Economics 482 Professor Richard Startz
Econometric Methods

Learning Goals

Grand Objectives

- **Be able to understand, interpret, and implement multiple regression and related statistical techniques**
- **Know the limitations and pitfalls of regression methods**
- **Be able write a focused explanation of the findings of a statistical investigation, clearly and concisely and "very well written."**

Specific Objectives

1. Statistics Review for regression

1.1. Light review of statistics
  1.1.1. Probability distributions
    1.1.1.1.Expected value
    1.1.1.2.Variance and Standard Deviation
    1.1.1.3.Covariance and correlation
  1.1.2. Population versus sample statistics
    1.1.2.1.Algebra of summations and sums of squares
  1.1.3.

1.2. Interpreting coefficients as *ceteris paribus* marginal responses.
  1.2.1. Familiarity with both simple and multiple regression

1.3. Review of statistical properties of an estimator
  1.3.1. Idea of a Data Generating Process (DGP)

1.3.2. Distribution of estimator over repeated draws from a DGP

1.3.2.1. Mean (Is it Unbiased?) and Variance

1.4. Hypothesis tests on a simple mean

1.4.1. One-tailed and two-tailed *t*-tests

1.4.2. Confidence interval

2. Multiple Regression in the Classical Case

2.1. Least squares as data-fitting technique

2.1.1. Simple regression without constant

2.1.2. Simple regression with constant and intuition for *k*-RHS variable model

2.2. Least squares parameters as statistical estimators

2.2.1. Derive mean and variance of $\hat{\beta}_{ols}$.

2.2.1.1. Being able to use simple statistical algebra

2.2.1.2. Understanding relevance of classical OLS assumptions

2.2.2. Understand determinants of variance of $\hat{\beta}_i$

2.2.2.1. 1 RHS variable regression
2.2.2.2. 2 RHS variable regression
2.2.2.3. Multicollinearity

2.2.3. Prove Gauss-Markov theorem

2.3. Hypothesis testing and confidence intervals

2.3.1. Wald and likelihood-ratio tests

2.3.2. *t*-tests

2.3.3. *F*-tests

2.3.3.1. likelihood-ratio version
2.3.3.2. Chow test

2.3.4. Confidence intervals and regions

2.3.4.1. 1 RHS variable confidence interval
2.3.4.2. Joint confidence ellipse for 2-RHS variables

2.3.5. Type 1 versus Type 2 error

2.3.6. Size and Power

2.4. Data errors and outliers

2.5. Omitted variables bias

2.6. functional forms

2.6.1. Cross section models

2.6.1.1.Dummy variables

2.6.1.2.logs and other nonlinear transformations

2.6.2. Time series models

2.6.2.1. Lagged exogenous variables
2.6.2.2. Lagged endogenous variables

2.7. Forecasting

3. Generalized least squares

3.1. Known form of heteroskedasticity

3.1.1. Impact on OLS

3.1.2. GLS estimation

3.2. Heteroskedasticity

3.2.1. Models of heteroskedasticity

3.3. Serial correlation

3.3.1. testing

3.3.1.1.Durbin-Watson
3.3.1.2.Breusch-Godfrey

3.3.2. estimation

3.3.2.1. Cochrane-Orcutt

4. Alternatives to least squares – of which we'll discuss some

4.1. Instrumental variable estimation

4.2. Errors-in-variables

4.3. Simultaneous equation models

4.4. Panel data

4.5. Maximum likelihood estimation

4.6. Nonlinear least squares

4.7. Probit/Logit

5. Computer skills

5.1. EViews

6. Writing Skills

6.1. Focused writing which identifies a narrow question and answers it

6.1.1. Separation of writing and editing process

6.1.2. Writing for a specific audience

6.1.3. Rewriting

6.1.3.1.Rewriting

6.1.3.1.1. Rewriting