Keynesian position of the direct connection between M_t^d and Y.

Precautionary Demand. The urge to plan for unanticipated possibilities for favourable purchases and emergencies demanding immediate expenditures is what the precautionary demand means [21]. Because consumers and businesses are uncertain about the degree to which payments and receipts will be synced, they hold money as a safeguard. The precautionary demand for money is a positive function of income, much as the transaction demand. Thus,

$$M_p^d = f(Y) \text{ and } {dM_p^d}/{dY} > 0. \quad (3)$$

where M_p^d is the precautionary demand for money. Since both M_p^d and M_t^d are a positive function of income. The demand for these two motives can be expressed in a single equation (4):

$$L_T = f(Y) \quad (4)$$

where L_T captures the liquidity preference for both transaction and precautionary demand for money.

Speculative Demand. The goal of speculative demand for money, also known as asset or liquidity preference, is to "secure profit by knowing better than the market what the future will bring forth" [21]. After setting aside enough money for transactions and precautions, individuals and company owners with cash choose to generate speculative gains by investing in bonds. As a liquid store of value, capital retained for speculative purposes can be invested in interest-bearing bonds and assets at the right time. The relationship between the speculative demand for money and interest rates is inverse. The need for money for speculative purposes decreases when interest rates rise and vice versa.

This can be expressed algebraically as:

$$M_s^d = f(r) \text{ and } {M_s^d}/{dr} < 0. \quad (5)$$

where M_s^p is the speculative demand for money and r is the interest rate.

Given Equations (4) and Equation (5), the conventional money demand function, according to Keynes, is expressed as:

$$M^d = f(Y, r)$$
$${\partial M^d}/{\partial Y} > 0;\ {\partial M^d}/{\partial r} < 0 \quad (6)$$

where M^d is the total demand for money (liquidity preference), Y is the income (output) level, and r is the interest rate.

Model Specification

The model for this study is derived from the conventional Keynesian money demand function, where the actual money demand function is expressed as a function of income (Y) and interest rate (R).

$$\frac{M^d}{P} = f(\frac{Y}{P}, \frac{R}{P}) \quad (7)$$

Equation (7) states that the real money demand ($\frac{M^d}{P}$) is a function of real income ($\frac{Y}{P}$) and real interest rate ($\frac{R}{P}$). By incorporating other variables into the model, we obtain the augmented money demand function as follows:

$$\frac{M}{P_t} = L(\frac{Y}{P_t}, R_t, E_t) \quad (8)$$

Equation (8) stipulates that the actual money demand is a function of real income, interest rate and exchange rate. Authors [5] argued that omitting the exchange rate in the money demand function may cause misspecification biases. M is broad money; Y is the gross domestic product in nominal terms (income); R is the domestic interest rate; E is the official exchange rate expressed in the nominal exchange rate, and P is the price level.

Adopting the model of Authors [34] who reassess the money demand function for Sub-Saharan Africa, the model for this study is specified as follows:

$$lnM_t = \delta_0 + \delta_1 lnY_t + \delta_2 lnR_t + \\ + \delta_3 lnP_t + \delta_4 lnE_t + \varepsilon_t \quad (9)$$

Equation (3) portrays a transformed model of the money demand function in logarithmic form, which will facilitate the estimation of the elasticities of the various variables regarding the total money demand. If the parameters (in their absolute value) are more significant than unity, then money demand is elastic for the variable; but if it is less than unity, it is inelastic. Meanwhile, the parameter estimates of the model are expected to follow this pattern: $\delta_0 \neq 0, \delta_1 > 0;\ \delta_2 < 0;\ \delta_3 > 0, and\ \delta_4 > 0$. Therefore, income, price level, and exchange rate are expected to positively influence money demand, while the rate of interest is expected to put forth a negative effect. The broad money is the dependent variable, while income, interest rate, price level, and exchange rate are the explanatory variables in the model.

Sources and Nature of Data

The study's data spanning 1986 and 2021 were generally obtained from the Central Bank of Nigeria statistical bulletin. The variables upon which data were obtained include broad money, income (gross domestic product), interest rate, price level (inflation rate), and exchange rate. The income level and broad money are measured in billions of naira, interest rate and price level are measured in percentage, while the exchange rate is measured in terms of the naira/dollar rate.

Estimation Technique

The study first estimates the Keynesian and augmented money demand function at the general level using the total ordinary least squares estimation method. Further time series properties were ascertained using the unit root test. The unit root test is conducted using the augmented Dickey-Fuller (ADF) test, which is based on two assumptions: the constant assumption and the constant and trend assumption. The test model is specified as follows:

$$\Delta lnM_t = \alpha_0 + \alpha_1 lnM_{t-1} + \\ + \sum_{i=1}^{p} \gamma_i \Delta lnM_{t-i} + \varepsilon_t \qquad (10)$$

$$\Delta lnM_t = \alpha_0 + \alpha_1 lnM_{t-1} + \\ + \sum_{i=1}^{p} \gamma_i \Delta lnM_{t-i} + \delta t + \varepsilon_t \qquad (11)$$

Equation (10) captures the model for the ADF unit root test with constant assumption, while Equation (11) captures the one for the continuous and trend belief. The null hypothesis is that "there is a unit root" expressed as α_1 =1. The rejection of the null hypothesis will only occur if the ADF statistic is more damaging than the 5% critical tau value. Otherwise, the variable will be the difference in conducting the test further. For this study, we will only consider static variables at the level and first difference.

