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Neighborhood effects in social service provision. Competition or reflection?

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Neighborhood effects in social service provision Competition or reflection?

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Abstract

Expenditures by local governments often exhibit positive spatial auto-correlation. A spatial pattern might arise either from an *endogenous* effect (with local authorities being affected by the average behavior in the neighborhood) or from *exogenous/correlated* effects (with the behavior of close-by authorities simply reflecting common neighborhood characteristics or correlated shocks). In order to identify the underlying spatial process, this paper models the determination of local expenditure on social services within a spatial framework that allows for interdependent local authority behavior and spatially auto-correlated shocks, and performs an empirical analysis on a cross-section of UK local governments. The IV (instrumental variables) and ML (maximum likelihood) estimates of a SAR (spatial auto-regressive) model, as well as the ML estimates of a SARMA (spatial auto-regressive moving average) model suggest that the most likely source of spatial auto-correlation in social spending is endogenous mimicking among neighboring localities.

JEL classification: C31; H72.
Key words: social services; externalities; spatial auto-correlation.

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†preliminary; comments welcome.

1 Introduction

The past decade has witnessed an increasing interest in the spatial features of local government data, with a considerable number of papers testing whether local governments interact with their neighbors in the setting of tax rates,[1] expenditure levels,[2] and standards and regulatory measures.[3]

In particular, a recent strand of the applied public economics literature has explored the issue of "welfare competition,"[4] whereby in a decentralised system of welfare, local jurisdictions might compete with their neighbors to attract wealthy households and repel potential welfare recipients. In the presence of taxpayers' and welfare recipients' mobility, local jurisdiction choices would be interdependent, in the sense that a local authority might look at its neighbors' benefit levels before setting its own - to avoid becoming a "welfare magnet" - and would respond to the policies enacted by its neighbors. Consequently, one should observe that close-by localities' policies tend to be correlated. Moreover, as each jurisdiction acting in isolation does not take into account the externality it generates on the other jurisdictions when setting its own policy, decentralised welfare systems would be unstable and would lead to socially inefficient outcomes, in the sense that the benefit level is too low compared to the socially optimal one - the "race to the bottom" (Brueckner [11]).

However, it is well known that the observation that units belonging to the same area tend to behave similarly, or appear to be affected by the average behavior in their neighborhood, cannot be taken as evidence of strategic behavior. Suppose for instance that one observes that local welfare expen-

[1] Ladd [24], Besley and Case [5], Heyndels and Vuchelen [20], Brett and Pinkse [9], Brueckner and Saavedra [13], Buettner [14], Revelli [30], [31], Bordignon et al. [8].

[2] Case et al. [16], Kelejian and Robinson [23], Murdoch et al. [26], Bivand and Szymanski [6], [7], Revelli [32], [33].

[3] Brueckner [10]; Fredriksson and Millimet [18], [19].

[4] Smith [36], Shroder [35], Smith [37], Brueckner [11], Peterson et al. [28], Figlio et al. [17], Saavedra [34], Wheaton [38].

ditures exhibit positive spatial auto-correlation, in the sense that close-by localities tend to behave more similarly than far away ones in setting benefit levels. Actually, such spatial pattern might arise - following the Manski [25] terminology - from either of the following three sources.

The first is the presence of a really *endogenous effect*: the behaviour of a local authority tends to be affected by the average behavior in the neighborhood.

The second is an *exogenous* or *contextual effect*: even if local jurisdictions do not interact in any substantive sense, welfare expenditures of localities belonging to the same area tend to be correlated because of some exogenous characteristics *of the neighborhood* that affect welfare policy.[5]

The third potential source of spatial auto-correlation is the presence of *correlated effects*, meaning that some (unobservable) characteristics *of the jurisdiction* that affect the variable of interest tend to be correlated for close-by localities.[6]

As the policy implications of endogenous vs. exogenous effects are different, it is important to set up a proper theoretical and empirical framework in order to provide the conditions for identifying the underlying effect driving spatial auto-correlation.

The existing empirical literature on decentralised setting of welfare policies typically uses US state data and relies on the "race to the bottom" notion. It usually tests for inter-state competition by estimating a reduced-form reaction function where the benefit level (AFDC) in a state is related to a weighted average of neighboring states' benefit levels.[7]

[5]This is the effect that Revelli [33] finds to be predominant in the UK two-tiered structure of local government in non-metropolitan areas, where the lower tier authorities (districts) react in a similar fashion to upper tier authority policies (counties) due to a vertical fiscal externality, giving the impression of horizontal interaction.

