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Stability and Determinants of the Demand for Money in Kenya

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Abstract:
The structural characteristics of the Kenyan economy and its economy raise the issue of the correct monetary policy for the country, money demand takes a key role in macroeconomics in general and monetary economics in particular, which is why a stable feature of money demand is generally considered necessary for the formulation and conduct of an effective monetary policy. The goal of the study was to investigate the stability of the demand for money in Kenya using recent data due to lack of consensus. A clear understanding of the stability of money demand is important given its consequences for the formulation of monetary policy. The study employed Johansen testing approach for co-integration analysis based on the multiple regressions models and used annual data over the period 1982 to 2014. The purpose of the thesis was to investigate empirically the long-term and short-term determinants of demand for money, and to evaluate how demand for money reacts to inflation, treasury bills, gross domestic product, and commercial bank rates. To achieve these goals, it was hypothesized that the demand for money will make a significant contribution to the implementation of monetary policy by the use of the VECM. Empirical analysis was carried out successfully in R Econometric software; the critical values of ADF were non-stationary at-4.15 at 1%,-3.50 at 5% and-3.18 at 10%, suggesting the possible co-integration of the variables. The study utilizes the long-term correlation between the demand for money and its determinants, the multivariate p-value of the test: < 2.2e-16 acts as a way of cross-checking from a medium to long-term perspective. The results indicate that the demands of the broad monetary aggregates are stable. The existing system in which M2 is considered to be the intermediate target variable of monetary policy may therefore be considered acceptable. It is important that monetary authorities turn their attention to the sectoral implications of money demand for successful monetary and fiscal policies in Kenya. In order to achieve the desired policy goals, policy makers should consider the effect of aggregated real income components on the recognition of different inputs and feedback on them against their policy instruments. This eliminates the bias of the aggregate. Researchers can also take the same path and investigate the role of sector money demand in supporting policy design and management. On the basis of these results, stability and monetary demand determinants suggest that monetary targeting is a viable choice for the conduct of monetary policy for the Central Bank of Kenya.

Keywords: *Money stability, VECM*

1. Introduction

1.1. Background to the Study

Money is something recognized as a form of payment. The description of money is not correct. We will use a very technical concept (monetary aggregates) for analytical purposes, as Ozdemir and Saygili (2013) describe money as currency (bank notes and coins) in the hands of the public (households, businesses and government) plus sight deposits (bank accounts payable on demand, also called demand deposits or check accounts). This monetary sum is referred to as M1. M1 = currency in circulation + deposits in sight.

Banks offer enticing accounts that carry interest but cannot be drawn on a test as Akkas (2009) argues; he further argues that these funds can easily be converted to standard sight deposits. The ease of transition makes these assets somewhat close to sight deposits. They are included as M2 in the second definition of capital. M2 = M1 + time (or savings) deposits in banks with unrestricted access.

A wider measure involves instruments such as large deposit certificates or time deposits with longer term and theoretically limited access and foreign currency deposits with non-bank institutions. These instruments are less liquid, which means that they are more expensive or difficult to turn into cash or bank accounts (Sichei and Kamau, 2012). It's named M3. M3 = M2 + larger fixed-term deposits + accounts for non-bank institutions.

Such definitions are inherently vague and vary from country to country. Money is generally thought of in its narrower definition of M1. The study estimates the competitive demand for money (M2) in Kenya; it is a key issue in monetary economics. This is because a steady demand for money is necessary for an effective monetary policy (Opolot,

2006). From regular IS-LM models and their extension to open economies in the Mundell-Fleming fashion to international monetary models and modern classic models, money plays a central role in Kenya.

According to conventional economics, the principle of the quantity of money stock will decide the general level of prices while, according to Taylor (1994), the money stock of the monetarist will affect economic activity in the short term. In other words, there is a relationship between money supply and inflation, and this relationship is an essential aspect of macroeconomic policy as governments seek to manage inflation.

Money demand is the driving force behind the transmission mechanism for both monetary and fiscal policy (Sichei and Kamau, 2012). In the end, monetary demand stability is critical if monetary and fiscal policy is to have consistent overtime effects on real production and price rates. As well as being at the heart of the issue of monetary policy effectiveness, demand for money is critical in assessing the welfare consequences of policy changes and in determining the role of signage in the economy (Narayan and Mishra 2009).

Kenya's monetary policy aims to affect money credit and prices through the liquidity status of banks and other associated financial institutions. Given that demand for money helps to assess the liquidity needs of the economy, knowledge of the factors that determine this role and the existence of a stable long-term relationship between these factors and the money supply are valid enquiries by monetary authorities and researchers. As a result, this position of demand for money in the monetary cycle has produced quite a substantial body of empirical work (Skrabic and Tomic, 2009). AL-Abdulrazag and Dahlan (2011) offer the key reason for keeping money to facilitate transactions. The actual amount of economic activity must therefore be a significant factor in deciding the demand for money. We should expect a positive relationship between real GDP and demand for money. Money is paid for its buying power, and that purchasing power is determined by the price level. With higher prices, people are rising their appetite for money, which contributes to a positive relationship between prices and demand for money.

The study analyzes Kenya's long-term stability and the determinants of demand for money in order to achieve a stable demand for money for Kenya and forecast future rates of demand for money. Before addressing this problem, however, it is important to provide an adequate context for this study. Through the Economic Survey (2012), an introduction to Kenya through its historic emergence to its new global socio-economic position in the home of sub-Saharan Africa, a number of empiric cash demand studies have been effective in finding stable money demand relationships (Sichei and Kamau, 2012).

1.2. Problem Statement

Previous structural features of the Kenyan economy and its economic performance raise the issue of the correct monetary policy, with particular reference to the post-1990s era, the Goldenberg scandal, the 2000 Anglo Leasing Corruption scandal and post-election violence experienced in the region in 2007/2008, an era that led to the devaluation of the shilling. As a result, the country has been forced to implement systemic adjustments in the supply of financial services in order to stabilize the monetary performance of the economy (International Monetary Fund – IMF, 2013).

The study discusses one of the main issues in the theory and application of macroeconomic policy to the stability of demand for capital. This stability is a required condition for the accuracy of forecasting the effect of money on the real variables of the economy. Money demand plays a key role in macroeconomics in general and monetary economics in particular, and thus a stable feature of money demand is generally considered necessary for the development and conduct of an effective monetary policy.

1.3. The Specific Objectives of the Study Were to

- Analyze how money demand responds to inflation rates.
- Determine the influence of treasury bills and bonds on money demand in Kenya.
- Find out the impact of commercial bank rate on money demand in Kenya.
- Explore the effects of Gross National Product on demand for money in Kenya.

1.4. Significance of the Study

A stable demand for money is essential for the conduct of effective monetary policy while its estimation is crucial for policy making because it has a direct role in the trading activity of the market economy hence an effect on the general price level, (International Monetary Fund – IMF, 2013).

This study was to find out the basic relationship between the quantity of money individuals wish to hold and other variables on which that quantity depends on and establish its impact on stability of the money demand in the market. The study contributes to our understanding as to which monetary aggregation methodology yields a stable money demand in the context of ever globally increasing financial innovations. It will also benefit Ministry National Treasury and the Central Bank of Kenya, who are the main monetary policy makers, and other scholars who wish to study money demand aggregation (Economic Survey, 2012). The present study aimed to fill the existing gap in literature related to developing countries by providing a case study about Kenyan economy, and seeks to explain the factors that underlie the stability or instability of money demand (AL-Abdulrazag and Dahlan, 2011)

1.5. Limitations of the Study

The data sources relied on were mainly secondary data materials. The fact that meant that they might have been altered before documentation in order to suit the needs of the writer as per objectives under his/her study.

Another of the limitations of the present study was that, the effects of the credit boom witnessed in Kenya in the last decade were not directly incorporated into the formal model. This is largely due to data considerations as the relevant

variable measuring the credit supply is only available since 2003, which are rather short for modeling purposes within the cointegration framework adopted in this study. Nevertheless, assessing the effects of the credit boom on money balances and, possibly, on other economic variables such as consumption, is an interesting and highly relevant extension of the current thesis that is worthwhile pursuing in future research.

