

# ECON 626: Efficiency and Productivity Measurement

Fall 2008, TR 14-15:50 pm Bexell 211, 4 credits

R. Färe and S. Grosskopf

Office Hours:

R. Färe TR 8:30-10:00

S. Grosskopf TR 10:00-11:30

**Overview** This course is a graduate seminar which focuses on theoretical and empirical issues of measurement of productive performance, in a frontier framework. We develop frontier performance measures which satisfy reasonable index number properties and are easily estimated in a deterministic, nonparametric framework. The asymptotic properties of these estimators and statistical inference based on them will be taken up in Economics 627, which is the second of three courses required for a field in Econometrics.

As the major assignment in the course, students will be required to design a research project which employs (or extends) the methods developed in class. Typically the project would be an empirical analysis; students will have access to software and code to implement the algorithms used in frontier estimation of the performance measures covered in class.

The course is designed for graduate students in economics, AREC, forestry, finance, business, management, industrial engineering, health and any other discipline where performance measurement is important.

## Objectives

- The basic starting point is an understanding of axiomatic production theory and duality, which we shall review at the outset of the course.
- Knowledge of performance measures which satisfy reasonable index number properties and can be estimated in a nonparametric frontier framework, including for example Data Envelopment Analysis (DEA).
- Familiarity with relevant theoretical and applied literature.
- Ability to apply appropriate performance measures to an empirical problem.

## Learning Outcomes consistent with objectives

- Students are able to use duality theory to arrive at testable hypotheses with available data.
- Students are able to choose an appropriate performance measure to test hypotheses.
- Students are able to undertake a literature search and write review of theoretical and applied literature related to a specific empirical issue.
- Students are able to estimate and interpret appropriate performance measure in an empirical application.
- Students design a research project with a research question, hypotheses to be tested, review of relevant theoretical and empirical literature, collect appropriate data, estimate relevant performance measures, interpret and present results.

## Assessment

- The midterm exam will test the student’s knowledge of duality theory and theoretical properties of various performance measures. The final project will also be assessed in terms of the student’s understanding and application of duality theory.
- The midterm includes a written assessment of the contribution of the classic references to the theory and practice of performance measurement. The project includes a written review of the literature relevant to the research question.
- Students will have ungraded computer lab assignments to ensure their ability to estimate the performance measures they will be using in their projects.
- Students will receive feedback on the various components of their project over the course period. Revision is encouraged.
- Students will be graded on both presentation of their project as well as the written paper. The goal is to have the paper as a component of the student’s thesis/dissertation.

## 1 Requirements

Student will design a project, collect data, analyze, write up and present their results. There is one midterm.

Evaluation	Points	Date
Midterm	30	
Project	70	

## 2 Prerequisites

ECON 611 and Econ 612 or permission of the instructors.

**Statement Regarding Students with Disabilities** Accommodations are collaborative efforts among students, faculty and Services for Students with Disabilities (SSD). students with accommodations approved through SSD are responsible for contacting the faculty member in charge of the course prior to or during the first week of the term to discuss accommodations. Students who believe they are eligible for accommodations but who have not yet obtained approval through SSD should contact SSD at 737-4098.

**Academic Honesty** Please visit <http://oregonstate.edu/admin/stucon/achon.htm> for university policies regarding academic honesty.

## 3 Texts

R. Färe and S. Grosskopf, *New Directions: Efficiency and Productivity*, Springer Verlag, 2005, paperback.

C. Daraio and L. Simar, *Advanced Robust and Nonparametric Methods in Efficiency Analysis: Methodology and Applications*, Springer Science + Business Media, Inc., New York, 2007.

T. Coelli, D.S. Prasado Rao, Christopher O’Donnell, G. E. Battese, *An Introduction to Efficiency and Productivity Analysis*, second edition, Springer Science + Business Media, Inc., New York, 2005.

