Section V
Conclusions

This study discusses different models to forecast both short and long-term interest rates. Future movements in interest rates are critical to the financial decisions of businesses and households. Forecasting the behaviour of interest rates thus helps to reduce the risk associated with large fluctuations in the interest rates. Forecasting any economic variable can be a difficult task since the forecasts will depend on the model used to generate them. Hence it is important to study the properties of forecasts generated from different models and select the "best" on the basis of an objective criterion.

This study also highlights the differences between modelling short and long-term interest rates. This is reflected in the choice of variables in the multivariate models.

The conclusions for each interest rate are as follows:

- For the call money rate, an ARMA-GARCH model is best suited for very short-term forecasting while a BVAR model with a loose prior can be used for longer-term forecasting.
- For the 15-91 day Treasury Bill rate, the LVAR models produce the most accurate short and long-term forecasts.
- For 1-year government securities, BVAR models out-perform the alternatives at the short and long ends.
- For 5-year government securities, the BVAR models do not perform well. Overall, VECM outperforms all the alternative models. VECM also generally outperforms the alternatives at the short and long forecast horizons.
- For 10-year government securities, forecasting performance of all the models is satisfactory. The model that produces the most accurate forecasts is LVAR, or, in other words, a BVAR with a very loose prior. LVAR model produces the most accurate short and long-term forecasts.

The selected models conform to expectations. Standard ARIMA models are based on a constant residual variance. Since financial time series are known to exhibit volatility clustering, this effect is taken into account by estimating ARCH/GARCH models. It is found that although the ARCH/GARCH effects are significant, the ARCH model produces more accurate out-of-sample forecasts relative to the corresponding ARIMA model only in the case of call money rate. This result is not surprising since the out-of sample period over which the alternative models are evaluated is relatively stable with no marked swing in the interest rates.

It is also found that the multivariate models generally produce more accurate forecasts over longer forecast horizons. This is because interactions and dependencies between variables become stronger for longer horizons. In other words, for short forecast horizons, predictions that depend solely on the past history of a variable may yield satisfactory results. This difference between univariate and multivariate models is illustrated in figures 3A-3E with respect to different forecast horizons. The advantage of using multivariate models is also highlighted in figures 4A-4E that depict forecasts made by a real time forecaster at a given point in time.

In the class of multivariate models, the Bayesian model generally outperforms its contenders.

Unlike the VAR models, the Bayesian models are not adversely affected by degree of freedom constraints and overparameteiztion. In two cases, i.e., for TB 15-91 and GSec 10, the level VAR performs best suggesting that a loose prior is more appropriate for these models. Notice that with a loose prior, the Bayesian model approaches the VAR model with limited restrictions on the coefficients.

The VECM model outperforms the others only in the case of the GSec 5-years rate. Although inclusion of an error correction term in a VAR is generally expected to improve forecasting performance if the variables are indeed cointegrated, this contention did not find support in this study. This may be because cointegration is a long run phenomenon and the span of the estimation period in this study is not sufficiently large to permit a rigorous analysis of the long-run relationships. Thus, it is not surprising that the VAR models generally outperform the corresponding VECM forecasts.

Thus, to sum up, the forecasting performance of BVAR models for interest rates is satisfactory. The BVAR models generally produce more accurate forecasts compared to the alternatives discussed in the study and their superiority in performance is marked at longer forecast horizons. The variables included in the BVAR models are: inflation, Bank Rate, liquidity, credit, spread, Libor 3 and 6-months and forward premia 3 and 6-months. These variables are selected from a large set of potential series including the repo rate, Cash Reserve Ratio, foreign exchange reserves, exchange rate, stock prices, Ways and Means Advances (by RBI to Centre and State Governments), turnover (total turnover of all maturities), 3 and 6-months US Treasury Bill rate (secondary market), reserve money and its growth rates.

A closing remark on one caveat on the research method used in the Study. BVAR forecasts have one important limitation. The search for an optimal prior requires an objective function (i.e., the Theil U-statistic) that is optimized over the out-of-sample forecasts. The chosen prior, therefore, may not be optimal beyond the period for which it was selected. This shortcoming is not limited to BVAR models; it is a problem for all models selected on the basis of out-of-sample forecasts. In other words, the selected specification may not produce the ‘best’ forecasts outside the sample for which the selection was made.