Convergence of municipal expenditure in South Africa

Kabeya Clement Mulamba[1], Fiona Tregenna

Abstract

This paper examines whether there was convergence of municipal expenditure in South Africa. Convergence describes a situation in which there is a rapid growth rate of real per capita total expenditure for municipalities that had an initial lower level of expenditure, while those with initial higher levels exhibit a slower growth rate. Municipal budget information was collected for 54 municipalities for the period 2005/2006 to 2014/2015, and regression techniques were applied to estimate the functions of municipal total expenditure. Empirical results show that there was absolute and conditional β-convergence of real per capita municipal total expenditure for the period under consideration. The coefficients of variation (CV) were calculated to understand the evolution in the dispersion of both municipal expenditure and own revenue. The obtained CVs were then used in a graphical representation, which attested to the existence of σ-convergence for expenditure and own revenue.

Key words*:* convergence, municipal expenditure, municipalities
JEL classification*:* H7, R5

1 Introduction

Municipalities are an important segment of public sector in South Africa. They are responsible for the provision of a range of essential services such as potable water, sanitation, refuse removal and electricity. It is worth to also note that South African municipalities differ in many aspects, such as capacity, needs, socioeconomic profiles and landscape. The design of national policies on municipalities is in many cases informed by these differences. However, there is the possibility that local fiscal policies can converge towards a common equilibrium over time, despite structural differences that exist between municipalities. It becomes important to identify areas in which municipalities are converging and/or diverging to inform policy choices. The present paper tests whether there is convergence in municipal spending. To answer this research question, an empirical analysis of σ-convergence, absolute and conditional ß-convergence was carried out.

The concept of convergence, which has been popularised by the works of Barro (1990, 1995), Sala-i-Martin (1996), and Barro and Sala-i-Martin (1992), is mainly used in economics to understand disparities between entities, regions, countries, and so on. Likewise, disparities between local fiscal policies can be analysed using the concept of convergence in a system of fiscal decentralisation such as South Africa. From a theoretical perspective there are two opposing views in the literature regarding the issue of convergence of local fiscal policies. The one view, which is based on the Tiebout (1956) theorem, argues that local fiscal policies cannot converge, instead they diverge. This is because municipalities, in a fiscal decentralisation system

[1] Corresponding author: Senior Economist, Local Government Finance Policy, National Treasury, South Africa. Email: mkclement@gmail.com, Tel: +2712 315 5262.

are in competition between themselves for resources. Therefore, they always supply different levels of services and determine different levels of local taxes. The decision on the quantity and levels of services to be supplied by a municipality is influenced by the community's preferences and needs. Given that different communities have different preferences, municipalities will supply different levels of services, thus local fiscal policies will diverge.

The divergence of local fiscal policies can also be explained by competition between municipalities with regard to fiscal capacity. For instance, In South Africa, metropolitan municipalities and other local municipalities in urban areas have strong economic base than the rest of the country. Compared to the rest of municipalities, these municipalities' operating budgets are funded by 70% of income generated from own sources such as property tax, service charges, and other fees. On the contrary, operating budgets of small municipalities in rural areas are largely funded by fiscal transfers. This is because these municipalities have limited economic base to generate own revenues. However, there are other arguments in the literature that support the convergence of spending in local government (Scully, 1991; Annala, 2003, Skidmore, Toya and Merriman, 2004; Skidmore & Deller, 2008).

The lack consensus regarding the convergence of local fiscal policies is an indication that an empirical analysis is required to answer the research question. The present paper is built on previous works (Scully, 1991; Annala, 2003; Skidmore, Toya & Merriman, 2004; and Skidmore & Deller; 2008) to empirical measure the convergence of municipal expenditure in South Africa for the period of 2005/2016-2014/2015. As also pointed out by Rey and Montouri (1999), the empirical analysis in this paper takes into account the spatial interactions that may exist between municipalities. This means the techniques of spatial econometrics are used to diagnose the existence of spatial interactions. In addition, Bala (2011) argues that the influence of neighbouring jurisdictions should be considered in the analysis of convergence by applying spatial econometric modelling. For instance, Rey and Montouri (1999) use spatial regression techniques to analyse US regional income convergence.

To the best of the author's knowledge, there is no study that analyses the convergence of municipal expenditure in South Africa. Therefore, this study is the first attempt to shed light on the effectiveness of the fiscal decentralisation framework in South Africa in assessing whether this framework contributes in the reduction of disparities between municipalities. The structure of this paper is as follows. Section 2 presents the discussion on fiscal decentralisation and the hypothesis of convergence. The discussion of the broad literature on the convergence of fiscal policies, with emphasis on the convergence of municipal expenditure is presented in section 3. The research methodology is discussed in section 4, and the data is presented in section 5. The empirical findings of this paper are discussed in section 6, and the conclusion is presented in section 7.

2 Fiscal decentralisation and the hypothesis of convergence

The study of convergence of local fiscal policies should be put into the context of fiscal decentralisation. To begin with, fiscal decentralisation is viewed in many developing countries as a mechanism to accelerate development and reduce poverty (Caldeira, Foucault and Rota-Graziosi, 2012). South Africa adopted this system with the expectation that municipalities will

maximise social development and economic growth (Republic of South Africa, 1998). Due to apartheid policies, the South African society is characterised by socio-economic ills such as inequalities between classes and races, and poverty.

During apartheid, many South Africans, in particular black people, were excluded from the mainstream economy. They did not have access to acceptable levels of essential services such as water, sanitation, electricity, and refuse removal. After the fall of apartheid, key service delivery functions and fiscal powers were assigned to municipalities with the view of redressing these inequalities and transforming the society. This is based on two main principles of fiscal decentralisation: a) the proximity of local government to community; and b) the principle of competition between local jurisdictions. Caldeira and Rota-Graziosi (2014) argue that these principles are mainly used in the literature to justify fiscal decentralisation. These authors also argue that there other effects of fiscal decentralisation, including inequalities. In the discussion set out below, this paper uses the relationship between fiscal decentralisation and inequalities, the principles of efficiency and competition as basis for the analysis of convergence of municipal expenditure.

Fiscal decentralisation and divergence

It is argued in the literature that, under certain circumstances, fiscal decentralisation may lead to inequalities between local jurisdictions (Prud'homme, 1995; Manor, 1999; and Brueckner, Borge &Rattsø, 2014). These inequalities are triggered by the autonomy that local governments have in the provision and financing of public services. For instance, Tiebout (1956) argues that fiscal federalism promotes the interjurisdictional competition among local governments. This entails that individuals, households and businesses in a municipalities are assumed to freely move from one jurisdiction to the other in search of the local authority that is able to match the provision of local public goods with their own tastes and preferences. This creates horizontal competition amongst local jurisdictions. One of the consequences of the outflow of households and businesses from one jurisdiction to the other is that municipalities where this outflow occurs could have their tax base decreasing. To avoid this outflow also called "tax mobility" municipalities will efficient in the provision of public services so that these services match the communities' tastes and preferences. That is to say different municipalities will offer different bundles of taxes-expenditure, which translate into divergence of fiscal policies.

In brief, (partial or full) fiscal decentralisation, in contrast to centralisation can lead to divergence of local fiscal policies. In fiscal decentralisation local governments match the supply of local services with residents' preferences and needs, which are different from one jurisdiction to the other. Hence, there will be heterogeneity in the delivery of public service in fiscal decentralisation.

It can also be seen from the above discussion that there is a contrast between what countries perceive to achieve when embarking on a process of fiscal decentralisation and what the theory predicts as effect of decentralisation. For instance, Caldeira and Rota-Graziosi (2014) argue that many developing countries perceive fiscal decentralisation as a way of accelerating economic development, and social peace.