[6]The presence of spatially auto-correlated shocks to local expenditure, for instance, creates a spatial pattern, while no substantive interaction is going on.

[7]Shroder [35] is an exception, in that he estimates a structural model including a benefit setting equation and a recipiency ratio determination equation. Brueckner [11] reviews the empirical welfare competition literature.

As far as EU countries are concerned, it is rarely the case that welfare policies are set in a decentralised way, with most redistributive policies being set at the national level. Moreover, the increasing degree of labour mobility across national boundaries has raised the issue of whether even national redistribution system can be sustainable (Oates [27]).

However, in several instances do local authorities provide a wide array of "personal social services" that strongly affect the well-being of the poor. In the UK, while the bulk of welfare policies is decided at the national level based on uniform national standards (minimum income guarantee, jobseeker's allowance and housing benefits), still local authorities devote a reasonably large share of total revenues to social public spending, in terms of care and assistance to the elderly, help to families and children with social needs, as well as a number of services to people with disabilities and health needs. In financial year 2000/2001, English local authorities spent above £10 billion (around $15 billion) on personal social services, corresponding to about 20% of total local spending, and amounting to almost half of expenditure on education (which is the major responsibility of English local government). While most of the above social services do not typically take the form of a money transfer to the poor, still they mainly benefit low-income households, in that the need for such social services tends to be highly correlated with income deprivation.

The striking feature of local spending on personal social services in the UK is that it shows substantial positive spatial auto-correlation. For instance, the classical measure of spatial dependence, the Moran statistic (Anselin [2]), definitely rejects the hypothesis that the location of an authority does not affect its social service provision policy.[8] When computed on a raw measure of social service provision across 146 English local authorities (the level of social expenditure per beneficiary), the Moran test yields a value of 0.68, with

[8]The Moran test is a sort of spatial Durbin-Watson statistic that represents a measure of the similarity in value (covariance) and association in space (contiguity). It is asymptotically normally distributed under the null hypothesis of absence of spatial auto-correlation (Anselin [2]).

a standard normal value of 16.8, meaning that one can confidently reject the null of no spatial auto-correlation. Even after controlling for a set of local indicators of needs and preferences that may be responsible for the observed spatial pattern (see the empirical section below), the Moran test on the OLS regression residuals rejects the null of no spatial auto-correlation at above the 99% level of confidence.

One could consequently wonder whether the spatial pattern in social service provision is simply the result of omitted neighborhood variables and spatially auto-correlated shocks (an *exogenous* effect), or is instead the outcome of some form of competition among local jurisdictions (an *endogenous* effect).

However, one could argue that the nature of the social services that UK local authorities provide makes the relevance of welfare competition dubious. In fact, the mobility of the beneficiaries of UK personal social services - both the one that actually occurs and the one that is perceived by local policy-makers - is likely to be rather low, virtually ruling out the race to the bottom hypothesis.

On the other hand, an endogenous neighborhood effect might arise from the existence of an "informational" externality, even in the absence of any "resource" flow (welfare-induced migration). As information flows across near-by jurisdictions, the demand for public services in a jurisdiction might depend on the level of those services in neighboring jurisdictions, due to some sort of interdependent preferences (Pollak [29]). If local preferences really are interdependent - in the sense that the demand for a service in a jurisdiction depends on how much of that service is consumed in the neighborhood - then incumbent local governments might be forced to follow the spending pattern that prevails in the neighborhood. Hence a sort of "copy-catting" behavior that would emerge among local authorities trying to keep up with their neighbors.

Various forms of this idea - usually in a framework of asymmetric in-

formation between poorly informed taxpayers and opportunistic politicians - constitute the underpinnings of recently developed yardstick competition models.[9] However, the notion that the demand for public services might be affected by the consumption of such services in the neighborhood has not been applied before to the study of decentralised social service provision.

Moreover, the hypothesis of the relevance of this sort of competition is reinforced in the UK local government context by the fact that the Department of Health (DoH) has recently set up a Personal Social Services (PSS) Performance Assessment System. The objective of the system is to assess the performance of each council with social service responsibilities, and in particular "to ensure that social care issues are properly addressed, to promote good practice and to identify councils that are performing poorly and ensure that they take action to improve" (DoH, PSS Performance Assessment System).[10] A statistical overview of the performance and rating of each council - the "performance star rating" - is published every year, starting from May 2002. The rationale for publishing such rating is spelled out clearly by the Social Services Inspectorate:

"The ratings are intended to improve public information about the current performance of services, and the prospects for improvement at local, regional, and national levels. Social services have wide responsibilities for the care and support of families in difficulty, and the protection of children at risk of harm: for helping older people to live as independently as possible, and for supporting people with disabilities. People have a right to know how well their councils are performing in meeting these responsibilities, whether they are receiving such services themselves, have a family member receiving such services, or are a council tax payer. Central government needs to know how well each council is meeting the aims and objectives for improvement it

[9]Empirical analyses based on yardstick competition models are Besley and Case [5], Bivand and Szymanski [6], [7], Revelli [31], and Bordignon et al. [8].

