STRATEGIC INTERACTIONS AMONG SOUTH AFRICAN MUNICIPALITIES

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Abstract

The objective of this essay is to empirically test strategic interactions among South African Municipalities. Strategic interactions among municipalities are one of the features of fiscal decentralisation. There is strategic interaction when the determination of expenditure levels in one municipality depends simultaneously on expenditure levels in its neighbouring jurisdictions, all other things being equal. Municipal expenditure on community services budgeted in the year 2009/10 is examined by specifying Spatial Autoregressive and Spatial Error Models. The Maximum Likelihood and the Generalised Methods of Moments are used to estimate these spatial models. Three criteria are applied to determine neighbourliness between municipalities. The first criterion is based on the contiguity between municipalities. The second criterion defines neighbouring municipalities as those that have more or less similar socio-economic characteristics. The last principle is based on the centroid distances between municipalities. The results show the existence of strategic interactions amongst South African municipalities with regard to expenditure levels on community and social services. Nevertheless, based on the centroid distances, the existence of strategic interaction is not confirmed between municipalities in all cases.

JEL Classification: H70, H77

1. INTRODUCTION

In a system of multi-level government, sub-national governments, including municipalities, tend to exhibit a certain level of interaction for different reasons. Firstly, in fiscal decentralisation, municipalities can voluntarily interact with each other through cooperation and collaboration. Municipalities can jointly plan and budget for a specific programme or project whose benefit expands to the entire region beyond individual municipal areas. A good example of voluntary cooperation is the Gauteng City-Region. This platform was recently initiated by three neighbouring metropolitan municipalities (City of Johannesburg, City of Tshwane, and City of Ekurhuleni) and the provincial government of Gauteng for the purpose

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of joint planning and collaboration in matters that affect the region.

Secondly, in fiscal decentralisation systems, municipalities can also strategically interact with each other. From a municipal fiscal policy perspective, strategic interaction refers to the way municipal tax and/or expenditure levels are determined. So, there is strategic interaction when the determination of expenditure levels in one municipality depends simultaneously on expenditure levels in its neighbouring municipalities, all other things being equal.

Strategic interactions among municipalities or among other sub-national governments have been the focus of many studies in public finance, urban economics, regional and geographical sciences for the last three decades. These studies are in majority looking at advanced countries in North America and Europe. There are very few empirical studies that focus on developing countries in general and Africa in particular. So far, there is not yet a study that focuses on South African municipalities to assess the level of strategic interactions in either taxes or expenditure or both. This essay attempts to bridge the gap by providing an empirical evaluation of strategic interactions among South African municipalities.

The interest on strategic interactions is because of the impact they can have on municipalities' performance. Suppose that due to interactions with its neighbours a given municipality determines current expenditure which is below its potential level. Such behaviour could cause the municipality either to lower the quantity (or level) of local public service delivery or to provide local public service of inferior quality than it should.

The hypothesis in this essay is that South African municipalities strategically interact. This hypothesis is based on some features that can be observed with regard to the functioning of municipalities in the country. Strategic interactions are due to institutional or political norms and set up. In other words, since South Africa is a unitary country, it therefore implies that policies of the ruling party at the national level have higher probability of being implemented at local level because each municipal council, although independent, would want to conform to norms established by national government. It is also important to note that the African National Congress (ANC) which is the ruling party at national level dominates and controls most of the municipal councils in South Africa. ANC lead-municipalities will be obliged to a certain degree to conform to what other ANC-lead municipalities in their neighbourhood are doing. This behaviour can be observed in the manner municipal expenditures and taxes are determined.

Similarly, due to neighbourhood effects, peer group pressure and copy catting behaviour, sub-national governments take into account actions of neighbouring governments when setting tax rates (Wilson, 1986) and deciding on the provision of local public services (Tiebout, 1956). Municipal current (operating) expenditures on community services budgeted in the year 2009/10 are examined by specifying Spatial Autoregressive (SAR) and Spatial Error (SEM) Models. The Maximum Likelihood (ML) and the Generalised Methods of Moments (GMM) are used to estimate these spatial models. The estimation of the SAR and SEM helps determine the magnitude and significance of strategic interactions of South African municipalities.

While it is true that municipalities can strategically interact due to various reasons, this essay considers the neighbourliness aspect only. In other words, strategic interactions can only exist when municipalities under consideration are neighbours. Hence, defining neighbourliness becomes fundamental to examining strategic interactions among municipalities. The notion of neighbourliness is not limited to geographical consideration. Other criteria can be used to define neighbourliness. In this essay, three criteria are applied to determine neighbourliness between municipalities. The first criterion is based on the contiguity or geographical boundaries between municipalities. The second criterion defines neighbouring municipalities as those that have more or less similar socio-economic characteristics. The last criterion is based on the centroid distances between municipalities.

The essay is organised as follows. Section 2 presents the theoretical framework from which the empirical modelling of municipal expenditure function is based. The literature review is presented in section 3. It gives an overview of studies that have analysed strategic interactions among local governments. The methodology used is presented in section 4. Section 5 presents a discussion on the data used in in the analysis. The discussion on the criteria used to define neighbourliness between municipalities is presented in section 6. The empirical findings are discussed in section 7 and section 8 concludes the essay.

