Constructing Divisia Monetary Aggregates for Nigeria

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This study computes Divisia monetary aggregates DM1, DM2, and DM3 for Nigeria using the Tornqvist-Theil quantity index for the period 2007M12 to 2020M12 and evaluates the performance of the higher-order aggregate (DM3) with a corresponding higher aggregate of the simple sum broad money supply (M3). Applying the indicators to money demand function the results showed that DM3 performed better than the matching simple sum measure M3 due to its faster convergence rate. This is because the Divisia aggregates contain additional information in the form of user-costs and spending shares that are not considered in the compilation of the traditional measure, information that may be important for the proper execution of monetary policy. It is therefore, recommended that the Divisia broad money index be used as complement to the simple sum broad money supply for policy decisions.

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1. Introduction

Central banks are often interested in monetary aggregates as indicators of near-term economic variables, such as future expenditure or inflation to guide monetary policy decision making process. This is a fundamental motivation for compilers to get closer to the best underlying measure of system-wide liquidity. Furthermore, recently, there has been far-reaching researches and debates among policy makers on the appropriate measure of monetary aggregates for Nigeria due to the uncertain link between money supply and macroeconomic variables (Doguwa, *et al.* 2014; Hussin & El-Rasheed, 2019; Idris, 2019). Empirical studies have shown that some definitions of monetary aggregates capture changes in macroeconomic variables better

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than the others, hence the need to periodically derive the appropriate definition of money for any given economy as what makes up the definition tends to change over time (International Monetary Fund- Monetary and Financial Statistics Manual Compilation Guide, 2016). This is even more important given the dynamic nature of the Nigerian financial sector in the last one and half decades - in terms of instruments and payments system innovations, like CBN bills held by money holding sectors, point-of-sales terminals, mobile payments, etc. Over the years, there have been many attempts at properly weighting the monetary components within a simple-sum aggregate, but without theory, any weighting scheme is questionable (Serletis & Xu, 2020). Therefore, the Divisia approach overcomes this challenge, given that there is a theory behind it as discussed in the theoretical literature review section.

The traditional measure of monetary aggregates (sequenced M1, M2, M3, M2A and so on) computed based on simple sum aggregation have come under criticism due to aggregation bias and its inability to successfully capture developments in the financial system (Barnett, 1980; Barnett *et al.*, 1984; Barnett *et al.*, 1992; Barnett & Alkhareif, 2015). Therefore, other aggregation procedures such as the variable elasticity of substitution (VES) and the Divisia monetary aggregation (also known as monetary services indices) have attracted interest as an alternative or complement to simple sum aggregation. The "Divisia monetary aggregates" developed by William Barnett measures the flow of "monetary services" derived from holding a portfolio of monetary assets (Anderson *et al.*, 2019). This study is motivated by need to have a more robust measure of monetary aggregates for Nigeria.

While several studies (such as Barnett 1980, 2016; Barnett *et al.*, 1984; Belongia 1996) have advocated and showed the relative advantages of the Divisia aggregates over the corresponding simple sum, Khainga (2014) showed that the Divisia and simple sum performed equally and therefore, suggested that they should be used as complements. A Divisia monetary aggregate measure of money is constructed by assigning various weights to monetary sub-components that reflect the flow of monetary services (Barnett, 1980). Monetary services provided by Divisia account for substitution among the components of the money supply in contrast to simple sum monetary aggregates, which regard all sub-components of money to be perfect substitutes for one another in terms of moneyness. The component variables which include currency outside depository corporations, transferable deposits, savings, time and foreign currency deposits, as well as CBN bills held by the money holding sectors, are assigned equal weights instead of unequal weights that are indicative of their importance or usefulness in carrying out transactions.

The ”Barnett critique” blames the failure of money to explain real activity on the traditional simple sum monetary aggregates, which assumes perfect substitution among the components of money supply. Given the growing number of financial assets with varying degrees of ”moneyness”, an alternative measure of money supply is necessary. As a result, the Divisia monetary aggregates, have emerged as a viable alternative as it assigns varying weights to various assets (Polat, 2018).

Several studies (Ellington, 2018; Barnett and Su 2016, 2017; Belongia and Ireland 2014, 2015) have demonstrated that Divisia monetary aggregates outperform their simple sum counterparts, which lack economic theoretical foundations (Barnett & Nguyen 2021). The only known previous studies carried out on Divisia for Nigeria is that of Gebregiorgis and Handa (2005) and El-Rasheed and Abdallah (2017). Gebregiorgis and Handa (2004) used Index of Industrial Production as proxy for real output while this study used real GDP which is the indicator of interest. Also currency, demand and savings deposits were employed as financial instruments for their study, while the current study used additional new instruments (term/time and foreign currency deposits, as well as securities other than shares included in broad money) to capture the new developments in the financial system. Although, the variables and methodology employed by El-Rasheed and Abdallah (2017) and this study have some similarities, our study covered the broadest definition of money supply in Nigeria (M3) with longer period. Thus, the objective of this paper is to construct Divisia monetary aggregates for Nigeria using the broadest definition of money supply to complement the existing simple sum aggregates due to its inherent aggregation bias. The study also examines alternative money demand functions for Nigeria using the Divisia monetary aggregates and the simple sum aggregate to observe the sensitivity of the money demand function to the monetary aggregates used. The study is germane for the Central Bank of Nigeria (CBN) since the Bank has relied substantially on monetary aggregate targeting in the conduct of its monetary policy in order to ensure effective policy decisions.

Following the introduction, the rest of the paper is structured as follows: Section 2 presents literature review, Section 3 discusses the methodology, Section 4 presents results and discussion, while Section 5 concludes the paper and provide policy recommendations.

2 Literature Review

2.1 Theoretical Literature

The nexus between monetary microeconomics and statistical index number theory, was espoused by Barnett (1980). In the seminal paper, he argued that monetary assets are interest yielding assets, as such using simple sum aggregation, does not have a sound theoretical basis in economics nor in statistics. Simply put, different monetary assets possess different qualities and characteristics in terms of their utility derived and their importance. In effect, Barnett (1980) combined monetary theory with the economic theory of statistical index numbers, arguing that, rather than the simple summing of monetary assets, a new microeconomic and aggregation-theoretic approach to monetary economics is required. The novel technique used neoclassical monetary theory's aggregator functions and the statistical theory of index numbers to develop asset approximations to those functions. As a result, the aggregated data and models formed from it are consistent with the theory that generated the data, as well as the theory that generated the models within which the data are used. In general, aggregation methods should preserve the information contained in the elasticity of substitution.

Therefore, the Divisia monetary aggregation relies upon the theory of demand and the statistical theory of index aggregation. This approach treats monetary assets as function of demand. Impliedly, monetary assets are termed as consumer goods, where their utility function determines the utility derived, and thus their marginal utility. In constructing the Divisia index, each asset's proportional utility is proxied by its flow of marginal utility, which is the difference between the assets value and its service to the user, called its 'service flow'. Therefore, in an equilibrium, the service flow, is the marginal utility of the asset. The marginal utility of monetary assets can be proxied by the user costs of the components. This can be interpreted as the proportion of the interest income or income derived by holding these assets, as against holding other assets as a store of value. Monetary assets can be classified according to their degree of liquidity. Highly liquid assets (cash or currency) tend to have high user cost, that is, interest or yield per asset over time. Thus, these classes of assets are assigned greater weights in the Divisia index. While other assets that are purely used for store of value without user cost, get zero weights. Therefore, the objective of a Divisia monetary index, is to construct an index that measures the flow of monetary services from an aggregation of monetary assets, where the utility derived or user cost derived per asset value in monetary asset varies per unit cost of monetary measure from one asset to the other. The major challenge is not the determination of the weights nor the construction of the index, but the determination of the flow of values of the user cost (Thornton & Yue, 1992).

The simple sum monetary aggregation is only consistent with microeconomic theory in the case where economic decision makers hold only one monetary asset, according to Anderson *et al.* (1997). Given the variety of assets with varied maturities and returns, this assumption about the elasticities of substitution among monetary assets can be shown to be unreasonable. The Divisia index, on the other hand, does not require such a strong assumption on substitution elasticities but, instead, classifies monetary assets based on their discounted spread, or user costs. The discounted interest foregone by the household as a result of opting to hold the asset can be defined as the user cost of the monetary asset (Anderson *et al.* 1997). It depicts the discounted spread between the rate of return on a benchmark asset and the rate of return on a specific monetary asset. The benchmark asset is defined as ”a risk-free asset that can only be utilized for inter-temporal wealth transfer and provides no additional services” (Anderson *et al.*., 1997).

2.2 Empirical Literature

Several studies have tried to provide empirical basis for the adoption of alternative measures of systemwide liquidity to guide policy decision to ensure price stability. Some of these studies are reviewed in this section.

Celik and Uzun (2009) conducted a study on the comparison of simple sum and Divisia monetary aggregates using panel cointegration for United States, United Kingdom, Euro Area and Japan for the period between1980Q1 and 1993Q3. Evidence from their results showed that there exists a long run relationship between the Divisia monetary aggregates and income as well as interest rates which is relatively robust compared to that of simple sum monetary aggregates. Barnett and Su (2015) examined the use of Divisia monetary aggregates in nominal GDP targeting by using diagnostic tests of bivariate time series properties of Divisia M2 and nominal GDP stochastic processes to test Belongia and Ireland (2017) and Barnett *et al.* (2016) proposals on Divisia monetary aggregate as an intermediate target with nominal GDP as the final target. The finding showed no evidence to contradict the potential relevance of Divisia monetary aggregates in targeting nominal GDP, either as an intermediate target or as an indicator. Stracca (2004) studied Divisia monetary aggregate in the euro area-wide data from 1980 to 2000 by evaluating the demand for Divisia monetary aggregate using Johansen co-integration test. The results suggested that the Divisia monetary aggregate has more comparable quality information from a forward-looking perspective than simple sum M1 and M3.

Darvas (2014) examined the role of money shocks on output and prices in the Euro area using structural vector autoregressions (SVAR) for monthly data from 2001:M1 to 2014:M9. The study revealed that Divisia aggregates have a significant impact on prices, interest rates and output, which was approximately 18 months after a shock. Also, findings from the Euro area corroborated the evidence from US data that the Divisia monetary aggregates are useful in assessing the impacts of monetary policy and they work better in the SVAR models compared to simple-sum measures of money. Belongia and Ireland (2017) analysed demand for Divisia money in United States using quarterly data from 1967:Q1 to 2017:Q2. They used Johansen's (1991) maximum likelihood approach to evaluate the money demand equations, and the results showed that information in the Divisia monetary aggregates can help determine monetary policy stance,5 as well as the influence of monetary policy on output and inflation.

Reimers (2002) examined different Divisia monetary aggregates for the Euro area from 1980 to 2000. Three methods were used for the analyses (i) vector error correction model (VECM) and single-equation techniques (ii) Information content of the aggregates as regards future output was examined, and (iii) using the P-star framework to determine the importance of money for future price movements. The results showed that Divisia aggregates were important for Harmonised Index of Consumer Prices (HICP) development and GDP deflator movement. Uzun (2010) conducted a study to examine the superiority of Divisia monetary aggregation over the simple sum method, employing two testing methodologies; the system estimation (Seemingly Unrelated Regression) from 1980Q1 to 1993Q3 using time series and panel data studies for the United States, the United Kingdom, the Eurozone, and Japan. The result of the study revealed the existence of a long run link between Divisia monetary aggregates and income (measured by real GDP) as well as interest rates compared to the simple sum monetary aggregates.

