Эконометрика — МИЭФ, 2024 midterm 2

МИЭФ · Эконометрика · 2024 · midterm 2

QUESTION 1

Multiple-choice test

Instrumental variables in econometrics can be characterized as:

1. Transformed original independent variables in the model.
2. Variables used instead of unobserved variables.
3. Endogenous variables that can be used to identify relationships in the presence of exogeneity.
4. Exogenous variables that can be used to identify relationships in the presence of multicollinearity.
5. Exogenous variables that can be used to identify relationships in the presence of endogeneity.

QUESTION 2

Multiple-choice test

A student uses a Linear Probability Model to investigate how the grade in econometrics, X, affects the probability of admission to a master's programme, where $Y = 1$ if the student was admitted and $Y = 0$ otherwise:

$$P(Y_i = 1 \mid \beta) = \beta_1 + \beta_2 X_i + u_i. \tag{1}$$

The student's friend makes an error in the dataset and marks admitted students with 0 instead of 1. Which statement is wrong when comparing estimates of model (1) using the correct and incorrect data?

1. The slope estimates have the same absolute value but opposite signs.
2. The determination coefficients are the same.
3. The Durbin-Watson statistics are symmetric around 2.
4. The standard errors of both coefficient estimates are the same.
5. The standard errors of the regressions are the same.

QUESTION 3

Multiple-choice test

A student uses a Logit model to estimate the probability of passing econometrics based on a midterm grade. The largest marginal effect is attained at a grade of 45 and equals 0.0325. The student's grade is 55 and the corresponding marginal effect is 0.0219. A friend scored 35. What is the friend's marginal effect?

1. 0.0325.
2. 0.0272.
3. 0.0219.
4. 0.0113.
5. There is not enough information to calculate it.

QUESTION 4

Multiple-choice test

Refer to the model

$$Y_t = \alpha_0 + \beta_0 S_t + \beta_1 S_{t-1} + \beta_2 S_{t-2} + u_t.$$

The expression

$$\beta_0 + \beta_1 + \beta_2$$

represents:

1. The short-run change in Y caused by a temporary increase in S.
2. The short-run change in Y caused by a permanent increase in S.
3. The long-run change in Y caused by a permanent increase in S.
4. The long-run change in Y caused by a temporary increase in S.
5. None of the above.

QUESTION 5

Multiple-choice test

To seasonally adjust a series in a model, one should:

1. Use dummies for all seasons.
2. Add a time trend to the model.
3. Transform the model from levels to first differences.
4. Apply an autoregressive transformation.
5. Take logarithms of the variables.

QUESTION 6

Multiple-choice test

Indicate the correct statement:

1. If X_t is a random walk with drift, the first-difference series

$$\Delta X_t = X_t - X_{t-1} = \beta_1 + \varepsilon_t,$$

where ε_t is white noise, is non-stationary.

2. The time-trend process

$$X_t = \beta_1 + \beta_2 t + \varepsilon_t$$

is stationary.

3. The MA(1) process

$$X_t = \varepsilon_t + \alpha_2 \varepsilon_{t-1}$$

is stationary.

4. The AR(1) process

$$X_t = \beta_2 X_{t-1} + \varepsilon_t, \qquad \beta_2 < 1,$$

is non-stationary.

5. A random walk without drift becomes stationary after taking logarithms.

QUESTION 7

Multiple-choice test

A student investigates the linear relationship between the growth rate of net exports, $grne$, and the growth rate of GDP, $grgdp$, for a sample of countries in 2022:

$$grgdp_i = \alpha_1 + \beta_1 grne_i + u_i, \tag{1}$$

where

$$grgdp_i = \frac{GDP_i - GDP_{i,-1}}{GDP_{i,-1}}, \qquad grne_i = \frac{NEXP_i - NEXP_{i,-1}}{NEXP_{i,-1}}.$$

The student then uses growth indices,

$$gigdp_i = \frac{GDP_i}{GDP_{i,-1}}, \qquad gine_i = \frac{NEXP_i}{NEXP_{i,-1}},$$

and estimates

$$gigdp_i = \alpha_2 + \beta_2 gine_i + u_i. \tag{2}$$

Which statement about coefficients and statistics of models (1) and (2) is wrong?

1. The estimates of α_1 and α_2 are the same.
2. The estimates of β_1 and β_2 are the same.
3. The values of SST are the same.
4. The values of SSR are the same.
5. The values of R^2 are the same.

QUESTION 8

Multiple-choice test

The following model determines desired and actual savings:

$$S_t^* = \gamma I_t, \tag{1}$$

$$S_t - S_{t-1} = \lambda(S_t^* - S_{t-1}) + \mu(I_t - I_{t-1}) + u_t, \tag{2}$$

where S_t^* is desired savings, I_t is disposable income, and S_t is actual savings.

