Indian G-Sec Market: How the Term Structure Reacts to Monetary Policy

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Introduction

Behavior of term structure is a major source of interest rate risk and influences the decision making process of the participants in money market and government securities (G-Sec) market regarding holding and trading. Monetary policy is a major determining factor of term structure. The first quarter of the current financial year found hikes in monetary policy rates in India to be followed by upward shifts in the domestic term structure, which adversely affected the G-Sec portfolios of the market participants. This paper wants to find out how term structure responds to monetary policy actions in India.

Literature Review

There are a number of studies in USA on how term structure responds to the expectations about the central bank's monetary policy actions. Cook *et al* (1989) found that changes in the federal funds target rate (FFTR) in the 1970s caused large movements in short term interest rates, moderate movements in medium term rates, and small movements in long term rates. Kuttner (2001) estimated that the bond rate's response to expected changes in monetary policy is negligible, while their response to unexpected changes is significant. Faust *et al* (2002), as reported by Goukasian *et al* (2006), using prices from federal funds futures contracts derived the unexpected component of Federal Reserve policy decisions and assessed their impact on the future trajectory of interest rates.

Goukasian *et al* (2006) measured the expected and unexpected components of the changes in the FFTR and the sensitivity of the term structure of zero rates to those changes. They used two alternative models of term structure – the Nelson-Siegel model and the extended Vasicek model. They calibrated both models along with data on changes in the FFTR and studied the impact of monetary policy on the shape of the term structure. They found extended Vasicek model to perform better than the (Nelson-Siegel-Svensson) NSS model.

Conventional wisdom is that expectation of an increase in a policy rate leads to an immediate increase in the benchmark rates and decrease in bond prices. Kuttner (2001) reported that studies of Cook *et al* (1989) and Roley *et al* (1995) found strong evidence of the above wisdom in 1970s but weak evidence in 1980s and 1990s in the context of USA.

Objective

The objective of the paper is to find in India

a. the impact of monetary policy shocks contained in announcement of the monetary policy statement or credit policy statement by the Reserve Bank of India (RBI) on short end, medium part and long end of the term structure

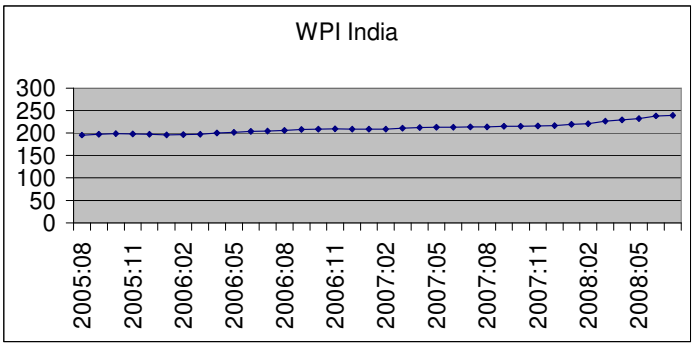
b. the reactions of the sensitive ends of the term structure to expected and unexpected changes in monetary policy, and

c. the differences, if any, in the reactions between immediate pre-inflation period December 07 - March 08 and inflationary period April 08 - August 08 and to examine whether there is any change in structure of the relationship between term structure and monetary policy shocks.

Links between yields in G-Sec market and monetary policy in India

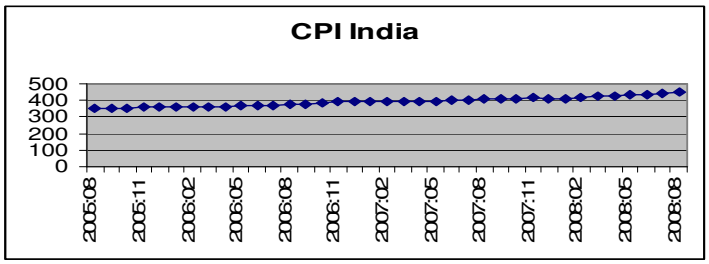
The RBI under the heading "Government Securities Market" in its Annual Reports mentions various links between G-Sec yields and monetary policy and between monetary policy and the driver factors like inflation. In the context of the current financial year, Diagram I shows that in India wholesale and consumer prices were relatively stable till the end of the financial year 2007-08 and started looking up thereafter whereas in USA the CPI was steadily rising during 1970s and then the rise became slow in 1980s and 1990s[1], which were the periods of studies Cook *et al* (1989) and Roley *et al* (1995) respectively and the outcomes were different between these periods.

