

## Problem Set 1

Due Date: 2/25/2010

Econ 608

1. Consider the model  $y_t = \mu + \beta t + \alpha y_{t-1} + \varepsilon_t$  where  $\varepsilon_t$  is iid with mean zero, variance  $\sigma^2$  and  $2 + \delta$  finite moments for some  $\delta > 0$ .

(a) Derive the limiting distribution of the t-statistic testing the hypothesis that  $\alpha = 1$ . Note that, unlike in class, the autoregression includes an intercept and a time trend.

(b) By replacing the Brownian motion with discrete approximations, simulate the lower 1, 5 and 10<sup>th</sup> percentiles of the distribution you derive in (a).

2. Suppose that  $\{\varepsilon_t\}_{t=1}^T$  is iid  $N(0,1)$ . Let  $S_T(r) = T^{-1/2} \sum_{s=1}^{\lfloor Tr \rfloor} (\varepsilon_t - \bar{\varepsilon})$ . Find the limiting distribution of  $S_T(r)$ .

3. (a) An updated version of the Nelson and Plosser dataset is on the course website. Do an ADF test for a unit root (including an intercept and trend in the regression) for each of these series. In all cases, select the number of lags from 0 to 8 by the BIC.

(b) Use the method of Stock (1991) to form a 95 percent confidence interval for the largest autoregressive root of each of the series in (a).

4. Do a Monte-Carlo simulation in which time series of length 100 are generated from the following data generating process

$$y_t = \alpha y_{t-1} + u_t$$

$$x_t = \alpha x_{t-1} + v_t$$

where  $u_t$  and  $v_t$  are mutually independent standard normal iid time series. In a regression of  $y_t$  on  $x_t$ , including an intercept, simulate the probability of rejecting the hypothesis that the slope coefficient is zero, if  $\alpha = 0.9, 0.95, 0.99, 1$  when the nominal size of the test is 5 percent.

5. Download the following series from the economic database at the Saint Louis Fed

<http://research.stlouisfed.org/fred2/>

Quarterly real gross domestic product log differences (billions of chained 2000 dollars, seasonally adjusted).

Monthly nonfarm payrolls log differences (seasonally adjusted)

Monthly real personal consumption expenditures log differences (seasonally adjusted)

Monthly real personal disposable income log differences (seasonally adjusted)

Use Chow-Lin interpolation to back out the implied log differences in monthly real GDP.