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Measuring spatial effects in the presence of institutional constraints: The case of Italian Local Health Authority expenditure[☆]

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ABSTRACT

Over the last decades spatial econometric models have represented a common tool for measuring spillover effects across different geographical entities (counties, provinces, regions or nations). The aim of this paper is to investigate the issue of measuring spatial spillovers in the presence of institutional constraints that can be geographically defined. In these cases, assuming that spatial effects are not affected by the institutional setting may produce biased estimates due to the composition of twodistinct sources of spatial dependence. Our approach is based on redefining the contiguity structure so as to account for the institutional constraints using two different contiguity matrices: the within matrix, which defines contiguity among units obeying the same institutional setting, and the between matrix, which traces spatial linkages among contiguous units across different jurisdictions. This approach allows to disentangle the two sources of spatial correlation and to easily test for the existence of binding institutional constraints. From the econometric perspective, we extend Lacombe (2004) approach to incorporate the aforementioned institutional constraints in a spatial Durbin model with individual specific slopes, while inference is conducted using a two-way cluster robust variance–covariance matrix controlling for both spatial and time correlations. We apply this methodology to analyze spatial dependence of per-capita public health expenditures in Italyat Local Health Authority level using a balanced panel dataset from 2001 to 2005. Our results show robust evidence of a significant and positive spatial coefficient for the within effect, while the between effect, although significant, is very close to zero, thus confirming the importance and validity of the proposed approach.

1. Introduction

It is widely recognized that sample data collected from geographically close entities are not independent, but spatially correlated, which means that observations of closer units tend to be more similar than further ones (Tobler, 1970).[1] Spatial clustering or geographic-based correlation is often observed for economic and socio-demographic variables such as unemployment, crime rates, house prices, per-capita health expenditures and the alike (Sollé Ollé, 2003; Moscone and Knapp, 2005; Revelli, 2005; Sollé Ollé, 2006; Kostov, 2009; Elhorst and Freret, 2009; Elhorst et al., 2010; Moscone et al., 2012). Theoretical models usually recognize the existence of spatial spillover which declines as distance between units increases; empirically these features can be captured by

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[1] It is worth emphasizing that non-spatial structured dependence may also be observed. In these cases, measures of geographical proximity are replaced by measures of similarity allowing to investigate peer effects through social or industrial networks (LeSage and Pace, 2009; Bramoullé et al., 2009).

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means of a weight matrix, attaching higher weights to the nearest neighbors.[2]

The aim of this paper is to investigate the issue of measuring spatial spillovers in the presence of institutional constraints that can be geographically defined. When this occurs, the units of interest may share common borders but obey to different institutional settings. Hence, we expect to observe spatial dependence mainly among neighbors within the same institutional cluster, rather than among neighbors belonging to different clusters. We cast this idea in a theoretical framework where health expenditures of local units are set as a result of a mimicking behavior/yardstick competition among local authorities.

From the econometric perspective, we extend (Lacombe, 2004) approach to incorporate the aforementioned institutional constraints in a Spatial Durbin Model (SDM) with individual specific slopes. Starting from the conventional first-order spatial contiguity matrix,[3] our approach better defines the contiguity structure so as to account for the institutional constraints using two different contiguity matrices: the first one, the within matrix, defines contiguity among units sharing both borders and institutional cluster; the second, the between matrix, traces spatial linkages among contiguous units across different institutional clusters. An important feature of this approach is that it can be directly applied toall those situations where institutional constraints are binding and can be geo-referenced (e.g., Euro membership within the EU, MERCOSUR membership in Latin America or, for example, towns within counties, provinces or regions). This strategy allows us to disentangle the within institutional cluster spatial effect, from the between cluster effect by means of exogenously defined spatial contiguity matrices. Moreover, under the assumption of independence among observational units that do not share common clusters, inference is conducted using a two-way cluster robust variance–covariance matrix, controlling for both spatial and time correlation (Cameron et al., 2011).

We apply this methodology to analyze spatial dependence of per-capita public health expenditures in Italy at Local Health Authority (LHA) level using a balanced panel dataset from 2001 to 2005, a level of analysis never explored before. Given the regional structure of the Italian National Health System (NHS), this case lands itself perfectly to be analyzed through the proposed methodology. Our interest in investigating health expenditures' spatial dependence is due to the relevance of this spendingitem for the Italian National Accounts, especially at regional level.[4]About 70% of the budget for regions with ordinary autonomy and about 40% for those with special autonomy. See the hyperlink "http://www.corteconti.it/export/sites/portalecdc/" "Relazione sulla gestione finanziaria delle regioni, Esercizi 2010–2011" (in Italian).