Diagram I



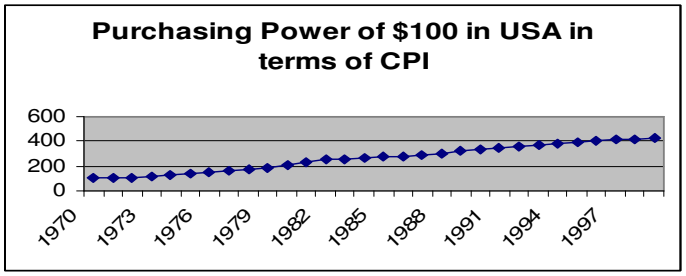
[1] http://www.newstrackindia.com/newsdetails/3307,

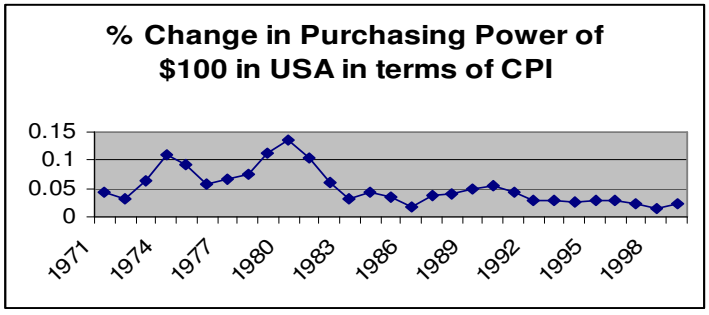
http://www.merinews.com/catFull.jsp?articleID=132698 accessed on 15-Sep-08



Source:

http://dbie.rbi.org.in/businessobjects/enterprise115/desktoplaunch1/InfoView/main/main.do?objId=6169, accessed on 25 December 2008





Source: http://www.bls.gov/cpi/data.htm accessed on 25 December 2008

Hence, regarding the Indian G-Sec market there is a scope of suspicion about differences between the two periods in

(i) the nature of sensitivity of the term structure to monetary policy shocks, and

(ii) the concerns of the market participants regarding trading and reinvestment vis-à-vis liquidity because trading and reinvestment aim at profit but the opportunity cost of holding or procuring liquidity may be a high rate of return. There was prolonged price stability till the last quarter of 2007-08. It can be suspected that during the stable period a market participant would like to make trading and reinvestment gains apart from ensuring liquidity. But as inflationary period comes near, his liquidity concern dominates the trading and reinvestment concerns and the latter may vanish altogether if inflation rate rises fast.

Modeling

In order to measure the impact of monetary policy shocks in India it is proposed here to use the 3 month MIBOR to measure the impact of changes in the monetary policy rates on zero coupon (ZC) rates computed with NSS model and extended Vasicek model. It is proposed here to examine the responses of ZC rates of the securities of residual short term, medium term and long term maturities to changes in 3 month MIBOR (Mumbai Inter Bank Offer Rate). In India the shortest maturity of new G-Sec issue is 91 days. The longest maturity of new ZC G-Sec issue is 364 days. Therefore the models with NSS rates as regressands need to be compared with and validated by the models with market rates or yield to maturities which, for maturities beyond 1 year, belong to coupon-paying bonds

since stripping is not allowed in India. The market rates are reported by Clearing Corporation of India (CCIL)[2].

Nath (2007) reported that in India, the most widely used benchmark reference rate, MIBOR (Mumbai Inter-Bank Offer Rate), disseminated by National Stock Exchange (NSE) since 1998 is the most widely accepted benchmark rate and used in the interest rate swap contracts; it is a dynamic benchmark rate and hence is considered to have contained the information on monetary policy and the driver factors like inflation rate; further it is a very important infrastructural support to the market participants since all interest rate derivative pricing are done on the basis of MIBOR.

