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The Effect of Stock Prices on Demand for Money: The Case of Kenya

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Abstract

This study sought to investigate empirically the effect of stock market prices on the long-run demand for real money balances in Kenya. Modern time series econometric methods of co-integration and error correction modelling (ECM) were used to fit quarterly time series data for the period 1996:I–2011:II. The analysis established the existence of a positive effect of stock market prices on the demand for real money balances in Kenya during the sample period. Among others, the findings suggested the wealth effect from stock prices dominated the substitution effect in demand for money in Kenya during the sample period. The arising monetary policy implication is one: control for the wealth effect from stock market was important for stable money demand function that would make monetary policy effective in Kenya. Nevertheless, more research is required, including also on the effect of money supply on stock prices.

***Keywords**: Stock market, demand for money, wealth effect, income effect, co-integration, Kenya*

***JEL Classification**: E2, E4, E5.*

1. Introduction

A stock market is a financial market typical in the financial system of most countries. In general, the establishment and development of the stock market in Sub-Saharan African (SSA) countries after the onslaught of financial sector liberalisation programmes since the 1980s is considered especially important for economic growth and development. This is because it serves as a platform for mobilisation and investment of financial resources by both private and public sector institutions in an economy (Levine, 1996; Levine & Zervos, 1996, 1998).[1] On the one hand, private firms and public sector institutions either raise funds for new investment through initial public offers or augment existing capital base through trading of secondary securities, including stocks (shares), bonds and other public sector debt papers of diverse maturities. On the other hand, firms and households in the private sector save for varied motives by purchasing financial instruments issued in a stock market. It is in this context that the establishment and development of stock markets is also considered to promote the culture of saving in tandem with the promotion of economic growth by increasing the quality and quantity of investment (Yartey and Adjasi, 2007; Singh, 1997; Bencivenga, Smith & Starr, 1996; Demirgüç-Kunt & Levine, 1996).

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[1] For a detailed historical account and related developments, see Yartey and Adjasi (2007).

Notable, however, the establishment and development of stock market provide to firms and households an opportunity to diversify their portfolios of financial and non-financial assets held as stores of wealth (Yartey & Adjasi, 2007; Dow & Elmendorf, 1988). Nevertheless, first, given the variety of competing financial and non-financial assets that exist in an economy, decisions by firms and households as regards the most optimal wealth portfolio would crucially depend upon the respective rates of return. Stocks offer returns in terms of dividends, and while money balances lacks a pecuniary rate of return, other financial assets are characterised by varied pecuniary rates of return also tied to their maturity period and/or inflation rate. Second, competition and portfolio adjustment by firms and households that may ensue from the existence and development of stock market may impact on the conduct of monetary policy. This would particularly be the case in developing countries where holding of money balances features prominently in the portfolios of firms and households; and monetary targeting is a basis of monetary policy regime. Granted, the development of stock market that could lead to substitution of money balances in favour of stocks would cause non-tenability of the growth rates of money supply targeted to achieve the desired macroeconomic objectives.

The purpose of this paper is to establish empirically the extent to which the development and growth of stock markets impact on the demand for money and, therefore, the conduct of monetary policy in Kenya. Specifically, the paper explores the extent to which stock market prices impact on the stability of money demand function and its implications on the conduct of monetary policy. The analysis is based on Kenya, a country, which has a long history of both the existence and development of stock market, namely the Nairobi Stock Exchange (NSE) which has been existing since 1954 (Ngugi, 2003a).

The paper is organised as follows. Following this section, section two motivates the analysis by dwelling on the evolution and development of stock market in Kenya. Section three reviews both theoretical and empirical literature related to money demand and money demand-stock prices nexus. Section four outlines the methodology of the study, followed by section five that presents and discusses the empirical findings of the study. Section six gives the conclusion, a summary of the findings and the arising policy implications of the study as well as suggesting areas for further research.

2. Evolution and Development of Stock Market in Kenya

At independence in 1963, Kenya inherited a financial sector dominated by commercial banks, most of which were foreign banks, and a small number of specialised non-bank financial institutions (NBFIs). Both types of financial institutions operated under the East African Currency Board (EACB), established in 1919 by the British colonial government to supply and maintain at par the unit value of local currency in the East African region with the value of currency in the United Kingdom (UK). A stock market, namely, the Nairobi Stock Exchange

(NSE) also existed when Kenya attained her political independence in 1963. When it was established in 1953, the NSE was accepted by the London Stock to serve as an overseas stock exchange (www.nse.co.ke/history; Ngugi, 2003a). In 1954 the NSE was registered as a private voluntary association of stock brokers under the Societies Act with the main responsibilities of championing the development of securities market and regulating trading activities of the market (www.nse.co.ke/history; Ngugi, 2003a).

In 1954 the NSE had 46 listed companies, and the number of companies listed in the NSE rose to 56 in 1960 (Nyasha & Odhiambo, 2014). According to Ngugi (2003b), the securities traded in the NSE during the period 1954-1963 included government stocks, loan stocks, preferential shares and common shares of companies not only in Kenya but also in Tanzania and Uganda. The number of companies listed at the NSE rose dramatically out of government promotion after Kenya became politically independent from the British colonial rule in 1963. First, soon after the attainment of political independence the government of Kenya (GoK) started to implement Kenyalisation, a policy that aimed to transfer economic and social control of the economy from expatriate population to indigenous citizens.[2] Through this policy the GoK allowed the indigenous population to participate in the securities market, and even more significant, the GoK granted bank loans to indigenous populations for purchasing shares and other securities from foreign firms (Kemboi & Tarus, 2012; Nyasha & Odhiambo, 2014; Leys, 1975). Second, the development of the NSE was spurred by the neo-liberal economic management that existed in the East African region in the early 1960s. Pro-capital markets macroeconomic policy remained in existence after the end of British colonial rule in the present mainland Tanzania (Tanganyika) between 1961 until the promulgation of the Arusha Declaration in February 5, 1967. Similarly, market based neo-liberal macroeconomic policy prevailed in Uganda after the attainment of political independence in 1962. It can thus be maintained that the 'indigenization policy' and neo-liberal macroeconomic environment in the East African region during the 1960s augured well for private ownership and investment in stocks and other financial assets.

