BANK RATE AND THE TRANSMISSION MECHANISMS OF MONETARY POLICY IN KENYA

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Abstract

This paper investigates the transmission mechanisms from changes in the bank rate to various economic outcomes using a Structural VAR and monthly data over 2000-2012. Specifically, the paper analyses and decomposes how a bank rate shock affects real output, the price level (CPI), lending rates, the exchange rate and the NSE stock price index. The bank rate is measured by the CBR after July 2006 and the TBR+3% rule before July 2006.

The results show that an increase in the bank rate innovations has relatively weak effects on growth. At 10% significance level, growth increases in the 2nd and 3rd months (a puzzle), but is offset by a decline in the 8th-11th months. The effects on overall inflation are also relatively weak with the CPI significantly declining only at the 10% level in the 4th-7th months.

The results also show innovations in the bank rate have more persistent effects and significantly increase the lending rate at least at the 5-10% levels in the 1st – 6th months. However the impact of bank rate innovations in reducing private bank credit is significant only in the 3rd-5th months at 5-10% levels. Thus the increases in lending rates are not strongly translated to lower credit to the private sector.

Strong effects of innovations in the bank rate are also found on the exchange rate with a 10% increase in the bank rate appreciating the exchange rate by 0.1-0.5% point in the first 5 months, thereby explaining the decline in inflation in the 4th-7th months. The NSE index significantly declines at the 10% level in the 4th-9th months.

Granger-causality results show that the most important relationships at 10% significance level or higher are from the bank rate, domestic credit to the private sector and the NSE index to the nominal exchange rate (NER), with NER in turn Granger affecting GDP, the CPI, and domestic credit to the private sector. These results are, to a large extent, supported by earlier studies on Kenya's monetary transmission mechanisms such as Cheng (2006) and Maturu et al. (2011), despite these studies analyzing the transmission mechanism from other short-term interest rates.

I. Introduction

The principal objectives of CBK are to (i) formulate and implement monetary policy directed at achieving and maintaining stability in the general level of prices; and (ii) foster the liquidity, solvency and proper functioning of a stable market-based financial system. The CBK's monetary policy has two pillars: the first is a monetary programme that assigns a prominent role to monetary aggregates, as reflected by the announcement of targets for the growth of the M3 and its components. The second pillar is the Central Bank Rate (CBR), introduced in June 2006, in accordance with Section 36(4) of the CBK Act, to signal the stance of monetary policy. The CBR is for example defined as the lowest rate at which the CBK charges on loans it extends to commercial banks as the lender of last resort. Before the introduction of the CBR, the bank rate was 3 percent above the Treasury bill rate which was in use since 2000. The central bank has been utilizing a fairly consistent monetary policy regime since the liberalization of the economy in the 1990s (Maturu et al. 2011).

The open market operations (OMO) are the main instruments used to manage the liquidity situation and to steer interest rates according to the monetary policy stance. OMO is mainly conducted in the form of repos and reverse repos. Under repos, the CBK agrees to sell government securities to commercial banks at agreed interest rates (repo rate) for a specified period (currently 7 days) with an understanding that the CBK will repurchase the securities from the commercial banks at the end of the period thus mopping liquidity from the banking system. Under reverse repo, the CBK agrees to purchase government securities from commercial banks at agreed interest rates (reverse repo rates) for a specified period with an understanding that the CBK will resell the securities to the commercial banks at the end of the period hence injecting the requisite liquidity into the banking system. The CBK started experimentation with repos in September 1996. More recently, the CBK also utilizes Term Auction Deposits (TAD) to mop liquidity from commercial banks when its securities are exhausted or when it considers it desirable to offer longer tenor options (currently at 14, 21 and 28 days). TAD entails transfer of commercial banks deposits to CBK at an auction price but with no exchange of securities

The CBK also provides, as a lender of last resort, liquidity to commercial banks but in a manner that would not comprise the adopted monetary policy stance. Through the open discount window (standing facilities), the CBK provides liquidity with overnight maturity to

individual banks facing unforeseen liquidity shocks. It therefore provides a type of insurance mechanism for banks, but at penalty interest rates with the initiative to seek support on the side of the banks. The CBK discount window is closely linked to its monetary policy stance, with the window rate determined by CBR. The current window rate is CBR+6%.

The third component of the monetary policy operational framework is the minimum cash reserves requirement. The minimum cash reserves ratio is aimed at (i) stabilising money market interest rates without recourse to frequent central bank interventions in the open market; and (ii) creating or enlarging the structural liquidity shortage of the banking sector to increase the effectiveness of monetary policy actions. Although the minimum cash reserves ratio has existed since June 1978, it was not actively utilized until the early 1990s[1].

Despite these monetary policy developments, little research has been done to understand the monetary transmission mechanisms in Kenya through the bank rate (the CBR and before it the TBR+3% rule). The available studies have focused on other intermediate short-term interest rates such as the repo rate and the interbank rate (Cheng 2010, Maturu et al. 2011) which are largely endogenous to the bank rate. The objective of this paper is therefore to extend these studies with a focus on the transmission channels through which the CBR and the TBR+3% policy affect economic outcomes. Specifically, the paper analyses and decomposes how a bank rate shock affects real output, inflation, lending rates, exchange rate and the stock market prices index.

The rest of the paper is organized as follows. Section II discusses the transmission mechanisms of monetary policy; Section III explains the methodology for investigating the monetary transmission mechanisms in Kenya; Section IV presents the empirical results; while Section V concludes by discussing potential policies towards enhancing the transmission mechanisms of monetary policy in the country.

[1] The ratio was for example raised from a low of 6% in 1992 to a high of 20% in March 1994 before being reduced gradually to a low of 10% in October 2000, calculated on average of over 14 days with 8% minimum on any one day. In July 2003, the ratio was revised from a monthly average of 10% to 6% maintained daily. On December 1, 2008, the cash reserves ratio was reduced to 5%; and on June 11, 2009, to 4.5%. On May 31, 2011, it was raised to 4.75% and effective from December 15, 2011, to a monthly average of 5.25%, subject to a daily minimum ratio of 3%.