This paper investigates the response of the term structure to changes in 3 month MIBOR. Since all MIBOR rates circulated by FIMMDA– overnight, 3 day, 14 day, 1 month and 3 month – are determined by polling at 10.30, 9.40, 11.30, 11.30 and 11.30 am respectively every working day, 3 month MIBOR is supposed to contain maximum market information because of its longest term to maturity. Though liquidity is the maximum in the overnight MIBOR, it can be shown that there is a stronger flow of causality from 3 month MIBOR to the term structure.

In India benchmark ZC rates associated with different maturities continuously up to 30 years are provided on everyday basis by NSE-CCIL estimates of Nelson-Siegel parameters and CCIL estimates of experimental NSS Parameters. This

[2] CCIL provides exclusive clearing and settlement for transactions in Money, GSecs and Foreign Exchange in India. CCIL manages the NDS-OM (Negotiated Dealing System – Order Matching) electronic trading platform in G-Sec and NDS-CALL electronic trading platform in call money in India.

paper works with NSS model because this fits better with market data than does Nelson-Siegel model as per Swamynathan (2005). But it is imperative to generate the short rates on the basis of extended Vasicek model using the very long term rate denoted as 'L' when maturity tends to be infinitely long and the very short term rate denoted as 'S' in Goukasian *et al* (2006) when maturity tends to be zero. These rates are taken from estimates using NSS parameters since there is no real life instrument with maturity zero or infinity in India.

The following models are to be estimated for the samples individually as well as collectively after stationarity tests before examining the structural changes:

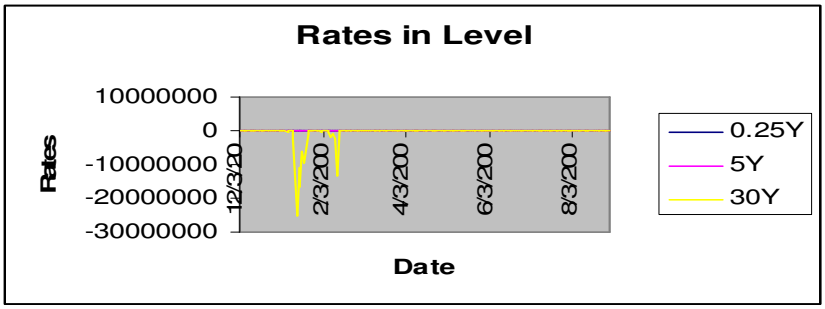
$R_t = a_1 + a_2 M_t + u_t$,

where R_t is the ZC rate, M_t the 3 month MIBOR rate and u_t error term. Here Chow's 1st test Analysis of Covariance (or Chow Test henceforth) is to be performed because of sufficient number of observations as per Patterson (2000). Chow test produces a numerical figure which follows F distribution. If the estimated F value is more than the table value it is decided that the parameters have different values between two different samples. These models are linear because not the entire term structure, rather an infinitesimal linear segment of the term structure corresponding to a particular maturity like 91 days or 5 years is taken as the regressand here.

Since these are time series data, it should be checked whether they are stationary. This can be done with Augmented Dicky Fuller (ADF) Test. It is found that the first difference of all the selected variables – 91 days ZC rate (short-term rate both for NSS and extended Vasicek, henceforth 91D rate), 5 years rate (medium-term rate), 30 years rate (long-term rate) and 3 month MIBOR are stationary

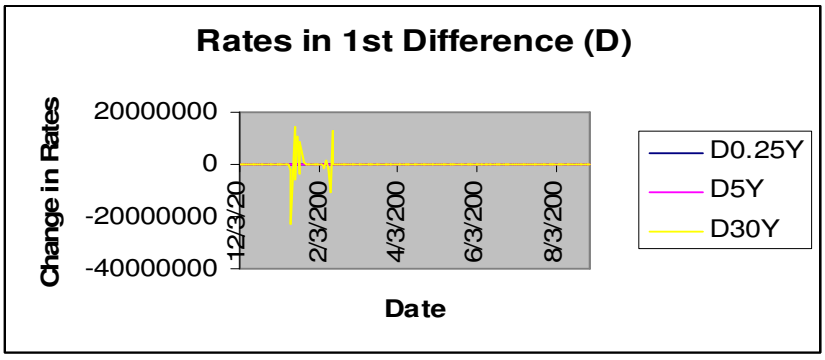
while in level they are all non-stationary. This is true for both the periods individually as well as collectively. The rates in level are displayed in Diagram II.

