Looking across Borders: A Test of Spatial Policy Interdependence using Local Government Efficiency Ratings

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Abstract:

Spatial patterns in (local) government taxation and spending decisions have received a lot of attention. Still, the focus on taxation or expenditure levels in previous studies may be incomplete. Indeed, (rational) individuals are likely to consider the level of spending on (or taxation for) public goods provision simultaneously with how much public goods they actually receive – thus assessing the 'price/quantity' of government policies. Therefore, the present paper argues that incumbents may want their 'price/quantity' ratio to be close to that in neighbouring regions. Analysing Flemish local governments' efficiency ratings for the year 2000 (which relate total spending to the quantity of locally provided public goods), we confirm the existence of neighbourhood effects in local government policies.

Introduction

Since the seminal contributions of Salmon [67] and Case *et al*. [23, 24], spatial patterns in (local) governments' taxation and spending decisions have received a great deal of scholarly attention. Generally, empirical analyses indicate that governments do not take their taxation and expenditure decisions in isolation (for reviews, see Brueckner [21], Revelli [62]). While regarding various settings and time periods, one constant in previous empirical analyses of spatial interdependence is that they have concentrated on either taxation or expenditure levels. Although this attention is reasonable given that such policy decisions are often easily observable by the populace, a strict focus on either policy issue in isolation disregards the fact that (rational) individuals are likely to assess the costs of public goods provision relative to the level of public goods that is actually provided by the government. That is, they can be expected to regard the 'price/quantity' of public provision (whether or not in relation to that of neighbouring governments) rather than make assessments based on the level of taxation or government spending alone. Solé Ollé [69, p. 686, italics added], for example, claims that "in a decentralised system, a means of demonstrating to voters that a tax increase is necessary is to show that taxes are higher elsewhere *for the same benefits provided*". And Brueckner [21, p. 178, italics added] argues that "a minimum level of public good provision *relative to taxes* (…) must be delivered for jurisdiction i's government to remain in office".

In line with this reasoning, the present paper argues that voters assess the 'price/quantity' of public provision in their jurisdiction relative to that in neighbouring jurisdictions to judge their incumbent's performance.[1] We thereby measure the 'price/quantity' of local governments'

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[1] In line with most previous empirical analyses of spatial policy interdependence, 'neighbourhood' is in the present paper interpreted as geographical proximity. Obviously, other interpretations are possible (e.g. in terms of similarity in socio-economic characteristics or inter-area population mobility) (e.g. Baicker [13]).

provision through an application of the technical efficiency measurement methodology (Lovell [55]). Specifically, we estimate a multi-output cost frontier relating Flemish municipal governments' total expenditures to their level of public goods provision in the year 2000 and employ deviations from the obtained 'best-practice' frontier to generate a measure of government efficiency. This measure indicates how efficiently expenditures are employed to generate public goods and thus reveals the 'price/quantity' of local governments' policies. Using this measure of government efficiency as our main dependent variable, our results reveal the existence of a significant spatial pattern in local government efficiency ratings and thus support the view that government efficiency might constitute an important competitive device between jurisdictions.[2] Interestingly, and in contrast to some previous work, the presence of this spatial pattern is only weakly related to the political situation in the Flemish municipalities.

The remainder of the paper is structured as follows. The first section describes the theoretical framework. Our main proposition here is that the ratio of public spending to public goods provision is likely to be an important element in interjurisdictional comparisons. In the remaining sections, we empirically assess this proposition by analysing the behaviour of Flemish local governments. Specifically, section 2 provides information about the Flemish context. The measurement of the ratio of expenditures to public goods provision through local government efficiency ratings is discussed in section 3. Section 4 presents the empirical analysis and section 5 concludes.

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[2] Previous analyses have predominantly focused on a jurisdiction's own socio-economic and political characteristics to explain variations in government efficiency ratings (for a review, see De Borger and Kerstens [33]). Still, independent from this work, a recent contribution by Revelli and Tovmo [64] likewise investigates the possibility of spatial interdependence in government efficiency using Norwegian local government data. Though relying on a different approach to measure efficiency, their results are in line with our findings.

1. Theoretical framework

The literature examining spatial patterns in (local) governments' fiscal policies is rapidly expanding. Recent reviews of this literature by Brueckner [21] and Revelli [62] indicate that fiscal decisions in neighbouring jurisdictions play a prominent role in the decision to set ones own tax rate or level of public goods provision. Several theoretical explanations have been suggested to explain this spatial interdependence: spillover effects, tax competition, yardstick competition and reference point effects. In section 1.1, we briefly consider the main traits of each of these models. Then, in section 1.2, we argue that the focus on either taxation or expenditure levels in previous theoretical and empirical studies may be somewhat restrictive.[3] The assessments of jurisdictions' (relative) performance could also be based on both public spending and public goods provision or, more specifically, the government's cost efficiency in providing public goods. This suggests that government efficiency might constitute an important competitive device between jurisdictions.

1.1 Four models for fiscal interdependence

As mentioned, four different theoretical models have been brought forward to explain the interdependence in policy outcomes across jurisdictions. The first of these, the spillover model, points at the beneficial or harmful externalities created by policies in one region on the well-being of inhabitants in neighbouring regions (e.g. Kelejian and Robinson [49], Solé-Ollé [70], Werck *et al*. [77]). Examples of such spillovers are numerous and include expenditures for recreational facilities, pollution prevention or public safety. Due to such spillover effects, the optimal policy in each jurisdiction depends on the policies chosen in neighbouring regions.

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[3]   This argument appears harder to make for the spillover model. Hence, the remainder of this work concentrates on the three remaining alternatives.

Technically, the reaction function of any jurisdiction i – representing i's best response to choices in other jurisdictions – will have a non-zero slope (leading to a spatial pattern in the observed policies).