2. Literature Review

2.1. Theoretical Contributions

2.1.1. Classical Economics

Economics, starting with the classical tradition, prevailed over the four main functions mentioned below to formulate their money theories. According to Bahmani-Oskooee and Gelan (2009) on Classical Theory, all goods markets are continuously cleared and relative price stability is balanced to ensure that the equilibrium is achieved. The economy is always at full employment rates, with the exception of the occasional deviation due to real disruptions. In such an economy, the function of money is clear, it serves as a numeraire that is a commodity whose unit is used to convey prices and value, but whose own value remains unaffected by that function. It also promotes the exchange of goods (medium of trade) as Brooks (2008) points out that the use of money satisfies a double coincidence of wants. This does not, however, affect the calculation of market prices, real interest rates, the balance of goods and the amount of real profits. Money is 'good' with no clear economic consequences. Its role as a store of value is perceived as limited by the traditional assumption of information and negligible transaction costs (Narayan and Mishra, 2009).

The cost of the modern theory of money demand started to emerge from the early contributions of Leon Walras (1908), whose theory of money demand is simply part of his general theory of contribution equilibrium. Apart from Walras, there was little focus on money demand per se in the pre-1900 contributions of classical economists like Mill (1848) and neoclassical economists like Wicksell (1906) of the early 20th century, given the strong recognition by these scholars that a certain amount of real money holdings would be needed by economic agents under a specific set of circumstances. The definition of money holdings began to take a formal shape in quantity theory, especially through the writings of Moutot and Vitale (2009). Earlier Fisher (1911) provided the popular formulation of quantity theory via the so-called exchange equation.

2.1.2. Quantity Theory

Quantity theory gives rise to a direct and proportionate relationship between the quantity of money and the price level. In the classical equilibrium system, this relationship was formed by two alternative but similar expressions (Schumpeter, 1954). The first version, called the 'equation of exchange' is linked to Irving Fisher of Yale University and the second 'Cambridge approach or cash balance approach' is linked to the Cambridge University economists, in particular (Buigut, 2009).Skrabic and Tomic-Plazibat (2009) versions are mainly concerned with money as a means of exchange and therefore generate models of transaction demand for money. Although Fisher (1911) concentrated on the structural aspects of the payment system in his analysis, Cambridge economists focused on individuals' reasons for keeping money.

2.1.3. Fisher's 'Equation of Exchange'

In the classical quantity theory, demand for money was not even mentioned; instead, the focus was on the principle of 'transactions speed of circulation of money,' which calculates the average number of times a unit of money is used to carry out transactions during that period. This theory, consistent with Fischer (1911), is based on the 'equation of exchange,' $M_S V_T = P_T T$, which relates to the quantity of money in circulation (MS) to the amount of transactions (T) and the price level of goods exchanged (PT) over a period of time by a proportionality factor (VT) called the 'transaction velocity of circulation. This equation is not an identity; it is a state of equilibrium. Money is kept simply to facilitate transactions and has no intrinsic utility (Tang, 2007). Fisher's writings, Schumpeter (1954) pointed out that the exchange equation (MS) is normally the essential 'active' variable and (PT) the 'passive' factor. While MS, VT, and T are only 'near triggers' of PT, there are dozens of other variables acting on PT through MS, VT, and T. The velocity variable integrates the technical factors and is supposed to be stable in the short term. The quantity of money is supposed to be calculated independently of the other variables shown in the equation, i.e. the variable (T), the number of transactions.

Within the classical economics context of the balance of full employment, it is believed that there is a stable relationship between the amount of transactions and production (Civcir, 2003). In view of these factors, the exchange equation can be shown as; $M_S V_T = P_T$where M_S, V_T, and T imply that these variables are calculated independently of others. It is evident from this context, by treating M_S, V_T, and T exogenous and holding V_T and T constant, that the amount of the balance of prices is strictly proportional to the quality of income, that is, and that income is 'neutral'

2.1.4. Cambridge Approach

An alternative paradigm to quantity theory relates the quantity of money to nominal income and underlines the role and significance of money demand in deciding the impact of money supply on price rates. This so-called Cambridge or Cash Balance Approach is mainly associated with the neoclassical economists Moutot and Vitale (2009) in particular and Marshall (1923), among others associated with Cambridge University.

Three problems presented by Rotich and Isaya (2007) vary from those discussed earlier in the cash balance method. First, priority is focused on consumer preference rather than on market balance. The Cambridge economists questioned what determines the amount of money that an individual person would like to possess, and the ability to

perform transactions makes money keeping appealing in comparison to the earlier approach of Fisher, who posed the question as to what determines the amount of money that the economy requires to carry out in a given quantity of transactions.

That is, the emphasis has changed from a model where V was decided by the payment process to one where agents have the desired demand for money (Moutot and Vitale, 2009). Second, money is held not only as a medium of trade as Fisher's case, but also as a store of value that satisfies its holder by adding convenience and security, and third, the principle of money demand is more clear as discussed below. In this relation, the Cambridge economist pointed to the role of wealth and the interest rate in deciding demand for capital. The Cambridge version of the quantity theory offers a more accurate explanation of the monetary equilibrium with the classical model by focusing on the public demand for money, in particular the demand for real money balances, as an significant factor deciding the amount of the equilibrium price associated with the quantity of money in question. Sanvi et al. (2011) The reliance on the Cambridge formulation on demand for money is noteworthy as it reflects both Keynesian and monetarist theories. More significantly, critical analysis has moved from systemic considerations and the needs of the society to the human actions of preference (Brooks, 2008).

2.1.5. Other Neoclassical Approaches

The neoclassical economists considered the primary role of money as a medium of exchange. It was sought for the command over goods and services that it provided. Money was economically interesting as it was spent and circulated throughout the system. Its store of value function was also emphasized (Bordo, 2009). One short coming however was there was no explicit role for interest rates in determining the demand for money in their writings. They attributed rather various other factors affecting the demand for money. For example Laidler (1993), suggested that the uncertainty about the future was a factor influencing the demand for money Moutot and Vitale (2009) postulated a negative relationship between money demand and the anticipated inflation, which was recognized by Marshall (1926).

Previously, the Cambridge economists implicitly stated the potential importance of the interest rate as a key variable affecting money demand by the term ‘other things are equal’ where the factor k in the Cambridge model discussed above contained possible influence of the rate of return on alternative assets. Lavington (1921) identified the interest rate as a key determinant of the marginal opportunity cost of holding money that Fischer (1930) later concurred. Hicks (1935) argued that the money demand theory should be built within a framework of traditional value theory, in which money demand is the outcome of a problem of choice among alternative assets subject to a wealth (balance sheet) constraint, and hence, is influenced mainly by anticipations of yields and risks of these assets as well as by transactions costs. However, it was Keynes who provided a convincing explanation on the importance of interest rate variable affecting money demand and emphasized the significance for macroeconomic analysis of the interest sensitivity of money demand, ‘liquidity preference’ (Sanvi*et al.,* 2011).

2.1.6. Keynesian Theory

Keynes offered a more thorough analysis than his predecessors, looking at the topic of money demand in a radically different theoretical context. When the classical and neo-classical economists analyzed the value of money demand in terms of 'money in motion,' that is, there is no hoarding probability because all income is expended (Wallace, 2005), Keynes examined money in terms of 'keeping' (as in the Cambridge approach) and concentrated on the motivations that lead people to hold on to money and demand for money because a result of these motives. Through this way, Keynes aligned himself with the Mercantilist view.

Keynes argued that individuals kept money for three reasons: trade, protection, and speculation. The transaction motive is analogous to the emphasis on quantity theories put on money as a medium of trade. He argued that the amount of transactions carried out by an individual, and also by an aggregate of individuals, has a stable relationship to the level of income, indicating that the ‘transaction demand’ for money depends on the level of income (Sanvi et al., 2011). The need for money transfers occurs as a result of non-synchronization of payments and receipts.

Individuals are also unsure about the payments they may like or need to make. He presumed that this precautionary motive often generates a demand for capital. Precautionary demand for money therefore sets out a contingency plan for unscheduled spending in unexpected circumstances. Money is used as a medium of exchange for this reason, and depends on the amount of income (Rotich and Isaya, 2007). Nevertheless, his major contribution to the theory of money demand derived from the role that speculative motive plays. The speculative demand for money is what Keynes called 'liquidity preference. ‘Keynes tried to formalize one element of Marshall's earlier (1926) suggestion that uncertainty about the future was a factor that affected demand for capital. Rather of thinking about uncertainty in general, Keynes focused on one economic variable, the future level of the interest rate, and, more precisely, on future bond yields.

The store of value feature is emphasized by Misati et al. (2010) on the speculative motive of the demand for money. Individuals may keep their wealth either in money or in bonds. The premium that individuals are able to carry on bonds depends on the interest rate, because prospective investors would prefer to receive at least the existing interest rate on their bond portion of their portfolio. Keynes argued that at every price there was a value, or even a set of values, of the interest rate that could be considered natural. If the rate is above this normal level, there is a tendency for people to expect it to fall and increase when the rate is below that level.

