Determinants of Money Demand: An Empirical Examination

Edwin Kipchirchir and Naftaly Mose
Egerton University, Kenya

For Correspondence: edkirui003@gmail.com

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Abstract

Tremendous changes have been witnessed in the developing countries' macroeconomic landscape over the past few decades. For instance, several forms of financial innovations have been witnessed in the sub-Saharan African region over the past decades. These changes can shift various parameters of the money demand model and function. However, few empirical studies have been carried out in this scope in East Africa. It is against this backdrop that this study will employ the panel estimation technique to analyse the major determinants for money demand in East Africa for the period 2007 to 2020. The study will consider mobile money transactions, ATMs, inflation, interest rates and economic growth variables. The result of the pooled ordinary least squares estimator has identified mobile money, ATMs, and economic growth has a positive influence on money demand while interest rates negatively influence the money demand function. The result has identified the role of monetary authorities and policymakers in controlling use of mobile money, ATMs, income and interest rates to grow money demand in East African economies.

JEL Classifications: E41, E44, E52

Keywords: money demand, monetary policy, money demand determinants, panel

Introduction

One of the most important prerequisites or inputs for formulating and implementing monetary policy is money demand. It is, therefore, important to examine money demand and try to get an understanding of the relationship between money demand and its determinants. Money demand is the desire to hold financial assets either in the form of bank deposits or cash (Goldfeld & Sichel, 1990). Economic agents specifically individuals (households) are usually motivated to hold money for various motives that include transaction, precautionary and speculative reasons. These
three motives drive the economic agents to demand money in various forms. It is also important to note that money provides liquidity to economic agents by facilitating transactions and can also earn interest. The demand for money usually stems from the trade-off between the liquidity benefit of holding money and the interest benefit of holding other equivalents of money (Handa, 2009).

Money demand is influenced by several macroeconomic economic factors such as inflation, income, savings, financial innovations and interest rate (Musimbi & Mose, 2023). In the past few decades, the East African Community (EAC) has experienced huge financial innovations that have strengthened its financial sector in an attempt to boost its economic growth for member states. This explains the development of various financial innovations, in particularly, such as mobile money (MPESA and AIRTEL). Improved technology in the communications industry to a larger extent has improved financial services in EAC. MPESA, introduced in 2007, enables individuals to transact, for instance, transfer, deposit or save money using a mobile phone without necessarily having a bank account (Jack & Suri, 2011; GSMA, 2022). The number of ATMs has been steadily increasing since it was first introduced in various EAC countries in the early 1990s. There were about 2,400 ATMs spread all over Kenya by the year 2020 (IMF, 2022). The amount transacted through ATMs has steadily increased as more individuals in the EAC now prefer to use ATMs when transacting. This is because ATMs are more accessible and more cost-effective. Other key determinants of money demand included when specifying the money demand model for the EAC were the level of income (Gross Domestic Product) and interest rate. As income increases motives for holding money is likely to increase. On the other hand, the demand for money usually stems from the trade-off between the liquidity benefit of holding money and the interest benefit of holding other equivalents of money (Handa, 2009). In East Africa specifically, inflation, savings, interest rate and economic growth has been increasing and thus are expected to influence money demand function, monetary policy and fiscal policy objectives (Musimbi & Mose, 2023).

Various forms of financial innovations can have different effects on the demand for money (Kasekende, 2016). For instance, new financial innovations such as ATMs, debit cards or mobile money (M-PESA) are likely to improve the efficiency and minimize transaction costs involved
The money that would have been held in the form of cash would now be replaced by these financial innovations. This, in turn, would result in a decline in the demand for cash. Similarly, as economic agents such as households move away from more liquid assets (cash) to demanding less liquid assets (mobile money or ATM money), they are more likely to demand less money (Chukwunulu, 2019). In contrast, new financial innovations could potentially increase the demand for money if payment systems are efficient, but individuals are likely to demand more liquid assets (Dunne & Kasekende, 2018). For example, in the case of mobile money (MPESA), individuals will demand both cash and mobile money via the use of mobile phone technology but do not initially shift from more liquid assets to less liquid assets. This, therefore, implies that the relationship between sources of money demand and demand for money can either be inverse or direct. This will render the money demand model inefficient for prediction and policy making. The study will aim to identify the major determinants of money demand in East Africa.

