Simultaneous Equation Models

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This course considers systems of equations. In contrast to single equation models, simultaneous equation models include more than one dependent variable. These models can be grouped into two major types: 1) recursive models, and 2) nonrecursive models. Recursive models do not create any special problems, while nonrecursive models require special treatment. For each of these major types of models, we will discuss the specification, identification, estimation, and assessment of these systems of simultaneous equations. Nonrecursive models introduce the problem of identification, or, how to establish that the parameters of the model are estimable. Nonrecursive models also require alternative estimation techniques.

As time permits, advanced topics will be covered such as limited dependent variables, measurement error, and handling longitudinal data. As background, students should have a good understanding of the classical linear regression model and matrix algebra.

Most of the readings are drawn from four econometric texts:


All of the readings are available in the summer program library.

Topics and Readings:

I. Introduction to Simultaneous Equation Models

a. A brief introduction to simultaneous equation models

II: Review of the Classical Linear Regression model

a. Review of matrix algebra

Readings:

• Johnston: pp.89-100, 122-138 (ed. 4: 459-483)
II: Review of the Classical Linear Regression model (cont.)

b. Classical linear regression model

Readings:
· Gujarati: chp.9
· Greene: chp.6
· Johnston: chp.5 (ed 4: chap 3)

Note: if you feel you need to review, read Gujarati chp.2 & 6 or Johnston chp.1-2 first.

III: Overview of simultaneous equation models

Recursive vs. nonrecursive models; path diagrams/equations/matrices; reduced vs. structural form; direct, indirect and total effects.

Readings:
· Gujarati: chp.18
· Bollen: pp.32-34; 36-39
· Kmenta: 13.1 or Greene: 16.1-16.2

IV: Recursive models

a. Specification

Readings:
· Gujarati: p. 764
· Johnston: pp.467-468 (ed 4: 305-309)
· Kmenta: pp.719-720

b. Identification

Readings:
· Bollen: p. 88-98
· Kenny: p. 34-41, 61-62
· Greene: examples 16.11-16.12

c. Estimation

Readings:
· Gujarati: p. 681-682
· Johnston: p. 468-469 (ed. 4: 314-318)
· Kmenta: p. 720
IV: Recursive models (cont.)

d. Decomposition of effects

Readings:
· Bollen: pp.36-39

Defining mediation.

Readings:

Optional Reading:

V: SUR (seemingly unrelated regressions) models

Readings:
· Greene: pp.674-688
· Kmenta: 12.3

Example:
VI: Nonrecursive simultaneous equation models

a. Specification.
Readings:
  · Gujarati: 18.3-18.4

b. Identification
Reading:
  · Gujarati: chp.19.1-19.3

c. Estimation
Reading:
  · Gujarati: 20.1
c1. Indirect least squares
Readings:
  · Gujarati: 20.3
  · Johnston: pp. 469-472 (ed 4: 314)
c2. 2SLS
Readings:
  · Gujarati: 20.4, 20.5
  · Greene: 16.4, 16.5.2, and 16.5.2b
  · Kmenta: pp.681-687
Examples:
c3. 3SLS
Readings:
  · Johnston: pp.486-490
  · Kmenta: pp.695-701
c4. MLE
Readings:
  · Greene: 16.6.2
Example:
VI: Nonrecursive simultaneous equation models (cont.)

d. Comparison of Methods
Reading:
- Greene: 16.7
- Kmenta: pp.711-714

e. Decomposition of Effects
Readings:
- Bollen: pp.376-389

VII. Assessment of models

a. Equation by equation
a1. Endogeneity tests:
Reading:
- Gujarati: 19.4-19.5
- Greene: 16.8

a2. Assessment of Instruments
Reading:
Optional reading:

b. Global goodness of fit statistics for overidentified models
Reading:
- Bollen: pp.263-289
Additional Topics: (covered as time permits)

Modeling change

Readings:

Optional Reading:

Consequences of measurement error

Reading:
Bollen: chp.5 , Greene: 9.5

Simultaneous equations with limited dependent variables

Readings:

Bollen: 433-446.

Example:

Optional readings: Maddala 5.1, 5.8, chapter 7 and chapter 8.


Power Issues in Simultaneous Equations

Readings:

Lagged Endogenous Variables with autocorrelation

Readings:
Kmenta: 13.5

Standard Errors of indirect effects

Readings:

Endogeneity tests for models with dichotomous dependent variables

Readings:

Using simultaneous equations to handle spatial effects

Readings:

Autocorrelation or heteroskedasticity in simultaneous equations

Readings:
Kmenta: 13.5
**Application Papers:**

**Recursive: Presentation on Monday, July 30.**

**SUR: Presentation on Thursday, Aug 2.**

**Nonrecursive: Presentation on Monday, Aug 6.**

**Nonrecursive: Presentation on Thursday, Aug 9.**

**Categorical Variables: Presentation on Wednesday, Aug 15.**

**Issues to consider related to the application papers**
1. Provide a very brief description of what the paper is trying to do, highlighting the theoretical model and how it is implemented statistically.
2. Evaluate how well the first issue is accomplished.
3. What complexities are encountered, and how are these resolved?
4. In what ways do these intersect with issues we’ve discussed in class?
5. Evaluate the paper overall. Discuss why you have given this assessment.