Third, the 'currency board monetary policy regime' of the EACB was not permissive to fiduciary and government borrowing to finance government listing securities in the NSE. According to Ngugi (2003a), the number of listed public sector securities listed in the NSE was 66 of which 45% were of the government of Kenya, 23% were of the Tanganyika government, and 11% were of the government of Uganda. Fourth, the listing of both private and public sector securities was, by no doubt, supported by the existence of a common currency (the East African Shilling) that was used in all formal business transaction in the three countries. Notable, the existence of a common currency and foreign exchange regime (conversion of the EA shilling into and from the UK pound sterling) served intra-country flow and change of ownership capital and wealth

[2] Leys (1975) incorrectly dubbed it *Africanisation* policy.

across the EA countries and even in the rest of the world (RoW). In the overall, Ngugi and Njiru (2005) informs that the number of companies listed in the NSE, of which the majority were owned by Kenyans, rose from 56 in 1960 to 63 in 1969.

The NSE experienced structural shocks between the second half of the 1960s and the first half of the 1980s. The launch of the Arusha Declaration in Tanzania in 1967 led to nationalisation of private companies that were listed in the NSE (Ngugi, 2003: 17; Amorolo, 1971). Related to this was the departure of expatriate population from Tanzania of capital outflow from Tanzania mainland that could have included de-listing or sale of stocks from the NSE. Moreover, in 1976 the government in Uganda launched nationalisation of private property that also affected private firms that were listed in the NSE (Nyasha & Odhiambo, 2014). Consequently, the number of ordinary share of companies quoted in the NSE decreased from 63 in 1969 to 51 in 1978 (Parkinson, 1984:324).

The launch of the IMF and World Bank supported economic reforms in the 1980s, coupled with a study by IFC (1984), argued for the development of capital markets in Kenya.[3] To this end in 1990 the GoK established a Capital Market Authority (CMA) that was charged with the "… responsibility of promoting and facilitating an orderly growth and development of an efficient capital market in Kenya" (www.nse.ke/nse-history; NSE, 1996; Ngugi, 2003). Among others, the CMA licensed the Nairobi Securities Exchange (NSE), an act that served its transition in 1991 from a quasi informal capital market into a formally company registered under the Companies Act. Further development in the stock market in Kenya was marked by the introduction of a Central Depository System (CDS) and automation of the NSE in 2006. Such developments triggered increased interest by investors in raising funds from alternative sources, mainly, the stock market. In 1995, the GoK lifted the restriction that barred foreign investors from participating in capital markets in Kenya and repealed the Foreign Exchange Control Act in 1995 in order to lift all forms of foreign exchange controls (Nyang'oro, 2013). Ngugi (2003: 28) also informs that in 1997 the GoK issued "… guidelines to govern the issuance of corporate bonds and commercial paper in order to facilitate diversity of financial assets traded in the market." In July 2011, the NSE changed its name to Nairobi Securities Exchange (NSE) to mainly evolve into a full service securities exchange that would support "… trading, clearing and settlement of equities, debt, derivatives and other associated instruments" (www.nse.se/ke). Furthermore, in September 2011 the NSE converted from a company limited by guarantee to one limited by shares. In November 2011, the FTSE (Financial Times Stock Exchange) NSE Kenya 15 and FTSE NSE Kenya 25 indices were launched. The two indices were a result of extensive market consultations with local assets and fund managers; and it also reflected the growing interest in new domestic investment together with diversification opportunities (Kemboi & Tarus, 2012).

[3] Such a development also characterized other countries in SSA (see Yartey & Adjasi, 2007).

The direct promotion of the capital markets development in Kenya led to the increase of companies listed in the NSE from 53 in 1991 to 56 in 1994 and 58 in 1998. Furthermore, a regulation by the CMA in 2002 that required reservation for resident Kenyans a minimum of 25 percent of the shares in IPO (Initial Public Offer) and state-owned companies under privatization appeared to have caused enhanced more local participation in the in NSE. Ngugi (2003a) informs that the *Kenyalisation* policy that was implemented after attainment of political independence in 1963 led to ownership of the majority of shares of the companies listed in NSE by the local residents in Kenya. In particular, Ngugi (2003) established that the majority of shareholders in 38 percent of the listed firms were local residents. Ngugi (2003: 36) also found that 6 percent of the top 20 shareholders were local residents that owned more than 50 percent of all shares in 57 percent of all companies listed in the NSE. Accordingly, shareholding by foreign investors decreased—dropping from 33 percent in 2003 to 8 percent in 2008. By 2005 there were 50 active companies listed in the NSE, and the number rose to 58 at the end of 2011, and to 60 at the end of 2012.

The transition of the NSE into a formally registered company impacted positively on both volume of sales and market capitalisation. On the one hand, the volume of shares traded in the NSE rose from KSh 5,856.5m in 2008 to KSh11m in 1990 (Nyang'oro, 2013). It is worth noting here that the NSE experienced downturns in 2001, 2002, and 2009 seemingly due to uncertainty of outcomes from national political elections that increased risk-aversion by foreign investors in the stock market during those period (Nyang'oro, 2013; Mwanzia, 2013). Despite of this hiccups, the volume of share traded by the NSE picked up to reach KSh7,546m in 2010. On the other hand, market capitalization followed the same trend, as it also rose to KSh1,230.5 in 1995 and reached the highest level of KSh1,306bn in 2000 (Kinuthia and Etyang (2014:197).