**Literature Review**

Classical economists postulated that money is a medium of exchange and came up with the transaction motive for holding money, which depicts the significant relationship that exists between the quantity of money in circulation and the volumes of price and transactions. This resulted in the development of the quantity theory of money demand, which perceives income as the key determinant of money demand (Serletis, 2007). According to this theory, the demand for money in an economy is solely a function of the volume of transactions taking place in an economy (Fisher, 2007) and available income.

Contrary to Fisher, Keynes (1936) argued that there are two key factors influencing the demand for real money balances. The two factors are income and interest rate. Also, according to Keynes, the number of transactions is a positive function of income and hence if income increases, the demand for real money balances is also expected to increase for both transactional and precautionary motives. Moreover, Keynes opined that money demand for speculative motive is interest rate elastic since the interest rate is one of the opportunity costs of holding money variables.
One of the most well-known inventory theories of money demand is the Baumol-Tobin inventory model. Baumol (1952) and Tobin (1956) developed an approach that explains the demand for money by analyzing the costs and benefits associated with holding money. The benefit of holding money is the liquidity while the cost of holding money is the interest that is forgone. Therefore, the main argument of the Baumol-Tobin inventory model is that transaction demand for money has a direct relationship with income (Y) and an inverse relationship with nominal interest rate (r) earned on alternative assets like bonds. Moreover, the transaction costs involved when converting wealth between money and interest-earning assets also have a direct relationship with the demand for money. For instance, the introduction of ATMs, mobile money, and Internet banking are all associated with a decrease in transaction costs. Thus, more wealth is likely to be held in the form of interest-earning assets such as bonds and less in the form of cash.

Several empirical studies have listed sources of money demand using different methodologies such as ARDL, GMM, OLS and SVAR estimates. Most studies used found different determinants of demand for money. Table one presents an empirical literature review.

<table>
<thead>
<tr>
<th>Author(s)</th>
<th>Sample</th>
<th>Estimation Technique</th>
<th>Period of Study</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aggarwal (2016)</td>
<td>India</td>
<td>OLS</td>
<td>1996-2013</td>
<td>Interest rate and income are key</td>
</tr>
<tr>
<td>Dou (2018)</td>
<td>China</td>
<td>SVAR</td>
<td>1996-2016</td>
<td>currency substitution, financial innovation, capital mobility, government debt income, inflation rate, and interest rate are key</td>
</tr>
<tr>
<td>Bal, et al. (2020)</td>
<td>Emerging economies</td>
<td>ARDL</td>
<td>1996-2017</td>
<td>income, the interest rate is significant</td>
</tr>
<tr>
<td>Mlambo &amp; Msosa (2020)</td>
<td>African states</td>
<td>GMM</td>
<td>1995-2014</td>
<td>ATM and mobile money are key</td>
</tr>
<tr>
<td>Kipsang (2013)</td>
<td>Kenya</td>
<td>ARDL</td>
<td>1970-2012</td>
<td>Inflation and income are key</td>
</tr>
</tbody>
</table>
Materials and Methods

The study employed a quantitative research design to capture trends and determinants of money demand in East Africa. To estimate the sources of money demand the study employed a panel of four countries (Kenya, Uganda, Tanzania and Rwanda) for the period 2007 to 2020. This particular period and sample countries were chosen because reliable and comprehensive data are available. It was during this period that the EAC's financial sector underwent tremendous changes that resulted in financial sector development and various forms of financial innovations emerging. For instance, mobile money (M-PESA) was developed during this particular period and the number of transactions done via ATMs increased tremendously. The study was limited by the unavailability of mobile money data for Burundi and South Sudan.