Diagram II



Though there are outliers, there is no need to filter them out since the first differences in the rates are showing the desired results in Diagram III.

Diagram III



This means they are all integrated of order one. Further their similar movements create enough opportunity to suspect that they are interrelated in the long run. This would be confirmed with the help of cointegration estimate. Now, applying

ordinary least square (OLS) technique, separate regressions of short term rate, medium term rate and long term rate are run on 3 month MIBOR and the ADF Test is performed for the residuals to check whether the residuals are stationary. If they are stationary the relationships would be established as long-term relationships. The following three regressions are run:

$R_t = \alpha_1 + \alpha_2 M_t + u_{1t}$ for the sample period: December 07 - March 08

$R_t = \beta_1 + \beta_2 M_t + u_{2t}$ for the sample period: April 08 - August 08

$R_t = \delta_1 + \delta_2 M_t + u_{3t}$ for the integrated sample period: December 07 - August 08

Next Chow Test is performed by estimating

$F_{(2,177)} = ((RSS_3 - (RSS_1 + RSS_2))/k)/ (RSS_1 + RSS_2)/(n_1+n_2-2k)$, where k is the number of coefficients, i.e. 2, n_1 and n_2 are sample sizes and $n_1 + n_2$ is the integrated sample size. If the estimated F value is less than the corresponding table value the null hypothesis of parametric stability is not rejected and vice versa.

Regarding the expected and unexpected changes in the monetary policy rate Shiller (1985) found people to remember the recent past but blur the more distant. Giannikos *et al* (2007) reported about a number of studies that showed the importance of expectations in shaping the term structure, such as Fama (1984), Campbell *et al* (1991), Mankiw *et al* (1986), Cox *et al* (1985), Bekaert *et al* (1997) and Chance *et al* (2001). Boudoukh (1997) was favoring the exponential smoothing approach, which applies exponentially declining weights to past returns in order to calculate conditional volatilities since using declining weights helps capture the cyclical behavior of return volatility. This means the market agents form expectations more on the basis of recent past and less on the basis of

remote past. Nath *et al* (2003) mentioned an important documentation in this regard made by the J P Morgan's RiskMetrics that applied declining weights to past daily returns to compute volatility with a decay factor $\alpha = 0.94$. Vohra (2001) delineated how to make forecast by assigning weight α to current information and $(1-\alpha)$ to past information where $0 < \alpha < 1$. This means a major part of next period value is the current period value. Here expected and unexpected components of 3 month MIBOR are calculated after estimating the autoregressive model $Y = \alpha Y_{t-1}$ which is found to be the best fitted compared to alternative models like $Y = \alpha + \beta Y_{t-1} + \delta Y_{t-1}$ and $Y = \alpha + \beta Y_{t-1}$. So the following models are proposed $R_t = \alpha_1 + \alpha_2 M_t$

$\Delta R_t = a_1 + b_1 \Delta \text{expected } M_t + u_{1t}$

$\Delta R_t = a_2 + b_2 \Delta \text{ unexpected } M_t + u_{2t}$

In order to validate the above results especially with respect to the NSS rates, the short rates are generated applying the extended Vasicek's model

$R_t = L - (S*(1-\exp(-0.3*m_t))/(0.3*m_t)) + (\text{curvature}*((1-\exp(-0.3*m_t))^2)/(4*0.3*m_t))$, where L is the longest term rate when maturity $m \to \infty$ and S is shortest term rate when $m \to 0$, '*' is the sign of multiplication, 'curvature' means change in the slope of the price yield curve of the chosen maturity[3]. NSS formula is applied in computing L and S following Bayazit (2004). For this experiment any typical Indian 91 days TB like the one maturing on 24 August 2007 is chosen. Then the relationship between 91D rate and 3 month

[3] Goukasian *et al* (2006), p 9

MIBOR is tested and found similar as our earlier results except the fact that the experiment based on NSS model resulted better in terms of t value and $\overline{R}^2$ value. Therefore we are reporting the results relating only to the NSS rates[4]. Further, as far as NSS rates are concerned we are reporting mostly the results relating to 91D rate during the inflationary period and the periods before but close to the inflationary period since other rates are not found to react reasonably to monetary policy rates. But, while validating the results, we shall be reporting the results relating to market rates of TBs of residual maturities of 91 days and coupon paying bonds issued by Government of India (GOI) of residual maturities

