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Monetary Policy at the turn of Financial Markets: A Forerunner or Follower?

Jared Osoro* and Camilla C. Talam**

Abstract

This paper seeks to establish whether the monetary policy stance of Central bank of Kenya (CBK) at the turn of financial markets is pre-emptive or a cleanup. The feedback loop between monetary policy reaction and the markets' response presupposes a sequencing that runs from the former to the latter. That hardly rule out the possibility of monetary policy responding to financial markets' actions, not necessarily pre-empting them. Deploying a structural vector autoregressive (SVAR) model on Kenyan data for the period December 2013 to June 2024, we establish that there is a dynamic interaction among key financial market prices that is not necessarily at the prompting of monetary policy. This points to how financial markets are pre-emptive, and the monetary authority playing catchup. Such sequencing comes with the possibility of monetary policy reacting to market movements more than markets responding to monetary policy signal, underlying the tension between monetary policy and fiscal policy. The direct connection between the CBK's policy signal and the inter-bank rate justifies the CBK's interest rate corridor around the former. We however consider that as a necessary but not sufficient framework for efficient policy signalling and transmission unless it is accompanied by measures to address inter-bank market segmentation as well as those that can injects vibrancy in the horizontal repo market. We further contend that the positioning of the foreign exchange policy in support of monetary policy objectives is encumbered by the small-open-economy attributes that limits the assumption that full flexibility is sufficient for full effectiveness.

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1.0 Introduction

The interaction between central banks and commercial banks in the process of monetary policy conduct invokes issues superficially basic but whose answers are seldom settled. Why commercial banks are exposed to monetary policy is one such issue (Di Tella and Kurlat, 2021). How deposit rates respond to monetary policy is another (Kang-Landsberg and Plosser, 2022). That these issues are open reveals how the monetary conduct is a complex affair.

The complexity of monetary policy conduct stems from the expectation that the deployment of either pricedbased or quantitybased tools simultaneously enables the management of economic fluctuations and achievement of price stability. The monetary policy influence on economic activity and price stability is indirect, with financial institutions, typically banks in a bank-led system, the primary conduit of its transmission. Of necessity therefore, central banks keenly watch financial markets' behaviour just as markets watch central banks' policy signals.

The intensity of interest of central banks on financial markets and vice versa, and the aspects of focus, is dependent upon their respective motivations. Monetary policy conduct as implied by the reaction function is the public good that macroeconomic stability proffers. The financial firms' response function is motivated by the perceived implication of monetary policy on the profitability agenda. By implication therefore, the feedback loop between monetary policy reaction and the markets' response presupposes a sequencing that runs from the former to the latter. That however does not rule out the possibility of monetary policy decisions responding to financial markets' actions and not necessarily pre-empting them.

Whether monetary policy is a forerunner or a follower especially at the turn of markets is an empirical question that is the objective of this paper. We explore the question in the context of Kenya, a small open economy with a liberalized capital account that underpins a floating exchange rate regime, and a pricebased monetary policy framework. The Kenya financial system is simultaneously attuned to economic cycles and the underlying macro policies that seek to attenuate any imbalances. As key market prices, interest rates and exchange rates

reveal the basic domestic and external imbalances, drawing a focus on how monetary policy responds to market turns.

On the back of the mandate of the Central Bank of Kenya (CBK) to conduct monetary policy towards achieving and maintaining general price stability are known strengths and limitations of the underlying framework (CBK, 2021). Even then, there are expectations that the finetuning of the monetary framework that is evolving from monetary aggregate targeting to a forward-looking price-based approach makes it more effective.

The forward-looking monetary policy framework for a small open economy such as Kenya fronts interest rates and a flexible exchange rate as adequate levers in addressing market turns revealed in not just sharp swings in financial prices but also in the underlying financial resources flow. The implicit assumption of such adequacy is limiting based on two questions. One, is the role of monetary policy necessarily embedded in the turning points of market swings? Two, is monetary policy sufficiently anticipatory of market turning points in the form of investor appetite shocks and sudden stop shocks underlying exchange rate swings owing to the open capital account?

To the extent that these questions are seeking answers, policy makers and market participants have a motivation to seek an understanding of whether monetary policy is a forerunner or a follower of market turns. That is the essence of this paper. Through deployment of a structural vector autoregressive (SVAR) model on Kenyan data for the period December 2013 to June 2024, this paper establishes that there is a dynamic interaction among key financial market prices, not necessarily at the prompting of monetary policy, is a pointer to how financial markets are pre-emptive and the monetary authority playing catchup. We content that with such sequencing comes the possibility of monetary policy responding to market movements more than markets responding to monetary policy signal, underlying the tension between monetary policy and fiscal policy.

The direct connection between the CBK's policy signal, the Central Bank Rate (CBR) and the inter-bank rate provides justification for the CBK's interest rate corridor around the former. We however consider that as a necessary but not sufficient framework for efficient policy signalling and transmission unless it is accompanied by measures to address inter-bank market segmentation and inject vibrancy in the horizontal repo market. We further contend that the positioning of the foreign exchange policy in support of monetary policy objectives is encumbered by the small open economy attributes that limits the assumption that full flexibility is sufficient for full effectiveness.

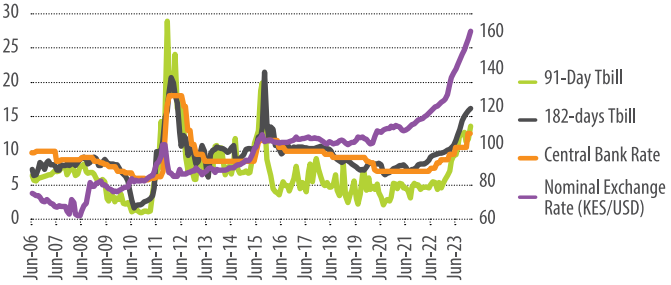
The rest of the paper is organized as follows: Section 2 section sets the analytical context that precedes the relevant literature review in section 3. The model that underpins the empirical assessment is presented in section 4 and the findings outlined in section 5. Section 6 concludes and provides policy implications of the findings.

2.0 Context

We make the argument that the understanding of whether monetary policy is a forerunner or a follower of market turns is missing at two levels.