On Keynes's contribution to the theory of money demand, researchers have put forward a variety of other hypotheses, including income and interest rates as reasons to investigate the existence and determinants of the functions of money demand. Such theories indirectly present a wide variety of possibilities, with focus on sales, speculation, precautions or the value of keeping money (Bordo, 2009). After Keynesian we also have post- keynes theories on money demand, e-inventory-theoretic approach and consumer demand theory approach.

3. Research Methodology

3.1. Research Design

Based on existing theoretical and empirical literature, this research perceived a causal association between the stability of demand for money and economic development in Kenya. The descriptive design was therefore adopted to investigate the effect of other variables on demand for money in the Kenyan economy.

3.2. Area of Study

The study focused on the determinants of demand for money in the economy in general. Kenya was therefore the geographical field of research.

3.3. Types and Data Sources

The study was focused on the compilation and examination of secondary data used to explain patterns, display relationships and draw conclusions. The study relied mainly on data from the Kenya National Bureau of, Annual Journal Statistics for the period 1982 to 2012 on the determinants of money supply and demand in the economy.

3.4. Data Analysis

The data obtained was statistically analyzed using parametric procedures. In this method, 'R' Econometric Software was used for quantitative data and analyzed to test hypotheses. The findings were then presented descriptively and quantitatively within the context of the conceptualized system as set out in the objectives. The P value of each variable was determined to determine the significance of the variable at which the threshold for the rejection of the null hypothesis was set.

3.5. Models of Data Analysis

According to Keynes, money held for investment and precautionary purposes is mainly a function of income levels, LT = f (f) and speculative demand for money is a function of interest rates, L = f (r), so total demand for money is a function of both income and interest rates (Wallace, 2005).

$L = f(Y) + f(r)$ 3.1

$L = f(Y, r)$ 3.2

Where L represents the total demand for money

According to Sichei and Kamau (2012), demand for money is the guiding force behind the transmission process for both monetary and fiscal policy. To this end, the stability of demand for money is required to ensure that economic growth maintains in line with planned economic growth.

L = f {(Determinants of money demand)}

This study employed VECM in data analysis.

The money demand variables are defined by the four components in the study;

Md = f (Y, r) according to the Keynesian..... 3.3

Hence the model under study was derived as;

$M_{2t} = \beta_0 + \beta_1 Tbr_t + \beta_2 Inf_t + \beta_3 M_{1t} + \beta_4 Cbr_t + \beta_4 Gnp_t + U_t$ 3.4

Where;

M_{1t} = Narrow Money Supply

This is money supply category that includes all physical money such as coins and currency in circulation along with demand deposits and other financial assets that can easily be transformed into cash. This is the key determinant of demand for money; changes in these factors are what make it possible for certain expenditure to increase without reducing other expenditure.

M_{2t} = Wide Money Supply

It includes M1 plus short-term bank deposits and 24-hour money market funds.

Tbr_t = Treasury Bond Rate

It represents the relative demand and supply of money that the borrowers are going to lend; it's just like everything else that is being traded. When the demand for a product rises, the price increases.

Inf_t = Inflation

This is a persistent rise in the general price level for goods and services. That is because the general price level increases, every monetary unit buys less goods and services.

Cbr_t= Commercial Bank Rate

Commercial bank rate is an unsecured promissory note with a maturity of 1 to 270 days; it offers a way for companies to borrow money to meet short-term obligations. Commercial paper rates are the rates at which companies pay to borrow this money on the commercial paper market.

Gnp_t= Gross National Product

It is the total value of all final goods and services generated within a nation in a given year, plus the income received by its people (including those residing abroad) minus the income of non-residents residing in that country.

Gross net product calculates the value of goods and services generated by people of the country irrespective of their location. Gnp is a measure of the economic situation of a country on the premise that higher Gnp contributes to higher quality of life and thus higher demand for investment capital.

Subscript $_t$ = the time period for the data 1982 to 2012

U_t= is the stochastic or Error term
β_0, β_1, β_2, β_3, and β_4>0 are regression coefficients.

3.6. Autocorrelation Function

Autocorrelation is the association between the variable lagged at one or more intervals and the variable itself. Correlogram or autocorrelation function is an autocorrelation graph for different lags of time series results. According to Gujarati (2003), autocorrelation coefficients for variable time lags refer to a condition in which two or more consecutive errors are correlated. It is a common problem in time series data and, due to most regression problems involving time series, the data show positive autocorrelation.

3.7. Cross Plots

Cross plots is another way to visualize petrophysical data. It is important to analyze the direct relationship between the two variables. Cross plots provide an intuitive graphical method to look at co-movements between two different variables, cross plots may show much more about structure than standard log depth, as it may also be helpful to compare the plot with a simple OLS regression line as well as a non-parametric approximation (Luetkepohl, 2005).

3.8. Tests for Stationarity

A stationary series (weak or stationary covariance) is that which has a constant mean and variance for each given time period and 'the value of covariance between the two time periods depends only on the distance or lag between the two time periods and not on the time at which the covariance is measured' (Gujarati, 2003). A series that is not stationary shall be referred to as non-stationary. When a sequence is non-stationary, it must be separated d times before it is stationary. It is then stated that order d is incorporated. This is indicated as I (d), where d is the order of integration. The order of integration refers to the number of unit roots in the sequence or the number of differentiation operations required to make the variable stationary.

An I (0) series is a stationary one, while the I (1) series comprises one root unit. Classical regression models deal with the relationship between stationary variables, but most economic indicators usually follow a non-stationary course. The use of non-stationary data will lead to spurious results or the danger of running a nonsense regression. In such a case, the results will be meaningless. The usual t-ratios will not follow a t-distribution and the F-statistic will not follow an F-distribution. It is likely that significant t-ratios and a high R^2 will be obtained even though the trending variables are completely unrelated (Johansen, 1995).

There are several tests for stationarity including a visual plot of the data, unit root test and those that directly test for stationarity, among others. This study made use of the Augmented Dickey-Fuller (1981) which is discussed below. According to Gujarati (2003), the stationarity of the time series can be evaluated directly with the root unit test. Dickey-Fuller (DF) and Augmented Dickey-Fuller (ADF) are the most commonly used root test systems. The purpose of the DF test is to check the null hypothesis in the data collected.

Equation:

$\Delta y= \beta_2 t + \omega y_{t-1} + v_t$…… 3.5

The hypotheses for the above equation would be:

H_0: Series contains a unit root (H_0: ω =0)

H_1: Series is stationary. (H_1: ω <0)

In practice, models under the above hypotheses have three cases:

- When there is a test for a random walk against a stationary autoregressive process of order one (AR(1)).
- When there is a test for a random walk against a stationary (AR (1)) with a drift.
- When there is a test for a random walk against a stationary (AR (1)) with a drift and time trend.

For ease of computation and interpretation, Dickey Fuller test employs the following equation:

$\Delta_y = \beta_1 + \beta_2 t + \omega y_{t-1} + v_t$…… 3.6

Whereyt is the relevant time series, Δ is the first difference operator, t is the linear pattern, and vt is the error term. The error term should satisfy the assumptions of normality, constant error variance and independent (uncorrelated) error conditions. According to Quinn (1980), the findings based on the DF test would be skewed if the terms of the error are not independent of the above equation. The drawback of the DF test is that it does not take into account potential autocorrelation in the error phase or term (vt). To fix this limitation, the ADF can be used and this function 'increases' the function using m lags of the dependent variable.By inserting a lagged difference term on the right side of the DF equation, this test corrects a high-order serial correlation. The following equation is used by ADF:

$\Delta_y=\beta_1+\beta_2 t +\omega y_{t-1}+\sum_{i=1} d_i \ \Delta y_{t-I} +v_t$…….. 3.7

3.8.1. The VAR Model

VAR is classified as a system of ARDL equations describing the dynamic evolution of a set of variables from their common history (here vector involves multiple variables involved) VAR consists of a set of K endogenous variables for k = 1

VAR_p -process is then defined as:

$$Y_t = A_1 Y_{t-1} + \cdots + A_p Y_{t-p} + \varepsilon_t$$ ……3.8

With A_i are $(K \times K)$ coefficient matrices for $i = 1,\cdots, p$ and ε_t is a K -dimensional process with $E(\varepsilon_t) = 0$ and time invariant positive definite covariance matrix $E(\varepsilon_t \varepsilon_t^T) = \sum_\varepsilon$ (white noise process) that follows standard Wiener process (Johansen and Julius, 1990).

