University of Otago
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Department of Economics

ECON412: Macroeconometrics

Outline 2025

Objective: In ECON412 we examine aspects of time-series and nonstationary panel data econometrics that are widely used in the estimation and testing of macroeconomic relationships. Upon successful completion of ECON412, you should be able to:

- Demonstrate an understanding of contemporary econometric methods used in time-series and panel time-series data analysis in macroeconomic contexts
- Interpret and critically evaluate applied time-series and panel time-series econometric studies in the literature.
- Apply macroeconometric methods, using appropriate computer software, to relevant data in practice and interpret the results obtained.
- Explain the relevant estimation and testing methods and interpretation of results.

Prerequisites: The paper assumes knowledge of econometrics roughly equivalent to the material covered in ECON375 Econometrics, including familiarity with the basics of at least one of the main econometric or statistical software packages (e.g., Stata, EViews, OxMetrics, R).

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Lecture times: Monday 2-2.50pm & Tuesday 10-11.50am, Semester 1
Location: OBS608

Lecture recordings (either of the live sessions or pre-recorded) will be available if anyone is not able to attend due to illness or other reasonable constraints. Any changes to teaching arrangements or assessment details will be posted on Blackboard.

Workload: Note that ECON412 is a 20-point semester paper. Under the University's points conventions, this corresponds approximately to an average workload of 16 hours per week (including contact hours), or roughly 240 hours in total over a 15-week period (including the end-of-semester exam period).

Lecture notes: Copies of lecture overheads and assignments will be posted in advance on Blackboard (https://blackboard.otago.ac.nz/). For recordings, go to 'Lecture recordings 2025' (left-hand menu) or the 'Tools' page and then 'EchoVideo Recordings'. Clicking on either of these links will redirect you to the ECON412 recordings.

Assessment: ECON412 is 100% internally assessed, based on four assignments (each worth 25% of the overall mark), which can be submitted by email (in Word or pdf format).

Due dates: Assignment 1 18 March Assignment 2 15 April
Assignment 3 13 May Assignment 4 13 June*
*subject to confirmation

Academic Integrity

Academic integrity means being honest in your studying and assessments. It is the basis for ethical decision-making and behaviour in an academic context. You are expected to be aware of, and act in accordance with, the University's Academic Integrity Policy. Academic Misconduct, such as plagiarism or cheating, is a breach of Academic Integrity and is taken very seriously by the University. Types of misconduct include plagiarism, copying, unauthorised collaboration, submitting work written by someone else (including from a file sharing website, text generation software, or purchased work), taking unauthorised material into a test or exam, impersonation, and assisting someone else's misconduct. It is your responsibility to be aware of and use acceptable academic practices when completing your assessments.

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Artificial Intelligence tools: If you use AI tools, such as ChatGPT or Copilot, you must fully disclose their use in submitted internal assessment work, including full details of how and why you used them. (In Assignment 1, you will be asked to use ChatGPT and critique what it produces.) You should be wary of large language models (LLMs) in general; although developing rapidly, they are purely statistical models with no actual 'understanding'. While their output sounds authoritative, it can often be misleading, incorrect, or even totally fake. This is particularly dangerous when you do not have sufficient understanding of a topic to spot the errors.

Topics and Reading

The list below is relatively extensive. Don't be put off by this! You are **not** expected to read everything. The aim is to provide a range of material that you can choose from depending on which areas you need to reinforce or in which you have a particular interest (e.g., because you are using specific techniques in your dissertation). Some of the more advanced material may be of use beyond this course.

A taste of what 'cointegration' is about can be obtained from the material posted on the Nobel Prize website commemorating the award of the Nobel Prize in Economics in 2003 to Professor Clive Granger. This includes a video of Professor Granger's prize lecture at:

http://www.nobelprize.org/nobel_prizes/economic-sciences/laureates/2003/granger-lecture.html

General reading: (* denotes reading that is initially the most accessible).

