Econometrics IV: Time Series Econometrics

Take Home Examination

Answer ONE Question: Any reference material allowed.

Time Allowed: Six weeks

Due Date & Time: Friday 26 January 2007.

Electronic Filing: Submit your papers by email to peter.phillips@yale.edu
Question A (Unit Root Model Selection)

Part 1: In the simple autoregression

\[ X_t = \theta X_{t-1} + u_t \]  \hspace{1cm} (1)
\[ u_t \equiv iid \ N(0, \sigma^2), \quad X_0 = 0, \] \hspace{1cm} (2)

it is proposed to test for the presence of a unit autoregressive root (\( \theta = 1 \)) against stationary alternatives (\( |\theta| < 1 \)) by using model selection methods. The following information criteria are considered: PIC, BIC, HQ (Hannan Quinn), and AIC.

1. Which of the criteria (PIC, BIC, HQ and AIC) provide consistent model selection choices as \( n \to \infty \).

2. What minimal penalty is needed to ensure consistency in such information criteria?

3. Suppose an investigator uses the above model and criteria to assess evidence for the presence of a unit root in \( X_t \) when the true generating mechanism for \( X_t \) has innovations with time varying volatility of the form \( u_t = g\left(\frac{1}{n}\right) \varepsilon_t \), with \( \varepsilon_t \equiv iid \ N(0, \sigma^2) \) and where \( g(r) \) is a deterministic continuously differentiable function for \( r \in [0,1] \). How are your conclusions in parts 1 and 2 affected by the presence of this misspecification?

4. Perform a simulation experiment to show the performance of the criteria in finite samples. Discuss your findings.

Question B (Your Own Empirical Project)

Choose your own empirical project. Carry out an empirical application of time series or panel econometric methods. Write up your project as a scientific paper, paying attention to the quality of your presentation, including graphics of the data and results as necessary. Be sure to provide a full discussion of the methods being used and indicate limitations of the approach you are using wherever you think it is appropriate.