The second framework, the tax competition model, argues that governments often compete over a mobile tax base (e.g. Wilson [78]; Buettner [22]). This implies that they attempt to attract individuals or firms through the taxation and spending decisions they make. It is assumed that policies in all jurisdictions jointly determine the distribution of this mobile tax base across jurisdictions. The reason is that when a firm or individual judges a certain region to be an optimal location for whatever reason (e.g. clean air, closeness to relatives or consumers, and so on), "there might still be some degrees of freedom in choosing the specific community" (Buettner [22, p. 226]). This leaves some leeway for jurisdictions to competitively employ its policy agenda to attract the mobile tax base. As a consequence, each jurisdiction is (indirectly) affected by the policies pursued in neighbouring jurisdictions. Once again, jurisdiction i's reaction function has a non-zero slope.

A third group of scholars has brought forward that one jurisdiction may mimic policy decisions in neighbouring jurisdictions as a rational response to voters who employ the policies pursued by neighbouring governments as a yardstick to assess their own government's competence (e.g. Besley and Case [15], Salmon [67]). The idea is that politicians are forced into a 'yardstick competition' with neighbouring jurisdictions (cfr. Shleifer [68]) because voters use these jurisdictions to assess the quality of their own incumbents – and re-elect or substitute them accordingly.[4] A similar result emerges in a principal-agent framework where welfare-

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[4] Interestingly, the 'assumption' that voters take policies in neighbouring jurisdictions into account and punish incumbents for *relative* underperformance finds considerable support in the literature assessing the political

maximising politicians (i.e. the principals) assess the performance of self-interested bureaucrats (i.e. the agents) by using neighbouring agents' performance as a yardstick. These agents will then have an incentive to mimic each others' behaviour (see Bivand and Szymanski [16], Revelli and Tovmo [64]).

Finally, Ashworth and Heyndels [9] argue that the use of neighbouring governments' policies as a reference point generates so-called *transaction* (dis)utility to voters (Thaler [72]). This transaction utility is the additional utility that people experience – besides the *acquisition* utility from a given policy – from their consideration of this policy as good (or bad) relative to a reference point (in this case, neighbours' policies). As is well-known from prospect theory (e.g. Kahneman and Tversky [48]), people tend to feel worse about a 25% income tax in the own jurisdiction when it is compared to a 20% income tax in neighbouring jurisdictions (for given levels of public goods) than when this tax is compared to a 30% income tax elsewhere. The reason is that they not only consider the 25% income tax as such, but also the 5% gain (or loss) compared to neighbouring jurisdictions. As this transaction utility is likely to also affect voting behaviour, the (rational) response of politicians is to follow each other's lead.

1.2 Government efficiency as a competitive device

Empirical analyses of spatial policy interdependence have heretofore focused on taxation or spending levels in isolation. Such a strict focus on, say, (relative) tax rates implicitly assumes, however, that residents are more likely to accept high taxes (or, at least, that the electoral retribution for these is lower) when taxes are high in neighbouring jurisdictions – *even when* the provision of public goods is higher in these neighbouring jurisdictions. The reason is that voters

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costs of taxation (e.g. Ågren [1], Besley and Case [15], Bosch and Solé Ollé [18], Vermeir and Heyndels [75]; see, however, Revelli [61]).

concentrating exclusively on tax rates do not consider this unequal provision of public goods. Intuitively, this makes little sense. One reason why a focus on tax rates or public spending levels may nonetheless be appropriate is the high visibility of these policy instruments. Clearly, relative performance assessment relies on the individual's ability to analyse all the necessary information and tax rates or expenditures on (some subset of) public goods are generally easily observable. This makes the crucial assumption that people have sufficient information on provision in both their and neighbouring jurisdictions to engage in relative performance assessments (at least) tenable.

Still, in reality, competition between jurisdictions – whether this derives from the urge to attract a mobile tax base or because voters engage in relative performance assessments – is not likely to be restricted to *either* taxation *or* expenditure levels. In fact, Salmon [67, p. 33], in the first application of relative performance evaluation to decentralised governments, already argued that "it is important (…) that voters take into account burdens of taxation as well as public services". More recently, Alt and Lassen [5, p. 2] argue that "voters want more competent politicians in office, as they can provide more public goods for given levels of taxation and private consumption" (see also the citations of Brueckner [21] and Solé Ollé [69] in the introduction). As voters thus are likely to prefer as much public goods as possible for a given tax payment (or, equivalently, pay as little taxes as possible for a given amount of public goods), there exists a need to regard what one pays (i.e. taxation or spending levels) *and* what one gets (i.e. the level of public goods provision).

We take up this contention by arguing that voters assess the relation between public spending and public good provision (or government efficiency) in their own jurisdiction relative to that in neighbouring jurisdictions. The main idea is that if voters have comparative information on the level of services provided in addition to information about relative taxes, they will use both

these information sources to discipline the incumbent. Indeed, when, all other things being equal, the level of public spending relative to public goods is higher in ones own jurisdiction compared to that in neighbouring jurisdictions, the incumbent in the home jurisdiction is likely to be extracting rents (or might be extracting more rents than incumbents elsewhere).[5] Therefore, voters will want to replace their incumbent at the next elections. As a consequence, for any given incumbent the probability of being re-elected not only depends on the efficiency of public good provision in ones own jurisdiction, but also on the efficiency of provision in neighbouring jurisdictions. The reaction function of any jurisdiction i will therefore have a non-zero slope (leading to a spatial pattern in the observed efficiency ratings).