Useful texts:

K. Patterson, *An Introduction to Applied Econometrics: A Time Series Approach*, Macmillan, 2000.

W. Enders, *Applied Econometric Time Series*, 4th Edition, John Wiley, 2015.*

D.F. Hendry and B. Nielsen, *Econometric Modeling: A Likelihood Approach*, Princeton University Press, 2007.*

J.L. Castle and D.F. Hendry, *Modelling Our Changing World*, Palgrave Macmillan, 2019.* downloadable at https://link.springer.com/book/10.1007%2F978-3-030-21432-6

K. Juselius, *The Cointegrated VAR Model: Methodology and Applications*, Oxford University Press, 2006.

M. Soderbom, F. Teal, M. Eberhardt, S. Quinn and A. Zeitlin, *Empirical Development Economics*, Routledge, 2015.*

B.H. Baltagi, *Econometric Analysis of Panel Data* (6th ed.), Springer, 2021.

More technically advanced treatments are available in:

A. Banerjee, J. Dolado, J.W. Galbraith, and D.F. Hendry, *Co-integration, Error Correction, and the Econometric Analysis of Non-Stationary Data*, Oxford University Press, 1993.

D. Hendry, *Dynamic Econometrics*, Oxford University Press, 1995.

D.F. Hendry and J.A. Doornik, *Empirical Model Discovery and Theory Evaluation: Automatic Selection Methods in Econometrics*, MIT Press, 2014.

D.F. Hendry, *Introductory Macro-econometrics: A New Approach*, Timberlake Consultants Ltd, 2015, downloadable at http://www.timberlake.co.uk/media/wysiwyg/intromacroeconometrics/DFHMacroEcts15.pdf

J.L. Castle and D.F. Hendry, *Climate Econometrics: An Overview*, Foundations and Trends in Econometrics, vol. 10, no. 3-4, pp.145-322, 2020, downloadable at http://dx.doi.org/10.1561/0800000037

R. Nymoen, *Dynamic Econometrics for Empirical Macroeconomic Modelling*, World Scientific, 2020.

M.H. Pesaran, *Time Series and Panel Data Econometrics*, Oxford University Press, 2015.

A. Spanos, *Probability Theory and Statistical Inference: Empirical Modeling with Observational Data*, Cambridge University Press, 2019.

J. Hamilton, *Time Series Analysis*, Princeton University Press, 1994.

K. Patterson, *A Primer for Unit Root Testing*, Palgrave Macmillan, 2010.

K. Patterson, *Unit Root Tests in Time Series, Volume 1: Key Concepts and Problems*, Palgrave Macmillan, 2011.

V. Martin, S. Hurn and D. Harris, *Econometric Modelling with Time Series: Specification, Estimation and Testing*, Cambridge University Press, 2013 (Part 5).

Concise single textbook chapters that introduce some of the key concepts, at an accessible level, include:

J.M. Wooldridge, *Introductory Econometrics: A Modern Approach*, 7th Edition, Cengage, 2020, Chapter 18.*

Other useful textbook coverage of some of the material in this paper is given in:

K.G. Stewart, *Introduction to Applied Econometrics*, Brooks/Cole Thomson Learning, 2005, Chs 15-18.*

M. Verbeek, *A Guide to Modern Econometrics*, 5th Edition, Wiley, 2017, Chs 8-9.

An accessible set of YouTube videos by Ben Lambert covers some of the material in the course. These are mostly included in the undergraduate course in econometrics playlists (parts 1 and 2) at https://www.youtube.com/user/SpartacanUsuals/playlists; the most relevant are listed in the individual topics below.

Topics and specific reading:

References in **bold** are highly recommended (most are available on eReserve via the ECON412 Blackboard page). References in squared brackets are more advanced readings. Topics and readings are a general guide; changes may be made depending on our rate of progress, relevant new references, etc.

1. Motivation and a review of basic concepts in time series analysis: stochastic processes, DGPs, realizations and models; stationarity and non-stationarity, order of integration

   Nobel Prize in Economics 2003, resources cited above

   Patterson, *op. cit.*, Chs 1-3.

   D.F. Hendry, Econometrics - alchemy or science?, *Economica*, 47, 1980, 387-406, reprinted in D.F. Hendry, *Econometrics - Alchemy or Science?*, Blackwell, 1993, pp.11-28.

