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MONETARY POLICY AND ECONOMIC GROWTH IN KENYA: THE ROLE OF MONEY SUPPLY AND INTEREST RATES

Enock Nyorekwa Twinoburyo [1] and Nicholas M. Odhiambo

Abstract

Using the autoregressive distributed lag (ARDL) bounds testing approach; this paper examines the short-run and long-run impact of monetary policy on economic growth in Kenya for the period 1973 to 2013. The paper uses both the broad money supply and the 3-month Treasury bill rate as proxies of monetary policy. Both short-run and long-run empirical results support monetary policy neutrality, implying that monetary policy has no effect on economic growth – both in the short run and in the long run. This could be due to the fact that the increasing fiscal deficits funded domestically in Kenya could have weakened the transmission of monetary policy actions into the real economy. The study recommends that policies aimed at improving the institutional and regulatory environment for the financial sector and monetary policy conduct should be pursued in Kenya. There is also a need for improvement in policy coordination, particularly monetary and fiscal policies.

Key Words: Kenya, Money supply, interest rates and economic growth

JEL Classification: E1, E43, E51 and E52.

1 Introduction

The dominance of output gaps in the last decade in most economies, particularly developed economies, has heightened the debate on the role of monetary policy in addressing demand deficiencies and economic growth, suggesting a growing consensus that monetary policy matters

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for economic growth (Woodford, 2007; White, 2013). However, the relative importance of money supply and interest rate based monetary policy on economic growth remains varied across both the theoretical and empirical literature (see, among others, Arestis, 2009; Asongu, 2014). Monetarist theory emphasises the role of money, while the Keynesian, post-monetarist, New Classical, New Keynesian and New Consensus models – emphasise the role of interest rates (Arestis, 2009). The New Consensus model, for example, is premised on short-term interest rates as the sole monetary policy instrument for short-run output stabilisation (Arestis, 2009). Long-run monetary policy neutrality on output is predominantly traced across the evolution of monetary policy and output theories (Palley, 2007).

Monetary policy in practice has also been varied and so are the respective empirical findings, revealing mixed results on the impact of monetary policy on economic growth (Asongu, 2014). Relevant empirical studies have largely focused on developed economies and the few that examined developing economies have centred on the impact of money supply on economic growth (Mishra *et al.,* 2012; Davoodi *et al.,* 2013 and Asongu, 2014). The studies that support a positive impact of monetary policy on economic growth include inter alia Khabo and Harmse (2005), Rafiq and Mallick (2008), Jawaid *et al.* (2011), Nouri and Samimi (2011), Onyiewu (2012), Vinayagathasan (2013), and Havi and Enu (2014). Studies that find limited or no impact of monetary policy on economic growth include Lashkary and Kashani (2011), Coibion (2011), Monteil *et al.* (2012), Kamaan (2014), and Mutuku and Koech (2014).

Other studies reveal differing results, depending on the choice of monetary policy variable. Fasanya *et al.* (2013) found a long-run impact of monetary policy instruments (external reserve and exchange rate) on economic growth in Nigeria in accordance with theoretical expectations, but found money supply to be insignificant. Mugume (2011) also found an expected negative impact on economic growth using the 3-month Treasury bill (T-bill) rate as a proxy of monetary policy, and a statistically insignificant effect on output when broad money (M2) was used as the monetary policy variable. Also, Chaudhry *et al.* (2012) found that call money was insignificant in the short run but positively significant in the long run, suggesting short-run neutrality. Long-run monetary policy (money supply) neutrality is backed by several empirical studies (Bernanke and Mihov, 1998; Bullard, 1999; Nogueira, 2009; Asongu, 2014). A number of other studies revealed inconsistent results for the theoretical postulations (Amarasekara, 2009; Vinayagathasan, 2013).

The empirical evidence remains ambiguous, and seemingly dependent on country characteristics, the choice of monetary policy variables used and methodology (Walsh, 2003; Berg *et al.,* 2013). Most studies on this subject have relied on Vector Auto Regressive (VAR) methodology, where results depend on the restrictions imposed, and this may have limitations, particularly for developing economies (Ivrendi and Guloglu, 2010, Grace Li *et al.,* 2013). In addition, a number of other factors explain the strength and dependability of the relationship between monetary policy instruments and economic growth. Overall the financial structure of the economy matters for monetary policy transmission in the economy (Mishra *et al.,* 2012; Opolot *et al.,* 2013). The factors that matter relate to the country's financial sector development dynamics and include its

size, composition and competition within the financial sector, the level of financial innovations, degree of financial integration with the international markets and the exchange rate regime. The institutional and regulatory environment, including the operational and institutional independence of the Central Bank, also matter.

The main aim of this paper is investigate the short-run and long-run impact of monetary policy (broad money supply and 3 month Treasury bill rate) on economic growth in Kenya. The paper also employs the Auto Regressive Distributive Lag (ARDL) estimation, which has pronounced advantages for small samples like the one employed in this study. To our knowledge, this could be the first time ARDL has been used to examine the impact of monetary policy on economic growth in Kenya.

The remainder of the paper is structured as follows: Section 2 presents the overview of Kenya's economic and financial structure. The estimation methodology and the empirical results are presented in Section 3 and 4 respectively. The conclusions are presented in Section 5.

