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Local Municipality Productive Efficiency and Its Determinants in South Africa

Nara F. Monkam¹

Department of Economics, University of Pretoria, Private bag X20
Hatfield 0028, Pretoria, South Africa

Email: nara.monkam@up.ac.za

Abstract

The paper assesses the technical efficiency of 231 local municipalities in South Africa for 2007 and investigates the potential determinants of efficiency gaps among local municipalities in the country using the nonparametric Data Envelopment Analysis (DEA) and the parametric Stochastic Frontier Analysis (SFA) techniques. In relation to the DEA technique, efficiency scores are subsequently explained in a second stage regression model with potential explanatory factors using a Tobit regression model. The results show that on average, B1 and B3 municipalities could have theoretically achieved the same level of basic services with about 16% and 80% fewer resources respectively; the difference between the most efficient and the least efficient municipalities being quite substantial. The results also show that B4 municipalities could have theoretically achieved the same level of basic services with about 62% fewer operating expenditures. Furthermore, fiscal autonomy and the number and skill levels of the top management of a municipality's administration were found to influence the productive efficiency of municipalities in South Africa. The paper findings raise concerns over the future of local municipalities in South Africa, especially B3 and B4 municipalities, about their capability to efficiently deliver on expected outcomes on a sustainable basis.

JEL classifications: H11; H71; H72; H77

Keywords: Municipalities, spending efficiency, sub-national government finance, fiscal decentralization; DEA analysis, Tobit, SFA,

1. Introduction

The traditional consensus in the theory of fiscal decentralization generally emphasizes that the devolution of expenditure responsibilities and revenue powers from a higher level of government to sub-national levels of government are bound to improve accountability, responsiveness, and good governance of local governments. These expected outcomes of a sound fiscal decentralization process are often ascribed to the following factors: first, citizens are better able to articulate their needs and preferences to local government officials who are closer to people and have a comparative advantage through knowledge of local circumstances; and second, citizens, through tax compliance, will demand accountability in terms of service delivery. Additionally, fiscal decentralization accompanied by political and administrative decentralization would allow for higher efficiency levels of service delivery as local governments would provide goods and services to their constituents according to their wishes and as the assignment of functions and allocations of resources would take into account economies of scale and jurisdictional spillovers. Furthermore, efficiency in service

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delivery is likely to be reinforced by central government oversight, citizen participation in decision-making processes, and civil society organizations' monitoring and evaluation. In this context, it follows logically that democracy and governance are likely to be achieved as citizens become an integral part of the institution and the political dialogue.

However, in South Africa, the process of fiscal decentralization has yet to produce the expected results. Specifically, in the recent years, South Africa has been experiencing growing dissatisfaction with service delivery at the local level. In fact, local municipalities in South Africa have hitherto been plagued by significant service delivery and backlog challenges, poor financial management, corruption, and poor capacity due to lack of skills. This situation has resulted in a great number of local municipalities in financial distress and a loss of confidence and trust in local governments. The problems and challenges faced by local municipalities in South Africa are so crucial and alarming that questions have been raised concerning their capability to efficiently deliver on expected outcomes on a sustainable basis. Furthermore, and perhaps most alarmingly, the necessity to envisage a reverse tendency toward centralization has been proposed as a possible panacea.

With this background in mind, the objective of the paper is twofold: to identify the most efficient local municipalities in South Africa in terms of providing the best possible public local services at the lowest possible cost and to investigate the empirical determinants of local spending efficiency in order to draw policy conclusions about efficiency and effectiveness in local service delivery in South Africa.

The paper therefore assesses the spending efficiency of 231 local municipalities in South Africa for 2007 using the nonparametric Data Envelopment Analysis (DEA) and the parametric Stochastic Frontier Analysis (SFA) techniques. In relation to the DEA technique, efficiency scores are subsequently explained in a second stage regression model with potential explanatory factors such as income, education, job vacancy using a Tobit regression model. The results show that on average, B1 and B3 municipalities could have theoretically achieved the same level of basic services with about 16% and 80% fewer resources respectively; the difference between the most efficient and the least efficient municipalities being quite substantial. The results also show that B4 municipalities could have theoretically achieved the same level of basic services with about 62% fewer operating expenditures. Furthermore, fiscal autonomy and the number and skill levels of the top management of a municipality's administration were found to influence the productive efficiency of municipalities in South Africa.