Scharnagl and Mandker (2015), using wavelet analysis compared the relationship between the simple sum and Divisa monetary aggregates with real GDP and inflation. The study, which spans the period 1967-2013 was based on the United States data. Findings showed the relationship between money growth and inflation to be stronger using Divisia monetary aggregates compared to the simple sum aggregates. Gogas *et al.* (2013) used a Support Vector Regression (SVR) model equipped with the Linear and Radial basis function kernel to assess the predicting abilities of simple sum and Divisia monetary aggregates with regard to US GDP from 2008Q1 to 2011Q4. The study employed two alternative Divisia aggregates namely the series produced by the Center for Financial Stability (CFS Divisia), and the series produced by the Federal Reserve Bank of St. Louis (MSI Divisia). The result showed that the Divisia monetary aggregates were superior to the simple sum monetary aggregates in terms of standard forecast evaluation statistics.

Others, like Ghosh and Bhadury (2018) examined the undetermined influence of Divisia monetary aggregates in explaining exchange rate variations for India, Israel, Poland, UK and the US, by applying bootstrap Granger causality method to monthly data for India (1994:M4 to 2008:M6), Israel (1994:M1 to 2011:M11), Poland 2001:M1 to 2015:M6), United Kingdom (1999:M1 to 2013:M12) and United States (1994:M1 to 2017:M2). The results from the full sample bootstrap method suggested that

Divisia monetary aggregates significantly Granger cause exchange rates for Israel, Poland, UK and US. Also, that Divisia significantly Granger causes the real effective exchange rate for India.

An empirical evaluation of simple sum and Divisia monetary aggregates in India was conducted by Acharya and Kamaiah (2001) for two sample periods (1970-1996 and 1985M4-1994M9) using money demand stability, information content and Davidson-Mackinnon J-tests. The results of the study revealed that the Divisia aggregates have an edge over their simple sum counterparts which corroborate outcomes of earlier research works. Alkhareif and Barnett (2012) analysed Divisia monetary aggregates for the Gulf countries using monthly data from 2004:M6 to 2011:M12. The study showed the dynamics of some variables like the dual price aggregates, aggregate interest rates, and Divisia aggregate user cost growth rates. The result revealed the superiority of the Divisia indexes over the simple sum monetary aggregates in monitoring the business cycles of the economies' and indicated direct evidence of higher economic harmonization between the Gulf countries especially in relation to their financial markets and monetary policy. In a similar study by Polat (2018) for the Turkish economy for the period 2006 to 2016 using SVAR, results showed the robustness of Divisia aggregates in predicting quantity and price variables compared to its simple sum counterpart. However, under different specifications, though the relative power of the Divisia aggregates in predicting quantity and price variables was present, it could be argued that theoretically well-rounded formation of the Divisia index was not that much empirically justified for the case of Turkey.

Leong *et al.* (2010) examined the effectiveness of monetary policy in Malaysia using alternative monetary aggregates of quarterly data from 1981:Q1 to 2004:Q4 applying Augmented Dickey-Fuller test and Johansen's Maximum-Likelihood procedure. The findings showed the stability of Divisia M2 in the money demand function. Thus, concluding that monetary targeting in Malaysia could still be used in promoting the effectiveness of monetary policy. Tariq and Matthews (1997) used cointegration approach to analyse the demand for simple sum and Divisia monetary aggregates for Pakistan from 1974:Q4 to 1992:Q4 by comparing simple sum M1 and M2 with Divisia estimates. Though both measures produced a consistent demand for money and scored well in post-sample stability tests, the Divisia measure appeared to perform somewhat better on conventional statistical criteria, according to the data.

El-Rasheed (2018) carried out a study on the Divisia monetary aggregates, demand for money stability, income and inflation fluctuations in 4 selected sub-Saharan Africa (SSA) countries, namely Kenya, Malawi, Nigeria, and South Africa from 2000Q1 to 2015Q3 using the ARDL and Toda Yamamoto causality methods. The results indicate that Divisia monetary aggregates perform well in explaining the stability of money demand functions and shows a significant 2-way causality between money and income. Also, a related study by Khainga (2014) on Divisia monetary aggregates and demand for money in Kenya, from 1995Q4 to 2011Q3 using ARDL approach reveals that the constructed Divisia indices perform equally well as traditional measures. On the other hand, Ndjokou (2021) in a study on the performances of Divisia relative to traditional monetary aggregates in terms of growth and inflation within the period 1992Q1 to 2009Q4 in BEAC[3] and BCEAO[4] using VAR/VECM revealed that traditional monetary aggregates have better empirical performances.

Gebregiorgis and Handa (2004) worked on monetary aggregation for Nigeria between 1970:M1 to 2000:M4 for currency, demand deposits and savings deposits of simple sum, VES and Divisia aggregates using Johansen cointegration and error-correction modeling techniques. The result showed that currency did better than narrow or broad money measures in explaining industrial production and simple sum of M1 and M2 outperformed both the VES and Divisia aggregates in Nigeria. El-Rasheed and Abdallah (2017) conducted a study on Divisia monetary aggregates and demand for money in Nigeria from 2000Q1 to 2015Q4 using ARDL approach. The finding suggests that Divisia aggregates performed better in explaining the variations of monetary stock in the economy and indicated a long-run co-integration between the Divisia monetary aggregates and income, inflation, interest and exchange rates.

The CBN has relied substantially on monetary aggregate targeting in the conduct of

[3]The BEAC is a common Central Bank for six countries, namely: Cameroon, Central Africa Republic, Congo, Gabon, Chad and Equatorial Guinea.

[4]The BCEAO is in charge of the monetary policy of eight (8) countries, namely: Ivory Coast, Senegal, Togo, Burkina Faso, Mali, Benin, Bissau-Guinea and Niger.

monetary policy which calls for continuous improvement in monetary data compilation process. Furthermore, the financial sector of Nigeria has evolved both in terms of reforms and instrument innovations over the last two decades. This may have impacted monetary aggregates but not completely explained by the simple sum aggregates. Gebregiorgis and Handa (2004) constructed Divisia aggregate for Nigeria but suffered lack of sufficient data particularly on GDP and benchmark rate. This study improves on the work of Gebregiorgis and Handa (2004) by using GDP data which is a better proxy for income in the construction of the Divisia aggregates as well as captures current development in the financial system and instrument innovation.

3. Data and Methodology

3.1 Data

To construct Divisia monetary aggregates for monetary services, data on both nominal values and the rate of return on each monetary asset are required (Barnett, 1978, 1980). Table 1 provides a basic description of the data set used in the study. For the construction of the Divisia monetary aggregate, the study used monthly data, which were sourced from the CBN statistics database from end-December 2007 to end-December 2020, totaling 53 observations. The cost of living index is proxied by the consumer price index (CPI), obtained from the National Bureau of Statistics.

Table 1: List of Variables for Divisia Index Construction

S/N	Monetary Assets	Rate of Return
1	Currency Outside Depository Corporations	0%
2	Transferable Deposits	Deposit Rate
3	Time Deposits	3-month deposit rate
4	Savings Deposits	Savings Rate
5	Foreign Currency Deposits	3-month LIBOR
6	CBN Bills held by Money Holding Sectors	OMO Bills rate

The LIBOR was obtained from https://www.global-rates.com/interest-rates/libor/american-dollar/2019.aspx

Table 2 is the clustering and nesting of the components of monetary assets as in Barnett and Nguyen (2021). Therefore, Divisia aggregate M1 (DM1) is made up of the same components with simple sum aggregate, SM1. Divisia M2 (DM2) aggregate comprises of DM1 components and savings, time and foreign currency deposits.

Lastly, Divisia M3 aggregate (DM3) consist of the components of DM2 and CBN bills held by money holding sectors.

For the money demand function, the study used quarterly data, which were obtained from the CBN Statistics database. The data include gross domestic product, interest rates, treasury bills rates, consumer price index, exchange rates, and monetary aggregates (simple sum and Divisia).

Table 2: Nesting of Components of the Simple Sum and Divisia Monetary Aggregates

S/N	Monetary Assets	SM1	SM2	SM3	DM1	DM2	DM3
1	Currency Outside Depository Corporations	1	1	1	1	1	1
2	Transferable Deposits	1	1	1	1	1	1
3	Time Deposits	0	1	1	0	1	1
4	Savings Deposits	0	1	1	0	1	1
5	Foreign Currency Deposits	0	1	1	0	1	1
6	CBN Bills held by Money Holding Sectors	0	0	1	0	0	1

Note: 1 (0) indicates the presence (absence) of a monetary asset in the corresponding monetary aggregate

3.2 Theoretical Framework of Demand for Money

The demand for money in an economy has elicited so much attention in the literature given the role of money as medium of exchange, store of value, unit of account and means of deferred payment. Various schools of thought, from the Classical to the post-Keynesians, have given different postulations on demand for money with reliance on the functions of money in their formulations of quantity theory (Sriram, 1999). The quantity theory was developed under the classical framework led by Fisher (1911), concentrating on motives for holding money. Irving Fisher focused on the institutional specifics of the payment mechanism in his formulation. Keynes (1936) put forward three distinct motives for holding money by an economic agent and these include; transactions, speculative and precautionary motives.

Keynes posited that the transaction motive for holding money is to enable economic agents utilize the function of money as a medium of exchange to carry out transactions. The transaction motive is deemed to be a function of income and the relationship is expected to be stable over time. The precautionary motive for holding money is to hedge against unplanned payments that may arise. Therefore, holding money for precautionary purposes is a contingency arrangement for unforeseen expenses. Lastly, the third motive for holding money is speculative, also referred to as "liquidity preference" in his theory. In explaining this motive, Keynes emphasized future yield on securities as the main driver of agents holding money.

A break-through in the literature on demand for money was achieved by the classical quantity theory using the concept of "velocity of circulation of money" which measures the average number of times a given unit of currency is used for transaction in a given period. Fisher (1911) propounded this approach known as "equation of exchange" and is represented thus;

$$MV = PT \tag{1}$$

where, M is the quantity of money in circulation, V is the velocity of circulation of money, P refers to the price level of items transacted and T is the volume of transactions carried out. According to Fisher (1911), this equation is an equilibrium condition and not an identity, and that money does not have any intrinsic utility but held to facilitate exchange of goods and services.

Neo-classical economists such as Pigou (1917) and Marshal (1923) provided an alternative to the quantity theory called Cambridge or cash balance approach. Their approach shifts focus from what determines the desire to hold money from an economy's perspective to a decision to be made by individuals given the opportunity cost to hold money. They clearly brought out the role of wealth and interest rate in demand for money.

Although, all the schools of thought analysed the demand for money from different perspectives, the implications are almost the same. In summary, the optimal quantum of real money balances is negatively related to the rate of returns (interest rates) and positively related to real income. Their divergence is in choosing the appropriate transaction (scale) variable and the opportunity cost of holding money (Sriram, 1999[5]).

[5] See for detailed explanation of these theories

3.3 Model Specification

Macroeconomic researchers usually assume that the demand for money is a function of scale variable and the opportunity cost of holding money. The scale variable, they claimed, is real income or real consumption spending, whereas the opportunity cost variable is the interest rate on an alternative asset. The general form of the money demand function is specified as:

$$M = f(y,\ x) \tag{2}$$

where M is the money stock; y is the income level which is the scale variable and x is the opportunity cost variable. Earlier studies on money demand in Nigeria, such as Doguwa *et al.* (2014), Tule *et al.*. (2018) and Nakorji and Asuzu (2019) have used (GDP), domestic and foreign interest rates, exchange rate, inflation rate (consumer price index), stock prices, financial innovation and a host of others in their models. Therefore, the model takes the following specification:

$$M = f(RGDP,\ INTR,\ TBR,\ CPI, EXR) \tag{3}$$

where: M is money supply (simple sum and/or Divisia aggregates), real GDP (RGDP) is a proxy for income, CPI is consumer price index, INTR is 3-months deposit interest rate, TBR is 91-day treasury bills rate and EXR is exchange rate.