With the unit root properties of the series being ascertained, it becomes pertinent to check for the presence of co-integration among the variables. This is done using the autoregressive distributed lag (ARDL) bounds testing approach. This approach generates F-statistic, compared with the 5% lower and upper bounds. For co-integration (or levels relationship) to exist, it is expected that the F-statistic must lie outside the I(0) and the I(1) bounds at the 5% level.

With the establishment of co-integration based on the ARDL bounds testing approach, determining the short-run and long-run estimates of the model becomes an utmost necessity. This is done with the ADRL error correction model (ECM). The model is specified as follows:

$$\Delta lnM_t = \\ \beta_0 + \sum_{i=0}^{p} \beta_1 \Delta lnM_{t-i} + \sum_{i=0}^{q} \beta_2 \Delta lnY_{t-i} + \\ \sum_{i=0}^{q} \beta_3 \Delta lnR_{t-i} + \sum_{i=0}^{q} \beta_4 \Delta lnP_{t-i} + \\ \sum_{i=0}^{q} \beta_5 \Delta lnE_{t-i} + \theta ECM_{t-1} + \varepsilon_t \qquad (12)$$

Equation (12) is the ARDL error correction (ECM) model specified to estimate how the short-run distortions are corrected to achieve a long-run equilibrium. The variables are as defined earlier, with p and q being the optimal lag length of the dependent and explanatory variables, respectively. The optimal lag is automatically selected based on an iterative process in estimating the ARDL model. This process generates a series of results, where the best is determined based on the Akaike Information Criterion (AIC). The coefficient of the ECM_{t-1}, being θ captures the speed of adjustment. It is expected to be negative and statistically significant before the model can be considered to adjust to long-run equilibrium. The greater the value of θ, the greater the speed at which the model changes to attain long-run equilibrium.

RESULTS AND DISCUSSION

Preliminary Issues. The preliminary analysis captures the descriptive properties of the variables, and the correlation analysis portrays the behaviours of the variables utilised in the study.

The descriptive measures of the variables indicate that changes in broad money (*lnM*) averaged 7.4243%, and the variable's standard deviation is 2.1073%. The minimum and maximum values of the variable are respectively 3.17% and 10.6046% over the 36 years. In the case of changes in income (*lnY*), the variable averaged 9.3028% and possessed a standard deviation of 2.1258%; its maximum and minimum values are 12.064% and 5.2790%, respectively. For the changes in the rate of interest (*lnR*), its mean value is 2.8869%, its standard deviation is 0.2120%, while 3.3945% is the maximum value and 2.3514% is the minimum value of the variable. The changes in the price level (*lnP*) are characterised by a mean value of 2.6219% and a standard deviation of 0.9816%, with 4.3407% being its maximum value and -1.4979% being its minimum value. Changes in the exchange rate have a mean value of 4.1449%, while its standard deviation is 1.4448%. The minimum value of the variable is reported to be 0.7034%, while its maximum value is 5.9914%, as reported in Table 1.

Table 1 – Descriptive Statistics

	lnM	*lnY*	*lnR*	*lnP*	*lnE*
Mean	7.4243	9.3028	2.8869	2.6219	4.1449
Median	7.6209	9.6495	2.8773	2.4932	4.8153
Maximum	10.6046	12.064	3.3945	4.3407	5.9914
Minimum	3.1700	5.2790	2.3514	-1.4979	0.7034
Standard Deviation	2.4073	2.1258	0.2120	0.9816	1.4448
Skewness	-0.2898	-0.4455	-0.1072	-1.6945	-0.7649
Kurtosis	1.7530	1.9148	3.9104	10.0742	2.4116
Jarque-Bera	2.8362	2.9573	1.3121	92.2952	4.0294
Probability	0.2422	0.2279	0.5189	0.0000	0.1334
Observations	36	36	36	36	36

The descriptive properties of the variables further disclose that all the variables are negatively skewed, given that their skewness coefficient is all negative. The interest rate and the price level are leptokurtic, given that their coefficient of kurtosis is greater than 3. In contrast, broad money, income, and exchange rate are all platykurtic, given their kurtosis coefficient is less than 3. Meanwhile, all the variables except the price level are normally distributed, given that their respective Jarque-Bera statistic is all insignificant at the 5% level.

In ascertaining how the variables correlate, the Person correlation coefficient is estimated, and Table 2 captures the result.