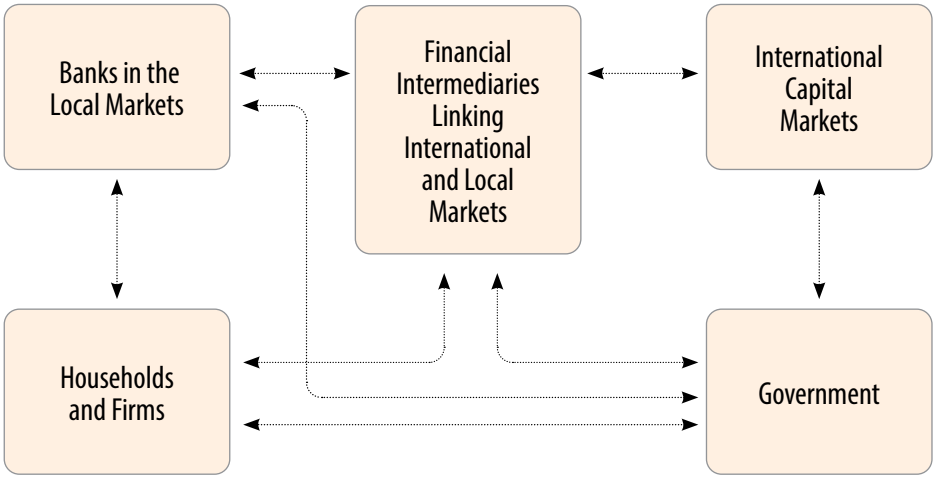
- The first one is that popular commentary by market analysts has a deliberate leaning towards how a given monetary policy stance as signalled by the CBR is connected to the market and foreign exchange market prices rates. At the core of such commentary is the intention of informing market positions that will either lead to, or sustain, profitability. Therefore, whether monetary policy leads or follows market turns is given peripheral treatment at best. Even the process underlying the strong claims of monetary policy being ahead, or behind, the curve is at best lacking the appropriate rigour and at worst not at all articulated.
- The second one is that a dearth of Kenyan-specific literature on how the complexities of the interaction between the domestic and international financial markets limits the understanding of whether a CBR change reflects a monetary policy stance on the lead or one that is chasing market speculation. As **Figure 1** shows, both the short end of the money market and the foreign exchange market are often a step ahead of the policy signal.

Figure 1: Short- term Rates (%) and Nominal Exchange Rate



Source: CBK

Figure 2: Domestic- International Financial Markets Interaction



We make a further argument that formalizing the understanding of monetary policy conduct with the small open economy attributes necessitates the appreciation of the intricate connection between the domestic and international financial markets as illustrated in **Figure 2**. The connection, *a priori*, reveals itself in the quantities involved in the flow and the prices in the form of interest rate and exchange rate.

Underlying the intuitive illustration of the domestic-international financial markets interaction are three critical issues that are cardinal to monetary policy conduct by the CBK, just like in any other small open economy.

One is the extend to which price stickiness is pertinent to the monetary policy stance. Tracing it to the classic Fleming (1962) and Mundell (1963), this has evolved into considerations of which currencies the prices are sticky in. Dornbusch (1976) and Obstfeld and Rogoff (1995) analyse the stickiness from a producer currency angle while Betts and Devereaux (2000) approaches it from a local currency standpoint. Gopinath and Itskhoki (2022) has stretched the analysis to incorporate a dominant currency pricing framework.

The essence of these studies is to put a spotlight on the issue of aggregate demand that is central to monetary policy conduct. The question is whether the CBK's policy rate embodies the aggerate demand considerations and is a representation of the neutral rate of interest. The neutral rate of interest is defined as one that bridges output growth with its potential while equating savings and investment on the back of inflation that is hitting its target.

- Two is the acknowledgement that relative to advanced economies, Kenya and other emerging and developing economies have shallow markets characterised by limited substitutability of assets. On the back of the limited substitutability of local and foreign bonds (Fanelli and Straub (2021) and Bianchi and Lorenzoni (2022), the question is whether or not the asset markets question is key to the CBK's policy signal.
- Three is the appreciation that as a small open economy, the issue of external debt limits and sudden stops, whether in the context of the public sector or private sector, is binding on monetary policy [Mendoza and Smith (2006) and Korinek and Sandri 2016)].

Ultimately, the monetary policy conduct towards balancing savings and investments has an influential international dimension. Based on historical trend, we contend that the Feldstein – Horioka Puzzle (Felstein and Horioka, 1980; Vamvakidis and Wacziarg, 1998) where high correlation between domestic rates of investment and savings point to limited financial integration – has some relevance to Kenya (**Figure 3a)**. The external savings inflows to fill the domestic savings gap amidst limited financial integration are an exact equivalent of the economy's current account balances (**Figure 3b**).

The extent to which public finance occasions market turns and forces the hand of monetary policy is pertinent. Contextualising monetary policy based on the foregoing will enable an appreciation of whether the CBK's monetary policy at the turn of markets is pre-emptive or a cleanup.

Figure 3(a): Gross National Savings (% of GDP) : Total Investments (% of GDP) Association; 1990 - 2023

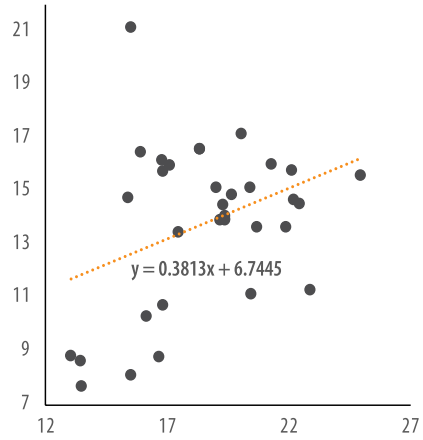
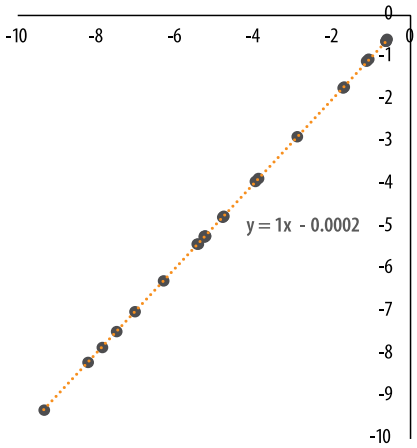


Figure 3(b): Current Acount Balance (% of GFP) : Savings Gap (% of GDP) Associaiton; 2000 - 2023



3.0 Literature review

There is extensive literature on how monetary policy seeks to address macroeconomic imbalances rising from the influence of demand on the back of supply constraints that upend price stability. When output and inflation gaps are positive and the economy is growing faster than its potential output with general prices at a higher level than the target, expectation of higher prices are engendered. If the Friedman (1970) view that inflation is a monetary phenomenon prevails, then monetary policy will entail deployment of nominal instruments to reduce liquidity in the economic system.

As monetary policy frameworks evolve from quantity based to price based, and take the form of inflation targeting or its variant, there is convergence in the argument that the appropriate policy signalling rate is one attuned to a balance between broader economic goals and financial market dynamics (IMF, 2015; Maehle, 2020). That rate should be as close, or ideally be equal, to the neural rate (Wicksell (1936) and Obstfeld (2023).