It is generally accepted that most economic variables are non-stationary, and some non-stationary data exhibits co-movement in the long-run due to some macroeconomic factors that are common to them. In this regard, there is need to determine the long-run properties of the variables used in the study. Many approaches abound for conducting cointegration analysis, among which are the residual based approach by Engle and Granger (1987), the maximum likelihood approach by Johansen and Juselius (1990) and Johansen (1992), as well as Pesaran and Shin (1995) autoregressive distributed lag (ARDL) models. The study adopted the ARDL approach due to its flexibility, as it allows for the combination of 1(0) and I(1) variables. The ARDL approach also has the advantage of addressing the challenge of serial correlation in economic time series. Following Pesaran *et al.* (2001), the ARDL model is stated as:

$$\Delta_{y_t} = \varphi + \sum_{i-1}^{k-1} A_{i,1}\Delta_{y_{t-i}} + \sum_{i=0}^{k-1} B_{i,1}\Delta_{x_{t-i}} + \theta_1 y_{t-1} + \theta_2 x_{t-1} + \varepsilon_t \tag{4}$$

where: y_t is the dependent variable, φ is the constant term, A and B are parameters to be estimated, x_t is the explanatory variable; θ_1 is the adjustment parameter, θ_2 is the long-run component while, ε_t is the error term which is assumed to be white noise.

Following Pesaran *et al.* (2001) bound testing approach for co-integration, we specify error correction model in line with equation 5 as follows:

$$\begin{aligned}\Delta LMA_t = {} & \alpha_0 + \textstyle\sum_{j=1}^{p} \alpha_j \Delta LMA_{t-1} + \sum_{j=0}^{q} \beta_{1j} \Delta LGDP_{t-1} + \sum_{j=0}^{q} \beta_{2j} \Delta LINTR_{t-1} \\ & + \textstyle\sum_{j=0}^{q} \beta_{3j} \Delta LTBR_{t-1} + \sum_{j=0}^{q} \beta_{4j} \Delta LCPI_{t-1} + \sum_{j=0}^{q} \beta_{5j} \Delta LEXR_{t-1} \\ & + \delta_1 LMA_{t-1} + \delta_2 LGDP_{t-1} + \delta_3\ LINTR_{t-1} + \delta_4 LTBR_{t-1} + \delta_5 LCPI_{t-1} \\ & + \delta_6 LEXR_{t-1} + \varepsilon_t \end{aligned} \tag{5}$$

where MA is the simple sum/Divisia monetary aggregates while all other variables are as earlier defined. The L in the variables represents natural log transformation.

The a priori expectations of the elasticity parameters (β_1, β_2, β_3, β_4 and β_5) should be greater than 0, as GDP, CPI and EXR predictors are expected to have positive relationship with money supply whereas TBR and INTR are expected to have a negative relationship with the dependent variable.

After determining the existence of cointegration amongst the variables via bounds testing, the long-run coefficients are obtained from equation 4:

$$\gamma = -\frac{\hat{\theta}_2}{\hat{\theta}_1} \tag{6}$$

Equation 5 will be estimated to obtain the long-run parameters after selecting the appropriate lags for all variables using the various information criteria. The dynamic error correction model for the short run parameters is derived by including the lag elements of all the variables in the following general equation form:

$$\Delta_{y_t} = \sigma + \sum_{j=1}^{p} \alpha_j \Delta_{y_{t-j}} + \sum_{j=0}^{q} \beta_{1j} \Delta_{x_{t-j}} + \omega ect_{t-1} + \varepsilon_t \tag{7}$$

The coefficients β_{1j} are the short-run elasticities and ω is the adjustment factor which measures the speed of return to equilibrium after a shock.

3.3.1 Simple Sum Monetary Aggregates

Monetary authorities across different jurisdictions carry out classification of monetary aggregates for easier identification using prefixes M0, M1, M2, and M3, depending on the depth of the financial system and level of the liquidity of the instruments defining the monetary aggregates. The current definition of broad money supply in Nigeria, is based on functional approach to monetary aggregate compilation following the framework of Monetary and Financial Statistics Manual and Compilation Guide (MFSMCG) 2000 & 2016 using the traditional approach of summing together the different components into a single aggregate without weighting the components. Given m monetary assets, the simple sum monetary aggregate is specified as:

$$M = \sum_{i=1}^{k} m_i \tag{8}$$

where M stands for the nominal monetary aggregate; m_i stands for nominal value of the i^{th} monetary item and $i = 1, 2, \ldots\ldots.., k$. This measure treats the components ($m_i s$) as perfect substitutes (IMF, 2016).

Following the inclusion of a new monetary instrument in the Nigerian definition of broad money, namely debt instruments issued by the Central Bank and owned by the private sector, M3 is the broad definition of money supply. Consequently, M3 is the intermediate target in Nigeria's monetary policy framework. The following are the detailed definitions of the monetary aggregates compiled in Nigeria:

(a) M1 encompasses currency outside depository corporations and public non-financial corporations' transferable deposits at CBN, as well as private sector transferable deposit at the Other Depository Corporations (ODCs). M1 is denoted as:

$$M1_t = CoDC_t + TD_t \tag{9}$$

where CoDC stands for currency outside depository corporations, TD stands for public non-financial corporations (PNFCs) transferable deposits at the CBN, and ODCs is for private sector transferable deposits.

But;

$$CoDC_t = CIC_t - VC_t \tag{10}$$

where, CIC stands for currency in circulation, while VC stands for ODC vault cash.

(b) Narrow money (M1) and other deposits (savings, time/term, and foreign currency deposits of resident sectors with ODCs) are included in the definition of the money supply (M2). Clearly, M2 considers not only those financial assets which can be used directly as medium of exchange but also as close substitutes. Central or Federal Government and non-residents[6] transferable and other deposits at ODCs are not included as components of money supply. These deposits are generally excluded because they do not respond to movements in macroeconomic variables such as changes in national income, interest rate, and exchange rate, to the same degree as those of the money holding sectors (IMF-MFSMCG, 2016). Furthermore, analytical approach to monetary and fiscal policy formulation also supports this exclusion to enable net analysis of central government financial position. The non-residents hold significant portion of their deposits to facilitate foreign transactions rather than domestic spending.

[6] Non-residency is decided by the entity's primary economic interest, not by nationality. If a company intends to conduct business in a country for more than a year, it is regarded a resident; otherwise, it is a non-resident (IMF-MFSMCG 2016).

In terms of identity, M2 is specified as:

$$M2_t = M1_t + OD_t \tag{11}$$

where,

M1 is as previously defined and *OD* is other deposits.

(c) Nigeria's broad money definition, M3 includes money supply (M2) and securities other than shares held by the money holding sectors and denoted from the use side as follows:

$$M3_t = M2_t + SOS_t \tag{12}$$

where: *M2* is money supply, *SOS* is securities other than shares held by money-holding sectors.

Correspondingly, M3 specification from the source side is written as:

$$M3_t = NFA_t + NDC_t - OIN_t \tag{13}$$

where NFA denotes net foreign assets, NDC is net domestic credit, and OIN denotes other items net.

This method of aggregation simply assumes perfect substitutability of monetary assets included. However, monetary assets included are not close substitutes of assets excluded. It is not always obvious that the assets *a priori* designated as components of broad money liabilities are perfect substitutes (Gebregiorgis and Handa, 2004).

3.3.2 Divisia Monetary Aggregates

Divisia (1925) created the Divisia index as a continuous timeline integral for perishable consumer items. The Divisia index's growth rate is a weighted average of component growth rates. The weights in the growth rate aggregate are the expenditure shares of the components with user cost pricing at any given moment. However, the index's level is not a weighted average of the component values. The level is a line integral with a high degree of nonlinearity. The Divisia index is developed directly from customer behavior optimization. There is no inaccuracy in approximation. However, economic data are not available in continuous time. The share weights must be measured somewhere inside the discrete period to discretize the continuous time Divisia index.

Tornqvist (1936) advocated that the average of the share at the start and end of the discrete time period be used. Because the average shares change over time, the resultant index is chained- rather than fixed-base. Theil (1967) was another proponent of discretization. The resultant index is known as the Tornqvist–Theil Divisia index or the Tornqvist–Theil index, and is based on Tornqvist and Theil's study.

As earlier discussed, Divisia approach to monetary aggregation draws from the theoretical underpinning of statistical index number. It is a quantity index that measures the change of quantity of money from one period to another by assigning different weights to the growth rates of the components of money (e.g currency, transferable and other deposits) based on the usefulness of each components for transactions purposes (IMF, 2016). Divisia aggregates are founded on user-cost (opportunity cost) which is the proxy for capturing the relative importance of the individual components for consummating transactions. The nominal user-cost is obtained by computing the spread between a benchmark rate (the interest rate that is paid on a financial instrument that cannot be used for making transactions in the short-run) and the rate paid on a certain component of the monetary aggregate.

The Divisia aggregate encompasses the trade-off between the medium of exchange and store of value functions of money components. The postulation is that the relatively illiquid financial assets are less probable to be used for transaction purposes than highly liquid assets included in the national definition of money supply and, that higher interest rates are paid on the less liquid assets (IMF-MFSMCG, 2016). National currencies and non-interest-bearing transferable deposits are attached the largest weights because they are mostly used directly as media of exchange while those that are not directly used as medium of exchange are assigned the lowest weight.

Let M_{it} be the quantity of the i^{th} nominal monetary asset and S_{it} its relative share of the expenditure on the services of the monetary aggregate in period t. In line with Anderson *et al.* (1997), the Tornqvist-Theil Divisia monetary quantity aggregate/index (DMA) is specified as:

$$DMA_t = DMA_{t-1}\prod_{i=0}^{n}\left(\frac{M_{it}}{M_{it-1}}\right)^{0.5(S_{it}+S_{it-1})} \tag{14}$$

where; DMA_t is Divisia index, $DMA_{t-1}$is the lagged Divisia index, S_{it} is the expenditure share of the monetary assets i at time t, S_{it-1} is the lag of expenditure share of the monetary assets i at time t, M_{it} is the monetary assets i at time t.

We can obtain the percentage change of equation (14) by taking the logarithm and other transformations as follows:

$$\Delta logDMA_t = \sum_{i=1}^{n}\frac{1}{2}\left(S_{it}+S_{it-1}\right)\Delta logM_{it} \tag{15}$$

Note that $\Delta log\emptyset_t = log\emptyset_t - log\emptyset_{t-1}$, $(\emptyset_t = DMA_t, M_{it})$
The weight S_{it} is based on the user cost of the components and on the relative amount outstanding of the different money components and is defined as:

$$S_{it} = \frac{M_{it}\pi_{it}}{\sum_{j=1}^{n} M_{jt}\pi_{jt}} \tag{16}$$

In equation (16), $\sum_{j=1}^{n} M_{jt}\pi_{jt}$ represent the entire expenditure on monetary assets and π_{jt} denotes the user cost of money for asset j at time t. This can also be represented as the sum of the product of the monetary assets, M_{jt} and their respective user costs, π_{jt}.

