Master in Financial Engineering at EPFL:

Econometrics

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First semester

Goal
The course covers the basic econometric models and methods that are usually applied to obtain inference results. The basic textbook will be Greene, W., 2008, *Econometric Analysis*, sixth edition, Prentice Hall.

Content

- Linear regression model; assumptions and specifications; Least square (LS) estimator; algebraic and statistical properties of LS estimator; goodness of fit; Partitioned regression; Gauss–Markov Theorem; hypothesis testing; multicollinearity; large sample properties of LS estimator

- Inference; linear restrictions; discrepancy vector and Wald statistic; restricted least square and loss of fit; $F$-statistic; testing nonlinear restrictions

- Model specification; dummy variables; test for structural breaks; omitted and superfluous variables; Vuong’s test for nonnested models

- Generalized regression model; heteroscedasticity; White’s covariance matrix estimator; Breusch–Pagan test for heteroscedasticity; Harvey’s model for heteroscedasticity

- Panel data models; Pooled model; LS estimation of Pooled model; Fixed effects model; Least Square Dummy Variable; testing differences across groups; Random effects model; generalized

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least square estimation of Random effects model; Hausman’s specification test; Mundlak’s model; dynamic panel data model

- Instrumental variables; instrumental variable estimation of dynamic panel data model; instrumental variable estimation in presence of measurement errors; instrumental variable estimation of generalized regression model

- Generalized method of moments (GMM); orthogonality conditions; exactly identified case; overidentified case; optimal weighting matrix; consistency and asymptotic distribution of GMM; overidentifying restriction test

- Maximum likelihood (ML) estimation; identification; maximum likelihood estimator; asymptotic efficiency; consistency and asymptotic distribution of ML estimator; information matrix equality; invariance; estimating asymptotic covariance matrix

- Likelihood ratio test, Wald test, Lagrange multiplier test

- Pseudo Maximum Likelihood estimation

Assignments

There will be an assignment each week and it will be due the following week. Assignments will cover theoretical and applied exercises. The latter will include using real data from Wharton Research Data Services (WRDS) and Standard & Poor’s Compustat to prepare you for your internships in the financial sector.

Familiarity with a software, such as Matlab, for simulations and empirical analysis is required.

Grade

30% Homeworks, 30% Midterm exam, 40% Final exam.

Both exams are closed-book, closed-notes.

Before the course

Appendix A on matrix algebra, Appendix B on probability and distributions, and Appendix D on Laws of Large Numbers and Central Limit Theorems of Greene’s book should be reviewed before the Econometrics course will start. This material will be heavily used during the course but will not be taught.