The market capitalisation of the NSE also rose from KSh34bn in 1991 to KSh80bn in 1994, and surpassed KSh1tr in June 2008, largely due to the IPO by Safaricom, one of the leading mobile phone companies registered in Kenya (Kulundu, 2013:4). As at the end of 2011, the average market capitalization of the NSE was KSh1,035.8bn. It is claimed that the increase in market capitalization resulted partly from an increase in stock prices (appreciation of stock values), and partly from an increase in the volume of traded shares (Nyang'oro, 2013; Ngugi, 2003). The lift of legal restriction to foreign investors also increased activities in the NSE. For example, Nyang'oro (2013:5) notes that "… the total foreign turnover increased over time from a low of K 5Shs. 695 million in 1996 to the highest KShs. 78,765 million by the end of 2011."[4] In relation, foreign investor activity rose from 3 percent in 1995 to 44 percent in June 1997, with a peak of 52.5 percent in December 1996 (Ngugi, 2003: 36).

[4]Nyang'oro (2013) notes, however, some cases of decrease in capital outflow due to the pull out of foreign stocks by foreign sales rather than purchase of equities, more notable during the financial crisis in 2008.

In the quest to deepen the market, the NSE introduced trading in corporate bonds in November 1996 that took off with a three-year bond of the East African Development Bank (EADB) (Ngugi, 2003). Furthermore, in 1998 the GoK introduced a floating rate bond in the NSE, partly to shift into long-term debt the short-run debt instruments in the form of treasury bills, and also to address an inverse in the yield curve (Ngugi, 2003: 42). Several other products became listed in the NSE: commercial papers, investment funds, local and offshore venture capital, and not the least assets-backed securities of mortgage companies.

Generally, it is appreciated that the stock market in Kenya is still small, characterised by low liquidity, and structural and regulator weaknesses (Nyang'oro, 2013; Ngugi, 2003). For example, only 10 companies participated through the IPO in the equities primary market in Kenya during the period 2000 – 2011. Poor activity owes its explanation to poor market condition in the country. Yartey and Adjasi (2007) also note that the stock market in Kenya and some other emerging markets in SSA countries are characterised by very high return to investment. This may provide an incentive to increased activity in the NSE. Notable, however, the NSE also has been characterised by failure of some listed firms, not a typical outcome in vibrant stock markets, even though, the increase in the number of firms listed and/or trading in the market could be increased by attendance to listing barrier and offer of fiscal incentive(s).

3. Literature Survey

3.1 Theoretical Framework

In conventional theory, the demand for real money balances is determined by two main factors: a scale variables, which is either real measured income, wealth or permanent income; and a short-term interest rate, usually a yield on short-term risk free bond (Laidler, 1993). In this regard, the traditional money demand function reads as follows:

$$m_t^d = -\beta_0 + \beta_1 y_t + \beta_2 R_t + \beta_3 \pi_t^e + u_t \quad \text{..... (1)}$$

where m_t^d is real money balances demanded, which is nominal money balances deflated by the general price level (P), mostly measured either by the consumer price index (CPI) or gross domestic product (GDP) deflator; y_t is real income that is nominal GDP deflated by the general price level; R_t is nominal interest rate, which measures the own rate of return on money balances demanded; and π_t^e is expected inflation, which measure the opportunity cost of holding money balances relative to physical assets.[5]

In theory, the relationship between money demand and real income is positive, and the effect of interest rate and the expected inflation rate on demand for money is negative. Also in theory, the scale variable serves to capture the transaction motive of the demand for money; and interest rate serves to capture the

[5] Sichei and Kamau (2012) assert that the omission of own rate of return leads to the breakdown of the estimated money demand function in the face of financial innovations.

speculative motive of the demand for money. The effect of the scale-variable on the demand for money is positive; and it is negative in the case of the interest rate.

It should be noted, however, that the conventional money demand theory is located—and was developed—in developed market economies with, among others, developed financial and non-financial institutions and markets that serves effective and efficient pricing of financial and non-financial assets. In comparison, financial and non-financial institutions and markets developing economies are still underdeveloped. In the context of the money demand theory, therefore, innovations of financial institutions, their instruments, and markets, and even regulatory frameworks are still in the making. In the meantime, first, substitutes for money is not limited to financial assets. Rather, physical assets, including real estate, ornaments, and even livestock serve as substitutes for money. Expected inflation is thus considered as a proxy measure of the opportunity cost of holding real money balances relative to physical assets. In theory, the effect of expected inflation rate on demand for real money balances is negative. Second, financial innovation has been evolving and is marked, by the introduction/development of capital markets, among others, the stock market.

However, the development of stock markets and other financial innovations after liberalisation of the financial sector in most developing countries have been instrumental to the development of research interest on its implications on demand for money and monetary policy. In theory, following Friedman (1988), the policy relevance of stock market in money demand studies builds on two arguments. First, is the argument that an increase in stock prices affects money demand through its positive wealth effect, which arises from the implied increase in nominal wealth, the portfolio adjustment from risky to safe assets, and an induced rise in the volume of financial transactions. Second, is the possible existence of a substitution effect between real money balances and stocks. Implicitly, increase in stock market prices would increase the opportunity cost of holding real money balances, leading to a substitution of money for stocks.

According to Carpenter and Lange (2002), a standard money demand model can be improved by including stock market variables. In fact, Friedman (1988) specifically maintained that the functional relations and stability of money demand function would be improved because the stock market offers an avenue for portfolio diversification whereby economic agents can hold either or both money and stocks depending on the level of returns on each of the two assets.

3.2 Empirical Literature

Empirical studies that have investigated the hypothesised effect of interest rates and/or stock prices on the nature of money demand function in developing countries are quite few and laden with mixed results. A study in the US by Friedman (1988) established a positive relationship between real quantity of broad money demanded relative to income and the deflated price of equities (standard and poor's composite); and contemporaneous real stock price was

negatively related to the real quantity of broad money demanded relative to income. According to Friedman (1988), the positive relation appeared to reflect the existence of wealth effect of stock market on demand for real money balances; and the negative effect reflected the existence of substitution effect between two real money balances and stock prices.

