PO 7005
Quantitative Methods II

Hilary 2016, TRISS Seminar Room
Wednesdays 15:00-17:00

Contact Information

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Description

This course extends the analytical and theoretical background developed in Quantitative Methods I. It focuses on building a greater understanding of the methods introduced in that course, such as the workings of multiple regression and problems that arise in applying it, as well as going deeper into the theory of inference underlying regression and most other statistical methods. Quantitative Methods II also covers new classes of models for binary and count data, emphasizing the need to t appropriate models to the underlying processes generating the data being explained.

This course is primarily about data analysis and developing a deeper understanding of the generalized linear model. The focus is on practice, and this focus is reflected in the choice of texts and in the emphasis on applied coursework. While this course deals to some degree with the generalized linear model on a mathematical and theoretical level, its main focus is practical, the ability to use the techniques when faced with the need in practical research. Consequently the learning method combines lectures and reading with hands-on statistical programming exercises using real datasets.

The learning outcomes associated with this twelve-week course are aimed at students being able to:

- Develop a deeper understanding of the linear regression model and its limitations;

- Know how to diagnose and apply corrections to some problems with the generalized linear model found in real data;
- Use and understand generalizations of the linear model to binary and count data;
- Develop a greater familiarity with a range of techniques and methods through a diverse set of theoretical and applied readings;
- Know where to go to learn more about the techniques in this class and those called for that were not covered in this class.

Prerequisites

Quantitative Methods I for Political Science or an equivalent course. A basic knowledge of mathematics, in particular algebra and simple calculus, is beneficial but not assumed. The statistical software **R** will be used for examples, and it is assumed that students have already gained some familiarity with it.

Meetings

The course lasts 12 weeks (incl. reading week). It will consist mostly of lectures and presentations, with some practical data analysis relating to weekly problem sets. If possible, bring your (charged) laptop computers. *Install (and familiarise yourself with)* **R** *if you have not already done so.*

Grading

- Problem sets: 50%. There will be five problem sets, handed out in class or by email. They must be returned on Turnitin BEFORE the beginning of the following class. Scanned versions of your (neatly written) answers are fine. Group work is fine, but the answers and especially the write-up should be your own. Answers should always be explained. Assignments will be distributed and due as specified in table 1.

  Late papers will be downgraded according to the standard school policy. Exemptions will be granted only on the basis of illness or bereavement, documented in all cases.

- Replication project: 50%. This project will be a quantitative reanalysis of a published quantitative work. Your job will be to obtain the data from the original author (or obtain the same data she used for the original piece), replicate

Assignment #	Week Distributed	Week Due	Main Topics
1	3	4	Matrix operations, CLRM
2	5	6	Properties of OLS; Hyp. testing
3	8	9	Specification; Nonspherical disturbances.
4	10	11	Endogeneity; LDV
5	12	13	Panel data; time series

Table 1: Assignment schedule

her analysis, and extend the analysis using a new model or new variables whenever possible. If done properly this replication may be suitable for publication, which should be your objective. This project will require you to begin searching immediately for an article to replicate, including contacting the author or taking equivalent steps to obtain the data for your replication. The article you replicate may be from any field in political science, but must be an empirical application using inferential statistics. The only other restriction is that you may not replicate any article assigned for class reading or exercises. Your project must be submitted with your own replication dataset, so that someone else could replicate your analysis. You must also include a copy of the article whose analysis you have replicated. The deadline for the replication project will be the same as for the paper deadline associated with the non-quantitative courses. Examples of published replications may be seen in the volumes 41 and 42 of the American Journal of Political Science, available for browsing through JSTOR. The deadline to submit your replication paper is April 20 at 11:59PM (i.e., 2 weeks after our last class)

Please submit *all your written work* through Turnitin (turnitin.com):

- Class ID: 11532527
- Password: quantastic

Please also follow the standard of academic honesty set forth in the College Calendar (see H18 paragraphs 76-79).[1]

[1] For more information on Turnitin and academic integrity, please visit:
`http://tcd-ie.libguides.com/plagiarism`,
`http://www.tcd.ie/CAPSL/readysteadywrite/`, and
`https://www.tcd.ie/Science/current/PDF/plagiarism/Plagiarism.pdf`

Readings

For this class I recommend the following two textbooks:

- Dougherty, Christopher. *Introduction to Econometrics.* Oxford University Press, 2011. Fourth edition. Easy and clear. Unfortunately no matrix notation, hence the need for another book:
- Verbeek, M. (2012). A guide to modern econometrics. Chichester, England: John Wiley & Sons. 4th edition. Verbeek's textbook is well-organised, clear and concise, uses matrix notation, and is at the right level for this class.

