

Measuring eco-efficiency using the Stochastic Frontier Analysis approach

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Abstract

The concept of eco-efficiency has been receiving increasing attention in recent years in the literature on the environmental impact of agricultural activity. Eco-efficiency compares economic results derived from the production of goods and services with aggregate measures of the environmental impacts (or pressures) generated by the production process. As such it is a useful tool for policymakers to check the extent to which producers can maintain their present economic value while reducing the negative environmental impact of production.

In the literature to date, in order to aggregate the various environmental pressures with the aim of constructing an index of eco-efficiency, frontier approaches to eco-efficiency have exclusively used Data Envelopment Analysis (DEA). While DEA has many advantages, it is extremely sensitive to outliers and measurement errors in the data. In this paper we propose to use a Stochastic Frontier Analysis (SFA) approach to measuring eco-efficiency, which has the advantage that it is well-suited to dealing with measurement errors in the data. Moreover, SFA permits an analysis of the potential substitutability between environmental pressures and outliers and can easily be extended to incorporate determinants of eco-efficiency in a one-stage procedure.

We illustrate our simple proposal with some applications using data on environmental pressures for a sample of dairy farms in the northern Spanish region of Asturias. The survey contains information on nutrients balances and greenhouse gas emissions which is used to calculate environmental pressure indicators. Using this data allows us to compare our results with a previous study using the same data with a DEA approach.

Keywords: eco-efficiency, stochastic frontier analysis, dairy farms.

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