Table 2 – Correlation Analysis

	lnM	*lnY*	*lnR*	*lnP*	*lnE*
lnM	1.0				
lnY	0.9963	1.0			
lnR	-0.3614	-0.3467	1.0		
lnP	-0.2236	-0.2462	0.0693	1.0	
lnE	0.9545	0.9625	-0.2066	-0.2707	1.0

It is clear from Table 2 that both income (*lnY*) and exchange rate (*lnE*) has a robust positive correlation with broad money (*lnM*). This is evident in the high correlation coefficient of 0.9963 and 0.9545 for *lnM* and *lnY*, and *lnM* and *lnE*, respectively. Thus, *lnM* moves in the same direction as *lnY* and *lnE*. The two variables exhibit a weak negative correlation with broad money for interest rate (lnR) and the price level (lnP). Therefore, *lnM* moves in an opposite direction from *lnR* and *lnP* within the study period. Since correlation does not establish a cause-effect relationship, such reported correlations cannot be used to show whether the explanatory variables affect the dependent variable. Consequently, further analysis will be conducted to establish a cause-effect relationship.

Robust Ordinary Least Squares (OLS) Estimation. The Robust OLS method estimates both the Keynesian and augmented money demand functions. Table 3 captures the money demand function based on the Keynesian postulation, and Table 4 captures the result of the increased money demand function.

Table 3 – Robust OLS estimates for the Keynesian Money Demand Function

Variable	Coefficient	Standard Error	z-Statistic	Probability
lnY	1.1146	0.0195	57.1126	0.0000***
lnR	-0.2660	0.1957	-1.3594	0.1740
C	-2.1275	0.6517	-3.2647	0.0011**
Robust Statistics				
R^2	0.7586	Adjusted R^2		0.7440
Rw^2	0.9961	Adjust Rw^2		0.9961
Akaike info criterion	65.1798	Schwarz criterion		68.6831
Deviance	1.1025	Scale		0.1380
Rn^2 statistic	3770.8250	Prob (Rn^2 stat.)		0.0000
Non-robust Statistics				
Mean dependent variable	7.4243	SD dependent variable		2.4073
SE of regression	0.2169	Sum squared residual		1.5524

Notes: ** and *** denote significance at 1% and 5%, respectively.

The result in Table 3 captures the estimates of the variables constituting the Keynesian money demand function extracted to form the money demand function captured in Equation 13.

$$lnM_t = -2.1275 + 1.1146lnY_t - \\ -0.2660lnR_t \quad (13)$$

Income put forth a positive and significant effect on the total money demand function, while the impact of interest rate is negative but insignificant. Based on the signs of the parameter estimates (positive for income and negative for interest rate), this result aligns with the prediction of the Keynesian postulations, where it is expected that the effect of income on money demand will be direct. In contrast, that interest rate should be an inverse one. Thus, a rise in income will increase the money demand for transitionary purposes, while a rise in interest rate will result in a decline in the total demand for money. This is because individuals will like to take advantage of the market interest rate by purchasing bonds, thereby holding little money for speculative purposes. The money demand function portrayed in Equation 13 is income elastic but interest rate inelastic. A 1% increase in the level of income will cause the demand for money to increase by 1.1146% on average. The elasticity of the money demand function for payment can be seen in how the change in money demand is far more significant than the change in income. This result of a positive effect of income and a negative effect of interest rate on the money demand function is to the findings of studies like Authors [1, 12, 15, 29, 36].

The robust estimates further reveal exciting issues surrounding the forecast. For instance, the R^2 shows that interest rate and income jointly explain 75.86% of the total variations in the money demand function. Meanwhile, the weighted R^2 (Rw^2) indicates that the two variables account for about 99.61% of the unlimited money demand function variations.

With other variables being incorporated into the Keynesian money demand function, we obtain the augmented money demand function in which the estimates present in Table 4 are extracted to reflect Equation 14, in which the price level and exchange rate are incorporated.

Table 4 – Robust OLS estimates for the Augmented Money Demand Function

Variable	Coefficient	Standard Error	z-Statistic	Probability
lnY	1.2503	0.0412	30.3751	0.0000***
lnR	-0.0680	0.1142	-0.5951	0.5518
lnP	0.0451	0.0209	2.1621	0.0306**
lnE	-0.1965	0.0585	-3.3616	0.0008**
C	-3.2306	0.4440	-7.2754	0.0000***
Robust Statistics				
R^2	0.7388	Adjusted R^2		0.7051
Rw^2	0.9989	Adjust Rw^2		0.9989
Akaike info criterion	69.8666	Schwarz criterion		81.9079
Deviance	0.6599	Scale		0.1015
Rn^2 statistic	14682.590	Prob (Rn^2 stat.)		0.0000
Non-robust Statistics				
Mean dependent variable	7.4243	SD dependent variable		2.4073
SE of regression	0.2355	Sum squared residual		1.7190

Notes: ** and *** denote significance at 1% and 5%, respectively.

$$lnM_t = -3.2306 + 1.2503lnY_t - \\ -0.0680lnR_t + 0.0451lnP_t - \\ -0.1965lnE_t \quad (14)$$

The money demand function captured in Equation 14 still aligns with the income level, positively affecting the total money demand. At the same time, the interest rate puts forth a negative impact.

