Econometrics

Final exam

15.05.2020

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Part 1: Multiple choice questions (10 points)

Circle the correct answer clearly.

1. Which of the following is true of R^2?

a. R^2 is also called the standard error of the regression.

b. A low R^2 indicates that the Ordinary Least Squares line fits the data well.

c. R^2 usually decreases with an increase in the number of independent variables in a regression.

d. R^2 shows what percentage of the total variation in the dependent variable, Y, is explained by the explanatory variables.

2. Consider the equation, Y = β1 + β2X2 + u. A null hypothesis, H0: β2 = 0 states that:

a. X2 has no effect on the expected value of β2.

b. X2 has no effect on the expected value of Y.

c. β2 has no effect on the expected value of Y.

d. Y has no effect on the expected value of X2.

3. Consider the following simple regression model: y = β0 + β1x1 + u. Suppose z is an instrument for x. Which of the following conditions denotes instrument exogeneity?

a. Cov(z,u) > 0

b. Cov(z,x) > 0

c. Cov(z,u) = 0

d. Cov(z,x) = 0

4. The model $y_t = e_t + \beta_1 * e_{t-1} + \beta_2 * e_{t-2}$, *t=1,2,…*, where e_t is an i.i.d. sequence with zero mean and variance σ_e^2, represents a(n):

a. static model.

b. moving average process of order one.

c. moving average process of order two.

d. autoregressive process of order two.

5. In the linear probability model, the interpretation of the slope coefficient is

a. the change in odds associated with a unit change in X, holding other regressors constant.

b. not all that meaningful since the dependent variable is either 0 or 1.

c. the change in probability that Y=1 associated with a unit change in X, holding others regressors constant.

d. the response in the dependent variable to a percentage change in the regressor.

6. Exclusion of a relevant variable from a multiple linear regression model leads to the problem of:

a. perfect collinearity.

b. dummy variable trap.

c. misspecification of the model.

d. homoscedasticity.

7. Which of the following assumptions is known as exclusion restrictions?

a. The assumption that an instrumental variable is excluded from a regression model and is correlated with the error term.

b. The assumption that an instrumental variable is excluded from a regression model and correlated with an exogenous explanatory variable.

c. The assumption that an exogenous explanatory variable is excluded from a regression model and is uncorrelated with the error term.

d. The assumption that an endogenous explanatory variable excluded from a regression model and is uncorrelated with the error term.

8. In the equation $c = \beta 0 + \beta 1i + u$, c denotes consumption and i denotes income. What is the residual for the 5th observation if $c5=\$500$ and $\hat{c}5=\$475$?

a. $975

b. $300

c. $25

d. $50

9. Which of the following tools is used to test multiple linear restrictions?

a. t test

b. z test

c. F test

d. Unit root test

10. In the simple linear regression model, the regression slope

a. indicates by how many percent Y increases, given a one percent increase in X.

b. when multiplied with the explanatory variable will give you the predicted Y.

c. indicates by how many units Y increases, given a one unit increase in X.

d. represents the elasticity of Y on X.

Part 2: True/false questions (20 points)

Indicate whether the statement below is true or false, no points granted without explanations.

1. A data set is called an unbalanced panel if it has missing years for at least some cross-sectional units in the sample. (True)
2. 95% confidence intervals are larger than 99% confidence intervals. (False)
3. Time-series analysis generates forecasts by identifying causal relationship between variables. (False)
4. If the t statistic for the presence of a unit root in a variable is -7.22 and the 5% critical value is -2.86, there is strong evidence against a unit root in the variable. (True)
5. If the heteroskedasticity is present in the model, then estimates are no longer unbiased. (False)

Part 3: Conceptual Questions (30 points)

1. Describe the properties that valid instrumental variable should satisfy and the estimation procedure, step by step.

2. Explain the difference(s) and similarities between the linear probability model and probit/logit model, write down econometric model for LPM, probit and logit separately, and discuss how they differ.

3. Define the strongly persistent (highly dependent) time series process and state one example of such process.

See Wooldridge's Corresponding Chapters.

Part 4: Solve the problem (40 points)

Show your work, no points granted without explanations.

To analyze the effect of a minimum wage increase, a famous study used a quasi-experiment for two adjacent states: New Jersey and (Eastern) Pennsylvania. A differences-in-differences estimate was calculated by comparing average employment changes per restaurant between to treatment group (New Jersey) and the control group (Pennsylvania). In addition, the authors provide data on the employment changes between "low wage" restaurants and "high wage" restaurants in New Jersey only. A restaurant was classified as "low-wage," if the starting wage in the first wave of surveys was at the then prevailing minimum wage of $4.25. A "high wage" restaurant was a place with a starting wage close to or above the $5.25 minimum wage after the increase.

a) Explain why we can apply the diff-in-diff estimator to the employment changes of the "high wage" and "low-wage" restaurants in this context? Which is the treatment group and which is the control group?

Answer: In the above example, the increase in wages ("treatment") occurs not because of changes in the demand or supply of labor, but because of an external event, namely the raising of the minimum wage in New Jersey. The effect of this policy change can be estimated by the differences-in-differences method. The treatment group is the "low wage" restaurants since the wages there are actually changed. The "high wage" restaurants are the control group.

b) The following information is given

	Low wage	*High wage*
FTE Employment *before*	19.56	22.25
FTE Employment *after*	20.88	20.21

where *FTE* is "full-time equivalent" and the numbers are average employment per restaurant.

Calculate the change in the treatment group, the change in the control group and finally diff-in-diff estimate of the effect of the policy change, $\beta^{diff-in-diff}$. Since the minimum wages represent a price floor, did you expect the effect to be positive or negative?

Answer: Change in treatment group is +1.32, change in the control group is -2.04. Therefore, $\beta^{diff-in-diff} = 1.32 - (-2.04) = 3.36$. The prior expectation would be negative as increasing the minimum wage reduces employment.

c) The standard error for $\beta^{diff-in-diff}$ is 1.48. Test whether or not this is statistically significant.

Answer: The t-statistic is 2.27, the coefficient is statistically significant at the 5% level.

d) Write down a regression, which will estimate $\beta^{diff-in-diff}$ as one of its coefficients.

Answer: $Y_{it} = \alpha_0 + \beta_0 * AFTER_t + \alpha_1 * LW_i + \beta_1 * AFTER_t * LW_i + u_{it}$

Where LW is a dummy variable for low wage restaurants and AFTER is a dummy variable for the post-treatment period.

e) Based on the table above, provide values of all the coefficients.

Answer: $Y_{it} = 22.25 - 2.04 * AFTER_t - 2.69 * LW_i + 3.36 * AFTER_t * LW_i + u_{it}$