One important qualification should here be mentioned. Using the government's efficiency in providing public goods as the key variable amounts to assuming that voters know the level of efficiency of their and competing governments. This clearly places considerable information requirements on the voter. Still, when people know about tax rates and spending levels in their and neighbouring jurisdictions (as is assumed in previous studies on spatial interaction), it does not appear unreasonable to suppose that they have at least some impression about the efficiency of government provision in their and neighbouring jurisdictions. Generally, numerous possibilities exist through which people can gather at least some impression of the overall performance of their incumbent as well as that in neighbouring jurisdictions (e.g. informal

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[5] This (implicitly) assumes that politicians do not make agreements concerning the degree of rent extraction they pursue. Clearly, if all politicians agree to provide public goods at, say, twice their minimum cost, voters cannot learn the true level of wasted resources by regarding other jurisdictions. Though such collusion is clearly a theoretical possibility, it is doubtful whether it could also arise in reality. Uncertainty about the tolerance of rent-seeking behaviour across politicians may limit the occurrence of such political 'cartels'.

social gatherings such as weddings, funerals or birthday parties). Our central argument is that this information will be used to assess the relative performance of incumbents.[6]

2. Institutional setting

The Flemish municipal setting offers a number of advantages to test the proposition outlined in section 1.2. Firstly, the institutional setting is the same in all municipalities. That is, local governments consist of the College of Mayor and Alderman (the executive body) and the local council (the legislative body). Councillors are chosen via municipal elections that take place once every six years (at the second Sunday of October) using the same electoral procedures in all municipalities. Following the election, the party (or coalition of parties) that controls a majority of the seats in the council decides on the composition of the executive board (thereby choosing the Mayor and Aldermen form among their council-members). The political system in the Flemish municipalities can thus be characterized as a parliamentary system where the executive board is formed by a political majority. Importantly, this homogeneous setting allows us to analyse policy interdependence without a need to control for differing institutional factors.

Secondly, though the municipalities constitute the lowest level of government in Belgium (next to the national, regional and provincial levels), they have considerable autonomy in raising revenues and assume significant responsibilities at the expenditure side (e.g. in education, local infrastructure, public safety, social services, cultural policies and public administration). In

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[6] Note that the results of the empirical analysis provide information about the accuracy of this assumption. A zero spatial interaction effect may simply designate unobservability of efficiency, not necessarily absence of interaction. A non-zero effect, on the other hand, suggests that people have some sense of how efficient governments are *and* use this information in the assessment of their incumbents.

fact, Flemish local governments are allowed to pursue any policy that promotes their constituents' interests provided these initiatives are not prohibited explicitly by federal legislation. This autonomy also shows from the revenue structure of the Flemish local governments. For example, while surcharge taxes on the regional property tax (i.e. the local property tax, LPT) and the federal personal income tax (i.e. the local income tax, LIT) constitute a main revenue source of Flemish municipalities (about 83% of total tax revenues in 2000), significant variation exists in the extent to which the municipalities use these two revenue sources. Indeed, in the fiscal year 2000, the LIT rate varied between 0% and 8.5% of federal tax receipts while the minimum and maximum LPT rates were 438% and 2000% of the regional tax respectively. This implies that inhabitants pay a supplement equal to approximately 5 to 20 times their regional property tax bill (and 0-8.5% of their federal personal income tax bill) to the local government. Hence, while the major part of income taxation thus accrues to the federal government, local governments absorb the main part of property taxation in Flanders.

Finally, the small size of most Flemish municipalities (44 km² on average) constitutes another beneficial element. Indeed, when the distance to ones reference group influences the ease of gathering information about this reference group, the proximity of neighbouring jurisdictions in the Flemish context entails that obtaining information about one's neighbours is fairly easy. As such, the assessment of relative performance becomes feasible (thereby at the same time giving politicians an incentive to take neighbours' policies into account).

These three elements have prompted several scholars to analyse Flemish (and, by extension, Belgian) data. Heyndels and Vuchelen [45] and Richard *et al*. [65], for example, show that incumbents in Belgian municipalities take into account LIT and LPT tax rates in neighbouring jurisdictions when setting their own rates. This is corroborated by survey evidence in Flanders (Ashworth and Heyndels [8, 10]). Local politicians' evaluation of how high/low local tax

burdens are as well as their view on the need for tax increases/decreases is found to depend on the tax rates in neighbouring jurisdictions (see also Heyndels and Ashworth [44]). Finally, Vermeir and Heyndels [75, p. 12] show that voters in Flemish municipalities "use tax rates in neighbouring municipalities as a yardstick to evaluate tax policy in their own municipalities". This implies that politicians' mimicking behaviour may well be a rational reaction to the fact that voters assess local tax policies relative to that in neighbouring municipalities.

3. Determining Flemish local government efficiency

As mentioned, our analysis focuses on the ratio of public spending to public goods provision (termed government efficiency in the following) as the indicator used for relative performance assessments rather than concentrating on either tax rates or expenditure levels. High efficiency signifies that the government needs only few resources to generate high levels of public goods while low efficiency indicates that high spending levels are associated with low levels of public good provision. As such, it indicates how effective the incumbent is in translating expenditures into public goods – or, reversely, how strongly (s)he indulges in rent-seeking behaviour. Hence, these efficiency ratings provide a way to operationalise the voter's actual cost-benefit assessment of the government's performance.

Several methods have been brought forward in the literature to measure efficiency (for an excellent introduction, see Lovell [55]). All these methods have two things in common. Firstly, each approach starts out by generating a 'best practice frontier', which contains the input-output combinations designating optimal or efficient behaviour. Then, as a second step, deviations from this frontier are used to determine the extent of (in)efficiency of combinations not on the best practice frontier. Despite these two common features, differences occur on two

fronts. Firstly, the determination of the best practice frontier can be either parametric or non-parametric. In non-parametric approaches such as Data Envelopment Analysis (DEA; Farrell [38]) or Free Disposal Hull (FDH; Deprins *et al*. [34]), the frontier is generated as a piecewise linear envelopment of the data. FDH thereby yields a frontier with "a staircase shape in the input-output space", while DEA "convexifies the staircase FDH-frontier" because it assumes that the production possibilities set is convex (De Borger and Kerstens [33, p. 309]). Parametric approaches, on the other hand, determine the best practice frontier on the basis of a specific functional form using econometric techniques. Secondly, interpretation of deviations from that frontier as (in)efficiency can be deterministic or stochastic. Deterministic approaches interpret any deviation from the best practice frontier as inefficiency. However, given the existence of measurement error and other stochastic influences, this may not be appropriate. Hence, stochastic approaches (first developed by Aigner *et al*. [2], Meeusen and van den Broeck [56]) attempt to differentiate between the effects of measurement error and inefficiency.