It should be noted that the user cost of monetary asset *i* is a function of the difference between a benchmark rate and the asset's own rate of return r_{it} , discounted at the benchmark rate[7]. The benchmark asset does not provide monetary services during the planning period of the economic agent except at the last period of the planning horizon, that is, it only performs a store of value function. It may also be viewed as an asset used mainly to transfer wealth from one period to another. The user cost of a monetary asset is also viewed as the opportunity cost or price of transaction service

[7] See Barnett (1978)

of the monetary asset and is denoted as:

$$\pi_{it} = P_t \left(\frac{R_t - r_{it}}{1 + R_t} \right) \quad (17)$$

where R_t is the benchmark rate at time t, r_{it} is the holding period yield on monetary asset i at period t and P_t is the cost of living index or price index.
The benchmark return is mostly expected to be the maximum available holding period rate for a given class of monetary assets (Barnett 1978 and Dahalan *et al.* 2005) at any point in time. Based on the monetary assets considered and their individual rates in Nigeria, we define R_t as:

$$R_t = Max(D\_r_t\ ,\ S\_r_t\ , T\_r_t\ , FC\_r_t\ , CB\_r_t\ , TB\_r_t)\ + K \quad (18)$$

where, D_r_t is the rate of interest on demand deposits, S_r_t is the interest on savings deposits, T_r_t is the interest rate on time deposits, FC_r_t is the interest return on foreign currency deposits, CB_r_t is the interest yield on CBN bills, TB_r_t is the interest return on 91-day Nigerian treasury bills and lastly, K is a constant term with a value of 0.001. The constant term is conventionally determined to ensure that the interest rate earned on any monetary asset considered is not higher than the benchmark rate (Anderson *et al.* 1997; Khainga, 2014; and Hussin & El-Rasheed, 2019). The study used equation (14) to construct Divisia monetary aggregates for Nigeria for the period 2007M12 to 2020M12.

3.3.3 Money Demand Function

Money demand research has grown significantly in recent years (Sriram, 1999) owing to the understanding that stable money demand function and robust determinants of the demand for real money balances is critical in the conduct of monetary policy because it allows the effects of a policy-driven change in the monetary aggregate on output, interest rates, and ultimately, prices to be predictable (Nachega, 2001). A stable money demand function is also important in explaining and predicting the behavior of other macroeconomic variables (Essien *et al.*, 1996, Carpenter & Lange, 2002).

Several research on money demand in Nigeria have revealed mixed outcomes, studies such as Doguwa *et al.* (2014), Tule *et al.* (2018), Audu *et al.* (2018), Nwude, *et al.* (2018), Nkang *et al*. (2018), Idris (2019) and Ekechukwu *et al.* (2020) have found stable relationship between money supply and a range of macroeconomic variables but with varying conclusions in terms of significance of the variables in their models. However, Akinbobola (2012), Apere and Karimo (2014), Obassaju and Bowale (2015), and Charisma *et al.* (2018) reported an unstable relationship among broad money supply, output and/or inflation. These mixed results have sustained the desire for reevaluation of existing concepts and measurement methods in the search and continuous monitoring of the behavior of appropriate monetary aggregates as indicators of movements in output and inflation in Nigeria.

4. Results and Discussion

4.1 Summary Statistics

The descriptive statistics are presented in Table 3. It can be seen that SM3, DM3, CPI and EXR are positively skewed while RGDP, INTR and TBR are negatively skewed. The Jarque-Bera statistic and the corresponding probability values indicate that all the variables are normally distributed except, CPI and EXR as it rejects the null hypothesis of normality. This notwithstanding, the data can be subjected to further analysis.

Table 3: Summary Statistics of Variables in the Models

	SM3	DM3	RGDP	CPI	INTR	TBR	EXR
Mean	310.96	338.57	15583.09	180.04	8.52	8.79	249.45
Median	305.74	331.65	16045.90	158.62	9.01	9.95	172.00
Maximum	577.44	646.02	19550.15	355.90	13.15	14.49	490.00
Minimum	100.00	100.00	10990.87	77.93	2.74	0.03	119.00
Std. Dev.	136.82	160.15	2332.18	77.50	2.43	3.97	116.22
Skewness	0.27	0.32	-0.33	0.63	-0.17	-0.59	0.61
Kurtosis	1.86	1.87	2.17	2.25	2.68	2.31	1.84
Jarque-Bera	3.55	3.71	2.48	4.73	0.50	4.08	6.25
Probability	0.17	0.16	0.29	0.09	0.78	0.13	0.04
Observations	53	53	53	53	53	53	53

4.2 An Appraisal of Simple Sum and Divisia Monetary Aggregates

The descriptive statistics of the monetary aggregates in Table 4 show clear variations in the indices of the alternative aggregates. The mean ranges from the least of 172.47

for DM1 to the highest of 310.96 for SM3. The median, which is an alternative measure of central tendency, ranges from 169.67 for CODC to 331.65 for DM3. This behavior is further buttressed by the standard deviation, which ranges from 28.56 for DM1 to 136.82 for SM3. This study found that DM2 is more stable than SM2 and this is attributable to the holistic inclusion of all financial assets under M2. This contradicts El-Rasheed and Abdullah (2017), who found that DM2 was more volatile than SM2 owing to non-inclusion of more financial assets in broad money definition despite financial liberalization in the Nigerian financial system. Furthermore, DM3 is more volatile than SM3 revealing that more financial assets need to be captured as components of M3, for instance money market funds. These results suggest that there are clear differences among the aggregates which requires further investigation to determine the most appropriate.

Table 4: Descriptive Statistics of Different Measures of Monetary Aggregates

	Monetary Aggregates						
	CODC	SM1	SM2	SM3	DM1	DM2	DM3
Mean	178.67	239.14	309.65	310.96	172.47	305.91	338.57
Median	169.67	230.40	299.00	305.74	172.64	302.08	331.65
Maximum	340.49	501.00	641.70	577.44	248.78	613.03	646.02
Minimum	90.63	100.00	100.00	100.00	100.00	100.00	100.00
Std. Dev.	55.85	77.09	127.12	136.82	28.56	120.61	160.15
Skewness	0.46	0.92	0.55	0.27	0.08	0.45	0.32
Kurtosis	2.85	4.36	2.70	1.86	3.11	2.56	1.87
Jarque-Bera	1.91	11.47	2.91	3.55	0.09	2.21	3.71
Probability	0.39	0.00	0.23	0.17	0.96	0.33	0.16
Observations	53	53	53	53	53	53	53

The simple sum aggregates were transformed to equal 100 at the beginning period, 2007:01 to allow comparison with the Divisia aggregates.

Figures 1 to 3 graphically depict the simple sum and Divisia aggregates. In Figure 1, there is relatively large difference between the simple and the Divisia measures. The variance could be explained by the simple sum aggregation assigning equal weights to the components of M1, namely, currency outside depository corporations and transferable deposits, which differs from the Divisia measure that attach different weights to the sub-components. This backs up Khainga's (2014) claim that the degree of substitutability among M1's components appears to be lower than that of the higher-ordered aggregates, such as M2 and M3.

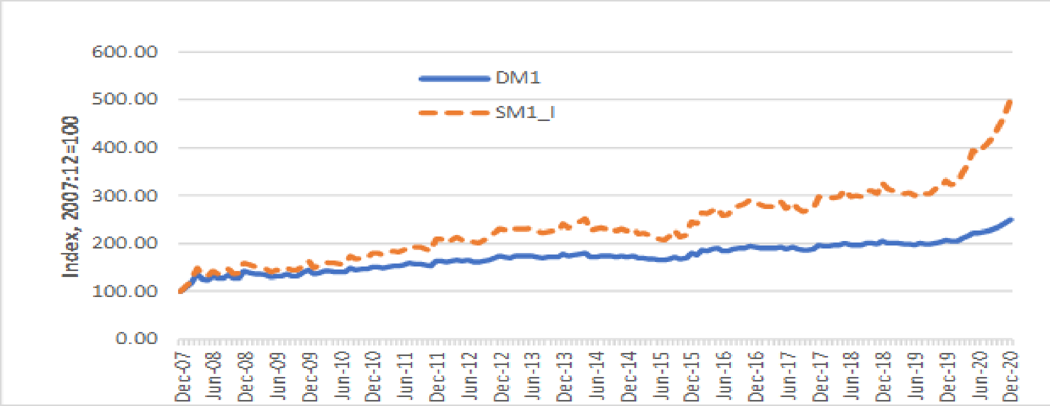

Figure 1: Simple sum M1[8] and Divisia M1

Figures 2 and 3 indicate that the degree of substitutability among the sub-components of M2 and M3 is higher, as evidenced by the lower variation between the two monetary aggregates measurements. The higher the sequence of the monetary aggregates, the higher the level of substitutability of their components in terms of moneyness. Although, M3 has a larger difference than M2 between the two measures of money supply, it could be that the additional component to M2 to obtain M3 is a store of value instrument as against medium of exchange.

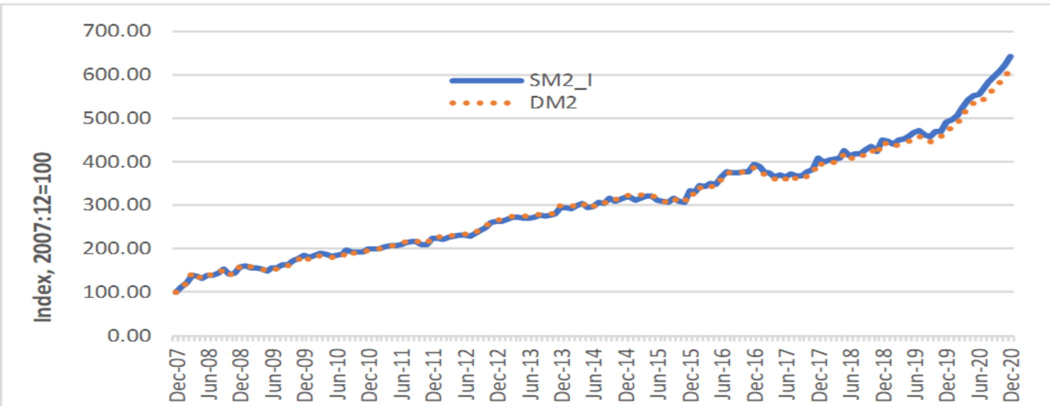

Figure 2: Simple sum M2 and Divisia M2

[8]Note that SM1_I, SM2_I and SM3_I are the indices of Simple Sum aggregates to enable comparison with Divisia indices.

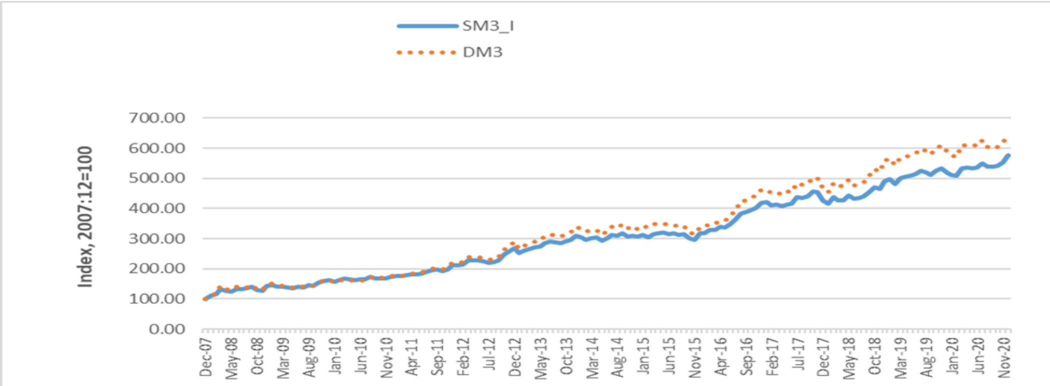

Figure 3: Simple sum M3 and Divisia M3

Figure 4 to 6 indicate the growth rates of the simple sum and Divisia monetary aggregates. An inspection of the trends shows the two series moving almost identically, except that there was a shift from the beginning of 2009 onwards. The relatively slower growth of the aggregates post 2008 was owing to tight liquidity experienced at the inter-bank segment of the financial markets, due to the outflow of portfolio investment, occasioned by the 2007/08 global financial crisis. To ensure the stability of the financial system, the CBN undertook several monetary policy measures to guarantee adequate liquidity in the banking system (CBN Annual Report, 2008). The deployment of these measures led to liquidity surfeit in the system that needed to be mopped-up. Ever since, the Bank has sustained tight monetary policy stance with occasional eases as evident in the plots.

