

Assignment 1: deadline: 2024-04-29, 08:30

1. The data for this exercise is found on the course page in the file `sp5may.dat`. It has 3 columns: $\log(\text{futures price})$, $\log(\text{spot price})$ and $\text{cost-of-carry} (\times 100)$. The time interval is 1 minute. Let f_t and s_t be the log prices of future and spot respectively (from columns 1 and 2). Consider $y_t = f_t - f_{t-1}$ and $x_t = s_t - s_{t-1}$. Build a regression model, with time series errors, between $\{y_t\}$ and $\{x_t\}$ where $\{y_t\}$ is the dependent variable. That is,
 - Find a model $y_t = \beta_0 + \beta_1 x_t + \epsilon_t$; what are the estimates of β_0 and β_1 ?
 - Store the residuals.
 - Is ‘white noise’ a good model for the residuals?
 - Try fitting an ARMA model to the residuals. Does an ARMA(p,q) process give a better model than the ‘white noise’ model?
 - If you restrict model selection to AR(p), is there a satisfactory AR(p) model which represents an improvement over white noise?
2. The data for this exercise is found in the file `q-gdpdef.txt` on the course page. It contains the data for the United States for the first quarter of 1947 to the last quarter of 2008. Data is in the format year, month, day and deflator. The data are seasonally adjusted and equal to 100 for the year 2000. Build an ARIMA model for the series and check the validity of the fitted model. Use the fitted model to predict the inflation for each quarter of 2009.
3. The monthly log returns of IBM stock and the S&P 500 index from January 1926 - December 2008, with 996 observations can be found in `m-ibmsp2608.txt`.
 - (a) Plot the two time series, one above the other. Is there evidence of similarity between the two series?
 - (b) Make scatterplots of IBM versus S&P 500 at lags of 0 and ± 1 . Make a scatter plot of S&P 500 versus S & P 500 at lag 1. Compute the acf of the bivariate time series. What are your conclusions?
 - (c) Try fitting a VAR model to the data. Which model seems most appropriate?
 - (d) Consider the coefficients for the VAR(5) model. Is it reasonable to take $\Phi_4 = 0$? Is there evidence that the current return of IBM stock is influenced by past behaviour of the market index? Does the current return of IBM stock influence future behaviour of the market index?
 - (e) Construct a VMA(5) model for the IBM, S&P bivariate series. Does the model fit well? Do the residuals correspond to $WN(0, \Sigma)$? How does it compare with the VAR(5) model?