In an attempt to replicate the study by Friedman (1988) by using data for Japan, McCornac (1991) found the existence of a positive relationship (wealth effect) between demand for real money balances and lagged equity prices, whereby the Nikkei composite index, deflated by Gross National Product (GNP) deflator, was used as a measure of stock prices. The results suggested the existence of a positive relation (wealth effect) between money demanded and lagged equity prices. The study also found the existence of a risk spreading effect, but not for a substitution effect. Moreover, in a study that examined the impact of stock market fluctuations on money demand in Italy, Caruso (2006) found stock market fluctuations to account for temporary movements for liquidity preference, with wealth effects existing in earlier years while substitution effect was found to exist in later years of the sample. Similarly, de Bondt (2009), who examined the role of equity markets on demand for money in the Euro area by using the European Monetary Union (EMU) stock price index as a proxy, found equity markets to positively affect money demand through the wealth effect, as equities were a significant store of household wealth, and thus a part of a financial transaction motive.

Studies in developing countries are quite few, partly because of the underdevelopment of their financial structure and nascent stock markets. A study by Karim and Guan (2004) investigated the relevance of stock prices and foreign opportunity cost variables to the money demand function in Malaysia. Data comprised of real GDP, savings rate, three-month treasury bill rate, exchange rate index, and stock prices (captured by the Kuala Lumpur Composite Index). The study found that the wealth effect dominates the substitution effect. Also, a study by Majid et al. (2007) established empirically the existence of a positive and significant effect of stock prices on the long-run demand for narrow money (M1) in Indonesia. Similarly, a study by Hye et al. (2009) found stock prices to have a positive and statistically significant wealth effect on money demand in the long-run in Pakistan. Also, Diu and Pfau (2010) established the existence of money demand and stock prices, among others. The study revealed that an increase in stock prices raises the wealth of households instead of being a substitute financial asset for money, and thus enhancing real money demand. Similarly, a study in India by Padhan (2011) established the existence of a long-run equilibrium relationship between money balances demanded and some right hand variables that included stock prices. Moreover, the study also established the existence of a unidirectional causality that ran from GDP and stock prices to monetary and liquidity aggregates. The results also supported the existence of a stable money demand function. Furthermore, Bitrus (2011) established that stock market variables improve performance of money demand function in Nigeria; and that the estimated money demand function was stable over the sample period.

Notable, there seems to be limited empirical literature on the effect of stock prices on money demand in developing countries in general, and in SSA in particular. Even more significant, while the stock market in Kenya is the oldest in the East African region, and indeed one of the oldest in the SSA countries, there lacks even a single study on its effect on money demand behaviour. Besides, Sichei and Kamau (2012) inform that prior to Adam (1992), work on demand for money turned out disparate findings regarding determinants and stability of money demand in Kenya. This was attributed to differences in sample size, composition of explanatory variables, and appropriate specification of dynamic adjustment in the demand for money. Therefore, this study explored the seemingly grey area given that smallness of stock markets is an homogeneous characteristic across Less Developed Countries (LDCs). This contention is investigated by using data from Kenya. The Kenyan financial structure and its depth during the period under study justifies the modelling of both interest rates and stock prices in the money demand function for estimation so as to establish the arising monetary policy implications.

4. Methodology

4.1 Estimation Model

The money demand model for estimation builds two innovations into the traditional money demand function. One is the inclusion of stock market prices in the estimation of the long-run money demand function, an argument that builds on Friedman (1988). The other innovation is characterised by the inclusion of return on foreign assets in the estimation model. Kenya is a small open economy, and thus external factors such as variations in exchange rates affect the composition of optimal money holdings. This follows from two factors. One is that the financial system, and indeed the economy at large, is characterised by a significant participation of foreign investors whose portfolio choices are undoubtedly influenced by returns on both domestic and foreign financial assets and exchange rate movements. Mundell (1963) was the first to propose the idea that demand for money could depend on exchange rate in addition to income and interest rate. Similarly, Bitrus (2011) maintains that returns on foreign assets may be influenced by exchange rate movements.

Given equation (1) and the two innovations, a semi-log money demand function estimated for Kenya reads as:

$$LM2_t = \alpha + \beta_1 LRY_t + \beta_2 DPR_t + \beta_3 TBR_t + \beta_4 LEXR_t + \beta_5 LRSP_t + \varepsilon_t \quad \ldots\ldots (2)$$

where: *LRM2* is the logarithm of real broad money (M2), α is a constant, β_i are parameters, *LRY* is the logarithm of real GDP, *DPR* is the weighted average commercial banks deposit rates, *TBR* is the 91-day Treasury Bill rate, *LEXR* is the logarithm of nominal exchange rate, *LRSP* is the logarithm of real stock prices, and ε is an error term satisfying white noise properties.

The coefficients of *DPR* and *TBR* are semi-interest elasticities. As Tsheole (2006) points out, interest rates enter in levels rather than in logarithms because they can be negative. The remaining coefficients are elasticities, which indicate the percentage change in the quantity of money demanded from a percentage point change of the respective variables. Note that in this study an increase in the exchange rate denotes depreciation of the domestic currency relative to foreign currencies, while the opposite applies in case of a decrease.

In theory, the testable hypotheses are thus: $\beta_1 > 0$, implying that an increase in income leads to an increase in demand for money for transaction purposes; $\beta_2 > 0$, that is, a rise in the own rate of return makes holding money more attractive; and $\beta_1 < 0$, meaning that demand for money is a decreasing function of the rates of return on alternative financial assets. In theory, the effect of stock market prices on money demand is either positive through the wealth effect, or negative through the substitution effect. Thus, either $\beta_4 < 0$, and $\beta_5 < 0$, or $\beta_4 > 0$, and $\beta_5 > 0$. The impact of exchange rate on domestic demand for money is expected to be positive ($\beta_4 > 0$) due to wealth effect; or negative ($\beta_4 < 0$) due to currency substitution effect. Assuming wealth holders evaluate their asset portfolio in terms of domestic currency, then exchange rate depreciation would increase the value of their foreign assets held by residents, and thus be wealth enhancing. In this regard, $\beta_4 > 0$—i.e., depreciation of the domestic currency—would impact positively on the domestic demand for real money balances. On the other hand, if wealth holders develop an expectation that the exchange rate is likely to fall further following an initial depreciation, they will respond by raising the share of foreign assets in the portfolio. Currency depreciation means higher opportunity costs of holding domestic money. In this regard, exchange rate depreciation would decrease the demand for domestic money, and hence $\beta_4 < 0$ (Sahadudheen, 2011).