Conceptually, the determination of the appropriateness of monetary policy is based on the neutral rate that is unobserved and therefore estimated through other macroeconomic variables. This creates an endogeneity problem on whether real and financial activity signal changes in monetary policy or whether monetary policy affects real and financial variables to occasion the closure of the output gap. Even then, the estimation of the neutral rate is considered important especially in advanced markets in informing viewpoints on monetary policy stances. For instance, Brand *et al* (2018) illustrate trends in estimated the neutral rate in the European Union (EU) zone over time and the role of risk aversion and mark ups in explaining the gap between the neutral rate and financial variables. It draws the conclusion that financial activity drives monetary policy rather than the inverse.

The European Central Bank (ECB) studies on the trend of the neutral and its components to seek to determine the link between monetary policy and financial cycle fluctuations. (ECB, 2024). The underlying models range from term-structure based models (Ajevskis, 2018; Christensen and Rudebusch, 2017), survey-based models by ECB, Fed Reserve of New York, macroeconomic models (Barsky and Bogusz,

2014; Gerali and Neri, 2019), and econometric models (Jarocinski, 2022; Brand and Mazelis, 2019; Krustev, 2018; Kupkovic, 2017; Fiorentini et al, 2018).

The most widely used model for advanced economies is the Laubach-Williams (2003) that has recently been replaced with the Holston, Laubach and Williams (2023) model, so-called the HLW model, that is adapted for the post-pandemic period. The HLW model uses the Kalman filter model that is useful to examining how unknown variables evolve over time. The Kalman filter is linear and uses the simple form of equations that detail the relationships between variables based on the prediction estimate of a variable and the updated estimate of the variable. The HLW model embeds the assumption of the IS and Phillip Curves, and are consistent with the Mundell-Fleming model and New Keynesian theory linking demand and supply to interest rates and inflation.

As Kiley (2015) illustrates, there is a weak relationship between output and interest rates and explains the gap by accounting for credit conditions that are the outcome of monetary policy. This points to monetary policy driving financial conditions that affect real activity through demand movements that explain the cyclical component of the neutral rate. The cyclical component represents the volatile component of the neutral rate that would remain after accounting for trend factors such as growth, productivity, and demographics.

Further, Juselius et al (2016), Cukierman (2016) and Boria (2014) espouse the view that financial imbalances and financial cycles need to be considered in estimating r* as their omission affects not only the estimation of the neural rate but real variables such as potential growth used to estimate the neutral rate and ultimately monetary policy. The import of the argument is that the activity of financial actors such as banks matter for monetary policy, thus monetary policy may simply follow financial cycles and may not necessarily have a leaning on business fluctuations.

While the macroeconomic stability agenda of monetary policy is revenant to financial market actors, their primary interest is on how the policy decision has a bearing on profitability. Literature suggests that tight monetary policy increase earnings through higher interest on loans and net worth of banks' relative to easing of monetary policy, holding credit risk constant (Di Tella and Kurlat, 2017, Kashyap and Stein, 2023).

Unconventional monetary policy also been linked to higher risk tolerance by banks. During the Quantitative Easing (QE) periods that was associated with low interest rates and a build up of risks that amplified business fluctuations, influencing monetary policy in the subsequent periods. This suggests a two-way relationship where monetary policy potentially influences financial market behaviour though asset price channel and financial markets affect monetary policy through asset price and bank lending channels (Kashyap and Stein, 2023). This two-way relationship affects monetary policy operationalization particularly through the chosen intermediate target that is forward-looking.

The success of money targeting is heavily influenced by the accuracy of liquidity forecasting and accurately estimating the money demand function. Changes in financial innovations that affect various elements of

the money demand function have complicated money targeting raising questions as to the effectiveness of this monetary policy framework in maintaining price stability (Nyamongo and Ndirangu, 2013). A further challenge in effective of money targeting relies on liquidity management within the banking system including an efficient and well-developed interbank market (IMF, 2015).

A key focus on improving monetary policy effectiveness in developing economies is the transition to interest-based monetary policy framework with a focus on careful use of operational and intermediate targets and the use of transitional operational targets (Maehle, 2020; Maehle and King, 2022). This relies on a better understanding of the main channels effective for monetary policy transmission to inform use of operational targets.

Kenya's process of modernizing monetary policy through inculcating forward-looking inflation targeting attributes is well documented (CBK, 2021; Nyamongo et al, 2021). This process has bene informed by research on policy transmission channels and effectiveness. Cheng (2007), Misati et al (2014), and Mwega (2014) conclude that the interest and exchange rate channels are the most important for monetary policy transmission in Kenya despite monetary policy having slow and weak impact on inflation.

There also appears to be an emerging asset price channel of monetary policy transmission possibly through illustrating business cycle fluctuations (Misati and Nyamongo, 2012). A notable finding from the literature is the emergence of asset price channel of monetary policy observed through the stock market that is attributed to reveal business cycle fluctuations that impact monetary policy transmission. This calls for a closer examination of the role of business fluctuations impacting monetary policy and possibly impacting Kenya's neutral rate through the banking sector which are the key intermediaries in monetary policy transmission, through their participation in money and financial markets.

4.0 The model

This paper's analytical approach is grounded on the fact the Kenya's small-open-economy attribute implies that monetary policy conduct has to take on board possible spillover effects from external markets. In line with Bernanke (2015), we take the Taylor rule as a good description of how monetary policy have been made in the past but hardly a prescription of how it should be made now and going forward. The original specification of the Taylor rule, which was specific to the US economy (Taylor 1993), is:

$$r = p + \delta y + \delta(p - p^*) + p^* \quad \text{..... [1]}$$

where r is the federal fund rate, p is the rate of inflation and p^* is the inflation target, y is the percentage deviation of real GDP from a target[1]. Obviously, it is only a variant of the Taylor rule that can be relevant in our context, such relevance being predicated on two considerations.

First, the real growth target is unobservable, being the potential output that is defined as what the economy can sustain when capital and labour are fully employed. That means that the output gap, the difference between actual real GDP growth and the potential output, is subject to the reliability of the latter's measurement.

Second, Bernanke (2015) argues, monetary policy decision making is a systematic process as opposed to an automatic one. In that case, if there is any rule underlying it, it ought to incorporate as much information as would reflect the understanding of complexities and dynamics of economies. This is especially so in developing economies with shallow markets and weak policy transmission mechanisms.

1. In the original Taylor rule, the inflation target is 2 percent while the coefficients for the two gaps (the inflation gap and the output gap) are equal ($\delta = 0.5$).

In the case of Kenya, we define r as the Central Bank Rate (CBR), the lowest rate that the CBK charges on loans to commercial banks. To the extent that the changes in r signal how monetary policy responds to inflation trends, the attitude of the policy maker towards macroeconomic stability needs to be reconciled with the profit motivation of the financial intermediation system.