[10]http://www.doh.gov.uk/scg/pssperform/system.htm

has set for social services."[11]

Consequently, it is not unreasonable to think that the observed spatial auto-correlation in social service provision can be the result of some sort of competition arising from performance comparisons.

The rest of the paper is organised as follows. Section 2 presents a model for the determination of local spending on personal social services that allows for local interdependence and spatial effects, and section 3 discusses the econometric issues involved in empirically implementing it. Section 4 presents the estimation results, based on a data set for the 146 UK local governments that provide social services - single-tier authorities, and upper tier authorities in two-tiered non-metropolitan areas of England - in financial year 2000/2001. Finally, section 5 concludes.

2 A model of social service provision

2.1 Model set-up

Consider a set of N local jurisdictions. In each jurisdiction i live g_i identical individuals that have zero income and own no property, and h_i identical individuals earning exogenously given income q_i and owning property of value b_i. Total population in the jurisdiction is: $p_i = g_i + h_i$.

The government in each jurisdiction is in charge of providing social services.[12] The g_i non-taxpayers directly benefit from local public expenditures on social services, that are funded by the property taxes paid by the h_i taxpayers. The government is assumed to maximise the utility of the representative taxpayer, that also depends on the level of social services provided

[11] Social Services Inspectorate, Department of Health, *Performance Ratings for Social Services in England, 2001-2002* (May 2002).

[12] At this point, we do not need to be precise about what social expenditure corresponds to. It could take the form of a subsidy or money transfer to the poor (a welfare benefit as the AFDC in the US), or it could represent free provision of, say, education, health or accommodation.

to the poor. While it is reasonable to think that taxpayers are the majority of the resident population, and do not directly benefit from social spending (but rather pay its cost), still there are a number of reasons why they could favour social expenditure - for instance because they see it as a local public good and believe it increases social cohesion in the jurisdiction and reduces potential threats to their property.[13]

Consequently, the representative taxpayer's utility depends on her own private consumption - that we denote by y_i - and on the indirect benefits she receives from social expenditure (z_i), as well as on a vector of J individual characteristics ($\mathbf{c}_i$):

$$u_i = u(y_i, z_i; \mathbf{c}_i) \tag{1}$$

Per capita private consumption of taxpayers equals income q_i (net of national taxes and contributions) - that will be considered exogenous throughout the model - minus the local taxes each of them pays to fund local public expenditure. In their turn, local taxes are raised on residential property b_i at the rate t_i. Denoting by x_i and m_i the level of per capita social expenditures and per capita (lump-sum) central government grants, and assuming a local government balanced budget constraint, the taxpayer's budget constraint can be expressed as:[14]

$$y_i = q_i - \tau_i(x_i - m_i) \tag{2}$$

where: $\tau_i = \frac{b_i}{b_i^a}$ is the tax price of local public spending on social services for the representative individual, and b_i^a is the average property tax base in the jurisdiction (property tax base divided by the total number of residents). Since the tax base is - as income - uniformly distributed among the h_i income-earners, the tax price of social expenditure can be expressed as: $\tau_i = \frac{p_i}{h_i}$.

[13] For a discussion of those theories, see Smith [37].

[14] The hypotheses of balanced budget and lump-sum grants reflect the institutional features of the UK system.

We need to specify the link between social expenditures and the benefits the representative taxpayer gets from them. To a large extent, such relationship is determined by the nature of the good being provided, that is on its degree of "publicness." For the moment, we adopt a fairly general specification, according to which the benefit a taxpayer gets from the existence of a local system of welfare depends on total social expenditure (X_i) and on the number of beneficiaries of such expenditure (g_i) in the following way:

$$z_i = \frac{X_i}{g_i^{\sigma}} = s_i g_i^{1-\sigma} \tag{3}$$

where s_i is expenditure on social services divided by the number of beneficiaries (the poor residents g_i), and σ represents the degree of congestion in the consumption of social services. If $\sigma = 1$, social services are perceived as a pure private good (as in the classical case of a welfare benefit). On the other hand, if $\sigma = 0$, the representative taxpayer sees local welfare as a pure public good and only cares about the total amount that is spent on social services ($X_i = s_i g_i$).