In the present analysis, we employ a stochastic parametric reference technology. This implies that we use econometric techniques to determine the best practice frontier and that we differentiate between the effects of measurement error and inefficiency. This allows us to limit the attribution of measurement error to inefficiency, which should lead to a more accurate assessment of (in)efficiency. Technically, such stochastic frontier models have a composed error consisting of a symmetric component (u) and a one-sided non-negative component (e) that represents inefficiency. While the former component is assumed to be white noise, the latter is assumed to be distributed half-normally (cfr. De Borger and Kerstens [32], Méon and Weill [57]). Both error terms are assumed to be independent. Employing a translogarithmic function (developed by Christensen *et al*. [25]) and assuming a multiplicative composite error term, the stochastic frontier model can be written as (dropping municipality subscripts for convenience):

$$\ln T = a + \sum_{j=1}^{n} \beta_j \ln y_j + \frac{1}{2} \sum_{j=1}^{n} \sum_{k=1}^{n} \lambda_{jk} \ln y_j \ln y_k + u + e \qquad (1)$$

where T designates the input indicator, y_j indicates the output indicators, *n* points to the number of outputs in the model and β_j and λ_{jk} are parameters to be estimated.[7] Specifically, we rely on data from 304 of the 308 Flemish municipal governments in the year 2000 to estimate local government efficiency ratings (data availability precluding the inclusion of the remaining four municipalities). Our input variable (T) equals total current expenditures in the municipality. To measure the level of local public goods provision, we include four output variables that have been employed in previous work on local government efficiency (see Vanden Eeckaut *et al*. [74], De Borger *et al*. [31], De Borger and Kerstens [32]): (a) the number of subsistence grants beneficiaries, (b) the number of students in local primary schools, (c) the surface of public recreational facilities (in hectare) and (d) the total length of municipal roads (in km). These output variables relate to important responsibilities of local governments with respect to social, educational, recreational and infrastructure services.[8] Nevertheless, and as more extensively discussed in De Borger *et al*. [31] and De Borger and Kerstens [32], they are only crude proxies

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[7] Unfortunately, information on variation in output quality was not available. For the same reason it was not possible to control for differences in input prices. The latter may, however, be less problematic as input prices can be assumed unknown to voters and subject to common shocks – in line with yardstick competition theory (e.g. Besley and Case [15]). We are grateful to an anonymous referee for pointing this out.

[8] The Flemish municipalities also have significant responsibilities in refuse collection, police protection and administrative tasks. As our output indicators for these services – i.e. the share of garbage collected through door-to-door collections, the inverse of the number of crimes and total population size – are less satisfactory as indicators or government outputs, we have not included these in the analysis in the main text. Still, to assess whether these additional outputs affect our results, two alternative multi-output cost frontiers have been estimated (and efficiency estimates derived from these). One adds the share of garbage collected through door-to-door collections as an additional output variable. The other adds population size and the inverse of crime as additional outputs. The results are qualitatively similar using these alternatives (results available upon request).

for the level of public goods provision. This, regrettably, reflects the general problem with defining and measuring public sector inputs and outputs (cfr. Levitt and Joyce [54]; De Borger and Kerstens [32]).[9]

From the estimation of the multi-output cost frontier given in equation (1) (full results provided in appendix A), we obtain estimates of the composed error term (u + e). To isolate the inefficiency element, we employ a procedure outlined in Jondrow *et al.* [47] and adjusted for cost frontiers by Bauer [14]. They argue that, for any jurisdiction i, the conditional distribution of u_i given $(u_i + e_i)$ contains all available information about u_i. Either the mean or the mode of this conditional distribution can then be used as a point estimate of u_i: i.e. $E(u_i \mid u_i + e_i)$ or $M(u_i \mid u_i + e_i)$ respectively. The values of these point estimates range from 0 to 1 and indicate to what extent the municipality is cost inefficient (in the sense that expenditures can be reduced by, say, 20 percent without reducing current output levels). For ease of interpretation, we invert this index to represent that the said municipality is 80 percent efficient (rather than 20 percent inefficient). Higher numbers thus represent more efficient municipalities. As can be seen from table 1 below, the average value of the efficiency measure is 84 percent (indicating spending can be reduced on average with approximately 16 percent without reducing current output levels) and varies between a minimum of 51 percent and a maximum of 93 percent. These

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[9]   Panel data could admittedly be a help in resolving some of the problems related to these measurement issues (and to capture the dynamic process implied by the mimicking literature). Unfortunately, however, time series data were not available for several of our output variables. Nor could we add the efficiency ratings generated by previous Belgian studies to our sample as these were derived either from all Belgian municipalities or from the Walloon municipalities only, while our data are restricted to the Flemish municipalities.

efficiency measures are used as our proxy for the ratio of expenditures to public goods
provision in the empirical analysis in the following section.[10]

4. Empirical analysis

4.1 Empirical Specification

In this section we turn to the question whether government efficiency ratings demonstrate a
spatial pattern across the Flemish municipalities. This would be expected if, as argued in
section 1, these efficiency ratings (as an indicator for the 'price/quantity' of local governments'
policies) are an element in the competitive behaviour of rivalling jurisdictions. As a starting
point, consider the following spatial lag model:

$$\text{Efficiency} = \alpha + \rho W \text{ Efficiency} + \beta X + \varepsilon \tag{2}$$

where α, ρ and β are parameters to be estimated, X represents a vector of control variables
(further discussed below) and W is a square row-normalized spatial weights matrix indicating
whether or not two municipalities are neighbours. Neighbours are thereby defined in a purely
geographical sense as two municipalities that share a border. The entries in each row of this
matrix are thus 1/n (with n the number of neighbours of the municipality in row r) when the
municipality in row r shares a border with the municipality in column c and 0 otherwise. This

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[10] We also estimated government efficiency using Free Disposal Hull, Data Envelopment Analysis assuming
constant or variable returns to scale and a deterministic parametric frontier approach. The outcomes using the
various approaches are highly correlated to the measure used in the main text (r=0.63; r=0.71; r=0.59; r=0.88
respectively) such that our results are unlikely to be strongly affected by our choice of efficiency measurement.

simple border-sharing criterion is the most common approach in the literature. It can be justified by the fact that proximity is a crucial element in the dissemination of information about local policies (Allers and Elhorst [4]). Moreover, distance is significantly negatively linked to migration flows, indicating that "people prefer to move short distances if at all" (Day [30, p. 135]). Hence, spatially contiguous neighbours may be the most important 'competitors'. Finally, we note that as council meetings in Flanders are open to the public (except when personnel issues are discussed), the actual policy decisions of neighbours are assumed to be observable. Therefore, we employ the contemporaneous ratio of expenditures to public goods provision in competing jurisdictions in the estimation (see also Buettner [22], Bordignon *et al.* [17], Allers and Elhorst [4]).

