



Econometrics II, fourth problem set.

1. **Time series.** For this problem, if you use Matlab, files in the ML sub-directory of the Matlab folder on the web page will be very useful. Gretl is also easy to use, and this file will help if you want to use Julia. The The sp500.csv data set has 1000 observations of daily closing prices of the S&P 500 index, plus two other variables. Using the sp500.csv data,
 - (a) Compute percentage returns as 100 times the log difference of closing price. Discuss what stylized facts you observe, using plots, statistics, and any other tool you find useful.
 - (b) Estimate ARCH(1) and ARCH(4) models for percentage returns.
 - (c) Estimate a GARCH(1,1) model.
 - (d) Compare the models, looking at likelihood values. Which of the three models do you prefer? But do the models have the same number of parameters? Find out what is the "consistent Akaike information criterion" or the "Bayes information criterion" and what they are used for. Compute one or the other, or both, and discuss what they tell you about selecting between the three models.

2. **Time series.** Write a "Matlab" script that generates two independent random walks, $x_t = x_{t-1} + u_t$ and $y_t = y_{t-1} + u_t$, where the initial conditions are $x_0 = 0$ and $y_0 = 0$, and the two errors are both iid $N(0,1)$. Use a sample size of 1000: $t = 1, 2, \dots, 1000$.
 - (a) regress y upon x and a constant.
 - (b) discuss your findings, especially the slope coefficient, the t statistic of the slope, and R^2 . Are the findings sensible, given that we know that x has nothing to do with y ?
 - (c) compute the variance of y_t and x_t conditional on the initial conditions $y_0 = 0$ and $x_0 = 0$. Does the variance depend on t ?
 - (d) which of the assumptions of the classical linear regression model are not satisfied by this data generating process?
 - (e) present estimation results using transformation(s) of y and/or x so that the regression using the transformed variables confirms that there is no relationship between the variables. Explain why the transformation(s) you use are successful in eliminating the problem of a spurious relationship.

3. **Panel data.** Stock and Watson “Introduction to Econometrics”, 3rd Edition, discuss panel data in Chapter 10. The book is available from the UAB library as an e-text. They use the data set `fatality.xlsx`, which is explained in `fatality.docx`. Using this data, and the software of your choice (hint: Gretl is easy)

- (a) replicate the results in Eqn. 10.2 and Figure 10.1.
- (b) replicate the results in Eqn 10.8 and Figure 10.2.
- (c) replicate the fixed effects panel data results in column 2 of Table 10.1