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**Department of Political Science
UNIVERSITY OF TORONTO**

**SPECIAL TOPICS:
Statistical Analysis and Inference for Political Scientists
POL 2800H 1 S
Spring 2016**

Instructor: Harald Bathelt
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Lecture Hours: Monday, 10:00 AM-1:00 PM
Lecture Room: Sidney Smith Hall, Room 561 (basement)

Course Description:

This course advances important quantitative methods and techniques used in the analysis of empirical data in Political Science and other Social Sciences. It aims to provide a comprehensive understanding of statistical methods for graduate students required to (i) quantify relations and dependencies between variables and (ii) conduct statistical tests in a variety of applications. Students are required to have some background knowledge of research design, basic descriptive statistics, testing and regression analysis at the undergraduate level. The course will help students develop an intuitive, as well as a more formal understanding of these methods. Although formal language will be used, the course does not require in-depth mathematical knowledge. The requirements for the course include a basic understanding of algebra, functions, derivations, calculus, set theory, combinatorics and the sum operator. Prior to the course, it is recommended that students refresh their understanding of regression analysis and hypothesis testing by reviewing Gujarati and Porter (Introduction and Ch. 2), McNabb (Ch. 15), Anderson et al. (Ch. 14), or other similar literature.

The topics of the course include probability distributions, statistical testing and inference, as well as linear and non-linear, simple and multiple regression and correlation techniques. The application of these methods through the use of statistical software (primarily SPSS) will also be part of the course, although this is not the main focus. Canadian census data comprising a large set of socio-economic variables for metropolitan/urban areas for the years 1991, 2001, 2006 and 2011 will be the basis for the analyses conducted in class and for the assignments.

The overall goal of the course is to provide students with an understanding of the theory and methods behind statistical analyses. By the end of the course, students should be able to (i) conduct their own statistical analyses using different inferential statistics and regression

models, (ii) read and understand the key literature in the field, and (iii) extend their statistical and econometric knowledge further through independent reading.

Course Structure:

Although the course is necessarily lecture-based, there will be plenty of room for active student participation in discussions and problem-solving in the classroom. Course evaluation will be based on three assignments, seminar participation and a final take-home exam. To conserve paper, students are encouraged to print all assignments double-sided.

The focus of the course is on understanding the various models, methods and tests, rather than their lab-based application. Assignments are designed to review the important methods discussed in class. In addition to this, students should practice all methods on their own through simple exercises using SPSS and the Canadian census data set or any other database.

All assignments are expected to be handed in on the due date in class. The due date for the assignments will usually be one week after they are handed out in class. The take-home exam will be handed out during the last class (April 4). The due date for the take-home exam will be April 21.

For the assignments and the take-home exam, a lateness penalty of 3% per day will be deducted from the mark for the first 7 days. After this 7-day period, papers will receive a grade of 0% (special arrangements can only be made based on proper and timely documentation, such as a doctor's note). Students are strongly advised to keep rough and draft work and hard copies of their research papers and assignments until the marked assignments have been returned.

Blackboard:

The course uses the management system Blackboard, which helps to establish efficient communication between instructor and students. One of its advantages is that students can access their marks at any time on an individual basis. To access the Blackboard-based course website, students need to go to the UofT portal login page at <http://portal.utoronto.ca> and log in using their UTORid and password. If students need information on how to activate their UTORid and set their password for the first time, it is recommended go to <http://www.utorid.utoronto.ca>. The Help Desk at the Information Commons and telephone assistance under 416-978-HELP can also answer other related questions.

Once students have logged into the portal using their UTORid and password, they are advised to look for the "My Courses" module, where they will find the link to this course website along with links to all of their other Blackboard-based courses. At times, the instructor may decide to send out important course information by e-mail. To that end, all UofT students are required to have a valid UofT e-mail address. Students are responsible for ensuring that their UofT e-mail address is set up AND properly entered in the ROSI system.