II. Transmission channels of monetary policy

The monetary transmission mechanisms describe how policy induced changes in short-term interest rates or the nominal money stock (and its components) impact on variables such as output, prices, lending rates, the exchange rate and stock market prices (Ireland 2010). Understanding these mechanisms is important for the appropriate design, management and implementation of monetary policy. There are four main channels through which monetary policy actions impact on variables such as output and prices (Mishkin 1995). In addition, expectations of changes in these transmission channels have an important bearing on the effectiveness of monetary policy actions (Christensen 2010). This is particularly the case when the central bank has gained credibility, its actions are predictable and it actively communicates its policy to the public, with communication enhancing the signaling effects of monetary policy.

The first is the interest rate channel. In this channel, an increase in the bank rate causes an increase in lending interest rates which reduces private investment and consumption expenditures, hence reducing output and pressure on prices (Ireland 2010). Movements in the policy rate are therefore only effective to the extent they influence the lending interest rates of banks and thereby economic activity in the country. Under this channel, a tight monetary policy increases the payments that firms and households have to make to service their floating rate debt.

The effectiveness of this channel depends on the competitiveness of the banking sector. Banks in oligopolistic market structure may decide to lower their profit margins rather than pass on the effects of the bank rate changes to borrowers. There might as well be asymmetric effects between bank rate and lending rates. Banks may be reluctant to reduce lending rates when the bank rate is reduced thereby undermining the effectiveness of the interest rate channel in providing countercyclical support to economic activity during a downturn. Hence changes in bank rate may have little impact on credit conditions due to inelastic demand for credit or because of the banks practice of keeping spreads constant, while they could reduce their profit margins rather pass the burden of the policy rate to borrowers.

The second is the credit channel, which complements the interest rate channel. This can be decomposed into the (a) bank lending channel; and (b) balance sheet channel (Ireland 2010).

Under the bank lending channel, open market and other operations that accompany an increase in the bank rate for example may lead to a contraction in bank reserves which forces banks to cut back on their lending, in turn making firms and households to cut back on their investment and consumer spending. The balance sheet channel on the other hand postulates that, in the presence of financial market imperfections, firms' cost of credit, whether from banks or any other external source increases when the strength of their balance sheets deteriorates. Hence an increase in interest rates following a tight monetary policy may work to reduce the capitalization value of the firms' long-term assets, weakening their balance sheets and increasing the cost of borrowing.

The third is the exchange rate channel**.** This channel is important in small open economies with a flexible exchange rate. An increase in the bank rate for example raises domestic interest rates relative to foreign rates so that the domestic currency appreciates to equate the non-adjusted returns of the debt instruments denominated in domestic and foreign currencies (uncovered interest rate parity). Increased capital inflows and the appreciation of the exchange rate reduces net exports and therefore aggregate demand with negative Keynesian effects on output and reduced pressure on prices. An appreciation of the exchange rate also reduces domestic inflation by lowering the shilling import prices. These impacts are often amplified through inflationary expectations as the exchange rate is a highly visible macro price. In the absence of adequate information, economic agents may interpret the appreciation of the exchange rate as an early indicator of the monetary conditions and reduce inflationary pressures in the economy and vice-versa (Christensen 2010).

The fourth is the asset price channel. An increase in the bank rate makes debt instruments more attractive than equities in the eyes of investors, hence causing a fall in equity prices. Facing a lower Tobin's q (market value of a firm versus the historical cost of its capital), investment projects that were only marginally profitable are abandoned, leading to a fall in output and prices. The decline of equity prices following a monetary tightening also reduces household financial wealth (if equities dominate), leading to a fall in consumption, output and prices. In low income countries, bond markets are still in their infancy and are dominated by short-term government securities so that this channel may be weak (Christensen 2010).

III. Methodology for Investigating Monetary Transmission Mechanisms in Kenya

In assessing the transmission mechanisms, many studies use the vector autoregression (VAR) approach pioneered by Sims (1980). This approach sidesteps the need for structural modeling by treating every endogenous variable as a function of exogenous variables as well as the lagged values of all of the endogenous variables in the system. The mathematical representation of a VAR is:

$$y_t = A_1 y_{t-1} + ... + A_p y_{t-p} + Bx_t + \varepsilon_t$$

where y_t is a vector of endogenous variables, x_t is a vector of exogenous variables, and $A_1....A_p$ and B are matrices of coefficients to be estimated, and ε_t is a vector of innovations that may be contemporaneously correlated but are uncorrelated with their own lagged values[2].

To identify the VAR equations and to obtain non-recursive orthogonalization of the error terms for impulse response analysis, a structural VAR (SVAR) is estimated. This requires imposition of enough restrictions to identify the orthogonal (structural) components of the error terms. Let y_t be a k-element vector of the endogenous variables and $\Sigma e_t e_t'$ be the residual covariance matrix, then the SVAR model can be written as:

$$Ae_t = Bu_t$$

where e_t and u_t are vectors of length k, e_t is the observed (or reduced form) residuals, u_t is the unobserved structural innovations while A and B are k x k matrices to be estimated. The structural innovations are assumed to be orthonormal, that is, their covariance matrix is an identity matrix $E[u_t u_t] = I$. The assumption of orthonormal innovations imposes the following identifying restrictions on A and B:

$$A\Sigma A' = BB'$$

[2] For a discussion of the VAR methodology, see *Eviews 6 software manual*.

Noting that the expressions on either side of this expression are symmetric, this imposes $k(k+1)/2$ restrictions on the $2k^2$ unknown elements in A and B. Therefore, in order to identify A and B, one needs to supply at least $2k^2-k(k+1)/2 = k(3k-1)/2$ additional restrictions.