Generally, a positive and significant coefficient estimate of ρ can be interpreted as evidence of competition in local government efficiency ratings. Importantly, however, spatially correlated omitted variables or the existence of common shocks across municipalities may cause the estimate of ρ to be spuriously significant. In that case, the true model would rather look like:

$$\text{Efficiency} = \alpha + \beta X + \varepsilon \qquad \text{with } \varepsilon = \lambda W \varepsilon + v \qquad (3)$$

where v is an independently and identically distributed error term. Clearly, when spatial interdependence is driven only by such common shocks, no evidence in support of our main thesis is revealed. Another problem when estimating equation (2) is that OLS estimation leads to biased and inconsistent estimates due to the simultaneity in the determination of efficiency across jurisdictions (Cliff and Ord [26]). Instead, one should use either instrumental variables analysis (IV) or maximum likelihood estimation (ML) (see Anselin [6]). Though IV-estimation has been argued to be somewhat less efficient than its ML counterpart (e.g. Das *et al.* [28]), it has the advantage of providing consistent results even in the presence of spatial error correlation

(Kelejian and Prucha [50]). We more extensively return to these issues when discussing the empirical results in section 4.2.

Our set of control variables (X) includes both socio-economic and political elements that may influence the municipality's efficiency rating (summary statistics for all variables are provided in table 1). All these variables are measured in 2000, except where noted otherwise. Firstly, we include the per capita income level in the municipality. Based on the argument that high-income citizens might be "more effective in demanding more efficient government" (Knack [51, p. 777]), a positive relation with government efficiency ratings can be expected. However, governments can more easily generate revenues when citizens' income levels are higher. This might decrease the perceived requirement to be efficient (leading to a negative coefficient estimate). Secondly, we control for the share of owner-occupiers in the population. As homeownership entails a significant financial investment and local government policies are likely to influence housing prices (Oates [58], Reback [60]), homeownership is likely to encourage citizens to insist on efficient government behaviour (Green and White [41], DiPasquale and Glaeser [36]). In other words, homeowners are more likely to monitor their local government than renters "because they perceive a greater return to government efficiency" (Grosskopf *et al*. [42, p. 454]; see also Davis and Hayes [29], Duncombe *et al*. [37]). This leads us to expect a positive relation between homeownership and government efficiency ratings.[11] Thirdly, we include population density – measured as the number of inhabitants per 100 square kilometres – to control for possible economies of scale in the supply of (local) public goods. The fourth socio-economic control measures the number of pre-1977 communities that make up

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[11] Data availability leads us to use 1991 data on the percentage of houses with a known resident that are occupied by the owner. Note that this time-lag also mitigates the potential reverse causality problem that arises if citizens are more likely to buy (rather than rent) housing accommodation in efficiently run municipalities. We are grateful to Robert Nuscheler for this insight.

the present municipality. Following a large-scale municipal amalgamation operation in Belgium in 1976, most current 'municipalities' are composed of several pre-1977 'communities'. Crucially, inhabitants of the pre-1977 communities may still identify with this community (Geys [39], Lago Penas [53]). The ensuing 'intra-municipality' struggle may reduce overall efficiency of government performance – leading us to expect a negative coefficient estimate.

We furthermore include three variables controlling for the overall financial situation of the municipality. Firstly, the lagged level of long-term local public debt (measured as a share of total municipal revenues) gauges the strain of past (investment) decisions on municipal finances. While loans allow a municipality to spread its investment costs over the economic lifetime of the investment, interest and amortization of incurred debts must be paid out of the present budget. Hence, a given level of expenditures then translates into lower levels of (non-durable) public goods provided in the current period. While this does not necessarily indicate that highly indebted municipalities are less efficient in the current period with the funds they spend outside interest payments, this effect should be controlled for in the analysis (and is likely to generate a negative coefficient estimate). Secondly, we include the lagged level of the fiscal surplus (measured as a share of total municipal revenues). The idea here is that bad financial management might be correlated with bad management in other aspects. As higher numbers indicate better financial performance, we expect a positive coefficient estimate for this variable. Thirdly, we include the level of general purpose grants awarded to the municipality by higher level governments (measured as a share of total municipal revenues). To the extent that politicians take less care in spending grant monies than in spending tax monies, a higher share of grants in total spending should be related to lower levels of government efficiency (Grossman *et al*. [43]).

Finally, we introduce a set of political variables to control for a number of characteristics of the local governments ruling in the year 2000 (and which were elected in 1994). The first political variable equals the effective number of parties in the governing coalition, measured as $1/\sum_{i=1}^{n} p_i^2$, with n the number of coalition partners and p_i the seat share of party i in the College of Mayor and Aldermen (Laakso and Taagepera [52]). Recent evidence indicates that the number of parties in the local government often significantly affects Flemish local government decision-making (e.g. Ashworth *et al.* [11, 12], Coffé and Geys [27], Goeminne *et al.* [40]). We expect a negative relation with the local government's efficiency rating based on the argument that the level of government fragmentation increases the probability of government indecisiveness and gridlock (Alesina and Drazen [3], Tsebelis [73]). As Tsebelis [73] and Volkerink and de Haan [76] argue that a similar gridlock effect could well arise when the coalition partners have varying ideological standpoints, we also include a measure for the ideological fragmentation of the governing coalition. This is measured as the standard deviation of the ideological positions of the coalition partners (Volkerink and de Haan [76]).[12] The third political control variable is the government's ideological position – defined as the weighed average ideological position of all government parties.[13] This builds on the idea that right-wing politicians generally more fiercely support the workings of the market, while left-wing politicians favour higher government intervention (see Hibbs [46], Tavares [71], Bräuniger

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[12]   In mathematical terms, ideological fragmentation equals $\sum_{i=1}^{n}(p_i(Complexion_i - ICG)^2)$, where p_i is the seat

share of party i in the College of Mayor and Aldermen, Complexion refers to the ideological position of this

party on a Left-Right scale (from 0 to 10) and ICG amounts to the weighted average ideological position of all

government parties (see below). The parties' placement on the ideological scale is based on a self-placement

survey among presidents and spokesmen of the parties in the municipalities. The data derive from

Deschouwer [35] and range from 2.6 (Agalev) to 6.1 (VLD).