With r as a risk-free rate, it is plausible to assume that the strategic intention of monetary policy is to set the policy as close as possible to a neutral rate, r^*, that prevails when saving in the economy as equal to investment at the point when y is equal to zero. At a basic level, if we assume that there is one interest rate i that has some link to r, the equilibrium condition that equates saving to investment can be specified as:

$$S(Y,i,\alpha) = I(Y,i,\alpha) \quad \text{..... [2]}$$

where S is saving, Y is the actual real GDP, and α are other factors that influence saving and investment. We take the objective of monetary policy as would be inspired by, but not entirely based on, the Taylor rule to be the driving of Y towards its potential such that it is deemed as effective if $y = 0$, in the process influencing inflation that is arising from the demand side; there are however more complexities to monetary policy if there as supply shocks. Under the circumstances, the equilibrium condition in equation 2 can be restated as:

$$S(Y^*,r^*,\alpha) = I(Y^*,r^*,\alpha) \quad \text{..... [3]}$$

where Y^* is the potential real GDP, therefore

$$Y - Y^* = y.$$

The profit orientation of commercial banks, the primary conduit of monetary policy transmission, is by no means anchored on the intent to close the output gap or narrow the difference between the risk-free rate and the natural rate. In any event, the two notions are based variables that are not directly observable namely the potential output and the neutral rate. The difficult of reconciling policy intentions with banks' profit motivation based on the potential limitations of the unobservable variables finds favour in Williams (2023) and Obstfeld (2023) drawing from the 1931 insight of John H. Willians[2] that:

> *"The natural rate is an abstraction; like faith, it is seen by its works. One can only say that if the bank policy succeeds in stabilizing prices, the bank rate must have been brought in line with the natural rate, but if it does not, it must not have been."*[3]

Whether the cost-benefit analysis of central banks, especially in developing markets, investing in using r* as a guide to monetary policy is an open question. It is clear though that while commercial banks keenly watch monetary policy conduct, their intermediation optimisation strategies are attuned to asymmetric alignment of assets and liabilities such that savings are

2. Williams, J.H. (1931) "The Monetary Doctrines of J. M. Keynes," The Quarterly Journal of Economics 45 (4), 547 – 587.

3. The neutral rate rare is also called the natural interest rate (Blanchard 2022) even though Obstfeld (2023) argues that the two are different but only equal under certain short-run – long-run considerations.

priced off the safe rate and investments off risky rate.

The implication of the distinction between safe rates and risky rates is that the one interest rate (i) assumption in equation 2 is relaxed. With that, the equilibrium condition in equation 2 now takes the form:

$$S(Y,i,\alpha)=I(Y,i+\beta,\alpha) \text{ ..... } [4]$$

where β represents the risk premium above the safe rate. The risk premia are revealed in the lending rates, government borrowing rates, and indeed any rate that reflects the opportunity cost to return on equities.

The small-open-economy considerations imply that the Kenyan saving – investment interaction has an international dimension that monetary policy conduct has to take into consideration.

In line with Obstfeld (2023), the policy signalling rate that is a variant of the basic Taylor rule will incorporate local inflation conditions, the economy's current account balance, financing conditions that reflect both local and international resource flows and how they reveal themselves in key processes of exchange rate and interest rates. Based on the foregoing, the empirical model specification for monetary policy signalling in Kenya will be:

$$r_t = \emptyset + \delta_0 r_{t-1} + \delta_1 (p_{t-\omega} - p^*) + \delta_2 Y^g_{t-w} + \delta_3 exr_{t-\omega} + \delta_4 i^*_{t-w} i_{t-\omega} + \delta_5 (r+\beta)_{t-\omega} + \delta_6 \aleph_{t-w} + \delta_7 (f^* + \beta)t_\omega + \delta_8 (g-g^*)_{t-\omega} + \varepsilon \text{ ..... } [5]$$

where $\emptyset$ is a constant, Y^g is real GDP Growth, exr is the nominal exchange rate (defined as amount of local currency per unit of the US dollar), i^* is the treasury bill rate -inflation rate differential and represents asset prices, specifically equities of listed corporations. The model controls for f^* (the foreign riskfree rate) and $g - g^*$ (is the local -international interest rate differential of a tenor close to the ordinary period of policy rate review). The appropriate lag for each independent variable is ω while ε is the stochastic error term.

Underlying the model are three key assumptions:

- One, the anticipated resource flows aligned to the interest rates differentials and backed by the uncovered interest rates parity principle. In the event of sudden stops and quick reversals, there is pressure in the foreign exchange market.
- Two, the shallow market condition is a bunding constraint that reveals itself in nonsubstitutability of domestic and foreign financial assets. That reveals itself in in the risk margin on the cost of external borrowings.
- Three, while liquidity forecasting is key to operationalizing the policy signal, it is subject to imperfections arising from the interplay between fiscal policy and monetary policy interaction as well as segmentation in the interbank market. We can surmise that the creation of an interest rate corridor around the policy rate is meant to address the imperfections, although it may come with the limitation of the CBK trading its lender of last resort credentials for being an active market participant.

The specified model points to the need to acknowledge the limitations of the assuming that with the move from a quantitybased to a pricebased monetary policy framework means that a change in the policy rate on the back of a flexible exchange rare is sufficient to address market shocks. This is more so when noisy traders, responding to perceptions induced by shocks, both domestic and external, occasion market turns that force policy adjustment with a lag.

5.0 Empirical findings

5.1 Data and Estimation Process

This paper's empirical assessment uses monthly data from December 2013 to June 2024 from the CBK, the Kenya National Bureau of Statistics (KNBS) and the Federal Reserve Economic Data (FRED). Beyond having a full dataset for the empirical model for the period, we are able to cover various shocks with implication on monetary, including the 2016 – 2019 interest rate capping regime, banking sector reforms in line with the post-global financial crisis regulatory measures, progress in the modernization of monetary policy from money to inflation targeting, and the COVID-19 pandemic.

We deploy the Structural Vector Autoregression SVAR process due to its usefulness in studying the transmission of policies and shocks. SVAR has been extensively used in studying monetary policy transmission principally due to its three main advantages.

- Firstly, the SVAR allows for policy analysis using impulse responses to determine the effect of a specific shock similar to a VAR model.
- Secondly, the use of a various restrictions is useful for identifying channels of policy transmission as well as simulation of shocks.
- Thirdly, SVAR provides flexibility in determining the economic structure underlying a model thus useful for isolating exogenous shocks from independent movements, which gives it an advantage over the conventional vector autoregressive VAR.