2. THEORETICAL BACKGROUND

Empirical studies that examine strategic interactions among municipalities or local governments are based on theoretical frameworks which explain the relationship between municipal expenditure as the dependent variable and a set of explanatory variables. It is from this framework that any adopted empirical model is specified and estimated. Furthermore,

strategic interactions among municipalities occur for one reason or the other. Generally, the theory recognises three reasons why strategic interactions occur between neighbouring municipalities. These reasons are explained later in this section.

Various theoretical models have been proposed in the literature to understand municipalities' behaviour as economic agents. Brennan and Buchanan (1977) discuss the leviathan model as a framework to explain local government spending or budgeting. Special interest group as discussed by Mueller and Murrel (1986) and the political model described by Craig and Inman (1986) also feature among these theoretical models. The median voter is commonly used in many studies. This essay adopts the median voter as a theoretical framework to derive an empirical model. The following paragraph provides a discussion on the median voter model.

3.1 Median voter framework

The aim of this subsection is not essentially to discuss in details the merits and drawbacks of each of the above mentioned theoretical frameworks. The focus is rather on the median voter as the adopted theoretical framework. Case, Hines and Rosen (1989) argue that the median voter is a commonly preferred framework because of its ease in explaining local government fiscal decisions. Also, in democracies, the median voter framework is more or less well suited to model local government policy formulation (Congleton, 2002).

Municipal taxes and expenditure constitute an important instrument through which the matching of communities' needs and what municipal government proposes to offer as local services is manifested. However, it is also evident that, in general, communities' needs and preferences for local public services are spread and not the same for the entire jurisdiction. So, the challenge is for a municipal government to find a suitable package of taxes and expenditure able to provide local services level that satisfies all residents.

The median voter framework recognises the dispersion in communities' needs. It further assumes that there is a median voter who has needs and preferences as all members in that jurisdiction. The median voter framework further assumes that if communities' needs and preferences, including those of the median voter, are to be cardinally quantified and arranged in linear order, the following pattern will be observed. It will emerge that community's needs and preferences will more or less be equally distributed on either side of the median voter's needs and preferences.

Hence, the needs and preferences to be matched with municipal expenditure and taxes will be those of the median voter in that community (Bailey, 1999) as they are at the centre. In other words, the median voter theorem supposes the majority rule such that the needs and preferences of the median voter represent needs and preferences of all residents in that jurisdiction so that the objective of the elected municipal government by a majority vote will be to maximise the utility of the median voter.

The median voter framework is also adopted because municipalities in South Africa are a sphere of government whose politicians are elected by respective communities for 5-year tenure. The legal and regulatory framework within which South African municipalities operate is designed in a way that communities participate in municipal decision making process both from the strategic planning, to budget decision as well implementation of programs and projects. Therefore, municipal councillors' election and communities' participation in municipal decisions can guarantee the idea that tax and expenditure levels are more or less informed by the needs and preferences of the majority or the median voter.

But, the median voter like any theoretical frameworks is without any pitfalls. The oversimplification of the model constitutes a major shortcoming. In reality, municipal councils do not necessarily act to maximise the utility of the median voter as argued by Case et al (1989). Sometimes municipal councils behave as utility maximisation agents and not necessarily seeking to maximise the utility of the median voter as suggested by the model. Aaberge and Langørgen (2003) argue that this behaviour generally occurs when a dominant party or coalition is governing a municipal council.

The influence of interest groups as stated by Mueller and Murrel (1986) can also impact on municipal fiscal policies and service delivery. In fact, municipalities are no more seeking to maximise the utility of the median voter but that of the interest groups. In the context of South Africa where the law protects and permits activism, it is possible that municipal expenditure and tax levels be influenced by some interest groups. For instance, it has been observed recently the tendency of some municipal taxpayers' associations to boycott paying property rates due to municipalities for one reason or the other. This can result in concerned municipalities adjusting their budgets to satisfy the demands of these associations for them to be able to collect all revenues from property rates. It is also important to note that the influence of special interest groups at municipal level is still at the infancy level in South Africa. But, it is expected to grow as democracy at municipal level also grows.

Based on the fact that each municipal government is responsible within its own jurisdiction to provide local services, the demonstration of the median voter can mathematically be expressed as follows. To be able to fund expenditures on these local services, a municipal government is assigned fiscal powers to mobilise resources through taxes, user fees, fiscal transfers and other sources. As demonstrated by Case et al (1989) and Mbakile-Moloi (2006), in a situation where the influence of neighbouring municipalities is not taken into consideration, the utility of the median voter is summarised in equation (2.1) below. Where U_i symbolises the utility of the median voter in municipality *i*, Y_i represents the income of the median voter in the concerned municipality, T_i is the local tax that the median voter is obliged to pay and (Y_i -T_i) is the disposable income of the median voter in municipality i, G_i is the level of local public service provided and ψ_1 symbolises a vector of exogenous factors affecting the median voter's utility, these factors include amongst others political and economic and demographic variables.

$$U_i = U[(Y_i - T_i), G_i, \psi_i)] \tag{2.1}$$

Equation (2.2) below summarises the municipal budget constraint under the assumption that the local public service is measured in per consumer units.

