Estimating hospital production functions through flexible regression models

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\textbf{ABSTRACT}

The subject of discussion is health care production functions. The parametric two-factor Cobb–Douglas and transcendental logarithmic (translog) production functions are frequently used. However, empirical and theoretical work has often questioned the validity of the parametric Cobb–Douglas and translog as a model for the production of health care.

The aim of this study is to propose a new flexible form of production function based on Generalized Additive Models (GAMs) and to compare it with the classical approaches, using data from public hospitals in the Spanish Region of Galicia during the period 2002–2008.

\section{1. Background}

Two models are commonly used in the estimation of hospital production function \cite{1}: the Cobb–Douglas model and the transcendental logarithmic (translog) model. Cobb–Douglas has long been popular among economists because it is easy to work with and can explain the substitution between health care inputs. However, empirical and theoretical work has often questioned the validity of the parametric Cobb–Douglas as a model for the production of health care \cite{2,3}.

In comparison with the Cobb–Douglas model, the translog function model has a number of advantages. This model adds the effects of interactions between inputs. The Cobb–Douglas model, in contrast, omits this effect, which is less realistic. Thus, most of the hospital production function studies have used this flexible translog function form \cite{1,3}.

Nevertheless, in some circumstances, parametric models like the Cobb–Douglas or Translog models can be very restrictive. Using these models for estimation and prediction, the functional shape of continuous inputs is “forced” to follow a linear parametric form, which frequently does not fit the data closely.

The relative lack of flexibility of parametric models has led to the development of non-parametric regression techniques based on the broad family of generalized additive models (GAMs; see \cite{4,5}). These techniques do not impose a parametric form on the effects of continuous inputs; instead, they assume only that these effects are additive and reasonably smooth, and can be estimated using a variety of non-parametric local smoothing methods.

This paper studies the use of Additive Models (AMs) to calculate hospitals production functions. The results of the new approach have been compared with the two most popular production functions used in the health care sector, the Cobb–Douglas and the translog models.

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