Due to its similarities with a VAR and its reliance on the use of a VAR, one can determine if effects of a policy vary based on the type of restrictions applied by comparing the impulse responses of a VAR and SVAR model, this makes the SVAR useful in forecasting as well. Financial market variables are sensitive to various factors leading to challenges in identifying drivers of market behaviour and noise. In small open economy with shallow financial markets and a segmented interbank market, isolating noise from signal can be challenging.

The SVAR compared to the VAR is useful in the context of our study as it as it enables the distinguishing movements in financial and macroeconomic variables that can be attributed to a monetary policy shock thus a monetary policy signal from independent movements of financial variables due to noise. Additionally, given the structural challenges and nuances of a small open economy with shallow financial markets, determining the economic structure using short-run restrictions on key variables based on economic theory and judgement become important to get meaningful results.

We therefore adopt the SVAR model as it best fits the Kenyan dataset as it seeks to examine the relationship between financial markets movements in response to a monetary policy signal and the role of other factors. We are also able to determine if financial markets follow monetary policy signals or lead them through how they impact asset prices.

5.2 Preliminary Diagnostics

The descriptive statistics presented in (**Appendix I)** support the determination of the variables to be included in the empirical model as well as confirm that the data is normally distributed. We rely on the correlation matrix (**Appendix II**) to avoid multicollinearity in the SVAR specification. The unit root tests confirm all variables are integrated of order I(1) and become stationary (I(0)) upon first differencing (**Table 1**). This has informed a VAR model specification to use the first difference of all the variables that are integrated of order I (1) as levels.

The Lag Length criteria test as confirmed by the FPE and AIC criteria indicates that two lags are appropriate for the specified model. The LM Autocorrelation test, and the VAR stability tests are two main diagnostic tests were undertaken on the SVAR model. The LM autocorrelation test confirmed that the VAR model has no autocorrelation present at the selected lag (**Table 2**). The stability test confirms that the SVAR specification is stable (**Figure 3**).

Table 1: Unit Root Test Results

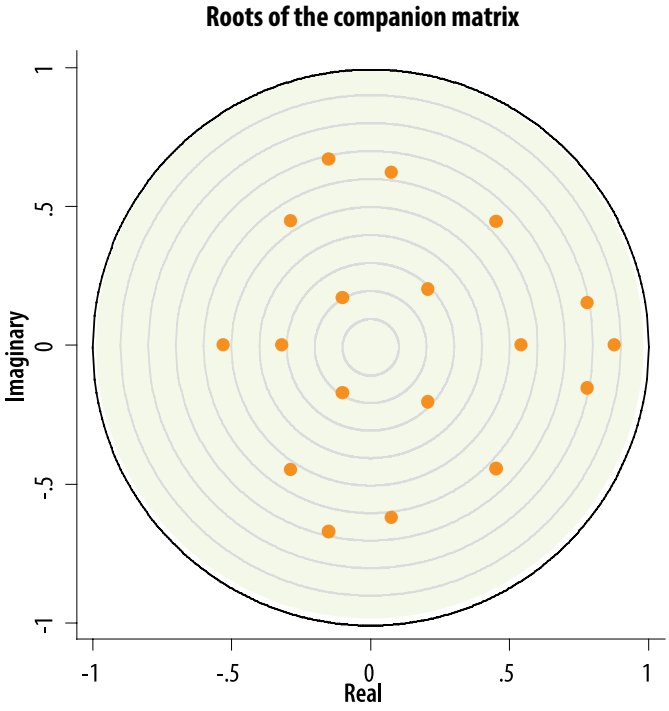
Variables	Test Technique (ADF)	Order of integration
CBR	I(1)	Differenced in SVAR
INTBNK	I(1)	Differenced in SVAR
91-day TB	I(1)	Differenced in SVAR
DEP	I(1)	Differenced in SVAR
LEND	I(1)	Differenced in SVAR
LEXR	I(1)	Differenced in SVAR
INFGAP	I(1)	Differenced in SVAR
RGDP	I(1)	Differenced in SVAR

Table 2: LM Autocorrelation test

Lagrange -multiplier test			
Lag	chi2	df	Prob > Chi2
1	167.0432	81	0.0000
2	73.9635	81	0.69739

H0: no autocoerelation at lag order

Figure 4: SVAR Stability Test



5.3 Results

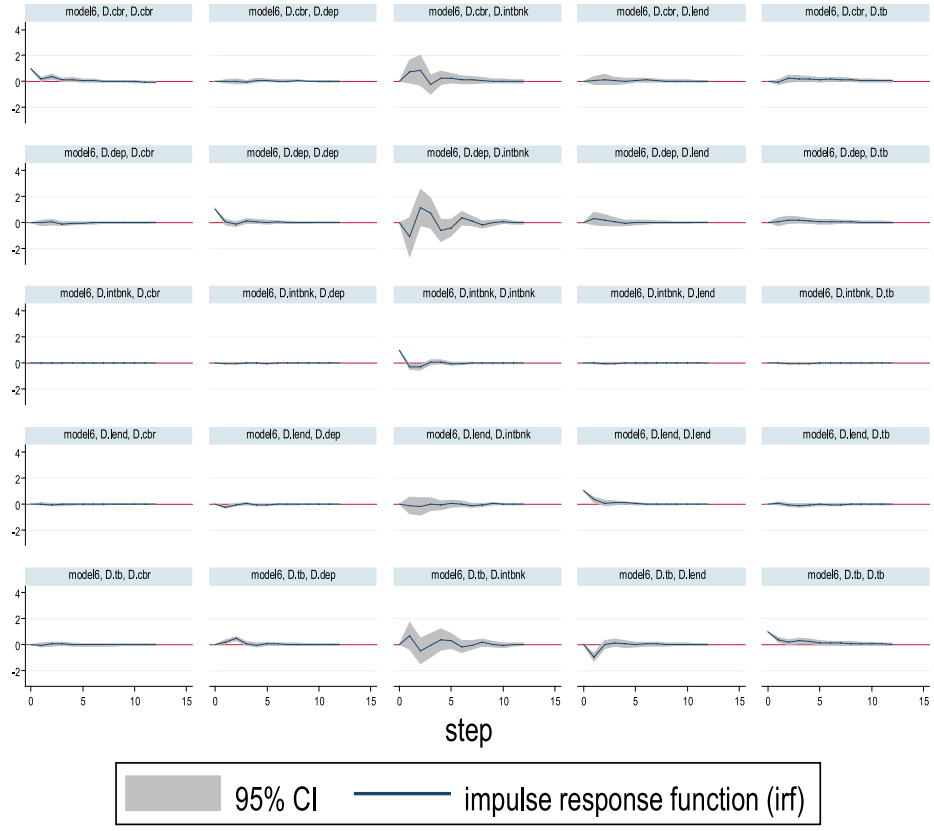
We estimate monetary policy shocks based on equation 5 on five sets of variables, namely, interest rates, the nominal exchange rate, inflation, asset prices and growth controlling for the global interest rate, the domestic – global interest rate differential, foreign investment in domestic markets and the risk premium, as exogenous variables. **Table 3** shows the forecast error variance decomposition, a key component of the structural analysis. It helps to illustrate the importance of the policy shock – in this case monetary policy – in explaining variations in the model's variables, especially how policy changes that represent the short-run account for longer period fluctuations.