Also, the effect of income is significant, while that of interest rate is insignificant. In the augmented money demand function, a 1% increase in the level of income will cause the money demand to increase by 1.2503% on average (which is greater than that of the Keynesian money demand function in Equation 13). Further, the price level exerts a positive and significant influence on the total money demand, while the exchange rate wields a negative and significant effect. A 1% increase in the price level will lead to a 0.0451% increase in the demand for money. Due to rising prices, individuals will need more money to purchase the same bundle of commodities. A 1% increase in the exchange rate will likely lead to a 0.1965% decrease in money demand. This can be explained in terms of the fact that due to the declining value of the domestic currency, individuals will instead demand the US dollar with a substantial value can continue holding the naira, which continuously losses its weight in the foreign exchange market. The augmented money demand function is income elastic but inelastic for the interest rate, price level, and exchange rate. The positive effect of the price level can be described to align with the findings of Authors [29], while the negative impact of the exchange rate on the money demand function aligns with the results of authors [12, 24].

Unit Root Test. The unit root test is conducted to determine the time series properties of the time series variables utilised in this study. The trial follows the augmented Dickey-Fuller (ADF) approach. The test is based on two assumptions – the constant assumption and the continuous with-trend assumption.

Table 5 captures the result of the test for all the variables.

Table 5 – The ADF Unit Root Test Result for the Variables

Variable	Constant Assumption		Order of Integration	Constant and Trend Assumption		Order of Integration
	ADF Statistic			ADF Statistic		
	Levels	First Difference		Levels	First Difference	
lnY	-3.9922*	-	I(0)	-0.1608	-3.9521*	I(1)
lnR	-4.0026*	-	I(0)	-2.9848	-5.3421*	I(1)
lnP	-4.5697*	-	I(0)	-4.7023*	-	I(0)
lnE	-2.6201	-5.9304*	I(1)	-2.6166	-6.1009*	I(1)
lnM	-2.7369	-3.9891*	I(1)	0.3618	-4.9615*	I(1)

Note: * denotes significance at the 5% level

Under the constant assumption, *lnY, lnR, and lnP* are all stationary at levels, while *lnE* and *lnM* only became stationary at the first difference. Thus, *lnY*, *lnR*, and *lnP* are I(0) variables, while *lnM* and *lnE* are I(1) variables. With the constant and trend assumption, only *lnP* is reported to be stationary at a level, while every other variable was reported to be fixed at the first difference. In both cases, the unit root test reveals that the variables are integrated in a mixed order of I(0) and I(1). This scenario requires a different approach to testing for co-integration apart from the conventional Engel-Granger test.

Cointegration Test. With the reported order of integration of the variables (mixed with I(0) and I(1)), the autoregressive distributed lag (ARDL) Bounds testing approach for co-integration becomes the potent approach to detect the relationship of the current level among the variables. Table 6 reflects the result where the test is conducted using an F-statistic.

Table 6 – F-Bounds Test for Cointegration Result

F-Bounds Test		Null Hypothesis: No levels of relationship		
Test Statistic	Value	Significance, %	I(0)	I(1)
F-statistic	21.5388***	10	2.20	3.09
k	4	5	2.56	3.49
		1	3.29	4.37

Note: *** denotes significance at the 1% level

It is clear from Table 6 that the F-statistic of 21.5388 is outside the 5% and 1% critical

bounds values. For co-integration to exist, the F-statistic must be greater than the lower and upper necessary bounds statistics, so we cannot accept the null hypothesis of no levels relationship. Consequently, co-integration exists, and the need to estimate both the short-run and long-run estimates of the model becomes necessary. This is still being done using the ARDL approach.

ARDL Short-Run Error Correction Model

Model Selection. In estimating the model using the ARDL approach, it is pertinent to detect the best model. The model selection is based on the Akaike Information Criteria (AIC). The model with the lowest AIC is considered to be the best. Figure 2 presents the result.

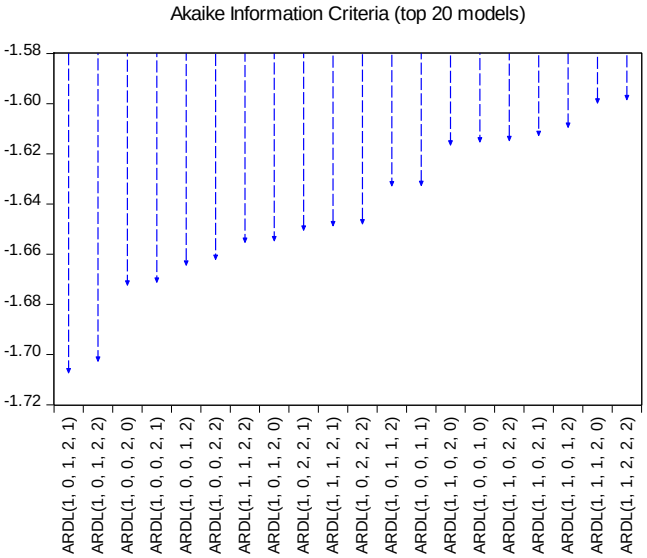

Figure 2 – Model Selection Criteria using AIC

With 81 models being evaluated, our result considered the top 20 models. The least AIC is -1.71, corresponding to ARDL(1, 0, 1, 2, 1) model. Therefore, the model utilised in estimation follows the above ARDL model with the selected lags.

