THEORY AND PRACTICE OF EFFICIENCY & PRODUCTIVITY MEASUREMENT:
STATIC & DYNAMIC ANALYSIS

Summer Course, 2 weeks

Organized by Universidad Santo Tomas, Chile

In collaboration with
WAGENINGEN UNIVERSITY, the Netherlands

Week 1: 12 - 16 January 2015
Parametric Efficiency and Productivity Analysis
Location: Santiago, Chile

Lecturers:
Subal Kumbhakar
Professor of Economics
Binghamton University, USA

Chris Parmeter
Associate Professor of Economics
University of Miami, USA

Teacher assistant:
Alvaro Reyes
Associate Professor
Universidad Santo Tomas, Chile

Week 2: 19 - 23 January 2015
Dynamic Efficiency and Productivity Analysis
Location: Santiago, Chile

Lecturers:
Spiro Stefanou
Professor of Agricultural Economics
Pennsylvania State University, USA and Business Economics, Wageningen University

Alfons Oude Lansink
Professor of Business Economics
Wageningen University, NL

Teacher assistant:
Alvaro Reyes
Associate Professor
Universidad Santo Tomas, Chile

Sponsors:

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Introduction to the Summer School

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. The summer school, however, challenges this assumption and presents concepts, models and tools needed to analyze and quantify the levels of inefficiency and productivity at a point in time and their movement over time.

This international summer course will be organized in Latin America to bring efficiency analysis tools into companies, government and universities in situ. The summer school is also designed to bridge the gap between theory and practice. It is organized into distinct parts: “Parametric, Static Approaches” (Week 1) and “Dynamic Approaches” (Week 2). Students may enroll for either week 1 or 2, or both weeks. Although each week is independent, students are encouraged to take both weeks.

Week 1: Parametric Efficiency and Productivity Analysis
The parametric course uses Stochastic Frontier Analysis to measure efficiency and productivity by letting the data span the frontier to establish best practice. This approach coupled with the microeconomic theory of the firm provides firm-specific measurements of efficiency and best practice role models for improving performance.

Week 2: Dynamic Efficiency and Productivity Analysis
The dynamic efficiency course presents nonparametric and introduces some parametric perspectives to measure efficiency and productivity. When addressing dynamic efficiency we need to distinguish between a) tracking efficiency over time (which involves modeling exogenous versus endogenous forces and the impact of covariates/environmental variables on econ performance), and b) persistence which involves identifying the contributions of structural (deterministic) sources and the stochastic sources. The sources of economic dynamics include: i) economic forces (e.g., adjustment cost and financial constraint models), ii) technological characteristics (e.g., physical/biological nature of production, and vintage investment/stock non-convexities like we see with lumpy investment), and iii) cognitive capacity (e.g., learning to adapt to new asset levels).

Course activities
The course consists of theory and method sessions in the morning followed by an afternoon practicum session. The practicum will include applications of the theory, computer analyses 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, electrical 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.

Objective
Participants will learn the theories concerning efficiency and productivity measurement and will develop proficiency with software to facilitate the initiation of their own research in efficiency and productivity measurement. The course deals with both conceptual and methodological issues. 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;
- The input and output perspectives of technical and allocative efficiency;
- Characterizations of efficiency and productivity growth from a primal, dual and distance function perspectives;
- Decomposition of productivity growth that explicitly accounts for the presence of inefficiency;
- Use DEA models to measure technical, allocative, and scale efficiency levels and productivity growth;
- Characterize definitions of variables of interest to be employed (goods and services; inputs, outputs, environmental, nonmarket goods/services);
- Assess the appropriate use of parametric and nonparametric approaches given the data and problem setting (understanding the advantages and disadvantages of both perspectives);
- Use these approaches to articulate the forces driving efficiency gains and productivity growth;
- Use these approaches for benchmarking, identifying best practice and role models to plan for performance enhancement/gains;

The “Dynamic Analysis” course will further cover:
- Delineation of variable and quasi-fixed factors and their treatment in efficiency and productivity (Dynamic Course);
- Use econometric approaches to address efficiency and productivity change measurement over time (Dynamic Course).

**Target Group**
The course is oriented toward faculty members, government agencies, researchers and others with background in agricultural and applied economics.

**Language**
The course will be taught in English.

**Duration**
Two full weeks comprising 2 distinct parts each of which can be taken separately. Each course will involve daily sessions, with a 3-hour theory session in the morning and a 3-hour practicum session in the afternoon.

**Group size**
20-30 participants

**Location:** Universidad Santo Tomas, Ejercito 146. Santiago, Chile.
Morning sessions:
9.30-12.30 Lecture room (to be determined)
Afternoon sessions:
14.0-17.00 Computer room (to be determined)

**Prerequisites:**
Microeconomic theory at the graduate level such as the treatment in H. Varian, Microeconomic Analysis, W.W. Norton. Completion of a course in dynamic optimization is strongly recommended. 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. Both STATA and R applications will be discussed.

**Credits and Examination:**
Each course load is 1.5 ECTS.
Course Materials:
(Parametric and Dynamic Course) Reading materials on dynamic production analysis prepared by the authors will be sent to participants in advance of course.

Participants should make sure they have these books before the course starts (books are not included in participation fee).
Articles and other accompanying materials will be distributed during the course.