Table 3: Forecast Error Variance Decomposition

Months/Variables	CBR - Interbank rate	91-day T-bill rate - Deposit rate	Deposit rate - Lending rate	Exchange rate - Interbank rate	Exchange rate - 91-day T-bill rate	CBR - Inflation gap	CBR - Interbank rate	91-day T-bill rate - Inflation gap	NSE Index - CBR	NSE Index - Interbank rate	NSE - Index 91-day T-bill rate
0	0	0	0	0	0	0	0	0	0	0	0
1	0.776787	0.227881	0.309873	55.7527	3.70045	0.316582	0.776787	-0.06967	0.816368	-0.75781	-0.00285
2	0.888551	0.485472	0.174483	-8.6384	9.19811	0.857292	0.888551	0.308016	0.504513	2.72494	0.817211
3	-0.213689	0.089968	0.069685	1.10965	6.65526	0.124142	-0.21369	0.261167	0.373008	1.10461	0.386555
4	0.296902	-0.015791	-0.057729	0.110751	4.10068	0.080648	0.296902	-0.03217	0.177406	-1.96284	0.232069
5	0.275335	0.100111	0.000176	-0.967852	4.15431	0.016146	0.275335	-0.01447	0.091567	0.938394	0.382489
6	0.143775	0.071555	0.017231	-0.676287	3.33045	0.01037	0.143775	-0.07212	-0.02945	1.10427	0.221407
7	0.120908	0.032297	0.014306	2.302	2.20559	-0.07562	0.120908	-0.17342	-0.04603	-0.26268	0.17484
8	0.113001	0.049147	0.008127	-0.548437	1.35279	-0.07482	0.113001	-0.13967	-0.05203	-0.20274	0.195769
9	0.035609	0.047699	-0.006943	-1.04491	1.11149	-0.08477	0.035609	-0.05842	-0.04675	0.249501	0.148242
10	0.038691	0.02927	-0.001209	0.738653	0.901542	-0.09371	0.038691	-0.04755	-0.05009	0.05934	0.103745
11	0.046482	0.024476	0.008538	0.398053	0.651478	-0.08736	0.046482	-0.05282	-0.04281	-0.12992	0.08624
12	0.015869	0.023528	0.003554	-0.622453	0.501315	-0.06887	0.015869	-0.03449	-0.03712	-0.02251	0.059581

The first set of impulse response functions examines the responses of key interest rates ranging from the overnight short term lending rate between banks to the long-term lending rate, in response to a monetary policy shock. We find that a one percent rise in the monetary policy rate, raises the interbank by 1.65 percent in the first two months before declining to its mean within 12 months, while the deposit rate increases by 0.71 percent in response to the one percent rise in the 91-day treasury bill rate that emanates from a one percent rise in the monetary policy rate (**Figure 5**). Similarly, the lending rate increases by 0.48 percent, in response to a one percent rise in the deposit rate, triggered by the rise in the monetary policy rate.

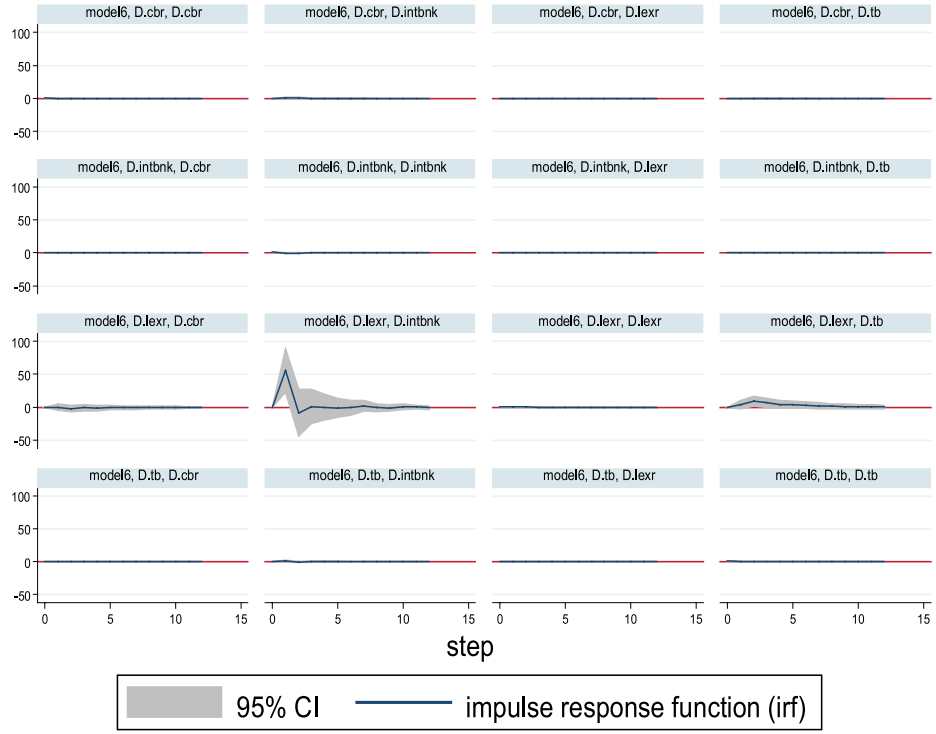
Figure 5: Impulse Responses of Key interest rates to Monetary Policy Shock



Graphs by irfname, impulse variable, and response variable

While we find no direct link between the monetary policy rate and the exchange rate, a one percent rise in the nominal exchange rate (thus a depreciation) increases the 91-day Treasury bill rate by 12.9 percent in the first two months. The effect lingers for first 4 months and dissipates within 12 months. A one percent rise in the nominal exchange rate (depreciation) triggers by a one percent rise in the monetary policy rate and leads to noise and volatility in the response of the interbank rate with a rise of 55 percent in the month and a decline of 8 percent in the second month (**Figure 6**). The effect is short-lived and dissipates within the first two months.