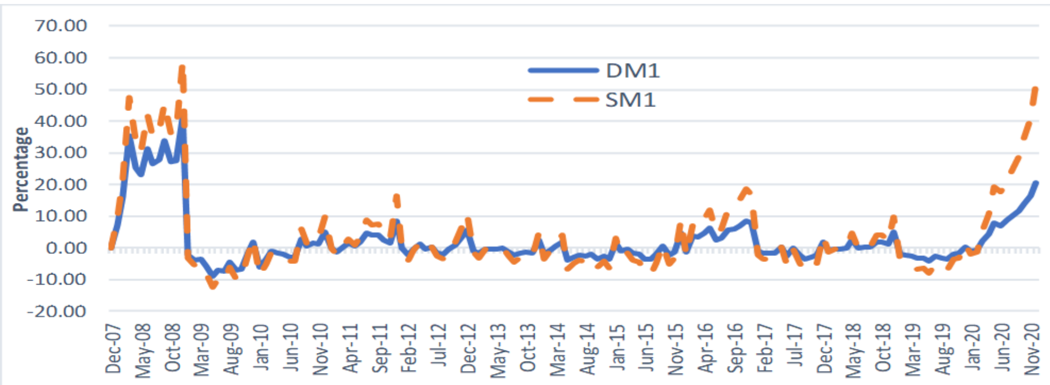

Figure 4: Growth Rates of Simple Sum M1 and Divisia M1

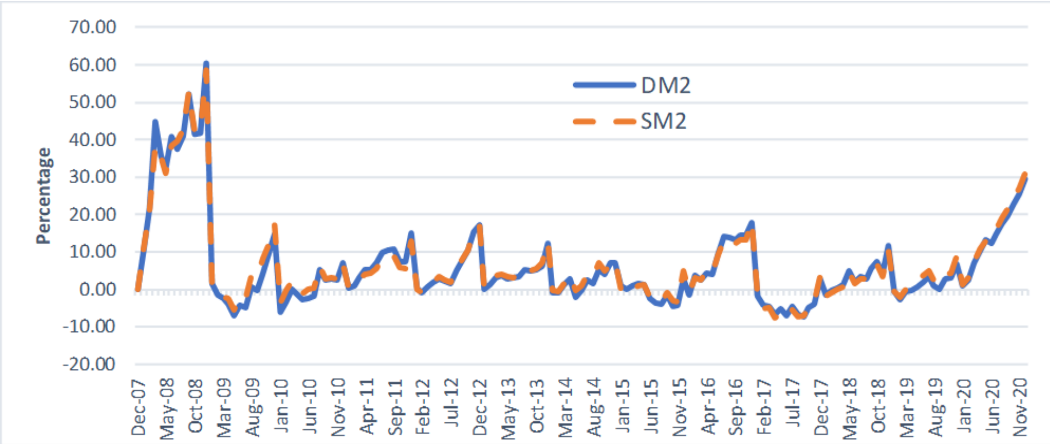

Figure 5: Growth Rates of Simple Sum M2 and Divisia M2

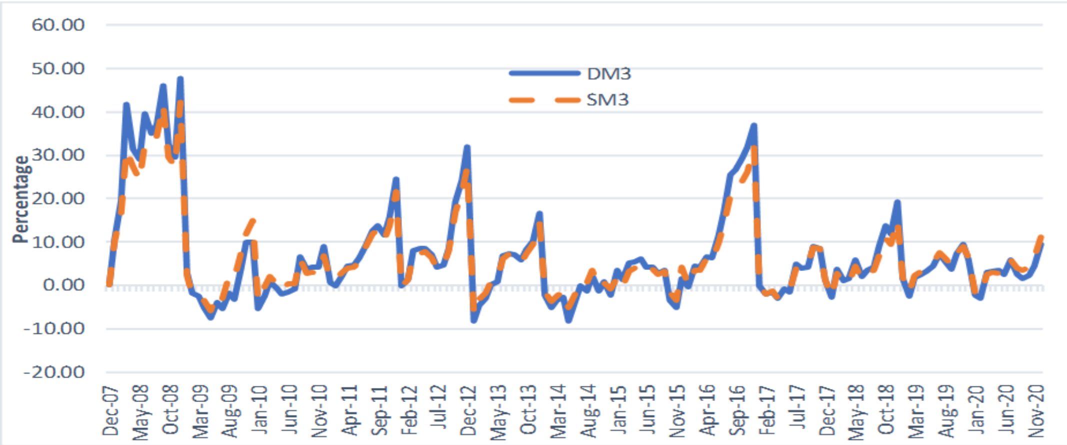

Figure 6: Growth Rates of Simple Sum M3 and Divisia M3

4.3 Application to the Money Demand Function

4.3.1 Unit root test results

The study adopted Augmented Dickey-Fuller (ADF) and the Phillips-Perron (PP) tests to determine the order of integration of the variables. The unit root test results presented in Table 5 depicts that LSM3, LDM3 and RGDP are I(0) that is, they are stationary at levels while, LCPI, LINTR, LEXR and LTBR are I(1) variables, that is, stationary at first difference. This outcome validates the use of ARDL technique.

Table 5: Unit Root Tests

Variables	ADF Test		Phillips-Perron Test		Intercept=I Intercept & Trend = I & T
	I(0)	I(1)	I(0)	I(1)	
LDM3	-3.8847**	-10.5952*	-4.1289**	-10.7335*	I & T
LSM3	-4.0622**	-9.7433*	-4.1943*	-10.3535*	I & T
LRGDP	-1.1977	-3.4526***	-4.4140*	-13.5347*	I & T
LINTR	-0.1688	-4.9756*	-1.0324	-4.9675*	I
LEXR	-2.3507	-5.0641*	-1.9855	-5.0641*	I & T
LCPI	-1.1767	-5.5539*	-1.1767	-5.5732*	I & T
LTBR	1.7786	-2.7662***	1.3301	-2.9126***	I
Critical Values:					
1%	-3.5627	-3.5654	-3.5627	-3.5654	I
5%	-2.9188	-2.9199	-2.9188	-2.9199	
10%	-2.5973	-2.5979	-2.5973	-2.5979	
Critical Values:					
1%	-4.1485	-4.1485	-4.1446	-4.1485	I & T
5%	-3.5005	-3.5005	-3.4987	-3.5005	
10%	-3.1796	-3.1796	-3.1786	-3.1796	

Note: *** ,**, and * indicate significant at 1%, 5% and 10% respectively.

Table 6 shows the computed and critical values of the F statistic for testing the existence of co-integration between SM3, DM3 and other explanatory variables as specified in the model. The hypothesis of no co-integration is tested using the F-critical values provided by Pesaran *et al.* (2001). A maximum lag order of 4 is selected based on Akaike information criteria (AIC). The hypothesis of no co-integration is rejected based on the observed F-statistics values. The computed F-statistic of 3.507 for Divisia index and 3.992 for simple sum are both higher than the upper bounds of 3.35 at 10 per cent level of significance, indicating the existence of long-run relationships among the variables considered in the models.

Table 6: F-Bounds Tests

Test Statistic	Value	Signif. level	I(0)	I(1)
Divisia Monetary Index				
F-statistic	3.507	10%	2.26	3.35
k	5	5%	2.62	3.79
		2.50%	2.96	4.18
		1%	3.41	4.68
Simple Sum Aggregate				
F-statistic	3.992	10%	2.26	3.35
k	5	5%	2.62	3.79
		2.50%	2.96	4.18
		1%	3.41	4.68

4.3.2 Empirical results

The results of the long-run broad money demand (M3) for Divisia and simple sum are presented in Table 7. The results reveal that the demand for Divisia money is a function of real level of income (RGDP), general price levels (CPI), treasury bills rate (TBR) and exchange rate (EXR), leaving no role for interest rate, which is insignificant in the model. On the other hand, the determinants of the money demand for simple sum include real level of income, general price levels and exchange rate. Treasury bills rate and interest rate do not play their expected roles of opportunity cost in the case of simple sum.

In line with theory, the coefficient of exchange rate is negative and statistically significant which by economic implication means that as exchange rate depreciates, the quest for holding money increases as highlighted by Frenkel & Johnson (1976). This is probably due to the need for economic agents to stock foreign exchange as Nigeria is an import dependent economy. With the depreciation of the domestic currency, more naira is required to purchase the dollar.

Conversely, the 91-day treasury bills rate and inflation yielded positive and statistically significant coefficients, connoting that as the rates increase, the demand for Divisia money responds in the same direction. Increase in the general price level implies that more money is required to buy the same quantity of goods and since the components of Divisia money attract weights in accordance with the degree of liquidity, it therefore, means that the demand for Divisia money increases to meet the rise in the price level. Interest rate which is supposedly the primary opportunity cost of holding money (Friedman, 1966), yields a negative coefficient, in line with theory, but not statistically significant. This could imply that interest rate is ineffective in Nigeria. In other words, preference for holding money cannot be altered in Nigeria by variations in interest rate. Astonishingly, the level of income turns out to be negatively related to the demand for Divisia money, indicating structural distortions in the Nigerian economy. This explanation also holds for the demand for simple sum aggregate except for treasury bills rate which yielded a negative coefficient.

Table 7: Long-Run Coefficients for Divisia and Simple Sum

Variable	Coef.	S.E	t-stat	Prob.*
Divisia Monetary Index				
RGDPG	-1.7268	0.7579	-2.2782	0.0303
LCPI	1.1696	0.1771	6.6052	0.0000
INTRG	-0.0077	0.0091	-0.8438	0.4057
LTBR	0.1894	0.0947	2.0004	0.0549
LEXR	-0.4256	0.2174	-1.9578	0.0599
Simple Sum Monetary Aggregates				
RGDPG	-1.8610	0.9267	-2.0083	0.0526
LCPI	1.1745	0.1801	6.5197	0.0000
INTRG	0.0108	0.0068	1.5871	0.1217
LTBR	-0.0214	0.0866	-0.2470	0.8064
LEXR	-0.4211	0.2321	-1.8143	0.0785

Table 8 presents the outcome of the estimated short-run dynamics (ARDL representations of money demand functions) for both Divisia and simple sum aggregates. The error correction term (ECM) of money demand function for Divisia M3 has the expected negative sign and is statistically significant. Result shows that about 27 per cent of disequilibrium in Divisia M3 demand is corrected in each quarter. The error correction term of the simple-sum function is also negative and statistically significant, though with a slower speed of equilibrium restoration of about 21 per cent. Furthermore, the Divisia function out-performs the simple-sum in terms of model fitness with an adjusted R^2 of 47.9 per cent compared to 41.2 per cent, respectively.