An important distinctive of a VAR_p -process is its stability i.e. it generates stationary time series with time invariant means, variances and covariance structure, given sufficient starting values. Stability was tested by evaluating the characteristic polynomial:

$$\det(I_K - A_{1z} - \cdots - A_p z^p) \neq 0 \quad \text{For } |z| \leq 1 \quad \text{.....3.9}$$

If the solution of the above equation has a root for z = 1, then either some or all variables in the VAR_p -process are integrated of order one, that is, I (1). It might be the case, that cointegration between the variables does exist. This instance can then be better analyzed in the context of a VECM. In practice, the stability of an empirical VAR_p -process can be examined by considering the companion form and measuring the eigenvalues of the coefficient matrix. A VAR_p -process can be written as a VAR_p -process:

$$\xi_t = A\xi_{t-1} + \upsilon_t \quad \text{.....3.10}$$

$$\xi_t = \begin{bmatrix} Y_t \\ \vdots \\ Y_{t-p+1} \end{bmatrix}, \; A = \begin{bmatrix} A_1 & A_2 & \cdots & A_{p-1} & A_P \\ I & 0 & \cdots & 0 & 0 \\ 0 & I & \cdots & 0 & 0 \\ \vdots & \vdots & \ddots & \vdots & \vdots \\ 0 & 0 & \cdots & I & 0 \end{bmatrix}, \upsilon_t = \begin{bmatrix} \upsilon_t \\ 0 \\ \vdots \\ 0 \end{bmatrix} \quad \text{.....3.11}$$

According to Gujarati (2003), the VAR model has some positive features. First, it's really easy because we don't have to think about which variables are endogenous or exogenous. Second, the calculation is also very straightforward, in the sense that each equation can be calculated separately with the OLS process. Third, the predictions obtained from VAR models are, in most cases, stronger than those obtained from much more sophisticated simultaneous equation models (Edgerton and Shukur, 1999). In addition to the forecasting purposes, VAR models also provide a basis for causality checking.

3.9. Cointegration Tests

The data was co-integrated using the Johansen (1995) co-integration test process. Co-integration is the presence of a long-term relationship (co-movement) between variables in a non-stationary sequence. It is necessary to determine the order of integration of the individual time series before testing for co-integration. The vector X_t is integrated in order d (1) if it is stationary for the first time after it has been differentiated d times. Cointegration also maintains that 1(1) can be calculated using the OLS method and generate non-spurious tests.

The data was tested for cointegration by using Johansen (1995) cointegration process. Cointegration is the existence of long-term relationship (co-movement) between variables in a non-stationary series. It is necessary to determine the order of integration of the individual time series before checking for co-integration. A variable X_t is integrated of order d(1) if it becomes stationary for the first time after being differenced d times. Cointegration also asserts that 1(1) can be estimated using OLS method and produce non spurious results.

3.9.1. Johansen Technique Based on VARS

According to Gujarati (2003), the Johansen technique has many advantages over other co-integration techniques. The main goal of this co-integration was to determine whether or not the variables in the demand for the money model were co-integrated. The presence of a co-integrated relationship forms the basis of the vector error correction model (VECM) specification. The basis for this procedure is the identification of the number of co-integration vectors within the VAR model. A likelihood ratio test of the hypothesis procedure was used to identify the number of co-integration vectors. The preferable test for co-integration is the test of Johansen. This is a test that has all the statistical characteristics that are desirable. The drawback of the test is that it depends on asymptotic properties and is therefore vulnerable to design errors in small samples. At the end of the day, some judgment in combination with economic and statistical model building is inevitable (Johansen, 1995).

3.10. Diagnostic Testing

Regression diagnostics play a crucial role in establishing a reliable predictive relationship between dependent variables

3.10.1. ARCH-LM Test

The diagnostic test functions of the VAR package include arch test, normality test and stability. Former three functions return a list object with the VAR attribute class to test what plot and print methods exist. The plots for each

equation include the residual plot, the empiric distribution plot and the ACF and PACF residuals and their squares. The plot approach provides additional grounds for changing its appearance (Luetkepohl, 2005).

3.10.2. Portmanteau Test and Breusch- Godfrey LM Test

The Portmanteau test and the Breusch-Godfrey LM test were carried out in the serial feature test to check the lack of serial correlation in the residuals of a VAR_p . For both tests, small sample modifications were also determined, whereby Edgerton and Shukur (1999) implemented the adjustment for the LM test.
The Portmanteau statistic is defined as:

$$Q_h = T\sum_{j=1}^{h} tr(\hat{C}_j'\hat{C}_0^{-1}\hat{C}_j\hat{C}_0^{-1}) \quad \text{3.12}$$

The test statistic has an estimate $\chi^2(K^2h - n^*)$ distribution, and n^* is the number of coefficients excluding deterministic terms of a VAR_p - model. The limiting distribution is only valid for h tending to infinity at a suitable rate with growing sample size. Hence, the trade-off is between a decent approximation to the χ^2 distribution and a loss in power of the test, when h is chosen too large. The small sample adjustment of the test statistic is given as:

$$Q_{hh}^* = T^2\sum_{j=1}^{h}\frac{1}{T-j}tr(\hat{C}_j'\hat{C}_0^{-1}\hat{C}_j\hat{C}_0^{-1}) \quad \text{3.13}$$

The Breusch-Godfrey Lagrangian Multiplier statistic is based on the following auxiliary regressions (Johansen and Julius 1990):

$$\hat{\varepsilon}_t = A_1Y_{t-1} + \cdots + A_pY_{t-p} + CD_t + B_1\hat{\varepsilon}_{t-1} + \cdots + B_h\hat{\varepsilon}_{t-h} + \mu_t \quad \text{3.14}$$

The null hypothesis is: $H_0 : B_1 = B_2 = \cdots = B_h = 0$ therefore, the alternative hypothesis is the form $H_1 : \exists B_i \neq 0$ for $i = 1, 2, \ldots, h$.
The test statistic is defined as:

$$LM_h = T(K - tr(\sum\nolimits_R^{-1}\sum\nolimits_e^{\sim})) \quad \text{3.15}$$

Whereby $\sum_R^{-1}$ and $\sum_e^{\sim}$ assign the residual covariance matrix of the restricted and unrestricted model, respectively. The test statistic LM_h is distributed as $\chi^2(hK^2)$.

3.10.3. Lomniki-Jarque-Bera Test for Non- Normality

The Jarque-Bera (JB) (1990) test of normality is used to detect a violation of the OLS assumption of normal residual distribution in the model. This is against the assumption of the classical regression model that the residuals will generally be distributed with a mean 0 and constant variance. The consequence of violations of this principle is that model inferential statistics, such as the t-test and the F-test, are made null. The JB test is based on the skewness and curtosis of the distribution.

According to Quinn (1980), the Kurtosis of the normal distribution is 3 and the corresponding skewness is zero. Luetkepohl (2005) notes that the test checks whether the third and fourth moments of standardized residues are consistent with the standard normal distribution as used in the test statistics below:

$$JB = \frac{T}{6}\left[T^{-1}\sum_{t=1}^{T}(\hat{\upsilon}_t^s)^3\right]^2 + \frac{T}{24}\left[T^{-1}\sum_{t=1}^{T}(\hat{\upsilon}_t^s)^4 - 3\right]^2 \quad \text{3.16}$$

This statistic has an asymptotic distribution if the null hypothesis is correct (Jarque-Bera, 1990). In this thesis also skewness and kurtosis of the standardized residuals are reported, the null hypothesis of normality of a distribution is rejected if the p-value of the JB-statistic is greater than the chosen level of significance.

4. Results and Discussions

4.1. Descriptive Statistics Results

In the Table 1 below, descriptive statistics for the endogeneous variable results have been discussed. The description aids in embedding the model in an existing VECM tradition for money demand and an interpretation for the policy purposes.

Treasury bond rates reflect the relative demand and supply of money that borrowers will lend to the economy, inflation, as stated, is a gradual rise in the general price of goods and services. That is because the general price level increases, every monetary unit buys less goods and services.Narrow money supply is the key determinant of money demand; adjustments in these factors are what make it possible for some expenditure to rise without cutting other expenditure, whilst the commercial bank rate is spending and borrowing directly by raising the risk associated with the bank rate and expectations of more interest rate fluctuations, as well as raising the anticipation of money demand. Gross

National Product is the total value of the final goods and services generated by the economy of a nation over a given period of time typically measured annually.