4.2 Measurement of the Variables and Data Sources

This analysis was based on broad measure of money balances, that is, the M2, which in Kenya sums currency in circulation, demand deposits, call, savings, and time deposits of residents. The M2 was deflated by the CPI because demand for money is a demand for real money balances (Sriram, 2001). The CPI was used because it is considered to be the most appropriate for Kenya, its data are readily available, and it is a fair approximation of prevailing prices due to appropriate weighting (Adam, 1992).[6] Like most previous studies, real GDP—which is the nominal GDP deflated by the CPI—was used as a measure of real income (*RY*). Besides, like Ngugi and Kabubo (1998), the CPI was used to generate the inflation rate. Inflation in Kenya was assumed to be static; and therefore actual inflation was used as a proxy for expected inflation.

The NSE 20 share index was used to capture the effect of stock prices on money demand in Kenya.[7] The index, which is an equal-weighted geometric mean of 20

[6] The CPI base of February 2009 was rebased to CPI October 2001.

[7] The NSE 20 share index is one of the main indices used in the analysis. The others are Nairobi All Share Index (NASI) and American International Group (AIG) 27 share index.

large ordinary stocks traded on the NSE, was preferred because it reflects changes in different types of securities traded in all segments of the NSE. The index was deflated by the CPI to obtain real stock prices (*RSP*). Moreover, weighted average of the nominal deposit rates (*DPR*) of commercial banks was used as a proxy measure of the own return to money. Like Ngugi and Kabubo (1998), we used the nominal 91 day Treasury bill rate (*TBR*) as a proxy for short-term return on financial assets alternative to real money balances. The nominal exchange rate (*EXR*) of KSh per unit of United States Dollar (USD) was used to capture the external monetary sector effect on money demand in Kenya. The USD was chosen because it is the basic currency used by the central bank in Kenya to intervene in the foreign exchange market.

The analysis was based on quarterly time series data for the period 1996 to 2011. The data for broad money (M2) were obtained from row 25 of the Central Bank of Kenya (CBK) Depository Corporation survey. Data for the real GDP for 2000:Q1 to 2011:Q4 were obtained from various quarterly economic performance reports published by the Kenya National Bureau of Statistics (KNBS). Real GDP estimates for the period 1996:Q1 to 1999:Q4 were obtained through the interpolation of annual data obtained from semi-annual statistical bulletins of the CBK. The study employed the quadratic match sum method in EViews (Version 7) to interpolate into quarterly period the annual GDP data. Interest rates and exchange rates were obtained from the website of the CBK; and both CPI and the NSE 20 Share index were obtained from leading economic indicators published by the KNBS.

4.3 Estimation Methods

Most time series data are known to suffer from unit roots, that is, they are not stationary in levels, mainly because the modelling of non-stationary time series would lead to spurious regression results. For this reason, *a priori* the statistical properties of the data for the variables of the estimation model were investigated to establish whether they were stationary in levels or not. The now commonly used Augmented Dickey Fuller (ADF) and Philips-Perron (PP) methods were used to test for the order of integration of the variables. Given the unit root tests, the Johansen (1988) and Johansen and Juselius (1990) approaches were used to explore the existence of long-run relationship—i.e., co-integration—in variables of the estimation model.[8] This was considered necessary because if all variables of the estimation model are integrated of order one I(1) per unit root tests but are not co-integrated, estimation of the equation by using the first differences would be the only valid regression model.

Given the co-integration of the variables of the estimation model, a Vector Error Correction Model (VECM) was estimated to capture the long- and short-run dynamics of money demand in Kenya. The VECM formulated reads as follows:

[8] The advantage of this approach is that it can establish multiple co-integrating vectors as opposed to singe equation co-integration procedures.

$$\Delta L\_2_t = \alpha_0 + \sum_{j=1}^{k} \alpha_{1j} \Delta L\_2_{t-j} + \sum_{j=0}^{k} \alpha_{2j} \Delta L\_{t-j} + \sum_{j=0}^{k} \alpha_{3j} \Delta D\_{t-j} + \sum_{j=0}^{k} \alpha_{4j} \Delta T\_{t-j} + \sum_{j=0}^{k} \alpha_{5j} \Delta L\_{t-j} + \sum_{j=0}^{k} \alpha_{6j} \Delta L\_{t-j} + \gamma EC\_{t-1} + v_t \ldots\ldots(3)$$

where: j is the lag length; Δ denotes change; while EC_{t-1} is the one period lagged error correction term that captures the potential departure effects of the variables from a long-run equilibrium. The size and significance of the coefficient of the EC_{t-1} indicates the tendency to restore equilibrium in the money market after deviation in the short-run.

Diagnostic tests for the constancy of parameter estimates of the VECM were investigated. The Jarque-Berra Normality test, autocorrelation Lagrange Multiplier (LM) test, and white heteroskedasticity test were used in residual tests. Moreover, test for stability was carried out to identify any significant structural break in data. The inverse roots of Auto Regressive (AR) characteristic polynomial graph was used to identify the existence of a structural break in the estimation model. If some roots lie outside the unit circle, it is a sign of a structural break, and that the estimated model is not stable.

5. Empirical Results

5.1 Time Series Properties of the Data

Table 1 presents a descriptive statistics of the estimation variables.