2 Overview of Kenya's economic and financial structure

Despite attaining independence in 1963, Kenya only recently attained lower middle income status with a GDP per capita of USD 1358.3 in 2014, remaining the largest economy in the East African region (World Bank, 2015). Kenya's monetary policy formulation and implementation has been coordinated by the Central Bank of Kenya, after its establishment according to the Central Bank of Kenya Act, 1966. Pre-1966, monetary policy was controlled by the East Africa

Currency Board (EACB)[2] that also served Uganda and Tanzania. Monetary policy conduct has since endured three major episodes: from 1966 to 1993, 1993 to 2011 and 2011 to date. The first episode was characterised by direct measures in the form of credit restrictions, fixed cash ratio, and liquid asset ratios, as well as the setting of minimum deposit and maximum lending rates. Fiscal dominance prevailed for most of the 1970s. The fixed exchange rate regime prevailed until the early 1980s, when the crawling peg exchange rate system anchored to a basket of currencies was adopted (Kinyua, 2001).

The 1993 to 2011 epoch consisted of the full liberalisation of key markets including the exchange rate market in October 1993; the complete removal of quantitative controls on the capital account in 1995; and the amendment of the Central Bank of Kenya Act in 1997, espousing its monetary autonomy. The amendment of the Act also mandated the Central Bank of Kenya (CBK) to shift from targeting broad money (M3) to targeting broader money M3X and MXT[3] as the intermediate target. However, the actual transition to broader aggregates happened in 1998 (Kinyua, 2001). The monetary targeting regime remained in place until September 2011, when the CBK adopted short-term interest rates as the main operational target, while retaining the monetary targeting framework. The Central Bank Rate (CBR) which is set and announced monthly by CBK's monetary policy committee is used as the reference rate for pricing monetary policy operations (Andrle *et al*., 2013). A number of other monetary instruments, including open

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[2] Formed in 1919, its offices were based in London and the East African shilling was pegged against the British pound. Its offices were transferred to Nairobi in 1960.
[3] M3 is defined as currency in circulation and term and non-term domestic deposits held with banks and NBFIs. M3X is M3 plus foreign currency deposits (FCDs) held by residents, whereas M3XT is M3X plus holdings of government paper by the non-bank public.

market operations (OMO), standing facilities (as a lender of last resort), required reserves, foreign market operations, licensing and supervision of commercial banks, and communication of bank decisions, are used to achieve the monetary policy stance (Andrle *et al.*, 2013).

Kenya operates a flexible free floating exchange rate regime, with limited CBK interventions in the foreign exchange market. These are conducted through auctions or through direct interventions in the dealing system, under which the market is informed, but amounts and rates are not published. The average rate through auctioning is, however, published after the auction closes (Berg *et al.,* 2013). The capital account of balance of payments has since 1995 remained open with no quantitative capital controls. The Chinn and Ito (2008) index and de jure openness index of capital and financial accounts shown in Figure 1 corroborate Kenya's higher level of financial integration, with a higher index value corresponding to fewer restrictions in international transactions.

Figure 1: Chinn-Ito Financial Openness Index (1997-2011)
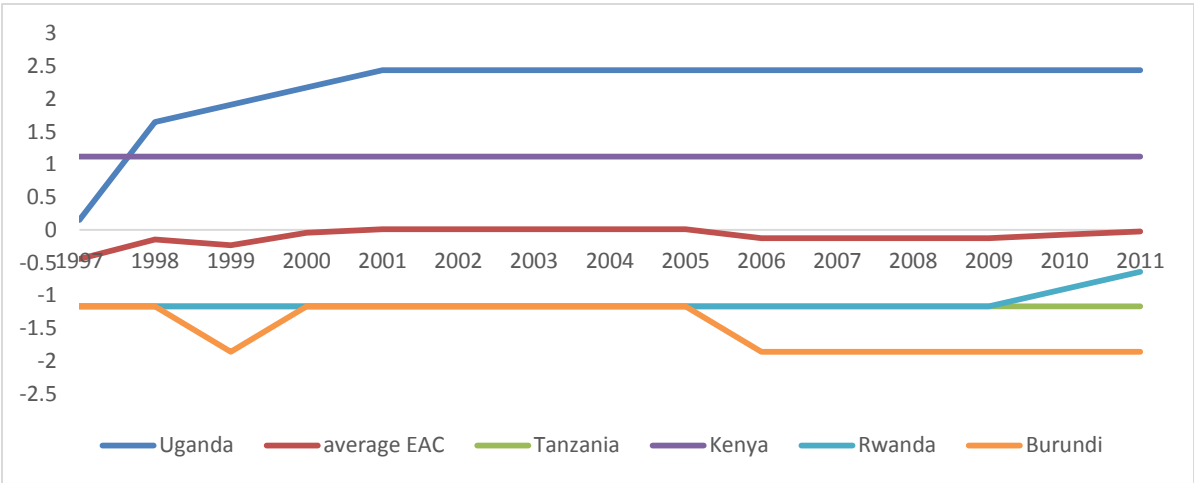
Source: Chinn and Ito (2015)

The CBK Act was amended again in 2012 to provide enhanced transparency of its operations (Kinyua, 2001). The increased CBK monetary autonomy is corroborated by Dincer and Eichengreen (2013)[4] measure of Central independence, the Central Bank Independence Weighted (CBIW). As shown in Table 1, Kenya exhibits a higher degree of central bank independence compared to its regional counterparts and its level is comparable to a number of countries in Europe, a region which has the most independent central banks according to this measure.

Table 1: Central Bank Independence Index Weighted (CBIW)

	2005	**2006**	**2007**	**2008**	**2009**	**2010**
Kenya	0.67	0.67	0.67	0.67	0.67	0.67
Uganda	0.28	0.28	0.28	0.28	0.28	0.28
Tanzania	0.46	0.56	0.56	0.56	0.56	0.56
Africa	0.31	0.33	0.34	0.36	0.35	0.34
Europe	0.71	0.71	0.71	0.71	0.72	0.72
Asia	0.36	0.37	0.37	0.38	0.38	0.38
Northern America	0.2	0.2	0.2	0.2	0.2	0.2

However, pronounced fiscal expansion in the form of large fiscal deficits funded from the domestic markets runs the risk of fiscal dominance and crowding out of monetary policy, thus reducing its effectiveness (IMF, 2016).