$$T_i \geq G_i \tag{2.2}$$

To maximise the utility of the median voter, a given municipality will choose the level of *T* and *G* which maximises equation (2.1) subject to equation (2.2). By also assuming that preferences of the median voter exhibit non-satiation so that equality is held in equation (2.2) and by applying the Lagrangian to have the objective of utility maximisation and the budget constraint, the following equation is derived:

$$L = U\ \left((Y_i - T_i), G_i, \psi_i\right) + \lambda(G_i - T_i) \tag{2.3}$$

The first order condition of equation (2.3) to comply with the requirement that the municipality should maximise the utility of the median voter as summarised in equation (2.1) subject to budget constraint in equation (2.2) is expressed as:

$$\frac{\partial L}{\partial T_i} = \frac{\partial L}{\partial G_i} = 0 \tag{2.4}$$

A rational municipality that seeks to maximise the utility of the median must chose a package of municipal taxes and local public service to satisfy equation (2.4). If functions of municipal taxes and local public services were to be derived from equation (2.4) above, it is clear that these will solely depend on municipal's own characteristics.

Demonstrations presented in equations (2.1) to (2.4) assume that municipalities are closed entities without any interactions with their counterparts. Given that, the hypothesis of this essay states that there are interactions among neighbouring municipalities, it becomes critical to identify a variable to be incorporated in the model in order to capture for those interactions. The next sub-section provides an economic explanation of strategic interactions and how these are manifested through municipalities' budgets.

2.2 Channels for strategic interactions

The theoretical model in 2.1 describes that a municipality can derive a demand for local services or expenditure function from the utility of the median voter. In this model, the influence of expenditure decision from neighbouring municipalities is not considered. Brueckner (2003) states that in a fiscal federalism system, a municipality *i* determines its spending level G_i based simultaneously on a set of its own environment characteristics, represented by the vector X_i, and the corresponding expenditure level in neighbouring municipalities. It is assumed that the level of expenditure in municipality *i* is affected by the level of G_j taken in neighbouring jurisdictions, indicating the presence of strategic interactions. Therefore, the process of determining public spending level in municipality i should include also the corresponding level of spending in neighbouring jurisdictions represented by G_j in equation (2.5) below.

$$G_i = G(X_i, G_j) \tag{2.5}$$

The process depicted in (2.5) is known as horizontal strategic interactions because the interactions happen among governments of the same level. The strategic interactions can also be vertical in the sense that the determination of public spending or tax level by a lower (upper) government takes also into account the spending or tax level of upper (lower) government. The focus in this essay is limited to horizontal strategic interactions among South African municipalities.

The literature proposes three channels through which strategic interactions among

municipalities can occur (Brueckner, 2003). These are the spillover effects model, the tax mobility or resource flow model, and the yardstick competition model.

2.2.1 The spillover effects channel

Strategic interaction amongst municipalities can happen due to spillover effects emanating from the provision of some local public goods by surrounding jurisdictions as argued by Lundeberg (2006), Solé-Ollé (2006), and Revelli (2002) to just list the few. In other words, there is spillover when local public services provided by a municipality do not only benefit its residents but even resident from neighbouring jurisdiction are benefiting.

The nature of some local public services is that they have additional welfare (benefits) or disutility (negative effects) for communities from other jurisdictions. For instance, local public services such as recreational parks, health facilities and local roads in a municipality are accessed by everyone, municipal residents and non-residents, without discrimination based on residency. Access by non-residents can even increase in number if these facilities are in shortage in quantity or have poor quality in neighbouring municipalities (Solé-Ollé, 2005).

Let us assume that local public services provided by all municipalities are identical. Let us also assume that residents from a municipality i are benefiting from what neighbouring municipalities are providing. To account for the spillover effect, the median voter utility function can be represented by equation (2.6).

$$U_i = U\left[(Y_i - T_1), G_i, G_j, \psi_i\right] \tag{2.6}$$

A rational municipality, even in a presence of some spillover benefits, will still be efficient by satisfying the condition in equation (2.4) above. However, the reaction function of municipal expenditure is the one described in equation (2.5) above where the level of expenditure for identical services set in neighbouring municipalities is considered as factor that helps determine the level of expenditure in a given municipality.

2.2.2 The yardstick competition channel

It is assumed under this model that voters are imperfectly informed about the costs of public services and taxes that their government determine. Voters compare public spending and tax levels in other jurisdictions with what their government is offering to help them assess the

government performance (Salmon, 1987). From this assessment, residents determine whether the incumbent politicians deserve to be voted again in the office (Besley and Case, 1995).

Elhorst and Fréret (2009) also argue that it is easy for residents to observe public spending and tax levels in neighbouring jurisdictions and use that as a tool to benchmark the performance of their own municipal government. This implies that municipal government tends in anticipation of such behaviour from residents to mimic the spending and tax levels of neighbouring jurisdiction in view of securing their chance of re-election into office (Revelli, 2006). Therefore, the utility function that should inform a rational municipality about an efficient choice of taxes and expenditure should be the one described in equation (2.6) and not in equation (2.1).

2.2.3 The resource flow channel

Strategic interactions among municipalities can happen as a consequence of competition between them. The competition occurs in the manner in which municipalities determine their budgets. It is argued that municipalities chose a bundle of taxes and decide to finance services not only to maximise the utility of the median voter but also to attract and retain some resources (i.e. private capital) in their jurisdictions (Allers and Elhorst, 2011). The concept of resources flow is based on the idea of tax competition presented by Tiebout (1956). He argues that residents who are dissatisfied with the bundle of taxes and expenditure offered by a municipality can move to another jurisdiction where the package corresponds to their preferences is offered. Under this model, a given municipal government will consider the level of tax and spending of neighbouring municipalities to determine its own taxes and public spending and vice versa.

