ECON20003 Quantitative Methods 2

Tutorial 12 (Week 6 - Thursday)

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Introduction

Zheng Fan

- Ph.D candidate in Economics at Unimelb
- know more about me: zhengfan.site

If you need help,

- Consultation & Ed discussion board (your first priority)
- Email Dr. Xuan Vu for all subject matters
- Consult Stop 1 for special consideration
- Email: fan.z@unimelb.edu.au (last resort!)

Before posting any questions, make sure you have reviewed the materials on Canvas and questions on Ed discussion board!

Tutorial Overview

In this tutorial we study

- Time series model

- Autocorrelation, and its detection

- Some final tips

Time series model

ARDL($\mathbf{p}, \mathbf{q}$) model:

$$Y_t = \alpha + \beta_1 Y_{t-1} + \ldots + \beta_p Y_{t-p} + \gamma_0 X_t + \gamma_1 X_{t-1} + \ldots + \gamma_q X_{t-q} + \varepsilon_t$$

Time series model

TSLR4: Conditional on the independent variables, the random errors in any two different time periods are **uncorrelated**.

BUT

- First-order serial correlation:

$$\varepsilon_t = \rho \varepsilon_{t-1} + u_t$$

- or even higher order

$$\varepsilon_t = \phi_1 \varepsilon_{t-1} + \phi_2 \varepsilon_{t-2} + \ldots + \phi_q \varepsilon_{t-q} + u_t$$

Test serial correlation

The DW d-test statistic is: only first order serial correlation in the residuals.

$$d = \frac{\sum_{t=2}^{n} \left(\varepsilon_t - \varepsilon_{t-1}\right)^2}{\sum_{t=1}^{n} \varepsilon_t^2} \rightarrow \quad d \approx 2\left(1 - r_{\varepsilon_t, \varepsilon_{t-1}}\right) \quad \rightarrow \quad 0 \le d \le 4$$

$$r = 1 \rightarrow d = 0 \text{ and } r = -1 \rightarrow d = 4$$

Test serial correlation

The Breusch-Godfrey LM (Lagrange multiplier) test can detect higher order serial correlation in

$$\varepsilon_t = \phi_1 \varepsilon_{t-1} + \phi_2 \varepsilon_{t-2} + \ldots + \phi_q \varepsilon_{t-q} + u_t$$

$$H_0 : \phi_1 = \phi_2 = \ldots = \phi_q = 0 \quad H_1 : \text{ not all } \phi_j = 0$$

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    - Prediction: individual vs mean, interval construction

Some Final Remarks

- Binary choice models

  - Linear probability model limitations

  - Interpretation of marginal effects in Logit and Probit

- Time series analysis

  - Autocorrelation: graphical tools, Durbin–Watson, Breusch–Godfrey

  - Stationarity and unit roots (test)

  - Consequences of nonstationarity and spurious regression

- Always ask:

  - Are the assumptions satisfied?

  - Is the model correctly specified?

  - Is the interpretation economically meaningful?

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After revising the material thoroughly, attempt the **practice exam** under timed conditions.

End of Tutorials

Thank you for your efforts throughout this short summer semester.

I wish you all the best in the exam and in your future studies.