[13]   Using definitions for *n*, p_i and Complexion as before (see previous footnote), government ideology is measured

as $\sum_{i=1}^{n}(p_i.Complexion_i)$.

[19]). It is not a priori clear, however, how these different preferences would translate into higher (or lower) efficiency of the government itself.

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Table 1 about here

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4.2 Empirical results

As mentioned, the analysis is based on data for the Flemish municipalities in the year 2000. Due to data availability with respect to some of our control variables, this analysis is based on 300 observations. The results are presented in table 2. Columns (1)-(3) estimate the model including all control variables, while in columns (4)-(6) insignificant variables are deleted one by one to generate a more efficient model.

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Table 2 about here

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Columns (1) and (4) present a non-spatial model estimated by OLS. However, the test statistic for Moran's I in both cases is statistically significant, such that the null hypothesis of no spatial effects can be rejected. There thus appears to be a spatial pattern in the data. Unfortunately, Moran's I does not reveal whether a spatial lag model (equation (2)) or a spatial error model (equation (3)) is more appropriate. This, however, is determined by the robust LM tests developed by Anselin *et al*. [7]. These tests are robust in the sense that the presence of spatial lag (error) dependence does not bias the results for the test on spatial error (lag) dependence. The results – in the bottom row of table 2 – indicate that both the test for spatial lag dependence and that for spatial error dependence are statistically significant at conventional levels (though

the former effect is much stronger). Based on these findings, a ML spatial lag model appears most appropriate and the results of these estimations are reported in columns (2) and (5). Still, given that the presence of spatial error dependence cannot be rejected, only IV estimation may provide consistent results (Kelejian and Prucha [50]). These results are shown in columns (3) and (6), using neighbours' socio-economic covariates (i.e. income, population concentration, homeownership rate, debt, surplus and grants) as instruments for neighbours' efficiency. These instruments are jointly highly significant in the first stage regressions ($F[6, 283] = 23.00$; $p<0.01$), suggesting there is no issue of weak instruments. This is reinforced by the fact that they pass the Andersen canonical correlation test. The Hansen-J test cannot reject the null hypothesis of over-identification, indicating that the instruments are – as required to obtain valid estimation results – exogenous to the second-stage regression (see bottom row of table 2).

The coefficient of central interest in these estimations is the parameter testing for a spatial lag in the dependent variable (ρ). In both specifications, this parameter is statistically significantly different from 0, in line with the predictions from section 1. Municipalities with more efficient neighbours tend to be more efficient themselves. To ensure that we are actually measuring spatial interdependence, we re-estimated the model using a weights matrix where neighbours are defined according to the alphabetical order of municipalities' names (cfr. Ågren [1], Brown and Rork [20], Case *et al*. [24]). Every municipality is awarded one (or two) 'neighbours' preceding and following it in the alphabetical ordering. Since this alphabetical ranking has nothing to do with the competitive forces between municipalities, the use of such a weighing scheme should not lead to significant estimates of the spatial parameter ρ. Indeed, both when using one and two 'neighbours' on each side of a municipality in the alphabetical ordering, the estimations indicate the absence of spatial interactions (available upon request).

Referring back to the theoretical section, the spatial pattern established in table 2 could derive from competition over a mobile tax base or from politicians copying each others' policies in response to voters' relative performance assessments. To distinguish between these explanations, it has been argued that the political context should be taken into account (Ågren [1], Allers and Elhorst [4], Besley and Case [15], Bordignon *et al.* [17], Solé-Ollé [69]). Mimicking, so the argument goes, "should occur irrespective of re-election opportunities [if it] were due to tax competition" (Allers and Elhorst [4, p. 505]), while the influence of political conditions on spatial interdependencies provides support for the models that invoke electoral motives for politicians' mimicking behaviour. In other words, a discriminating test rests on discovering discrepancies in politicians' behaviour under different electoral conditions.[14] To investigate this in our setting, we test for differences in the size of the spatial interdependence parameter (ρ) depending on the level of political fragmentation in the municipality, the proportion of parties in power and the size of the governing majority.[15] The reasons these variables might influence incumbent's mimicking behaviour are as follows:

▪ The 'clarity of responsibility' hypothesis suggests that it is harder to assign blame to individual parties when political fragmentation increases (Powell and Whitten [59]). As acting on one's own desires is then politically less costly, fragmentation might reduce mimicking behaviour. On the other hand, coalition members are generally less certain about their position after the following elections. They not only need to win seats in the election, but must also be successful in the ensuing coalition negotiations (Ashworth *et al.* [12]). This

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[14]   Bivand and Szymanski [16] and Revelli [63] test whether yardstick competition is responsible for the spatial pattern in their data by analysing the effects of discrete shocks in the information available to voters (e.g. through the introduction of a national evaluation procedure of local government performance). Both studies find that improvements in public information on government performance reduce the political agency problem and thereby incumbents' incentive to mimic (which in turn limits the spatial pattern in the data).

additional uncertainty may increase their incentive to mimic. To test these hypotheses, we follow Solé-Ollé [69] and separate our sample in coalitions and one-party governments.[16]

- Parties' probability of regaining power after future elections may be higher when a larger share of the parties that gain representation in the local council are also taken up in the local government. The reason is that there are few alternative ways of forming a majority government. Hence, even when the local government performs badly, incumbents are more certain of re-election. We analyse whether in such a setting mimicking is less pervasive by splitting the sample in municipalities where the proportion of parties in power (PPP) is more (or less) than 0.5 (cfr. Allers and Elhorst [4]).