There are two considerations emerging from the discussion on the channels of strategic interactions among municipalities. First, in the case of expenditure, the determination of the channel depends on the nature of local public service that the expenditure is financing. For example, the selected expenditure category funds a pure local public good, spillover effects may be considered as channel of interaction. This is because the provision of public goods is in essence characterised by externalities. Secondly, the definition of neighbourliness is also an important factor. This implies that spillover effects cannot be considered as a channel in cases where municipalities do not share same borders.

Lastly, analysing strategic interaction among municipalities using the approach of single

equation, like it is the case in this essay, it becomes from an empirical point of view to disentangle whether these interactions are the result of spillover effects, yardstick completion or resource flow competition. The only difference would be on the interpretation of the empirical estimation which should take into account the nature of local public service under investigation and the definition of the neighbourliness.

3 LITERATURE REVIEW

There are different approaches and methods applied in the literature to examine strategic interactions among municipalities or governments. Some studies only examine tax levels of municipalities or local governments without considering the expenditure side. Amongst these studies the following few can be cited: Allers and Elhorst (2005), Bordignon, Cerniglia, and Revelli (2003), Bosch and Solé-Ollé (2007), Revelli (2002), Hayashi and Boadway (2001). Štastná (2011) argues that there is a shift in the literature to focus on municipal spending rather than tax because in general municipalities have limited competency in terms of taxation on one hand. On the other hand, he argues that strategic interactions mainly occur through municipal spending.

There are other studies that consider the expenditure side. The common element in both groups of studies is that they are all based on the same theoretical principles and use similar methods. The focus of this review is more on studies that examined strategic interactions in municipal expenditures because this is the area of application of this essay. The review also focuses on methods used in previous empirical studies.

The point of departure is the approach presented by Case et al. (1989). These authors used the median voter theorem to examine the strategic interactions among US State governments in the determination of expenditure. They found that geographical proximity between US states does not necessarily lead to fiscal interactions amongst them. Instead their findings confirm that states that have socio-economic similarities tend to mimic each other in terms of fiscal decisions. This essay borrows the approach of Case et al (1989) in terms of the median voter theorem and in terms of the definition of the neighbourliness which is critical in determining examining strategic interactions between South African municipalities.

Revelli (2006) examined the effects that spending on social services in one locality has on neighbouring localities in UK. The author found that the spatial dependency observed in social services spending is mainly due to mimicking behaviour by localities. Foucault, Madies

and Paty (2008) studied spatial interactions among French municipalities through different categories of municipal spending. They argue that interactions between municipalities occur when the mayors in the concerned municipalities share the same political ideology.

Birkelöf (2009) examines the strategic interactions between Sweden municipalities with regard to expenditure for social services. The author found that there is indeed a positive interaction among neighbouring municipalities. Murdoch, Rahmatian and Thayer (1993) investigated the recreation spillovers among municipalities in the Los Angeles area. They found that the municipalities responded positively to spillover from recreation expenditures in neighbouring municipalities. Lunderberg (2006) assess the spillover effects of recreational and cultural services spending between Swedish municipalities the spatial Seemingly Unrelated Regression method. This author argues that indeed in the context of Swedish municipalities there is evidence of spillover effects in recreational and cultural services spending.

Minkoff (2009) analyses the spatial interactions amongst 3105 counties in the US in the determination of redistribution spending levels. He uses the modified spatial 2SLS as an estimator and finds that counties decision on redistributive spending influence each other. In other words, the decision to spend on redistribution services in a given country is determined by that county's own policy choices and economic characteristics as well as the policy choices and economic characteristics of its neighbouring counties. Sollé-Ollé (2006) used the Instrumental Variables (IV) and Generalised Method of Moments (GMM) to examine spatial interactions among Spanish local governments. The author argued that the estimates from the IV method are consistent and efficient than those of GMM model proposed by Kelejian and Prucha (1998).

Ermini and Santolini (2010) study focuses on 246 Italian municipalities. These authors use the spatial 2SLS, the Maximum Likelihood method (ML) in a spatial model to examine factors that explain the spending levels of municipalities. Their findings suggest that there is evidence of strategic interactions between Italian municipalities due to spillover effects.

Many studies of strategic interactions among municipalities or subnational governments focus on developed countries and less in developing countries. This essay seeks to fill this gap by assessing the presence of spatial interactions between South African municipalities. The purpose is to confirm whether indeed South African local municipalities behave similarly as

local governments in developed countries in the determination of their expenditure levels as proven by empirical studies in the literature.