For more general restrictions, the relationship $Ae_t = Bu_t$ is written as a set of equations, identifying each element of the e_t and u_t vectors with special symbols. Elements of the A and B matrices to be estimated must be specified as elements of coefficient vectors.

In our analysis, the monetary policy stance is represented by the bank rate (CBR) while endogenous variables are given by real GDP, CPI, the lending rate (LR), credit to the private sector (DCP), the nominal exchange rate (NER) and the NSE stock index, with exogenous variables, as in Cheng (2006), represented by the international oil price, the weighted dollar export price index for Kenya's main exports (tea, coffee and horticulture), foreign interest rates (captured by the US Treasury bill rate) and seasonal (quarterly) dummies[3].

The study uses monthly data over January 2000-December 2012, with the bank rate given by the CBR after July 2006 and the TBR+3% rule before July 2006[4]. Monthly GDP and CPI data are linearly interpolated from quarterly data. As in many VAR studies, the analysis is done in level variables. Sims (1980) and others recommend against differencing the data even if the variables contain a unit root as the goal of the VAR analysis is to determine interrelationships among the variables, not parameter estimates. Differencing throws away information concerning the co-movements in the data such as the possibility of cointegrating relationships (Enders 1995). All the variables are expressed in logarithms.

As in Enders (1995), Cheng (2006) and Maturu et al. (2011), we impose the following short-run restrictions on the structural VAR:

[33] The data to derive all these variables were downloaded from the websites of the Kenya National Bureau of Statistics, CBK and the US Federal Reserve Bank (Washington and St. Louis).
[4] Combining the two periods was essential to get adequate degrees of freedom.

$$\begin{bmatrix} e1 \\ e2 \\ e3 \\ e4 \\ e5 \\ e6 \\ e7 \end{bmatrix} = \begin{bmatrix} 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ c2 & 0 & 0 & 0 & 0 & 0 & 0 \\ c4 & c5 & 0 & 0 & 0 & 0 & 0 \\ c7 & c8 & c9 & 0 & 0 & 0 & 0 \\ c11 & c12 & c13 & c14 & 0 & 0 & 0 \\ c16 & c17 & c18 & c19 & c20 & 0 & 0 \\ c22 & c23 & c24 & c25 & c26 & c27 & 0 \end{bmatrix} \begin{bmatrix} e1 \\ e2 \\ e3 \\ e4 \\ e5 \\ e6 \\ e7 \end{bmatrix} + \begin{bmatrix} c1 \\ c3 \\ c6 \\ c10 \\ c15 \\ c21 \\ c28 \end{bmatrix} \begin{bmatrix} u1 \\ u2 \\ u3 \\ u4 \\ u5 \\ u6 \\ u7 \end{bmatrix}$$

where ei represent the residuals of LGDP, LCPI, LCBR, LLR, LDCP, LNER and LNSE, respectively, with i=1...7 while ui is the unobserved structural innovations. The assumption is that none of the variables have a contemporaneous effect on GDP; only GDP has a contemporaneous effect on CPI; only GDP and CPI have contemporaneous effects on CBR (the Taylor rule), and so on.

IV. Empirical Results

Figure 1 in the Appendix shows the endogenous data used in the SVAR analysis. They conform to what is known about their evolution.

Table 1 shows four out of five tests (final prediction error test, Akaike information criterion, Schwarz information criterion and Hannan-Quinn information criterion) support a lag length of at most 12 months. Figure 2 shows the inverse roots of the characteristic polynomial which show that the estimated SVAR is largely stable (stationary) as the roots (except only a few) have modulus less than one and lie inside the unit circle.

Figure 3 and Table 2 (in the Appendix) show the effects of a one-standard deviation shock in the bank rate (CBR) on endogenous variables. The results show that an increase in the bank rate innovations has weak effects on growth. At 10% significance level (t-value cutoff of 1.3), growth increases in the 2nd and 3rd months (a puzzle), but is offset by a decline in the 8th-11th months. The effects on overall inflation are also weak with the CPI significantly declining only at the 10% level in the 4th-7th months.

The results also show innovations in the bank rate have more persistent effects and significantly increase the lending rate (LR) at least at the 5-10% levels in the 1st – 6th months. However the impact of bank rate innovations in reducing private bank credit is significant

only in the 3rd-5th months at 5-10% levels. Thus the increases in lending rates are not strongly translated to lower credit to the private sector.

Strong effects of innovations in the bank rate (similar to those on the lending rate) are on the exchange rate with a 10% increase in the bank rate appreciating the exchange rate by 0.1-0.5% in the first 5 months, thereby explaining the decline in inflation in the 4th-7th months. The NSE index significantly declines at the 10% level in the 4th-9th months. Overall (Figure 4), innovations in the bank rate accounted for an average of 20.1% of the variations in the GDP, 15.6% of the variations in CPI, 14.4% of the variations in the lending rate, 10.8% of DCP, 16.7% of NER and 22.4% of the variations in the NSE index[5]. Granger-causality results (Table 3) show that the most important relationships at 10% level or higher are from CBR, DCP and NSE to NER, with NER in turn Granger affecting GDP, CPI, and DCP.

These results are, to a large extent, supported by earlier studies on Kenya's monetary transmission mechanisms. In his study, Cheng (2006) analyzed the impact of the repo rate on output, prices and the nominal exchange rate using monthly data over 1997-2005. The study found the impact of the repo rate on output to be non-significant. Cheng explains the weak transmission mechanism from monetary policy stance to real variables (output) to structural problems in the financial market including inadequate financial infrastructure and a weak legal framework.