Software
Software in the computer lab will be used to solve empirical data sets. (Stata and R will be used)

TIMETABLE AND OUTLINE (see at the end of the document)
Each course will involve daily sessions, with a 3-hour theory session in the morning and a 3-hour practicum session in the afternoon.

Course fee:

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<tr>
<th>Fee</th>
<th>Chilean $</th>
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<tr>
<td>1 week</td>
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<td>2 weeks</td>
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The course fee does not include books. It includes additional training material, coffee / tea, lunches and informal reception.

Registration Procedure:
If you want to register, please send the inscription form attached to: areyes@santotomas.cl

Please make sure you provide the most recent contact details so that in case of any changes you will be notified promptly. After your Internet registration you will receive a short notification that your name has been registered. At least 2 weeks before the course you will receive a confirmation about the location and the schedule.

Registration and payment have to be done before November 30th, 2014.

Further Information
For further information please contact Alvaro Reyes: areyes@santotomas.cl, Phone 56-2-26324701
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<thead>
<tr>
<th>Day</th>
<th>Lecture</th>
<th>Practicum</th>
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| 1   | 1. Introduction  
Cross-Sectional Methods  
- Distribution Free Methods  
- Maximum Likelihood Methods  
Skewness  
- Tests of Skewness  
- The Wrong Skew Problem  
Estimating Firm Specific Inefficiency  
- Confidence Intervals  
- Tests of Correct Distributional Form | Estimation/Inference of Cross-Sectional SF models in R  
Commands and application in Stata |
| 2   | 2. Panel Data Methods  
- Distribution Free Methods  
- Maximum Likelihood Estimation  
- Time Constant Variables  
Measurement of Technical Change | Estimation/Inference of Panel Data SF models in R and Stata |
| 3   | 3. System Methods  
Cost System Issues  
- Input/Output Oriented Inefficiency  
- Fixed Inputs  
- Greene's Problem | System Estimation/Inference of SF models in R and Stata |
| 4   | 4. Determinants of Inefficiency  
- The Scaling Property  
- Mean versus Variance effects  
Alternative SF models (mixture models/ZISF) | Estimation in R and Stata |
| 5   | 5. Non- and semiparametric methods for estimating SF models  
- Kernel Smoothing  
- Semiparametric Production Frontier  
- Deconvolved Technical Inefficiency  
Nonparametric Estimation of the Determinants of Inefficiency | Estimation of Non/semiparametric SF models in R and Stata |
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<th>Day</th>
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<td>Characterizing Dynamic Production and Efficiency</td>
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<td>• Overview (SES)</td>
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<td>• Defining Dynamic Production Possibility Sets (SES)</td>
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<td>• Congestion &amp; Weak Disposability (SES)</td>
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<td>• Dynamic Optimization (SES)</td>
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<td>• Technical Efficiency measures (AOL)</td>
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<td>o Radial &amp; Directional Distance measures</td>
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<td>• Directional distance function (AOL)</td>
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<td>Computational approaches to DEA</td>
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<td>Starting Dynamic DEA</td>
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<td>Commands and application in Stata</td>
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<td>Application: NY Dairy Farm panel; US electric utility firms panel</td>
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<td>2</td>
<td>Representing Dynamic Production Possibilities</td>
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<td>• Input Requirement Set (SES)</td>
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<td>• Measuring the boundaries with DEA (SES)</td>
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<td>• Cost Efficiency (AOL)</td>
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<td>• Duality with the directional input distance function (AOL)</td>
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<td>• Decomposition of cost efficiency (allocative &amp; technical) (AOL)</td>
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<td>• Efficiency of variable and quasi-fixed factors of production (AOL)</td>
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<td>Operationalizing efficiency concept measurement with Dynamic DEA</td>
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<td>Application: Variety of panel data sets.</td>
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<td>Econometric Approaches (SES)</td>
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<td>• Stochastic Frontier Estimation</td>
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<td>• Measuring Cost Efficiency</td>
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<td>• Evolution of Efficiency (basic)</td>
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<td>• Distance Function Estimation</td>
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<td>Parametric estimation of stochastic frontiers, shadow cost function system, using panel data, incorporating time into efficiency component, distance function estimation</td>
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<td>Application: Using panel of dairy farms; electric utility panel</td>
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<td>Productivity Growth (SES/AOL)</td>
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<td>• Defining TFP Growth under dynamic adjustment</td>
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<td>• TFP growth decompositions</td>
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<td>• Parametric Approaches to:</td>
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<td>TFP Growth estimates using econometric estimation of</td>
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<td>□ Dynamic Dual system with efficiency</td>
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<td>□ Dynamic Directional Distance Function with efficiency</td>
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<td>Application: EU country-level panel of food manufacturing</td>
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<td>Returning to more Dynamic DEA estimation</td>
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<td>Some New Directions &amp; Discussion</td>
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<td>New Directions: (SES and AOL)</td>
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<td>• Evolution of Efficiency (advanced)</td>
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<td>• Incorporating real options and dynamic efficiency</td>
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<td>Open Questions (SES and AOL)</td>
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<td>• Structural Modeling vs Technical Modeling</td>
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<td>• Where is the literature going?</td>
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