Short-Run Error Correction Estimates. With the optimal model being ARDL(1, 0, 1, 2, 1), it is worth noting that the level of income (lnY) will be excluded from the short-run model estimation; hence, the reason for its disappearance in the ARDL short-run error correction model (ECM) presented in Table 7.

Table 7 captures the ARDL short-run estimates of the money demand function where the variables are expressed differently.

Table 7 – Short-Run ECM Result

Variable	Coefficient	Standard Error	t-Statistic	Probability
Δ(lnR)	-0.0921	0.0828	-1.1122	0.2771
Δ(lnP)	0.0611	0.0134	4.5621	0.0001***
Δ(lnP(-1))	0.0465	0.0135	3.4392	0.0021***
Δ(lnE)	0.1061	0.0618	1.7165	0.0989*
CointEq(-1)	-0.2852	0.0228	-12.4962	0.0000***
R^2	0.6238	Mean dependent var		0.2143
Adjusted R^2	0.5719	SD dependent var		0.1271
SE of regression	0.0832	Akaike info criterion		-2.0004
Sum squared resid	0.2007	Schwarz criterion		-1.7760
Log-likelihood	39.0074	Hannan-Quinn criteria		-1.9239
Durbin-Watson stat	1.6106			

Note: * and *** denotes significance at the 10% and 1% level, respectively

An extract of the forecast is utilised to construct the money demand function portrayed in Equation 15.

$$\Delta lnM_t = -0.092\Delta lnR_t + 0.0611\Delta lnP_t + 0.0465\Delta lnP_{t-1} + 0.1061\Delta lnE_t - 0.2852ECM_{t-1} \quad (15)$$

The short-run money demand function expressed in Equation 15 reveals that changes in interest rate have a negative but insignificant influence on changes in the total money demand function. However, the sign aligns with the prediction of economic theory. The changes in the price level and its one-period lag are observed to positively and significantly influence the short-run current money demand function. A 1% increase in the price level increases the demand for money by 0.0611% on average, while its one-period lag increases money demand by 0.0465% on average. The lag effect so experienced can be explained from the point of few that if high prices characterised the past period, the individuals would hold more money in anticipation that such rising prices will continue to the next period. Also, the exchange rate positively and significantly

influences the short-run money demand at the 10% level. Therefore, a 1% increase in the exchange rate will call for a 0.1061% increase in money demand in the short run. Consequently, an increase in the exchange rate will increase the cost of imports, causing individuals to demand more money to purchase foreign goods in the domestic market. It is also worth noting that the short-run money demand function is inelastic for interest rate, price level, and exchange rate.

The error correction mechanism (ECM_{t-1}), having an error correction coefficient of -0.2852 indicates that only 28.52% of the entire short-run distortions in the current money demand function are corrected annually. This speed of adjustment is relatively slow, suggesting that it will take an average of about three years and five months before the model can be completely restored to long-run equilibrium. The R^2 portrayed that the variables account for 62.38% of the total variations in the money demand function, while the Durbin-Watson statistic of 1.6106 confirms the absence of serial correlation.

ARDL Long-Run Levels Estimates. The long-run estimates of the model are presented in Table 8, in which it can be observed that the only variable that has a significant long-run influence on the money demand function is the income level.

Table 8 – Long-Run Levels Estimates

Variable	Coefficient	Standard Error	t-Statistic	Probability
lnY	1.2257	0.1706	7.1837	0.0000***
lnR	0.3990	0.5817	0.6859	0.4993
lnP	-0.0700	0.1218	-0.5747	0.5708
lnE	-0.2013	0.2260	-0.8909	0.3818
C	-3.6717	2.3350	-1.5724	0.1289
EC = *lnM* - (1.2257*lnY* + 0.3990*lnR* -0.0700*lnP* - 0.2013*lnE* -3.6717)				

Note: *** denotes significance at the 1% level

The result in Table 8 is extracted to obtain the long-run money demand function expressed in Equation 16.

$$lnM_t = -3.6717 + 1.2257lnY_t + 0.3990lnR_t - 0.0700lnP_t - 0.2013lnE_t \quad (16)$$

It is evident that the long-run money demand function is income elastic, and a 1% increase in revenue will lead to a 1.2257% increase in the demand for money. Further, the long-run money demand function is inelastic for the interest rate, price level, and exchange rate. Interest rate now positively influences the long-run money demand function though the such effect is not significant. A similar scenario on the reverse can be observed for the price level and exchange rate, where they now put forth a negative but insignificant long-run effect. As noted by Authors [28], the negative impact of the exchange rate suggests that "depreciation leads to increased demand for money balances for transaction purposes". Further, the adverse effects of the price level on the money demand function are similar to the findings of authors [1, 24]; and the positive effect of interest rate on the money demand function is identical to the results of the authors [24].