On the other hand, an exogenous increase in the repo rate was followed by a decline in prices and an appreciation of the exchange rate with effects culminating 9-12 months later, as per our results. The study therefore found a strong link between monetary policy and nominal variables with the effects through exchange rate channel dominating. Tight monetary policy makes domestic assets more profitable vis a vis foreign assets, resulting in capital inflows, thereby appreciating the exchange rate. This makes imports cheaper, easing inflation. In the

[5] VARs have been criticized on several grounds (Walsh 2010). Some of the impulse responses for example do not accord well with most economists' priors. A related but more general point is that many of the VARs do not incorporate forward looking variables that central banks look at when formulating policy. In addition, the residuals from the VAR regressions that are used to represent policy shocks often bear little relationship to standard interpretations of the historical records of past policy actions and periods of contraction and expansionary policy. As well, the implied policy reaction function from a VAR may differ from the results obtained from more direct attempts to estimate reaction functions or to model policy behaviour. It is important to interrogate whether is anticipated or unanticipated monetary policy actions that matter for the performance of the economy.

study, variations in the repo rates accounted for about one-third of the fluctuations in prices and one-half of the fluctuations in the nominal exchange rate, while accounting for only about 10% of the output variation.

In their study, Maturu et al. (2011) extended the Cheng study by analyzing more transmission mechanisms to include credit and stock market channels, although they used quarterly data. They found the latter two channels important in Kenya with an increase in short-term rates (repo and interbank rates) reducing the stock-market index (peak fall effects in the fourth quarter) and domestic credit to the private sector with inflation effects being felt in the fourth quarter. As in Cheng (2006), they found a tight monetary policy appreciates the nominal exchange rate with a peak appreciation in the third quarter. Maturu et al. found the interest rate channel more important than the exchange rate channel.

V. Concluding Remarks: Towards Enhancing the Transmission Mechanisms of Monetary Policy in Kenya

The literature identifies four major constraints to the effectiveness of monetary policy in developing countries: (i) low financial depth; (ii) widespread dollarization; (iii) fiscal dominance; and (iv) excess liquidity of the banking system (Christensen 2010). These constraints would need to be addressed to enhance the transmission mechanism of monetary policy in a country.

Christensen (2010) classifies Kenya as a frontier market economy whose financial market is advanced, but does not yet have access to global financial markets to the same extent as emerging market economies in the region such as MENA countries and South Africa. Its M3/GDP ratio is about 34% compared to an average of 63% for emerging market economies in 2008-10, although these indicators have improved over time (its share of private sector credit to deposits was 88% compared to an average of 96% for emerging market economies). Lack of financial depth weakens the interest rate channel; while lack of a deep secondary market for equities and real estate weaken the assets channel.

Monetary policy also affects financial claims and liabilities in local currency, but not in foreign currency. Hence the greater the dollarization of the economy, the less the scope for an independent monetary policy. Dollarization or the use of foreign currencies might indicate

lack of confidence in the stability of the local currency. While there is no evidence of large dollarization in Kenya, Figure 6 shows a large increase in the share of foreign currency deposit liabilities in the country. These account for about 20% compared to 5.5% for example in South Asian in 2010 (Christensen 2010).

Fiscal dominance on the other hand implies that expectations about inflation are intrinsically linked to fiscal performance. Fiscal dominance leads to inflationary expectations reacting to fiscal events and reflect lack of a credible anchor to prices. It can also compromise central bank independence if the government openly resists a central bank's moves to raise interest rates. More importantly, fiscal dominance generally crowds out private sector credit and may undermine economic growth. Under fiscal dominance for example, a tight monetary policy might have perverse effects on the economy if it increases the risk of default on government debt leading to a depreciation of the currency and increased inflation.

A major achievement of the Kenyan authorities over the last decade has been the elimination of fiscal dominance which has allowed a coherent monetary policy to emerge (Adam et al., 2010). This is reflected in a substantial decline in the proportion of public sector credit to total credit (Figure 6), although some of the progress was reversed during the recent global financial crisis, as government increased stimulus spending to cushion the effects of the economic downturn. As noted however by Adam et al, the dragon of fiscal indiscipline is never completely slain, so an important consideration becomes the capacity of alternative monetary regimes (such as inflation targeting) to offer an effective bulwark against recurring fiscal indiscipline outside the role of the IMF as an agent of restraint. Monetary policy cannot on its own solve structural problems of fiscal control: this requires deeper political considerations, even though a credible and transparent monetary regime may play an important role in securing fiscal discipline on an ongoing basis.

Finally, excess liquidity of the banking system makes banks less sensitive to interest rates or reserve ratio increases and therefore requires more monetary policy tightening to have the desired effects. Excess reserves may be due to the perceived lack of low-risk lending opportunities including money market instruments in which banks can invest. Weaknesses in property rights, poor enforceability of contracts and lack of credit rating agencies have held banks from lending to the private sector. Saxegaard (2006) uses a threshold VAR model for a number of sub-Saharan African countries and finds that excess liquidity weakens the

monetary transmission mechanism and thus the ability of monetary authorities to influence demand conditions in the economy. Figure 7 show that while the ratio of excess reserves in reserve money has been stable, there have been episodes when the ratio has been high (such as in 2003 and 2010), creating a monetary overhang.

In summary, improving the transmission of monetary policy requires an independent and credible central bank; well functioning secondary markets to help the central bank influence variables such as the interbank rates and the money stock while competition in the banking sector is necessary if changes in the policy rate are to have an impact on markets. Uncompetitive banks means that changes in the policy rates are not transmitted to the lending and deposit rates of customers. Initially, a substantial degree of international integration is required to influence the arbitrage between domestic and foreign assets through the exchange rate channel.