The following books are also very good (esp. Kennedy):

- Kennedy, Peter. *A guide to Econometrics.* Wiley-Blackwell, 2008. 6th edition. Very helpful to get the intuition. I strongly recommend this book. Unfortunately, it does not stand on its own and you will need a more systematic treatment.
- Gujarati, Damodar N. *Basic Econometrics.* Tata McGraw-Hill Education, 2008. You can use this instead of Dougherty.
- Faraway, Julian. *Practical Regression and ANOVA using R.* Very useful for practical recipes in R. And it is free.
  Download it at: http://cran.r-project.org/doc/contrib/Faraway-PRA.pdf
- A (much) more advanced treatment is Greene, William H. *Econometric Analysis.* Pearson, 2012. Seventh edition.

Schedule Overview (susceptible to change)

Week	Main Topic
1	Review of Statistics
2	Matrix algebra
3	The Classical Linear Regression Model (I)
4	The Classical Linear Regression Model (II)
5	Inference and Hypothesis Tests
6	Specifying the Regression
7	*Reading Week: no class*
8	Relaxing the Assumptions of the Classical Model (I)
9	Relaxing the Assumptions of the Classical Model (II)
10	Qualitative and Limited Dependent Variables Models
11	Panel Data
12	Times Series Models

Schedule Details

Week 1. Review of Statistics

Required Readings:
Dougherty, Ch. 'Review',
Or Gujarati, Appendix A

Week 2. Matrix Algebra

Required Readings:
Gujarati, Appendix B (PDF will be made available)
Dougherty, R5, R6

Week 3. The Classical Linear Regression Model (I)

Derivation of the classical linear regression model (OLS); Interpreting the linear model and its coefficients; Estimating the error variance.

Required Readings:
Dougherty, Ch. 1, 3
Verbeek 2.1, 2.2, 3.1.

Recommended Readings:
Kennedy, Ch. 3
Gujarati , Ch 3, 7, 9

Week 4. The Classical Linear Regression Model (II)

THIS WEEK WE MEET IN ROOM 5040 OF THE ARTS BUILDING.
Deriving the Variance of b; Properties of OLS; Gauss-Markov Assumptions and proof; Geometric interpretation of OLS; Partitioned regression; Frisch-Waugh

Required Readings:
Dougherty, Appendix 2.1, Ch. 3
Verbeek 2.3

Recommended Readings:
Gujarati, Ch. 3 (esp. the Appendix)
Kennedy, Ch. 3

Week 5. Inference and Hypothesis Tests

Hypotheses on a coefficient; R-squared; t-test, F-test and J test; Goodness of fit: R^2, AIC, BIC; Confidence interval; Prediction

Required Readings:
Dougherty, Ch. 2
Verbeek 2.4–2.5, 2.10

Recommended Readings:
Kennedy, Ch. 4
Gujarati, Ch. 4, 5, 8

Week 6. Specifying the Regression

Variables to include; Omitted variable bias; Choosing a functional form; non-linearities, logs, etc.; Dummy variables; Interaction effects

Required Readings:
Dougherty, Ch. 4–6
Verbeek Ch. 3

Recommended Readings:
Gujarati Ch. 6, 9, 13
Kennedy, Ch. 5, 6, 12, 15

Week 7. Reading Week

Week 8. Relaxing the Assumptions of the Classical Model (I)

THIS WEEK WE MEET IN ROOM 5040 OF THE ARTS BUILDING.

Heteroskedasticity; Autocorrelation; Multicollinearity; Outliers

Required Readings:
Dougherty, Ch. 7, 3.4, 12
Verbeek Ch. 4, 2.8, 2.9

Recommended Readings:
Gujarati Ch. 10–12
Kennedy Ch. 8

Week 9. Relaxing the Assumptions of the Classical Model (II)

Endogeneity; Reverse Causality; Instrumental Variables; Two-stage least square; Validity of instruments

Required Readings:
Dougherty, Ch. 9

Verbeek, Ch. 5

Recommended Readings:
Gujarati Ch. 18–20
Kennedy Ch. 9, 11

Week 10. Qualitative and Limited Dependent Variables Models

MLE; Logit and Probit; Tobit and Duration if time allows
Required Readings:
Dougherty, Ch. 10
Verbeek, Ch. 6.1, 7

Recommended Readings:
Gujarati, Ch. 15.
Kennedy, Ch. 16, 17

Week 11. Panel Data

Fixed vs. Random Effects

Required Readings:
Dougherty, Ch. 14
Verbeek, Ch. 10

Recommended Readings:
Gujarati, Ch. 16
Kennedy, Ch. 18

Week 12. Time Series Models

Mostly univariate: ARMA, stationarity, unit roots; VAR, Cointegration and VEC if time allows.

Required Readings:
Dougherty, Ch. 11, 13

Verbeek, Ch. 8, 9

Recommended Readings:
Gujarati, Ch. 21, 22
Kennedy Ch. 19