Therefore, the question of inequalities between local jurisdictions in fiscal decentralisation is worrisome for policy makers. First, inequalities should be understood to inform the assignment of expenditure responsibilities and revenue to local governments. Second, it is important to know whether the degree of disparities across local governments falls or increases over time. This is the aim of the analysis in this paper.

Fiscal decentralisation and convergence

Contrary to the view regarding the relationship between fiscal decentralisation and regional inequalities, there are various reasons to expect the convergence of municipal expenditure in fiscal decentralisation system. First and most importantly, municipal expenditure can converge as a result of convergence in municipal own revenue and/or fiscal transfers. This largely depends on the design of the fiscal framework for local government. For instance, it is argued that the local government grants system in Wisconsin State in the United Sates, partly takes into account both fiscal capacity and fiscal effort (Skidmore & Deller, 2008). Fiscal capacity, which relates to the economic base in the area, is the key factor in determining the potential of a municipality to collect own revenues. Fiscal effort is related to administrative and technical capacity of the municipality concerned to effectively collect its rightful revenues. These authors conclude that poorer municipalities in the state of Wisconsin in the United States get more financial support from the state government in the form of grants than richer municipalities. In the long run, this may result in convergence in municipal expenditure.

If the system of fiscal transfer is purposely designed to limit the autonomy of local governments in choosing the levels of services, then the hypothesis of heterogeneity of local public service is ruled out (Brueckner, Borge & Rattsø, 2014). This situation can occurs where there are conditional or earmarked fiscal transfers, which give little latitude to municipalities in determining the level of expenditure.

Based on the discussion above, it is worth noting that the framework for revenue assignment in South Africa is purposely designed to take into account disparities that exist among municipalities with regard to fiscal capacity. Municipalities with strong fiscal capacity mobilise more income from own sources and get less fiscal transfers, whereas those that have limited fiscal capacity get more fiscal transfers as a way of compensation for the constraint to collect income from own sources.

The Local Government Equitable Share (LGES), which is the biggest form of fiscal transfer, is an unconditional grant that each municipality receives from the division of nationally raised revenue. The determination of the LGES is based on local conditions such as poverty level in order to allow municipalities to provide essential services to indigent households. In other words, although the LGES is unconditional, the national government uses it as a tool to achieve redistribution policies. In this regard, even if municipalities have the discretion on which service to finance with the LGES, there is an implicit obligation on their behalf to conform to these national redistribution policies. Based on this, it is expected that municipalities will exhibit a certain level of convergence with regard to their expenditure.

Second, Skidmore and Deller (2008) argue that municipal services can be considered to some extent as inputs to the country's production activity (Skidmore & Deller, 2008). Based on this argument, it is important to note that South African municipalities provide a range of infrastructure and services, such as roads, bridges, water distribution, electricity supply, waste collection, environmental protection, community services and public safety. These services are considered as inputs to the country's production process in the sense that economic agents such as firms and households use them to produce other goods and services. This means that the production of these services by municipalities can be considered as private good, which are characterised by diminishing returns.

There are some implications resulting from this assumption. For instance, an increase in income levels will trigger a rise in demand for municipal infrastructure and services, which ultimately will lead to growth in municipal expenditure. But from the supply side of these services, there is less incentive for municipalities with initial higher levels of expenditure to increase spending over time, whereas there is much incentive for those with lower initial levels to rapidly increase their spending. Such behaviour leads to convergence in municipal expenditures over time.

The assumption of diminishing returns municipal expenditure implies that a higher level of initial municipal expenditure will lead to slower growth in real per capita municipal expenditure at a given time, all other things being equal. In other words, the ratio there will be a slow growth of expenditure for municipalities that had higher initial levels of expenditure. It also means that lower initial levels of municipal expenditure lead to rapid growth rates of municipal expenditure at a given time, all other things being equal. This situation corresponds to convergence in municipal expenditure.

Third, infrastructure and services provided by municipalities are consumption goods. Therefore, the convergence of municipal expenditure is driven by diminishing marginal utility in the consumption of these infrastructures and services. It is argued that residents in municipalities with initial lower levels of spending will receive higher marginal benefits from additional municipal expenditure than those in municipalities with initial higher levels of spending, all other things being equal (Skidmore & Deller, 2008). This situation will lead residents in municipalities with initial lower levels of spending to be more willing to pay for additional local taxes for additional services (both quantitatively and qualitatively) than those in municipalities with initial higher levels of expenditure. As a consequence, the whole situation will result in rapid growth rates of spending in municipalities with initial lower spending levels and slower growth rates than in those with initial higher spending levels.

The fourth reason for the convergence of municipal expenditure relates to the notion of resource flow and yardstick competition. Skidmore and Deller (2008) only make reference to yardstick competition without explaining in detail how this could lead to convergence. It is argued here that the yardstick competition is amongst the reasons for convergence in municipal expenditures at the top. The literature proposes three hypotheses to explain strategic interactions between municipalities, which include the resource flow competition, yardstick competition, and spillover effects (Bosch & Solé-Ollé, 2007; Foucault, Madies & Paty, 2008; and Birkelöf, 2009).

The main implication of the hypothesis of yardstick competition is that the determination of municipal expenditure in a given jurisdiction is simultaneously influenced by municipal expenditure in neighbouring jurisdictions. Consequently, it can be assumed that, for a group of municipalities, there a possibility that, over time, their expenditure levels will converge to a common equilibrium. Similarly the resource flow competition may also to convergence of municipal expenditure at the low levels.

3 Overview of previous empirical studies

There are many studies in the field of regional economic integration that examined the convergence of macroeconomic variables, including fiscal policies between sub-regions and countries belonging to a region (Afexientou & Serletis, 1996); Bertarelli, Censolo & Colombo , 2014; Delgado & Presno, 2011; Esteve, Sosvilla-Rivero & Tamarit; 2000; Kočenda, Kutan & Yigit, 2008; Tibulcă, 2014; Blot & Serranito, 2006; and Delgado, 2008, 2013; and Apergis & Cooray, 2014).

Proponents and opponents of regional economic integration both apply the concept of convergence to either support or oppose their hypothesis of regional integration. The former argue that regional economic zones lead to the convergence of macroeconomic variables such as the incomes, fiscal policies and development of the countries concerned. Sperlich and Sperlich (2011) point out three main reasons to explain how regional economic zones contribute to the convergence of countries' macroeconomic variables. First, it is argued that the formation of regional economic integration is associated with the transfer of technology and knowledge between countries. It is argued that countries with initial lower levels of income experience rapid growth as they gain from the technology and knowledge of countries with initial higher levels of income.

There are very few studies in the literature that focus on the convergence of expenditure at subnational level, including municipalities. Annala (2003) studied the β-convergence of state and local fiscal policies in the US for the period 1977 to 1996. The author found that there was convergence of state and local fiscal policies over time. In addition, his findings confirm that the rate of convergence of subnational fiscal policies is more rapid than the convergence of per capita state output. Scully (1990) investigated the convergence of state and local fiscal policies from 1929 to 1985 in the United States of America. This author argues that the spatial convergence of per capita incomes and income distribution leads to the spatial convergence of fiscal regimes. In addition, Scully (1990) argues that the convergence of fiscal policies at subnational level is partly due to migration, as explained in the Tiebout model (Tiebout, 1956).

Merriman and Skidmore (2001) studied the convergence of state expenditure on health care for a period of ten years. Their empirical findings confirm that there is convergence of state spending on health in the US. These authors argue that there are three reasons for this convergence. First, the convergence of state spending on health care is a result of the convergence of state income levels. This is similar to the empirical finding in Scully (1991). Second, the increased importance of uniform federal rules has contributed significantly to the convergence of state spending on health in the US. Third, differences in initial conditions across states explain the convergence of spending on health care. Skidmore and Deller (2008)

confirmed the existence of σ-convergence and β-convergence of municipal capital, current and total expenditure in the US state of Wisconsin for the period 1990 to 2000.