4. METHODOLOGY

4.1 Model specification

The approach taken in this essay is to specify two spatial models to investigate strategic interactions among municipalities in South Africa. Each specification model is evaluated using a set of tests as explained in 4.3 below. The first specification model as shown in (4.1) is called the Spatial Autoregressive Model (SAR):

$$Y = \alpha + \rho WY + X\beta + \varepsilon \tag{4.1}$$

where α is the intercept, Y denotes a $N \times 1$ vector of the dependent variable which consists of current expenditure of N municipalities, X denotes a $N \times k$ matrix of exogenous variables that explain the dependent variable Y, W symbolises an $N \times N$ spatial weight matrix that is constructed to show the neighbourliness among municipalities. Each element of matrix W is either equal to 1 or zero. The element $w_{ij} = 1$ means that municipality i is neighbour to municipality j. Conventionally, municipality i cannot be neighbour to itself, hence, element w_{ii} or w_{jj} is always equals to zero for all $i \neq j$. Section 4.4 below gives details on criteria used to define neighbourliness.

The vector WY is the weighted average of all other municipalities' current expenditure. It is also referred to as the spatial lag of the dependent variable Y. The parameters ρ is the spatial autoregressive coefficient and shows the impact and direction of neighbours' current expenditure on one municipality's level of current expenditure. In other words, ρ shows the degree of interaction amongst municipalities.

SAR in equation (4.1) shows that current expenditure in one municipality is not only explained by exogenous variables represented in the matrix of exogenous variables *(X)*, but it is also explained by the average of current expenditure of neighbouring municipality symbolised by *(WY)*. The condition set in SAR requires that equation (4.1) be evaluated using specification tests as explained in 4.3.

The second specification model is shown in (4.2) and is called the Spatial Error Model

(SEM):

$$Y = a + X\beta + \varepsilon$$
$$\varepsilon = \lambda W\varepsilon + u \qquad (4.2)$$

All symbols in equation (4.2) are the same as in equation (4.1). In addition, $W\varepsilon$ represents a column vector of spatial autocorrelation for the error term ε. The parameter λ represents spatial autocorrelation coefficient. It also shows the degree of unobservable interaction amongst municipalities which impacts on one municipality's current expenditure determination.

The SEM equation depicted in equation (4.2) displays autocorrelation in the error term among observations. This correlation is unobservable and captured in the error terms. This also indicates what is referred to as spatial heterogeneity in spatial econometrics (LeSage, 1999). On condition that the specification tests in 4.3 suggest the adoption of SEM, the sufficient condition would be that λ is statistically significant for the model to be applied.

4.2 Estimation methods

Two econometric techniques are applied to estimate equation (4.1) and (4.2). These techniques are the Maximum Likelihood (ML) and the Generalised Methods of Moments (GMM). Although the requirement of normal distribution is not satisfied in the sample data, the ML is used because of the traditional central limit theorem.

LeSage and Pace (2009) assert that the application of the traditional OLS method in the presence of interactions among geographical units as depicted in equation (4.1) and (4.2) can yield inconsistent estimates and inconsistent estimation standard errors. This is mainly due to the two features of spatial data. Firstly, SAR shows spatial dependence among observations which violates the OLS assumption. Secondly, SEM depicts spatial heterogeneity when it models autocorrelation in the error term and violates the OLS assumption of uncorrelated errors.

4.3 Estimation steps

The "general-to-specific" procedure is also adapted to guide on which specification model is well suited for the sample data. This procedure consists of the following steps. First, the traditional OLS estimator is applied in as shown in equation (4.3). Second, spatial

specification tests are conducted on the residuals of equation (4.3) to detect the presence of interactions among neighbouring municipalities and therefore determine between SAR and SEM the appropriate model that suits the sample data. Third, the appropriate model is estimated as pointed out by the spatial specification tests using ML and GMM techniques alternatively. Lastly, findings of both the ML and GMM are compared focusing more on sign, size and significance of either the spatial autoregressive parameters (ρ) or the spatial autocorrelation coefficients (λ).

4.3.1 Step one: Specification and estimation of a model without strategic interactions

The first step consists of estimating equation (4.3) which does not account for strategic interactions among municipalities with regard to current expenditure. Equation (4.3) is estimated to extract the residuals and evaluate them by applying a set of spatial specification tests. The aim of this procedure is to determine whether there patterns of dependency in the residuals. Equation (4.3) is solved by applying the standard OLS method.

$$Y = a + X\beta + \varepsilon$$
$$\varepsilon \sim N(0, \sigma^2) \qquad (4.3)$$

where *Y* represents a *N x 1* vector of independent variable which consists of current municipal expenditure, *X* denotes a *N x k* matrix of independent variables, β is a column vector of 1 by k dimensions which denotes fixed but unknown parameters, and ε denotes the error terms that are assumed to be independently and identically distributed (i.i.d.) for all municipalities, with zero mean and variance σ^2, and α is the constant term parameter.

In Equation (4.3) current expenditure of one municipality which is symbolised by *Y* depends on a vector of some social, economic, cultural and other relevant characteristics of that jurisdiction which is denoted by *X*. Equation (4.3) also assumes that municipalities do not interact strategically among themselves in the determination of current expenditure.

4.3.2 Step two: Spatial specification tests

The diagnosis of strategic interactions among municipal current expenditure is done by applying some statistical tests, notably the Moran's I statistic, the Langrage multiplier Lag (LM-lag) test, the Langrage Multiplier Error (LM-error), the Robust Langrage multiplier Lag (RLM-lag) test, and the Robust Langrage multiplier error (RLM-error) test. Details on these tests are provided in the Appendix.

