ECON 124: Problem Set #3

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Dr. Deniz Baglan

Alejandro Ouslan

Problem 1

The file entitle **MONEYDEM.XLS** contains quarerly values of seasonally adjusted U.S.3-month (TB3mo) and 1-year (TB1yr) treasury bill rates. Each series is measured over the period 1959:Q3 to 2001:Q1.

(a) Plot the time series of each series seperately. Does earch series appear to have a constant mean and variance over time?

(b) Plot each time series on the same figure. What can you say about the relationship between the two series?

(c) Use OLS to estimatethe relatiohnship between long-jterm and short-term interes rates as :

$$TB1yr_t = \alpha + \beta TB3mo_t + \epsilon_t$$

(d) What does the estimate of β tell you about the relationship between long-run and short-run interes rates?

(e) Test the null that $\beta = 1$. Is this result in accortdance with macroeconomic theory?

(f) Plot the residuals from the regression in part (c) vs. TB3mo. Do you observe any pattern?

(g) Use the White Test to test for the presence of heteroskedasticity.

(h) Estimate the mmodel again, but calculate the robust (White) standard errors.

(i) What happens to the coefficients of the model in part (h) relative to part (c)? What happens to the standart errors of the model in part (h) relative to part (c)? Why?

(j) Create a dummy variable that is equal to 1 when TB3mo is in excess of 10.00 and zero otherwise. Include this variable in the regression model as

$$TB1yr_t = \alpha + \beta TB3mo_t + \delta D_t + epsilon_t$$

and run OLS

(k) Test the null that the dummy variable is relevant in part (j). What happens to the fit of the model in part (j) relative to part (c)?

(l) What happens to th efit of the model in part (j) relative to part (c)?

Problem 2

The file entiled SIM_2.XLS contains simulated data sets. The series Y1, contains (T=100) values of a simulated AR(1) process. Use this series to perfem the following task.

(a) Plot the sequence against time. Does the series appear to be stationary?

(b) Plot the SCF and PACF.

(c) Estimate the AR(1), AR(2), ARMA(1,1), ARMA(1,4), and ARMA(2,1) models with intercepts.

(d) Estimate the series as both and AR(2) and ARMA (1,1) process without an intercept.

(e) Use $\bar{R}^2$, AIC and SC to choose the best single model over parts (c) and (d).

(f) Are you surprised by the result from part (e)? Why or why not?

(g) Using your idel model, plot the ACF and PACF of the residuals. Do they appear to be white noise?

Problem 3

The file QUARTERLY.XLS contains the quarterly values of the CPI that have not been seasonally adjusted (CPINSA). The series is over the period 1960:Q1 to 2008:Q1.

(a) Plot the CPINSA sequence against time. Does the series appear to be stationary?

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(b) Plot the ACF and PACF of CPINSA.

(c) Create the growth rate series $log(CPINSA_t/CPINSA_{t-1})$ and plot this series against time. Does the series appear to be stationary?

(d) Plot the ACF and PACF of $log(CPINSA_t/CPINSA_{t-1})$

(e) Create the growth rate series $log(CPINSA_t/CPINSA_{t-4})$ and plot this series against time. Does the series appear to be stationary?

(f) Plot the ACF and PACF of $log(CPINSA_t/CPINSA_{t-4})$

(g) Use the ACF and PACF from part (f) and estimate a tentative model. Try several other alternative models.

(h) Use $\bar{R}^2$, AIC and SC to choose the best model from part (g).

(i) Instead of seasonally differing the series, regress $log(CPINSA_t/CPINSA_{t-1})$ on (three) dummy variables to controll for seasonality.

(j) Plot the residuals in part (i) versus time. Does this series appear to be stationary?

(k) Plot the ACF and PACF for the residuals in part (i). What do you conclude here?

Problem 4

The file QUARTERLY.XLS contains U.S. interest rate over the period 1960:Q1 to 2008:Q1. Our goal here is to estimate a quarerly model of spread between a long-term and a short-term interest rate. Specifficaly, the interest rate spread (s) can be formed as the difference between the interest rate on a 10-year U.S. goverment bonds (r10) and the rate on a three-month treasury bills (Tbill) as

$$s_t = r10_t - Tbill_t$$

(a) Plot s_t against time. Does the series appear to be stationary?

(b) Plot the ACF and PACF of the time series. What do you conclude?

(c) Estimate an AR(2) model for s_t.

(d) Look at the ACF and PACF of the residuals from the regression in part (c). What do the Ljung-Box Q-statistics say about autocorrelation in the residuals?

(e) Estimate an AR(7) model for s_t.

(f) Look at the ACF and PACF of the residuals from the regression in part (e). What do the Ljung-Box Q-statistics say anout autocorrelation in the residuals?

(g) Which model appears to perform better in terms of goodness-of-fit measures and diagnostic checks?

(h) Estimate both the AR(2) and AR(7) models over the period 1960:Q1 to 2005:Q3. Obtain the one-step-ahead forecast and the one-step-ahead forcast error

$$\hat{e}_{t+1} = y_{t_1} - \hat{y}_{t_1|t}$$

for 2005:Q4($\hat{y}_{t+1|t}$) and compare that the true value of s_t in 2005:Q4(y_{t+1}). Which model has the smaller forecast error? Hint: this may be easier to compute in Excel (after etimation).

(i) Estimate a ten-step-ahead forcast for each model as in part (h). Which model has the smallest mean square forecast error

$$\begin{aligned} MSE &= \frac{1}{10}\sum_{i=1}^{10} \hat{e}^2_{t+1} \\ &= \frac{1}{10}\sum_{i=1}^{10} (y_{t+1} - \hat{y}_{t+i|t})^2 \end{aligned}$$

Which model performs better? Is this surprising?