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Multi-product costs and standby capacity derived from queuing theory: the case of Belgian hospitals

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Abstract

Empirical hospital cost function studies can be divided into two categories: studies estimating traditional multi-product cost functions and studies including demand uncertainty (assuming that hospitals provide standby capacity to cope with uncertain demand and stressing that the relationship between the uncertain demand, excess capacity and costs should be investigated). Most studies include (the inverse of) the occupancy rate in a relatively basic cost function. The first contribution of this paper is to incorporate an indicator of reserve capacity into a genuine multi-product cost function. The second contribution is to propose an alternative indicator to proxy the reserve margin. The often used occupancy rate has an important shortcoming: the same occupancy rate can hide different turnaway probabilities and waiting times, obscuring the true degree of reservation quality. Since turnaway probabilities and

waiting times are typical queuing theory indicators, an indicator for average waiting time (derived from queuing theory) is incorporated into a proper multi-product cost function to capture the degree of standby capacity into a proper multi-product cost function. The study uses 1997 data on Belgian general care hospitals to estimate a multi-product cost function and calculate cost elasticities, marginal costs and the degree of economies of scale. The results further show that providing standby capacity has a significant impact on total costs.

Acknowledgements

Notes

The translog functional form for example satisfies this requirement, being a reason for the widespread use of the translog function.

The underlying birth-and-death process is a special type of continuous time Markov chain.

If this assumption is left, calculation of the typical queuing indicators becomes very complicated and it is often not possible to derive exact closed form expressions.

The typical queuing term 'utilization rate' is equivalent to the 'occupancy rate' which was used in the previous sections describing hospital cost function studies that accounted for uncertain demand.

Using L'Hôpital's rule:

Because of the long history of involvement of the Catholic Church in the provision of health care, the majority of hospital care is provided by state-subsidized, not-for-profit

(catholic) private initiative, i.e. most private hospitals are owned by religious charitable orders. The public and the private (not-for-profit) sectors operate in the same market and receive more or less comparable levels of resources.

National Institute for Sickness and Invalidity Insurance.

Although the limited input price variation already suggests it would not promise well, we did estimate a model using cost share equations. However, as it was only to be expected, this generated poor results.

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