[4] In an alternative manner short term rates can be generated following the exposition of Hull (2009). Here the Vasicek Model is $dr = a(b-r)dt + \sigma\, dz$, where $dz = \varepsilon\sqrt{dt}$ is a Brownian motion. Here Hull showed that the Vasicek term structure having shapes like upward sloping, downward sloping and slightly humped can be determined as a function of r_t once a, b and σ are chosen.

Choudhry (2004) describes the Vasicek term structure to essentially be a model of the stochastic evolution of the short term rate assuming that changes in the short-term interest rate is a Markov process and describing an evolution of short-term rates in which the evolution of the rate is a function only of its current level, and not the path by which it arrived there; the practical significance of this is that the valuation of interest-rate products can be reduced to the solution of a single partial differential equation.

The Vasicek term structure as a partial differential equation is given by $dr = a(b-r)\, dt + \sigma\, \varepsilon\sqrt{dt}$

$\Rightarrow dr = a(b-r) + \sigma\varepsilon$, for $dt = 1$ for one period

$\Rightarrow \Delta r = ab - ar + \sigma\, \varepsilon$ since dr is the limiting case only,

$\Rightarrow ar = ab + \sigma\varepsilon - \Delta r$

$\Rightarrow r_t = b + (\sigma\varepsilon - \Delta\, r_t)/a$

$\Rightarrow r_{t-1} = b + (\sigma\varepsilon - \Delta\, r_{t-1})/a$

Deducting r_{t-1} from gives

$\Delta r_t = 1/a\, (\sigma^*\Delta\varepsilon - \Delta^2 r_t)$

Next regression of Δr_t on $\Delta^2 r_t$ can be run and the parameter 'a' can be estimated. Then one day forward rates for the Indian 91D T-bill of maturity on 24 August 2007 can be generated.

of 5 years because in terms of $\bar{R}^2$ the 5 years rate is better fitted with 3 month MIBOR.

In Indian context, where the short rates like call rate, overnight MIBOR and 91D rate are accepted as short term benchmark rates while entering swap contracts, there is possibility of two way causality between 91D rate and 3 month MIBOR. If both of cointegration and two-way causality are confirmed the vector autoregression (VAR) relationship is to be decided for forecasting purposes.

Data

The data on 3 month MIBOR are collected from NSE and the NSS rates of short-term 91 days, medium-term 5 years and long-term 30 years are collected from CCIL during the period from August 05 to September 08. The data on daily market rates of the GOI securities of above maturities are also collected from CCIL.

Results

The results of regressions are as follows:

Category I: NSS rates as regressands

(1) 91D rate = 2.17 + 0.49 3M MIBOR

(2.1) (4.23) $\bar{R}^2 = 0.18$

Sample Period: December 07 - March 08

(2) 91D rate_t = -2.4 + 1.03 3M MIBOR_{t-1}

(-4.3) (17.3) $\bar{R}^2 = 0.623$

Sample Period: December 07 - March 08

(3) 91D rate = -2.95 + 1.11 3M MIBOR

(-5.6) (20.1) $\overline{R}^2 = 0.8$

Sample Period: April 08 - August 08

(4) 91D rate = -2.36 + 1.03 3M MIBOR

(-4.18) (16.93) $\overline{R}^2 = 0.61$

Sample Period: December 07 - August 08

(5) Chow Test F = 34.6803 for equations (1), (3) and (4)

(6) $3M\ MIBOR_t = 0.998\ 3M\ MIBOR_{t-1}$

(714.7) $\overline{R}^2 = 0.96$

Sample Period: April 08 - August 08

(7) $91D\ rate_t = -1.18 + 0.44$ expected $3M\ MIBOR_{t-1} + 0.6\ 7.88\ \ 91D\ rate_{t-1}$