Academic integrity:

Academic integrity is fundamental to learning and scholarship at the University of Toronto. Participating honestly, respectfully, responsibly, and fairly in this academic community ensures that the UofT degree that students earn will be valued as a true indication of their individual academic achievement, and will continue to receive the respect and recognition it deserves. For further details and information on academic integrity, see <http://www.artsci.utoronto.ca/osai/students>.

Accessibility Needs:

The University of Toronto is committed to accessibility. If students require accommodations for a disability, or have any accessibility concerns about the course, the classroom or course materials, Accessibility Services should be contacted as soon as possible at accessibility.services@utoronto.ca or <http://www.accessibility.utoronto.ca/>.

Course Evaluation:

The course evaluation will be based on the following aspects:

- 5% assignment 1 (handed out in lecture 4: February 1; due lecture 5: February 8)
- 10% assignment 2 (handed out in lecture 7: February 29; due in lecture 8: March 7)
- 15% assignment 3 (handed out in lecture 10: March 21; due lecture 11: March 28)
- 60% take-home exam (handed out in lecture 12: April 4; due Thursday, April 21)
- 10% seminar participation

Further details about the course and suggestions from students will be discussed in class.

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Required Readings:

It is suggested using Gujarati and Porter (2009) as the primary source book for the course, as it offers a comprehensive overview of econometric methods that extends well beyond the course. It can also be used as a reference book for further research. Since the course offers a more formal approach to methods of statistical inference and regression analysis, it should be no problem to understand and follow suggestions in other statistical textbooks through independent study. Alternatively, Wooldridge (2013) offers a very good overview of the topics discussed in class. This book is less formal and easier to read but not as extensive and not as useful as a future reference book.

As the first part of the course focusses on probability distributions and statistical inference and since not all students might have a strong background in these areas, Anderson et al. (2014) offer an easy-to-read introduction into these topics. It may be particularly helpful in the first half of the course and even as an introductory text to the more formal readings in the second half.

To become familiar with SPSS, students can use Pallant (2013) as an introduction; Wagner (2015) or Field (2013) are equally possible, or any other SPSS book or online data base. SPSS will not be a core topic in the class; therefore, those who have no experience with this software might need some introductory reading or companion of how to use it. Before buying a book, it is recommended looking into online databases. There is plenty of instructional material for SPSS available for download.

*Gujarati, D. N. and Porter, D. (2009): Basic Econometrics. 5th Edition. New York: McGraw-Hill.

A highly recommended book that covers much more than just introductory material. It can be used as a textbook as well as a reference frame when conducting statistical analyses in later research projects. The book goes well beyond the scope of the course.

*Anderson, D. R., Sweeney, D. J., Williams, T. A., Camm, J. D. and Cochran, J. J. (2014): Statistics for Business and Economics. 12th Edition. Mason, OH: South-Western (Nelson Education).

[or: Anderson, D. R., Sweeney, D. J. and Williams, T. A. (2010): Statistics for Business and Economics. Customized 11th Edition. Mason, OH: South-Western (Nelson Education).]

A very good, clearly structured, easy to understand, and comprehensive introduction to descriptive statistics, statistical testing and regression analysis at the undergraduate level. The customized edition is less expensive.

Alternative Suggested Readings:

Wooldridge, J. M. (2013): Introductory Econometrics: A Modern Approach. 5th Edition. Mason, OH: South-Western (Nelson Education).

Also a very good reader on econometrics that covers introductory and some advanced topics. The book is probably a bit easier to read than Gujarati and Porter but does not cover as much advanced material.

Additional Optional Readings:

Agresti, A. and Finlay, B. (2009): Statistical Methods for the Social Sciences. 4th Edition. New York, NY: Pearson.

This text provides a math-based introduction to statistics. It covers topics from elementary probability through logistic regression. Each chapter includes problem sets with examples that are drawn from the social sciences.

Ashenfelter, O., Levine, P. B. and Zimmermann, D. J. (2003): Statistics and Econometrics: Methods and Applications. New York: Wiley.

A systematic, comprehensive and precise introduction to most course topics. The book details the necessary mathematical background and goes substantially beyond what is covered in the course; it is advisable for students with some background in statistics and/or mathematics.