Moran's I test

Moran's I statistic is applied to detect whether the non-spatial model is misspecified. It is based on the residuals of the OLS and the spatial lags in the spatial weight matrix W. The transformed value of the Moran's I is instead used in this essay. It is suggested to adopt equation (4.3) of non-strategic interaction among municipalities if the null hypothesis of the standardised Moran's I test is not rejected. On the contrary, if the null hypothesis is rejected in favour of the alternative hypothesis, this means the OLS residuals are autocorrelated and the model without strategic interaction as shown in equation (4.3) is not appropriate.

Langrage Multiplier tests

Although, the rejection of the null hypothesis of the standardised Moran's I statistic suggests that a spatial model is suitable for the sample, it does provides clear indication on which model is suitable between SAR and SEM. To establish the appropriate spatial model, the Langrage Multiplier (LM) tests are applied.

Langrage Multiplier lag(LM-lag) and Robust Langrage Multiplier lag (RLM-lag) statistics test the existence of spatial dependency in the residuals of OLS model and indicate whether the SAR model is suitable for the data sample. In general, when the computed values of the LM-lag test is greater than 6.666 and the probability value smaller than the adopted percentage threshold, the null hypothesis of non-significance of the estimated spatial lag parameter ρ is rejected. The rejection of the null hypothesis of the LM-lag implies SAR is suitable to model strategic interaction among municipalities in the determination current expenditure.

When the null hypothesis of LM-lag is rejected and at the same time the null hypothesis of the LM-error as it is discussed in the following paragraph, it is still not clear which model between SAR and SEM is suitable. In such a case, it is suggested to apply the Robust LM lag and Robust LM error test as sufficient condition to really determine the model that is suitable for the data sample.

Under the null hypothesis, the robust LM-lag postulates that there is no spatial dependency in the dependent variable. If the computed value has a probability value smaller than the percentage level of significance, then the null hypothesis is rejected. In this circumstance, SAR is suitable to model municipal current expenditure interactions.

The Langrage Multiplier error (LM-error) and the Robust LM-error (RLM-error) test whether strategic interactions among municipalities can be well captured in the disturbance term. In both cases, the null hypothesis implies that the SEM is suitable to model strategic interactions among municipalities. The procedure consists of comparing the computed values of each test and their critical values.

If the computed value of LM-error is greater than the critical value and at the same time its corresponding probability value smaller than the threshold significance level, the null hypothesis can be rejected in favour of the alternative hypothesis. If the null LM-lag test is also rejected as explained in previous paragraphs, RLM-error is conducted together with RLM-lag tests as sufficient conditions. SEM is adopted in this case if null hypothesis of the RLM-error is rejected.

5 DATA DESCRIPTION

5.1 Dependent variables

Current municipal expenditure on community and social services[2] is used as dependent variable for the year 2009/10. This information is sourced from Local Government database from the National Treasury[3]. The analysis considers 192 municipalities out of 278 municipalities in South Africa to test strategic interactions in current expenditure for community and social services as the first sample.

5.2 Explanatory variables

This essay considers the following four characteristics as independent variables. The choice of these variables is first of based on Goode (1993) who argues that municipal expenditure are affected by the structure of the economy, demographic features, as well as sociological and geographical factors. Secondly, the choice is also due to the availability of information at municipal level which is still a challenge at this stage in South Africa. Lastly, these variables are among variables that are considered in most of empirical studies on municipal strategic interactions.

[2] Current expenditure refers to expenditure on municipal consumption and not on capital investment.
[3] Republic of South Africa, Department of National Treasury: Local Government database. This database contains information on South African municipal budgets.

Population density

This information is sourced from Global Insight and it is measured in terms of number of people per square kilometre in a municipality. There is a relationship between population density and municipal expenditure because population density is related to economies of scale. It is therefore expected that an increase on population density in a municipality will result in the increase of municipal expenditure.

Per capita GDP

The information on GDP (2005 South African prices) for each municipality is collected from Global Insight. It is assumed that municipal expenditure function is determined as a reaction function to community's demand of local public service. The community's demand of local public service is determined by their tastes and preferences. Among factors that can influence community's preferences is the level of income. In this essay, per capita GDP is considered as a proxy of income level that influences the level of municipal current expenditure. The other argument of including per capita GDP as an explanatory variable is that its level determines the level of potential income that can be generated by municipalities to fund their expenditure.

Per capita National Government grant

This variable is measure in South African Rand in nominal terms. It is the non-conditional transfer that is allocated to each municipality in terms of the Division of Revenue Act[4] of the South African Parliament. This information is sourced from National Treasury database. Given that government operating grant is non-conditional, it is expected that any increase of this variable corresponds to the increase in municipal expenditure.

Education

This characteristic indicates number of people aged 15 years and older with at least a matric level of qualification (secondary or high school level qualification) as a percentage of total population. Similar to per capita GDP and Population density, it is sourced from Global Insight for the year 2009. The variable education is included in the analysis to capture the influence of community's preferences on municipal expenditure. It is assumed that a more

[4] The Division of revenue Act is an annual Act of South African Parliament in which the national raised revenue is distributed vertically to all three spheres of government and horizontally for national and provincial departments, and municipalities.

educated population will demand more local public services.