Table 1 also provides the description of the minimum, mean and maximum values, which according to Green (2007) is the starting point for all statistical analysis. The goal is to obtain an overall view and an image of the entire research procedure.

Variable	Min	Mean	Max
Money su pply narrow (Ksh)	13352	170361	710744
Money supply wide (Ksh)	21324	352453	1469037
Treasury bank rate (Ksh)	1.410	13.682	39.340
Commercial bank rate (Ksh)	4.41	17.44	45.50
Gross national product (Ksh)	1046000	1591874	2149000
Infation rate (Ksh)	1.55	12.61	4 5.98

Table 1: Annual Average Distribution Rate of Monetary Instruments and Gnp
Source: Knbs 1982-2012

The Table 1 shows the minimum, mean and maximum distribution rates of monetary instruments and the GNP, over the period from 1982 to 2012.

From the analysis, it is very obvious that there is not much variability in the time series variables. It means that, irrespective of the swings encountered in the economy, booms and recessions, the demand for money has still stayed constant in line with economic growth. The comparisons between the minimum and the median average for the 30-year period also showed the same. This is of great significance as it explains what's going on in the results.

4.2. Autocorrelation Functions and PAC Tests

Analysis of data primarily foccused on two issues; first, whether there was a relationship between the amount of autocorrelation present in the graph and the inference based on visual analysis and whether the amount of autocorrelation differed over the different phases of the single subject graph. Second, when a substantial degree of autocorellation was present, visual analysis researchers were more likely to assume that there was no clinically important improvement in perfomance. Autocorellation values were substantially higher in the tratment phases of the single topic designs.

The behaviour of these variables over time is shown in the graphs as determined in Appendix 4. The resultant numbers range from + 1 to-1. Autocorrelation reflected a perfect positive correlation, with an increase in one of the time series variables under analysis contributing to a proportionate increase in the other time series variables, whereas a value of-1 represents a perfect negative correlation.

Such values have been useful for security research computing. For example, from the variables under analysis, if one has traditionally had a strong positive autocorrelation value and you have observed the variable making solid progress over the past few years, you may reasonably expect the movement over the next several years (the leading time series) to suit the slow time series and move upwards.

Regression analysis plays a crucial role in evaluating the validity of a good predictive relationship between variables. ACF is used to assess non-stationary involvement in the demand for money (Luetkepohl, 2005). This is the covariance function of lag k to variance ratio. Since the two (covariance and variance) are derived from the same data set and have the same function, ACF is therefore less or simply called a pure number.

The partial auto functions (PACF 'S) for time series variables are shown in Appendix 4. In this case, small values tend to be reached rapidly with an increasing number of observations.

Visual inspection of the correlograms gives a quick look at whether there is a large residual correlation remaining. The constant value of ACF and PACF varies between + 1 and –1, the graph of ACF checking for the presence of self-correlation, in fact, the crucial stage in the stability / instability of the monetary demand equation in the national economy, which has enormous implications for the effectiveness of the monetary policy course to be adopted by the Central Bank of Kenya.

In conclusion, therefore, the comprehensive series of ACF and PACF tests indicated in Appendix 4 imply that the variables under review do not pose any specification problems. As a result, short-term volatility in demand for large amounts of money during the Goldenberg scandal and post-election violence in 2007/2008 will seem to be a stable feature of adjustments in the gross national product, interest rates and lagged real money, as well as the ECM term, which captures variations in the real money stock from its desired balance position (IMF-2013).

4.3. Cross Plots

Cross plots help in selecting petrophysical parameters for money demand, identifying trends and problems, and compresses large amounts of data into small spaces. The cross plots showed a clear co-movement for all variables; this was the primary subject of the empiric investigation. The result introduces a definition of co-movement as a measure that precisely fits the notion of co-movement variables. The measure provides estimates for bivariate and multivariate time series for each time (t). The money demand study explains the determinants that indicate that co-movement has risen in recent years and that there is a varying asymmetry between negative and positive co-movements.

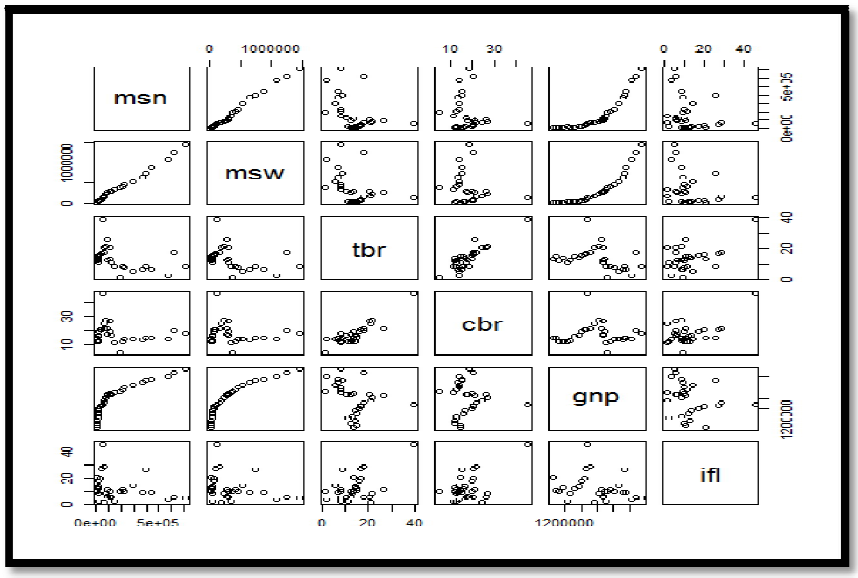

Figure 1: Cross Plots of Time Series Variables
Source: Own Data Analysis from R

If the demand for money is constant, a monetary policy consisting of a monetary rule that targets the rate of growth of the monetary aggregate (M2) tends to stabilize the economy or, at the very least, removes monetary policy as a source of macroeconomic uncertainty. In addition, if demand for money does not shift unpredictably, controlling money supply is a secure way to achieve a steady rate of inflation. This can be seen most easily with the varying co-movement of the variables of demand for money mentioned above.

4.4. Stationarity Analysis

4.4.1. Augmented Dickey-Fuller Unit Root Test

Variable	Deterministic Terms	Lags	Test Value	Critical Values		
				1%	5%	10%
MSN	Constant, trend	2	7.315	-4.15	-3.50	-3.18
DMSN	Constant	1	-1.354	-5.58	-2.93	-2.60
MSW	Constant, trend	2	1.300	-4.15	-3.50	-3.18
DMSW	Constant	1	1.841			
TBR	Constant, trend	2	-1.665	-4.15	-3.50	-3.18
DTBR	Constant		-5.751			
CBR	Constant, trend	2		-4.15	-3.50	-3.18
DCBR	Constant		-5.673			
GNP	Constant, trend	2	-2.335	-4.15	-3.50	-3.18
DGNP	Constant		-2.35			
IFR	Constant, trend	2	-2.219	-4.15	-3.50	-3.18
DIFR	Constant		-2.219			

Table 2: Augmented Dickey-Fuller Unit Root Test Results
Source: Own data analysis from R

The critical values of ADF test are -4.15 at 1% -3.50 at 5% and -3.18 at 10%. It can be concluded that all-time series are integrated of order (1).

4.4.2. Other Unit Root Tests

The test for unit root results using ERS, KPSS, P-P Z-A and S-P are reported in Table 3 below.

Variable	ERS	KPSS	P-P	Z-A	S-P
Money Supply Narrow	0.1831	1.1206	0.2782	-3.5082	-2.3940
Money Supply Wide	0.7228	1.1068	-0.1827	-3.3938	-2.5976
Treasury Bill Rate	-1.2061	0.5522	-17.1134	-6.3472	-5.3349
Commercial Bank Rate	-1.7575	0.1595	-12.6961	-4.5046	-2.8179
Gross National Product	0.9199	1.0998	-1.0000	-4.5574	-1.3838
Inflation Rate	-2.1368	0.1896	21.4138	-5.3307	-2.5252

Table 3: Other Unit Root Test Results
Source: Own data analysis from R

Both ADF and other unit root test conducted in the study as presented indicate that the variables are non-stationary at 1%, 5% and 10%. The non-stationary indicates the possible existence of co-integration between variables. The results further showed that the variables of the univariate time series became stationary on the first differencing.