2.2 The derivation of a demand equation

Given equations (2) and (3) above, the individual budget constraint can be re-written as:

$$y_i = \widetilde{q}_i - \widetilde{\tau}_i z_i \tag{4}$$

where: $\widetilde{q}_i = q_i + \tau_i m_i$ is residual income including central government grants, and $\widetilde{\tau}_i = \frac{g_i^{\sigma}}{h_i}$ is the price of social services to the taxpayer, and is given by the ratio of direct beneficiaries (weighted by the congestion parameter σ) to taxpayers. In the standard case of $\sigma = 1$, it equals the usual recipiency ratio: $r_i = \frac{g_i}{h_i}$ (Shroder [35]).

The local government maximises the utility function of the representative individual, subject to the budget constraint. This yields a demand function

for social services (z_i). Following the common practice in applied local public economics, the demand function for z_i can be written in log-linear form as:

$$z_i = \prod_{j=1}^{J} c_{ij}^{\alpha_j} \tilde{q}_i^{\lambda_q} \tilde{\tau}_i^{\lambda_\tau} e^{\varepsilon_i} \tag{5}$$

where λ_q is the income elasticity, λ_τ is the price (recipiency ratio) elasticity, and ε_i is a random term.

Using the definition of $\tilde{\tau}_i$ and the relationship between z_i and s_i, and taking logarithms, the optimal level of social spending per beneficiary equals:

$$\ln(s_i) = \sum_{j=1}^{J} \alpha_j \ln(c_{ij}) + \lambda_q \ln(\tilde{q}_i) - \lambda_\tau \ln(h_i) + [\sigma(1+\lambda_\tau) - 1] \ln(g_i) + \varepsilon_i \tag{6}$$

If the number of taxpayers and poor were exogenous - i.e., if they were determined only by local conditions and not by welfare policies - one could simply estimate the above equation by OLS. In particular, if σ were equal to 1, it could be expressed as:

$$\ln(s_i) = \sum_{j=1}^{J} \alpha_j \ln(c_{ij}) + \lambda_q \ln(\tilde{q}_i) + \lambda_\tau \ln(r_i) + \varepsilon_i \tag{7}$$

However, the above equation might be mis-specified for the following reasons. First, in the presence of mobile welfare recipients (and taxpayers), own and neighboring jurisdictions' welfare policies might affect the recipiency ratio r_i. Consequently, as the recipiency ratio in jurisdiction i would then be endogenous, a system of simultaneous equations is required. Second, even in the absence of welfare recipients' or taxpayers' mobility, there could be an informational spill-over that makes local choices interdependent. The next section introduces and formalises these concepts.

2.3 Local interaction in social policy making

In the presence of heterogeneous welfare systems at the local level, it might be the case that potential welfare recipients move across jurisdictions in order

to enjoy better social services. Actually, the presumption that the residential choice can be affected by the level of welfare benefits has spurred a large theoretical and an increasing empirical literature on welfare competition and the risk of a race to the bottom (Brueckner [11]). In the presence of welfare recipient mobility, the number and proportion of welfare recipients in jurisdiction i would not be exogenous.

In particular, and maintaining the assumption that $\sigma = 1$, the recipiency ratio in jurisdiction i will depend - apart from a number of relevant and exogenous characteristics of the jurisdiction that define a sort of "natural" recipiency ratio (r_i^*) - on social policy in jurisdiction i (s_i) and on a measure of social policy in nearby jurisdictions.

Following the spatial econometrics literature (Anselin [2]) as well as the recent empirical works on local strategic interaction (Brueckner [12]), assume that the latter takes the form of a spatially weighted average of neighboring jurisdictions' expenditures, with non-stochastic weights w_{in} for jurisdictions i and n ($i = 1, ..., N$, $n = 1, ..., N$), $w_{in} > 0$ for adjacent (border sharing) jurisdictions and zero otherwise, and $w_{ii} = 0$. Using again a log-linear specification, the recipiency ratio can be expressed as:

$$r_i = r_i^* s_i^{\gamma_s} (\prod_n s_n^{w_{in}})^{\gamma_{-s}} \tag{8}$$

which, after taking logarithms, is an expression similar to equation (13) in Shroder [35].

