

Modeling Efficiency in Economics

Methods Workshop: In a 1-day session we will review quantitative methods for modeling efficiency in economics using parametric models, which present special statistical modeling challenges. The course will tackle the estimation of Stochastic Frontier (SF) models for both cross-sectional and panel data. This class of statistical models has become a popular tool for efficiency analysis and a continuous stream of research has produced many reformulations and extensions of the original models, generating a flourishing industry of empirical studies. Our aim is to provide a thoroughly overview of this literature from the early basic models of Battese and Coelli, to the most advanced and complete specifications introduced by Greene.

The theoretical model underpinning the SF assumes that no economic agent can exceed the ideal “frontier” and the deviations from this extreme represent the individual inefficiencies. From the statistical point of view, this idea has been implemented by specifying a regression model characterized by a composite error term in which the classical idiosyncratic disturbance, aimed at capturing measurement errors and any other classical noise, is included together with a one-sided disturbance, which represents inefficiency. Whether cross-sectional or panel data, production or cost frontier, time invariant or varying inefficiency, parametric SF models are usually estimated by likelihood based methods, and the main interest is on making inference about both frontier parameters and inefficiency.

As core aspect of the course, we will carefully present and discuss reasons and opportunities on how to choose among alternative estimation strategies that are sensitive to different types of data, presenting many examples based on existing and well known datasets.

Although the estimation of SF models is already possible using, among others, Stata and LIMDEP canned routines, usually they remain limited as they allow estimating only a restricted range of models, especially in the panel data case. Furthermore, these routines are not able to test some important hypotheses that often remain simply “maintained”. As advancement with respect to standard available routines, this course is based on a new set of commands written for Stata (`sfcross` and `sfpanel`) that cover all major statistical models used in this literature.

This course should be of interest to all those researchers using cost and production micro/macro data in economics, social science and statistics, which wants to improve their expertise in this specific field of quantitative methods. In particular, we would like to highlight that although SFs have been mainly used for micro data, recently its use has been extended also to sector and macro level analyses. Among the many, potential fields of analysis could be *i)* the exploration of macro-variables on firm/region/country technical and allocative efficiency; *ii)* construction of score indicators for country ranking (as the famous WHO health system score indicator developed by Greene); *iii)* the analysis of foreign direct investment and imported capital goods as channels for increased efficiency in less developed countries; *iv)* the role of country education policy in improving efficiency outcomes measured through the PISA indicators.

A basic level of econometrics and micro-economics is required.

Level of difficulty:

Intermediate/High.

Modeling Efficiency in Economics Course description

TOPICS

1. Introduction to the Stochastic Frontier modeling:
 - The economic problem
 - The empirical problem and the choice of distributional assumptions required for the identification of the inefficiency term
 - Computing the efficiency score

2. Cross-sectional models:
 - The standard cross sectional model
 - Dealing with exogenous determinants of inefficiency and heteroschedasticity
 - Estimation and identification problems

3. Panel data models:
 - The standard panel data models: Pitt and Lee (1981) and Schmidt and Sickels (1984)
 - Macro-panel data models
 - Micro-panel data models (Greene, 2005)

We will comment on the strengths, weaknesses and robustness of various empirical models. The course will provide a tool kit of formal methods for understanding which could be the best model to estimate for given a set of data. The application for each section will be based on different datasets referring to different sector of the economy or on simulated data that will enhance the peculiarities of the statistical models presented.

For this course, we will use ad hoc routines written in STATA 11. The Stata 11 programs, a primer on stochastic frontiers (in the format of a STATA Journal Article) and a pdf copy of the slides will be available for consultation.

**Course extension:
Workshops on real data and projects (1 or 2 days)**

The standard 1-day course could be extended with two or more *half-day* workshop sessions during which the instructors could work jointly with researchers in implementing the empirical analysis for specific research projects.

In these sessions each researcher or teamwork will approach the estimation of SFs using real data linked to the specific project. The help will be targeted to suggest the best model and estimation strategy based on the data available and the hypotheses under testing.

Presenters

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