The overview of previous empirical studies discussed in this section is just indicative and not exhaustive. But one important feature observed in the literature is that there various definitions of the concept convergence, and different technical approaches to measure them. Some of the technical approaches contract others. Given that this paper is the first attempt to measure the convergence of municipal expenditure in South Africa, and due to the lack of available data for a long period, this paper analyses the commonly used three definitions of convergence, namely the σ-convergence, absolute and conditional β-convergence, and employs the simple cross-section regression techniques.

4 Methodology

There are various measures proposed in the literature to describe the dispersion of the output growth over time. These measures include amongst others the standard deviation of the output, the inequality indexes such as the Gini or Theil Indexes. In this paper, the coefficient of variation is used to study the σ-convergence of municipal expenditure in South Africa for the period 2005/2016 – 2014/2015. Unlike the standard deviation that measures the dispersion of municipal expenditure in the cross section, the Coefficient of Variation (CV) measures the extent of variability of municipal expenditure in relation to the average municipal expenditure in the cross-section. The annual CV formula employed is given below.

$$CV_t = \frac{\left(\frac{1}{n}\sum_{i=1}^{n}\left(y_{it} - Y_t\right)^2\right)^{1/2}}{Y_t} \tag{1}$$

where

y_{it} is the expenditure for a municipality i at the time t; and

Y_t is the average expenditure for the cross-section of municipalities at the time t.

As it can be seen, there is CV for each year. With this information, a graph is created to see the trend in the evolution of the CV. If the derived CV curve declines as with time, it shows that there is reduction in dispersion of expenditure among municipalities over time. But it is important to note that σ-convergence does guarantee that there is β-convergence.

Conditional β-convergence

Equation (2) represents the specification model to measure the conditional β-convergence of municipal expenditure in South Africa for the period 2005/06-2014/2015.

$$\ln\left(\frac{g_{it}}{g_{it_0}}\right) = \delta + \beta \ln\left(g_{it}\right) + \alpha_k \ln\left(X_{kit}\right) + \varepsilon_i \quad (2)$$

where

g_{it_0} is an *N x 1* vector of initial levels of real per capita total expenditure in a municipality;

$X_{kit,}$ is an *N x M* matrix of *k* control variables, including dummy variables in municipality i at the time t;

ε_i is the residual; and

δ , β_1 and β_k are the model parameters to be estimated.

In essence, equation (2) above expresses that the growth rate of municipal expenditure between 2005/2006 and 2014/2015 in a particular municipality is explained by the initial level of real per capita total expenditure, control variables and the error term in that municipality. The parameter β_1 captures the conditional β-convergence of municipal expenditure.

Taking into account the existence of spatial interactions between municipalities, equation (2) can be expanded to include the spatial lag term as shown in equation (3) below.

$$\ln\left(\frac{g_{it}}{g_{it_0}}\right) = \delta + \beta_1 \ln\left(g_{it_0}\right) + \rho W \ln\left(\frac{g_{jt}}{g_{jt_0}}\right) + \alpha_k \ln\left(X_{kit}\right) + \varepsilon_i \quad (3)$$

where

The terms W, $\left(\frac{g_{jt}}{g_{jt_0}}\right)$ and the parameter ρ require some clarification. W term is the standardised square matrix whose elements are zero and one. It is referred to in spatial econometrics as the spatial weight matrix and measures the degree of neighbourliness between municipalities in the sample. Section 5.4 discusses in detail the criteria used in the present paper to determine neighbouring municipalities. $\left(\frac{g_{jt}}{g_{jt_0}}\right)$ is a vector of average growth rate of real per capita total expenditure in neighbouring municipalities. By incorporating this term in the equation, it means that the growth rate of expenditure in a given municipality is simultaneously influenced by the average growth rate of l expenditure in neighbouring municipalities. The parameter ρ is referred to as the spatial autoregressive coefficient and measures the degree of interaction between a municipality and its neighbouring jurisdictions with respect to the growth in expenditure. The specification shown in equation (3) refers to Spatial Autoregressive Model

(SAR). Two other spatial models, notably the Spatial Error Model (SEM), and the Spatial Durbin Model (SDM) can be derived from equation (2) above.

The SEM specification for the conditional β-convergence for municipal expenditure is given in equation (4) below.

$$\ln\left(\frac{g_{it}}{g_{it_0}}\right) = \alpha + \beta_1 \ln\left(g_{it_0}\right) + \beta_k \ln\left(X_{kit}\right) + \varepsilon_i$$

$$\varepsilon_i = \lambda W\left(u_j\right) + u_t \qquad (4)$$

All the terms in equation (4) have the same meaning as in equation (3). However, the distinctive feature of equation (4) is that there are two components in the error term ε_i. The component u_j represents the average error due to neighbouring municipalities. In other words, these are unobserved shocks that affect neighbouring municipalities. These shocks are then transmitted to a particular municipality through the error term. The component u_i is the idiosyncratic error for the municipality concerned. The parameter λ captures the strategic interactions between municipalities. There is conditional ß-convergence if β_1 is negative and statistically significant, hence the hypothesis of conditional β-convergence of real per capita municipal total expenditure cannot be refuted.

The SEM specification in equation (4) is suitable to explain the convergence of municipal expenditure in the context of strategic interactions. For instance, a random shock in one municipality through the error term ε_i has a possibility not only of affecting that particular municipality, but the expenditure of neighbouring municipalities will also be affected (Rey and Montouri, 1999).

Equation (5) below represents the SDM framework for conditional β-convergence of real per capita total municipal expenditure.

$$\ln\left(\frac{g_{it}}{g_{it_0}}\right) = \alpha + \beta_1 \ln\left(g_{it_0}\right) + \rho W\left(\frac{g_{jt}}{g_{jt_0}}\right) + \beta_k \ln\left(X_{kit}\right) + \phi_m W \ln\left(Z_{kj}\right) + \varepsilon_i \qquad (5)$$

where

$Z_{kj} = (g_{jt_0} + X_{kjt})$ is a matrix of m independent variables, including the initial level of real per capita total expenditure in municipality i.

The SDM model resembles the SAR in equation (3), except that the term $W\ln(Z_{kj})$, which captures the strategic interactions through independent variables, is added. According to equation (5), the growth rate of real per capita total expenditure in municipality i at time t is simultaneously explained by the initial level of real per capita total expenditure, control variables in that municipality, the average growth rate in real per capita total expenditure in neighbouring municipalities, the average initial level of real per capita total expenditure in neighbouring municipalities, and other characteristics in neighbouring municipalities.

Besides testing for convergence in municipal expenditure, the SAR, SEM and SDM are also used to examine whether there are strategic interactions between municipalities. Given that two hypotheses of strategic interactions are amongst the reasons to explain the convergence of municipal expenditure in this paper, the following conditions must be satisfied to either confirm or refute them. First, a spatial specification diagnosis should be carried out using various techniques to verify for the existence of spatial dependence. Second, if it is evident that there are spatial interactions, SAR, SEM, and SDM are estimated and Likelihood tests used to select the appropriate model.