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Appendix: Figure 1: Data used in the study

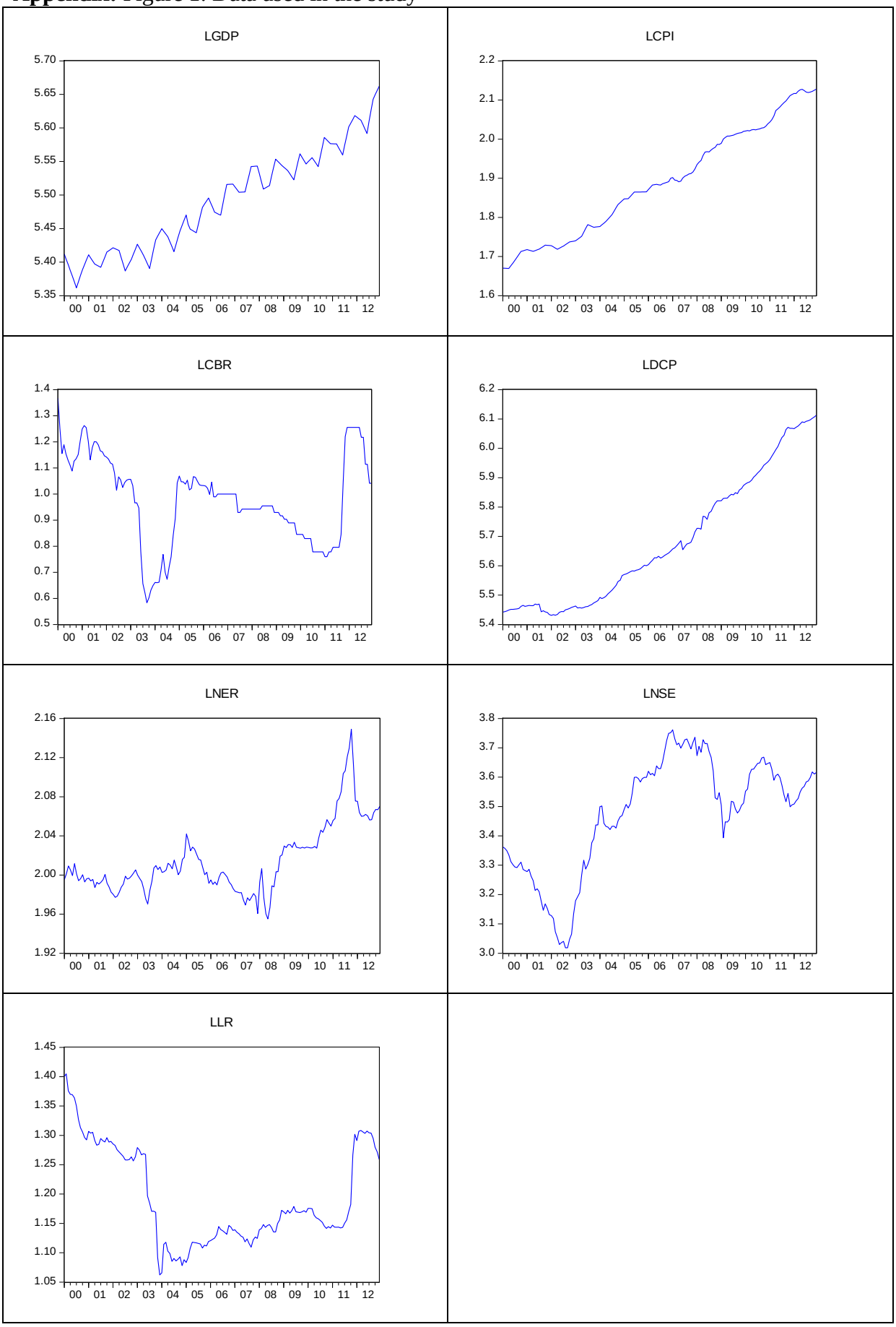

Table 1: VAR Lag Order Selection Criteria

VAR Lag Order Selection Criteria
Endogenous variables: LGDP LCPI LCBR LLR LDCP LNER LNSE
Exogenous variables: C LOILPRICE LTBR91USA LEXPORTPRICE QUARTER2 QUARTER3 QUARTER4
Sample: 2000M01 2012M12
Included observations: 144

Lag	LogL	LR	FPE	AIC	SC	HQ
0	2056.051	NA	1.85e-21	-27.87571	-26.86515	-27.46508
1	3282.123	2213.741	1.47e-28	-44.22393	-42.20281*	-43.40266
2	3365.594	142.5957	9.22e-29	-44.70269	-41.67101	-43.47079*
3	3422.214	91.22154	8.47e-29	-44.80853	-40.76628	-43.16599
4	3473.803	78.09927	8.46e-29*	-44.84448	-39.79167	-42.79130
5	3515.130	58.54662	9.91e-29	-44.73791	-38.67454	-42.27410
6	3557.762	56.25132	1.17e-28	-44.64947	-37.57554	-41.77503
7	3606.149	59.13921	1.31e-28	-44.64096	-36.55646	-41.35587
8	3652.839	52.52700	1.55e-28	-44.60888	-35.51383	-40.91317
9	3692.071	40.32119	2.14e-28	-44.47321	-34.36759	-40.36686
10	3773.138	75.43753*	1.75e-28	-44.91858	-33.80241	-40.40160
11	3845.923	60.65418	1.71e-28	-45.24893	-33.12219	-40.32131
12	3918.645	53.53134	1.83e-28	-45.57840*	-32.44110	-40.24014