Table 1: Descriptive Statistics of Variables for the Period 1996:1-2011:4

	LRM2	LRY	DPR	TBR	LEXR	LRSP
Mean	8.23	12.55	6.79	10.73	4.28	0.58
Median	8.20	12.52	4.84	8.44	4.32	0.57
Maximum	8.59	12.90	16.87	26.74	4.60	1.22
Minimum	8.03	12.33	2.2	0.83	4.00	-0.30
Std. Dev.	0.16	0.18	4.17	7.12	0.13	0.40
Skewness	0.96	0.35	1.24	0.92	-0.56	-0.18
Kurtosis	2.99	1.74	3.09	2.86	2.88	2.11
Jarque-Bera	9.90	5.51	16.41	9.03	3.37	2.45
Probability	0.01	0.06	0.000	0.01	0.19	0.29
Observations	64	64	64	64	64	64

The descriptive statistics in Table 1 shows that three variables of the estimation model—namely, weighted interest rate of the commercial banks (DPR), the 91-day treasury bills rate (TBR) and real stock price (RSP)—had a very big range. This suggests that the trio variables recorded big variations; an outcome that suggests the markets for three financial instruments in Kenya were very vibrant. Moreover, the Kurtosis statistic in Table 1, which is about 3, suggests that all the variables of the estimation model were about normally distributed such that they would lead to unbiased parameter estimates.

Fig. 1 plots the variables of the estimation model. A visual inspection of the graphs reveals that the variables are non-stationary at levels since none of them oscillates around a zero mean. Another characteristic is that the variables seem to have an intercept. This serves as a benchmark for a formal analysis of unit root.

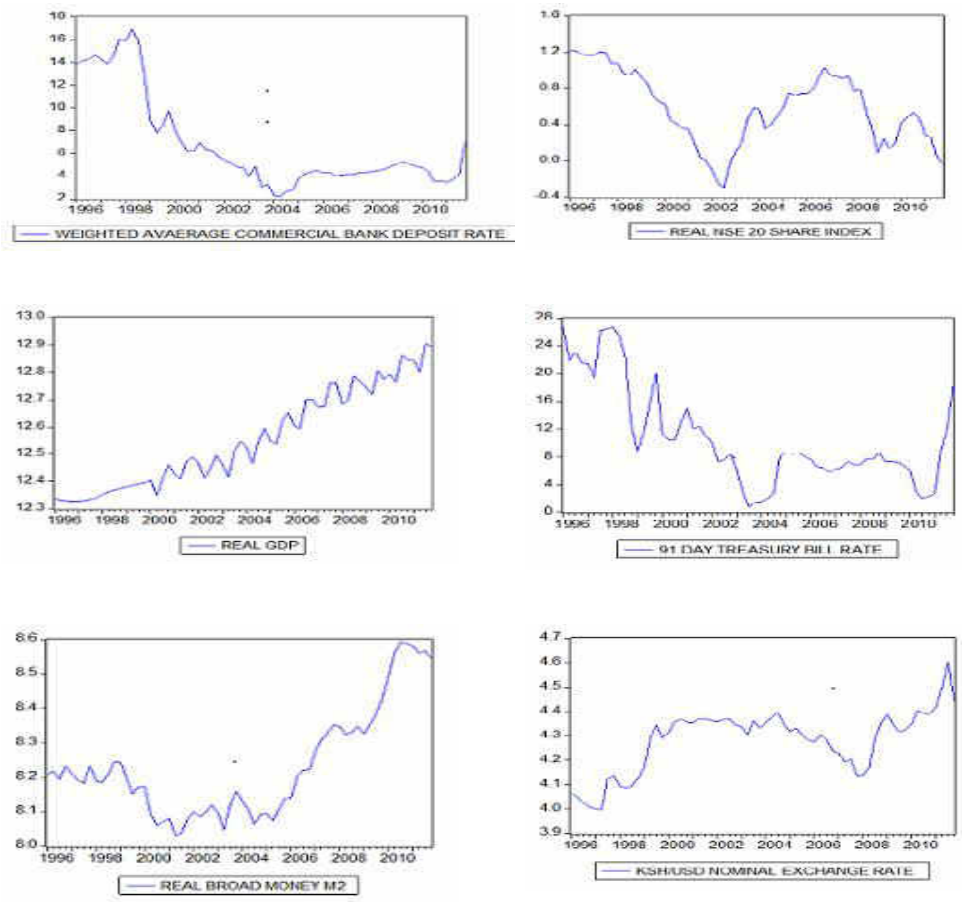

Figure 1: Plot of Variables of the Estimation Model, 1996:1-2011:4

A graphical analysis revealed that all the variables had a stochastic trend. Hence, it was important to perform unit root tests to ascertain the stationarity of the time series data. To this end, the ADF and PP tests were performed on each variable. The tests were carried out in level and in first differences. Both the ADF and PP were used to test the null hypothesis of a unit root against the alternative of stationarity. Table 2 reports the results.

Table 2: Unit Root Test Results

Variable	At levels				At First differences				Order of integration
	ADF		*PP*		*ADF*		*PP*		
	C	*C&T*	*C*	*C&T*	*C*	*C&T*	*C*	*C&T*	
LRM2	-0.26	-1.02	0.26	-1.15	-3.53**	-6.32*	-6.34*	-6.59*	I(1)
LRY	1.05	-1.86	0.46	-5.26	-4.17*	-4.43*	-14.60*	-16.76*	I(1)
DPR	-2.07	-0.70	-1.76	-0.94	-4.69*	-5.25*	-4.31*	-4.04**	I(1)
TBR	-2.07	-1.68	-2.30	-1.34	-6.01*	-4.22*	-5.77*	-5.95*	I(1)
LEXR	-1.67	-1.91	-1.64	-1.93	-6.17*	-6.08*	-5.78*	-5.63*	I(1)
LRSP	-1.70	-1.82	-1.62	-1.77	-5.62*	-5.58*	-5.66*	-5.61*	I(1)

Note: *, ** denotes 1% and 5% significance level, respectively.

The results suggest that the variables of the estimation model were not stationary, implying that the variables were not stationary in level; and thus the null hypothesis of a unit root for the variables of the estimation is not rejected. Notable, however, all variables were integrated of order one I(1) as they turned out to be first difference stationary first with a constant and then with a constant and a trend (T).