Absolute β-convergence

Equation (6) below is the specification to measure the absolute β-convergence:

$$\ln\left(\frac{g_{it}}{g_{it_0}}\right) = \alpha + \beta\ln\left(g_{it_0}\right) + \varepsilon_i \tag{6}$$

The growth of municipal expenditure is only explained by initial level of municipal expenditure. The SAR specification of the absolute β-convergence is given in equation (6) below. This equation is similar to the SAR specification for the conditional β-convergence in equation (3), except that there are no control variables. There is absolute convergence as specified in equation (6) if the growth rate in municipal expenditure in a given municipality is explained by the initial level of real per capita total expenditure in that municipality. However, in the context of strategic interactions between municipalities, this definition is extended. Hence, equation (7) states that the growth rate in real per capita total expenditure in a municipality is explained by the initial level of real per capita total expenditure in that municipality and the average growth rate of real per capita total expenditure in neighbouring municipalities, and the residuals.

$$\ln\left(\frac{g_{it}}{g_{it_0}}\right) = \alpha + \beta\ln\left(g_{it_0}\right) + \rho W\left(\frac{g_{jt}}{g_{jt_0}}\right) + \varepsilon_i \tag{7}$$

The SEM specification in equation (8) below corresponds to the absolute β-convergence of real per capita total expenditure, taking into account strategic interactions between municipalities.

$$\ln\left(\frac{g_{it}}{g_{it_0}}\right)=\alpha+\beta_1\ln\left(g_{it_0}\right)+\varepsilon_i$$

$$\varepsilon_i=\lambda W\left(u_j\right)+u_i \tag{8}$$

Equation (9) below is specified SDM to test the absolute β-convergence of real per capita total expenditure in South African municipalities.

$$\ln\left(\frac{g_{it}}{g_{it_0}}\right)=\alpha+\beta_1\ln\left(g_{it_0}\right)+\rho W\left(\frac{g_{jt}}{g_{jt_0}}\right)+\phi W\ln(g_{jt_0})+\varepsilon_i \tag{9}$$

Based on Elhorst (2011), the estimation procedure adopted in this paper is as follows. First, equations (2) and (6) are estimated with least squares. SAR and SEM equations are estimated with the maximum likelihood (ML) method. Second, the residuals equations (2) and (6) are tested using Moran's I statistic. The residuals of the SAR and SEM models are also tested using the Lagrange Multiplier (LMLAG, LMERROR, and LMSAR), Likelihood Ratio (LRATIOS), and the Walds tests to detect the presence of spatial dependence. All these statistics are used in this paper for robustness purpose.

The null hypothesis of the Moran's I statistic is that there is no spatial dependence in the residuals of equations (2) and (6). Therefore, the specification without taking into account spatial among municipalities will yield spurious inferences. The null hypothesis for the rest of the test is that the residuals of the estimated spatial models do not exhibit spatial dependence. This null hypothesis is rejected in favour of the alternative hypothesis if the computed probability value of the associated with a particular statistic is smaller than the required significance level (1%, 5%, and 10%). This implies that the estimated spatial model is appropriate.

If the spatial specification diagnosis results point to existence of spatial interactions, the next step is to estimate the SDM model. Therefore, the likelihood ratio test (LR) is used to compare SDM against SAR and SEM. The purpose of this comparison is to choose a spatial model that is suitable for the sample.

It is important to note that the suitability in this case refers to the model that best captures the strategic interactions. It can be recalled that each of the three spatial models specified in this paper captures strategic interactions differently. For instance, in the SAR model, strategic interactions are captured through the dependent variables, whereas in the SEM they are captured through the error terms. SDM captures the strategic interactions through the dependent and independent variables. Hence, it is important to determine, using the LR test, which model is suitable.

In this paper, the application of the LR test is done by first considering that SDM is the unrestricted model, whereas SAR and SEM are restricted models. The SDM is considered the unrestricted model because it captures two types of strategic interactions. Second, certain restrictions should be imposed on the unrestricted model and tested if these are statistically significant. The paragraph below shows how these restrictions are imposed on the SDM model.

The LR test is applied by imposing two restrictions on the SDM in equations (5) and (9). The first restriction consists of assuming that $H_0 : \phi = 0$.This means that the SDM can be simplified to SAR. This applies for both the conditional β-convergence as expressed in equation (5), and the absolute β-convergence in equation (9). Second, it is assumed that the SDM can be simplified to SEM., hence the null hypothesis: $H_0 : \phi + \rho\beta = 0$. There are four possibilities that emerge from these two restrictions: (i) if both null hypotheses, $H_0 : \phi = 0$ and $H_0 : \phi + \rho\beta = 0$, are rejected, it means that the SDM is well suited to represent the sample data; (ii) if $H_0 : \phi = 0$ is not rejected while $H_0 : \phi + \rho\beta = 0$ is rejected, this means that SAR describes the data well. This condition is only sufficient if the reported LMSAR statistic points to the rejection of the null hypothesis of no spatial dependence, otherwise the SDM is suitable; (iii) if $H_0 : \phi = 0$ is rejected and $H_0 : \phi + \rho\beta = 0$ is not rejected, SEM is suitable, provided also that the null hypothesis of no spatial dependence is rejected, otherwise SDM is appropriate, (iv) if $H_0 : \phi = 0$ and $H_0 : \phi + \rho\beta = 0$ are not rejected, it implies that both SAR and SEM are appropriate. It also means that the interactions between municipalities are occurring through the growth rate of real per capita total expenditure and through the unobserved shocks in the error terms.

5 Data

Fifty four out of two hundred seventy eight South African municipalities are selected as the sample for the analysis in this paper. They include all eight metropolitan municipalities, 19 large urban municipalities, referred to as secondary cities, and 27 large towns. The selection of this sample is based on the economic and population size importance of these municipalities. These municipalities hosted 60% of the total South African population in 2013, and 83% of national total gross valued added was generated in these municipalities in 2013. Due to missing data other municipalities are not included in the analysis.

To examine the convergence of municipal expenditure, municipal information of total expenditure for a period of 2005/2006 to 2014/2015 was collected. Information prior to 2005 was not available. Even Skidmore and Deller (2008) considered a ten-year period to analyse the convergence of municipal expenditure in the state of Wisconsin in the United States. Other control variables are selected in order to be able to analyse the conditional ß-convergence in particular. The selection of these variables is in line with the literature regarding the empirical specification of government expenditure. It is argued in the literature that municipal expenditure is affected by the structure of the economy, demography, and sociological and geographical factors. Table 1 in the Appendix presents the data used for the analysis in this paper.

To account for differences that exist among municipalities in terms capacity, three dummy variables are alternatively included in the specification: METRO, B1, and B2. The dummy variable takes the value 1 if a municipality in the cross-section is a metropolitan municipality. Otherwise, it takes the value zero. It is important to note that there are eight metropolitan municipalities in South Africa and all are included in the analysis. The dummy variable B1 takes the value 1 if a municipality is a local municipality classified as B1, otherwise it is zero. There are 19 local municipalities classified as B1 in South Africa and all are included in the analysis. The dummy variable B2 takes the value 1 if a municipality is a local municipality classified as B2, and if not it takes the value zero.[2]

Given that there are many municipalities that do not have the same borders in the selected sample, the criteria of geographic proximity to determine neighbourliness is ruled out in the present paper. However, centroid distances as shown below:

$$w_{ij} = \begin{cases} d_{ij}^{-1}, & i \neq j \\ 0, & i = j \end{cases} \tag{10}$$

where

w_{ij} is the element in the spatial weight matrix C with the same form as matrix (13); and

d_{ij} is the centroid distance between municipalities i and j in the sample.

Equation (10) shows that the spatial weight matrix takes two values, zero for elements on the diagonal, and the inverses of centroid distances between municipalities for other elements. The particular feature in the spatial weight matrix is that each municipality is neighbour to all other municipalities in the sample.[3]

Table 2 presents the summary descriptive statistics of the variables used in the analysis in this paper. It can be seen that the maximum growth of real per capita municipal total expenditure is equal to 61%, whereas the minimum growth is -4%. Despite the gap between the maximum and minimum growth rates, it can been seen that the dispersion of the growth rates of real per capita municipal total expenditure from its mean value is not wide, given the reported standard

2 The classification used in this chapter is borrowed from Palmer Development Group (PDG), which is a development consulting firm in South Africa. It has used various dimensions, including financial management capacity, access to services, human settlement typologies to cluster South African municipalities into seven groups. For the purpose of this chapter only three groups are included in the sample: Metropolitan municipalities, B1 and B2 local municipalities.