Equation	parms	RMSE	R-sq	chi²	p>chi²
D_tbr	5	5.8506	0.6020	31.7574	0.0001
D_cbr	5	6.4574	0.4563	17.6216	0.0242
D_gnp	5	19.6822	0.8421	112.0215	0.0000
D_inmsn	5	0.0440	0.7295	56.6330	0.0000
D_inmsw	5	0.0323	0.8370	107.8383	0.0000
D_inifr	5	0.3474	0.4554	17.5601	0.0248

Table 4: The Results of Cointegration Analysis
Source: Own Data Analysis from R

Using Johansen cointegration test analysis, results shown above Table 4, the critical value remains at a higher value, the results are not however different when Chi² used to explain the results at all levels, it remains to be higher than its probability. The maximum number of parameters remains to be five, with one cointegration equation which explains the long run equilibrium relationships of the five time series variables.

After establishing the existence of long, the next step is to confirm these relations by estimating an error correction model for each monetary aggregate. For the four monetary aggregates considered in this study, the VECM term is highly significant thus confirming the existence of cointegration between M_1 and M_2 and the regressors. Establishing cointegration through the error-correction model, VECM term is considered the most efficient way in the bounds testing approach.

D_tbr	Coef.	Std.Err.	z	p>|z|	95% conf	Interval
cel L1	-.3837	.5840	- 0.66	0.511	-1.5283	.7610
tbr LD	-.8963	.4410	-2.03	0.042	-1.7607	-.0319
cbr LD	-4680	-4346	1.08	0.282	-.3839	1.3198
gnp LD	1287	.0685	2.20	0.028	.0140	.2433
inmsn LD	68.6041	36.9402	1.86	0.063	-3.7973	141.0055
inmsw LD	-1.6767	44.3944	-0.04	0.970	-88.6881	85.3346
inifr LD	3.8183	3.3512	1.14	0.255	-2.7499	10.3865
cons	-12.5362	6.8515	-1.83	0.067	-25.9648	.8925
trend	-.1927	.1771	-1.09	0.276	-.5397	.1543

Table 5: Results of VECM with Both Constant and Trend for the Treasury Bill Rate
Source: Own Data Analysis from R

The cointegration in D_tbr with other variables between 1982 to 2012 are shown in the Table 5 above. All variables are obviously stationary. Nonetheless there is a clear relationship between the time series, but it remains to verify whether the series of residuals is stationary.

In the case of tbr LD (random walk with different trend) the lagged value and the lagged first difference, the P-values 0.042 and 0.028, the analysis shows that in the short run D_tbr has significant autogressive effect both at lags one and two. Also, D_tbr is significant, affected lag one and not lag two in gnp LD. These indicate that, during the study period, this condition affected directly the monetary performance in short run equilibrium.

The data series is strongly contemporaneous correlated with both <0.05 with the degree of co-movement of D_tbr and gnp LD trends being correlated and each affects the lags within the cycle.

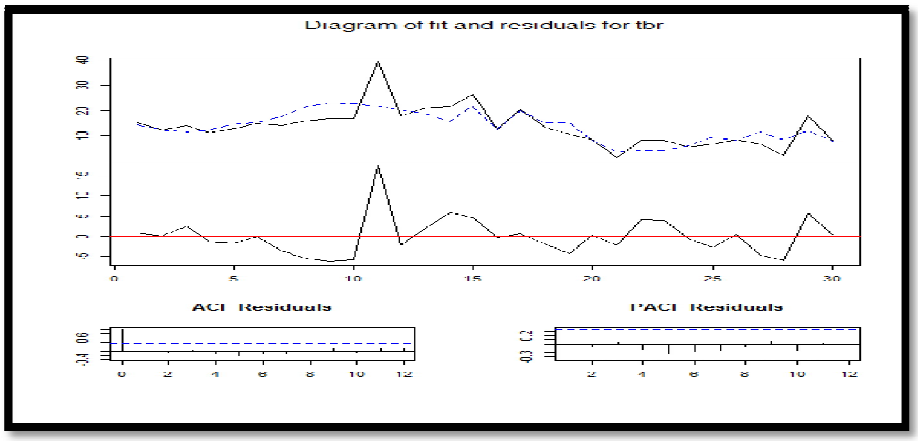

Figure 2: Results of VECM with Both Constant and Trend for the Treasury Bill Rate
Source: Own Data Analysis from R

D_cbr	Coef.	Std.Err	.z	p>|z|	[95% conf.	Interval]
Cel L1	.9412	.6446	1.46	0.144	-.3221	2.2045
tbr LD	-.9790	.4868	-2.01	0.044	-1.9330	-.0249
cbr LD	4937	.4797	1.03	0.303	-.4465	1.4340
gnp LD	.1089	.0646	1.69	0.092	-.0176	.2355
inmsn LD	74.8656	40.7716	1.84	0.066	-5.0452	154.7764
inmsw LD	-35.5801	48.9989	-0.73	0.468	-131.6162	60.4559
inifir LD	-1.7925	3.6988	-0.48	0.628	-9.0420	5.4569
cons	3.9559	7.5621	0.52	0.601	-10.8655	18.7774
trend	.0354	.2092	0.17	0.866	-.3747	.4454

Table 6: Results of VECM with Both Constant and Trend for the Commercial Paper Rate
Source: Own Data Analysis from R

Cointegration in D_cbr with other variables is indicated in the Table 6. It also remains to verify whether the series of residuals is stationary. In the case of c br LD (random walk with drift and trend), the lagged value and lagged first difference, the coefficient on LD (p-value 0.044< 0.05) and trend.

The analysis shows that the current performance of cbr has a significant autogressive effect on money demand meaning that the current performance is dependent of the last year's performance; also cbr is having a significant direct relationship with the rest of the variables in the lag, this contemporaneous correlation coefficient gives more information on the degree of significance co-movement between the monetary variables in the study and the cycle.

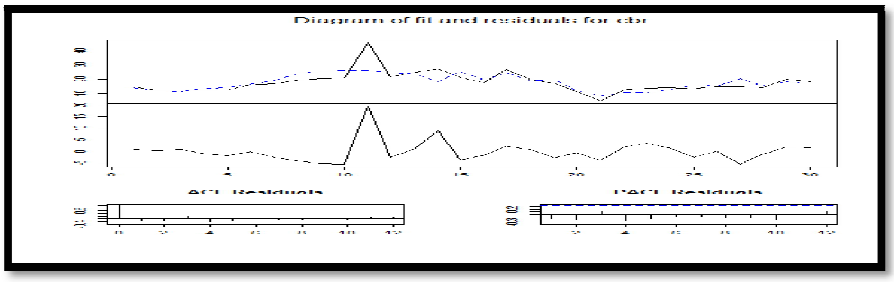

Figure 3: Results of VECM with Both Constant and Trend for the Commercial Paper Rate
Source: Own Data Analysis from R

D_gnp	Coef.	Std.Err.	z	p>|z|	[95% conf.	Interval]
Cel L1	-1.3067	1.9647	-0.67	0.506	-5.1574	2.5446
tbr LD	.7977	1.4837	0.54	0.591	-2.1101	3.7056
cbr LD	0.2917	1.4622	0.20	0.842	-2.5742	3.1576
gnp LD	.3980	.1968	2.02	0.043	.0123	.7837
inmsn LD	-147.6085	124.2729	-1.19	0.235	-391.1789	95.9620
inmsw LD	165.7733	149.3501	1.11	0.267	-126.9476	458.4941
inifir LD	-11.5400	11.2739	-1.02	0.306	-33.6365	10.5565
cons	6.5724	23.0495	0.29	0.776	-38.6039	57.7486
trend	0.3622	0.6098	0.59	0.553	-0.8330	1.5574

Table 7: Results of VECM with Both Constant and Trend for the Gross Net Product
Source: Own Data Analysis from R

The cointegration in D_gnp (p–value 0.043< 0.05) has shown a significant relationship at current year but not the last year performance since 1982. With the rest of the time series variables, results have shown that to attain short run equilibrium, with msn LD, this can be used to affect the determinants of money demand in the whole economy.
To achieve short run equilibrium therefore, the measure should be adopted based on inmsw, current performance of money demand in the economy.

The empirical regularities of the monetary variables were contemporaneous lag uncorrelated with the cycle; the deviation from their gnp trends were uncorrelated counter cyclical lags with the cycle.