Since all variables were I(1), the Johansen co-integration procedure was put to use. The beginning all was formulation of a Vector Auto Regressive (VAR) model of the money demand in equation (2). The optimal lag length of the VAR system was explored by five information criteria in EViews (Version 7). One is the Hannan-Quinn (HQ) criteria that suggested a one period lag length; but gave wrongly signed coefficients (Table 3). The other, which is the Schwarz Information Criteria (SIC), suggested a lag length of order five; but most determinants of demand for money were statistically insignificant. A lag length of order four and five, respectively suggested by the Final Prediction Error (FPE) and Akaike Information Criteria (AIC), were preferred because they were closely consistent with the lag length of four established by most previous empirical studies that used quarterly time series data (Majid et. al., 2007).

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Table 3: VAR Lag Order Selection Criteria

Lag	Log L	LR	FPE	AIC	SIC	HQ
0	-116.5999	NA	2.57e-06	4.155930	4.367205	4.238403
1	220.3814	594.0010	9.59e-11	-6.046827	-4.567902*	-5.469515*
2	254.3189	52.91948	1.07e-10	-5.976912	-3.230337	-4.904760
3	299.2748	60.95723	8.70e-11	-6.280503	-2.266278	-4.713513
4	367.9457	79.14608*	3.51e-11*	-7.387990	-2.106115	-5.326160
5	414.2346	43.93517	3.54e-11	-7.736765*	-1.187240	-5.180095

Notes: * Indicates lag order selected by the criterion
LR: sequential modified LR test statistic (each test at 5% level).
FPE: Final prediction error, AIC: Akaike information criterion, SC: Schwarz information Criterion, HQ: Hannan-Quinn information criterion

5.2 Results of Co-integration Tests

Given the optimal lag length, the Johansen co-integration test was put to use to ascertain the number of co-integrating equations in the estimation model.

The trace test suggests the existence of, at most, three co-integrating equations (vectors); while the maximum Eigen value test suggests the existence of two co-integrating equations (vectors) (Table 4). The existence of three co-integrating equations was adopted because the trace test is more powerful than the Eigen value (Rutayisire, 2010). The test results confirm existence of co-integration among the six variables of the estimation model.

Table 4: Johansen Co-integration Test Results Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.687154	169.2163	95.75366	0.0000
At most 1 *	0.543999	100.6557	69.81889	0.0000
At most 2 *	0.369414	54.32532	47.85613	0.0109
At most 3	0.268336	27.12009	29.79707	0.0987
At most 4	0.135529	8.686462	15.49471	0.3952
At most 5	0.001589	0.093831	3.841466	0.7594

Notes: Trace test indicates 3 cointegrating eqn(s) at the 0.05 level.

Unrestricted Cointegration Rank Test (Maximum Eigen value)

Hypothesized No. of CE(s)	Eigen value	Max-Eigen Statistic	0.05 Critical Value	Prob.**
At most 1 *	0.543999	46.33041	33.87687	0.0010
At most 2	0.369414	27.20523	27.58434	0.0558
At most 3	0.268336	18.43362	21.13162	0.1145
At most 4	0.135529	8.592632	14.26460	0.3216
At most 5	0.001589	0.093831	3.841466	0.7594

Notes: Max-eigen value test indicates 2 cointegrating equation(s) at the 0.05 level; * denotes rejection of the hypothesis at the 0.05 level; **MacKinnon-Haug-Michelis (1999) p-values

Given the three co-integrating vectors in the system, one unique co-integration money demand equation for Kenya was normalised, leading to a long-run equation that reads as:

$$LRM2 = -14.71 + 1.24\,LRY^{*} + 0.16\,DPR^{*} - 0.07\,TBR^{*} + 1.60\,LEXR^{*} + 0.22\,LRSP^{*}$$

[8.52] [10.36] [-6.98] [6.31] [3.41]..... (7)

Note: The t-statistics are in brackets.

All parameter estimates of the five determinants of money demand over the long-run are statistically significant at the 1% level of significance. The estimated long-run income elasticity coefficient is 1.24, which is larger than unity. This suggests that a 1 percent increase in income would lead to approximately a 1.24

percent increase in the demand for broad money (M2) in Kenya over the long-run period. Besides, the larger than unity income elasticity coefficient suggests an increase in income by a unit would lead to a more than proportionate increase in the demand for real money balances. This could be attributed to rapid monetization in Kenya (Rutayisirie, 2010).

The coefficient of the proxy for the own return to money (*DPR*), which is the commercial banks' weighted average deposit rates, is positive as expected; and also statistically significant at the 1% test level of significance. The size of the coefficient on *DPR* suggests that its increase by a 1 percent point would lead to 16 percent increase in the demand for real money balances. This suggests Kenyans are sensitive to deposits rates; and over the long-run they would take advantage of higher deposit rates by holding more money balances.

The coefficient of the treasury bill rate (*TBR*) has the expected negative sign; and it is also statistically significant at the conventional 1 percent test level. The finding suggests the existence of a significant trade-off between money balances and treasury bills in portfolio adjustment as Treasury bill rate varies. In particular, over the long-run the results suggest that a 1 percent rise in the 91 day Treasury bill rate would lead to about 7 percent decrease in money balances demanded in Kenya. Moreover, the results show that the coefficient of the exchange rate is positive and also statistically significant at 1 percent test level. The positive sign on the coefficient of the exchange rate suggests the dominance of wealth effect over substitution effect in the trade-off between holding domestic or foreign currency. The results suggest that a 1 percent depreciation of the KSh per unit of the USD exchange rate would lead to a 1.6 percent increase in the demand for broad money in Kenya. This is because depreciation will raise the value of foreign assets held by residents, which could be perceived by economic agents as an increase in wealth; and hence an increase in the demand for money domestically.