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[4] Survey included 17 African, 2 North American (USA and Canada) and 28 Asian countries

CBK is also responsible for the overall functioning and supervision of the financial system. By the end of 2013, the Kenyan financial system comprised 43 commercial banks, 1 mortgage finance company, 9 representative offices of foreign banks, 9 deposit-taking microfinance institutions, 112 foreign exchange bureaus and 2 credit reference bureaus (CBK, 2013). The insurance sector included 154 insurance brokers, 23 medical insurance providers and 4205 insurance agents. The commercial banking sector continues to denominate the financial sector. At the end of 2012, the assets of the pension sector, microfinance banks and insurance sector accounted for just 38% of the total commercial banking sector (KIPPRA, 2013). The six largest banks accounted for 51.4% of the commercial bank assets, 50.2% of the customer deposits and 61.8% of the pre-tax profits, and had a market share of 52.39% (CBK, 2013).

Kenya's financial sector has undergone rapid financial innovation over the last decade, exhibited in part by mobile money transactions, the number of transactions growing to about 65 million between March 2007 and August 2013 (Nyamwogo and Ndirangu, 2013). Over the corresponding period, the number of adults using mobile phone financial services (11.5 million) was more than double the 5.4 million using banks (FinAccess, 2013). The number of ATMs increased from 540 in 2006 to 2487 in December 2013 (CBK, 2013). The heightened innovation in the financial sector increased the velocity of money and instability of money demand at the risk of compromising the monetary policy effectiveness, in particular the monetary targeting regime (Nyamwogo and Ndirangu, 2013).

3   Estimation methodology

3.1   The ARDL Bounds Testing Approach

This paper adopts the Autoregressive Distributed Lag (ARDL) approach to co-integration developed by Pesaran and Shin (1998) and later refined by Pesaran *et al.* (2001). Unlike other co-integration techniques, ARDL permits a co-integration relation to exist, whether the underlying variables are *I*(1), or a combination of both *I*(1) and *I*(0). It also provides relatively robust results for small samples. The ARDL approach works well, even when the model has endogenous regressors, without posing the problems associated with serial correlation and endogeneity (Odhiambo, 2009). It also incorporates an adequate number of lags to capture the data generating process from general-to-specific modelling framework (Shrestha and Chowdhury, 2005). The ARDL approach allows for the appropriate lag selections (Pesaran and Shin, 1999).

The empirical model used in this study to test the impact of monetary policy on economic growth is underpinned by Levine and Renelt (1992) and the aggregate production framework used by Fosu and Magnus (2006). The modified model used in this study is expressed in an ARDL representation as follows:

$$\Delta lnRGDP_t = \gamma_0 + \sum_{i=1}^{n} \gamma_{1i} \Delta lnRGDP_{t-i} + \sum_{i=0}^{n} \gamma_{2i} \Delta lnM2_{t-i} + \sum_{i=0}^{n} \gamma_{3i} \Delta TBIL_{t-i}$$

$$+ \sum_{i=0}^{n} \gamma_{4i} \Delta lnRGCFC_{t-i} + \sum_{i=0}^{n} \gamma_{5i} \Delta lnTOP_{t-i} + \sum_{i=0}^{n} \gamma_{6i} \Delta lnRER_{t-i}$$

$$+ \sum_{i=0}^{n} \gamma_{7i} \Delta lnCPI_{t-i} + \delta_1 lnRGDP_{t-1} + \delta_2 lnM2_{t-1} + \delta_3 TBIL_{t-1}$$

$$+ \delta_4 lnRGFCF_{t-1} + \delta_5 lnTOP_{t-1} + \delta_6 lnRER_{t-1} + \delta_7 lnCPI_{t-1}$$

$$+ \mu_t \qquad\qquad\qquad (1)$$

Where RGDP is the real gross domestic product- a proxy for economic growth. Two monetary policy variables, real money supply and real short term interest rates, are represented by $M2$ and TBIL respectively. The other control variables are real exchange rate (RER), real gross fixed capital formation $(RGFCF)$, trade openness (TOP) and the real commodity price index (CPI). ln, μ, γ and δ are respectively natural logarithms, the white-noise error term, the short-run coefficients and the long-run coefficients of the model. Δ is the first difference operator, t denotes time period, and n is the maximum number of lags in the model.

Monetary policy is concerned with changes in the supply of money and short-term interest rates in a bid to attain the set out objectives. The key monetary policy variables used in many studies are money supply and short term interest rates – the latter largely for developing economies. This study adopts both on the grounds of extensive use in empirical studies (Christiano *et al.,* 1999; Ivrendi and Yildirim, 2013). Money supply is measured by M2, the sum of the currency in

circulation to domestic currency deposits and has been extensively used in empirical estimations founded on the monetarist school of thought (Maturu *et al.,* 2010). Money supply is expected to have a positive impact on economic growth. Short-run interest rates are measured by the 3 month Treasury bill rate, also backed by empirical applications and the Keynesian and New Keynesian theories (Clarida *et al.,* 1999). Short-run interest rates are expected to exert a negative effect on GDP.

Gross fixed capital formation (GFCF) is included as a measure of capital stock and is expected to have a positive and significant relationship with economic growth (Havi and Enu, 2014). Stable inflation is recognised as an integral component of monetary policy in Kenya and is measured by CPI. The coefficient of the term representing the rate of inflation is expected to be negative (see, among others, Khan and Senhadji 2001; Pollin and Zhu 2006; Yilmazkuday, 2013).