* 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

Figure 2: Inverse Roots of AR Characteristic Polynomial

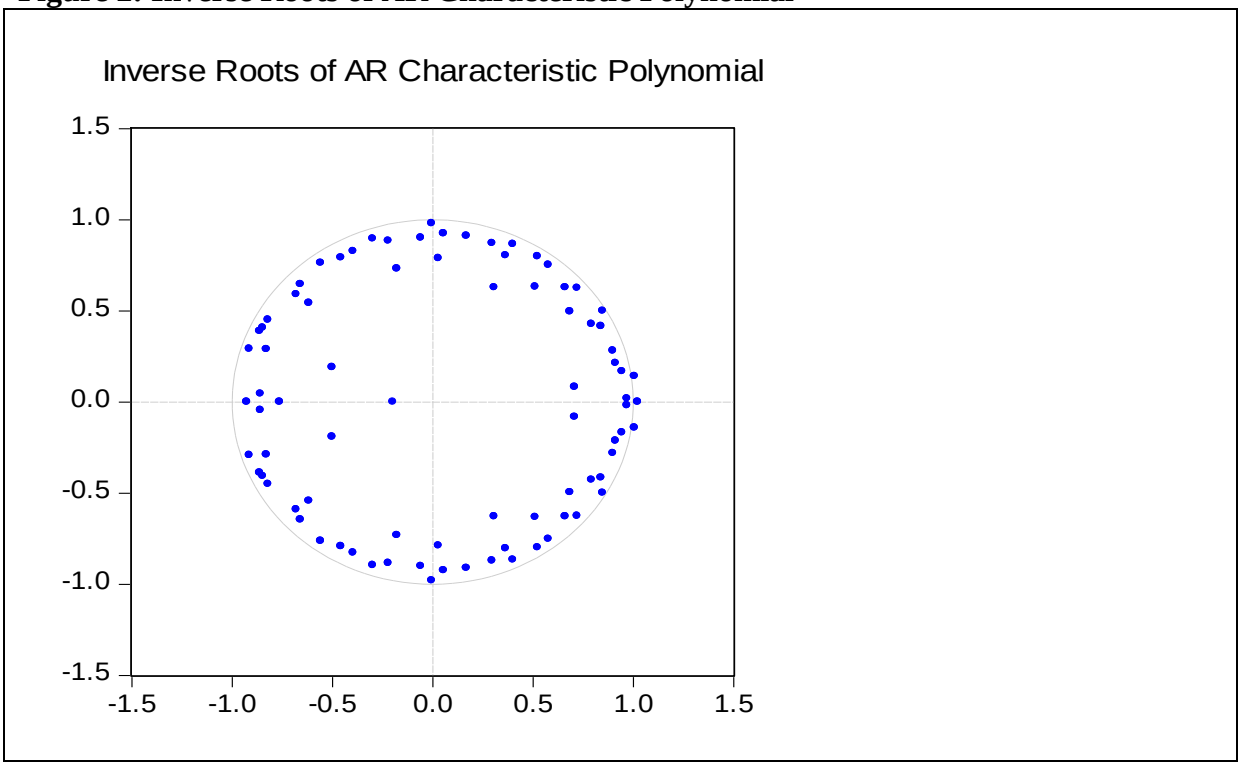

Figure 3: Impulse Response Functions for the CBR Transmission Mechanisms

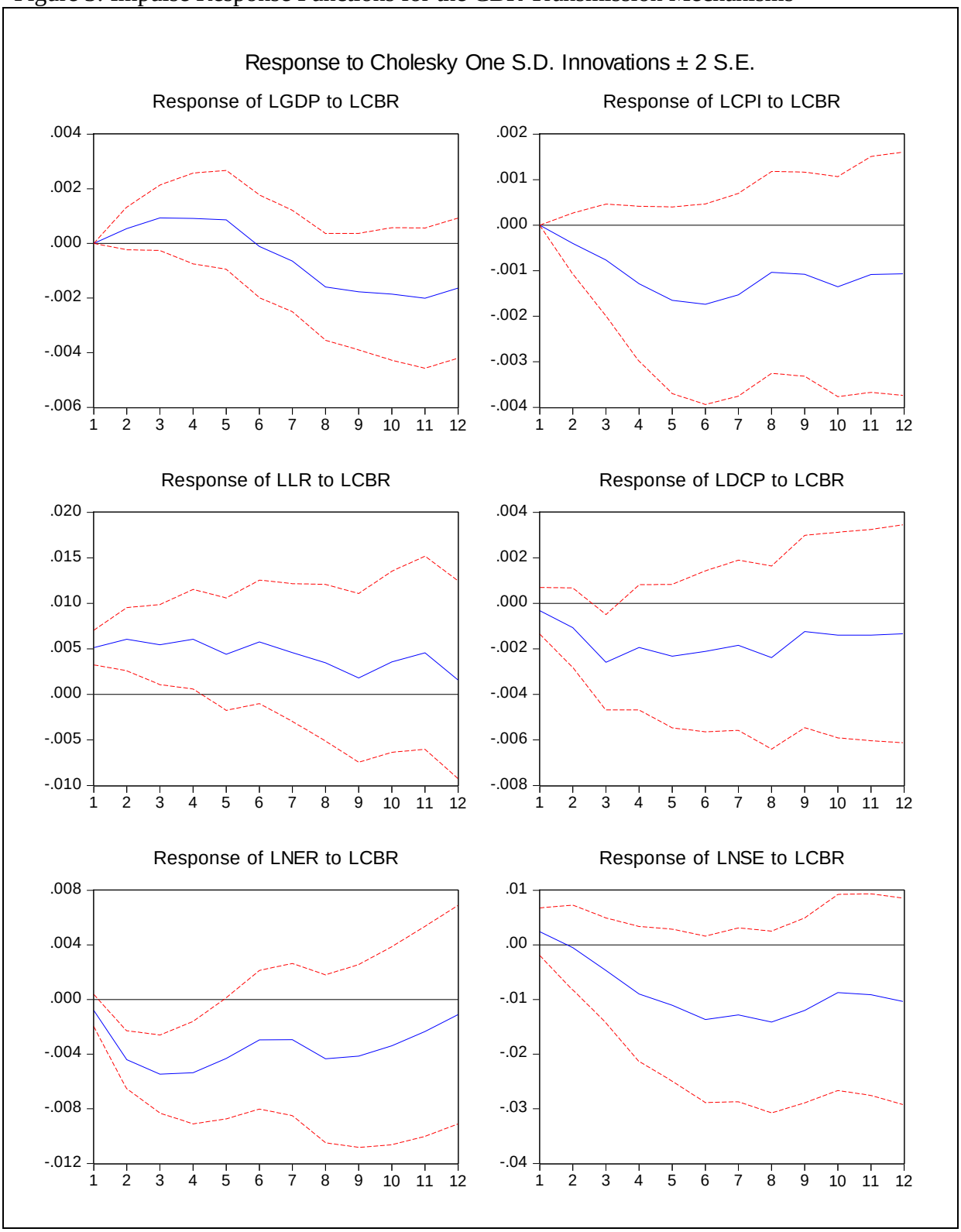

Table 2: Impulse Response Functions of the CBR Transmission Mechanisms

Period	LGDP	LCPI	LLR	LDCP	LNER	LNSE
1	0.000	0.000	0.005	0.000	-0.001	0.002
	-	-	(5.404)	(0.633)	(1.349)	(1.107)
2	0.001	0.000	0.006	-0.001	-0.004	0.000
	(1.395)	(1.215)	(3.505)	(1.226)	(4.158)	(0.125)
3	0.001	-0.001	0.005	-0.003	-0.005	-0.005
	(1.558)	(1.251)	(2.480)	(2.467)	(3.822)	(0.977)
4	0.001	-0.001	0.006	-0.002	-0.005	-0.009
	(1.099)	(1.512)	(2.221)	(1.401)	(2.864)	(1.457)
5	0.001	-0.002	0.004	-0.002	-0.004	-0.011
	(0.947)	(1.620)	(1.427)	(1.480)	(1.940)	(1.586)
6	0.000	-0.002	0.006	-0.002	-0.003	-0.014
	(0.121)	(1.578)	(1.701)	(1.192)	(1.162)	(1.793)
7	-0.001	-0.002	0.005	-0.002	-0.003	-0.013
	(0.699)	(1.377)	(1.211)	(0.987)	(1.053)	(1.610)
8	-0.002	-0.001	0.003	-0.002	-0.004	-0.014
	(1.627)	(0.934)	(0.807)	(1.186)	(1.410)	(1.698)
9	-0.002	-0.001	0.002	-0.001	-0.004	-0.012
	(1.654)	(0.963)	(0.390)	(0.587)	(1.236)	(1.417)
10	-0.002	-0.001	0.004	-0.001	-0.003	-0.009
	(1.531)	(1.117)	(-0.720)	(0.617)	(0.933)	(0.971)
11	-0.002	-0.001	0.005	-0.001	-0.002	-0.009
	(1.567)	(0.833)	(0.861)	(0.602)	(0.608)	(0.988)
12	-0.002	-0.001	0.002	-0.001	-0.001	-0.010
	(1.279)	(0.798)	(0.290)	(0.556)	(0.276)	(1.100)

Cholesky Ordering: LGDP LCPI LCBR LLR LDCP LNER LNSE
T-values in brackets

Table 3: VAR Granger Causality/Block Exogeneity Wald Tests