Replacing the expression for the recipiency ratio in the demand equation (7), one obtains a sort of reduced form reaction function that is commonly estimated in the empirical welfare competition literature:[15]

$$\ln(s_i) = \sum_{j=1}^{J} \beta_j \ln(c_{ij}) + \beta_q \ln(\widetilde{q}_i) + \beta_\tau \ln(r_i^*) + \beta_{-s} [\sum_{n=1}^{N} w_{in} \ln(s_n)] + \varepsilon_i \tag{9}$$

where:

[15] See for instance Saavedra [34].

$$\beta_j = \frac{\alpha_j}{1-\lambda_\tau \gamma_s}; \beta_q = \frac{\lambda_q}{1-\lambda_\tau \gamma_s}; \beta_\tau = \frac{\lambda_\tau}{1-\lambda_\tau \gamma_s}; \beta_{-s} = \frac{\lambda_\tau \gamma_{-s}}{1-\lambda_\tau \gamma_s} \qquad (10)$$

However, as argued above, the institutional features of the UK system of local government make the welfare competition hypothesis not very likely to be important.

An alternative mechanism that produces interdependence in local choices is the presence of an informational externality, whereby the demand for welfare services in a jurisdiction is affected by the level of welfare services in the neighborhood - an hypothesis that has seen applications in consumer demand theory (Alessie and Kapteyn [1], Case [15]).

Following Alessie and Kapteyn [1], the informational spill-over can be introduced in equation (7) in a simple way, by positing that: $c_{i1} = \prod_n s_n^{w_{in}}$. Assuming that $\sigma = 1$ and that the recipiency ratio is exogenous, the demand equation (7) can be expressed as:

$$\ln(s_i) = \sum_{j=2}^{J} \alpha_j \ln(c_{ij}) + \lambda_q \ln(\tilde{q}_i) + \lambda_\tau \ln(r_i) + \alpha_1 [\sum_{n=1}^{N} w_{in} \ln(s_n)] + \varepsilon_i \qquad (11)$$

3 Empirical implementation

Suppose that one wants to estimate a reaction function such as equation (11), where spending on social services in a jurisdiction depends on neighboring jurisdictions' spending. Clearly, standard methods (OLS) are biased because own and neighbors' spending levels are determined simultaneously, and any influence is bound to be reciprocal.

The literature offers two approaches for estimating a spatial reaction function. The first one is based on an IV (instrumental variables) principle (Kelejian and Robinson [23], Kelejian and Prucha [21], [22]). The basic idea underlying the above methods is that one needs to find variables that are correlated with neighbors' endogenous variable, while not being correlated

with the error term in the own equation. Neighbors' exogenous variables clearly are the most natural candidates. IV methods are being increasingly used in applied work, due to computational simplicity.[16]

The second approach - the standard one in the spatial econometrics literature (Anselin [2]) - is based on a ML (maximum likelihood) principle and is more demanding in terms of computational effort involved.

This paper adopts an encompassing approach, in that it shows estimates of a reaction function deriving from the interdependence hypothesis, that are based on IV as well as on ML principles. Moreover, it shows estimates of a model that allows both for a spatial process in the error term (correlated effects) and for a behavioral interaction process in the endogenous variable.

To see how estimation is carried out, consider equations (12)-(13) below, that are expressed in matrix form. All variables, unless otherwise indicated, are in logarithm. The $(N \times 1)$ vector of error terms $\boldsymbol{\varepsilon}$ is assumed to have a spatial moving average structure with spatial parameter ρ, with $|\rho| < 1$. $\mathbf{W}$ is the row-standardised $(N \times N)$ matrix of spatial weights w_{in} that, when premultiplied by the relevant vector, yields a spatially weighted average of the variable of interest; $\boldsymbol{\eta}$ is a $(N \times 1)$ vector of innovations, $\mathbf{C}$ is a $(N \times (J-1))$ matrix of exogenous variables, $\boldsymbol{\alpha}_{-1}$ is a $((J-1) \times 1)$ vector of parameters to be estimated, and $\tilde{\mathbf{q}}$ and $\mathbf{r}$ are $(N \times 1)$ vectors.

$$\mathbf{s} = \mathbf{C}\boldsymbol{\alpha}_{-1} + \lambda_q \tilde{\mathbf{q}} + \lambda_\tau \mathbf{r} + \alpha_1 \mathbf{W}\mathbf{s} + \boldsymbol{\varepsilon} \tag{12}$$

$$\boldsymbol{\varepsilon} = \rho \mathbf{W}\boldsymbol{\eta} + \boldsymbol{\eta} \tag{13}$$

An alternative specification for the error term is a spatial autoregressive process with parameter κ ($|\kappa| < 1$):

$$\boldsymbol{\varepsilon} = \kappa \mathbf{W}\boldsymbol{\varepsilon} + \boldsymbol{\xi} \tag{14}$$

[16] Recent examples are Figlio et al. [17], Buettner [14], and Fredriksson and Millimet [18], [19].