- An alternative, and arguably more direct, indication of re-election odds is the extent to which the incumbent government controls seats in the local council in excess of a simple majority. This not only increases the probability of ratifying decisions in the council (which mostly require a simple majority of the votes), but may also make the party/parties in the current government more confident in a return to power after the next election. Indeed, a larger majority position in the present legislation generally increases the probability of maintaining at least a majority position after the next elections. As a consequence, we expect a lower need for mimicking behaviour when the ruling government has more 'excess' seats in the local council (Ågren [1], Allers and Elhorst [4], Bordignon *et al*. [17], Solé-Ollé [69]). As a test for this hypothesis, we use the incumbent government's control of more than 60 percent

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[15] Technically, the spatial model is extended to allow for two regimes. We are grateful to Paul Elhorst for sharing his Matlab routines that allow us to perform this analysis.

[16] Government fragmentation may, as argued in the literature on the Weak Government Hypothesis (e.g. Ashworth *et al*. [11], Roubini and Sachs [66]), also lead to legislative gridlock. This may affect decisions about moving in or out of a municipality and thereby have its importance for the extent of mimicking behaviour in the tax competition model. Hence, the discriminating power of government fragmentation between the various theories may only be weak. We are grateful to Bruno Heyndels for pointing this out.

(or, alternatively, 65 and 70 percent) of the council seats as the dividing criterion between the municipal governments.[17]

The results are reported in table 3. To preserve space, we report the results from the maximum likelihood spatial lag model only. Also, and because the results are qualitatively similar as in table 2, we suppress coefficient estimates for the control variables.

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Table 3 about here

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Table 3 shows that the political situation in the Flemish municipalities generally has only a minor effect on mimicking by incumbents. Indeed, in only two of the five estimations is the difference between the spatial parameter of the two groups statistically significant at conventional levels. Nonetheless, a number of observations tend to support the prediction that the probability of re-election affects incumbents' incentive for mimicking. Firstly, we find that the spatial parameter ρ is significantly higher for coalitions – in which parties are generally less certain about returning to power – than for one-party majorities. Secondly, our results show that the spatial parameter ρ is not significantly different from 0 in municipalities where more than half of the parties in the local council are also part of the ruling government (i.e. PPP>0.5). In municipalities where less than half of the parties are in the governing coalition, there is a significant spatial pattern. Finally, turning to the effect of the government's seat share in the local council, we observe that the difference in the spatial parameters is always in the expected direction and statistically significant only for those municipalities where the government lacks a sizeable majority. Though electoral motives thus appear to play some role in explaining the

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[17]   Governments possessing higher seat shares are too few to allow for empirical testing. Note also that all governments controlled at least 50% of the seats.

spatial pattern in the data, the (lack of) strength of the results would indicate that they are not the main reason for the observed policy interdependence.

Before turning to the conclusion, we make some brief remarks on the results of our control variables. The findings are mostly supportive of our expectations, though they often fail to reach statistical significance. Significant support is found, however, for the hypothesis that a higher share of homeowners exerts a positive influence on government efficiency. This is in line with the idea that homeowners have made an important financial investment – making it more important for them to actually demand efficient government behaviour and monitor local politicians (Davis and Hayes [29], Duncombe *et al*. [37], Grosskopf *et al*. [42]). We also find that a higher number of pre-1977 communities in a municipality is negatively associated with efficiency. This could indicate that the inhabitants of merged municipalities still (at least partly) identify with their old community (cfr. Geys [39], Lago Penas [53]) and that the resulting 'intra-municipality' competition reduces overall efficiency. As expected, higher public debt is negatively related to government efficiency (as a larger part of public expenditures must be used for interest and amortization payments). This effect, like that of population concentration is, however, not robust over the various specifications (losing significance in the IV regressions). As indicated by the significant and positive effect of the fiscal surplus on government efficiency, bad financial management appears to be correlated with bad management in other aspects. Municipalities that have higher surpluses also witness higher government efficiency ratings. Finally, and surprisingly, we find that higher grants are related to higher efficiency ratings. Though a similar confounding result has been retrieved for federal grants to US cities by Grossman *et al*. [43], it is not clear what might generate this result. One possible argument is that grant transfers are not without supervision on expenditures (reducing a wasteful application of these resources), but this highly tentative explanation would require careful inspection in future research.

5. Conclusion

Recent scholarship has shown that governments' (fiscal) policies often display a spatial pattern. High tax rates (spending levels) in one region tend to be associated with high tax rates (spending levels) in neighbouring regions. The present paper extended previous work on such spatial interdependence – that has mainly concentrated on *either* taxation *or* expenditure levels – by pointing out that (rational) individuals can be expected to take into account both the level of spending on (or taxation for) public goods provision *and* the level of public goods in assessing their government's policy agenda (whether or not they do so in relation to the policies of neighbouring governments). Building on this notion that voters consider the 'price/quantity' of public policies, we argue that this leads to an interdependence between the ratio of public spending to public goods provision of a given jurisdiction and that of neighbouring jurisdictions.

An empirical test using Flemish municipal efficiency ratings in the year 2000 (which relate total expenditures to the level of public goods provision) supports this proposition. Indeed, the analysis uncovers a significant spatial pattern in Flemish local government's efficiency ratings. The attempt to elucidate what drives this pattern indicates that models invoking electoral motives for politicians' mimicking behaviour (i.e. yardstick competition and reference point effects) find only moderate support in our data. In contrast to previous findings using Dutch and Italian data (see Allers and Elhorst [4], Bordignon *et al.* [17]), the presence of the spatial pattern is only weakly related to the political situation in the Flemish municipalities.

