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Exploring the spatial pattern in hospital admissions

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Abstract

The determinants for the number of inpatient hospital admissions across Danish municipalities are analysed using balanced panel data from the period 1998–2004. The determinants include socio-demographic variables, home help service, residential homes capacity, proxy variables for morbidity, utilisation of primary care services, accessibility of hospitals and a number of other factors. Panel effects in the form of intra-municipal correlation and heterogeneity across years are controlled for. Spatial spillover effects across municipalities will be investigated in order to disclose the spatial dynamics of hospital admissions. Reverse causalities among the number of hospital admissions and certain health systems characteristics are further controlled for. The results are shown to be highly sensitive to such adjustments, as the effects of determinants – including those over which the municipalities exert some control – are seriously overestimated if such features are ignored.

Keywords: Spatial spillover; Spatial autoregression; Hospitals admissions; Reverse causality

1. Introduction

The growth of public health expenditures is a major topic of policy debates in most Western countries. Following the seminal paper of Newhouse (1977) [1], the study of determinants of health care expenditures has been a matter of extensive debate for more than two decades. This development has been reinforced by the increasing availability of national level data on health care, which has cast a large number of studies considering the effects of underlying factors such as income, demography and time effects [2] and technology progress [1–3]. However, most studies are based on cross-country data and thus fail to account for unobservable institutional factors. Restricting the analysis to a single country may, to an extent, reduce part of this heterogeneity across countries [4–9].

Variation in the utilisation of hospital services, which make up a substantive part of public health expenditures, has been investigated in numerous studies focusing on e.g. the prevalence and incidence of diseases, mixed opinions of the effectiveness of surgery, practice style, health supply resource and differing patient preferences as possible determinants. Medical research has been interested in the study of small area variation (SAV) as an indicator of the effectiveness of a given level of service delivery [10,11]. Economists have studied the same phenomena but have focused on supply factors, supplier induced demand (SID) and inadequate diffusion of medical information

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[12–15]. Studies of the geographical variability of utilisation patterns have focused mostly on the determinants and the consequences of variation in these. However, only a few studies (including [16–18]) have considered to the geographical dynamics of the variation which means that a number of questions are yet to be explored, e.g. is the geographical variation clustered in neighbouring geographical units.

The present study focuses on the variation in the number of inpatient hospital admissions. A number of factors may determine the use of hospital admissions such as socio-demographic variables, morbidity and mortality, availability of primary care services, accessibility of hospitals, etc. These determinants may, however, not be randomly distributed across the geographical units but may have an underlying spatial patterns. A non-random underlying spatial pattern may if ignored bias the significance of the determinants [9,19] and invalidate conclusions. Proper analyses of the spatial dynamics in the variation and its determinants may furthermore enclose important information for policy debates informing policy makers about a more complex pattern of variation partly determined by spatial geographic mechanisms.

Spatial mechanisms may emerge from several sources. Competition and learning effects among spatially clustered municipalities may lead to spatial clustering of health care behaviour, i.e. endogenous spatial spillover may be involved. Furthermore, exogenous spatial spillover may exist. Specifically, observed or unobserved determinants may affect the health care behaviour, not only in the municipality where they are observed, but also in a surrounding cluster of municipalities. Examples of such endogenous spillover readily occur. Provision of services at the regional level which partly induce or prevent hospitalisation may exert influence beyond the regional borderline. Likewise, hospitalisation may be affected by economic, demographic, social, labour market and urbanisation structures of the neighbouring regions. Finally, the very existence of spatial clustering of health care behaviour together with spatial clustering of observed as well as unobserved determinants may lead to spurious regression, in the sense that estimated relationships present themselves as stronger than they really are. At the extreme, variables which are unrelated apart from being independently spatially clustered may in such cases appear to be significantly related. Indeed, it has been shown that not accounting for spatial dynamics will potentially biased and lead to inefficient estimates of the parameters of an equation of public expenditure determination [9,19].

Only a few studies of small-area variation have considered the nature and implications of spatial variation in medical practice. Westert et al. found spatial disparities in hospital discharges [20]. Joines et al. found that hospitalisation rates for low back problems varied significantly across the counties of North Carolina [21]. They also found that counties with similar rates clustered geographically and they concluded that spatial effects are important and should be considered in SAV studies. The studies by Moscone and Knapp [22] and Moscone et al. [23] explored the spatial patterns of mental health expenditure and concluded that it was important to control for spatial spillover. Moscone and Knapp and Moscone et al. found a significant spatial effect suggesting that adjacent local authorities mimic their neighbours and tend to have similar mental health expenditure. Costa-Font and Pons-Novell show in their analysis of the public health care expenditure in the Spanish regions that a significant spatial dependence is present [17].

Yet another stream of studies applies panel data methods to account for potential unobservable differences in tastes and preferences in the health care expenditure function. Some evidence [2,4,5,7] uses various forms of times series cross section analysis, including random or fixed effects specifications. However, only few studies have considered spatial interactions together with the use of panel data in health economics [23,24]. Furthermore, the standard panel data methods applied are quite simplistic and thus fall into one of two caveats by being either heavily over-parameterized (e.g. fixed effects panel data specifications) or very parsimoniously parameterized (e.g. random effects panel data specifications). In-between forms allowing for time decay in intra-regional correlation (for example the seemingly unrelated regression approach) seldom find application. One aim of the present study is to integrate the seemingly unrelated regression approach with spatial spillover specifications in order to provide an investigation of the simultaneous importance of panel effects and spatial effects.

One further aspect relates to the application of health system characteristics as factors explaining variation