The well-known econometric problem that arises in the estimation of the above model consists in separately identifying parameter α_1, expressing an endogenous effect, and parameter ρ (or κ), expressing correlated effects. Such identification problem is due to the fact that the two processes tend to mimic each other. In other words, a spatial process in the error term might be mistaken for an endogenous effect.

In particular, an identification problem arises in a model that has a first-order spatial auto-regressive process in the dependent variable - equation (12) - with spatially auto-correlated error terms - equation (14) - when the spatial matrices $\mathbf{W}$ driving the spatial processes in the dependent variable and the errors are the same.[17]

There are two ways to identify a model with a spatially lagged dependent variable and a spatial process in the error term. The first one consists in imposing different spatial structures on the error terms and on the dependent variable - i.e., using different spatial weights matrices to describe the two processes (Anselin [2]). The second one consists in specifying a spatial auto-regressive (AR) process in the dependent variable, while allowing for a spatial moving average (MA) process in the unobservable component, that is to use a SARMA model (Anselin and Florax [3]) - equations (12) and (13) above.

The first option is somewhat disappointing, in that it basically means that one can only discriminate actual strategic interaction from common shocks if the two processes have different spatial structures. The second one, on the other hand, has the advantage of keeping the same spatial weights matrix, while modelling a simple spatial process in the error term. Consequently, the latter option is pursued in this paper.

Some recent literature on local strategic interaction - starting from Case et al. [16] - argues that in several instances local jurisdictions might regard as neighbors other jurisdictions that, while not being geographically close, share some common characteristics such as population size, income level or

[17] See in particular the discussion in Anselin [2], chapter VII, pp. 87-88.

demographic composition. The idea is that localities that are more similar may have more effect on each other than dissimilar localities that happen to share a border. However, inference on endogenous effects is not possible unless one has some a priori knowledge on neighborhood composition (Manski [25]). Consequently, I start from the observation that social policies in the UK local government system exhibit a spatial pattern, and try to identify the source of the spatial process - endogenous effects vs. exogenous/correlated effects - while no attempt is made to identify "neighborhoods" that may group localities according to criteria other than geographical location.

The empirical analysis proceeds as follows. First, I present the results of a number of spatial tests that have been developed within the spatial econometrics literature and that, while requiring only the OLS residuals of a non-spatial model, should point towards the most likely source of spatial dependence. Second, I estimate by ML reaction functions with spatial processes in the dependent variable and in the error term separately, and compare their respective likelihood in order to learn about their relative importance. Third, I estimate by IV the model with a spatially lagged dependent variable. If the instruments for neighbors' policies are chosen accurately, the spatial correlation that is identified through parameter α_1 should not be affected by potential auto-correlation in the unobservables. Finally, I estimate the complete SARMA model given by equations (12)-(13) by ML methods.

4 Data and estimation results

The social spending reaction function is estimated on a cross-section of 146 local authorities in England in financial year 2000/2001. The data set includes all English authorities providing personal social services, namely: 32 boroughs of the London metropolitan area, 36 metropolitan districts of the other five metropolitan areas, 44 non metropolitan unitary authorities, and 34 non metropolitan upper tier authorities (counties) in two-tier areas (de-

scriptive statistics and data sources of all the variables used in the analysis are reported in table 1).[18]

Ideally, the dependent variable should capture the performance of the local social service system. A reasonable approximation is represented by total expenditure on personal social services by a local authority, divided by the number of beneficiaries of such services. As the size of the beneficiaries of such services depends not only on the number of users, but also on the intensity of use, we chose to use the number of income deprived residents as a measure of users.[19]

The explanatory variables include the level of standard spending assessed by central government (SSA) based on observed spending needs (divided by the number of beneficiaries),[20] the residential property tax base per capita as a proxy for income (income data not being available at the local level), size and density of population to account for structural differences across localities, and the percentages of old and young residents over total population as a measure of tastes and preferences for social spending.[21] The recipiency ratio, that is considered exogenous in the empirical analysis, is computed as the ratio of income deprived people to taxpayers.

Finally, the equation includes four dummies according to the type of authority, as described above (London boroughs, metropolitan districts, unitary authorities, counties). Including the authority type dummies is important, in that it guarantees that any spatial dependence that may arise after

[18]The 146 authorities cover the whole of England, and do not overlap in social service provision.