The remainder of the paper is organized as follows: section two outlines the structure and scope of the sub-national government sector in South Africa. Section three presents an overview of the challenges faced by municipal governments in the country while section four reviews the municipal spending efficiency literature. Section five and six describe the empirical data and their sources as well as the empirical methodology used in the analysis. Section seven discusses the empirical results obtained. Finally, section eight contains concluding remarks and potential policy implications of the analysis conducted.

2. Structure and scope of the sub-national government sector in South Africa

According to the traditional fiscal decentralization theory, a true devolution of expenditure functions and revenue powers to lower levels of government accompanied by political and administrative decentralization would allow for higher efficiency levels of

service delivery as local governments would provide goods and services to their constituents according to their wishes and as the assignment of functions and revenue powers would take into account economies of scale and jurisdictional spillovers. This would be achieved through the application of the subsidiarity and correspondence principles or the decentralization theorem in the first and second pillars of fiscal decentralization.² Furthermore, efficiency in service delivery is likely to be reinforced by central government oversight, citizen participation in decision-making processes, and civil society organizations' monitoring and evaluation. In this context, it follows logically that democracy and governance are likely to be achieved as citizens become an integral part of the institution and the political dialogue.

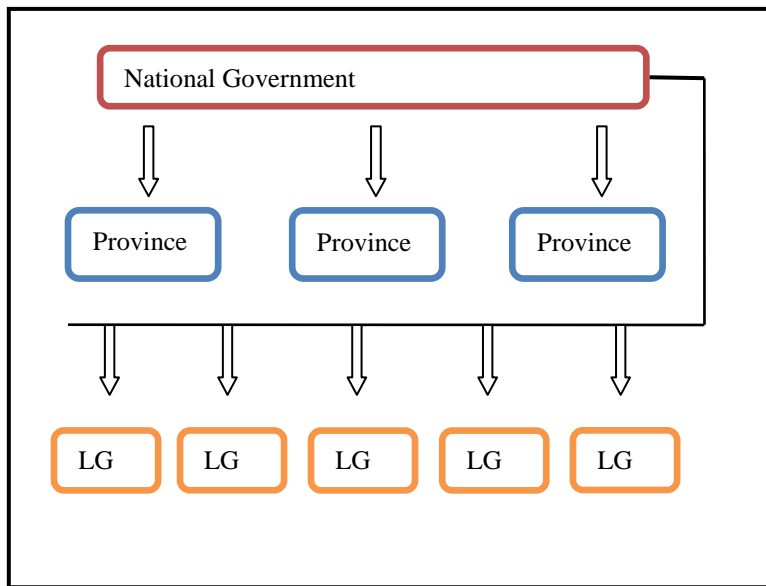
The decentralized system of governance in South Africa, to a large extent, seems to respect the theoretical principles and foundations of a sound fiscal decentralization which is characterized by a sound sub-national government structure, an appropriate assignment of expenditures and revenues, as well as an appropriate framework for sub-national borrowing; although concerns have been raised over the efficacy and fairness of the intergovernmental transfer system to provincial and especially local governments (Financial and Fiscal Commission 2011, UNDP 2005). However, despite an overall well-designed decentralization strategy, local governments in South Africa have yet to produce the expected results, notably, an efficient service delivery. In this context, the first step in the study of local efficiency performance and its main determinants would logically be to briefly review the status of fiscal decentralization in South Africa.

2.1 Overview

The 1996 Constitution of the Republic of South Africa divided the country into three spheres of government: a national government, nine provinces and 226 local governments. These spheres operate through a bifurcated structure of government establishing direct relations and responsibilities between national government and provinces on the one hand and between national government and local governments on the other hand, thus creating two separate spheres of sub-national governments in South Africa. However, as stated in the Constitution, these spheres of governments are “distinctive, interdependent, and interrelated” (section 40(1)). The figure below illustrates the bifurcated structure of government modeled on that of South Africa.

