

## Problem Set 10

Due Wednesday April 2, 4pm

### Data Exercises

- (1) Take the quarterly investment growth series *pdi* from the file “realgdpgrowth.xlsx”. Select an autoregressive model using the AIC criterion.
- (2) Take the s&p index “*adj close*” from the file “s&p.csv”.
  - (a) Transform into returns:  $r_t = 100 (sp_t - sp_{t-1}) / sp_{t-1}$ . Plot returns.
  - (b) Test the hypothesis of no serial correlation within this model by testing that the two autoregressive coefficients are jointly zero. Perform the test both using the classical Wald test and the heteroscedasticity consistent Wald test (for the former, you can obtain the coefficient covariance matrix by *mdl.CoefficientCovariance*, where *mdl* is your linear model from *fitlm*). Is there a difference in the statistical “finding”? Which of the two tests is appropriate?
- (3) In the problem set 9 you estimated an AR(4) for the growth rate of U.S. exports. Re-estimate this regression, this time computing both classical and robust standard errors. Is there a difference between the two standard errors?

### Theoretical Questions

- (4) Director Goldwater asserts that the GDP of Genovia follows an AR(1) process. Agent Underwood believes an informant, who told him that it is an AR(4) process. Goldwater says: “I believe it is an AR(1) process until you prove otherwise.” What evidence should Underwood provide to convince Goldwater?
- (5) Data analysts Sherlock and Mycroft have a disagreement whether an AR(2) model (Sherlock) or an AR(3) model (Mycroft) does a better job of forecasting background telephone noise. What practical method can be used to settle the dispute?
- (6) The AIC and BIC are a function of the number of estimated parameters. What is the relevant number of estimated parameters in an AR(1) model? AR(2)? An AR(k) model?

- (7) When you have  $N$  total number of observations on a series  $y_t$ , how many effective number of observations  $T$  are used when estimating an AR(1) model? AR(2)? An AR(k) model?
- (8) Autoregressions are estimated for U.S. unemployment rate among women, age 20+. The sum of squared residuals for some models are given in the following table. The sample size (common across models) is  $T = 747$ . Find the best forecasting model for women's unemployment rate based on the AIC.

	SSR
AR(0)	1191
AR(8)	41.58
AR(10)	41.46
AR(12)	41.23
AR(14)	40.51
AR(16)	39.97
AR(18)	39.43
AR(20)	39.23