3 Information on centroid distances between municipalities was sourced from Quantec Research. This data is not available publically, and was obtained by special request to Quantec.

deviation of 8.3%. This standard deviation is bigger than the mean, which may such that there might be some outliers in the data for the growth of municipal expenditure variable. Given that in all variable are entered in natural logarithm for the regression, the potential problem of outlier is avoided. The same applies in the case of growth rate of real per capita disposable income (GINCOME). This is an indication of some similarities between the municipalities selected for the analysis in this paper.

However, the reported summary statistics for POV and HHI show wide disparities. This is because there is a large gap between the standard deviations for these two variables and their respective mean values.

6 Empirical results

The primary objective in this section is to interpret the empirical findings in order to answer the research of whether there is convergence of municipal expenditure in South Africa. Since there are three concepts of convergence used in this paper, of which two concepts are measured using econometric models, this section first presents the σ-convergence using graphical representation.

The evolution of the dispersion of per capita real municipal total expenditure, measured though the coefficient of variation, is represented in Figure 1. Although, the curve is characterised by ups and downs, it is clear that it is decreasing. This shows that there are been reduction in the dispersion of per capita real municipal total expenditure from 2005/2006 to 2014/2015.

It is shown in Table 4 that the CV of per capita real municipal total expenditure was 0.53 in 2005/2006, whereas it is at 0.40 in 2014/2015. There is a decline of 0.13 (0.53 – 0.40). The minimum value of CV is recorded in 2012/2013 (0.36) and the maximum in 2008/2009 (0.53). The year 2008/2009 coincides with the period that the preparation for the 2010 FIFA WOLRD CUP started in South Africa. Host cities, which are all included in the sample increased their expenditure to focus on infrastructure development such as roads and stadia. This could partly be the reason why the dispersion of expenditure among municipalities in the sample increased. The average CV of per capita real municipal total expenditure for the period is 0.46.

In addition, a simple scatter plot (Figure 2) of lagged per capita real municipal total spending on provides a visual hypothesis of convergence. The declining trend shown in Figure 2 is an indication that municipalities with initial higher level of expenditure are experiencing slow growth of municipal expenditure. The next section provides the discussion on empirical findings.

This paper also examined the evolution in the dispersion of the per capita real municipal own revenue. Figure 3 show that there is a sharp CV for per capita real municipal own revenue from 2005/2006 to 2008/2009. This is followed by a sharp increase of CV until 2011/12. This period is characterised by wide disparities among municipalities with respect to own revenue. But it is important to note that there is a decline of CV for the entire period. .

The estimates for the absolute β-convergence of per capita real municipal total expenditure are reported in the first column of Table 5. Results in columns 2, 3, and 4 are the estimates of the conditional β-convergence. The difference between these estimates is that in

column 2 (A) the dummy variable *B2* is included, in column 3(B) dummy variable *METRO* is included, and the dummy variable *B1* is included in the last column. First, before going into discussion of the estimates, it is important to discuss the results of t the spatial specification diagnosis tests shown in the bottom part of the Table 5.3. Except for the *LMSAR*, the null hypothesis of no spatial dependence cannot be rejected. This is because the probability values associated with each of the statistics are greater than 0.1. This means the least square is the appropriate estimator and only the estimates for equations (2) and (2) are reported in Table 5.

Second, the Ramsey test was used to check if there is omission of variable in the specification. The reported probability value of the Ramsey statistic shown in first column is smaller (0.034) than 5%. This means the null hypothesis of no omission of variable in the specification of the absolute β-convergence is rejected. It is therefore an indication that there is omission of variables that explain the growth of municipal expenditure in the specification of the absolute β-convergence. Furthermore, with the estimation of the conditional β-convergence in columns 2, 3 and 4, the respective probability values of the Ramsey statistics cannot be rejected. This shows the soundness of the specification of the conditional β-convergence.

Third, it can also be seen that the R^2 of the conditional β-convergence in columns 2, 3 and 4 are greater respectively greater (86.56, 86.91, and 86.44) than R^2 reported in column 1(33.78). This shows that the conditional β-convergence models explain more than half the variation in the growth of per capita real municipal expenditure for the sample under examination. In all columns, the *F*-statistics are statistically significant.

Fourth, the primary variable of interest in this paper is the lagged per capita real municipal total expenditure (*EXP2005*). Its reported coefficient in the first column is negative and statistically significant (-0.0048). Similarly, the coefficients of *EXP2005* in other models are negative and statistically significant (-0.0123, -0.0125 and -0.0122). This indicates that that municipalities with lower initial spending experienced higher growth in expenditures than did municipalities with higher initial spending. In other words, there is evidence in favour of absolute and conditional β-convergence. The fact that there is not a big gap between coefficients of EXP2005 in columns 2, 3 and 4 demonstrates the stability of the estimated β-convergence models.

In the case of the absolute convergence, the point estimate (or speed of convergence) of *EXP2005* equals -0.0047, which means that a 1% increase in the initial level of real per capita municipal total expenditure is associated with 0.9952% of additional current level of per capita

real municipal total expenditure, all other things being equal.[4] Whereas the coefficients of EXP2005 in columns 2, 3 and 4 means that for every 1% increase in the initial level of real per capita municipal total expenditure is associated with 0.9877%, 0.9875%, and 0.9878% additional current per capita real municipal total expenditure respectively.

Fifth, the reported coefficients of *GRANT2005* and *REVENUE2005* in columns 2, 3 and 4 are positive and statistically significant. This shows that per capita real expenditure for municipalities which had initially higher levels of fiscal transfers and own revenue sources grew fast. The coefficient of *EDU* in columns 2, 3 and 4 are negative and significant. It is an indication that municipalities with high proportions of educated people grow slow. In addition, the point estimate for the growth of population in columns 2, 3 and 4 are positive and statistically significant. It is an indication of positive growth of population leads to a fast growth of per capita real expenditure, all other things being equal.

Sixth, it is important to note that none of the dummy variables in columns 2, 3 and 4 is statistically significant. This means the behaviour regarding the growth of per capita real municipal expenditure in the sample does not depend whether a municipality is a metropolitan, belongs to class B2 or class B1 municipalities.

Seventh, the results reported in Table 5, in particular the point estimates for *EXP2005* are consistent with the findings by Skidmore and Deller (2008) in the sense there is evidence of conditional β-convergence. It is important to also note that the evidence of σ-convergence of municipal expenditure is shown in the graphical representation discussed above. In order to test the hypothesis put forward in this paper that the convergence of municipal expenditure may be explained by convergence of revenue, the convergence of own revenue is examined using similar specification and procedures discussed in section 4. In other words, instead of using the ratio $\left(\frac{g_{it}}{g_{it_0}}\right)$ as the dependent variable and the term $\left(g_{it_0}\right)$ independent variable through which the convergence is capture, equation (5.14) below employ the ratio $\left(\frac{R_{it}}{R_{it_0}}\right)$ and the term $\left(R_{it_0}\right)$.

4 The 0.99 figure is obtained from equation (6) described in section 4:

$\ln\left(\frac{g_{it}}{g_{it_0}}\right) = cons\tan t + (\beta - 1)\ln(g_{it_0})$, which implies that

$$\ln(g_{it}) = cons\tan t - 0.0048\ln(g_{it_0}) + \ln(g_{it_0}) \equiv cons\tan t + 0.99\ln(g_{it_0})$$

$$\ln\left(\frac{R_{it}}{R_{it_0}}\right) = \delta + \beta_1 \ln\left(R_{it_0}\right) + \alpha_k \ln\left(X_{kit}\right) + \varepsilon_i \quad (11)$$

where

R_{it_0} is an *N x 1* vector of initial levels of real per capita own revenue in a municipality. The rest of variables are defined as in equation (2).