(-2.76) (4.69) (7.88) $\overline{R}^2 = 0.9$

Sample Period: April 08 - August 08

(8) 5Y rate = 5.37 + 0.26 3M MIBOR

(81.46) (29.9) $\overline{R}^2 = 0.59$

Sample period: August 05 – January 08

(9) 91D rate = 2.96 + 0.39 3M MIBOR

(14.65) (14.3) $\overline{R}^2 = 0.24$

Sample period: August 05 – January 08

Category II: Market ytms as regressands

(10) Δ91D rate = 13502.8 Δ3M MIBOR

(3.05) $\overline{R}^2 = 0.04$

Sample Period: December 07 - August 08

(11) Δ91D rate = -1.25 Δ3M MIBOR

(-1.51) $\overline{R}^2 = 0.03$

Sample Period: December 07 - March 08

(12) Δ91D rate = 22960.017 Δ3M MIBOR

(3.05) $\overline{R}^2 = 0.08$

Sample Period: April 08 - August 08

(13) 5Y rate = 2.94 + 0.56 3M MIBOR

(6.37) (11.26) $\overline{R}^2 = 0.44$

Sample Period: December 07 – August 08

(14) 5Y rate = 8.17 – 0.057 3M MIBOR

(14.00) (-0.87) $\overline{R}^2 = 0.01$

Sample Period: December 07 - March 08

(15) 5Y rate = 2.36 + 0.64 3M MIBOR

(5.93) (15.59) $\bar{R}^2 = 0.73$

Sample Period: April 08 – August 08

(16) Chow Test F = 6.75 for equations (10), (11) and (12)

(17) Chow Test F = 51.14 for equations (13), (14) and (15)

Interpretation of the Above Results

Equations (5), (16) and (17) with estimated F values more than the corresponding table values at 99% confidence level confirm changes in the parameters over the sample periods. This indicates more cautiousness of the market participants in handling G-Sec portfolios during inflationary periods. Further the regression model in 1st differences in both of regressor and regressand used by Cook *et al* (1989) in the USA context is found to be poor fitted in India in terms of t and $\bar{R}^2$ values in the case of NSS rates but better fitted in the case of market rates. It should be noted here that the slope coefficient in the case of 91D rate equation is very high but the $\bar{R}^2$ value is not much high in both the cases of NSS rates as well as market rates. This means though 3M MIBOR influences short rate very strongly but it is not the only determinant of the short rate and does not explain a major part of the variations in 91D rate. In contrast 3M MIBOR influences market 5 years rate marginally but it is a major determinant of variations in actual 5 years rate and explains a major part of the variations in 5 years rate. Equation (7) shows that NSS 91D rate responds significantly to expected 3 month MIBOR. Again equations (10), (11) and (12) show that change in market 91D rate responds significantly to change in 3 month MIBOR. Since expected 3 month

MIBOR is a major fraction of 3 month MIBOR, the change in market 91D rate is automatically dependent on change in expected 3 month MIBOR. This result goes against Kuttner (2001). Both NSS 91D rate and market 91D rate do not respond significantly to unexpected changes in 3 month MIBOR. In India the interest rate sensitive participants in money and G-Sec markets like the commercial banks design their operation plans including participation in the primary market auctions in the evening of the current working day for the next working day according to the expectations they from based on the market information available at that point of time. The RBI Auction Committee in the Indian primary market also, while setting the cut-off price or yield, keeps in mind the market information[5].

Comparison of (11) with (10) and (12) shows that the slope coefficient in (11) is negative capturing the fear of ensuing liquidity crisis and subsequent purchase of short term securities as store of future liquidity. Similar analysis can show that such a negative slope coefficient did not exist at the similar point of time during the previous year. Same can be concluded about 5 year maturity after comparing (14) with (13) and (15). It should be noted that the RBI was yet to announce changes in monetary policy rates during the period from December 2007 to March 2008. Equations (7) and (15) can be used for speculation and hedging if inflation is expected during the sample period. Equations (8) and (9) reveal trading and reinvestment activities during the period of price stability apart from liquidity management. 3 month MIBOR can change even in absence of monetary

[5] http://www.sbidfhi.com/gsecs.htm, http://www.sbidfhi.com/cwm/glossary/26/, accessed on 25 December 2008

policy actions and inflation. Such a change is considered to be temporary. For example, a rise in 3 month MIBOR may lead to liquidity problem from the view point of prices for the securities of both short and medium term residual maturities, but it will create reinvestment gain also for medium term coupon paying bond portfolio. Fight between these two opposite forces are responsible for less sensitivity of medium term securities towards monetary policy updates compared to short tern securities. During inflationary regime, selling medium term security may lead to substantial capital loss and buying the same needs more of costly liquidity. Hence the yields of such securities do not change much. In India, sizeable chunks of medium term securities are held by insurance companies apart from the banks. Insurance companies are more concerned about reinvestment losses than are the banks when yields fluctuate.

