Course description

Quantitative finance

Course name, ECTS, quarter / semester, contact hours

Quantitative finance, 4 ECTS, 3-4 quarters, 48 contact hours

Author of the course

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Outline

The purpose of this elective course, which is designed for first-year graduate students following the programs "Finance" and "Applied Economics and Mathematical Methods", is to familiarize the students with advanced methods of econometric research in economics and finance. The course focuses on the problem of endogeneity and the ways to address it in the analysis of cross-sectional and panel data. The course is of applied nature: the material is presented, whenever possible, in a non-technical way, examples of empirical studies published in leading international economics and finance journals are discussed, and the lectures are supplemented by exercises in the computer lab.

The topics covered include the causes and consequences of endogeneity, potential outcomes and treatment effects, instrumental variables methods, panel data techniques, difference-in-difference estimation techniques, as well as an overview of the matching models, regression discontinuity designs and sample selection. Computer exercises using the statistical software package "Stata" are an integral part of the course, which ensures that the students get hands-on experience of analyzing real world data.

The course consists of lectures (28 hours) and computer labs (20 hours). After the course, the students should understand the causes and consequences of endogeneity, know the main methods for addressing this problem, and be able to apply these methods when conducting econometric analysis. The students should also be able to use the statistical package "Stata", including its programming options (the so-called do-files).

The applied nature of the course manifests itself in the application of econometric methods to the analysis of typical issues in the field of economics and finance, such as estimating the return to education, testing for gender discrimination, assessing the effect of ownership structure on firm value, and evaluating the impact of the banking sector deregulation on the behavior of banks and borrowers. Such applications, in the form of either classroom examples or exercises in the computer lab, are intended to prepare the students for conducting own research, including their masters' theses.

Structure and content

Overview of the classical linear regression model (4 hours). • Classical linear regression. Assumptions. Ordinary least squares (OLS) and its properties. • Multiple regression. • Functional form. Choice of regressors.
Overview of the classical linear regression model (4 hours). • Categorical independent variables. • Interactions of independent variables. • Nonstandard standard errors.

Introduction to econometric package Stata (4 hours). • Basic capabilities of Stata, basic commands, elements of Stata language. • Using "do" and "log" files in Stata.
Causes and consequences of endogeneity (4 hours). • Mains sources of endogeneity: omitted variables, reversed causality, measurement error in the dependent and independent variables. • Potential outcomes and treatment effects. Links to regression analysis and endogeneity.
Introduction to econometric package Stata (4 hours). • Creating and changing variables in Stata. • Graphical capabilities.
Topic 5. Instrumental variables methods (4 hours). • The basics of the method. Estimation. Instrument validity (relevancy and exogeneity). Where do valid instruments come from? Examples. • Tests for instrument validity. The problem of weak instruments. Limitations of the IV methods.
Introduction to econometric package Stata (2 hours). • Basic commands of regression analysis. Hypothesis testing and model diagnostics. Instrumental variables (IV) methods (2 hours). • Commands of the IV methods. Diagnostic tests.
Topic 4. Analysis of panel (longitudinal) data (4 hours). • Examples of panel data. Fixed effects estimation. • Regressions with time fixed effects. • Random effects models. • Model diagnostics (Hausmann test, etc.).
Difference-in-difference (4 hours). • The difference estimator. Single Cross-Sectional Differences After Treatment; Single Time-Series Difference Before and After Treatment. • Double Difference Estimator: Difference-in-Differences (DiD) estimator. • Testing the key assumption of the DiD.
Analysis of panel (longitudinal) data (2 hours). • Fixed- and random-effects models in Stata. • The Hausmann test. The difference-in-difference estimator (2 hours). • Applying the DiD estimator using Stata.
Overview of the matching models, regression discontinuity and sample selection models (4 hours). • Matching models. Treatment effects and necessary identifying assumptions. Propensity score matching. • Regression discontinuity (RD) models. Sharp and fuzzy regression discontinuity designs. Identification of treatment effects in the sharp RD. • The Heckman selection model.
Overview of the matching models, regression discontinuity and sample selection models (4 hours). • Estimation of matching models in Stata • Estimation of regression discontinuity models in Stata • Estimation of sample selection models in Stata.

Prerequisites
Students' knowledge of the foundations of econometrics is a key prerequisite for the successful completion of the course.

Assessment
Students' progress is monitored during the course by **four home assignments** (which include problem sets and computer exercises in Stata).

All assignments will be evaluated of max 100%. They will be distributed in the class and will be due in approximately one week. Homework assignments are to be handed in **before class** on the day they are due. No late homework will be accepted.

At the end of the course there is a **final exam**, which is a closed book, closed notes test to be held in the classroom. The duration of the final is two academic hours.

Final grade consists of the following elements:

Home assignments	40% of the final grade
Final exam	60% of the final grade

Main reading list

- Roberts, Michael R. and Whited, Toni M. (2013) Endogeneity in Empirical Corporate Finance, In: George M. Constantinides, Milton Harris and Rene M. Stulz, Editor(s), *Handbook of the Economics of Finance*, Elsevier, Volume 2, Part A, Pages 493-572. Available in ScienceDirect.
- Li, K. and Prabhala, N.R. (2008) Self-selection models in corporate finance. *Handbook of Empirical Corporate Finance SET*, *1*, 37-86.
- Kohler, Ulrich and Kreuter, Frauke (2005) *Data Analysis Using Stata*, College Station, Texas: Stata Press.
- Stata Manual. Stata Corporation, 2012.

Additional reading list

- Angrist, J., Imbens, G., and Rubin, D. (1996). Identification of causal effects using instrumental variables. *Journal of the American Statistical Association*, 91(434):444-455.
- Atanasov, V., & Black, B. (2013). *Shock-Based Causal Inference in Corporate Finance Research*. working paper, at http://ssrn. com/abstract= 1718555.
- Börsch-Supan, A., & Köke, J. (2002). An applied econometricians' view of empirical corporate governance studies. *German Economic Review*, *3*(3), 295-326.
- Cameron, A. Colin and Trivedi, Pravin K. (2009) *Microeconometrics using Stata*. Stata Press, College Station, Texas.
- Holland, P. W. (1986). Statistics and causal inference. *Journal of the American statistical Association*, *81*(396), 945-960.
- Larcker, D. F., & Rusticus, T. O. (2010). On the use of instrumental variables in accounting research. *Journal of Accounting and Economics*, *49*(3), 186-205.
- Lennox, C. S., Francis, J. R., & Wang, Z. (2011). Selection models in accounting research. *The Accounting Review*, *87*(2), 589-616.
- Wooldridge, Jeffrey M. (2002) *Econometric Analysis of Cross Section and Panel Data*. MIT Press.