### OTHER REQUIRED READINGS

- Y. Aragon, A. Daouia and C. Thomas-Agnan, ‘Nonparametric Frontier Estimation: A conditional quantile based approach,’ *Econometric Theory* 2005, 21:358-359.
- D. W. Caves, L.R. Christensen and W.E. Diewert, ‘The Economic Theory of Index Numbers and the Measurement of Input, Output and Productivity,’ *Econometrica* 1982, 50:1393-1414.

- C. Cazals, J.P. Florens and L. Simar, ‘Nonparametric frontier estimation: A robust approach,’ *Journal of Econometrics* 2002,
- A. Charnes, C. Cooper, and E. Rhodes, ‘Measuring the Efficiency of Decision Making Units,’ *European Journal of Operational Research* 1978, 2:429-444.
- G. Debreu, ‘The Coefficient of Resource Utilization,’ *Econometrica* 1951, 19:273-292.
- R. Färe, S. Grosskopf, D. Margaritis, *Efficiency and Productivity: Malmquist and More*, Chapter 5, mimeo, 2005.
- M. Farrell, ‘The Measurement of Productive Efficiency,’ *Journal of the Royal Statistical Society, Series A*, 1957, 120(3):253-290.
- I. Gijbels, E. Mammen, B.U. Park and L. Simar, ‘On estimation of monotone and concave frontier functions,’ *Journal of the American Statistical Association*, 1999, 94:220-228.
- L. Simar and P. Wilson, *Statistical Inference in Nonparametric Frontier Models: Recent Developments and Perspectives*, Chapter 4, mimeo, 2007.

#### SOME OTHER REFERENCES

- A. Charnes, C. Cooper, A. Lewin and L. Seiford, eds., *Data Envelopment Analysis: Theory, Methodology and Applications*, Kluwer-Nijhoff, 1994.
- H. Fried, C.A.K. Lovell, and S. Schmidt, *The Measurement of Productive Efficiency: Techniques and Applications*, Oxford University Press, 1993.
- H. Fried, C.A.K. Lovell, and S. Schmidt, *Productive Efficiency and Productivity Growth* Oxford University Press, Oxford, 2008.
- Tim Anderson and Paul Rouse’s DEA dataset directory: [www.etm.pdx.edu/dea/dataset](http://www.etm.pdx.edu/dea/dataset)
- Tim Anderson’s DEA bibliography: [www.etm.pdx.edu/dea/deabib.html](http://www.etm.pdx.edu/dea/deabib.html)
- DEA web page: [www.DEAzone.com](http://www.DEAzone.com)

## 4 Outline

- Week 1      Axiomatic Production Theory: Appendix: *New Directions*  
                  Data Generating Processes: Simar and Wilson, Chapter 4, pp. 1-10  
                  Assignment: Literature Search (due beginning of week 2)
- Week 2      Efficiency Indicators and Indexes: Essay One *New Directions*  
                  Assignment: Research question and reference list (due beginning of week 3)
- Week 3      Efficiency Indicators and Indexes: Essay One *New Directions*  
                  Assignment: Read Farrell (1957) and Charnes, Cooper and Rhodes (1978)  
                  Library Visit: Barnard Classroom, 5th floor Valley Library: literature and data search
- Week 4      Thursday Oct. 21, Midterm
- Week 5      Productivity (Efficiency and Productivity: Malmquist and More, Färe, Grosskopf and Margaritis, mimeo.)  
                  Computer Exercise Using OnFront  
                  Assignment: Data description (due end of week 5)

- Week 6 Environmental Performance: Essay Two *New Directions*  
Assignment: Write Up of Methods Section
- Week 7 Issues in Aggregation: Essay Three *New Directions*
- Week 8 Other Frontier Estimators  
Simar and Wilson, Ch. 4  
Cazals et al, Gijbels et al, Aragon et al  
Assignment: Write-Up of Preliminary Results
- Week 9 Simar and Wilson, Ch. 4  
Assignment: Rough Draft of Project
- Week 10 Presentations
- 'Finals' Final Draft of Project Due Friday, Dec. 12, 5 p.m.