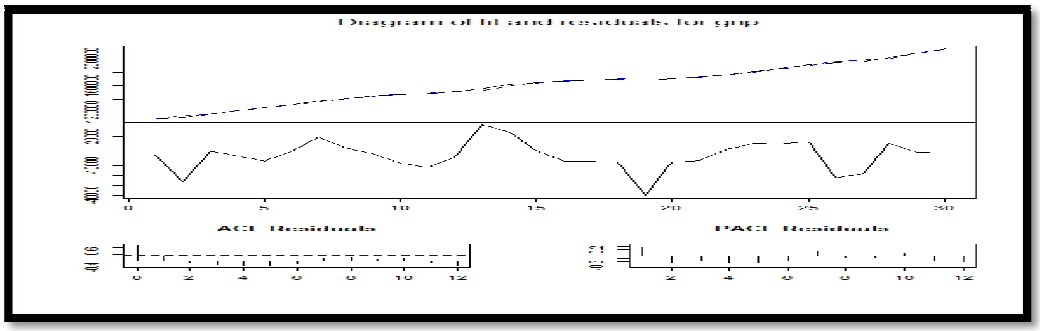

Figure 4: Results of VECM with Both Constant and Trend for the Gross Net Product
Source: Own Data Analysis from R

D_inmsn	Coef.	Std.Err.	z	p>|z|	[95% conf.	Interval]
Cel L1	0.0064	0.0044	1.46	0.145	-0.0022	0.0150
tbr LD	-0.0034	0.0033	-1.04	0.299	-0.0099	0.0031
cbr LD	0.0036	0.0033	1.09	0.277	-0.0029	0.0010
gnp LD	0.0001	0.0004	0.19	0.846	-0.0008	0.0009
inmsn LD	0.0635	0.2778	0.23	0.819	-0.4809	0.6079
inmsw LD	-0.2886	0.3338	-0.86	0.387	-0.9429	0.3656
inifir LD	- 0.0150	0.0252	-0.59	0.553	-0.0643	0.0344
cons	0.1368	0.0515	2.65	0.008	0.0358	0.2377
trend	0.0022	0.0013	1.63	0.103	-0.0004	0.0048

Table 8: Results of Vecm with Both Constant and Trend for the Narrow Money Supply
Source: Own Data Analysis from R

During the cointegration in D_inmsn, the result shows that the narrow money supply is dependent on the other determinants for money demand in the economy with constant trend p–value 0.819 and coefficient.
This has been revealed by significance of their coefficient at 95% confidence interval with inmsw LD -0.2886, this implies that for us to increase or decrease the supply of the narrow money supply in order to attain short run equilibrium then

wide money supply can be used to affect the net flow of narrow money in the economy. This is an indication that wide money supply takes a high percentage in determining the level of narrow money supply in the economy.
The data series is contemporaneous uncorrelated with the cycle; this shows the series is cyclical in that the degree of co-movement between the monetary aggregates is not significant.

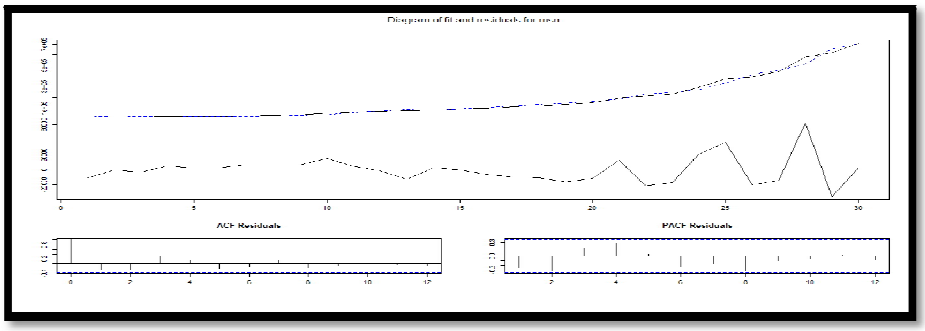

Figure 5: Results of VECM with Both Constant and Trend for the Narrow Money Supply
Source: Own Data Analysis from R

D_inmsw	Coef.	Std.Err.	z	p>|z|	[95% conf.	Interval]
Cel L1	0.0036	0.0032	1.11	0.266	-0.0027	0.0099
Tbr LD	-0.0027	0.0024	-1.12	0.263	-0.0075	0.0020
cbr LD	0.0036	0.0024	1.50	0.135	-0.0011	0.0083
gnp LD	-0.0001	0.0003	-0.25	0.801	-0.0007	0.0006
inmsn LD	-0.2324	0.2038	-1.14	0.254	-0.6319	0.1671
inmsw LD	0.6290	0.2449	2.57	0.010	0.1489	1.1090
inifir LD	-0.0142	0.0185	-0.77	0.442	-0.0505	0.0220
cons	0.0748	0.0378	1.98	0.048	0.0007	0.1489
trend	0.0002	0.0010	0.25	0.802	-0.0016	0.0021

Table 9: Results of VECM with Both Constant and Trend for Wide Money Supply
Source: Own Data Analysis from R

From Granger representative Theorem, if two or more variables Y and X's are cointegrated, then the relationship between the two can be expressed by ECM (Gujarati, 2007). This relationship is explained and determined in the foregone analysis and attempts to describe how money demand in the economy models directly estimate the speed at which monetary stability returns to equilibrium after a change in any of the determinants under study.
The empirical determinants of the monetary variables in the study were contemporaneous uncorrelated with the cycle, the deviation from the D_inmsw (p-value 0.010< 0.05) trends were uncorrelated with series counter cyclical and lags.

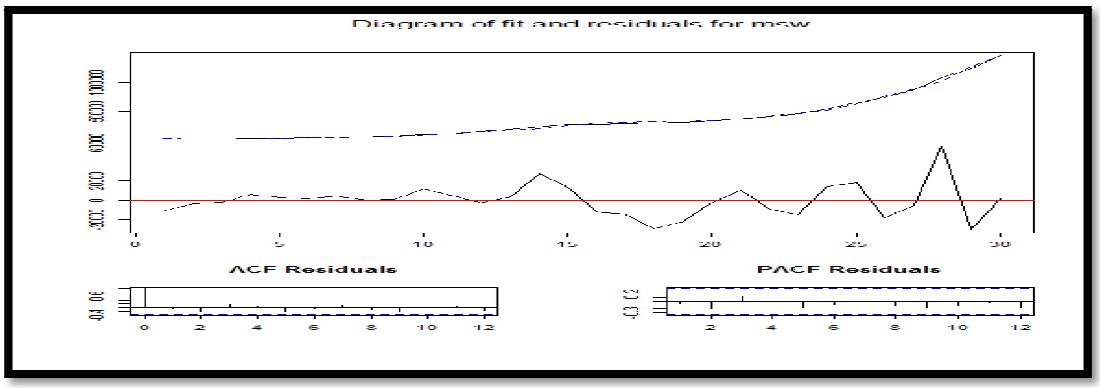

Figure 6: Results of VECM with Both Constant and Trend for Wide Money Supply
Source; Own Data Analysis from R

D_inifr	Coef.	Std.Err.	z	p>|z|	[95% conf.	Interval]
Cel L1	-0.0599	0.0347	-1.73	0.084	-0.1279	0.0080
tbr LD	0.0343	0.0262	1.31	0.190	-0.0170	0.0856
cbr LD	-0.0080	0.0258	-0.31	0.758	-0.0585	0.0426
gnp LD	0.0061	0.0035	1.75	0.081	-0.0007	0.0129
inmsn LD	3.9603	2.1932	1.81	0.071	-0.3383	8.2588
inmsw LD	-3.0349	2.6357	-1.15	0.250	-8.2008	2.1310
inifl LD	-0.1075	0.1990	-0.54	0.589	-0.4974	0.2825
cons	-0.9080	0.4068	-2.23	0.026	-1.7053	-0.1108
trend	-0.0181	0.0107	-1.69	0.091	-0.0391	0.0029

Table 10: The Results of VECM with Both Constant and Trend for the Inflation Rate
Source: Own Data Analysis from R

The cointegration results (p–value 0.589) in VECM with both constant and trend for the inflation rate as reported in the Table 10. From the results we conclude that because low, stable inflation is necessary for optimal economic growth, it is one of the main economic objectives of the central bank, which it tries to control by using its tools of monetary policy. However, to control inflation, its causes and their inter relationship in the economy must be understood.
The results show that the endogenous variables were not significant; this contemporary uncorrelated coefficient provides more details on the degree of co-movement of importance between the monetary variables in the analysis and the process.