[19]One theoretical possibility consists in using the DoH performance star ratings as the dependent variable. However, the star ratings summarise the Social Services Inspectorate's independent judgements of performance across all social services, on a scale of zero stars (10 authorities in 2002) to three stars (8 authorities in 2002). Consequently, a lot of information concerning the allocation of resources to social services - which is the very behavior we are interested in studying - would be lost.

[20]As central government uses SSA to compute the grant to be distributed to local authorities, it turns out that SSA and grant are almost perfectly linearly correlated.

[21]Clearly, the latter two variables might also be picking up a "needs" effect. However, central governmnet takes account of the demographic structure when computing the SSA.

controlling for authority type cannot be attributed simply to the fact that neighboring authorities are similar from an institutional or contextual point of view.

The results of the spatial tests are shown in the lower panels of tables 2 and 3. The Moran test and LM tests are based on the OLS residuals of a non-spatial model. Table 2 in particular shows the LM tests for an alternative hypothesis of a spatial lag, while table 3 shows the LM test results for an alternative hypothesis of a spatial process in the error term.[22] The robust LM tests developed by Anselin et al. [4] definitely suggest that a spatial lag in the dependent variable is the most likely source of spatial dependence (the $\chi^2(1)$ value at $p = 0.99$ is 6.63).[23] The same results are obtained by the likelihood ratio tests,[24] that are always higher for the spatial lag specification.

The estimation results in tables 2 and 3 show strong and significant positive effects of SSA and income on social spending (grant elasticity ranging from 0.58 to 0.62, and income elasticity ranging from 0.21 to 0.37, depending on the specification). The demographic variables do not have a significant impact, except for a positive effect of density of population. The recipiency ratio has a highly significant negative effect, with an elasticity (a price elasticity) ranging from -0.15 to -0.21.

Finally, the estimates of the crucial spatial parameters invariably point to the same result. The ML estimate of the auto-regressive coefficient α_1 in the spatial lag model is positive and highly statistically significant. Moreover, it is, as expected, slightly lower than the OLS one (since OLS does not take into account the simultaneity of own and neighbors' decisions), and very close to

[22] Lhe LM tests for auto-regressive and moving average errors are identical - Anselin and Florax [3]

[23] Unlike the traditional LM test for a spatial lag, the test developed by Anselin et al. [4] is robust to local misspecification in the form of a spatial moving average error. Similarly, the adjusted LM test for spatial autoregressive (and spatial moving average) errors is robust to local misspecification in the form of a spatial lag.

[24] Twice the difference between the log-likelihoods of the restricted and unrestricted models is distributed as a χ^2 with degrees of freedom equal to the number of restrictions (number of spatial parameters set to zero).

the IV one.[25] The spatial error models lead to estimates of parameters κ and ρ that are positive and statistically significant. However, with respect to the spatial lag model the likelihood is lower, and the robust LM tests definitely suggest that the omitted spatial process is a spatial lag of the dependent variable (robust LM test for spatial errors = 0.01; robust LM test for spatial lag = 7.96).

Moreover, when the SARMA model is estimated, α_1 again turns out to be positive and significant - an elasticity of own spending with respect to neighbors' spending of about 0.20 - while the coefficient measuring spatial dependence in the residuals (ρ) is not estimated to be significantly different from zero.

We can consequently conclude from the above evidence that the observed spatial pattern in social service provision does indeed appear to arise from an endogenous effect (substantive interaction among close-by communities), and cannot simply be explained by correlated unobservable effects.

5 Concluding remarks

This paper has set up a model of social service provision that allows both for the possibility of mimicking among neighboring jurisdictions, and for the presence of spatially auto-correlated shocks. Both processes would yield the observed spatial dependence in the provision of social services by UK local governments.

The spatial test results, as well as both the ML and the IV estimates, suggest that the most likely source of spatial dependence is a substantive interaction process, by which jurisdictions tend to mimic the behavior of their neighbors. In particular, the IV and ML estimates of the spatially

[25] The IV estimates in table 2 use neighbors' SSA as an instrument for neighbors' spending. Including further instruments from the matrix of neighbors' exogenous variables (**WC**, $\mathbf{W}\tilde{\mathbf{q}}$, **Wr**) leads to similar results.

auto-regressive coefficient on the lagged dependent variable yield roughly the same elasticity value of 0.20. Moreover, the estimate of the same parameter from a model that also allows for a moving average process in the error term yields again an elasticity of about 0.20, while the spatial dependence in the residuals - which would represent evidence of auto-correlated shocks to social service provision - is estimated to be not significantly different from zero.

