Random vs. Explained Inefficiency in SFA: The Case of Queensland Hospitals

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Long Abstract

Estimation of (in)efficiency became a popular practice that witnessed applications in virtually any sector of economy over the last few decades. Many different models were deployed for such endeavors, with Stochastic Frontier Analysis (SFA) models dominating the econometric literature. Among the most popular variants of SFA are Aigner et al. (1977), which launched the literature, and Kumbhakar et al. (1991), which pioneered the branch taking account of the (in)efficiency term via the so-called 'environmental variables'. Focusing on these two prominent approaches in SFA, the goal of this article is to try to understand the production inefficiency of public hospitals in Queensland.

Healthcare is an indispensable foundation of a 'healthy society', as it is a solid pillar of both a healthy population and a prosperous economy. Yet, the cost of an effective healthcare system can be incredibly high. The hospital, as the main provider of health services and as a central component of the healthcare system, is naturally a popular subject of study in this context. Evaluating hospital

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efficiency and finding possible ways of improvement have been discussed by many studies in the past decades, along with the development of the efficiency analysis approaches, e.g., the seminal works using DEA by Sherman (1984); Grosskopf and Valdmanis (1987) and those with SFA models by Wagstaff (1989); Zuckerman et al. (1994); Rosko (2001); Street (2003); Brown (2003), and more applications with their derived models, such as Chowdhury and Zelenyuk (2016) with the two-stage double-bootstrap DEA method proposed by Simar and Wilson (2007), and the studies analyzing panel data with SFA models, e.g., Bosmans and Fecher (1995) using Schmidt and Sickles (1984), Colombi et al. (2017) with Colombi et al. (2014), Linna (1998) applying Battese and Coelli (1992), and Herr (2008) with Greene (2005), to mention a few.

Regarding the hospitals in Queensland, Nghiem et al. (2011) evaluated the efficiency change and the influential factors of 35 public hospitals from 1996 to 2004 with Malmquist Productivity Index (MPI) and SFA. Meanwhile, O'Donnell and Nguyen (2013) estimated the efficiency level of 116 Queensland public hospitals during the same period later with a conventional SFA model. More recently, using DEA and partial quantile frontier models, Nguyen and Zelenyuk (2021) estimated the efficiency level of 15 Queensland Hospital and Health Service districts in FY 2016/17. One notable conclusion was that more hospitals in small size and remote area could partially explain the low efficiency level of some districts. It is also worth noting that the nation-wide studies like Gabbitas and Jeffs (2009) from the Australia's Productivity Commission also had some findings specifically for Queensland. Specifically, Gabbitas and Jeffs (2009) indicated that the inefficiency level of the Queensland public hospital system was estimated at about 20 percent, which is one of the highest among the State and Territory in Australia.[1]

To contribute to this interesting literature, in this paper, we aim to understand the efficiency of Queensland public hospitals during FY 2012/13 to FY 2015/16 and try to identify the factors that explain its variation using SFA framework. While there is a myriad of variants of SFA, here we will focus on two seminal works: Aigner et al. (1977) and Kumbhakar et al. (1991), and consider two specifications for each (Cobb-Douglas and Translog). The parsimonious forms of the models

[1] See more details of hospital efficiency analysis in Australia and peer regions in Wang and Zelenyuk (2021).

and specifications are also considered during the model selection process with the AIC and BIC criteria and likelihood ratio tests.

While doing so, we run into a known yet often overlooked phenomenon, where possible dramatic differences (and consequently very different policy implications) can be derived from different models, even within one paradigm of SFA models. This emphasizes the importance of exploring many alternative models, scrutinizing their assumptions, before drawing policy implications, especially when such implications may substantially affect people's lives, as is clearly the case in the hospital sector.

Markedly different results are obtained via different models, yet our main results reveal a 20 to 30 percent inefficiency level of Queensland public hospitals on average. Specifically, the efficiency of Queensland public hospitals shows a high level of divergence. In general, hospitals in larger size, in non-remote areas and with teaching function, tend to perform better than their reference groups, which indicates a scale effect existing in the hospital performance. The better performing hospital groups in the case of Queensland may benefit from their higher occupancy and bed turnover rates, while their efficiency level can be further improved if they could reduce the proportion of inpatient admissions. Accordingly, one of our suggestions is decentralizing the inpatient care from large hospitals to more local hospitals. The small and regional hospitals could then improve their efficiency by increasing the occupancy and turnover rates of beds, while the large major hospitals may also benefit from a moderate proportion of inpatient care.

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