Further NSS 91D rate is found to be cointegrated with 3M MIBOR but market 91D rate is not. In sharp contrast NSS 5 years rate is not found to be cointegrated with 3M MIBOR but market 5 years rate is. The importance of NSS 5 year rate would be realized once stripping is allowed in India. Differences in behavior patterns between theoretical NSS rates and market rates imply presence of unutilized arbitrage opportunities. Since theoretical price has no-arbitrage character, there exists market disequilibrium when market price is different than theoretical price and in the case of a stable equilibrium the market price would gradually move towards equilibrium through arbitrage process. For example, if the market rate is more than theoretical rate a typical trader would take a view that market rate would come down shortly. He will try to buy at a current lower price in order to sell at a higher future price. In order to explore future arbitrage

opportunities in the case of securities with 91 days and 5 years remaining maturity it is imperative to know the nature of long run relationship between their rates and 3M MIBOR. In order to specify the exact nature of causality, Granger test at 99% confidence level is performed in both cases and the results are in Table I and Table II respectively.

Table 1

Pairwise Granger Causality Tests			
Lags: 1			
Null Hypothesis:	Obs	F-Statistic	Probability
NSS 91D rate does not Granger Cause 3M MIBOR	100	14.1205	0.00029
3M MIBOR does not Granger Cause NSS 91D rate		7.46719	0.00747

Table II

Pairwise Granger Causality Tests			
Lags: 1			
Null Hypothesis:	Obs	F-Statistic	Probability
Market 5 years rate does not Granger Cause 3M MIBOR	162	3.26066	0.07285
3M MIBOR does not Granger		11.025	0.00111

Cause Market 5 years rate			

Both estimated 'F' values in Table I are more than table values thereby confirming two-way causalities with lag 1 in the case of theoretical 91D rate. But there is a one way causality from 3M MIBOR to market 5Y rate since the estimated F value for the first null hypothesis in Table II is less than the table value. In the case of NSS 91D rate and 3 month MIBOR since both the variables are causing each other and we like to see the evolution of both the variables as linear functions of their past history. Here Vector Auto Regression (VAR) model need to be used. Next VAR is run for two endogenous variables NSS 91D rate and 3M MIBOR with alternative lag structures and that model is chosen which gives the best combination of $\bar{R}^2$, F-statistic and Schwarz Information Criteria (SIC). SIC chooses the optimum number of regressor in a model. Keeping in view that increasing number of lags in the regressor leads to decreasing degree of freedom, the lower the SIC value the better is the model. F-statistic is a tool to test the null hypothesis $R^2 = 0$, if the value of F statistic is higher than the table value of the specified confidence level, R^2 is deemed to be significant. Very high F values imply very high R^2 value. The chosen VAR model is given below:

Y = 91D rate, X = 3 month MIBOR,

$Y_t = -0.56 + 0.26\ X_{t-1} + 0.75\ Y_{t-1}$

(-1.21346) (2.73262) (9.80246) $\bar{R}^2 = 0.89$, F = 389

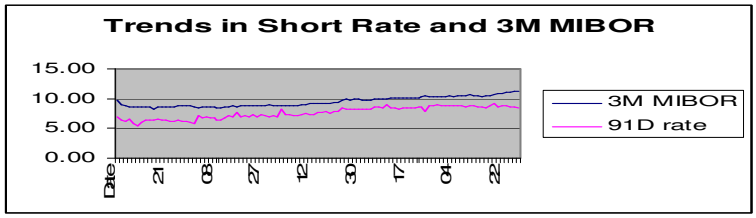
$X_t = 0.24 + 0.89\ X_{t-1} + 0.1 Y_{t-1}$

(1.40019) (25.0379) (3.75773) $\bar{R}^2 = 0.98$, F = 2077

SIC - 0.5

Since both NSS 91D rate and 3 month MIBOR are displaying trends, it is necessary to explore their movements with respect to long term average, i.e. whether they are coming back to the average once they moved away. Diagram IV is however, indicative of fluctuations away from the average.