Sample: 2000M01 2012M12
Included observations: 144

Dependent variable: LGDP

Excluded	Chi-sq	df	Prob.
LCPI	15.90648	12	0.1956
LCBR	10.76731	12	0.5490
LLR	9.371268	12	0.6709
LDCP	11.92723	12	0.4515
LNER	26.92125	12	0.0079
LNSE	15.65272	12	0.2077
All	114.7893	72	0.0010

Dependent variable: LCPI

Excluded	Chi-sq	df	Prob.
LGDP	17.74210	12	0.1237
LCBR	12.40127	12	0.4140
LLR	9.095555	12	0.6947
LDCP	12.21247	12	0.4288
LNER	18.64737	12	0.0974
LNSE	9.654470	12	0.6462
All	101.4544	72	0.0127

Dependent variable: LCBR

Excluded	Chi-sq	df	Prob.
LGDP	14.79015	12	0.2531
LCPI	13.79055	12	0.3143
LLR	8.598314	12	0.7368
LDCP	12.97965	12	0.3705
LNER	13.69530	12	0.3206
LNSE	17.00262	12	0.1495
All	98.14413	72	0.0220

Dependent variable: LLR

Excluded	Chi-sq	df	Prob.
LGDP	6.692674	12	0.8772
LCPI	12.77207	12	0.3858
LCBR	12.04625	12	0.4420
LDCP	3.205021	12	0.9939
LNER	10.69344	12	0.5554
LNSE	6.500866	12	0.8888
All	95.86017	72	0.0316

Dependent variable: LDCP

Excluded	Chi-sq	df	Prob.
LGDP	10.68876	12	0.5558
LCPI	9.481604	12	0.6613
LCBR	6.311933	12	0.8995
LLR	9.344667	12	0.6732
LNER	19.26683	12	0.0823
LNSE	19.02971	12	0.0878
All	89.38259	72	0.0807

Dependent variable: LNER

Excluded	Chi-sq	df	Prob.
LGDP	17.13106	12	0.1447
LCPI	14.13550	12	0.2921
LCBR	30.89782	12	0.0020
LLR	12.63117	12	0.3964
LDCP	44.15891	12	0.0000
LNSE	37.25485	12	0.0002
All	139.2131	72	0.0000

Dependent variable: LNSE

Excluded	Chi-sq	df	Prob.
LGDP	1.388497	12	0.9999
LCPI	6.971074	12	0.8595
LCBR	7.405063	12	0.8297
LLR	4.725185	12	0.9665
LDCP	15.80027	12	0.2006
LNER	10.07371	12	0.6095
All	66.73104	72	0.6533