We can consequently conclude that the observed spatial pattern cannot be attributed to correlated effects, but seems instead to be the result of an endogenous neighborhood effect.

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Table 1 Descriptive statistics

	obs.	mean	std. dev.	min	max	source
SSA	146	839.38	221.80	433.06	1634.28	CIPFA
income proxy	146	340.85	53.48	246.53	543.53	CIPFA
population density	146	24.33	26.22	0.6	133.2	CIPFA
population	146	338125	251978	36000	1332000	CIPFA
% old	146	7.05	1.50	4.3	12.7	CIPFA
% young	146	14.04	1.27	9.1	17.6	CIPFA
recipiency ratio	146	0.32	0.15	0.07	0.79	DETR

Notes

1) CIPFA: Chartered Institute of Public Finance and Accountancy, London (2000/2001);

2) UK DETR: Department of the Environment, Transport, and the Regions, UK Government, London (2000/2001).

Table 2 Spatial lag models

	AR lag		
	OLS	IV	ML
London borough dummy	0.704 (0.68)	0.733 (0.71)	0.602 (0.61)
Metropolitan district dummy	0.673 (0.54)	0.703 (0.55)	0.577 (0.48)
Unitary authority dummy	0.653 (1.41)	0.682 (1.42)	0.558 (1.29)
County dummy	0.671 (0.83)	0.697)(0.83)	0.573 (0.78)
SSA	0.577 (6.20)	0.581 (6.23)	0.614 (7.04)
income	0.219 (1.62)	0.225 (1.66)	0.233 (1.80)
population density	0.029 (2.11)	0.030 (2.18)	0.028 (2.11)
population	-0.022 (-0.95)	-0.021 (-0.92)	-0.022 (-0.98)
% old	-0.067 (-1.37)	-0.070 (-1.43)	-0.074 (-1.58)
% young	-0.102 (-0.83)	-0.099 (-0.81)	-0.058 (-0.51)
recipiency ratio	-0.210 (-4.21)	-0.212 (-4.25)	-0.148 (-4.14)
α_1	0.195 (3.07)	0.180 (2.74)	0.185 (3.13)
Moran I test - z value	2.12		
LM test lag - $\chi^2_{[1]}$			9.59
robust LM test lag - $\chi^2_{[1]}$			7.96
LR test - $\chi^2_{[1]}$			9.42
Observations	146	146	146

Notes

1) dependent variable: log(social spending per beneficiary);

2) t statistics in parentheses;

3) α_1=auto-regressive coefficient on spatially lagged dependent variable.

Table 3 Spatial error models

	AR error	MA error	SARMA
	ML	ML	ML
London borough dummy	1.137 (1.07)	1.067 (1.02)	0.471 (0.48)
Metropolitan district dummy	1.089 (0.81)	1.015 (0.88)	0.450 (0.41)
Unitary authority dummy	1.080 (1.55)	1.006 (1.63)	0.427 (1.29)
County dummy	1.076 (1.54)	0.997 (1.80)	0.444 (0.74)
SSA	0.589 (6.42)	0.601 (6.75)	0.624 (6.74)
income	0.365 (2.63)	0.364 (2.61)	0.212 (1.45)
population density	0.041 (3.05)	0.042 (3.10)	0.026 (1.87)
population	-0.011 (-0.47)	-0.010 (-0.44)	-0.024 (-1.02)
% old	-0.055 (-0.91)	-0.064 (-1.12)	-0.081 (-1.54)
% young	-0.061 (-0.46)	-0.061 (-0.48)	-0.050 (-0.43)
recipiency ratio	-0.164 (-4.18)	-0.163 (-4.16)	-0.145 (-3.98)
α_1			0.197 (2.77)
ρ		0.512 (2.01)	-0.105 (-0.29)
κ	0.419 (2.32)		
LM test error - $\chi^2_{[1]}$	1.64		
robust LM test error - $\chi^2_{[1]}$	0.01		
LM test SARMA - $\chi^2_{[2]}$			9.60
LR test - $\chi^2_{[1]}$	3.97	3.57	$9.49_{[2]}$
Observations	146	146	146

Notes

1) dependent variable: log(social spending per beneficiary);

2) t statistics in parentheses;

3) α_1 = auto-regressive coefficient on spatially lagged dependent variable;

4) ρ = coefficient on moving average process in the error term;

5) κ = coefficient on auto-regressive process in the error term.