Equation (11) is specified to estimate the rate of absolute β-convergence of per capita municipal own revenue. The rate of conditional β-convergence is also estimated by adding control variables in the equation (11). Moreover, spatial models can also be specified following the same procedure as discussed in section 4 of this paper. For the space purpose, only the parameter estimates are reported in this section.

Table 6 presents the parameter estimates for the absolute and conditional β-convergence of municipal own revenue in South Africa for the period 2005/2006 – 2014/2015. First reported statistics for spatial specification at the bottom of the Table 6 suggest that spatial models are not appropriate. It means least squares method is employed to estimate the absolute and conditional β-convergence. Second, the coefficient of *REVENUE2005* is negative and significant in the case of absolute β-convergence, whereas there are insignificant in the case of conditional β-convergence as shown in column 1, 2, 3, and 4. With regard to the absolute β-convergence, there is evidence that municipalities with initial higher levels of own revenue are experiencing a slow growth of per capita real own revenue, while those with initial lower levels of own revenue have faster growth of per capita real own revenue, all other things being equal. In other words, 1% increase of lagged per capita real own revenue is associated with 0.9977% additional current per capita real own revenue, all other things being equal.

Second, there are many control variables that are insignificant in columns 2, 3, 4. However, the reported *F*-statistics are significant, which is an indication that globally the variables included in the models are explaining the growth of municipal own revenue for the period under consideration. This is also confirmed by the Ramsey test in columns 2, 3 and 4 that do not reject the null hypothesis of variable omission.

Overall, there are key points to be noted from the graphical representation and empirical findings in the present paper. First, it is clear to notice that there is reduction in the dispersion of municipal expenditure for the sample under consideration over time. This points to the fact that σ-convergence has occurred for the period considered. Second, there is no evidence to suggest the existence of spatial interactions neither in the case of convergence of municipal expenditure nor convergence of municipal own revenue for the sample considered in this paper.

Third, the absolute and conditional β-convergence is confirmed for expenditure is confirmed for the sample of 54 South African municipalities considered in this paper. However, except for the case of absolute convergence, there is no evidence to suggest that the conditional β-convergence of expenditure is associated with convergence of own revenue.

7 Conclusion

The main objective of this paper was to answer this research question: Is there any convergence of municipal expenditure in South Africa. To answer this question three concept of convergence were adopted and employed in this paper: a) σ-convergence; b) absolute β-convergence; and c) conditional β-convergence. Information of real per capita total expenditure was gathered for a sample of 54 municipalities in South Africa in the period 2005/2006 to 2014/2015. Given that it is argued in the literature that there are strategic interactions between local governments in a system of fiscal decentralisation, it was also important to include spatial econometrics techniques in the specification. This paper contributes to the literature on convergence of municipal expenditure as this the first attempt to focus on South Africa.

Although the concept of convergence is widely used in economic growth studies, it was demonstrated other field of economic are also using this concept to measure the evolution of disparities or inequalities between regions or entities. It was therefore relevant to measure in this paper whether local fiscal policies are converging or diverging. Arguments to support the hypothesis of divergence of local fiscal policies and those that support the convergence were put forward in this paper. Given the lack of consensus in the theory, it emerged from this discussion that the question of convergence of local fiscal policies in a fiscal decentralisation system remains an empirical one. In other words, it depends on specific conditions in a country and an empirical assessment is required.

The coefficient of variation (CV) were calculated to tract the evolution in the dispersion of both municipal expenditure and own revenue. The obtained CV were then used in a graphical representation, which attested to the existence of σ-convergence for municipal expenditure and own revenue respectively. Second, although, SAR, SEM and SDM models were specified, the findings of spatial specification tests suggested that these models were not appropriate for the sample data. Therefore, the specified models that do not include spatial dimension were estimated using least squares method.

The empirical findings showed evidence of absolute and conditional β-convergence of per capita real expenditure. That is to say, for the sample of 54 South African municipalities and for the period under consideration, it was found that municipalities that has initial higher levels of per capita real expenditure experienced a slow growth of per capita real expenditure, whereas

those that had initial lower levels of per capita expenditure recorded fast growth of per capita real expenditure, all other things being equal. It is important to note that the empirical findings with regard to convergence of municipal expenditure are in the same line with findings of previous studies (Scully, 1991; Annala, 2003; Skidmore & Deller, 2008). For instance, Skidmore and Deller (2008) found that there is slow convergence of municipal total spending in the US state of Wisconsin, notably 0.77% in the case of absolute convergence.

The analysis was also done to test whether convergence of expenditure could be partly explained by convergence of revenue. To test this argument, absolute and conditional β-convergence of municipal own revenue were analysed through econometric modelling. The findings confirmed the existence of the absolute β-convergence, but there was no evidence of conditional β-convergence.

This paper has some limitations. For instance, the time period considered to analyse the convergence of real per capita municipal total expenditure is relatively short in comparison with other studies in the literature due to limited data availability in South Africa. In addition, other types of convergence, such as club convergence, could not be analysed due to the same problem of data availability. Similarly, because of missing information and inconsistencies the convergence in expenditure for other categories of municipalities, such as district and rural municipalities could not be tested.

The question of convergence of local fiscal policies is very important in a fiscal decentralised such as South Africa. The analysis carried out in this paper is just the first attempt and open the door for further research in the field to inform the formulation of policy for local government.

References

Afexientou, P.C. and Serletis, A. (1996). Government expenditures in the European Union: Do they converge or follow Wagner's Law? *International Economic Journal,* 10(3), 33-47.

Annala, C. (2003). Have state and local fiscal policies become more alike? Evidence of beta convergence among fiscal policy variables. *Public Finance Review,* 3, 144-165.

Apergis, N. and Cooray, A. (2014). Tax revenues convergence across ASEAN, Pacific and Oceania countries: Evidence from club convergence. *Journal of Multinational Financial Management*, 27, 1-21.

Bala, A.P. (2011). Economic convergence in SADC: Towards new empirical checks. *DOUNIA, Revue d'Intelligence Stratégique et des Relations Internationales*, 4, 144-158.

Barro, R. J. (1995). *Economic growth.* New York: McGraw-Hill.

Barro, R.J. (1990). Government spending in a simple model of endogenous growth. *Journal of Political Economy*, 98, 102-125.

Barro, R.J. and Sala-i-Martin, X. (1992). Convergence. *Journal of Political Economy*, 100(2), 223-225.

Bertarelli, S. Censolo, R. and Colombo, C. (2014). Fiscal convergence in the European Union before the crisis. *Contemporary Economic Policy*, 32(4), 784-801.

Birkelöf, L.C. (2009). Spatial interaction and local government expenditure for functionally impaired in Sweden. Unpublished PhD dissertation. Available at: http://www.google.com (accessed on 6 June 2012).

Blot, C. and Serranito, F. (2006). Convergence of fiscal policies in EMU: A unit-root tests analysis with structural break. *Applied Economics Letters*, 13(4), 211-216.

Bosch, N. and Solé-Ollé, A. (2007). Yardstick competition and the political costs of raising taxes: An empirical analysis of Spanish municipalities. *International Tax and Public Finance*, 14(1), 71-92.

Brueckner, J.K., Borge, L.E. and Rattsø, J. (2014). Partial fiscal decentralisation and demand responsiveness of local public sector: Theory and evidence from Norway. *Journal of Urban Economics*, 80,153-163.