The exchange rate measured by the real exchange rate is included as a proxy for a country's external competitiveness, in particular for the small open economies under study. An increase in the RER is expected to have a positive impact on economic growth (Rodrik, 2008; Haddad and Pancaro, 2010).

This study used the sum of exports and imports to GDP ratio as a proxy for trade openness. Trade openness is broadly considered as an engine of economic growth in the literature and the coefficient is expected to be positive (Sachs and Warner 1995, Rodríguez and Rodrik, 2001; Obstfeld and Taylor, 2003).

The bounds testing procedure is carried out by conducting the F-test for the joint significance of coefficients of the lagged variables. The null hypothesis of no co-integration is tested against the alternative hypothesis of co-integration in Eq. 1. Two sets of critical values have been constructed by Pesaran *et al.* (2001) under this null hypothesis. The first set of critical values are constructed under the assumption that variables in the ARDL model are integrated of order zero, $I(0)$. The second set of critical values are constructed under the assumption that variables in the model are integrated of order one, $I(1)$. The null hypothesis of no co-integration relationships is not rejected when the F-statistic falls below the lower-bound values. The null hypothesis of no co-integration is rejected when the calculated F-statistic is greater than the upper-bound values. However, the test is inconclusive when the F-statistic falls between the lower and upper bounds. Akaike Information Criteria (AIC) and Schwartz- Bayesian Criteria (SBC) are used for the ARDL model lag length selection (Pesaran and Shin, 1997).

The corresponding error correction model is presented in Eq. (2) as:

$$\Delta lnRGDP_t = \gamma_0 + \sum_{i=1}^{n} \gamma_{1i} \Delta lnRGDP_{t-i} + \sum_{i=0}^{n} \gamma_{2i} \Delta lnM2_{t-i} + \sum_{i=0}^{n} \gamma_{3i} \Delta TBIL_{t-i}$$

$$+ \sum_{i=0}^{n} \gamma_{4i} \Delta lnRGFCF_{t-i} + \sum_{i=0}^{n} \gamma_{5i} \Delta lnTOP_{t-i} + \sum_{i=0}^{n} \gamma_{6i} \Delta lnRER_{t-i}$$

$$+ \sum_{i=0}^{n} \gamma_{7i} \Delta lnCPI_{t-i} + \delta ECM_{t-1}$$

$$+ \mu_t \tag{2}$$

where δ is the coefficient of the error-correction term, ECM_{t-1}. δ is expected to be negative, statistically significant and between zero and one. The ECM measures the short-run speed of adjustment towards the long-run equilibrium path of the estimated model.

3.2 Data Sources

This study utilises annual time series data covering the 1973 to 2013 period. The data was obtained from different sources. The gross fixed capital formation, sum of exports and imports, real exchange rate, consumer price index and real GDP were obtained from the World Bank Development Indicators (2015). The Treasury bill rate was obtained from International Financial Statistics, while money supply was obtained from the Central Bank of Kenya

4 Empirical Estimation and Results

4.1 Stationarity Results

Time series data must be tested for stationarity before running ARDL co-integration tests to determine their order of integration. The presence of *I(2)* variables renders the ARDL inappropriate (Ouattara, 2004). This study employs both the Phillips-Perron test following Phillips and Perron (1988) and the Dickey-Fuller generalised least square (DF-GLS) test for autoregressive unit root recommended by Elliot *et al* (1996). The DF-GLS test has the best overall performance in terms of sample size and power over the traditional Augmented Dickey Fuller and also has substantially improved power when an unknown mean or trend is present (Hayashi, 2000). The graphical representation of the time series used in this study shows that

when conducting unit roots, all variables except real Treasury bill rate are trend stationary and should include both intercept and trend (see Appendix A). The unit root test results for all variables in levels and first difference are presented in Tables 2 and 3.

Table 2: Dickey- Fuller Generalised Least Squares (DF-GLS)

Variables	Stationarity of variables in Levels		Stationarity of variables in first differences		Status
	No trend	With trend	No trend	With trend	I(d)
LRGDP	-	-1.658	-	-3.220**	I(1)
RTBIL	-2.409**		-	-	I(0)
LM2	-	-3.097*	-	-	I(0)
LRER	-	-0.849	-	6.271***	I(1)
LCPI	-	-2.231	-	-3.908***	I(1)
LRGFCF	-	3.001*	-	-	I(0)
LTOP	-	-3.891***	-	-	I(0)

Note: *, ** and *** denote the rejection of the null hypothesis of unit root at the 10%, 5% and 1% significance levels respectively.

Table 3: Phillips-Perron (PP) Unit Root Test

Variables	Stationarity of variables in levels		Stationarity of variables in first differences		Status
	No trend	With Trend	No trend	With Trend	I(d)
LRGDP	-	-3.162	-	-5.463***	I(1)
RTBIL	-3.666***	-	-	-	I(0)
LRM2	-	-2.939	-	-9.269***	I(1)
LRER	-	-0.693	-	-6.191***	I(1)
LCPI	-	-1.626	-	-4.081**	I(1)
LRGFCF	-	-1.882	-	-7.598***	I(1)
LTOP	-	-3874**	-	-	I(0)

Note: *, ** and *** denote the rejection of the null hypothesis of unit root at the 10%, 5% and 1% significance levels respectively.

The unit root test results reported in Tables 2 and 3 reveal that all variables are integrated of order zero or one, supporting the application of the ARDL bounds testing approach to cointegration in this study. The results of the ARDL bounds testing approach to co-integration are reported in Table 4.