² The four fundamental pillars of fiscal decentralization are: 1) the assignment of functions and expenditure responsibilities, 2) the assignment of revenue sources to sub-national governments, 3) the allocation of intergovernmental fiscal transfers, and 4) rules on sub-national government borrowing. According to the *subsidiarity principle*, services should be provided at the lowest level of government compatible with the “benefit area” of the service. The same idea is expressed in Oates’ (1972) *decentralization theorem* which states that public services should be provided by the jurisdiction having control over the minimum geographic area that would internalize benefits and costs of such provision and for which there are no production economies of scale. The *correspondence principle* states that a jurisdiction should be assigned taxes that are related to its assigned expenditure responsibilities (Bahl and Smoke 2003, Bird 2001, Martinez-Vazquez 1998).

Figure 1: Bifurcated government structure in South Africa



Source: Fiscal Decentralization and Local Governance Course, Andrew Young School of Policy Studies, Atlanta, Georgia, July 2009

2.2 Provinces in the Intergovernmental Fiscal Relations in South Africa

With regard to the first pillar of fiscal decentralization, the 1996 Constitution assigns expenditure responsibilities to the nine provincial governments and clearly distinguishes between exclusive functions, i.e. only performed by provinces, and concurrent functions, i.e. functions that are shared between different spheres of government. Specifically, Schedule 5 to the Constitution confers a wide range of exclusive functions to provinces in South Africa including: provincial roads, ambulance services, provincial planning, and provincial recreation and amenities.

Schedule 4 of the Constitution also allocates a variety of concurrent functions to provinces such as: elementary and secondary education, health services, social welfare services, housing, public transport, tourism and agriculture. These functions are shared between national and provincial governments.

In regard to the second pillar of fiscal decentralization, that is, revenue assignment, the Constitution stipulates that provincial governments are entitled to an equitable share of national revenue provided for by an Act of Parliament (sections 214 and 227). Each provincial government's share in the national revenue is calculated following a formula annually determined and updated in a special Division of Revenue Bill of Parliament.³ Furthermore, the Division of Revenue Bill provides the various factors that should be taken into account in the equitable share formula.⁴

³ The Division of Revenue Act passed by the parliament provides for the equitable division of revenue raised nationally among the national, provincial and local spheres of government for each financial year (National Treasury Website, National Budget). Additionally, the "Annexure W1" to the Budget Review in the Division of Revenue Bill of each financial year provides an explanation of the formula and criteria for the division of the provincial and local government equitable share and for conditional grants to provinces and municipalities (National Treasury Website, National Budget, Division of Revenue Bill, Annexure W1 (Explanatory Memorandum to the Division of Revenue), Part 4 and Part 5).

⁴ Components of the provincial government equitable share formula include: the institutional component and the economic activity component which are not dependent on demographic factors; the education component, the

Although the 1996 Constitution, in its section 228, allows for provinces to levy a flat-rate surcharge on any tax other than corporate income tax, value-added tax, and rates on property or custom duties, this provision in the Constitution has yet to be implemented by the Parliament (Bahl and Smoke 2003). In effect, provincial own revenues are principally made up of tax receipts (casino taxes, horse racing taxes, liquor licences and motor vehicle licences); non-tax receipts; transfers received; sales of capital assets; and other own revenue sources. In general, provincial own revenues constitute a relatively small portion of total revenue for provinces. For example, fiscal year 2009/10 provincial own revenues amounted to 3.3 percent of total revenue for provinces (National Treasury, Provincial Budgets and Expenditure Review: 2005/06 – 2011/12).

Consequently, provincial governments in South Africa have limited taxing powers, that is, they have limited own financial resources and are thus dependent upon the national government (albeit through the Parliament) for funding of exclusive and concurrent powers and functions allocated to them (De Villiers 2008, Smoke 2000).

The figures below show the evolution of the distribution of revenue and expenditure by level of government in South Africa, from 1999 to 2010.