Berman, E. (2011): Essential Statistics for Public Managers and Policy Analysts. 3rd Edition. Washington, DC: CQ Press.

Covers a number of course topics well, with many applications and examples. It is well-suited for understanding the rationale behind some of the methods, without the use of formulas. Provides little mathematical reasoning/understanding.

Field, A. (2013): Discovering Statistics using IBM SPSS Statistics. 4th Edition. Thousand Oaks: Sage.

A detailed – sometimes too detailed – introduction to the use of SPSS at a fair price that also includes many procedures not needed in the course.

McNabb, D. (2009): Research Methods for Political Science: Quantitative and Qualitative Methods. 2nd Edition. Armonk, NY: M. E. Sharpe.

A very broad (and thick) overview of both quantitative and qualitative approaches. Part III is the most relevant for this course.

Morgan, G. A., Leech, N. L., Gloeckner, G. W. and Barrett, K.C. (2012): IBM SPSS for Introductory Statistics: Use and Interpretation. 5th Edition. New York: Routledge.

A very good, highly-rated introduction to the basic procedures in SPSS at a fair price.

Pallant, J. (2013): SPSS Survival Manual: A Step by Step Guide to Data Analysis Using IBM SPSS. 5th Edition. Berkshire, England: McGraw Hill.

A well-organized, highly-rated introduction to the basic procedures in SPSS at a very good price.

Salkind, N. J. (2014): Statistics for People Who (Think They) Hate Statistics. 5th Edition. Thousand Oaks: Sage.

A different, sometimes funny, but ultimately serious introduction to statistical methods. It is not just designed for beginners, and might be interesting for those students who need some extra motivation to engage in quantitative methods.

Wagner, W. (2015): Using SPSS for Social Statistics and Research Methods. 5th Edition. Thousand Oaks: Pine Forge Press.

A brief introduction to the basic procedures in SPSS; good overview at a fair price.

Examples of Online Instructional Materials for SPSS:

Fiddler, L., Hecht, L., Nelson, E. E., Nelson, E. N. and Ross, J.: SPSS for Windows 16.0: A Basic Tutorial. Social Science Research and Instructional Centre, California State University.

<http://www.ssruc.org/trd/spss16>

Detailed introductory online instructions which focus on the graphical user interface.

IBM (2015): IBM SPSS Statistics 23 Core System User's Guide.

ftp://public.dhe.ibm.com/software/analytics/spss/documentation/statistics/23.0/en/client/Manuals/IBM_SPSS_Statistics_Core_System_User_Guide.pdf

Detailed online instructions that focus on establishing, modifying and administering SPSS databases.

IBM (2015): IBM SPSS Statistics 23 Documentation.

<http://www.ibm.com/support/docview.wss?uid=swg27043946>

Links to various SPSS methods modules with comprehensive overviews each, but often in a rather condensed form.

Regression Manual:

ftp://public.dhe.ibm.com/software/analytics/spss/documentation/statistics/23.0/en/client/Manuals/IBM_SPSS_Regression.pdf

Other Online Sources:

WolframMathWorld.

<http://mathworld.wolfram.com/>

A detailed online dictionary which provides answers and explanations regarding mathematical and statistical/probabilistic procedures.

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TOPICS: Spring Term 2016

1. Introduction to SPSS: Descriptives, frequencies and crosstabs
2. Probability distributions 1: How to measure and plot chance
(incl. combinatorics, probability concepts, rules for operations, set theory, random and non-random sampling)
3. Probability distributions 2: The binomial, poisson and exponential distributions
4. Statistical inference 1: Normal distribution and test design
5. Statistical inference 2: Parameter tests and related t/F distributions
6. Statistical inference 3: Chi-square test and analysis of variance
7. Linear regression analysis 1: Linear regression/correlation model and statistical tests
8. Linear regression analysis 2: Statistical tests, OLS/ML estimates and non-linear models
(incl. introduction logistics regression)
9. Multiple regression analysis 1: Basic regression/correlation model and tests
10. Multiple regression analysis 2: Model assumptions, dummy variables and multicollinearity
(incl. introduction logit regression)
11. Multiple regression analysis 3: Heteroscedasticity and autocorrelation
12. Multiple regression analysis 4: Specification problems and non-linear models

Readings by Topic: Spring Term 2016

Readings marked by an asterix (*) represent core readings, which all students are required to read. The other suggested readings provide an alternative perspective on similar material.