Figure 4: Variance Decomposition of the impact of innovations in CBR

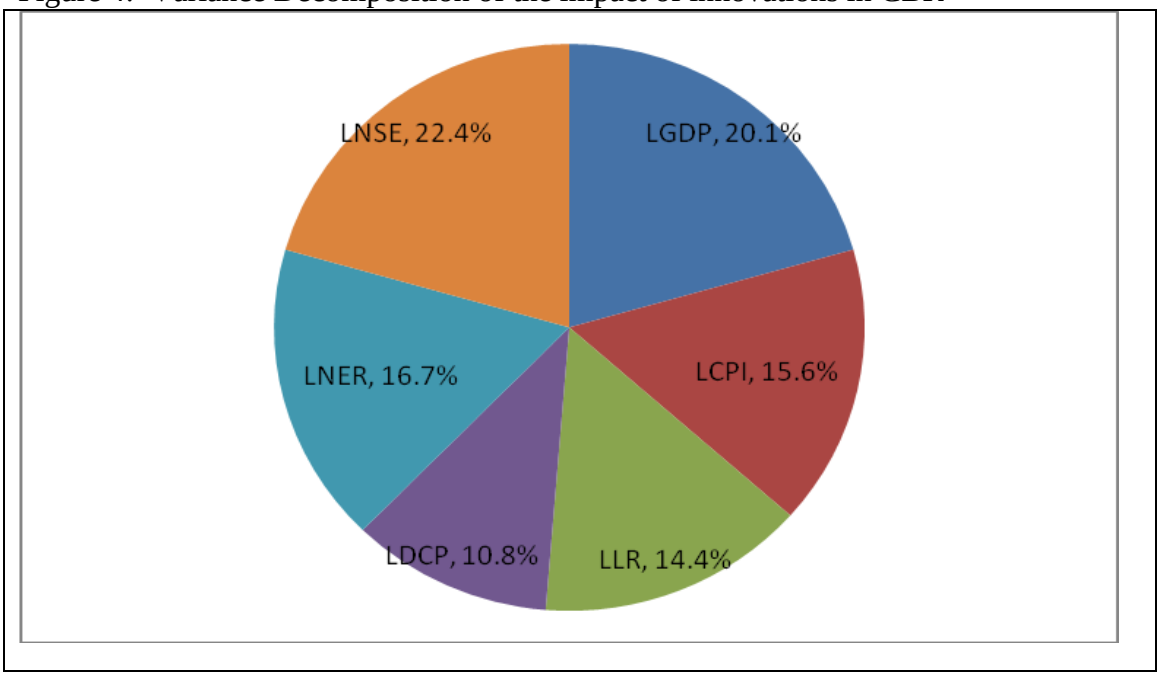

Figure 6: Percent share of Foreign Currency to Total Deposits (FCD_TD) and Credit to Public to Total Credit (DCG_DG) in Kenya, December 1995 to March 2013

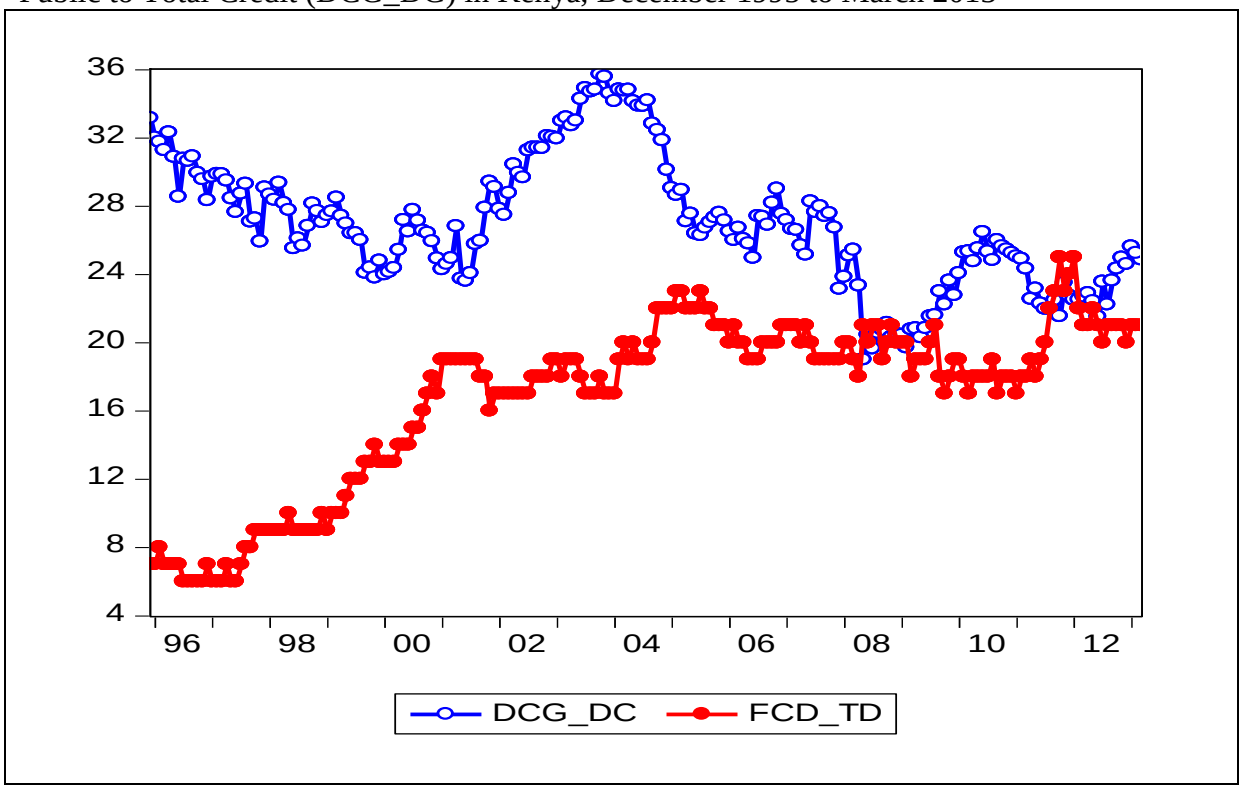

Figure 7: Percent Excess Reserves as a Proportion of Reserve Money, January 6, 2003 to January 18, 2012