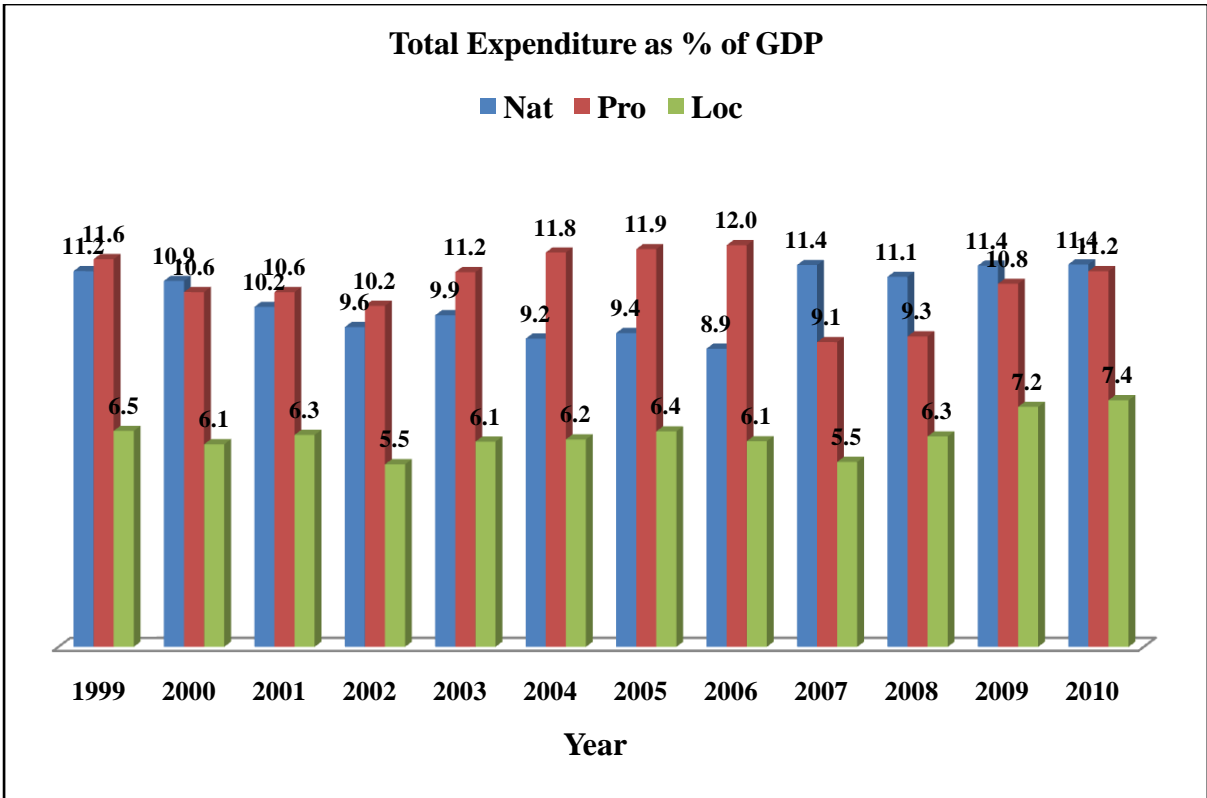
On average, over the period 1999-2010, the national and provincial governments provided the majority of government spending in South Africa, amounting to 10 and 11 percent of GDP respectively. Over the same period, local government spending amounted to about six percent of GDP. On the other hand, the national government collected the majority of government revenue, with on average about 23 percent of total revenue as percentage of GDP during 1999-2010.⁵ The average total revenues as percentage of GDP for provincial and local governments were 11 percent and six percent respectively over the same period.

Figure 2: Distribution of total expenditure⁶ by level of government in South Africa, 1999-2010

health component, the poverty component, and the basic component which is derived from each province's share of the national population (Division of Revenue Bill, National Budget 2011).

