



Strathmore Institute of Mathematical Sciences (SIMS)
Special Examination for the Degree of Bachelor of Business Science in
Financial Economics
BSE 4211: Panel Data Analysis

DATE: 1st April , 2026

Time: 2 Hours

Instructions

- This examination consists of FIVE questions.
- Answer ANY THREE Questions
- Show all workings and provide clear explanations.

Question 1

You are studying the effect of training expenditure on firm productivity using panel data. The following regression results are obtained using instrumental variables (2SLS):

$$Productivity = 1.8 + 0.7 \cdot Training + \epsilon$$

Additional information:

- First stage F-statistic = 18
 - Standard error of Training coefficient = 0.15
 - $R^2 = 0.45$
- (a) Explain why training expenditure may be endogenous in this model. (4 marks)
- (b) Explain how an instrument (e.g., government training grants) can solve this problem. (4 marks)
- (c) Interpret the coefficient on training and its standard error. (4 marks)
- (d) Assess whether the instrument is strong. What problems arise with weak instruments? (4 marks)
- (e) Briefly explain one advantage of using GMM instead of 2SLS. (4 marks)

Question 2

You estimate a panel model of firm profitability and obtain the following diagnostic test results:

- Cross-sectional dependence test: $p\text{-value} = 0.04$
 - Heteroskedasticity test: $p\text{-value} = 0.01$
 - Poolability test: $p\text{-value} = 0.20$
 - Serial correlation test: $p\text{-value} = 0.06$
- (a) What does cross-sectional dependence mean in this context? Why is it a problem? (4 marks)
- (b) Interpret the heteroskedasticity test result and explain its implications. (4 marks)
- (c) Based on the poolability test, should the data be pooled? Explain. (4 marks)
- (d) Interpret the serial correlation test result and explain how it affects inference. (4 marks)
- (e) Suggest one method to correct for these problems. (4 marks)

Question 3

A researcher is investigating the relationship between capital investment and labor productivity using panel data for a sample of firms observed over several years. A researcher estimates both Fixed Effects (FE) and Random Effects (RE) models. The results are reported below:

- FE coefficient on capital = 0.6 (SE = 0.15)
 - RE coefficient on capital = 0.7 (SE = 0.12)
 - Hausman test: $\chi^2 = 5.2$, $p\text{-value} = 0.02$
- (a) Which model should be preferred? Explain using the Hausman test. (5 marks)
- (b) Interpret the FE coefficient on capital. (5 marks)
- (c) Explain the concept of unobserved heterogeneity and how FE handles it. (5 marks)
- (d) Give one situation where RE would still be preferred. (5 marks)

Question 4

You estimate the following dynamic panel model using System GMM:

$$Growth_{it} = 0.3 + 0.4Growth_{i,t-1} + 0.25Investment_{it} + \epsilon_{it}$$

Additional results:

- SE (lagged growth) = 0.08
- SE (investment) = 0.07
- Sargan test p-value = 0.12

- (a) Why is a dynamic panel model appropriate in this case? (4 marks)
- (b) Interpret the coefficient on lagged growth. (4 marks)
- (c) Interpret the coefficient on investment. (4 marks)
- (d) What does the Sargan test tell us? Interpret the result. (4 marks)
- (e) Why is System GMM preferred over Difference GMM? (4 marks)

Question 5

You are analyzing panel data on inflation for several countries over time.

- (a) What is a panel unit root? Why is it important to test for it? (5 marks)
- (b) Briefly describe the Levin-Lin-Chu (LLC) test. State the null and alternative hypotheses. (5 marks)
- (c) Suppose the LLC test rejects the null hypothesis. What does this imply? (5 marks)
- (d) Explain what could happen if non-stationary data is used in regression. (5 marks)

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