Caldeira, E. and Rota-Graziosi, G. (2014). The crowding-in effects of simple unconditional central grants on local own-source revenue: The case of Benin. *Journal of African Economies*, 23(3), 361-387.

Caldeira, E., Foucault, M. and Rota-Graziosi, G. (2012). Does decentralisation facilitate access to poverty-related services? Evidence from Benin. National Bureau of Economic Research. *Working Paper* 18118.

Delgado, F.J. (2008). Tax burden in the European Union: An analysis of beta, sigma and gamma convergence. *Revista de Economía Mundial*, 22, 141-166.

Delgado, F.J. (2013). Are taxes converging in Europe? Trends and some insights into the effect of economic crisis. *Journal of Global Economics*, 1(1), 1-3.

Delgado, F.J. and Presno, M.J. (2011). Convergence of the fiscal pressure in the European Union: A time series approach. *Applied Economics*, 43, 4257-4267.

Elhorst, J.P. (2011). Spatial panel models. Available at: http://www.regroningen.nl/elhorst (accessed on 6 January 2014).

Esteve, V., Sosvilla-Rivero, R.S. and Tamarit, C. (2000). Convergence in fiscal pressure across EU countries. *Applied Economics Letters*, 7, 117-123.

Foucault, M., Madies, T. and Paty, S. (2008). Public spending interactions and local politics: Empirical evidence from French municipalities. *Public Choice*, 137, 37-80.

Kočenda, E., Kutan, A.M. and Yigit, T.M. (2008). Fiscal convergence in the European Union. *North American Journal of Economics and Finance*, 19, 319-330.

Manor, J. (ed). (1999). The political economy of democratic decentralisation. Washington, DC: The World Bank.

Merriman, D. and Skidmore, M. (2001). *Convergence in state government health care spending and fiscal distress*. Proceedings of the Ninety-Fourth Annual Conference of the National Tax Association.

Prud'homme, R. (1995). The dangers of decentralisation. *World Bank Research Observer*, 10(2), 201-20.

Republic of South Africa (1998). White paper on local government. Available at: http://mfma.treasury.gov.za/Legislation/Pages/default.aspx.

Rey, S.J. and Montouri, B.D. (1999). US regional income convergence: A spatial econometric perspective. *Regional Studies*, 33(2), 143-156.

Sala-i-Martin, X. (1996). The classical approach to convergence analysis. *The Economic Journal*, 106/437, 1019-1036.

Appendix

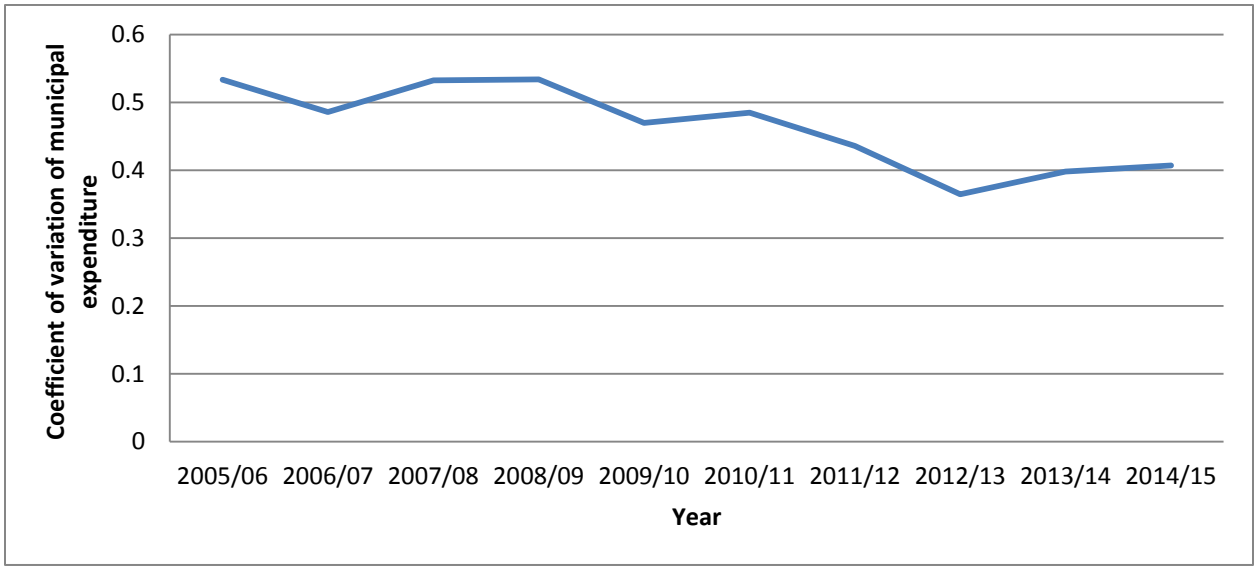
Table 1: Variables used in this paper

Variable	Description	Source
GEXP	Average annualised growth of real per capita municipal total expenditure	National Treasury (2014)
EXP2005	Real per capita municipal total expenditure in 2005/2006	National Treasury (2014)
GRANT2005	Total fiscal transfer allocated to a municipalities in 2005/2006	National Treasury (2014)
REVENUE2005	Per capital total municipal own revenue	National Treasury (2014)
GINCOME	Real total disposable income	Global Insight (2014)
GPOP	Average annualised municipal population growth rate	Global Insight (2014)
HHI	Household Infrastructure Index	Global Insight (2014)
EDU	The number of persons with at least a first university or post-secondary school degree as a proportion of total population	Global Insight (2014)
POV	The proportion of people that are living in poverty	Global Insight (2014)
MANU	The proportion of persons of working age (15 years and more) employed in the manufacturing sector	Global Insight (2014)

Table 2: Summary statistics

Variable	Mean	Max	Min	STD
GEXP	0.081	0.613	-0.049	0.083
EXP2005	4 238	13 991	1 183	2 259
GRANT2005	490	941	269	162
REVENUE2005	3 124	7 218	550	1 587
GINCOME	0.025	0.065	-0.084	0.025
GPOP	0.013	0.051	-0.020	0.013
HHI	0.781	0.915	0.475	0.092
EDU	0.012	0.033	0.002	0.006
POV	0.368	0.565	0.259	0.070
MANU	0.036	0.095	0.004	0.020

Figure 1: σ-convergence of per capita real municipal expenditure



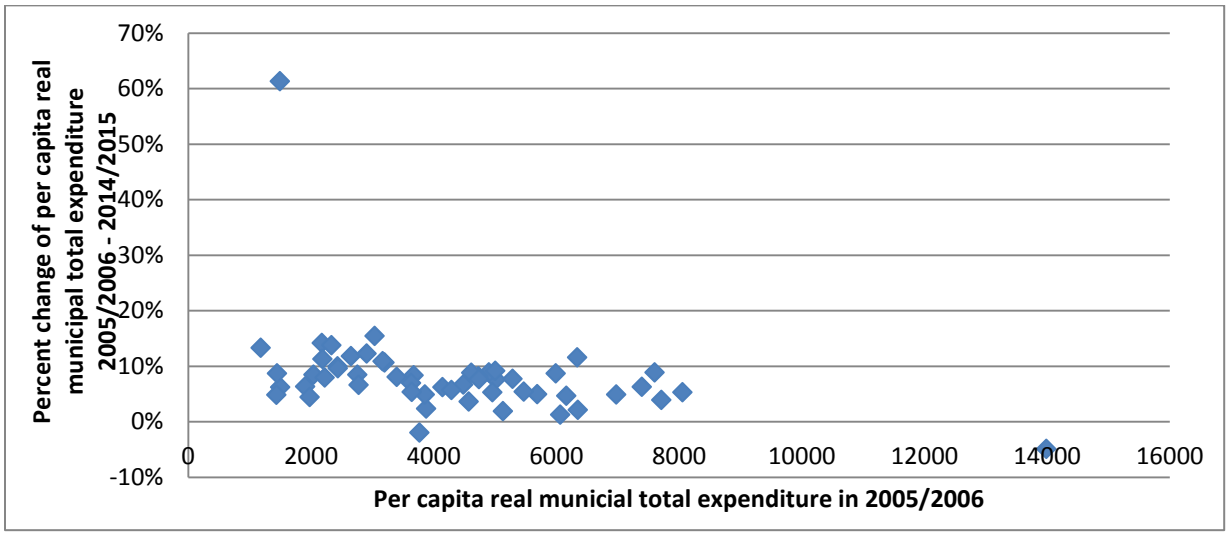
Source: Author's own calculation.