Table 8: Short-Run Error Correction Representation for Divisia and Simple Sum

Divisia Monetary Index					Simple Sum Monetary Aggregates				
Variable	Coef.	S.E	t-Statistic	Prob.*	Variable	Coef.	S.E	t-Statistic	Prob.*
C	0.490	0.101	4.836	0.000	C	0.488	0.087	5.616	0.000
D(LDM3(-1))	-0.233	0.125	-1.865	0.072	D(LSM3(-1))	-0.244	0.123	-1.983	0.056
D(LDM3(-2))	0.245	0.125	1.962	0.059	D(RGDPG)	-0.090	0.019	-4.713	0.000
D(RGDPG)	-0.112	0.025	-4.500	0.000	D(RGDPG(-1))	0.205	0.038	5.415	0.000
D(RGDPG(-1))	0.245	0.047	5.189	0.000	D(RGDPG(-2))	0.113	0.021	5.379	0.000
D(RGDPG(-2))	0.134	0.025	5.269	0.000	D(LTBR)	0.001	0.008	0.085	0.933
D(LCPI)	0.237	0.520	0.456	0.652	D(LTBR(-1))	0.019	0.014	1.402	0.170
D(LCPI(-1))	1.044	0.540	1.933	0.063	D(LTBR(-2))	0.020	0.013	1.519	0.138
D(INTRG)	0.003	0.001	3.293	0.003	D(LTBR(-3))	-0.035	0.014	-2.549	0.016
D(INTRG(-1))	0.003	0.001	3.351	0.002	CointEq(-1)*	-0.210	0.040	-5.242	0.000
D(LTBR)	-0.007	0.010	-0.704	0.487	R^2 = 0.5223, Adjusted R^2 = 0.4119, AIC = -3.8575,				
D(LTBR(-1))	-0.020	0.019	-1.070	0.293	SC = -3.4715, HQ = -3.7111, DW = 1.9298,				
D(LTBR(-2))	0.008	0.017	0.458	0.650	Prob = 0.0003				
D(LTBR(-3))	-0.049	0.017	-2.865	0.008					
CointEq(-1)*	-0.270	0.054	-4.967	0.000					
R^2 = 0.6309, Adjusted R^2 = 0.4789, AIC = -3.5534,									
SC = -2.9743, HQ = -3.3337, DW = 1.9714,									
Prob = 0.0003									

4.3.3 Post-Estimation Diagnostic Tests

To test for stability of the estimated equations and parameters, Breusch-Pagan-Godfrey heteroskedasticity tests, Breusch-Godfrey serial correlation LM tests, CUSUM and CUSUM Squares tests were conducted as presented in Appendix 2. The Breusch-Pagan-Godfrey heteroskedasticity tests and Breusch-Godfrey serial correlation LM test for Divisia and simple sum models revealed that the probability values are greater than 5% level of significance, hence, we fail to reject the null hypothesis and conclude that the models are homoscedastic and that the residuals are NOT serially correlated. Also, the cumulative sum (CUSUM) and cumulative sum of squares (CUSUM of Squares) tests as presented in the Appendix indicated that the estimated Divisia and simple-sum money demand functions are structurally stable as their plots of the CUSUM statistic are within the 5 per cent significance levels. This supports Poole's (1970) claim, as reported by Omotor and Omotor (2011), that the supply of monetary stock is the most appropriate target instrument for monetary policy that the Central Bank of Nigeria can concentrate on.

5. Conclusion and Policy Recommendation

The study constructed Divisia monetary aggregates for Nigeria and compared it with the simple-sum monetary aggregate. The demand for money analysis conducted suggests that Divisia broad money aggregate outperforms the traditional simple sum broad money aggregate in terms of speed of adjustment to restore equilibrium and model fitness. This result corroborates the study conducted by El-Rasheed and Abdullah (2017). The simple sum monetary aggregates have a major flaw in that they are unable to respond to financial innovations by treating all subcomponents as equals. On the other hand, we use the Divisia monetary aggregates, which, owing to the weights built for these aggregates, are a very promising alternative that well adjusts for financial innovations. This shows that the Divisia aggregate carries more information on monetary developments in the system. To this end, Divisia broad money aggregate should be considered by central banks as a complement to the traditional simple sum broad money supply for monetary policy decision making as practiced in other jurisdictions. Other monetary authorities that are currently not compiling the Divisia aggregates can also consider it as a complement to their respective simple sum monetary aggregates.

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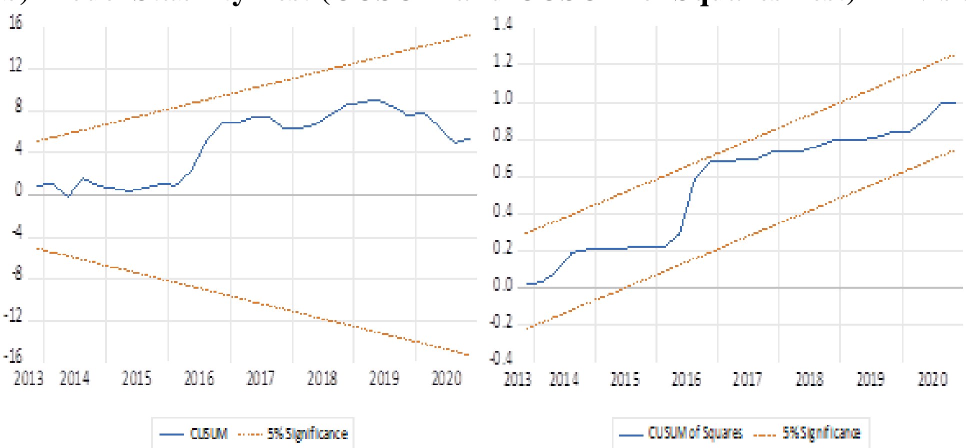
Appendix 1: Variable Movements

Appendix 2: Post Estimation Diagnostic Tests

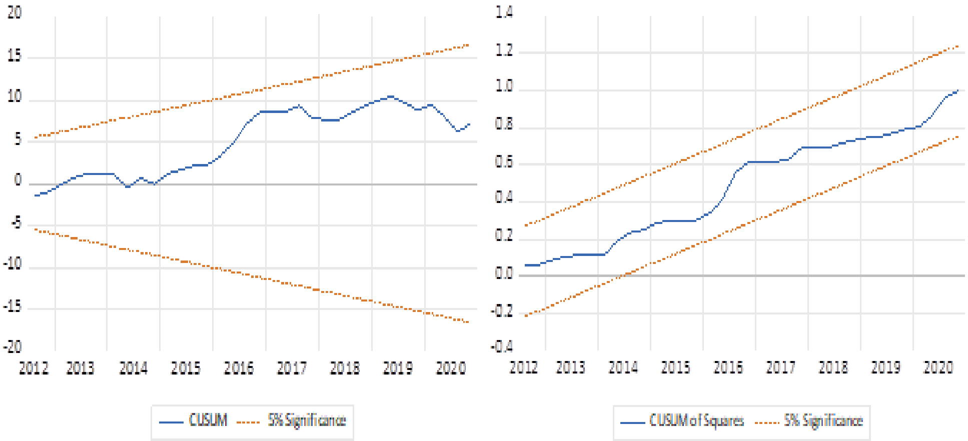
a) Serial Correlation and Heteroskedasticity Test

Serial Correlation and Heteroskedasticity Test			
Divisia Monetary Aggregate Equation			
Breusch-Godfrey Serial Correlation LM Test			
F-statistic	0.124	Prob. F(2,27)	0.884
Obs*R-squared	0.446	Prob. Chi-Square(2)	0.800
Heteroskedasticity Test: Breusch-Pagan-Godfrey			
F-statistic	0.990	Prob. F(19,29)	0.498
Obs*R-squared	19.278	Prob. Chi-Square(19)	0.439
Scaled explained SS	7.656	Prob. Chi-Square(19)	0.990
Simple Sum Monetary Aggregate Equation			
Breusch-Godfrey Serial Correlation LM Test			
F-statistic	0.230	Prob. F(2,32)	0.796
Obs*R-squared	0.694	Prob. Chi-Square(2)	0.707
Heteroskedasticity Test: Breusch-Pagan-Godfrey			
F-statistic	0.931	Prob. F(14,34)	0.538
Obs*R-squared	13.576	Prob. Chi-Square(14)	0.482
Scaled explained SS	5.386	Prob. Chi-Square(14)	0.980

b) Model Stability Test (CUSUM and CUSUM of Squares Test) - Divisia



c) Model Stability Test (CUSUM and CUSUM of Squares Test) – Simple Sum



Appendix 3: Computed User Costs, Weights and Indices

Period	User Costs						Weights						Divisia Indices		
	CODC	TD	SD	TTD	FCD	CB Bills	CODC	TD	SD	TTD	FCD	CB Bills	DM1	DM2	DM3
Dec-07	71.03	66.38	49.01	0.01	40.08	40.08	0.10	0.30	0.07	0.00	0.04	0.05	100.00	100.00	100.00
Jan-08	72.55	68.16	53.79	0.01	46.26	46.26	0.18	0.61	0.14	0.00	0.07	0.11	107.26	110.33	110.72
Feb-08	72.70	68.27	54.10	0.01	52.18	52.18	0.15	0.63	0.13	0.00	0.08	0.11	116.15	121.41	119.61
Mar-08	72.88	68.16	52.28	0.01	51.24	51.24	0.13	0.66	0.12	0.00	0.09	0.09	135.28	144.82	141.85
Apr-08	74.77	70.49	55.89	0.01	58.18	58.18	0.12	0.66	0.12	0.00	0.10	0.08	125.38	135.70	131.55
May-08	76.09	71.66	57.94	0.01	61.25	61.25	0.13	0.64	0.13	0.00	0.11	0.08	122.98	132.27	129.12
Jun-08	79.11	74.65	60.65	0.01	64.34	64.34	0.12	0.64	0.13	0.00	0.11	0.09	131.16	140.91	139.64
Jul-08	80.79	76.22	61.65	0.01	65.54	65.54	0.13	0.64	0.13	0.00	0.10	0.09	126.43	137.60	135.06
Aug-08	81.69	77.03	62.41	0.01	66.66	66.66	0.13	0.63	0.13	0.00	0.10	0.09	127.79	140.81	137.07
Sep-08	83.09	78.72	65.26	0.01	63.35	63.35	0.13	0.63	0.13	0.00	0.11	0.07	133.72	152.19	146.06
Oct-08	82.65	78.35	64.83	0.01	69.06	69.06	0.13	0.62	0.13	0.00	0.12	0.05	127.26	141.48	132.50
Nov-08	83.68	80.10	68.91	15.73	80.86	80.86	0.13	0.58	0.13	0.03	0.13	0.03	127.63	141.88	129.66
Dec-08	84.61	81.20	69.86	22.68	83.19	83.19	0.12	0.55	0.13	0.07	0.13	0.02	141.21	160.51	147.68
Jan-09	83.57	79.14	66.55	0.01	82.52	82.52	0.12	0.56	0.13	0.04	0.15	0.03	137.92	162.82	152.08
Feb-09	84.67	80.52	68.72	0.01	82.83	82.83	0.12	0.57	0.13	0.00	0.17	0.03	135.73	158.27	144.94
Mar-09	84.76	80.31	67.47	0.01	82.67	82.67	0.12	0.58	0.14	0.00	0.16	0.03	136.15	156.46	143.85
Apr-09	86.03	82.07	70.88	0.01	84.50	84.50	0.13	0.57	0.14	0.00	0.16	0.02	133.21	154.29	139.90
May-09	86.20	81.22	66.98	0.01	84.48	84.48	0.13	0.56	0.14	0.00	0.17	0.02	128.66	149.04	136.45
Jun-09	88.33	83.61	69.66	0.01	86.47	86.47	0.12	0.56	0.14	0.00	0.17	0.03	131.46	153.83	141.78
Jul-09	90.27	85.54	73.43	0.01	88.57	88.57	0.12	0.57	0.15	0.00	0.17	0.03	130.82	152.78	139.57
Aug-09	91.15	86.26	70.93	0.01	89.44	89.44	0.12	0.57	0.14	0.00	0.17	0.02	135.04	161.34	145.05
Sep-09	91.37	86.31	73.66	0.01	89.74	89.74	0.12	0.57	0.14	0.00	0.17	0.01	131.39	159.91	142.83
Oct-09	92.35	87.63	76.74	0.01	91.02	91.02	0.12	0.55	0.14	0.00	0.19	0.01	131.75	167.61	153.12
Nov-09	93.01	88.30	69.60	0.01	91.77	91.77	0.12	0.55	0.13	0.00	0.20	0.02	138.71	175.96	162.44
Dec-09	94.93	90.06	70.89	0.01	93.64	93.64	0.12	0.56	0.12	0.00	0.20	0.01	143.61	184.31	162.41