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Table 1: Summary statistics for control variables (N=300)

Variable	Mean	St. Dev.	Min	Max
Efficiency	84.353	6.020	51.129	93.968
Income	11.178	1.452	7.447	15.771
Homeowners	75.003	7.924	46	92
Population concentration	5.145	4.326	0.569	31.358
Amalgamation	2.980	2.072	1	12
Lagged public debt	1.280	0.522	0.270	4.340
Lagged Surplus	4.557	6.695	-19.032	27.342
Grants	12.778	3.293	6.788	39.201
Government fragmentation	1.780	0.744	1	5
Ideological fragmentation	0.571	0.811	0	2.890
Ideological position	5.006	0.593	2.7	6.1

Note: All variables are measured in 2000, except homeownership (where – due to availability – data from 1991 where used) and the lagged levels of public debt and fiscal surplus (both 1999).

Table 2: Estimation results

Variable	OLS (1)	ML (2)	IV (3)	OLS (4)	ML (5)	IV (6)
Intercept	70.176 *** (9.97)	51.998 *** (6.43)	8.801 (0.51)	71.093 *** (14.64)	52.899 *** (7.36)	11.144 (0.77)
Income	-0.072 (-0.26)	-0.021 (-0.08)	-0.100 (-0.36)	-	-	-
Homeowners	0.091 * (1.67)	0.087 * (1.91)	0.079 (1.55)	0.088 * (1.71)	0.087 ** (1.96)	0.082 ** (2.13)
Population concentration	-0.233 ** (-2.27)	-0.178 * (-1.84)	-0.046 (-0.36)	-0.251 *** (-2.77)	-0.184 ** (-2.22)	-
Amalgamation	-0.533 *** (-3.22)	-0.463 *** (-2.84)	-0.298 * (-1.76)	-0.538 *** (-3.37)	-0.460 *** (-2.91)	-0.273 * (-1.67)
Lagged public debt	-1.742 ** (-2.04)	-1.388 ** (-2.14)	-0.547 (-0.73)	-1.711 ** (-1.98)	-1.362 ** (-2.12)	-
Lagged surplus	0.098 ** (2.04)	0.102 ** (2.00)	0.110 ** (2.39)	0.097 ** (1.96)	0.101 ** (2.02)	0.129 *** (3.14)
Grants	0.868 *** (4.86)	0.792 *** (7.18)	0.611 *** (3.70)	0.882 *** (5.58)	0.798 *** (7.82)	0.607 *** (4.05)
Government fragmentation	-0.113 (-0.24)	-0.082 (-0.16)	-0.006 (-0.01)	-	-	-
Ideological fragmentation	0.242 (0.39)	0.223 (0.40)	0.179 (0.33)	-	-	-
Ideological position	0.343 (0.42)	0.263 (0.39)	0.073 (0.10)	-	-	-
ρ	-	0.216 *** (2.98)	0.730 *** (3.77)	-	0.217 *** (3.01)	0.705 *** (4.04)
R²	26.37		24.80	26.28		25.07
Loglikelihood		-913.52			-913.62	
Moran I	2.116 **			2.022 **		
LM spatial lag test	12.017 ***			12.128 ***		
LM spatial error test	5.388 **			5.331 **		
Hansen J			4.364			3.597
Anderson			117.88 ***			134.15 ***

Note: N = 300; robust t-statistics in brackets; ρ is the coefficient indicating a spatial lag in the dependent variable; *** denotes significance at 1% level, ** at 5% and * at 10%. Moran's I and (robust) LM tests are measures for spatial dependence in the residuals of the OLS regression (all of which have a standard normal distribution). Hansen J tests for over-identification of the instruments while Anderson tests the strength of our instruments (both have a Chi² distribution).

Table 3: ML Spatial lag models for different regimes

Variable	Coalition		PPP[a] >0,50		Majority[b] >60%		Majority[b] >65%		Majority[b] >70%	
	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No
ρ	0.324 ***	-0.001	0.128	0.243 ***	0.009	0.347 ***	0.065	0.286 ***	0.102	0.243 ***
	(3.26)	(-0.00)	(0.56)	(2.96)	(0.69)	(3.46)	(0.38)	(3.21)	(0.47)	(2.93)
N	187	113	42	258	122	178	76	224	44	256
Loglikelihood	-911.65		-913.20		-909.28		-911.56		-912.70	
t-test ($\rho 1 = \rho 2$)	-1.83 *		0.46		1.89 *		1.09		0.58	

Note: N = number of observations in each subsample; t-statistics in brackets; *** denotes significance at 1% level, ** at 5% and * at 10%; t-test ($\rho 1 = \rho 2$) attests the statistical significance of the difference of the spatial parameter in both subsamples.
[a] 'PPP' indicates proportion of parties with representation in the local council that is part of the governing majority
[b] 'Majority' designates the seat share of the ruling government in the local council

Table A1: Multi-output cost frontier results

Variable	Cobb-Douglas	Translog
O (subsistence grants beneficiaries)	0.269 *** (10.22)	0.361 (1.08)
S (students in local primary schools)	0.622 *** (11.85)	-0.387 (-0.31)
R (public recreational facilities)	0.134 *** (4.40)	-0.770 (-0.95)
W (length of municipal roads)	0.029 (0.98)	-0.579 (-0.84)
O^2	-	-0.506 ** (-1.97)
S^2	-	4.353 (0.78)
R^2	-	3.483 *** (2.89)
W^2	-	-0.539 (-0.34)
O * S	-	0.022 (0.45)
O * R	-	0.108 ** (2.38)
O * W	-	-0.110 ** (-2.39)
S * R	-	0.083 (-0.90)
S * W	-	0.120 (1.48)
R * W	-	0.062 (0.95)
LL0	-382.23	-382.23
LL full	-20.94	-2.45
LR-test	722.59 ***	759.56 ***
Cobb-Douglas vs translog		38.50 ***

Note: N = 304; all variables in natural logarithms; *** denotes significance at 1% level, ** at 5% and * at 10%. LL0 is loglikelihood of model with only a constant term, LL full that of the complete model. LR-test represents the likelihood ratio test assessing the adequacy of the explanatory variables. Cobb-Douglas vs translog tests the restriction that the coefficients for all quadratic and cross-product terms are jointly insignificant. Both tests have a Chi² distribution.