Stability Test. The estimated model is tested for stability of the parameter estimates using the cumulative sum (CUSUM) of squares. For the parameters to be stable, the CUSUM line must lie within the 5% critical upper and lower bounds, as indicated in Figure 3.

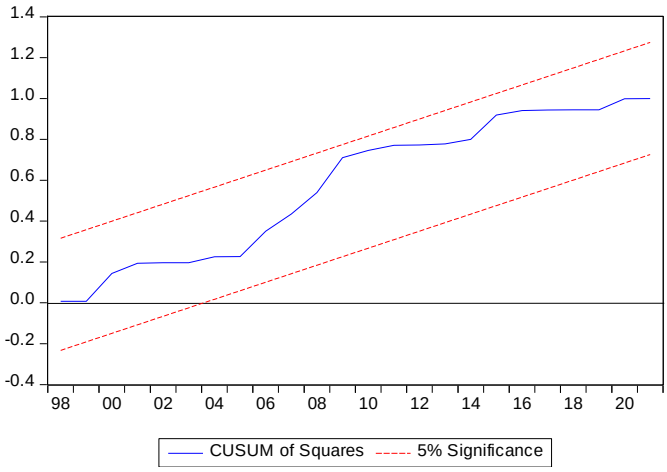

Figure 3 – Cumulative Sum (CUSUM) of Squares Test for Stability

Given that the CUSUM of squares lies within the 5% significant upper and lower bounds, we can conclude that the parameter estimates are stable for making inferences. The stability of the money demand function is an assurance that monetary policy will work effectively on a target variable, as earlier reported by Author [27, 19, 17, 37, 7, 33, 8, 2, 6, 3, 16, 11, 27, 22, 36].

CONCLUSIONS

1. The money demand function is income elastic in the long run: These findings imply that a slight change in the level of income in the economy will affect the demand for money which is a replica of the purchasing power of the individuals. This points to the fact that income is a critical variable that can be utilised to regulate the level of money demand in the economy, which is a crucial variable that determines the price level. These findings on the monetary policy imply that for the monetary authority to contract the level of money in circulation in the economy, an approach geared towards reducing the purchasing power of the individuals, such as the open market sales of securities, could be practical.

2. The money demand function is inelastic regarding interest rate, price level, and exchange rate: The implication here is that more significant changes in these variables will not bring a more remarkable change in the demand for money.

3. The price level and exchange rate have a positive and significant effect on the short-run money demand function: A rising price level and the exchange rate will put upward pressure on the demand for money to augment to depreciation in the value of the domestic currency. More money will be demanded at higher prices to purchase a given bundle of the commodity.

4. Income has a positive and significant influence on total money demand: In the presence of a money illusion, an increase in income level will prompt the individual to demand more money. This arises from the fact that the individual will likely wish to consume more, and the marginal propensity to finish will be high, thus calling for a greater demand for money to meet different needs.

5. The interest rate has a negative but insignificant influence on the total money demand function: Based on the Keynesian demand for money theory, the speculative market for money is a declining function of the interest rate. Thus, individuals will prefer to hold bonds when the interest rate is high, and the speculative demand for money is low. The reverse case has when the rate of interest reduces. This is because there is an inverse relationship between the bond value and interest rate.

6. The money demand function for Nigeria is stable: This points to the fact that monetary policy will have the desired outcome if applied in targeting any policy variable of interest. As identified by [30], a weak and unstable connection will not have the desired effect on the objective variable, and the targeted aggregate will no longer be able to convey the direction of monetary policy adequately.

The estimation of the money demand function is crucial for determining the potency of monetary policy in regulating the volume of money in circulation. This study estimated the Keynesian money demand function, a function of income and interest rate and the augmented money demand function that incorporates the price level and exchange rate in the Keynesian model. With data from 1986 to 2021, the study utilised the robust ordinary least squares approach. Since our research utilised time series data, detecting the time series properties of the variables becomes necessary. This was done using the augmented Dickey-Fuller (ADF) unit root test to see the stationary of the series. This is followed by the test for co-integration using the autoregressive distributed lag (ARDL) bounds testing approach. The error correction model was also utilised to detect short-run and long-run estimates of the model and the speed at which the model adjusts from the short-run distortions to a long-run equilibrium.

In line with the robust OLS, the result indicates the validity of the postulation of the Keynesian money demand function in Nigeria since income wielded a positive effect and interest rate put forth a negative impact. However, the result of income was significant, while that of the rate of interest was reported to be insignificant. In the augmented money demand function, where the price level and exchange rate were incorporated into the Keynesian money demand function, the result still revealed that income has a positive and significant effect on the demand for money. In contrast, interest rates generated a negative but insignificant effect. Meanwhile, the price level is reported to exert a positive and significant influence on money demand. At the same time, the impact of the exchange rate is seen to be harmful and essential simultaneously. In all cases, the money demand function is elastic regarding the income level but inelastic for the interest, price, and exchange rates.

