

Midterm 1
Financial Econometrics
University of Notre Dame
Fall 2018
Professor Mark

Write clearly, legibly, and efficiently in **black or dark blue ink**. Think before writing. Don't leave any question blank. Think before writing. Each question worth **10 points**.

1. What are the properties of a stationary time series?
2. Why is the concept of stationarity important in econometrics?
3. How would you use the ADF test to test the hypothesis that a time series $\{y_t\}_{t=1}^T$ has a unit root (i.e., is nonstationary)?

4. Let ϵ_t be i.i.d. with mean 0 and variance σ_ϵ^2 , and $|\rho_1 + \rho_2| < 1$ in the AR(2) model ,

$$y_t = \rho_1 y_{t-1} + \rho_2 y_{t-2} + \epsilon_t$$

- (a) What is the optimal (best) forecast of y_{t+1} conditional on information known at t ?
- (b) What is the optimal (best) forecast of y_{t+2} conditional on information known at t ?
- (c) Assume $y_0 = y_{-1} = 0$. What is the impulse response for y_1, y_2 , and y_3 for a one-time shock $\epsilon_1 = 1$?

5. Suppose you are trying to choose between an AR(1) model and an MA(1) model. How can you use AIC, BIC, and HQIC to help?

6. Let

$$x_t = \rho x_{t-1} + u_t$$

where $u_t \stackrel{iid}{\sim} (0, \sigma_u^2)$, and $0 < \rho < 1$. Assume the truth is,

$$r_{t+1} = \beta x_t + \epsilon_{t+1}$$

where $\epsilon_t \stackrel{iid}{\sim} (0, \sigma_\epsilon^2)$, where r_t is the one-period return on some asset. You ask if x_t helps predict the 2-period return, $r_{t+1} + r_{t+2}$ by running the regression

$$r_{t+1} + r_{t+2} = \gamma x_t + v_{t+2}$$

- (a) Show that the population slope γ is bigger than the population slope β .

- (b) Express the regression error v_{t+2} in terms of $\epsilon_{t+1}, \epsilon_{t+2}$ and u_{t+1} , and show that v_{t+2} is correlated with v_{t+1} .

7. Let p_t be the log dividend-adjusted price of a stock, where

$$p_t = p_{t-1} + \epsilon_t$$

where $\epsilon_t \stackrel{iid}{\sim} (0, \sigma_\epsilon^2)$. What is the optimal (best) predictor of p_{t+20} , conditional on information available at t ?