Public Policy 42000
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Problem Set 3

due October 24

1. Time series

a. Consider the process

$$
\begin{aligned}
&x_0 = 0 \\
&x_t = x_{t-1} + \varepsilon_t \;\; t = 1\ldots \\
&\varepsilon_t \text{ iid } \left(0, \sigma^2\right)
\end{aligned}
$$

Is the process stationary? Is the process exchangeable? Suppose you compare x_t and x_{t+1}. How does their behavior compare as $t \to \infty$?

b. Answer the same questions are 1.a, but replace the time series with

$$
\begin{aligned}
&x_0 = 0 \\
&x_t = .5x_{t-1} + \varepsilon_t \;\; t = 1\ldots \\
&\varepsilon_t \text{ iid } \left(0, \sigma^2\right)
\end{aligned}
$$

Interpret differences in your answers.

2. Policy choice and evidence uncertainty

Suppose you are asked whether you support a 1% increase in tariffs. You have as statistical evidence two studies. Study 1 concludes the expected effect of an increase in tariff is that economic growth will increase by .10 with a variance of .03. Study 2 concludes Study 1 concludes the expected effect of an increase in tariff is that economic growth will decrease by .10 with a variance of .03.

Formulate your decision problem and indicate what additional data-based information you would need to come to a conclusion. Assume you know your loss function!

3. Identification and regressor dependence

Suppose that observable variables x_i, y_i and z_i are related by the linear model.

$$y_i = \beta_1 x_i + \beta_2 z_i + \varepsilon_i$$
$$\operatorname{cov}(x,\varepsilon) = \operatorname{cov}(y,\varepsilon) = 0$$
$$\varepsilon_i \text{ iid } \left(0,\sigma^2\right)$$

a. Suppose you are told that $x_i = g(z_i)$ and are given the function $g(\ )$. Are the parameters β_1 and β_2 identified? Explain.

b. Suppose that $g(\ )$ is also unknown. Assume it is invertible.

4. Measurement error

Consider the linear model

$$y_i = \beta x_i + \varepsilon_i$$

Suppose y_i is measured with error, i.e.

$$y^* = y + \eta$$
$$\text{cov}(x,\eta) = \text{cov}(\eta,\varepsilon) = 0$$

Determine the relationship between β and the regression coefficient π in

$$y_i^* = \pi x_i + \xi_i$$

and interpret.