The money demand function for this study was specified generally as follows:

\[
\begin{align*}
MD_{it} &= f(MOB_{it}, ATM_{it}, GDP_{it}, INTR_{it}) \\
MD_{it} &= \beta_0 + \beta_1 MOB_{it} + \beta_2 ATM_{it} + \beta_3 GDP_{it} + \beta_4 INTR_{it} + \mu_i + v_t + \epsilon_{it}
\end{align*}
\]

\( i = 1,2, \ldots \ldots \ldots, N, t = 1,2, \ldots \ldots \ldots \ldots, T \)

Where:

- \( MD_{it} \) is the demand for money, expressed as demand for real money balances (M2)
- \( MOB_{it} \) is the mobile money expressed as the number of mobile money transactions
- \( ATM_{it} \) is the ATM money, expressed as the number of ATMs
- \( GDP_{it} \) is the income, expressed as gross domestic product
- \( INTR_{it} \) is the interest rate, expressed as interest rate returns
\( \mu_i \) is the country's fixed effects

\( v_t \) is the time fixed effects

\( \epsilon_{it} \) is the error term and is used to capture the unexplained variations in the model

\( \beta_0, \beta_1, \ldots, \beta_3 \) are parameters to be estimated

Subscripts \( i \) and \( t \) represent country and period respectively

The above money demand model was specified in logarithmic form. This allowed for the coefficients of the regression to be treated as elasticities (Gisore, 2022). Thus, the above money demand equation (2) was modified to be;

\[
\ln MD_{it} = \beta_0 + \beta_1 \ln MOB_{it} + \beta_2 \ln ATM_{it} + \beta_3 \ln GDP_{it} + \beta_4 \ln INTR_{it} + \mu_i + v_t + \epsilon_{it} \quad (3)
\]

This study utilized a secondary panel data set of four EAC countries namely Kenya, Uganda, Tanzania, and Rwanda. Secondary data is cheaper, readily available, and easy to access (Kothari, 2004). The panel data was obtained from international data repositories such as the World Bank and the IMF and local data bases. A data collection schedule was used when collecting the data. Table 2 presents data sources and measurements of variables for this study.

### Table 2: Data Sources

<table>
<thead>
<tr>
<th>Variables</th>
<th>Definition</th>
<th>Unit of Measurement</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>( MD_{it} )</td>
<td>Money demand</td>
<td>real money balances/M2</td>
<td>World Bank online database</td>
</tr>
<tr>
<td>( MB_{it} )</td>
<td>Mobile money</td>
<td>number of mobile money transactions</td>
<td>World Bank online database</td>
</tr>
<tr>
<td>( ATM_{it} )</td>
<td>ATMs money</td>
<td>number of automated teller machines</td>
<td>World Bank online database</td>
</tr>
<tr>
<td>( GDP_{it} )</td>
<td>Income</td>
<td>real Goss Domestic Products</td>
<td>Statistical abstracts</td>
</tr>
<tr>
<td>( INTR_{it} )</td>
<td>Interest rate</td>
<td>annual interest rate returns</td>
<td>Statistical abstracts</td>
</tr>
</tbody>
</table>

This particular study employed a panel data analysis technique to examine the major determinants of demand for money. Given the significance of dynamics and the potential for heterogeneity in
estimating a money demand function for the EAC, several panel data examination methods were used. Pooled ordinary least squares (POLs) estimator and fixed effect were used during the analysis. An advantage of the fixed effect model is that it addresses the problems of endogeneity, multicollinearity and omitted variable bias. The Hausman (1978) specification test is generally used to decide between applying either a fixed or random effects model. The Levin-Lin-Chu (LLC) unit root test was carried out to find out whether the panel regression model is stationary or non-stationary. Panel unit root test is done to minimize the chances of spurious regression findings and misleading output with no economic meaning (Gisore, 2022). Panel co-integration regression estimation is examined to account for co-integration relations existing between non-stationary panel data variables.

Results and Discussion
Levin-Lin-Chu (LLC) panel unit root test was applied to examine the order of integration of study variables and reduce inconsistent estimates and spurious regression findings. Table three below shows the panel unit root test results.