Table 4: ARDL Bounds Test Results

Dependent Variable	Function					F-test Statistics
LRGDP	F(LRGDP|LRM2, RTBIL, LGFCF, LTOP, LRER, LCPI)					5. 863***
Asymptotic Critical Values						
Pesaran *et al.* (2001), p.300. Table CI(III) Case III	1%		5%		10%	
	I(0)	I(1)	I(0)	I(1)	I(0)	I(1)
	2.12	3.23	2.45	3.61	3.15	4.43

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

Since the computed F-value of 5.863 exceeds the upper bound critical value of 4.430 at the 1 per cent level of significance, we cannot reject the existence of a stable long-run (level) relationship among the variables (LRGDP, LRM2, RTBIL, LGFCF , LTOP, LRER and LCPI), confirming that the variables are co-integrated.

The optimal lag for both the long-run and short-run ARDL models is selected based on Schwartz Bayesian criteria because the respective models were more parsimonious than Akaike information criteria. The model estimated is ARDL (1, 0, 0, 1, 0, 0, 2).

The long-run results are reported in panel A of Table 5, while the short-run dynamics are reported in panel B.

Table 5: Results of ARDL Model

Panel A: Long-run coefficients – (dependent variable – RGDP				
Regressor	Coefficient	Standard Error	T-Ratio	Probability
C	6.229***	1.083	5.754	0.000
LRM2	0.083	0.105	0.793	0.434
RTBIL	0.113	0.651	0.173	0.864
LGFCF	0.349***	0.067	5.143	0.000
LTOP	-0.264***	0.081	-3.275	0.003
LRER	-0.071	0.053	-1.356	0.185
LCPI	0.059***	0.018	3.237	0.003
Panel B: Short-run coefficients (dependent variable – ΔRGDP)				
ΔLRM2	0.068	0.086	0.790	0.436
ΔRTBIL	0.923	0.528	0.175	0.862
ΔLGFCF	0.285***	0.064	4.488	0.000
ΔLTOP	-0.215***	0.077	-2.786	0.009
ΔLRER	0.083	0.090	0.927	0.361
ΔLCPI	-0.089	0.13	-6.85	0.498
ΔLCPI(1)	-0.422***	0.118	-3.584	0.001
ecm(-1)	-0.817***	0.099	-8.273	0.000
R-Squared		0.843	R-Bar-Squared	0.791
SE of Regression		0.015	F-Stat F(8,32)	20.118
Residual Sum of Squares		0.007	DW statistic	2.263
Akaike Info. Criterion		109.164	Schwarz Bayesian Criterion	99.739

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

The results from both short-run and long-run analysis reveal that the coefficients of monetary policy measured by the 3 month Treasury bill rate and broad money M2 are statistically insignificant. The results suggest both short-run and long-run money supply and short-term interest monetary policy neutrality. This is corroborated by similar findings on Kenya by Kamaan (2014) and Mutuku and Koech (2014). Buigut (2009) also found that interest rate

monetary policy had no statistically significant effect on real output in Kenya. Long-run money supply monetary policy neutrality is found in other previous studies (see, among others, Bernanke and Mihov, 1998; Bullard, 1999; Nogueira, 2009; Asongu, 2014). Similarly, the short-run money supply neutrality is traceable in studies by Fasanya *et al.* (2013) and Chaudhry *et al.* (2012).

The insignificant impact of monetary policy on economic growth could be explained by the fiscal prominence and nature of the financial structure, characterised by a low level of development, banking sector dominance of the financial sector and the oligopolistic nature of the banking industry. Fiscal policy characterised by large and rising fiscal deficits in some instances has been found not to be coordinated with monetary policy, with a risk of compromising the monetary autonomy (Morekwa *et al.,* IMF, 2016). The results could also be attributed to the weak structural, institutional and regulatory framework (Mutuku and Koech, 2014). The volatility of the money multiplier, in part explained by rapid financial innovations, suggests the likelihood of prediction errors of output, velocity of money, and inflation, at the risk of undermining the reserve money targeting (Adam *et al.,* 2010; Nyamongo and Ndirangu 2013).

The other long-run results show that the coefficients of real gross fixed capital formation and consumer price index are positive and statistically significant, suggesting a positive impact on economic growth. However, the coefficient of trade openness is negative and statistically significant. The coefficient of real exchange rate is found to be statistically insignificant.

The other short-run results reveal that the coefficient of real gross fixed capital formation is positive and statistically significant. The result for trade openness is consistent with the long-run results, while the coefficient of real exchange rate is statistically insignificant. In the short run,

the consumer price index is found to have no impact but the coefficient of its lag is found to have a negative and statistically significant impact on economic growth in Kenya.

The coefficient of the error correction term of -0.817 is highly significant, corroborating both the quick convergence of the real GDP equation to its long run equilibrium (corrected in the next period/year) and the presence of co-integration (Banerjee *et al.,* 1998).

The short-run model passes all diagnostic tests against heteroscedasticity, normality, serial correlation and functional form, as reported in Table 6. The regression for the underlying ARDL model fits well, with an R-squared of 84.3%. The CUSUM and CUSUMQ presented in Figures 2 and 3 lie within the critical bounds at a 5 per cent confidence interval, confirming the stability of the model.

