SPRING 2023

Econometrics II Practice Problems

Multiple Choice Question Examples

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1. Based on a regression model that contains an intercept and a single explanatory variable, we computed the following where SSR is the sum of squared residuals:

$$\boldsymbol{X}^\top \boldsymbol{X} = \begin{bmatrix} 50 & 0 \\ 0 & 100 \end{bmatrix}, \quad (\boldsymbol{X}^\top \boldsymbol{X})^{-1} = \begin{bmatrix} 0.02 & 0 \\ 0 & 0.01 \end{bmatrix}, \quad \boldsymbol{X}^\top \boldsymbol{y} = \begin{bmatrix} 100 \\ 400 \end{bmatrix}, \quad SSR = 144$$

where $\boldsymbol{\theta} = [\theta_0, \theta_1]^\top$ is the vector of unknown population parameters, and $\hat{\boldsymbol{\theta}} = [\hat{\theta}_0, \hat{\theta}_1]^\top$ is the vector of OLS estimators. Note: $\hat{\boldsymbol{\theta}} = (\mathbf{X}^\top \mathbf{X})^{-1} \mathbf{X}^\top \mathbf{y}$

Which one of the following contains the elements of the vector $\hat{\boldsymbol{\theta}}$?

A. 2 and 4

B. 2 and 6

C. 4 and 6

D. 2 and 2

E. 4 and 4

2. Based on a regression model that contains an intercept and a single explanatory variable, we computed the following where SSR is the sum of squared residuals:

$$\boldsymbol{X}^\top \boldsymbol{X} = \begin{bmatrix} 50 & 0 \\ 0 & 100 \end{bmatrix}, \quad (\boldsymbol{X}^\top \boldsymbol{X})^{-1} = \begin{bmatrix} 0.02 & 0 \\ 0 & 0.01 \end{bmatrix}, \quad \boldsymbol{X}^\top \boldsymbol{y} = \begin{bmatrix} 100 \\ 400 \end{bmatrix}, \quad SSR = 144$$

where $\boldsymbol{\theta} = [\theta_0, \theta_1]^\top$ is the vector of unknown population parameters, and $\hat{\boldsymbol{\theta}} = [\hat{\theta}_0, \hat{\theta}_1]^\top$ is the vector of OLS estimators. Note: $\hat{\boldsymbol{\theta}} = (\mathbf{X}^\top \mathbf{X})^{-1} \mathbf{X}^\top \mathbf{y}$

What is the sample average of the dependent variable?

A. 8

B. 0.5

C. 0.25

D. 4

E. 2

3. Consider the following estimation results from a finite distributed lag model:

$$\widehat{y_t} = 4.5 + 1.2x_t + 0.8x_{t-1} - 1.2\ x_{t-2} + 2.2x_{t-3} + 1.5z_t$$

What is the long run propensity (LRP) ?

A. 1.2

B. -1.2

C. 0.8

D. 4.5

E. 3.0

4. Let $e_t \sim iidWN(0, \sigma^2)$. Consider the following stochastic processes:

I. $y_t = 1 + e_{t-1} + e_t$

II. $x_t = 0.5 + x_{t-1} + e_t$

III. $w_t = 1 + 0.5w_{t-1} + e_t$

IV. $z_t = 1 + z_{t-1} + e_t$

Which ones are integrated of order 1, I(1)?

A. I and II

B. II and III

C. II and IV

D. I and III

E. I and IV

5. Let $\epsilon_t \sim iidWN(0, \sigma^2)$. The stochastic process x_t is defined as

$$x_t = 10 + x_{t-1} + \epsilon_t$$

where the initial value is $x_0 = 0$. Consider the following statements regarding its properties:

I. Unconditional expectation is $E(x_t) = 0$

II. Unconditional expectation is $E(x_t) = 10t$

III. Variance is $Var(x_t) = \sigma^2$

IV. Variance is $Var(x_t) = \sigma^2 t$

Which one(s) of these are correct?

A. I and III

B. II and III

C. II and IV

D. I and IV

E. IV

6. Let $\{\epsilon_t : t = 0, 1, 2, \ldots\}$ be a white noise process with mean 0 and variance 4. Consider the following stochastic process.

$$x_t = 1 + \epsilon_t - 0.4\epsilon_{t-1}, \quad t = 1, 2, \ldots$$

What is $Var(x_t)$?

A. 0

B. 0.4

C. 4

D. 4.64

E. 0.64

7. **Which of the following is not an assumption in time series regression?**

A. Linearity in parameters

B. No perfect multicollinearity

C. Zero conditional mean (strict exogeneity)

D. Error terms are uncorrelated (no serial correlation)

E. Random sampling

8. Using annual observations on time series x_t, we estimated the following model:

$$\widehat{\log(x_t)} = 0.2 + 0.08\ t,$$

where $e_t \sim iidWN$ and *log* is natural logarithm and t is the time index.

What is the annual average growth rate of x_t?

A. 8 percent.
B. 0.08 percent.
C. 80 percent.
D. 0.2 percent.
E. 20 percent.