The model is:

1. Adaptive expectations model.
2. Rational expectations model.
3. Partial adjustment model.
4. Error correction model.
5. ADL(1,0) model.

QUESTION 9

Multiple-choice test

A student investigates the daily RUB/USD exchange rate in 2023 and estimates an AR(1) model:

$$E_t = 0.74 + 0.99E_{t-1}.$$

What can be said about Theil's U_2 coefficient for a forecast made with this equation?

1. $U_2 < 1$.
2. $U_2 = 1$.
3. $U_2 > 1$.
4. U_2 may be below, equal to, or above 1.
5. The measure is invalid here.

QUESTION 10

Multiple-choice test

What is the primary advantage of panel data over pure time-series or cross-sectional data?

1. Panel data eliminate autocorrelation and heteroscedasticity.
2. Panel data can better address omitted-variable bias by controlling for unobserved heterogeneity.
3. Panel data permit simpler estimation techniques.
4. Panel data ensure normally distributed errors that are uncorrelated with regressors.
5. Panel data can be analysed using ordinary simple linear regression without modification.

QUESTION 11

Multiple-choice test

You study academic performance across different schools over several years. The panel contains students' test scores, hours studied, and a school-specific variable indicating whether the school offers additional tutoring programmes.

How can school-specific fixed effects address potential bias, and what is their key advantage in this study?

1. They control for time-varying factors and allow accurate estimation of individual and school-level effects.
2. They control for unobservable, time-invariant characteristics of each school and reduce omitted-variable bias.
3. They permit more precise estimation of the overall effect of tutoring programmes on performance.
4. They are unnecessary because they create multicollinearity.
5. They apply only to unbalanced panels.

QUESTION 12

Multiple-choice test

Which of the following is a reason to use random effects instead of fixed effects?

1. Random effects provide unbiased and consistent estimators when disturbances are serially correlated.
2. Random effects provide unbiased and consistent estimators when disturbances are heteroscedastic.
3. Random effects eliminate serial correlation of the disturbance term.
4. Random effects preserve degrees of freedom and provide estimates for all model parameters.
5. Random effects account for unobserved heterogeneity, unlike fixed effects.

Part 2. Free-response questions — one session, 2 hours without a break.

Section A. Answer all questions from this section (original Questions 1-2).

QUESTION 13

Written Question 1 — 25 marks

(a)

- What is a stationary time series?
- Investigate the series

$$x_t = \alpha_0 + u_t + \mu u_{t-1}, \qquad t = 1, 2, \ldots, T, \tag{1}$$

for stationarity.

Assume that u_t is stationary, the initial state, such as x_0, is fixed,

$$E(u_t) = 0, \qquad \mathrm{Var}(u_t) = \sigma_u^2,$$

and

$$E(u_s u_t) = 0 \qquad \text{if } s \neq t.$$

(b)

Investigate the series

$$x_t = \alpha_0 + \alpha_1 x_{t-1} + \alpha_2 t + u_t, \qquad |\alpha_1| < 1, \qquad t = 1, 2, \ldots, T, \tag{2}$$

for stationarity, under the same assumptions about u_t and the initial state.

- What is detrending?
- Show that detrending series (2) produces a stationary time series.
- Does it follow that $x_t \in I(1)$?
- Show that the first differences Δx_t of series (2) are stationary.
- Is series (2) difference-stationary or trend-stationary? Explain.
- Explain in simple terms what a weakly dependent, or weakly persistent, time series is, in contrast to strong dependence or persistence.

- Give arguments that series (2), after detrending, is likely to be weakly dependent.
- What is the relationship between stationarity and weak dependence?

QUESTION 14

Written Question 2 — 25 marks

A company that promotes candidates and organises online elections asks you to build an econometric model using data from past elections. The dataset contains 110 observations:

- $VOTES$: number of votes cast for a candidate, in thousands;
- $ELECT$: binary variable equal to 1 if the candidate was elected;
- ADV: amount spent on candidate promotion, in thousands of US dollars;
- TV: number of candidate appearances at television events such as debates and speeches;
- ATT: personal attractiveness rating, from 1 to 10.

Candidate A is experienced and wealthy. Candidate A plans to spend $10,000 on advertising, make 55 television appearances, and has an attractiveness score of 7.

Candidate B is young and less experienced. Candidate B can spend $2,000 on advertising, make 25 television appearances, and has an attractiveness score of 10.

The following models are estimated. Standard errors or their counterparts are in parentheses. For Probit,

$$f(Z) = \frac{1}{\sqrt{2\pi}} e^{-Z^2/2}$$

is the standard normal density.