6 DEFINING NEIGHBOURLINESS

The estimation of the SAR and SEM requires the identification of each municipality's neighbours. The term neighbourliness is not limited to geographical proximity in the sense that neighbours are those that share the same physical border. It can refer to other aspects as well. Case et al (1989) argue that dimensions such as demographic, economic and social similarities can be used to determine neighbourliness. The same approach is applied in this essay in the sense that the neighbourliness is determined by considering alternatively the geographical proximity, the socio-economic similarities between South African local municipalities. But, in terms of spillover effects explanation of spatial interaction, the geographical proximity is the only aspect that is considered simply because externalities can only occur when jurisdictions are physically close to each other.

The degree of neighbourliness is summarised in the spatial weight matrix as explained section 4 above. Five spatial weight matrices are constructed and used alternatively. The first matrix describes the geographical proximity or contiguity between South African local municipalities. This matrix is constructed using information from the South African Municipal Demarcation Board 2006 map. According to this criterion, two municipalities are neighbours if and only if they the share the same borders. Based on this information the matrix *W* is constructed so that if two municipalities, *i* and *j*, which share the same borders are represented by element $w_{ij}=1$ and those that do not have same borders are represented by elements w_{ij}.

The second matrix is formed using the municipal socio-economic characteristics. At this stage the technique of Cluster Analysis is used to construct groups of municipalities that have approximately similar economic characteristics. The application of Cluster Analysis technique has produced 5 groups of municipalities. Municipalities belonging to the same cluster are considered as neighbours so that $w_{ij}=1$ and those that don't belong are non-neighbours *($w_{ij}=1$).* As with the previous spatial weight matrices, a municipality can't be neighbour to itself, hence $w_{ii}=0$ or $w_{jj}=0$. The purpose of grouping municipalities based on economic similarities is to test whether they also strategically interact when determining their current expenditure. Strategic interactions using this criterion of neighbourliness can only be possible through the yardstick competition and the resource flow channels as explained in section 3

above. The possibility of spillover channel in this case is limited in the sense that municipality belonging to the same cluster don't necessarily share the same borders.

The third, fourth and fifth spatial weight matrices are constructed based on centroid distances between municipalities. The thresholds of 100, 150 and 200 kilometers are used to consider whether two municipalities are neighbours or not respectively for the third, fourth and fifth matrix. In this regard, $w_{ij}= 1$ if the distance between the center point in municipality *i* and the center point in municipality *j* is smaller or equal to 100, 150 or 200 kilometers according to the case. For the pairs of municipalities with centroid distances greater than 100, or 150 or 200 kilometres $w_{ij} = 0$. Although the centroid distance between municipality *i* and itself is 0, by convention w_{ii} or w_{jj} is set to be equal to zero.

7 EMPIRICAL RESULTS

Information displayed in Table 1 below shows that there are large disparities among South African municipalities across all variables under examination. This is confirmed by high standard deviation values in the last column of the table.

Table 1. Summary descriptive statistics

Variable	Mean	Min	Max	STD
Per capita current expenditure	101	4	893	106
Pop density	102	0.5	2 134	256
Per capita grant	564	124	1 907	333
Education	18%	7%	39%	7%
Per capita GDP	25 811	1 733	194 752	24 173

Results from the spatial specification tests are summarised in Table 2 below. Based on the contiguity criteria, the computed Moran's I statistics is significant at 10 per cent. This implies that the null hypothesis of no strategic interactions between municipalities is rejected in favour of the alternative hypothesis of strategic interactions. It means that South African municipalities interact with other municipalities that share the same borders when determining current expenditure on community and social expenditure. These interactions could be because of local services benefits that spillover other jurisdictions, competition among municipalities to attract a pool of resources in their areas or due to counter the yardstick competition by local communities.

Since both the LM-lag and LM-error tests are significant at the 5 and 10 per cent level respectively, the robust LM tests are carried to determine the appropriate spatial specification to model municipal current expenditure based on the contiguity spatial weight matrix. These tests confirm SAR model is appropriate because the p-value is smaller at 10 per cent level.

The third row of Table 2 shows results of the specification tests when the socio-economic similarities are used as criteria of neighbourliness between municipalities. The Moran's I test confirms the existence of strategic interactions among municipalities with regard to current expenditure because the p-value of the computed value is less than 5 per cent to reject the null hypothesis. This is consistent with Case et al. (1989) findings which confirmed that American states with similar demographic features interact in the determination of their fiscal policies. South African municipalities with similar socio-economic characteristics strategically interact with each other to determine current expenditure on community and social services. These interactions may be due to yardstick or resource flow completion.

But, it is not clear what spatial specification model to adopt. Both the robust LM-lag and robust LM-error are insignificant with regard to socio-economic similarities between municipalities (Row 3 of table 2). It is decided to specify and estimate both the SAR and SEM models. The comparison between the spatial lag (ρ) and spatial error autocorrelation (λ) coefficients based on their magnitude and statistical significance is then used to determine which of the two models is well suited for the sample data.

Results in row four of Table 2 confirm the existence of strategic interactions between municipalities. It is important to note that the criteria used to determine neighbouring municipalities in the sample is the centroid distance of less or equal to 100 kilometre (distance100) between them. The robust LM tests also confirm that SAR is the most appropriate model in this case because the null hypothesis is rejected at 10 per cent.