Period	User Costs CODC	TD	SD	TTD	FCD	CB Bills	Weights CODC	TD	SD	TTD	FCD	CB Bills	Divisia Indices DM1	DM2	DM3
Jan-10	95.44	90.26	69.76	0.01	94.12	94.12	0.12	0.55	0.12	0.00	0.20	0.00	134.94	173.06	153.47
Feb-10	96.21	90.26	66.97	0.01	94.68	94.68	0.12	0.56	0.12	0.00	0.20	0.01	138.35	178.32	158.17
Mar-10	93.97	86.62	60.87	0.01	91.76	91.76	0.12	0.56	0.12	0.00	0.20	0.01	142.32	184.51	163.70
Apr-10	93.03	84.48	55.72	0.01	89.96	89.96	0.12	0.56	0.11	0.00	0.20	0.01	141.13	182.13	161.62
May-10	91.46	81.85	49.93	3.00	87.25	87.25	0.12	0.56	0.11	0.01	0.20	0.01	140.77	179.42	159.25
Jun-10	93.98	84.01	65.17	20.40	89.58	89.58	0.11	0.53	0.12	0.05	0.19	0.01	139.48	180.04	159.84
Jul-10	94.71	84.45	70.05	26.20	90.67	90.67	0.10	0.49	0.13	0.10	0.18	0.01	139.51	181.00	160.99
Aug-10	95.91	85.16	73.42	30.01	92.23	92.23	0.10	0.48	0.13	0.11	0.18	0.01	147.66	194.20	173.03
Sep-10	97.60	87.62	75.57	21.31	94.24	94.24	0.10	0.49	0.13	0.09	0.18	0.01	144.36	188.66	168.39
Oct-10	100.98	93.05	83.60	50.26	98.33	98.33	0.10	0.47	0.14	0.12	0.18	0.01	145.77	189.44	169.37
Nov-10	102.75	95.97	87.91	51.83	100.45	100.45	0.10	0.45	0.14	0.15	0.16	0.01	145.41	188.94	169.18
Dec-10	103.84	96.80	88.16	55.77	101.34	101.34	0.10	0.45	0.14	0.16	0.16	0.01	150.81	197.36	177.00
Jan-11	104.37	96.96	87.76	48.04	101.69	101.69	0.11	0.45	0.14	0.15	0.16	0.02	150.63	198.02	177.85
Feb-11	104.06	95.53	84.97	45.90	101.12	101.12	0.11	0.45	0.14	0.14	0.17	0.01	148.84	199.18	176.79
Mar-11	105.54	97.06	88.44	36.89	102.89	102.89	0.11	0.45	0.14	0.12	0.18	0.01	151.22	203.25	181.12
Apr-11	106.48	98.86	90.71	44.63	104.82	104.82	0.12	0.45	0.15	0.11	0.18	0.01	153.29	207.60	184.98
May-11	107.30	99.36	91.42	45.26	105.81	105.81	0.11	0.44	0.15	0.11	0.19	0.01	151.56	207.93	185.25
Jun-11	107.74	99.54	91.59	45.32	106.20	106.20	0.10	0.44	0.15	0.11	0.19	0.01	153.63	211.20	188.15
Jul-11	108.06	100.03	90.72	44.45	106.55	106.55	0.10	0.46	0.15	0.11	0.19	0.01	157.85	216.99	193.29
Aug-11	109.53	100.95	91.45	40.38	107.69	107.69	0.10	0.46	0.15	0.10	0.19	0.02	156.73	218.09	199.11
Sep-11	114.46	107.99	100.92	62.10	113.08	113.08	0.10	0.45	0.15	0.12	0.19	0.03	156.99	218.28	201.54
Oct-11	117.68	112.94	107.99	68.81	116.70	116.70	0.09	0.44	0.15	0.14	0.18	0.04	154.49	211.80	197.33
Nov-11	117.49	112.55	107.24	65.77	116.46	116.46	0.10	0.43	0.15	0.14	0.18	0.06	153.28	211.76	204.58
Dec-11	118.99	114.14	109.43	71.54	117.94	117.94	0.10	0.43	0.15	0.14	0.18	0.08	163.74	227.10	220.30

Period	User Costs						Weights						Divisia Indices		
	CODC	TD	SD	TTD	FCD	CB Bills	CODC	TD	SD	TTD	FCD	CB Bills	DM1	DM2	DM3
Jan-12	122.75	119.36	112.19	65.40	121.66	121.66	0.10	0.45	0.15	0.13	0.17	0.08	163.51	227.93	219.87
Feb-12	122.66	115.98	110.91	59.88	121.55	121.55	0.10	0.45	0.15	0.12	0.18	0.09	160.15	224.72	223.22
Mar-12	124.37	119.89	110.57	57.02	123.15	123.15	0.10	0.46	0.15	0.12	0.18	0.12	163.06	228.76	237.89
Apr-12	124.18	116.61	108.57	53.90	122.89	122.89	0.10	0.47	0.15	0.11	0.18	0.14	165.52	231.44	239.12
May-12	125.44	118.16	110.55	53.69	124.17	124.17	0.10	0.46	0.15	0.11	0.18	0.13	163.23	233.72	239.27
Jun-12	126.61	122.78	111.24	58.51	125.19	125.19	0.10	0.46	0.15	0.11	0.18	0.12	164.03	232.34	235.79
Jul-12	126.68	122.74	110.60	49.69	125.18	125.18	0.09	0.47	0.15	0.11	0.18	0.11	161.25	230.31	229.35
Aug-12	127.62	119.79	111.69	52.99	126.24	126.24	0.09	0.45	0.15	0.10	0.20	0.09	160.46	238.00	230.38
Sep-12	128.75	122.05	112.29	47.92	127.36	127.36	0.09	0.44	0.15	0.10	0.22	0.08	162.91	244.62	238.99
Oct-12	129.92	122.94	113.65	49.29	128.51	128.51	0.09	0.44	0.14	0.10	0.22	0.11	165.10	250.53	262.93
Nov-12	130.42	123.31	114.60	44.69	128.93	128.93	0.09	0.45	0.14	0.09	0.22	0.14	169.26	262.01	273.97
Dec-12	131.23	123.64	114.91	41.29	129.63	129.63	0.10	0.45	0.14	0.09	0.22	0.15	173.03	266.10	290.70
Jan-13	131.06	122.42	112.68	34.60	129.32	129.32	0.10	0.46	0.14	0.08	0.22	0.14	171.51	266.39	266.35
Feb-13	130.23	119.63	108.27	24.27	128.25	128.25	0.10	0.46	0.14	0.06	0.23	0.11	169.91	269.17	276.95
Mar-13	133.35	124.27	114.47	48.12	131.70	131.70	0.10	0.45	0.14	0.08	0.23	0.12	172.64	273.98	282.13
Apr-13	134.09	125.03	114.57	48.92	132.44	132.44	0.09	0.44	0.14	0.10	0.23	0.13	172.43	275.80	291.25
May-13	134.74	117.12	109.87	49.19	133.15	133.15	0.09	0.44	0.14	0.10	0.23	0.15	172.59	273.73	293.31
Jun-13	136.39	120.13	115.45	59.53	135.04	135.04	0.09	0.43	0.14	0.11	0.23	0.18	172.85	274.08	310.35
Jul-13	137.04	120.23	111.88	55.95	135.78	135.78	0.09	0.42	0.14	0.12	0.23	0.20	170.58	275.30	312.26
Aug-13	136.71	116.94	109.50	47.43	135.40	135.40	0.09	0.41	0.14	0.11	0.25	0.20	168.93	280.31	311.27
Sep-13	138.00	120.16	111.51	57.23	136.77	136.77	0.09	0.40	0.14	0.11	0.26	0.18	170.27	279.31	308.02
Oct-13	139.04	120.76	112.86	56.43	137.90	137.90	0.09	0.40	0.14	0.11	0.25	0.19	170.70	280.04	314.72
Nov-13	140.09	121.21	112.23	49.13	138.95	138.95	0.10	0.40	0.14	0.11	0.25	0.20	170.38	282.57	320.57
Dec-13	141.26	122.01	113.37	53.49	140.16	140.16	0.10	0.40	0.14	0.11	0.25	0.20	177.05	298.69	339.38

Period	User Costs						Weights						Divisia Indices		
	CODC	TD	SD	TTD	FCD	CB Bills	CODC	TD	SD	TTD	FCD	CB Bills	DM1	DM2	DM3
Jan-14	141.56	121.22	103.31	32.88	140.51	140.51	0.11	0.41	0.14	0.09	0.26	0.19	173.74	295.77	331.37
Feb-14	143.11	124.16	107.50	39.55	142.17	142.17	0.10	0.42	0.14	0.08	0.26	0.18	176.08	295.61	322.26
Mar-14	144.22	124.97	107.01	39.97	143.24	143.24	0.09	0.43	0.14	0.08	0.26	0.16	177.87	302.08	327.28
Apr-14	144.18	123.27	103.09	31.49	143.11	143.11	0.09	0.44	0.14	0.07	0.26	0.16	180.44	307.27	329.66
May-14	144.06	120.21	98.58	18.42	142.89	142.89	0.10	0.43	0.14	0.06	0.27	0.16	170.29	292.09	311.35
Jun-14	145.18	121.44	99.21	20.18	143.93	143.93	0.10	0.42	0.14	0.05	0.29	0.17	172.15	297.71	326.98
Jul-14	146.12	120.68	99.99	19.63	144.86	144.86	0.10	0.42	0.14	0.05	0.29	0.18	173.20	305.98	338.74
Aug-14	146.83	132.31	102.78	30.74	145.59	145.59	0.10	0.42	0.14	0.06	0.29	0.18	172.58	302.97	335.09
Sep-14	147.64	133.39	100.76	20.38	146.41	146.41	0.09	0.43	0.13	0.06	0.28	0.18	173.76	314.58	347.17
Oct-14	148.62	133.50	102.28	22.57	147.39	147.39	0.09	0.42	0.13	0.05	0.30	0.16	170.97	310.86	334.53
Nov-14	151.45	139.03	111.49	38.45	150.33	150.33	0.09	0.41	0.13	0.06	0.31	0.15	172.60	319.78	341.87
Dec-14	150.93	137.09	104.30	23.19	149.44	149.44	0.09	0.39	0.14	0.06	0.32	0.13	170.86	320.12	331.65
Jan-15	154.86	142.87	116.91	49.74	153.57	153.57	0.09	0.38	0.14	0.07	0.31	0.12	173.38	323.36	342.84
Feb-15	156.36	136.84	119.80	55.85	155.12	155.12	0.09	0.36	0.14	0.09	0.32	0.12	168.90	319.88	336.10
Mar-15	157.78	142.11	117.83	61.95	156.49	156.49	0.09	0.34	0.15	0.09	0.33	0.13	170.01	322.86	348.75
Apr-15	158.39	137.93	117.66	60.53	157.01	157.01	0.09	0.33	0.15	0.10	0.33	0.14	168.04	325.00	349.86
May-15	160.07	143.11	118.61	57.24	158.65	158.65	0.09	0.33	0.15	0.10	0.33	0.14	167.69	324.08	351.67
Jun-15	161.39	136.75	118.98	40.42	159.94	159.94	0.09	0.34	0.15	0.09	0.33	0.16	165.05	312.64	345.18
Jul-15	162.75	140.92	120.55	43.48	161.28	161.28	0.09	0.34	0.16	0.08	0.33	0.18	164.61	308.60	345.43
Aug-15	163.71	141.86	121.26	43.04	162.19	162.19	0.09	0.36	0.16	0.08	0.32	0.18	167.27	307.23	340.81
Sep-15	164.33	137.88	119.05	35.19	162.70	162.70	0.09	0.37	0.16	0.07	0.31	0.17	171.70	315.42	342.87
Oct-15	165.27	139.78	121.00	56.21	163.69	163.69	0.09	0.36	0.16	0.09	0.30	0.15	167.04	305.66	320.42
Nov-15	166.34	147.53	124.61	88.29	164.77	164.77	0.09	0.35	0.15	0.13	0.28	0.12	168.58	306.30	314.68
Dec-15	158.91	140.83	88.17	12.13	154.04	154.04	0.10	0.39	0.14	0.09	0.28	0.11	178.72	328.63	337.03