Diagram IV



But it is necessary to know how long they will continue to be so. Applying lag 'L' operator to the VAR equations we get

$(1-0.75L)Y - 0.26L\,X = -0.557$

$-0.11L\,Y + (1-0.89L)\,X = 0.24$

or

$AV = C$

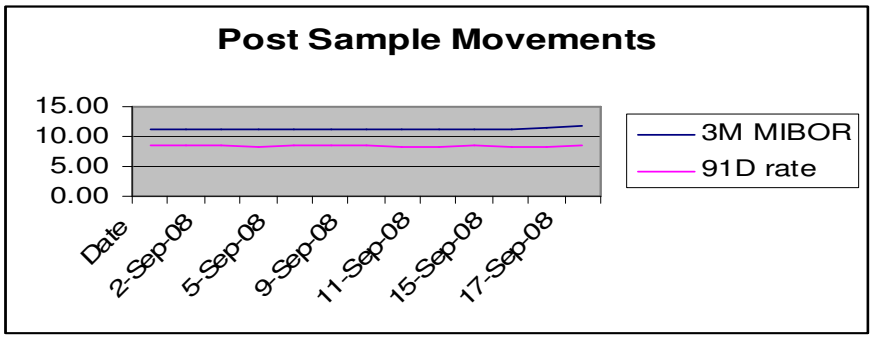
Where A_{2x2} is the matrix of coefficients of the variables X and Y, V_{2x1} is the column matrix of variables and C_{2x1} is the column matrix of constants. The value of

$|A_{2x2}| = (1 - 0.75L)(1 - 0.89L) - (- 0.26L\,X)(- 0.11L) = 1 - 1.64L + 0.6961L^2$

$= [L - \{(1.64+0.307896i)/2\}][L - \{(1.64 - 0.307896i)/2\}].$

The roots of L here are imaginary and equal to 0.82 ± 0.154i. They will lead to stepped fluctuations but mitigating gradually as per De Moivre's Theorem since $\sqrt{((0.82)^2 + (0.154)^2)} = 0.83$ which is less than unity. The mitigating nature of movement can be intuitively understood from the values of the coefficients in the VAR model which are less than unity and is clear from the following post sample movements in Diagram V in comparison with within-sample movement in Diagram IV.

Diagram V



The fluctuations during the post sample days are less intense compared to the inflationary regime. The softening of benchmark rates since 1 September 2008 was evident as reported in the afternoon by Reuter 'as investors bought back debt after a recent sharp spike in yields' and in the evening of the same day 'as a fall in

oil prices raised hopes of a moderation in inflation and unwound an early rise caused by an increase in reserve requirement for banks'[6].

Conclusion

This paper tried to model the response of term structure to monetary policy actions in India. The 3 month MIBOR is taken as the proxy of monetary policy rates. Time series econometric techniques are used to model zero coupon rates. Those models are verified with help of market rates of the corresponding residual maturities as well as the behaviour of the key variables during the post sample period. The findings of this paper include strongest sensitivity of the short end of the term structure towards expected monetary policy shocks, existence of unutilized arbitrage opportunities with respect to short term maturity and a fear about future liquidity conditions just before monetary tightening in the first quarter of the current financial year. The results can be used by the participants in money market and G-Sec market to design strategies regarding holding, selling and buying government securities, and borrowing and lending short term money when the RBI is expected to announce changes in monetary policy rates.

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[6] http://ri2.rois.com/j8WlSUgTEZESYeZ4J7Acw1d-Ee9aMLv8sfvp8bdYhKKDm/CTIB/RI3APINEWS?FORMAT=HTML&TEXT=1220258899nBOM257982, http://ri2.rois.com/j8WlSUgTEZESYeZ4J7Acw1d-Ee9aMLv8sfvp8bdYhKKDm/CTIB/RI3APINEWS?FORMAT=HTML&TEXT=122027470onBOM324224 accessed on 02-09-08

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