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Different Forecasting Methodologies and Their Verification on a Stress Testing Model

Executive Summary

Bachelor Thesis

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Chapter 1

Executive Summary

1.1 Motivation

Not only since the recent financial crisis has the process of forecasting financial time series been one of the most important challenges for both, regulatory institutions as well as the institutions directly involved and affected by the forecasts. There exist a broad range of different forecasting methodologies, from qualitative techniques, mostly based on expert judgement and assumptions, to time series forecasting, based on statistical models and complex forecasting systems. Every single forecasting technique is specialised to produce accurate forecasts for specific topics and tasks, ranging from the forecasting process of revenues for newly developed products to the process of forecasting international macro economic systems, containing dozens of different variables, all linked in a single forecasting model. Thanks to the technological development in the recent years, more complex models can be computed in shorter time and with higher accuracy, producing better forecasts for a set of variables in a shorter time horizon, using less resources. In my bachelor thesis, an overview over the currently most used forecasting techniques and models is given. I derived forecasts for the Swiss economy, using two different kind of forecasting models. After choosing the two models and deriving forecasts with those models, the results are used to apply a stress testing procedure for banks. In this stress test, The Swiss banking sector, represented by six of the largest Swiss banks, is investigated with respect to its reaction to the forecasted scenarios from the two models. I applied the results on a stress testing model, to see, how well the Swiss banking sector would react to the two macro economic scenarios.

1.2 Goal

The goal of my thesis was to give on overview of the currently used forecasting techniques in the financial industry. Based on the overview, I selected two advanced techniques, the Bayesian-VAR (BVAR) and the Global-VAR (GVAR), both based on the general characteristics of a vector-autoregressive-model (VAR), to investigate further. I chose the BVAR and the GVAR because both are advanced forecasting techniques that deal with the problem of overfitting and non-including of foreign variables respectively in forecasting and are therefore able to improve the forecasting models. I derived forecasts for the Swiss economy, represented by eleven macro economic variables, which I constructed using the Bloomberg data base. The eleven Swiss macro variables are chosen according to the input variables for the stress testing model. For each model, I computed an in-sample forecast to check the performance and accuracy of each model. Furthermore, I checked the resulting VAR systems for stability and consistency, using several statistical methods.
In addition to the forecasts for the Swiss macro economic variables, I chose six of the largest Swiss

banks to gather relevant figures for the income statement and the balance sheet, in order to have an overview of the current Swiss banking environment. Finally, I was able to conduct two stress tests for the Swiss banking sector, using a stress testing model, developed at Fintegral Consulting AG and modified by me, by redefining all underlying equations for the Swiss banking sector, to fit the Swiss banking environment. As a final task, I compared the outcomes of the two stress tests between each other, to see, how the two different models performed for the forecasts of the Swiss economy.

1.3 Approach

I transformed every variable in order to make them stationary. A stationary variable has a constant mean and variance over time. The Dickey-Fuller test tests for stationarity in the time series of the variable. For the two models, the BVAR and the GVAR, several assumptions and inputs had to be chosen.
In the case of the BVAR, which is based on Bayesian statistics, a prior distribution of the parameter in the Vector autoregressive system had to be chosen. I chose a Minnesota prior for my prior distributions for two main reasons. First, it reduces the computational time by a factor of several hundred, because under the Minnesota prior, the covariance matrix of the disturbance terms is fixed before the posterior sampling begins. For each variable in the resulting VAR system, the model is estimated assuming that all coefficients, except for the ones of their own lag terms, are equal to zero. The second reason why I chose the Minnesota prior is the fact that I have stationary data and the Minnesota prior suggests that each coefficient, expect their own lag terms, are equal to zero. This works reasonably well with stationary data, which should, in theory, predict a future value of its historic mean. Using those inputs, I computed two forecasts for the Swiss macro economic variables, one out-of-sample forecast and one in-sample forecast. The in-sample forecast was used to perform a sanity check of the results, by comparing the forecast values to the realised values of the variables. The out-of-sample forecast was then used to conduct the RAMSI stress test of the Swiss banking environment.
For the GVAR, I needed to gather some foreign variables as well as the Swiss economic variables. I chose a set of 9 international variables to simulate the current state of the world economy. After transforming those international variables into stationary time series, I estimated a vector autoregressive model containing my domestic variables as well as the foreign variables. For the resulting Global-VAR, I made an in-sample forecast as well as an out-of-sample forecast. I checked both forecasting results with the same statistical methods as I tested the results from the Bayesian-VAR for stability and consistency and compared the in-sample forecast with the realised values for the same time horizon. The result of the out-of-sample forecast, I paired again with the Swiss bank's data set and conducted the RAMSI stress test for the Swiss banking sector with the GVAR forecasts.
As a final step, I compared the results from the stress test based on the BVAR forecast with those based on the GVAR forecast and looked at the results from a critical point of view.

1.4 Findings

Even when the two forecasting methodologies are based on the same core assumptions and the out-of-sample forecasts do not differ very much from each other, the stress test results can be very different. In both scenarios, two large Swiss banks suffered losses coming from defaulted corporate loans, since both models suggested a rapid growth in the corporate lending rate over the next years. But the differences in the two models were large enough to let two banks suffer severe losses in the GVAR based RAMSI stress test, compared to the BVAR based stress test. In the GVAR based stress test, one bank suffered such severe losses that it was in the end downgraded to a rating below investment grade and another bank was suffering huge losses as well. The results based on

the BVAR forecasts were not as drastic as the ones from the GVAR forecast, but the same two banks suffered losses as well in this scenario. The two banks suffering the most, are having both large exposures in corporate loans, resulting in high losses given a rise in the corporate lending rate.

1.5 Outlook

Having an accurate and robust forecasting model is a very challenging task, not only can small differences in the models cause huge differences in the stress test, but finding the correct parameter of a model is difficult as well. Therefore a good estimate of the parameters of the main drivers of an economy are mandatory for a forecasting model to be accurate. Especially since the recent financial crisis, when older dependencies do not hold anymore and the volatility in the markets increased as well, a good forecasting model has to provide reasonable parameter estimates. The difficulty lies in deriving fast models that can estimate highly sensitive variables. Nevertheless forecasting techniques are becoming more and more accurate and are faster to estimate, thanks to the increase in computational power. With the recent upcoming of Bayesian techniques for the forecasting processes, more advanced models will be available for future stress tests and can provide more stability and security among financial institutions.