With the introduction of the time series properties of the variables, our result from the ADF test under constant assumption revealed that income, interest rate, and price level were stationary at

the station. In contrast, exchange rates and broad money were fixed at first differences. With the introduced constant and trend assumption, only the price level was reported stationary at a station, while all other variables were static at the first difference. In general, it can be reported that the variables exhibited stationary in a mixed order of level and first difference. This prompt the use of the ARDL bounds testing approach to examine if any long-run relationship exists in the model. Findings from the analysis revealed that co-integration exists, indicating a long-run relationship between money demand and the explanatory variables. Therefore, we estimate both the model's short- and long-run estimates. The short-run result showed that changes in the interest rate put forth a negative but insignificant influence on changes in money demand.

In contrast, changes in the price level, its one-period lag, and changes in the exchange range positively and significantly influence money demand. The implication is that the key variables that drive the demand for money in Nigeria are price level and the exchange rate. Higher prices entail that individuals will need more money to purchase the exact value of the commodity they used to buy with a lesser amount of money.

In contrast, a higher exchange rate indicates that the individual will demand domestic currency to purchase imported commodities. In the long run, the only variable that exerts a significant influence on money demand is the level of income. This is because it exerted a positive and significant effect on money demand. Apart from the income level, the interest rate also wielded a positive but insignificant impact on money demand. In contrast, the development of the price level and exchange rate became negative but insignificant in the long run.

In conclusion, the money demand function in Nigeria is elastic for the income level but inelastic for the interest rate, price level, and exchange rate. The implication is that any slight change in the income level will generate a more significant difference in the demand for money. Whereas changes in interest rate, price level, and the exchange rate will only bring a slight change in the need for cash. These points to the fact that monetary policy action geared towards influencing the rate of interest to influence the quantity of money in circulation will only partially bring forth the desired effect on the economy. Instead, a policy stance that will affect the income level will be more active. Consequently, the open market sales of securities which mob-up excess liquidity from the economy will be more effective in reducing the volume of money in circulation rather than an increase in the rate of interest. The effectiveness of such action is assured given that the money demand function for Nigeria is stable.

REFERENCES

1. Aiyedogbon, J. O., Ibeh, S. E., Edafe, M., & Ohwofasa, B. O. (2013). Empirical Analysis of Money Demand Function in Nigeria: 1986–2010. *International Journal of Humanities and Social Science, 3*(8), 132–147.
2. Akinlo, A. E. (2006). The stability of money demand in Nigeria: An autoregressive distributed lag approach. *Journal of Policy Modeling, 28*(4), 445–452. doi: 10.1016/j.jpolmod.2005.09.001
3. Algan, N., & Gencer, S. (2011). Modelling the money demand function in Turkey. *Ç. Ü. Sosyal Bilimler Enstitüsü Dergisi, 20*(1), 195-212 (in Turkish).
4. Altıntas, H. (2008). The stability of money demand in Turkey and predicting with bound testing approach: 1985-2006. *Erciyes Üniversitesi İİBF Dergisi, 30*, 15–46 (in Turkish).
5. Arango, S., & Ishaq Nadiri, M. (1981). Demand for money in open economies. *Journal of Monetary Economics, 7*(1), 69–83. doi: 10.1016/0304-3932(81)90052-0
6. Baharumshah, A. Z., Mohd, S. H., & Mansur M. Masih, A. (2009). The stability of money demand in China: Evidence from the ARDL model. *Economic Systems, 33*(3), 231–244. doi: 10.1016/j.ecosys.2009.06.001
7. Bahmani-Oskooee, M., & Chomsisengphet, S. (2002). Stability of M2 money demand function in industrial countries. *Applied Economics, 34*(16), 2075–2083. doi: 10.1080/00036840210128744

8. Bahmani-Oskooee, M., & Rehman, H. (2005). Stability of the money demand function in Asian developing countries. *Applied Economics, 37*(7), 773–792. doi: 10.1080/0003684042000337424

9. Baumol, W. J. (1952). The Transactions Demand for Cash: An Inventory Theoretic Approach. *The Quarterly Journal of Economics, 66*(4), 545. doi: 10.2307/1882104

10. Cagan, P. (1956). The Monetary Dynamics of Hyperinflation. In M. Friedman (Ed.), *Studies in the Quantity Theory of Money* (pp. 25–117). Chicago: University of Chicago Press.

11. Dogru, B. (2014). Analysis of long-and short-run balance of money demand in turkey using ARDL and VEC approaches. *The International Journal of Economic and Social Research, 10*(2), 20–31 (in Turkish).

12. Faridi, M. Z., & Akhtar, M. H. (2013). *An Estimation of Money Demand Function in Pakistan: Bound Testing Approach to Cointegration*. Retrieved from https://www.researchgate.net/publication/257526938_An_Estimation_of_Money_Demand_Function_in_Pakistan_Bound_Testing_Approach_to_Cointegration

13. Fisher, I. (1911). *The Purchasing Power of Money: Its Determination and Relation to Credit, Interest and Crisis*. New York: Macmillan.

14. Friedman, M. (1956). The Quantity Theory of Money – A Restatement. In M. Friedman (Ed.), *Studies in the Quantity theory of Money* (pp. 9–21). Chicago: University of Chicago Press.