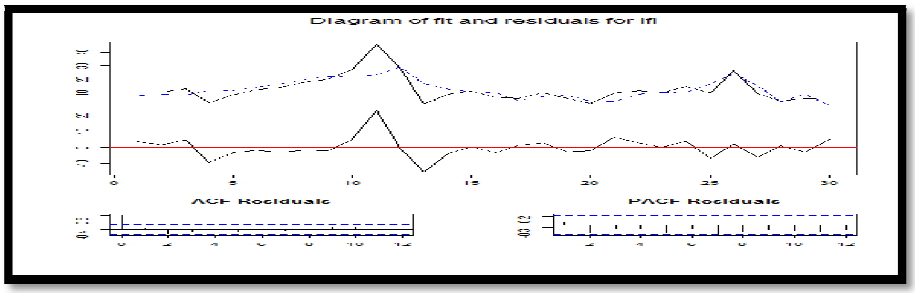

Figure 7: The Results of VECM with both Constant and Trend for the Inflation Rate
Source: Own data analysis from R

4.5. Stability Analysis

The stability analysis of monetary variables focuses on the long-term horizon. It exploits the long-term link between the demand for money and its determinants, and the stability analysis serves as a means of cross-checking from a medium to long-term perspective. Output shows that the variables are linked together, even though they are all trending and drifting.

Test method	chi2	df	p-value
Portmanteau Test (asymptotic)	488.9578	540	0.9435
Portmanteau Test (adjusted)	678.171	540	4.591e-05
Jacque-Bera Test	202.9979	12	<2.2e-16
Skewness only (multivariate)	50.9001	6	3.102e-09
Kurtosis only (multivariate)	152.0978	6	<2.2e-16
Breusch-Godfrey LM	180	180	0.486
Edgerton-Shukur F test*	180	-69	0.000
ARCH (multivariate)	468.7667	441	0.174
ARCH (multivariate)	588	882	1
ARCH (multivariate)	525	2205	1
ARCH (multivariate)	567	1323	1

Table 11: The Results of Stability Analysis Using Various Tests
(*) Edgerton-Shukur Uses F Test
Source: Own Data Analysis from R

Forecast Horizon	msw	tbr	cbr	gnp
[1,]	0.00411494	0.001234209	0.730456550	0.2641942998
[2,]	0.92878043	0.036733903	0.026626018	0.0078596527
[3,]	0.96982657	0.015960647	0.011655177	0.0025576040
[4,]	0.98732097	0.005746901	0.005952461	0.0009796710
[5,]	0.99270401	0.002954690	0.003777424	0.0005638772
[6,]	0.99494311	0.001848617	0.002795089	0.0004131825
[7,]	0.99607556	0.001455022	0.002155611	0.0003138088
[8,]	0.99688541	0.001139335	0.001732442	0.0002428099

Table 12: Forecast Error Variance Decomposition
Source: Own Data Analysis from R

In the final step, Forecast Error Variance Decomposition was conducted, this was done so as to estimate the value performance of a variable at some future point in time and in this study forecasts were done for the next 16 levels. In this section however, plotting of forecast data forms the main core.

This was necessary to aid in decision making and planning for the future. The section was found relevant to help in policy implication. This is guided by the core principle that if we can predict what the future will be like based on the previous year's performance analysis, we can modify our behavior now to be in a better position than use otherwise would have been, when the future arrives.

All forecasting methods are very involving and tedious repetitive calculations. This increases the probability of erroneous results, so the study ideally chose to use the 'R' econometric software for forecasting.

Based on these four variables, the decomposition tells us the proportional contribution of policy shocks to variations in the economy. It gives us a good idea of the transmission mechanism because we see whether a policy action has a negative or positive impact on target variables. Reduction in M_2 increases interest rates; therefore it reduces bank lending rate and directly affects the time series variables under study.

5. Summary, Conclusion and Policy Implications

The purpose of the study was to explore issues related to the demand for macro money for Kenya, with particular reference to the post-1990 era, the Goldenberg scandal, the 2000 Anglo Leasing Corruption scandal and post-election violence experienced in the country in 2007/2008, a period that led to the devaluation of the currency. This led to major financial disruption, including changes in the institutional arrangement providing a large network of financial infrastructure, after which most of the donor agencies withdrawn from Kenya 's assistance, which forced the country to structure the growth of its financial markets, structural changes in the supply of financial services to stabilize the economy's monetary performance.

The study shows that broad demand for money is a stable function of aggregated demand for money, with a focus on M2 in Kenya between 1982 and 2012, given the effect of the economic recession experienced during the data collection period. In the long term, the demand for money appears to have a dominant effect on inflation. The inflation rate of M2 is even higher than that of real income, which suggests a problem with targeting M2 in Kenya. Preferred demand for money has shown that income and inflation rates are significant determinants in the short term.It has been shown that the variability of the inflation rate is not important for M2 growth. A significant part of the study is the measurement of the super-exogeneity of the parameters of the chosen model. The preferred model was found to be stable, while the marginal models could not survive the stability test.

Keynesian school of thought claims that the interest rate is a key variable in the model of demand for money. In the Keynesian model, economic agents are expected to hold money for transactional and speculative purposes. These motivations are, to some degree, motivated by the interest rate as an opportunity cost measure. In this regard, the relationship between the demand for money is expected to be negative. Nonetheless, this study finds a positive interest rate on demand for capital, a trend that opposes both Keynesian and monetarist viewpoints.

The Central Bank of Kenya should be concerned with exchange rate stability as well as price stability. On the other hand, the Central Bank must make the path from a fixed exchange rate to a more flexible one, taking into account that the choice of a flexible exchange rate is likely to be of secondary importance to the sound development of fiscal, financial and monetary reform institutions. The government will therefore continue its structural reforms in order to stimulate economic growth and diversify its market in order to generate more job opportunities for its increasing population.

5.1. Conclusion of the Study

The econometric study of demand for money in the Kenyan economy was performed on the basis of economic theories that outline the basic determinants of demand for money for changes in income levels and interest rates. The variable vector used in the model was generated by the real demand for large money, the inflation rate, the gross national product, the interest rate of commercial banks on paper and the real interest rate on 91-day treasury bills.

The analysis led to the conclusion that there is a stable relationship between money demand and supply, that the GNP and the actual interest rates on treasury bills are exogenous in terms of the equilibrium relationship parameters. The test balance parameter restriction of the balance correction VECM shows that the balance adjustment dynamics is determined solely by changes in the amount of money, whereas adjustments in the short-term money supply are not followed by adjustments in the GNP and interest rates.

The results of the econometric calculations suggest that the actual interest rate elasticity of the demand for money was statistically important. However, when evaluating these outcomes, it should be remembered that the strength of the statistical inference criterion depends on both the number of findings and the extent of the relationship (Moutot and Vitale 2009). When short sampling periods are used, the relatively weak explanatory factors are difficult to differentiate from the significant ones; thus, statistical inference procedures may lead to an inconsistency in the presence of these processes which, according to economic theory, are somewhat weak but important in the analysis of monetary policy.

At the same time, it should be noted that the effect of interest rates on money demand has been marginally rising with the reinforcement of lending in the last 2012 year.

Despite the steady demand for money that characterizes Kenya 's economy, the unique features of price and interest rate creation in a small and open economy that implements a fixed foreign exchange rate regime should be considered when evaluating the possibility of using money demand for monetary policy purposes.

The regulation of the large amount of money cannot therefore serve the purpose of accurate inflation in the medium term, during which domestic demand can be controlled by means of monetary policy. Moreover, the low interest rate elasticity and the restricted capacity of the CBK to manipulate interest rates while retaining exchange rate stability completely preclude the application of monetary aggregates as intermediate monetary policy targets and support the view that the strategy of monetary aggregate regulation is not useful for a small and open economy. (IMF, 2013).

Despite the limitations given above to the application of demand for money, the stability of demand for money allows the aggregates of money to be used as indicators of economic activity. Taking into account the close relationship between large-scale money and money demand factors, the inverted demand for money can be used to effectively estimate GDP. (Economic Survey, 2012).

The demand for money will make a significant contribution to the implementation of monetary policy. By using money demand and simulating the cycle of money multiplication, it is possible to project the amount of bank reserves needed in line with the expected trends in the economy and bank lending. As a result, money demand and supply models can be used in the liquidity management process of the banking sector (IMF, 2012).

5.2. Policy Implications

The result confirms that the demands for broad monetary aggregates are stable. The current system in which M_2 is considered to be the intermediate target variable of monetary policy may therefore be considered acceptable. It is important that monetary authorities turn their attention to the sectoral implications of money demand for successful monetary and fiscal policies in Kenya. In order to achieve the desired policy objectives, policy makers should consider the effect of aggregated real income components on the recognition of different inputs and feedback on them against their policy instruments. This eliminates the distortion of the aggregate.

6. References

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