TITLE: **THEORY AND PRACTICE OF EFFICIENCY & PRODUCTIVITY MEASUREMENT: NONPARAMETRIC & PARAMETRIC APPROACHES**

INSTRUCTORS:

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COURSE DESCRIPTION

Productivity growth entails changes in scale, efficiency gains and technological change. Innovations are needed to keep pushing the competitive envelope, and efficiency gains are needed to ensure that implemented technologies achieve their potential.

Conventional economic approaches assume that all firms operate rationally and efficiently. This course presents the concepts, models and tools needed to quantify the levels of inefficiency and productivity at a point in time and over time.

Both nonparametric and parametric models addressing efficiency and productivity measurement are addressed. The nonparametric approach uses Data Envelopment Analysis (DEA) to let the data span the frontier to establish the best practice as a basis for measuring inefficiency. The stochastic frontier approach models inefficiency parametrically by specifying a functional form and error structure. These approaches coupled with the microeconomic theory of the firm provide firm-specific measurements of efficiency and best practice role models for improving performance.

This course is designed to bridge the gap between theory and practice. The course is organized into distinct parts which can be taken separately: Nonparametric and Parametric Approaches. Students may enroll for either the Nonparametric or Parametric week, or both weeks. The first week will address nonparametric approach; the second week will address the parametric approach. Students are encouraged to take both weeks, although each week is independent. Theory and method sessions each morning will be followed by an afternoon practicum session. The practicum will include applications of the theory, computer analysis with actual data sets, and interpretations in practice. Applications to various economic sectors will be considered such as agriculture, banking and finance, chain management, health, power generation, and sports. Extensions of these models will be addressed that measure the efficiency of value chains, characterize the dynamic linkages in decision making, and introduce hybrid nonparametric-parametric approaches.

The course learning objectives address both conceptual and methodological issues. Upon completion of this course, students will understand the underlying theory and become familiar with the software to initiate their own research in efficiency and productivity measurement.

In particular, students will understand the following from either course:

- Sources of efficiency from the perspective of technical feasibility, allocating scarce resource among competing ends, and the firm scale of operations (Both Courses);

- The input and output perspectives of technical and allocative efficiency (Both Courses)

- Characterizations of efficiency and productivity growth from a primal and dual perspective using production, cost, profit and distance functions (Both Courses)

- Decomposition of productivity growth that explicitly accounts for the presence of inefficiency (Both Courses)

- Use econometric approaches and software/techniques with cross-sectional and panel data to model and measure technical, allocative, and scale efficiency levels and productivity growth (Parametric Course)

- Use DEA models to measure technical, allocative, and scale efficiency levels and productivity growth (Non-parametric Course)

- Characterize definitions of variables of interest to be employed (goods and services; inputs, outputs, environmental, nonmarket goods/services) (Both Courses)

- Use econometric approaches to estimate using production, cost, profit and distance functions to support efficiency and productivity growth measurement (Parametric Courses)

- Assess the appropriate use of parametric and nonparametric approaches given the data and problem setting (understanding the advantages and disadvantages of both perspectives) (Both Courses)

- Use these approaches to articulate the forces driving efficiency gains and productivity growth (Both Courses)

- Use these approaches for benchmarking, identifying best practice and role models to plan for performance enhancement/gains (Both Courses)

PREREQUISITES:

Nonparametric Course:

Microeconomic theory at the graduate level such as the treatment in H. Varian, *Microeconomic Theory*, W.W. Norton. Knowledge of linear programming at the level of Chapter 17 of E. Silberberg and W. Suen, *The Structure of Economics: A Mathematical Analysis*, McGraw-Hill, 2000.

Parametric Course:

Microeconomic theory at the graduate level such as the treatment in H. Varian, Microeconomic Analysis, W.W. Norton Econometric theory and applications at the graduate level to include topics in Maximum Likelihood Estimation and System Estimation are required and some exposure to panel data econometrics is desirable.

COURSE MATERIALS:

Cooper, W.W., L. M. Seiford, and K. Tone, Data Envelopment Analysis: A Comprehensive Text with Models, Applications, References and DEA-Solver Software, Kluwer Academic Press, 2000. (Nonparametric Course)

Kumbhakar, S. and C.A.K. Lovell, Stochastic Frontier Analysis, Cambridge University Press, 2000. (Parametric Course)

Articles: To be announced and distributed in advance

Evaluation:

Participants will write a paper applying efficiency and productivity concepts discussed in the course. Details of the composition of the paper will be distributed to participants on the last day of the course. The paper will be due 90 days after the course's conclusion.

TIMETABLE AND OUTLINE

Each course will involve daily sessions, with a 3-hour theory session in the morning and a 3-hour practicum session in the afternoon.

Parametric Approaches (3-7 July 2006)

Lecturers:

Subal Kumbhakar
Professor of Economics
State University of New York, Binghamton, USA

Spiro Stefanou
Professor of Agricultural Economics
Pennsylvania State University, USA

- **3 July 2006**

  Definitions of technical and scale inefficiency; Input and output orientations (using functional relationships); Use of production & distance functions

- **4 July 2006**

  Cost Minimization Models to define allocative inefficiency (using functional relations); Decomposing cost function into technical and allocative inefficiency; Econometric specification of primal and dual functions; Role of error structure (errors in measurement vs. errors in optimization)

- **5 July 2006**

  Panel data specifications of production, cost and profits functions

- **6 July 2006**

  Productivity growth definition; Decomposition with inefficiency (using primal dual approaches); Specification of sources of inefficiency and productivity growth

- **7 July 2006**

  Extensions of parametric approaches: dynamic characterization of efficiency, latent class models

Nonparametric Approaches (10-14 July 2006)

Lecturers:

Harold Fried
Professor of Economics and
David L. and Beverly B. Yunich Professor of Business Ethics
Union College, USA

Loren Tauer
Professor of Applied Economics and Management
Cornell University, USA

10 July 2006

Definitions of technical and scale inefficiency; Input and output orientations (using set theoretic relationships); Use of production & distance functions (graphical, mathematical, programming specifications)

11 July 2006

Cost Minimization Models to define allocative inefficiency; Decomposing cost function into technical and allocative inefficiency; Linear programming-based formulations

12 July 2006

Variable specification issues: aggregation, short & long run, exogenous variables; Explaining inefficiency

13 July 2006

Productivity growth definition; Decomposition with inefficiency; Malmquist models

14 July 2006

Extensions of nonparametric approaches: stochastic specifications, benchmarking, identifying best practice, performance enhancement/gains, value chains