



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

DATE: December 18, 2023

Time: 2 Hours

Instructions

- This examination consists of FIVE questions.
 - Answer Any Four Questions
1. (a) Panel data have several advantage over cross section or time series data. Describe any four advantages of panel data. **(6 Marks)**
(b) You have a sample of N individuals for T years. Suppose you estimate by OLS the annual income equation:
$$y_{it} = \alpha_0 + \alpha_1 ed_i + \alpha_2 age_{it} + \alpha_3 (ed_i \times age_{it}) + \gamma y_{it-1} + u_{it} \quad (1)$$
where ed_i represents the years of education of the i th individual, age_{it} represents the age of the individual i in period t and u_{it} represents all unobservables.
(a) Suppose you estimate γ as 0.82 with the standard error of 0.12. State a set of sufficient assumptions for the consistency of the OLS estimator in this context. **(3 Marks)**
(b) Describe an alternative estimation technique that you could use to evaluate the validity of some of your assumptions. Justify your choice and explain carefully the conditions under which your estimator is consistent. **(6 Marks)**
 2. (a) Panel data can capture within-group variation, betwee-group variation and total variation of a variable. Using an appropriate example illustrate these sources of variation in panel data. **(6 Marks)**
(b) Within Transformation and First Differencing are used as transformations in Fixed effects models of panel data. With the help of equations and well defined notations, distinguish the two methods and state the objective of using them in the first place. **(6 Marks)**

- (c) In the context of panel data estimators, briefly explain when the Hausman-Taylor estimator is appropriate **(3 Marks)**

3. Consider the following panel regression model

$$y_{it} = x_{it}\beta + u_{it} \quad (2)$$

where $u_{it} = \mu_i + \epsilon_{it}$ Briefly describe how you would conduct the following hypothesis tests. Provide the relevant equations (where necessary) for each test.

- (i) Pooled OLS versus random effects **(3 Marks)**
 - (ii) Fixed effects versus random effects **(4 Marks)**
 - (iii) Serial correlation **(4 Marks)**
 - (iv) Cross-sectional dependence **(4 Marks)**
4. (a) In the context of panel unit root processes, distinguish between homegenous and heterogeneous panels and state why this distinction is important. **(4 Marks)**
- (b) Briefly describe the steps involved in the following panel unit root tests;
- (i) Levin-Lin-Chu test **(4 Marks)**
 - (ii) Im, Pesaran and Shin (IPS) unit root test **(4 Marks)**
- (c) Briefly describe Pedroni's test for panel cointegration **(3 Marks)**
5. Consider the following dynamic panel model

$$y_{it} = \phi_0 + \phi_1 y_{i,t-j} + x'_{it}\beta + \mu_i + \epsilon_{it} \quad (3)$$

The dynamic panel regression model above is characterized by two sources of persistence over time:

- (i) Describe the the sources of persistence and state their effect if a researcher uses OLS to estimate model(3) **(4 Marks)**
- (iii) The dynamic model (3) cannot be estimated by the standard fixed effects or random effects due to nickel (1981) bias. Fortunately, there are models that can deal with this challenge. Particularly, Arrellano and Bond (1991) and Arrellano and Bover (1995) and Blundell and Bond (1998) introduce the difference GMM and system GMM as alternative approaches to estimating dynamic panel. Briefly discuss the development of these methods. Be careful to present the necessary equations. **(11 Marks)**

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