We find robust evidence of a significant and positive spatial coefficient for the within effect, while the between effect, although significant, is very close to zero. This result confirms the importance and validity of our approach.

The remaining part of this article is organized as follows. Section 2 reviews the related literature. Section 3 briefly describes the institutional setting, discusses the regional and sub-regional health expenditure in Italy and presents some stylized facts. Section 4 briefly sketches our theoretical framework, presents the data and some descriptive statistics, provides the algebraic derivation of the within and between matrices and discuss the economic interpretation of the coefficients involved in our empirical model. Section 6 discusses the empirical findings, highlighting the importance of the institutional setting in explaining spatial correlation across LHAs. Finally, Section 7 offers some concluding remarks.

2. Related literature

This paper finds its roots into the broad literature on spatial econometrics and health care expenditures. To our knowledge the existing literature provides a partial answer to the issue of incorporating institutional constraints into spatial econometric models. (Parent and LeSage, 2008) and (Arbia et al., 2009) have explicitly tackled the problem of "institutionally clustered" data, suggesting the use of a non-conventional spatial weighting matrix which incorporates together distance and "clustering" information. In particular, Parent and LeSage(2008) investigate the pattern of knowledge spillovers arising from patent activity between European regions and tests whether different growth rates are due to differences in technology, transportation costs or geography. Using different specifications of the weighting matrix, the authors model the connectivity structures between regions by relying on technological as well as transportation and geographical proximity. They conclude that a model which combines both geographic and technological proximity and takes into account the asymmetric output gap between contiguous regions fits the data better. Arbia et al.(2009) analyze the growth experiences of European regions, in the period 1991–2004, at NUTS-2 level. In order to take into account institutional differences at national level the authors modify an inverse distance-based spatial matrix using an institutional heterogeneity index based on the linguistic distance between countries. They find that, holding the geographical distance fixed, regions sharing a similar institutional framework tend to converge more rapidly to each other. This implies that institutions play an important role with respect to geographical factors, obtaining further support for the (Rodrik et al., 2004) claim of "primacy of institutions over geography".

Unfortunately, these approaches present practical implementation problems related to the availability of relevant exogenous variables used to appropriately re-weight the distance matrix and to some degree of subjectivity in the selection of these variables. Furthermore, the proposed approach are unable to jointly assess the contribution of the different sources of spatial dependence, since either they are summarized in a single coefficient (Arbia et al., 2009), or they can only be analyzed sequentially (Parent and LeSage, 2008).

Pursuing a different objective, our approach follows (Lacombe, 2004). He studied the effects of Aid to Families with Dependent Children (AFDC) and Food Stamp Payments on female-headed households and female labor-force participation in the US.His goal was to asses the potential bias of different matching techniques meant to reduce the simultaneity bias associated with OLS estimates when latent or unobserved variables vary systematically over geographical regions. He found that OLS estimates of the county effect remain biased even after controlling for potential spatial correlation using different matching techniques and proposes a Spatial Autoregressive Model where the coefficient of within-state and between-state bordering counties are estimated separately. Only recently, Gérard et al.(2010) and Cassette et al.(2012) have recognized the importance of formally taking into account institutional differences in estimating the spatial spillovers, but with a focus on taxes rather than on expenditures.

In terms of health expenditure analysis, the international literature provides plenty of evidence (e.g., Skinner, 2011; Chernew and Newhouse, 2011; Gerdtham and Jonsson, 2000). Italy is not an exception and there is a large body of literature that has explored its determinants, typically at regional level (Levaggi and Zanola, 2003;

[2] Two sources of locational information are generally exploited. First, the location in Cartesian space (e.g., latitude and longitude) is used to compute distances among units. Second, the knowledge of the size and shape of observational units allows the definition of measures of contiguity, e.g., one can determine which units are neighbors in the sense that they share common borders. Thus, the former source points towards the construction of spatial distance matrices while the latter is used to build spatial contiguity matrices. It is worth noting that the aforementioned sources of locational information are not necessarily different. For instance, a spatial contiguity matrix can be constructed by defining units as contiguous when they lie within a certain distance; on the other hand by computing the coordinates of the centroid of each observational unit, approximated spatial distance matrices can be obtained using the distances between centroids. More details are available in (LeSage and Pace, 2009).

[3] Similarly to the time-series framework, spatial contiguity can be extended to higher orders. In spatial contexts the higher order refers to a different contiguity structure based on higher spatial lags. For a detailed discussion see (Anselin, 1988).

[4] About 70% of the budget for Regions with ordinary autonomy and about 40% for those with special autonomy. See the "Relazione sulla gestione _nanziaria delle regioni, Esercizi 2010-2011" (in Italian).

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