<table>
<thead>
<tr>
<th>Variables</th>
<th>LLC test at Level</th>
<th>Order</th>
<th>P-Value</th>
<th>LLC at First difference</th>
<th>Order</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Unadjusted t</td>
<td>Adjusted t</td>
<td></td>
<td>Unadjusted t</td>
<td>Adjusted t</td>
</tr>
<tr>
<td>lnDMO</td>
<td>-3.60</td>
<td>-3.22</td>
<td>I(0)</td>
<td>0.001</td>
<td>_</td>
</tr>
<tr>
<td>lnMOB</td>
<td>-10.54</td>
<td>-9.09</td>
<td>I(0)</td>
<td>0.000</td>
<td>_</td>
</tr>
<tr>
<td>lnATM</td>
<td>-8.08</td>
<td>-5.46</td>
<td>I(0)</td>
<td>0.000</td>
<td>_</td>
</tr>
<tr>
<td>lnGDP</td>
<td>-4.28</td>
<td>-3.44</td>
<td>I(0)</td>
<td>0.001</td>
<td>_</td>
</tr>
<tr>
<td>lnINTR</td>
<td>-6.34</td>
<td>-4.22</td>
<td>I(0)</td>
<td>0.000</td>
<td>_</td>
</tr>
</tbody>
</table>

All the study variables, that is, demand for money, mobile money, ATM money, interest rate and income were found to be stationary at level and statistically significant at one per cent level. This implies that all the study variables are integrated of order zero I(0). This, therefore, implies that there was no co-integration since the variables are integrated in the same order (zero). As a result, co-integration analysis was not necessary.
The study used a pooled ordinary least squares (POLS) technique combined with a fixed effect estimation method to examine the determinants of study variables. Hausman estimation preferred fixed effect over random effect as presented in Table four. From Table four result, it was concluded that the regression results were free all econometric problems such as autocorrelation, heteroskedasticity and cross-sectional dependence hence the findings were deemed reliable. The regression result is presented in Table four below.

Table 4: Regression Result

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>Std. Error</th>
<th>t-Statistic</th>
<th>Prob.</th>
</tr>
</thead>
<tbody>
<tr>
<td>lnMOB</td>
<td>0.38</td>
<td>0.062</td>
<td>6.110</td>
<td>0.000***</td>
</tr>
<tr>
<td>lnATM</td>
<td>0.17</td>
<td>0.075</td>
<td>2.310</td>
<td>0.021**</td>
</tr>
<tr>
<td>lnGDP</td>
<td>0.26</td>
<td>0.074</td>
<td>3.579</td>
<td>0.000***</td>
</tr>
<tr>
<td>lnINTR</td>
<td>-0.53</td>
<td>0.206</td>
<td>-2.584</td>
<td>0.013**</td>
</tr>
<tr>
<td>lnCONS</td>
<td>0.83</td>
<td>1.178</td>
<td>0.708</td>
<td>0.483</td>
</tr>
</tbody>
</table>

Goodness of fit test

<table>
<thead>
<tr>
<th>Specification</th>
<th>Adjusted R-squared</th>
<th>Prob.</th>
</tr>
</thead>
<tbody>
<tr>
<td>F-test</td>
<td>0.88</td>
<td>735.951</td>
</tr>
<tr>
<td>Hausman test</td>
<td>Prob &gt; chi²</td>
<td>5.12</td>
</tr>
<tr>
<td>Wooldridge test</td>
<td>Prob &gt; F</td>
<td>41.50</td>
</tr>
<tr>
<td>Breusch-Pagan LM test</td>
<td>Prob &gt; chi²</td>
<td>15.48</td>
</tr>
<tr>
<td>Modified Wald test</td>
<td>Prob &gt; chi²</td>
<td>13.91</td>
</tr>
</tbody>
</table>