Statistic or variable	(1) OLS	(2) OLS	(3) Probit	(4) Probit
Dependent variable	$VOTES$	$ELECT$	$ELECT$	$ELECT$
Constant	-26.613	-0.688	-5.416	-1.911
Standard error	(17.35)	(0.1286)	(0.922)	(0.292)
ADV	0.0849	0.00047	0.00224	—
Standard error	(0.00692)	(0.00005)	(0.00034)	—

Statistic or variable	(1) OLS	(2) OLS	(3) Probit	(4) Probit
TV	3.367	0.0185	0.0826	0.070
Standard error	(0.277)	(0.0021)	(0.0127)	(0.010)
ATT	11.086	0.0589	0.268	—
Standard error	(2.438)	(0.0181)	(0.115)	—
R^2	0.665	0.522	—	—
McFadden R^2	—	—	0.509	0.235
RSS	434574.8	23.874	20.664	34.77
LR	—	—	141.06	65.09
Log-likelihood	-1052.168	-71.238	-68.058	-106.04

(a)

- What is the difference in the meaning of regressions (1) and (2)?
- What are their comparative advantages for evaluating the candidates' chances?
- Evaluate the candidates' chances using model (1), assuming a larger expected number of votes indicates a higher chance of success.
- Compare the result with model (2).
- Using model (3), evaluate each candidate's probability of election and briefly explain the calculation.

(b)

- Are ADV and ATT jointly significant in equation (3)?
- Which equation should be used for further analysis?
- Investigate the marginal effect of TV for both candidates and compare it with the maximum marginal effect in model (3).

- Based on the analysis, what recommendation should be given to each candidate to maximise the probability of election?

Section B. Answer only one question from this section (original Question 3 or Question 4).

QUESTION 15

Written Question 3 — 25 marks

The regression output gives the result of regressing $\log E_t$, the logarithm of consumer expenditure on electricity, on $\log Y_t$, the logarithm of disposable personal income, $\log P_t$, the logarithm of a relative electricity price index, and $\log E_{t-1}$, lagged one year.

Annual aggregate data for the United States cover 1980-2014. Potential non-stationarity problems may be ignored.

$$\log E_t = -0.0367 + 0.0753 \log Y_t - 0.0447 \log P_t + 0.9161 \log E_{t-1}, \qquad R^2 = 0.998,$$

with standard errors

$$(0.836) \qquad (0.135) \qquad (0.052) \qquad (0.100). \qquad (1)$$

(a) (15 marks)

- Show how this regression specification can be derived from a partial-adjustment model.
- Based on model (1), obtain estimates of all parameters of the partial-adjustment model.
- What are the properties of these estimators?
- Explain the short-run and long-run dynamics of the model.
- Give an economic interpretation and assess the statistical quality of the regression, paying attention to both short-run and long-run dynamics.

(b)

- A commentator notes that the t statistics for $\log Y_t$ and $\log P_t$ are low and argues that these variables should be dropped. Do you agree?
- Which test or tests could help determine whether dropping them is reasonable?
- Another commentator observes that the ADL(1,0) specification can also be derived from an adaptive-expectations model in which expected future prices replace actual prices. What might such an adaptive-expectations model look like? No derivation is required.

- Might adaptive expectations be a more suitable framework here?
- Is there a test for choosing between the two interpretations?

QUESTION 16

Written Question 4 — 25 marks

In a bond market, demand for bonds B_t in period t is negatively related to the expected interest rate i^e_{t+1} for period $t+1$:

$$B_t = \beta_1 + \beta_2 i^e_{t+1} + u_t, \tag{1}$$

where u_t is not autocorrelated.

Expected interest rates follow an adaptive-expectations process:

$$i^e_{t+1} - i^e_t = \lambda(i_t - i^e_t), \tag{2}$$

where i_t is the actual interest rate in period t.

A researcher estimates

$$B_t = \gamma_1 + \gamma_2 i_t + \gamma_3 B_{t-1} + v_t. \tag{3}$$

(a)

- Show how model (3) can be derived from demand equation (1) and adaptive-expectations equation (2), using any finite Koyck transformation.
- Explain how estimates of all parameters of the adaptive-expectations model can be recovered from equation (3).
- Describe the properties of estimates obtained if equation (3) is estimated by OLS.

(b)

- Show how to obtain model (3) from equations (1) and (2) using a Koyck distribution.
- Explain how to obtain consistent estimates using the Koyck-distribution model.
- What other advantages does this method have?
- A commentator notes that specification (3) can also be derived from a partial-adjustment model. Might partial adjustment be a more suitable framework here? No mathematical derivation is required.