Endogenous Bad Outputs and Technical Inefficiency in U.S. Electric Utilities

Mike Tsionas[a] *and Subal C. Kumbhakar*[b]

ABSTRACT

In this paper, we consider a simultaneous modeling of good and bad outputs. We use an input distance function (IDF) with endogenous inputs as well as endogenous bad outputs, which is novel in the literature. Moreover, we model input efficiency to depend on the production of bad outputs which allows us to investigate whether emissions of pollutants (bad outputs) are related to technological performance (technical efficiency). We also model production of each bad output with a spatial structure separately, each depending on production of good outputs, inputs and other exogenous variables. These bad output production functions allow us to estimate both direct and indirect effects of good output on the production of bad outputs, which may be of special interest because they show the cost (to the society) in terms of releasing pollutants to the environment in order to increase production of good outputs. We apply the new technique to a data set on U.S. electric utilities with four bad outputs, three inputs and two good outputs. We used a Bayesian technique to estimate the model which is a system consisting of the input distance function, reduced form equations for each input, dynamics of inefficiency and bad output production technology—separately for each. Empirically, bad outputs are found to affect inefficiency positively. Percentage increases in inefficiency due to a percentage increase in each bad output are found to vary from 0.225% to 0.42%. Energy prices are found to be positively related to inefficiency. From the spatial specifications of bad outputs, we find that the spillover effects of increasing production of good outputs account for the majority of the total effect, indicating that neighborhood effects are more important than own effects. This means, the neighboring utilities played a crucial role indicating "contagion" of practices.

a Montpellier Business School & Lancaster University Management School, LA1 4YX, U.K. E-mail: m.tsionas@montpellier-bs.com.

b Corresponding author. Department of Economics, State University of New York, Binghamton, USA, & Department of Business Administration, Inland School of Business and Social Sciences, Lillehammer, Norway. E-mail: kkar@binghamton.edu.

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