Modelling and Forecasting the Term Structure of Swiss Government Bond Yields

Master Thesis

supervised by the

Swiss Banking Institute

University of Zurich

Prof. Dr. Urs Birchler

to obtain the degree of

Master of Arts in Banking and Finance UZH

Author Ralf Vetsch

Closing date January 29, 2013

Executive summary

Problem set and targets

The problem set of this master thesis is divided into two main parts. The first target is to provide you with an overview and discussion of the existing literature concerning bond yield curve modelling and forecasting. While our starting point for modelling the yield curve is set by Nelson and Siegel (1987) and for forecasting by Diebold and Li (2006). The second goal of this paper is to apply the yield curve forecasting model by Diebold and Li (2006) for the CHF Market. Thereby this paper shows how the model can forecast the Swiss government bond yield curve in the short, medium and long term. Further on we also compare our results with common benchmark models analogously to Diebold and Li (2006) and finally compare our key findings with those obtained by Diebold and Li (2006).

Methodology

The first part of the problem set will basically be elaborated in chapter two and is rather theoretical. In the first subsection we provide a brief introduction into time series analysis. Then we start with some basics concerning yield construction out of bond prices and go on to various approaches for modelling the term structure of interest rates in the second subsection. In the third subsection an overview of the different forecasting models applied in various recent papers is presented and on top of that we look at the results of the papers and show how they performed compared relative to each other. In the second part, we try to reproduce the work done by Diebold and Li (2006) with CHF market data, which in turn are provided by the Swiss National Bank. The yield curves get fitted analogously as in Diebold and Li (2006) paper with the same parameters, estimated in the same way. This provides us with a time series of the various parameters. To forecast the term structure of interest rates we forecast these parameters with an AR(1) process. Given these estimated betas we can calculate our interest rate forecasts for different maturities and forecasting horizons. The results we compare with the results obtained by various benchmark models analogously to the Diebold and Li (2006) paper. Finally we compare our results with the results obtained by Diebold and Li (2006) to answer the question whether the model is as appropriate for CHF market data as for the USD data.

Results

We managed to forecast interest rates at different maturities and forecasting horizons using the Diebold and Li (2006) model. We confirmed two trends also stated by Diebold and Li (2006). First, the longer the forecasting horizon gets the worse the forecasting accuracy becomes. Second, the longer the maturity of the forecasted interest rate the more accurate our forecast becomes. At the short time forecasting horizon the Diebold and Li (2006) model does not outperform the random walk model in terms of forecasting accuracy. By extending the forecasting horizon to six months, the Diebold and Li (2006) model performs even worse compared to the random walk approach. This is unexpected and contrary to the findings by Diebold and Li. The same holds also true when extending the forecasting horizon towards twelve months. Thus putting things together we did not find that the quite sophisticated model by Diebold and Li (2006) outperforms a simple random walk approach when applied to CHF data.

When comparing the Diebold and Li (2006) model with other commonly used forecasting models we obtained the following results. Again at the one month horizon differences are very small and we cannot state that the Diebold and Li (2006) model outperforms its competitor models. This holds true throughout the whole maturity range. By extending the forecasting horizon towards six and twelve months the difference between the models increases but with the increasing forecasting horizon standard deviation also increases, which relatives the increased differences between the models. But again the Diebold and Li (2006) model does not outperform the other models at any maturity as wells in terms of mean forecasting errors as well as in terms of root mean squared errors.

Concerning the result obtained with regard to the one month horizon forecast we can confirm the result by Diebold and Li (2006) with USD data holds also true for CHF data. Meaning that in both data sets the Diebold and Li (2006) model does not significantly outperform the various benchmark models but is also not worse than its competitors. Comparing the results obtained with extended forecasting horizons, our findings differ from the results of the Diebold and Li (2006) paper. While they found increasing outperformance of their model compared to the benchmark models when extending the forecasting horizon, we observe in the best case no underperformance but clearly no outperformance. Nonetheless we managed to get comparable absolute forecasting accuracy in any forecasting horizon and for most maturities.

Concluding remarks

So our result do not just disagree with the findings in the Diebold and Li paper, they also disagree with the results of other authors, like Bowsher and Meeks (2008) or Vereda et al. (2008). One possible explanation for this fact could be that their data set includes interest rates just until 2008 while our data reach into 2012. Thus in their data they did not have the extraordinary low interest rate period since the financial crisis. This may explain, at least to some extent, the different findings. On top of that they analysed a different market, i.e. the USD market while we looked at the CHF market. It would be interesting to analyse the Diebold and Li (2006) model with USD data but in the same period as we did. Also when taking into account the findings of Tabak et al. (2012) who did this exercise in the EUR market. Forecasting interest rate remains a difficult task and there are not always the most complicated models performing best, especially in times when the yield curve is very flat at a very low level and movements are marginally.