Table 6: ARDL-VECM Model Diagnostic Tests

LM Test Statistics	Results
Serial Correlation*CHSQ(1)	1.908(0.167)
Functional Form *CHSQ(1)	0.955 (0.329)
Normality *CHSQ(2)	1.014 (0.602)
Heteroscedasticity*CHSQ(1)	1.880(0.170)

Figure 2: CUSUM

Plot of Cumulative Sum of Recursive Residuals

The straight lines represent critical bounds at 5% significance level

Figure 3: CUSUMQ

Plot of Cumulative Sum of Squares of Recursive Residuals

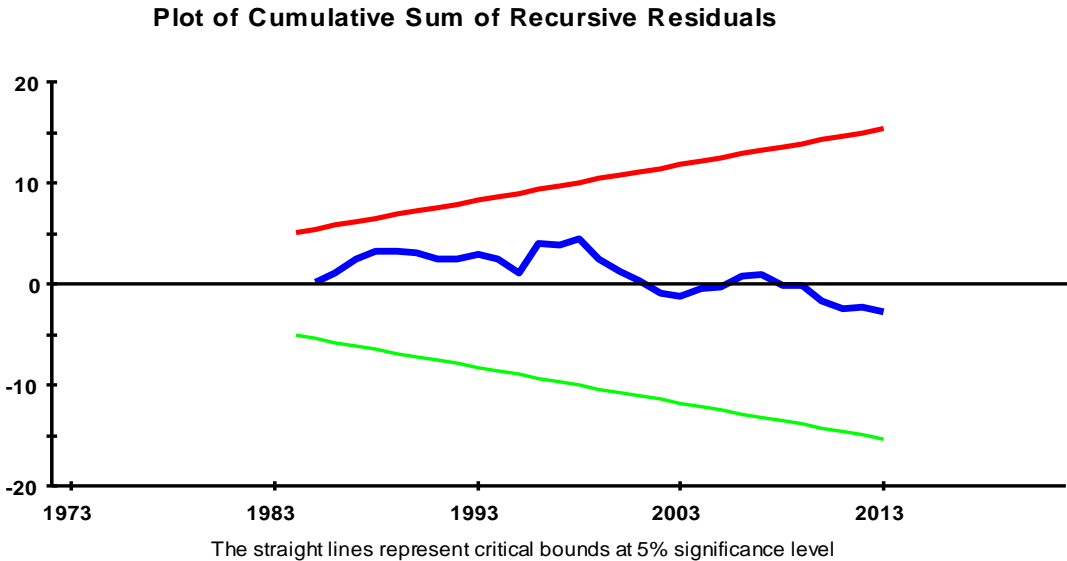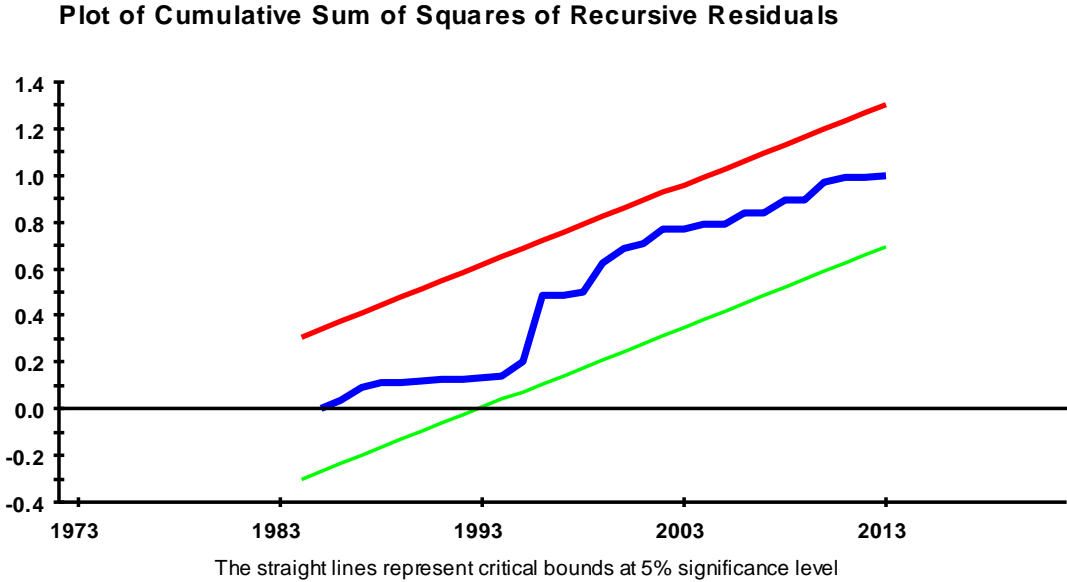The straight lines represent critical bounds at 5% significance level

5   Conclusion

There is growing consensus that monetary policy matters for growth, at least in the short run. The relative importance of price-based (short term interest rates) and quantity-based (money supply) monetary policy remains ambiguous. Kenya uses short-term interest rates as the operational target in a monetary targeting regime. Using the Auto Regressive Distributive Lag (ARDL) bounds testing approach, this study examines the short-run and long-run impact of monetary policy on economic growth in Kenya during the period from 1973 to 2013. The study also adopts broad money supply (M2) and the 3 month Treasury bill rate as monetary policy variables. Both short-run and long-run empirical results suggest monetary policy neutrality in Kenya, implying that monetary policy has no effect on economic growth, both in the short run and in the long run. The outcome may be explained by the fact that the bulk of the fiscal deficits are funded domestically. This may have weakened the transmission of monetary policy into the economy. Overall, the study recommends that policies aimed at improving the institutional and regulatory environment for the financial sector and monetary policy conduct are warranted. There is also need for policy coordination, particularly monetary and fiscal policies.

References

Adam, C., Maturu, B., Ndung'u, N., and O'Connell, S. (2010). Building a Monetary Regime for the 21st Century. In C. Adam, P. Collier, and N. Ndung'u (Eds.), Kenya: Policies for Prosperity. Oxford: Oxford University Press.