Table 3: σ-convergence of municipal expenditure in SA

CV 2005/2006	0.53309
CV 2014/2015	0.40688
CV MAX (Year)	0.53385
CV MIN (Year)	0.36427
Average CV for the period	0.46434

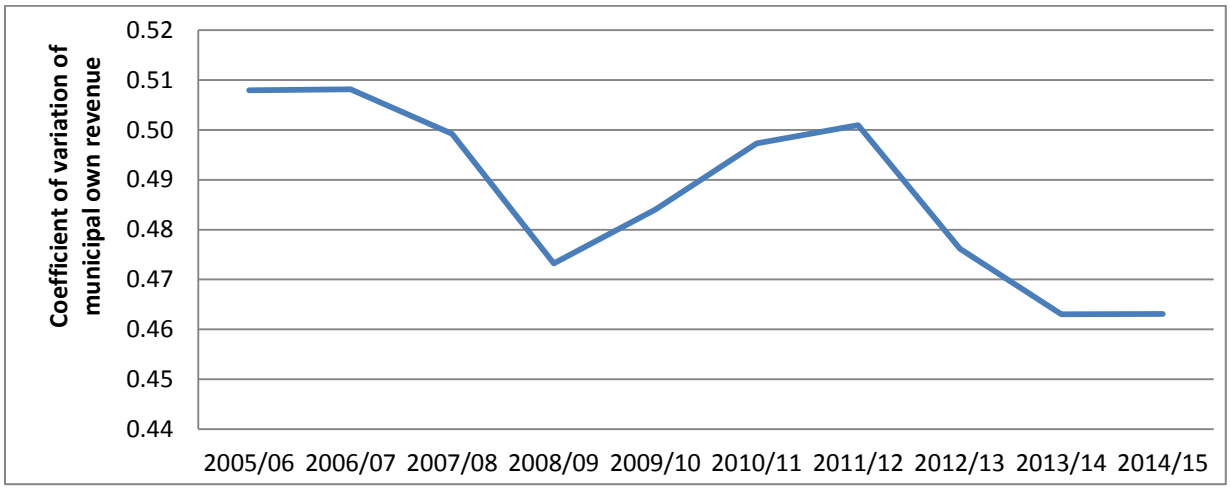
Source: Author's own calculation.

Figure 2 Convergence of per capita real municipal expenditure



Source: Author's own calculation.

Figure 3: σ-convergence of per capita real municipal own revenue



Source: Author's own calculation.

Table 5: Parameter estimates for β-convergence of municipal expenditure

Variable	Absolute β-convergence	Conditional β-convergence		
		A	B	C
Constant	0.0466***	-0.1110**	-0.0999*	-0.1162**
	(0.000)	(0.033)	(0.064)	(0.031)
EXP2005	-0.0048***	-0.0123***	-0.0125***	-0.0122***
	(0.000)	(0.000)	(0.000)	(0.000)
GPOP		0.4744*	0.4663*	0.4354*
		(0.056)	(0.067)	(0.079)
GINCOME		0.1171**	0.1049**	0.1236**
		(0.019)	(0.034)	(0.013)
MANU		-0.0001	0.00001	-0.0001
		(0.835)	(0.982)	(0.830)
HHI		-0.0058	-0.0059	-0.0056
		(0.176)	(0.184)	(0.209)
EDU		-0.0008*	-0.0008**	-0.0009*
		(0.077)	(0.049)	(0.066)
POV		0.0016	0.0024	0.0014
		(0.478)	(0.278)	(0.512)
GRANT2005		0.0023**	0.0025**	0.0021*
		(0.049)	(0.043)	(0.063)
REVENUE2005		0.0097***	0.0100***	0.0094***
		(0.000)	(0.000)	(0.000)
B2		0.0003		
		(0.527)		
METRO			-0.0010	
			(0.116)	
B1				0.0001
				(0.857)
R^2	33.78	86.56	86.91	86.44
F-statistic	15.64***	87.07***	89.51***	91.31***
	(0.000)	(0.000)	(0.000)	(0.000)
RAMSEY TEST	3.12**	0.15	0.29	0.23
	(0.034)	(0.931)	(0.832)	(0.874)
Moran	0.4448	-0.4618		
	(0.656)	(0.644)		
LMERROR	0.9375	0.3519		
	(0.332)	(0.553)		
LMLAG	0.9787	0.3638		
	(0.322)	(0.546)		
Walds	0.9574	0.7954		
	(0.327)	(0.372)		
LMSAR	12.4072***	1.8053		
	(0.000)	(0.179)		
LRATIOS	1.6513	0.7997		
	(0.198)	(0.371)		

*Figures in parentheses are the p-values obtained from robust standard errors; ***, ** and * refer to statistical significance at 1%, 5% and 10% respectively.*

Table 6: Parameter estimates for β-convergence of municipal own revenue

		Conditional β-convergence		
Variable	**Absolute β-convergence**	**A**	**B**	**C**
Constant	0.0243***	-0.0217	-0.0264	-0.0113
	(0.002)	(0.757)	(0.681)	(0.867)
REVENUE2005	-0.0023**	-0.0024	-0.0026	-0.0019
	(0.015)	(0.228)	(0.222)	(0.356)
GPOP		-1.1931*	-1.0856	-1.174
		(0.093)	(0.137)	(0.113)
GINCOME		0.0268	0.0311	0.0091
		(0.704)	(0.641)	(0.891)
MANU		0.00002	-0.00009	0.0001
		(0.976)	(0.922)	(0.883)
HHI		-0.0039	-0.0038	-0.0050
		(0.569)	(0.551)	(0.451)
EDU		-0.0009	-0.0008	-0.0008
		(0.184)	(0.251)	(0.287)
POV		-0.0053*	-0.0061*	-0.0045
		(0.078)	(0.097)	(0.167)
GRANT2005		0.0016	0.0016	0.0020
		(0.392)	(0.416)	(0.303)
B2		-0.0014		
		(0.142)		
METRO			0.0015	
			(0.176)	
B1				0.0006
				(0.867)
R2	12.70	41.72	40.30	39.54
F-statistic	6.32**	4.81***	4.73***	4.69***
	(0.015)	(0.000)	(0.000)	(0.000)
RAMSEY TEST	3.09**	0.70	1.45	1.17
	(0.035)	(0.559)	(0.241)	(0.333)
Moran	1.2576	-0.6746		
	(0.208)	(0.499)		
LMERROR	1.3530	0.2281		
	(0.244)	(0.632)		
LMLAG	1.3142	0.1847		
	(0.251)	(0.667)		
Walds	0.7841	0.4747		
	(0.375)	(0.490)		
LMSAR	2..2016***	5.5850**		
	(0.000)	(0.018)		
LRATIOS	2.1015	0.5899		
	(0.146)	(0.442)		

*Figures in parentheses are the p-values obtained from robust standard errors; ***, ** and * refer to statistical significance at 1%, 5% and 10% respectively.*