From the regression result, the coefficient of mobile money is 0.38 and positively significant. This implies that a one per cent increase in the number of mobile money transactions leads to about a 0.38 % increase in money demand in the East African economy. This positive relationship between mobile money and the demand for money could be attributed to an increased number of mobile money accounts and mobile money agents in the EAC which leads to an increased number of mobile money transactions and efficiency hence an increase in the amount of mobile money held in the form of mobile money coupled with improved efficiency. The increase in the amount of money held in the form of mobile money results in an increase in the demand for less liquid money in EAC economy. The results coincide with the findings of previous studies such as Mwangi's (2014) study in Kenya, Wahyunda's (2021) in Indonesia and Nakamya's (2014) in Uganda attributed to increased efficiency and low transaction cost. The findings support theoretical works of Baumol-Tobin inventory hypothesis which attribute increase in money demand due to reduction in transaction cost.
The coefficient of ATM money is 0.17 and positively significant. This implies that a one per cent increase in the number of ATM money leads to an increase in money demand by 0.17%. The coefficient is positive and conforms to economic theory specifically the Keynesian theory of money demand which outlined the three motives for holding money (transaction, speculative and precautionary). As the number of ATMs increases, the number of ATM transactions also increases hence increasing transaction money demand. As captured in inventory theory, ATM money enables economic agents to conveniently pay for goods and services using ATM cards and thus can be attributed low transaction cost involved. This particular finding that ATMs have a positive effect on money demand coincides with the findings of Nakamya (2014) in Uganda and Wahyunda (2021) in Indonesia.

For the case of income, the coefficient is 0.26 and positively significant. This means that a one per cent increase in income results in a 0.26% increase in money demand in East Africa. This finding is positive and conforms to the Keynesian theory of money demand. Keynes (1936) identifies income as the major factor that influences demand through transaction motive. As income increases the economy is likely to experience an increase in purchases and thus grow demand for money. The finding of this study is similar to the results of Kipsang (2013) and Mwangi (2014) in Kenya.

For the case of interest rate, the coefficient is 0.53 and negatively significant. These findings conform to the Keynesian theory of money demand. The demand for money usually stems from the trade-off between the liquidity benefit of holding money and the interest benefit of holding other equivalents of money (Handa, 2009). Moreover, Keynes opined that money demand for speculative motive is interest rate elastic since the interest rate is one of the opportunity costs of holding money variables. The finding of this study is similar to the finding of Kipsang (2013) and Mwangi in Kenya.

**Conclusion**

The objective of this study was to examine the determinants of demand for money in East African countries. Quantitative research design was employed with panel data technique while the data were obtained from secondary sources. The study period was from 2007 to 2020 for four EAC
countries. The results of panel fixed effects regression analysis have identified Mobile money, ATMs money and income positively influence money demand balances while interest rates slow money demand growth in EAC. The findings largely concur with the theoretical literature of Keynes and Inventory model which lists income, interest rate, and ATMs/Mobile money as key determinants of money demand in any economy. Similarly, the findings concur with most past empirical studies in developing and developed economies. This implies, that monetary authorities in the EAC need to include these variables when carrying out monetary aggregates targeting framework. This will render the model efficient for prediction and policy making. These monetary targets and objectives include a low level of inflation, an appropriate exchange rate, a high GDP growth rate, price stability, and a higher level of investment and savings. The findings of the study, therefore, provided a platform for the formulation and implementation of an effective monetary policy in the EAC.

The monetary authorities in the EAC should ensure that they keep a keen check on the ever-changing monetary aggregates due to financial innovations that might cause structural changes in the monetary environment. Such monitoring will allow adjustments to be made to monetary aggregates in case of the emergence of new forms of financial innovations such as mobile money and ATMS that might significantly affect the demand for money. For instance, they can make it easier for economic agents to make transactions i.e., improved payment systems. However, at the same time, they might complicate the monetary environment in which monetary policy is implemented. The governments of EAC need to stabilize the macroeconomic environment in which sound policies are formulated and implemented by the fiscal and monetary authorities. For instance, the Central bank needs to reduce interest rates to influence money demand positively in EAC. This will, in turn, create a stable macroeconomic environment that drives financial deepening as well as the development of new financial products in the EAC’s financial sector and spur income growth. The EAC governments, thus, need to come up with regulatory frameworks aimed at regulating, harmonizing and protecting economic agents using various forms of financial innovations such as mobile money and use of ATMs.
References


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