**Final Exam, December 2014**

**MgtF 405 Forecasting**

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**Instructions: This is a take-home exam. You have to complete all answers working on your own and may not consult with or discuss the exam with any other students or individuals. You have until noon (12:00pm) on Monday, December 15 to complete the exam. Your answers should be submitted electronically to the Finals dropbox on Ted. Please submit a file with the answers along with matlab code or any other codes used in the analysis. If you have any questions of clarification, please e-mail Leland Farmer.**

The final exam makes use of Chinese data on stock returns and various macro variables in the **China\_final.xlsx** file. This file contains monthly data over the period January 1995 – September 2014, a total of 237 observations. The variables are as follows:

1. Shanghai SE stock exchange price index (column B)
2. Chinese consumer price index (CPI, column C)
3. Dollar-Renminbi exchange rate (column D)
4. Price-earnings ratio for Chinese stocks (PE ratio, column E)
5. Dividend-price ratio for Chinese stocks (DP ratio, column F)
6. China’s Stock market capitalization (column G)
7. Chinese discount rate (Column H)
8. US imports from China (column I)
9. US 3-month T-bill rate (column J)

Compute the rate of return on the Shanghai SE stock price index (Pt) in column B: rt+1 = ln(Pt+1/Pt).

Make sure to transform any of the remaining variables so they are stationary – you can check if the variables need to be first-differenced by plotting the series to see if they are trending and/or by using a unit root (ADF) test. Variables such as the dividend-price ratio, the price-earnings ratio and interest rates are traditionally kept in levels (i.e., no need to transform those variables). Also make sure to lag the variables when you use them in the prediction models.

Answer the following questions:

1. Estimate a range of autoregressive (AR) models with up to four lags for Chinese stock returns using data up to 2009m12. Report which AR model you have chosen and explain your model choice. Assess how good your model is using diagnostics such as t-statistics for the AR coefficients, the R2 and information criteria. Also, present graphical evidence showing how well the model fits Chinese stock returns.

Deliverables: Model estimates and tests

Graphics

Explanation of choice of ARMA model

1. Next, using data up to 2009m12, estimate a multivariate prediction model that selects from the list of predictors included in columns C through J in the spreadsheet, in addition to any AR terms from part (1). This model should use a one-month forecast horizon. Make sure to lag any predictors. Explain if any of the predictor variables is significant and how you select your preferred prediction model. Provide statistical as well as graphical evidence on the model’s performance.

Deliverables: Model estimates and statistical evidence

Graphics

Explanation of choice of multivariate model

1. Evaluate the multivariate forecasting model in part (2) out-of-sample using data over the period 2010m01–2014m09. This is the data sample excluded from the analysis in parts 1 and 2. The parameters of the forecasting model should be updated recursively using only data that was available on the forecasting date.

Deliverables: Out-of-sample measures of forecasting performance

Statistical tests of bias, efficiency (Mincer-Zarnowitz, etc.)

1. Does your preferred multivariate model from part (2) perform better out-of-sample (2010m01-2014m09) than the prevailing mean model that only includes a constant and no time-varying predictor variables?

Deliverables: Statistical tests of relative forecasting performance

1. Does a simple equal-weighted combination of univariate forecasts based on each of the eight predictor variables in columns C-J produce better out-of-sample forecasts during 2010m01-2014m09 than your multivariate forecasts in part (3)?

Deliverables: Statistical tests of relative forecasting performance

The next two questions use the full data sample 1995m01 – 2014m09.

1. Extend your preferred model from part (2) to allow for time-varying volatility using a GARCH-type specification. Do you find evidence that the variance of monthly stock returns is time-varying and (if so) which GARCH model fits the data best?

Deliverables: Estimates from GARCH models

Explanation of model choice

1. Using the forecasts of mean and volatility from part (6), propose an investment rule that attempts to earn higher average returns than simply holding the Shanghai SE index. Carefully describe your investment rule and test if it works on your data sample.

Deliverables: Description and explanation of investment rule

Test of performance of investment rule