1. Introduction to SPSS: Descriptives, frequencies and crosstabs

Anderson et al., Chs. 2-3

*SPSS:

Pallant, Chs. 6-8

Wagner, Chs. 1-5

Online SPSS instructions

2. Probability distributions 1: How to measure and plot chance

Task: Familiarization with the database, its organization and variables; conducting simple SPSS analyses

*Anderson et al., Chs. 4, 5.1-5.4 and 6.1

*Gujarati and Porter, App. A.2-A.5

Wooldridge, App. B.1-B.4

3. Probability distributions 2: The binomial, poisson and exponential distribution

*Anderson et al., Chs. 5.5-5.6 and 6.4

*Gujarati and Porter, App. A.6

4. Statistical inference 1: Normal distribution and test design

*Anderson et al., Chs. 6.2 and 7

*Gujarati and Porter, App. A.6-A.8

McNabb, Ch. 12

Wooldridge, App. C

Assignment 1: handed out in class

5. Statistical inference 2: Parameter tests and related t/F distribution

*Anderson et al., Chs. 9-11

*Gujarati and Porter, Chs. 5.1-5.8 and App. A.6-A.8

Wooldridge, App. B.5

*SPSS:

Pallant, Chs.16-17

Wagner, Ch. 6
Online SPSS instructions

6. Statistical inference 3: Chi-square test and analysis of variance

*Anderson et al., Chs. 12 and 13
*Gujarati and Porter, Chs. 5.7-5.12

*SPSS:
Pallant, Chs. 16 and 18
Wagner, Chs. 6 and 10
Online SPSS instructions

7. Linear regression analysis 1: Linear regression/correlation model and statistical tests

*Anderson et al., Ch. 14
*Gujarati and Porter, Chs. 2, 3 and parts of 4
McNabb, Ch. 14
Wooldridge, Chs. 2 and 3

*SPSS:
Pallant, Chs. 11 and 13
Wagner, Ch. 8
Online SPSS instructions

Assignment 2: handed out in class

8. Linear regression analysis 2: Statistical tests, OLS/ML estimates and non-linear models

Task: Review matrix algebra (*Gujarati and Porter, App. B; Wooldridge, App. D)

*Anderson et al., Ch. 15.9
*Gujarati and Porter, Chs. 4 and 6
Wooldridge, Chs. 4 and 5

*SPSS:
Pallant, Ch. 14
Wagner, Ch. 9
Online SPSS instructions

9. Multiple regression analysis 1: Basic regression/correlation model and tests

Task: Matrix approach to linear regression (*Gujarati and Porter, App. C.1-C.10; Wooldridge, App. E)

*Anderson et al., Ch. 15

*Gujarati and Porter, Chs. 7 and 8

*SPSS:

Pallant, Chs. 12-13

Wagner, Ch. 8

Online SPSS instructions

10. Multiple regression analysis 2: Model assumptions, dummy variables and multicollinearity

*Gujarati and Porter, Chs. 9, 10 and 15

Wooldridge, Ch. 7

Assignment 3: handed out in class

11. Multiple regression analysis 3: Heteroscedasticity and autocorrelation

*Gujarati and Porter, Chs. 11 and 12

Wooldridge, Ch. 8

12. Multiple regression analysis 4: Specification problems and non-linear models

*Gujarati and Porter, Chs. 13 and 14

Wooldridge, Ch. 9

*SPSS:

Pallant, Ch. 14

Wagner, Ch. 8

Online SPSS instructions

Take-Home Exam: handed out in class