15. Garcia-Hiernaux, A., & Cerno, L. (2006). Empirical Evidence for a Money Demand Function: A Panel Data Analysis of 27 Countries 1988-98. *Applied Econometrics and International Development, 6*(1), 51–58.

16. Gencer, S., & Arisoy, İ. (2013). Türkiye de Uzun Dönem Geniş Para (M2Y) Talebinin Tahmini: Zamanla Değişen Katsayılar Yönteminden Bulgular. *Ege Akademik Bakis (Ege Academic Review), 13*(4), 515–515. doi: 10.21121/eab.2013418085

17. Hayo, B. (1999). *Estimating a European Demand for Money*. Retrieved from https://www.econstor.eu/bitstream/10419/39470/1/255041853.pdf

18. Hoffman, D. L., & Rasche, R. H. (1991). Long-Run Income and Interest Elasticities of Money Demand in the United States. *The Review of Economics and Statistics*, *73*(4), 665–674. doi: 10.2307/2109405

19. Hoffman, D. L., Rasche, R. H., & Tieslau, M. A. (1995). The stability of long-run money demand in five industrial countries. *Journal of Monetary Economics, 35*(2), 317–339. doi: 10.1016/0304-3932(95)01189-u

20. Inoue, T., & Hamori, S. (2009). An Empirical Analysis of the Money Demand Function in India. *Economics Bulletin, 29*(2), 1224-1245.

21. Jhingan, M. L. (2013). *Monetary Economics* (7th ed.). New Delhi: Vrinda Publications.

22. Jung, A. (2016). Is euro area money demand for M3 still stable? *The Quarterly Review of Economics and Finance, 60*, 29–39. doi: 10.1016/j.qref.2016.01.002

23. Keynes, J. M. (1936). *The General Theory of Employment, Interest, and Money*. London: Macmillan.

24. Kole, A., Wali, H. N., Idris, A. M., & Sanusi, I. H. (2020). Analysis of the Determinantsof Money Demand in South Africa: 1990-2019. *Bullion, 44*(3) 74-90.

25. Laideler, D. (1982). *Monetarist Perspectives*. Oxford: Phillip Allan Ltd.

26. Lucas, R. E. (1988). Money demand in the United States: A quantitative review. *Carnegie-Rochester Conference Series on Public Policy, 29*, 137–167. doi: 10.1016/0167-2231(88)90009-7

27. Lucas, R. E., & Nicolini, J. P. (2015). On the stability of money demand. *Journal of Monetary Economics, 73*, 48–65. doi: 10.1016/j.jmoneco.2015.03.005

28. Lungu, M., Simwaka, K., Chiumia, A., Palamuleni, A., & Jombo, W. (2012). Money Demand Function for Malawi- Implications for Monetary Policy Conduct. *Banks and Bank Systems, 7*(1), 50–63.

29. Manasseh, C., C. Nwakoby, I., C. Abada, F., C. Alio, F., & Okanya, O. (2021). Money Demand in Nigeria: Application of Autoregressive Distributed Lag (ARDL) Approach. *Asian Economic and Financial Review, 11*(4), 308–321. doi: 10.18488/journal.aefr.2021.114.308.321

30. Mishkin, F. (1999). *International Experiences with Different Monetary Policy Regimes*. doi: 10.3386/w6965

31. Nakorji, M., & Asuzu, O. C. (2019). Money Demand in the Conduct of Monetary Policy in Nigeria. *Economic and Financial Review, 57*(1), 1–21.

32. Osei, V. (2016). Estimating Money Demand for Ghana. *International Journal of Developing and Emerging Economies, 4*(2), 28–43.

33. Teles, P., & Zhou, R. (2005). A Stable Money Demand: Looking for the Right Monetary Aggregate. *Economic Perspectives, 29*(1), 50–63.

34. Odeleyea, A. T., & Akam, D. (2022). Money Demand Function: A Re-assessment in Sub-Saharan Africa. *Iranian Economic Review, 26*(1), 61–77.

35. Tobin, J. (1956). The Interest-Elasticity of Transactions Demand For Cash. *The Review of Economics and Statistics*, *38*(3), 241–247. doi: 10.2307/1925776

36. Tule, M. K., Okpanachi, U. M., Ogiji, P., & Usman, N. (2018). A Reassessment of Money Demand in Nigeria. *CBN Journal of Applied Statistics, 9*(1), 47–75.

37. Tumturk, O. (2017). Stability of Money Demand Function in Turkey. *Business and Economics Research Journal, 8*(1), 35–48. doi: 10.20409/berj.2017126243

38. Clausen, V., & Kim, J.-R. (2000). The Long-Run Stability of European Money Demand. *Journal of Economic Integration, 15*(3), 486–506. doi: 10.11130/jei.2000.15.3.486

39. Vorlak, L., Abasimi, I., & Salim, A. (2018). Estimating Money Demand in Cambodia. *Journal of Business Management and Economic Research, 2*(7), 32–42. doi: 10.29226/tr1001.2018.47