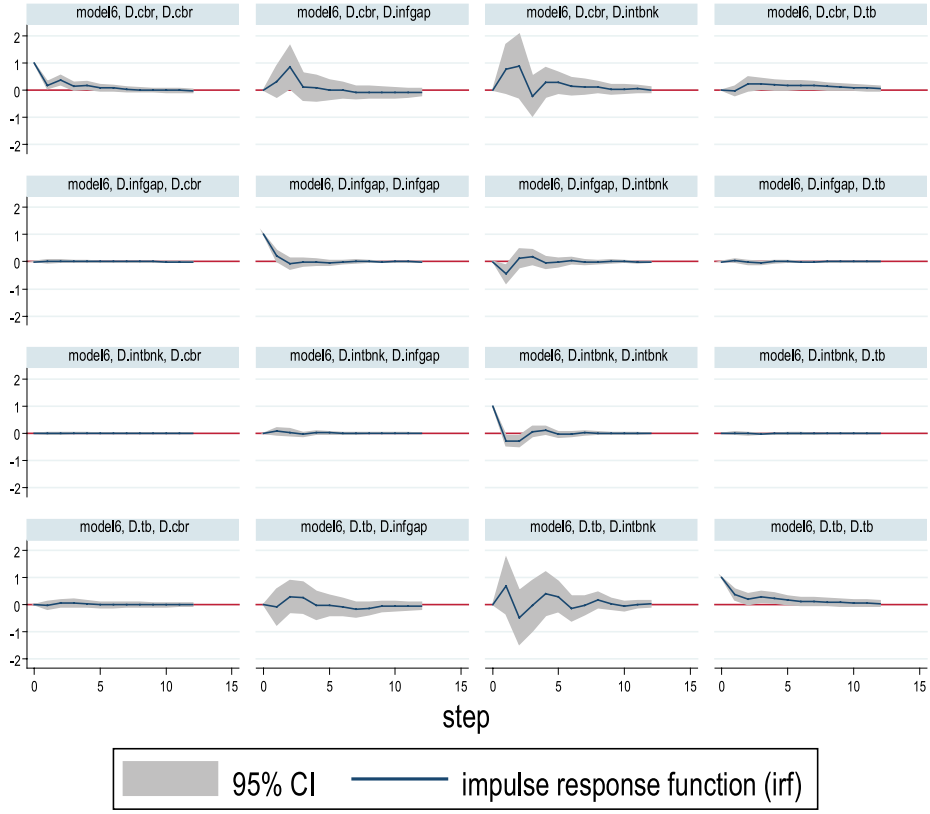
Figure 6: Impulse Responses of the Nominal Exchange Rate to a Monetary Policy Shock



Graphs by irfname, impulse variable, and response variable

We establish that a 1.0 percent rise in the monetary policy rate increases the inflation gap by 1.17 percent in the first two months before lowering the gap by 0.94 percent within 4 months. The impulse response of the inflation gap suggests that the effects of monetary policy influences inflation by the 9th month, while there is a two-month lag on its impact suggesting an element of sticky prices. In response to a one percent rise in the 91-day Treasury bill rate occasioned by a one percent rise in monetary policy, the inflation gap rises by 0.30 percent in the first month before declining by 0.26 percent by the third month (Figure 7).

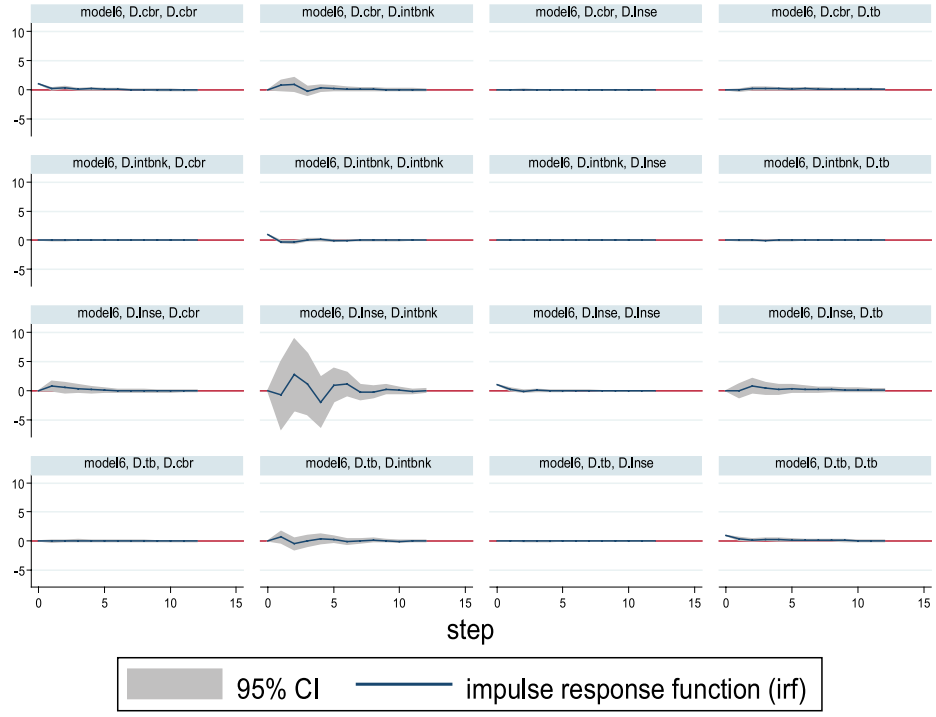
Figure 7: Impulse Responses of the Inflation gap to a Monetary Policy Shock



Graphs by irfname, impulse variable, and response variable

The response of equity prices to changes in monetary policy is not obvious. Nonetheless, monetary policy responds to a rise in equity prices. In response to a one percent rise in equity prices, the monetary policy rate increases by 0.82 percent in the first month following the equity price change. The effect dissipates within the first four months. Financial market behaviour revealed in the equity prices also affect the interbank and treasury bill rates. In response to a one percent rise in equity prices, 91-day Treasury bill rate increases by 0.81 percent in the second month and majority of the effect dissipates quickly within one period, while the interbank rate increases by 2.72 percent, but the effect appears to be noisy and lasts for five months (**Figure 8**).

Figure 8: Impulse Responses of the Equity price to a Monetary Policy Shock



Graphs by irfname, impulse variable, and response variable

Granger causality tests indicate that monetary policy granger causes the inflation gap and the nominal exchange rate and growth granger causes monetary policy. There are causality linkages between the interbank rate, 91-day T-bill rate, the nominal exchange rate and deposit and lending rates, the causal relationship amongst the variables runs in both directions. Interestingly, we find that equity prices and the deposit rate granger cause each other in both directions, while equity prices granger cause the nominal exchange rate.

6.0 Conclusion and Implication

Four key inferences can be drawn from the foregoing empirical undertaking that have a bearing on policy and market conduct.