   Banerjee et al, op. cit., Introduction and Overview, Ch. 1, especially pp.1-13, 27-42.

   Castle and Hendry, 2019, *op. cit.*, Chs 2 and 3.

   A. Spanos, Econometrics in retrospect and prospect, in T.C. Mills and K. Patterson, (eds), *Palgrave Handbook of Econometrics, Volume 1: Econometric Theory*, Palgrave MacMillan, 2006, pp. 3-58.

   [Hendry, 1995, *op. cit.*, Ch. 2.]

   B. Lambert YouTube videos, undergrad part 1 playlist, #166-168, 170-172

2. Autocorrelation and partial autocorrelation functions; autoregressive (AR), moving average (MA), ARMA, and ARIMA processes; stationarity and invertibility; outline of Box-Jenkins modelling

   For a brief introduction:

K. Cuthbertson, S.G. Hall, and M.P. Taylor, *Applied Econometric Techniques*, Philip Allan, 1992, Ch. 3.

Patterson, *op. cit*., Sections 6.1, 6.2, 7.2.

Verbeek, *op. cit*., Sections 8.1-8.3, 8.6-8.9.

More detailed coverage is available in, for example:

T.C. Mills, *Time Series Techniques for Economists*, CUP, 1990 (especially Chs. 5, 6, & 8).

B. Lambert YouTube videos, undergrad part 1 playlist, #173-182; part 2 playlist, #3-4

3. Autoregressive distributed lag models, special cases (including differenced data, common factor models), error correction mechanisms and general-to-specific modelling

For general discussions of the LSE/Hendry methodology, including diagnostic testing and encompassing:

C.L. Gilbert, Professor Hendry's econometric methodology, *Oxford Bulletin of Economics and Statistics*, 48, 1986, 283-307.

Hendry and Nielsen, *op. cit*., especially Chs 11 and 13.

Hendry, *op. cit*., 2015, especially Ch. 4.

D.F. Hendry, The methodology of empirical econometric modeling: Applied econometrics through the looking glass, in T.C. Mills and K. Patterson (eds), *Palgrave Handbook of Econometrics, Volume 2: Applied Econometrics*, Palgrave Macmillan, 2009, pp. 3-67.

A. Spanos, Reflections on the LSE Tradition in Econometrics: A student's perspective, *OEconomia*, 4, 2014, 343-380.

A. Spanos, Mis-specification testing in retrospect, *Journal of Economic Surveys*, 32(2), 2018, 541–577.

B. Lambert YouTube video on general-to-specific modelling
https://www.youtube.com/watch?v=p4c_ZBFNpL0

For a detailed discussion of the AD(1,1) model and models nested in it:

Hendry, 1995, *op. cit*., Ch. 7.

B. Lambert YouTube videos, undergrad part 2 playlist, #1-2, 5-7; part 1 playlist, 199

For insights into more recent developments in general-to-specific modelling:

Hendry and Nielsen, *op. cit*., Ch. 19.

D.F. Hendry, A brief history of general-to-specific modelling, *Oxford Bulletin of Economics and Statistics*, 86, 2024, 1-20.

Hendry and Doornik, *op. cit*.

Castle and Hendry, 2019, *op. cit*., Ch.6.

Nymoen, op.cit., Ch. 11

4. Non-stationarity in economic time series - random walks, difference stationary vs trend stationary models, problems with integrated series using 'standard' econometric techniques, spurious regressions

   Banerjee et al*, op. cit.*, Ch. 3.

   Patterson*, op. cit.*, Sections 6.2.4 - 6.2.8.

   Stewart, *op. cit.*, Sections 17.1-17.2

   B. Lambert YouTube videos, undergrad part 1 playlist, #168-169, 183-187, 192

5. Testing for unit roots - Dickey-Fuller, augmented Dickey-Fuller, Phillips-Perron tests, more powerful tests, practical examples

   Patterson*, op. cit.*, Sections 6.3, 6.4, 7.3, 7.6, 7.9, 7.10 [7.4, 7.5, 7.7, 7.8].

   Banerjee et al*, op. cit.*, Ch. 4, especially pp. 99-119.

   Enders, *op. cit.*, Ch.4.

