Financial Modelling (BEAM046)   Term 1 2022/3
Week 5 Tutorial Case: Volatility Forecasting

Introduction

You are a risk manager for a US corporation that wants to hedge a long position in NZD with a short position in AUD. The return on the hedged portfolio is given by

$$R_{p,t} = R_{NZD,t} - h_t R_{AUD,t},$$

where h_t is the time-varying hedge ratio. Your task is to estimate the time-varying minimum-variance hedge ratio, given by

$$h_t = \frac{\sigma_{NZD,AUT,t}}{\sigma_{AUD,t}^2}.$$

To estimate this, you need estimates of the conditional variance of AUD returns, and the conditional covariance between AUD returns and NZD returns. You decide to evaluate the multivariate rolling window and EWMA estimators. You will evaluate the estimators over a five-year period.

1. The data file on the course website contains six years of data for the USD/AUD and USD/NZD exchange rates from the Pacific Exchange Rate Service (http://fx.sauder.ubc.ca/). The first year will be used to initialize the EWMA estimator. Convert the exchange rates so that they are expressed as USD per AUD and USD per NZD. Compute simple returns for the AUD and NZD from the perspective of a US investor.

2. Estimate the conditional variance for the AUD returns and the conditional covariance between the AUD and NZD returns, using (a) an EWMA estimator with a decay factor of 0.94 and (b) a rolling window estimator with a window length of 250 days. Use these estimates to construct the time-varying hedge ratio. Calculate the return on the hedge portfolio and its variance. How effective are the EWMA and rolling window hedge ratios (i.e. what reduction in variance to you achieve relative to the variance of the unhedged NZD position)?

3. What are the optimal values of the decay factor for the EWMA model and the window length for the rolling window model? For the EWMA model, this is straightforward: you can use Solver to estimate the optimal decay factor. For the rolling window model, you first need to use the OFFSET function to specify the variance and covariance calculations so that they reference a cell that contains the window length. You can then use a Data Table to find the optimal window length.