Period	User Costs						Weights						Divisia Indices		
	CODC	TD	SD	TTD	FCD	CB Bills	CODC	TD	SD	TTD	FCD	CB Bills	DM1	DM2	DM3
Jan-16	160.57	138.14	91.07	18.19	152.84	152.84	0.11	0.43	0.14	0.04	0.28	0.12	176.29	323.49	335.85
Feb-16	164.78	143.68	95.28	21.35	156.94	156.94	0.11	0.44	0.14	0.04	0.27	0.12	185.22	340.38	351.76
Mar-16	170.95	151.31	109.03	39.90	163.84	163.84	0.10	0.44	0.14	0.06	0.26	0.11	184.65	336.58	350.75
Apr-16	174.61	162.61	109.55	49.09	167.63	167.63	0.10	0.43	0.14	0.09	0.24	0.12	187.21	342.30	359.51
May-16	180.27	167.38	115.92	54.82	173.33	173.33	0.09	0.45	0.14	0.10	0.22	0.12	189.70	342.08	358.06
Jun-16	187.79	179.05	137.58	91.54	182.37	182.37	0.09	0.41	0.14	0.12	0.24	0.11	183.37	360.07	375.37
Jul-16	193.19	177.23	150.25	111.06	188.62	188.62	0.08	0.36	0.14	0.15	0.27	0.10	184.32	374.75	393.50
Aug-16	195.43	175.11	152.77	108.58	190.90	190.90	0.07	0.35	0.15	0.15	0.28	0.13	188.72	373.69	423.24
Sep-16	197.30	185.13	154.11	115.40	192.80	192.80	0.08	0.37	0.15	0.15	0.26	0.17	189.63	372.24	427.01
Oct-16	198.64	185.99	153.62	107.60	193.89	193.89	0.08	0.37	0.15	0.15	0.25	0.18	191.11	376.30	436.14
Nov-16	200.49	187.61	154.11	106.97	195.79	195.79	0.08	0.38	0.15	0.14	0.25	0.19	194.00	375.99	444.41
Dec-16	202.66	192.05	157.12	106.79	196.55	196.55	0.09	0.38	0.15	0.15	0.24	0.20	192.53	386.72	461.33
Jan-17	204.71	187.95	158.27	106.99	197.11	197.11	0.09	0.36	0.15	0.16	0.23	0.21	190.54	379.23	461.18
Feb-17	207.78	195.92	160.64	105.79	200.12	200.12	0.09	0.37	0.16	0.15	0.23	0.22	189.26	370.02	452.39
Mar-17	211.35	199.28	163.29	107.84	202.14	202.14	0.09	0.37	0.16	0.14	0.23	0.23	189.39	368.93	453.90
Apr-17	214.73	202.55	165.78	105.52	204.00	204.00	0.09	0.38	0.16	0.14	0.23	0.24	189.30	360.78	447.19
May-17	218.77	208.91	170.78	108.10	207.84	207.84	0.09	0.40	0.16	0.13	0.23	0.24	192.83	366.80	457.30
Jun-17	222.20	212.31	173.39	114.40	209.47	209.47	0.08	0.40	0.16	0.13	0.22	0.25	187.71	359.55	454.53
Jul-17	224.90	214.61	175.43	107.18	210.63	210.63	0.08	0.40	0.16	0.14	0.22	0.26	192.23	369.26	484.39
Aug-17	226.69	215.82	175.17	98.64	211.82	211.82	0.08	0.40	0.17	0.13	0.22	0.28	187.88	360.90	479.80
Sep-17	228.45	213.68	176.47	97.73	213.44	213.44	0.09	0.39	0.17	0.13	0.22	0.30	185.42	358.19	480.77
Oct-17	225.89	205.55	155.97	52.97	205.62	205.62	0.09	0.40	0.17	0.11	0.23	0.32	186.88	367.38	502.73
Nov-17	231.52	216.05	176.83	99.62	215.67	215.67	0.09	0.40	0.16	0.12	0.23	0.31	187.95	370.95	500.73
Dec-17	232.72	217.25	177.00	101.48	214.78	214.78	0.09	0.38	0.16	0.14	0.22	0.24	196.03	397.92	467.66

Period	User Costs						Weights						Divisia Indices		
	CODC	TD	SD	TTD	FCD	CB Bills	CODC	TD	SD	TTD	FCD	CB Bills	DM1	DM2	DM3
Jan-18	232.22	215.78	166.59	60.81	209.04	209.04	0.09	0.40	0.16	0.12	0.22	0.18	194.56	391.93	455.21
Feb-18	234.07	216.72	167.91	70.72	210.61	210.61	0.09	0.42	0.17	0.09	0.23	0.20	195.39	396.25	485.06
Mar-18	236.02	218.22	169.32	76.72	211.14	211.14	0.09	0.41	0.16	0.10	0.23	0.21	195.56	399.18	472.65
Apr-18	235.02	212.76	155.65	42.14	201.81	201.81	0.10	0.42	0.17	0.08	0.24	0.19	195.96	402.68	474.72
May-18	237.73	213.08	158.10	42.67	204.33	204.33	0.09	0.43	0.17	0.06	0.24	0.19	200.74	417.55	494.79
Jun-18	240.66	214.66	160.05	54.88	204.26	204.26	0.09	0.43	0.17	0.07	0.24	0.19	195.62	405.11	476.60
Jul-18	243.39	210.60	161.87	54.10	204.97	204.97	0.09	0.42	0.17	0.08	0.25	0.19	196.51	410.98	483.75
Aug-18	245.94	220.47	163.56	53.45	207.16	207.16	0.09	0.42	0.17	0.08	0.25	0.19	196.27	409.20	487.59
Sep-18	249.90	228.99	174.57	75.17	213.90	213.90	0.09	0.42	0.17	0.08	0.24	0.20	199.89	420.13	509.32
Oct-18	250.15	229.62	167.79	58.51	206.18	206.18	0.09	0.42	0.17	0.08	0.24	0.21	199.93	427.61	531.74
Nov-18	252.24	218.07	169.52	60.99	207.97	207.97	0.09	0.41	0.17	0.07	0.25	0.22	198.22	414.58	523.21
Dec-18	254.16	235.50	171.08	60.24	208.29	208.29	0.10	0.41	0.17	0.07	0.25	0.22	205.61	443.89	558.06
Jan-19	259.31	243.66	188.96	91.81	218.05	218.05	0.09	0.40	0.17	0.08	0.25	0.22	201.64	440.66	566.76
Feb-19	260.41	244.37	186.30	84.15	217.00	217.00	0.09	0.39	0.18	0.09	0.25	0.22	200.83	432.31	544.22
Mar-19	259.04	241.41	172.63	52.70	207.04	207.04	0.10	0.40	0.18	0.07	0.25	0.22	200.43	440.95	567.90
Apr-19	263.26	247.32	184.27	78.41	214.95	214.95	0.09	0.40	0.18	0.07	0.26	0.23	198.70	441.99	572.28
May-19	265.38	248.27	182.38	71.77	215.30	215.30	0.09	0.39	0.18	0.08	0.26	0.23	198.88	446.54	576.56
Jun-19	267.75	249.18	181.50	68.05	216.18	216.18	0.09	0.39	0.18	0.08	0.26	0.23	197.20	452.39	582.65
Jul-19	270.54	243.70	183.75	75.10	218.53	218.53	0.08	0.38	0.18	0.09	0.27	0.23	199.94	459.09	598.92
Aug-19	275.13	250.86	195.04	93.15	232.40	232.40	0.08	0.38	0.18	0.10	0.26	0.24	198.78	448.28	589.50
Sep-19	278.00	255.74	197.08	93.50	236.69	236.69	0.08	0.37	0.18	0.10	0.26	0.24	198.27	444.40	579.07
Oct-19	278.57	250.65	187.34	76.62	236.74	236.74	0.08	0.37	0.18	0.09	0.27	0.24	201.73	455.67	598.88
Nov-19	283.55	259.09	199.77	100.43	250.70	250.70	0.09	0.37	0.18	0.09	0.27	0.25	201.95	458.12	610.54
Dec-19	285.94	260.88	202.19	144.92	252.91	252.91	0.09	0.35	0.18	0.12	0.25	0.22	206.28	473.45	590.41

Period	User Costs						Weights						Divisia Indices		
	CODC	TD	SD	TTD	FCD	CB Bills	CODC	TD	SD	TTD	FCD	CB Bills	DM1	DM2	DM3
Jan-20	288.18	265.30	202.68	159.60	246.04	246.04	0.09	0.34	0.18	0.16	0.23	0.17	204.42	477.35	577.06
Feb-20	290.36	268.95	203.81	153.09	251.71	251.71	0.08	0.34	0.18	0.16	0.23	0.15	204.97	485.54	572.77
Mar-20	292.70	271.07	205.05	154.13	271.93	271.93	0.08	0.35	0.18	0.15	0.24	0.15	210.77	506.91	608.40
Apr-20	295.10	271.79	208.96	155.27	272.06	272.06	0.08	0.35	0.19	0.15	0.24	0.14	215.14	522.10	609.81
May-20	292.61	265.55	179.42	125.04	270.65	270.65	0.08	0.37	0.18	0.13	0.24	0.12	222.35	535.80	611.52
Jun-20	293.44	262.51	170.07	140.04	273.99	273.99	0.08	0.39	0.18	0.12	0.23	0.11	220.85	531.69	605.68
Jul-20	297.06	271.29	172.17	154.66	281.23	281.23	0.08	0.38	0.17	0.14	0.23	0.11	224.16	543.21	625.07
Aug-20	300.94	276.65	173.71	164.62	285.83	285.83	0.08	0.39	0.17	0.14	0.22	0.09	226.96	555.79	605.10
Sep-20	304.50	282.30	220.16	175.02	290.72	290.72	0.07	0.38	0.20	0.14	0.21	0.05	230.23	566.83	599.99
Oct-20	304.15	289.66	228.33	161.42	290.32	290.32	0.07	0.38	0.21	0.13	0.20	0.02	235.08	580.63	603.52
Nov-20	305.11	288.63	221.95	174.04	289.92	289.92	0.07	0.39	0.21	0.13	0.20	0.01	239.86	594.52	617.01
Dec-20	304.33	287.69	199.12	163.02	287.00	287.00	0.08	0.41	0.20	0.12	0.19	0.02	248.78	613.03	646.02