- First, while a change in monetary policy stance has an effect on the interbank rate, the intermediation prices of deposit rates and lending rates are hinged on the 91-day treasury bill rates. In essence, the deposit rates respond to changes in the treasury bill rates and then triggers a change in the lending rates. The implication is that the market could respond to movements in the treasury bill rates whether or not that change has a direct link to a chance in the monetary policy stance.
- Second, it is instructive that exchange rate matters for monetary policy conduct, not just from the pass-through effect on inflation but also from the fact that it is connected to developments in the money market. It is not obvious though whether monetary policy signalling has an influence on the direction that the foreign exchange market takes.
- Third, as could be anticipated a priori, the effect of monetary policy on inflation has lag effects. We are cognisant that other factors besides demand pressure – such as supply constraints – may affect inflation in the initial lags but in a transitory manner. Its therefore feasible that monetary policy influence will be observed in the second-round effects of a rise in inflation rather than the transitory effects that could be self resolving. This resonates with the sticky prices argument.
- Fourth, equity prices seem to matter in monetary policy conduct, not necessarily because they respond to monetary policy but because monetary policy responds to their movements.

Ultimately, monetary policy appears to lag as it is impacted by financial market behaviour through asset prices, interbank and 91-day Treasury bill rate as conduits of its transmission signal. That way, market behaviour informs monetary policy formulation both directly through monetary policy observing financial market turns and indirectly through the transactions of market players that may not necessarily be anticipatory of a particular monetary policy action. By inference, monetary policy is a follower of financial markets.

The foregoing assessment is a reflection of how monetary policy conduct in a small open economy such as Kenya is nuanced from that of advanced systemic markets with deep financial markets. In the former case, the financial conditions such as the driver of stock prices, banking sector lending standards, the trend of bond yields in secondary markets, are important in shaping monetary policy formulation and effectiveness. The interaction among the key market prices, not necessarily at the prompting of monetary policy, is a pointer to how financial markets are pre-emptive and the monetary authority playing catchup. In the latter case, the global economic conditions that occasioned monetary authorities to raise policy rates in 2022 and commence policy accommodation in 2024 were accompanied by market movements in anticipation of regime turns.

The above inferences have implications on policy and market conduct. The possibility of monetary policy responding to market movements more than markets respond to monetary policy signal underlies the tension between monetary policy and fiscal policy. The 91-day treasury bill rates are as revealing about the market liquidity conditions as they are about the state of fiscal policy. Banks would likely attune their profit maximisation agenda as influenced by the pricing of deposits and credit in line with the 91-day treasury bill rates than what the CBR signals.

The direct connection between the CBR and the inter-bank rate provides justification for the CBK's interest rate corridor around the former. This however is a necessary but not sufficient framework for efficient policy signalling and transmission unless it is accompanied by measures to address inter-bank market segmentation and inject vibrancy in the horizontal repo market. Further, the positioning of the foreign exchange policy in support of monetary policy objectives is encumbered by the small open economy attributes that limits the assumption that full flexibility is all that is required for full effectiveness.

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Appendix

Summary Descriptive Statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
cbr	124	9.050403	1.513483	7	13
ovrt	124	13.63971	2.158551	11.148	18.4848
lexr	124	4.670119	.131749	4.456836	5.07326
tb	124	8.752673	2.492276	6.195	21.044
dep	124	7.204449	.854306	6.26	10.52101
sav	124	3.664275	1.766282	1.3313	7.0104
lend	124	13.91375	1.944095	11.75	18.3
inf	124	6.452954	1.529767	3.725	11.698
inftar	124	1.452903	1.529796	-1.28	6.7
inftar_up	124	-1.047258	1.529858	-3.78	4.2
rgdp	122	4.615902	1.70948	-.79	8.59
lgcab	124	-13.1838	.1633226	-13.46494	-12.76688
byield	92	7.731868	2.793144	4.396667	14.96167
driskprem	92	16.56611	3.462965	12.305	25.485
fedfunds	124	1.365645	1.649036	.05	5.33
friskprem	92	9.514476	4.232704	5.385	19.815
intdiff	124	7.684758	1.715602	4.18	11.38
lnse	124	7.912698	.4099396	7.286924	8.610933
fpat	124	-.1573033	.311935	-1.231822	.7651062

Correlation Matrix

	cbr	ovrt	lexr	tb	dep	sav	lend	inf	inftar	inftar~p	rgdp	lgcab	byield	drisk~m	fedfunds	frisk~m
cbr	1.0000															
ovrt	0.8519	1.0000														
lexr	0.2572	0.1692	1.0000													
tb	0.6720	0.5802	0.8454	1.0000												
dep	0.8322	0.6686	0.4580	0.7879	1.0000											
sav	0.5877	0.4319	-0.4261	0.0022	0.5185	1.0000										
lend	0.8440	0.9969	0.2418	0.6183	0.6375	0.3465	1.0000									
inf	0.2119	0.1613	0.3576	0.3598	0.0003	-0.1561	0.2162	1.0000								
inftar	0.2118	0.1614	0.3574	0.3597	0.0002	-0.1559	0.2163	1.0000	1.0000							
inftar_up	0.2119	0.1615	0.3574	0.3597	0.0003	-0.1558	0.2164	1.0000	1.0000	1.0000						
rgdp	0.1746	0.0949	0.1743	0.1951	0.1487	-0.1044	0.1175	0.1803	0.1802	0.1801	1.0000					
lgcab	0.2416	0.2698	-0.4871	-0.2175	-0.0552	0.3318	0.2625	-0.2746	-0.2745	-0.2744	-0.2929	1.0000				
byield	0.1879	0.0649	0.7900	0.6360	0.3009	-0.3526	0.1166	0.4306	0.4302	0.4303	0.1170	-0.4301	1.0000			
driskprem	0.5703	0.4063	0.7670	0.8095	0.5954	-0.0521	0.4462	0.4476	0.4473	0.4474	0.1700	-0.2599	0.9140	1.0000		
fedfunds	0.6159	0.3572	0.7243	0.7880	0.6967	0.0489	0.3804	0.2990	0.2986	0.2987	0.2670	-0.2802	0.7348	0.8690	1.0000	
friskprem	0.3715	0.1960	0.8179	0.7402	0.4794	0.2166	0.2298	0.4076	0.4072	0.4073	0.1849	0.3098	0.9627	0.9586	0.8909	1.0000
intdiff	0.2611	0.4276	-0.6262	-0.2830	-0.0083	0.5371	0.3912	-0.1511	-0.1508	-0.1508	-0.1458	0.5887	-0.7095	-0.4855	-0.5997	-0.7143
lnse	0.3724	0.3944	-0.7624	-0.3587	0.1249	0.8038	0.3150	-0.2190	-0.2188	-0.2188	-0.0100	0.4951	-0.6778	-0.4130	-0.3303	-0.5856
fpat	0.0920	0.1113	-0.3215	-0.1879	-0.1150	0.1278	0.1368	-0.2653	-0.2654	-0.2653	-0.0741	0.5294	-0.4178	-0.3114	-0.2487	-0.3789

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