Similarly, the SAR specification is appropriate to model municipal current expenditure on community and social services when spatial weight matrix is constructed based on the centroid distances of less or equal to 150 kilometre (distance150) between municipalities. This is because the computed Moran's I statistic, the LM-lag and the LM-lag robust are all significant at 5 per cent level.

Lastly, the SAR is also adopted when the spatial weigh matrix is constructed based on the centroid distances of less or equal to 150 kilometre (distance150) between municipalities. As

it is indicated in Table 2, the Moran's I and the LM-lag statistics are significant at 10 per cent level. The confirmation of strategic interactions between municipalities based on the centroid distances (Row 4 to 6 in Table 2) indicate that municipalities can influence each other even if they do not share the same geographical boundaries or have socio-economic similarities.

Table 2. Spatial specification tests[5]

Matrix criteria	Moran	LM-lag	LM-error	Robust LM-lag	Robust LM-error
Contiguity	1.851(0.064)**	4.329(0.037)*	2.711(0.099)**	2.997(0.083)**	1.380(0.248)
Cluster	4.910 (0.000)*	9.480 (0.002)*	10.214 (0.001)*	0.586 (0.443)	1.320(0.250)
Distance100	3.682(0.000)*	14.905(0.000)*	11.903(0.000)*	3.086(0.078)**	0.085(0.770)
Distance150	2.548(0.012)*	8.530(0.003)*	4.841(0.027)*	5.676(0.017)*	1.986(0.158)
Distance200	1.883(0.059)**	3.599(0.057)**	2.101(0.147)		

Table 3 below is an abridged format of estimation results. Due to space and because the focus is to evaluate the presence of strategic interactions among South African municipalities, only results on the spatial autoregressive (ρ) and spatial autocorrelation (λ) are reported here. Based on the contiguity criteria the spatial autoregressive coefficient (ρ) produced by applied ML statistically significant at 10 per cent but small in magnitude. It implies that with an average increase (decrease) of a unit of per capita current expenditure on community and social services in contiguous jurisdiction, the corresponding per capita current expenditure in a given municipality increases (decreased) by 0.165 unit, all other things being constant.

Table 3. Estimation results

	Maximum Likelihood		GMM	
Variable	**Coefficient**	**z-prob**	**Coefficient**	**probability**
Contiguity				
rho	0.165**	0.066	0.530*	0.041
Cluster				
rho	0.410*	0.013	0.769*	0.001
lambda	0.465*	0.006	0.442	0.673
Distance100				
rho	0.283*	0.001	0.570*	0.000
Distance150				
rho	0.296*	0.012	0.855*	0.000
Distance200				
rho	0.220	0.165	0.751*	0.001

[5] Figure in parenthesis are the p-values and where it indicates * it means that the coefficients are significant at 5 per cent level and those in ** are significant at 10 per cent level

The application of the GMM confirms that the spatial autocorrelation (ρ) coefficient is statistically significant at 5 per cent level but its size is big compared to SAR estimate when ML is applied. The coefficient of ρ suggests that an average increase (decrease) of per capita current expenditure on community and social services in contiguous jurisdictions by one unit explains an increase (decrease) in the corresponding per capita current expenditure of 0.530 units in a given municipality.

8 CONCLUSION

This essay tests whether South African municipalities do interact in the determination of the expenditure level. Municipal current expenditure on community and social services is modelled using alternatively two main econometric methods econometrics, notably the Maximum Likelihood (ML) and Generalised Method of Moments (GMM). A standard procedure, as suggested in the literature on spatial econometrics, is followed to estimate the aforementioned municipal current expenditure category. The notion of neighbourliness is defined in light of Case et al. (1993) assertion. In this regard, five criteria are used to construct spatial weigh matrix each based one criterion.

In addition, spatial specification tests are applied to assess whether indeed spatial interactions exist amongst municipalities. These tests include Moran's I statistic, LM-lag, LM-error, the robust LM-lag, and the robust Lm-error tests. After estimation of spatial models as guided by spatial specification tests, a traditional procedure of assessing the soundness of the parameters, particulars those that capture the spatial interaction is followed. This is done by looking at the sign, size and statistical significance of these parameters. It is also important to note a comparison between ML and GMM parameters is also carried out by looking at the sign, size and significance.

Results in this essay reveal that the hypothesis of spatial interaction amongst South African municipalities with regard to expenditure levels cannot be refuted. Nevertheless, based on the criterion used to construct the spatial weigh matrix that determines the structure of neighbourliness, there are instances where it is not sufficiently proven that spatial interaction does exist between municipalities.

It is important to note that while this essay tempts to bridge the gap in the literature on municipal spatial interactions, by focusing on the case of South Africa which is so far not much explored, it has some limitations which constitute a need for further research on the

topic. First, the essay only focuses on municipal expenditure and not municipal taxes or both. Further research can either look at strategic interactions through municipal taxation separately or considering both South African municipal expenditures and taxes as suggested by Allers and Elhorst (2011). Second, the essay does not focus on total municipal expenditure but only considers one category of municipal expenditure. It is important for future research to evaluate whether this hypothesis of existing strategic interactions for other municipal expenditure categories and/or total municipal expenditure. Third, the essay only considers the cross-section of South African municipalities in 2009/10. Further research could for instance evaluate strategic interactions in a panel data context in order to incorporate the dynamic aspect of these interactions.

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