Adefeso, H. A. and Mobolaji, H. I. (2010). The fiscal-monetary policy and economic growth in Nigeria*: Pakistan Journals of social sciences*, 7, (2), 137-142.

Amarasekara, C. (2009). The impact of monetary policy on economic growth and inflation in Sri Lanka. *Central Bank of Sri Lanka Staff Studies*, 38, 1-44.

Andrle, M. A., Berg, A., Berkes, E., Morales, R., Portillo, R.,Vavra, D., and Vleck, J. (2013). Forecasting and Policy Analysis Systems in Low Income Countries: The role of money targeting in Kenya, *International Monetary Fund Working Paper*, 239, Washington, D.C.

Arestis, P. (2009). New Consensus in Macroeconomics: A critical appraisal. *University of Cambridge.*

Asongu, S. A. (2014). A note on the long-run neutrality of monetary policy: New empirics. *European Economics Letters*, 3, (1), 1-6.

Bannerjee, A., Dolado, J. and Mestre, R. (1998). Error correction Mechanism Tests for cointegration in single equation framework. *Journal of Time Series Analysis*, 19 (3), 267-283.

Berg, A., Charry, L., Portillo, R. and Vlcek, J. (2013). The monetary transmission mechanism in the Tropics: A Narrative Approach. *International Monetary Fund Working Paper*, 197. Washington, D.C.

Bernanke, B. S and Mihov, I. (1998). Measuring monetary policy. *The Quarterly Journal of Economics*, 113, (3), August.

Bullard, J. (1999). Testing long-run neutrality propositions: Lessons from the recent research. *Federal Reserve Bank of St. Louis Review*, 81, (6), 57-78.

Central Bank of Kenya (2013). Annual Financial stability report, June. Available at: https://www.centralbank.go.ke/index.php/news/378-financial-2013-report.

Central Bank of Kenya (2013). Annual report. Available at: https://www.centralbank.go.ke/index.php/cbk-annualreports.

Central Bank of Kenya (2013). Annual supervision report. Available at: https://www.centralbank.go.ke/index.php/bank-supervision-reports.

Chaudhry, I.S., Qamber, Y. and Farooq, F. (2012). Monetary policy, inflation and economic growth in Pakistan: Exploring the co-integration and causality relationships. *Pakistan Journal of Commerce and Social Science*, 6, (2), 332-347.

Chinn, M. and Ito, H. (2015). The Chinn-Ito Index– A de jure measure of financial openness. Available at: http://web.pdx.edu/~ito/Chinn-Ito_website.htm

Christiano, L., Eichenbaum, M. and Evans, C. (1999). Monetary policy shocks: what have we learned and to what end? In Handbook of Macroeconomics, ed. by J. Taylor,and M. Woodfoord. North Holland.

Clarida, R. Gali J. and Gertler, M. (1999). Monetary policy rules and macroeconomic stability: Evidence and Some Theory, *The Quarterly Journal of Economics*, 115(1): 147-180.

Clarida, R. Gali J. and Gertler, M. (2001). Optimal monetary policy in open versus closed Economies: An Integrated Approach. *American Economic Review*, 91(2). 248-252.

Coibion, O. (2011). Are the effects of monetary policy shocks big or small? *NBER Working Paper*, 17034. Cambridge, M.A.

Davoodi, H., Dixit, S. and Pinter, G. (2013). Monetary transmission mechanism in the East African Community: An empirical investigation. *International Monetary Fund Working Paper*, 39.

Elliott, G., Rothenberg, T. J. and Stock, J. H. (1996). Efficient tests for an autoregressive unit root. *Econometrica*, 64, 813-36.

Fasanya, I. O., Onakoya, A. B. O. and Agboluaje, M. A. (2013). Does monetary policy influence economic growth in Nigeria*? Asian Economic and Financial Review*, 3, (5).

FinAccess (2013). Profiling developments in financial access and usage in Kenya. Available at :

http://fsdkenya.org/wp-content/uploads/2015/08/13-10-31_FinAccess_2013_Report.pdf

Fosu, E .O. A and Magnus, F. J. (2006). Bounds testing approach to cointegration: An examination of foreign direct investment trade and growth relationships. *American Journal of Applied Sciences*, 3(11), 2079-2085.

Grace Li, B., O'Connell, S., Adam, C., Berg, A., and Montiel, P. (2013). VAR meets DSGE: Uncovering the Monetary Transmission Mechanism in Low-Income Countries. Unpublished paper, Available at: http://econweb.umd.edu/~davis/eventpapers/oconnellvar.pdf.

Haddad, M and Pancaro, M. (2010). Can Real Exchange Rate Undervaluation Boost Exports and Growth in Developing Countries? Yes, But Not for Long. *Economic Premise 20*, World Bank PREM Network, June.

Havi, E. D. K. and Enu, P. (2014). The effect of fiscal policy and monetary policy on Ghana's economic growth: which policy is more potent? *International Journal of Empirical Finance*, 3, (2), 61-75.

Hayashi, F. (2000). *Econometrics*. Princeton University Press, Princeton and Oxford.

International Monetary Fund. (2016), Regional Economic Outlook: Sub-Saharan Africa. Washington D.C. April.

Ivrendi, M. and Yildirim, Z. (2013). Monetary policy shocks and macroeconomic variables: evidence from fast growing emerging economies. *Economics Discussion Papers*, 61, Kiel Institute for the World Economy.

Jawaid, S. T., Quadri, F. S., and Ali, N. (2011). Monetary-fiscal-trade policy and economic growth in Pakistan: Time Series Empirical Investigation. *International Journal of Economics and Financial Issues,* 1, (3), 133-138.