   J. Elder and P.E. Kennedy, Testing for unit roots: What should students be taught? *Journal of Economic Education*, 32(2), 2001, 137-146.

   Stewart, *op. cit.*, Sections 17.3-17.4

   P. Perron, Trends and random walks in macroeconomic time series: Further Evidence from a new approach, *Journal of Economic Dynamics and Control*, 12, 1988, 297-332.

   B. Lambert YouTube videos, undergrad part 1 playlist, #188-191

6. Cointegration, long-run relationships, tests for non-cointegration, Engle-Granger 2-step method, Granger representation theorem, testing for cointegration via the ECM

   Patterson*, op. cit.*, Ch. 8 with case studies in Chs 10-13.

   Banerjee et al*, op. cit.*, Ch. 7, especially pp. 204-238.

   M.P. Murray, A drunk and her dog: An illustration of cointegration and error correction, *The American Statistician*, 48(1), 1994, 37-39.

   S. Kripfganz and D.C. Schneider, ardl: Estimating autoregressive distributed lag and equilibrium correction models, *Stata Journal*, 23, 2023, 983–1019.

   N.R. Ericsson and J.G. MacKinnon, Distributions of error correction tests for cointegration, *Econometrics Journal*, 5, 2002, 285-318.

   M.H. Pesaran, Y. Shin and R.J. Smith, Bounds testing approaches to the analysis of level relationships. *Journal of Applied Econometrics*, 16(3), 2001, 289-326.

   Castle and Hendry, 2019, *op. cit.*, Ch.4.

   Castle and Hendry, 2020, *op. cit.*, Ch.7 (application to UK annual CO_2 emissions).

   Stewart, *op. cit.*, Ch. 18

Charemza and Deadman, *op.cit*., Ch. 5.

[R.F. Engle and C.W.J. Granger, Co-Integration and error correction: representation, estimation and testing, *Econometrica*, 55, 1987, 251-276.]

B. Lambert YouTube videos, undergrad part 1 playlist, #193-196; part 2 playlist, 6-7

7. Cointegration in multivariate systems, the Johansen approach, modelling with integrated variables

Patterson, *op. cit.*, Ch. 14 with applications in Ch. 15.

Hendry and Nielsen, *op. cit.*, Ch. 17

Stata help manual, vec intro — Introduction to vector error-correction models

K. Juselius, Searching for a theory that fits the data: a personal research odyssey, *Econometrics*, 9, 2021, 27pp. https://www.mdpi.com/2225-1146/9/1/5 (open access)

[Martin et al., *op. cit*., Ch. 18.]

[Juselius, *op. cit*., especially parts II-IV.]

[Verbeek, *op. cit*., Sections 9.4-9.8.]

8. Panel unit roots and cointegration: key characteristics of panel time-series: nonstationarity, parameter heterogeneity, cross-sectional dependence; testing for panel unit roots, cross-sectional dependence, cointegration; estimation in heterogeneous parameter models: mean group, augmented mean group, and common correlated effects estimators

M. Söderbom, F. Teal, M. Eberhardt, S. Quinn and A. Zeitlin, *Empirical Development Economics*, Routledge, 2014, Chs 26-28.*

M.H. Pesaran, On the interpretation of panel unit root tests. *Economics Letters*, 116(3), 2012, 545-546.

J. Ditzen, Estimating dynamic common-correlated effects in Stata. *Stata Journal*, 18(3), 2018, 585-617.

Baltagi, *op. cit*., Ch. 12.

Pesaran, *op. cit*., Chs 28, 29 and 31.

[A. Banerjee and M. Wagner, Panel methods to test for unit roots and cointegration, in T.C. Mills and K. Patterson (eds), *Palgrave Handbook of Econometrics, Volume 2: Applied Econometrics*, Palgrave Macmillan, 2009, pp. 632-726.]

[J. Westerlund, Testing for error correction in panel data, *Oxford Bulletin of Economics and Statistics*, 69, 2007, 709-748.]

[A. Chudik and M.H Pesaran, Common correlated effects estimation of heterogeneous dynamic panel data models with weakly exogenous regressors, *Journal of Econometrics*, 188, 2015, 393–420.]