According to the results, the effect of stock on the long-run demand for money in Kenya is positive. This finding suggests that the wealth effect dominates the substitution effect. Moreover, the elasticity of stock prices with respect to money demand is 0.22. This suggests that a 1 percent increase in the NSE 20 share index would lead to a 0.22 percent increase in the demand for real money balances. The less than unit elasticity of stock prices signified inelastic response of the demand for real money to activity in the stock market in Kenya. It suffices to note that the inelastic response of money demand over the long-run could also be attributed to the ongoing growth to maturity and development of the stock market in Kenya during the sample period.

5.3 Results of a Vector Error Correction Model

By assuming that there existed only one co-integrating equation for Kenya, the Johansen co-integration methodology was used to estimate a VECM that captures both the long- and short-run dynamics of money demand in Kenya.

The coefficient of the error correction term in the estimated VECM is negative as expected, and statistically significant at the conventional test levels of significance. This finding suggests that broad money (M2) responds significantly to re-establish long-run equilibrium relationship once a deviation occurs in the short-run. The estimated speed of adjustment to equilibrium is about 11 percent, implying that only 11 percent of deviation from equilibrium is corrected in the first quarter. The low speed of adjustment may be a reflection of low financial depth in terms of access to formal financial institutions in Kenya.

Diagnostic checks for the estimated VECM shows the estimated R-squared for the broad money (M2) is 0.63 (Table 6). This suggests that about 63 percent of variation in money demand was explained by variables included in the estimation model. Also notable, the adjusted R-squared indicates that the independent variables explain only about 36 percent of the variations in money demand over the short-run period. Furthermore, the LM statistic for autocorrelation test results has a probability of 0.84, suggesting that the null hypothesis of no serial correlation cannot be rejected. Granted, the estimated model does not suffer from high order serial correlation.

Table 5: Coefficients of Error Correction Terms

D(LRM2)	D(LRY)	D(DPR)	D(TBR)	D(LEXR)	D(LRSP)
-0.11	-0.09	4.44	-1.71	-0.05	-0.29
(0.05)	(0.04)	(1.36)	(5.62)	(0.10)	(0.24)
[-2.12]	[-2.38]	[3.26]	[-0.30]	[-0.50]	[-1.20]

Notes: Standard errors in ( ) and t-statistics in [ ]

Diagnostic checks
R squared = 0.63
Adjusted R squared = 0.36
Autocorrelation LM test = 27.61 (0.84)
Jarque Berra normality test = 19.21 (0.08)
Heteroskedasticity (white test with no cross terms) = 1047.48 (0.52)

A normality test for the residuals of the estimated money demand function was conducted by using the Jarque-Berra test. The probability value obtained is 0.08, which is less than 0.1; implying that the residuals are not normally distributed. However, the use of a constant in the model guarantees zero mean for the residuals. Also, the estimated chi-square value is 1047.48, with a probability value of 0.52. This finding suggests that the null hypothesis of no heteroskedasticity cannot be rejected, that is, the residuals were homoscedastic.

The Auto Regressive characteristic polynomial method was used to ascertain whether the estimated model was stable over the study period. The plots of results not shown here (for technical reasons) suggest that the estimated long-run money demand function for Kenya was stable because there were no roots outside

the unit circle.[9] This finding is consistent with that obtained by previous studies, among others, Kamau and Ndung'u (2003), Ndele (1991), Darrat (1985) and Pathak (1981), that, however, did not take into consideration stock prices. The consistency may, among others, suggest that the introduction of stock prices caused more stable rather than unstable money demand function.

6. Conclusion

The main objective of this study was to empirically investigate the effect of stock prices on money demand, and asses its implications on the conduct of monetary policy in Kenya. The study used quarterly data series for the period 1996:1 to 2011:4. The co-integration and error correction modelling was used in the analysis. The study employed real GDP, deposit rates, the 91 day Treasury bill rate, the nominal exchange rate (KShs./USD), and stock price movements in the NSE as regressors in the estimated money demand function. The hypotheses targeted to establish whether the movement in stock prices in the NSE had no effect on money demand in Kenya; and if it does not exert any effect on the conduct of monetary policy of the country.

The empirical results indicated that real GDP, deposit rates, treasury bill rate, exchange rate, and stock prices are significant in explaining variations in money demand in Kenya. There is evidence that the stock market has increased the level of income or wealth for households and firms in Kenya. A long-run relationship was found to exist between money demand and its determinants in this study. All the variables carried signs that were consistent with theory and previous empirical evidences.

The results suggest the existence of a stable long-run relationship among the variables studied, in spite of the financial innovations that have been taking place in the Kenyan financial system. Further, stock prices have a significant positive influence on money demand in the short-run. The inelastic effect established indicated that the NSE is still small and under-developed. Thus, stock prices serve as financial innovation for economic agents moving away from traditional financial assets like bank deposits and savings.

The results from this study carry the following policy implications: the development of the NSE in Kenya has a positive effect on the money demand function in Kenya. This finding suggests that monetary policy needs to be monitored frequently as the NSE continues to develop, if the monetary targeting framework used by the CBK is to be feasible. Downturns in the NSE should be seriously tackled and mitigated in the quest to ensure a stable money demand function on which the success of monetary policy depends.

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[9] The plot can be supplied to any interested person.

Some data limitations were encountered in the course of the study. Quarterly GDP data prior to the year 2000 was not available. Quadratic match sum interpolation technique provided by E-views (Version 7) was used to generate the quarterly data from annual data. This method might bear some influence on the direction of results. Real GDP was based on 2001 constant prices, CPI was based on February 2009=100, while the NES 20 Share index had a base year set on December 1966=100. For the purposes of this study, both the CPI and the NSE 20 Share index were rebased to year 2001. This rebasing might have a bearing on the quality of the results since some information might have been lost in the process. This study may trigger other studies on the effect of stock market variables on money demand in Kenya. Certainly the limitations of this study warrant a need for further research, for example, on the causality between money demand and stock market development in the period after financial reforms; the effect of other stock market variables such as market capitalization on money demand; and the significance of the stock market as a monetary policy transmission channel in Kenya.

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