Kahn, M. S., and Senhadji, A. S. (2001). Threshold effects in the relationship between inflation and growth. *International Monetary Fund* Staff *Papers*, 48 (1), 1-21.

Kamaan, C, K. (2014). The effect of monetary policy on economic growth in Kenya. *International Journal of Business and Commerce*, 3, (8), April.

Kenya Institute for Public Policy Research and Analysis (KIPPRA). (2013), Kenya Economic Report: Creating an Enabling Environment for Stimulating Investment for Competitive and Sustainable Counties.

Khabo, V. and Harmse, C. (2005).   The impact of monetary policy on economic growth of a small open economy: the case of South Africa. *SAJEMS NS*, 8(3).

Kinyua, J. K (2001). Monetary Policy in Kenya: Evolution and current framework, *Central Bank of Kenya.*

Lashkary, M .and Kashani, H. B. (2011). The impact of monetary variables on economic growth in Iran: A Monetarists' Approach. *World Applied Sciences Journal*, 15, (3), 449-456.

Levine, R. and Renelt, D. (1992). A sensitivity analysis of cross-country growth regressions. *American Economics Review* 82 (4): 942-63.

Maturu, B., Maana, I. and Kisinguh, K. (2010). Monetary policy transmission mechanism in Kenya: a VAR Approach. *Central Bank of Kenya working paper.*

Mishra, P., Montiel, P., and Spilimbergo, A. (2012). Monetary transmission in Low-Income Countries: Effectiveness and policy implications. *International Monetary Fund Economic Review* (60), 270-302.

Mishra, P., and Montiel, P. (2012). How effective is Monetary Transmission in Low Income Countries? A Survey of the Empirical Evidence. *International Monetary Fund Working Paper,* Washington D.C.

Monteil, P., Adam, C., Mbowe, W., and O'Conell, S. (2012). Financial architecture and the monetary transmission mechanism in Tanzania. *CSAE Working Paper*, 03.

Morekwa E. Nyamongo, Moses M.sichei and Nahanson K.Mutai (---) The monetary and fiscal policy interactions in Kenya; *Research department, Central Bank of Kenya.* Available at:

Mugume, A. (2011). Monetary transmission mechanisms in Uganda.   *Bank of Uganda Working Paper*. Available at: http://www.bou.or.ug/bou/home.html

Nogueira, R. P. (2009). Is monetary policy really neutral in the long-run? Evidence for some emerging and developed economies. *Economics Bulletin*, 9(3), 2432- 2437.

Nyamongo, E and Ndirangu, L. (2013). Financial Innovations and Monetary Policy in Kenya. *MPRA,* 52387.

Obstfeld, M. and Taylor, A. M. (2003). Globalization and Capital Markets. *NBER Chapters*, 121-188, NBER.

Odhiambo, N.M. (2009). Energy Consumption and economic growth nexus in Tanzania: An ARDL bounds testing approach. *Energy Policy*, 37, 617-622.

Onyeiwu, C. (2012). Monetary policy and economic growth of Nigeria. *Journal of Economics and Sustainable Development*, 3(7).

Ouattara, B. (2004). Foreign aid and fiscal policy in Senegal. Mimeo University of Manchester.

Palley T. I. (2007). Macroeconomics and monetary policy: Competing theoretical frameworks. *Journal of Post Keynesian Economics*, 30, (1), 61-78.

Pesaran, M. H. and Shin, Y. (1999). An autoregressive distributed lag modelling approach to cointegration analysis, in Econometrics and Economic Theory in the 20th Century: The Ragnar Frisch Centennial Symposium, Storm, S. (Ed.), Cambridge University Press, Chapter 11, 1–31.

Pesaran, M. H., Shin, Y. and Smith, R. (2001). Bound testing approaches to the analysis of level relationship. *Journal of Applied Econometrics*, 16, (3), 174–189.

Pollin, R. and Zhu, A. (2006). Inflation and economic growth: A cross-country nonlinear analysis. *Journal of Post Keynesian Economics* 28 (4), 593-614.

Rafiq, S. M. and Mallick, K. S. (2008). The effect of monetary policy on output in EMU3. A sign restriction approach. *Journal of Macroeconomics*, 30, 1756–1791

Rodríguez, F. R. and Rodrik, D. (2001). Trade policy and economic growth: A skeptic's guide to the cross-national evidence. *NBER Macroeconomics Annual*, 15: 261- 338.

Rodrik, D. (2008). The Real Exchange Rate and Economic Growth. *Brookings Papers on Economic Activity*, 39 (2), 365–439.

Sachs, J. and Warner, A. (1995). Economic reform and the process of global integration. *Brookings Papers on Economic Activity*, 1, 1-117.

Sakyi, D. (2011). Trade openness, foreign aid and economic growth in post-liberalization Ghana: An application of ARDL Bounds Test. *Journal of Economics and International Finance* 3(3), 146-156.

Vinayagathasan, T. (2013). Monetary policy and the real economy: A Structural VAR Approach for Sri Lanka. *National Graduate Institute for Policy Studies,* 13, (13).

Walsh, C. E. (2003). *Monetary Theory and Policy.* The MIT Press, Second Edition.

White, W. R. (2013). Is Monetary Policy a Science? The Interaction of Theory and Practice over the Last 50 Years*. Federal Reserve Bank of Dallas, Globalization and Monetary Policy Institute Working Paper* ,155. September.

Woodford, M. (2007). The case of forecast targeting as monetary policy strategy. Journal of economic perspectives, 21, (4), 3-24.

World Bank. (2015). World Development Indicators 2015.

Yilmazkuday, H. (2013). Inflation thresholds and growth. *International Economic Journal*, 27, 1, 1-10.

Appendix A: Graphical expositions of the time series variable data