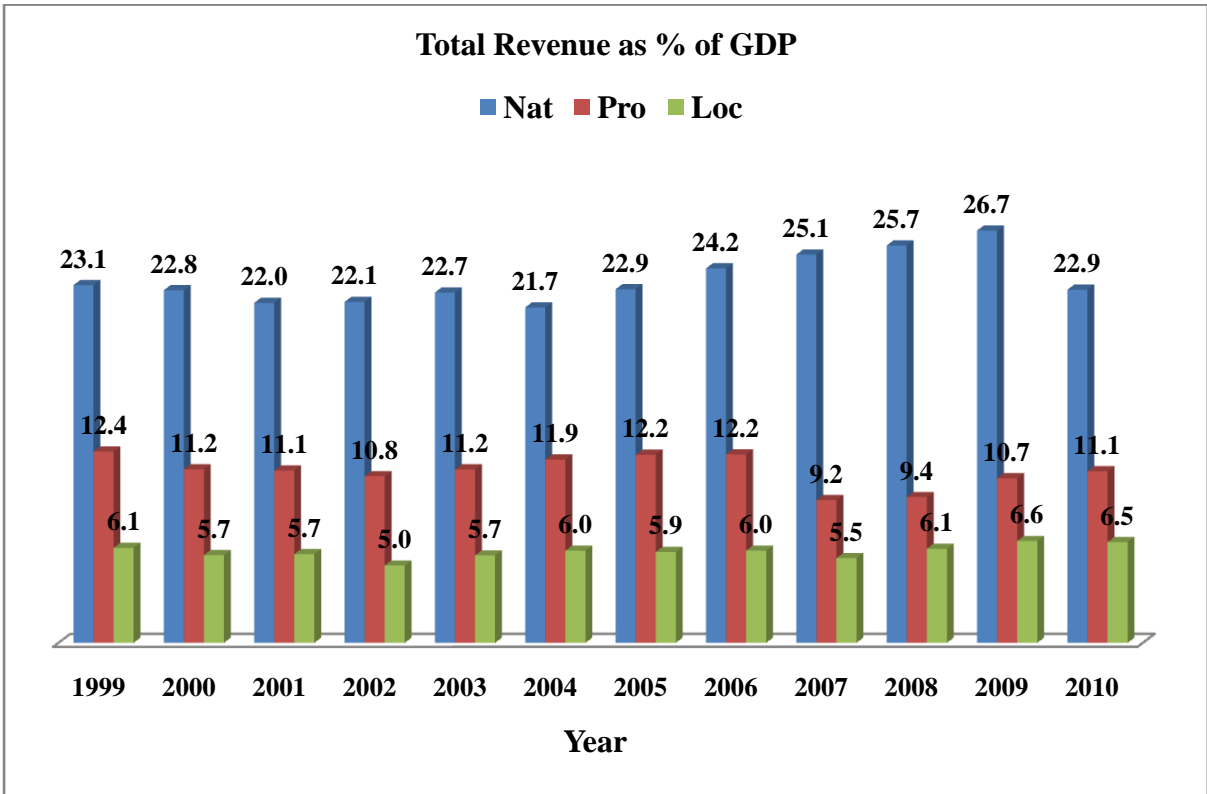
⁵ A large proportion of taxes inevitably have to be collected at national level: personal income tax, corporate income tax, value-added tax, and value-added tax on imports and customs duties.

⁶ Note that the calculations total expenditures by level of government exclude "Current and Capital transfers to foreign governments, international organizations and other general government units." The sharp decline in provincial expenditures between 2006 and 2007 is ascribed to the establishment of South African Social Security Agency (SASSA) which took over the function of social grants payments from the provincial government. This decline in expenditures was associated with a decline in provincial revenues during the same period.



Source: Author's own calculations from South African Reserve Bank, Quarterly Bulletin No 260, June 2011(Kbp4 & Kbp6).

Figure 3: Distribution of total revenue by level of government in South Africa, 1999-2010



Source: Author's own calculations from South African Reserve Bank, Quarterly Bulletin No 260, June 2011(Kbp4 & Kbp6).

Furthermore, in order to assess some aspects of fiscal decentralization in South Africa, fiscal decentralization indicators are calculated following the International Monetary Fund's Government Finance Statistics (GFS) methodology.⁷ The table below presents the main indicators of fiscal decentralization in South Africa for the period 1999-2010.⁸

Table 1: Main indicators of fiscal decentralization in South Africa, 1999-2010

Main Indicators	Description	Formula	RSA, 1999-2010
Sub-national expenditures (% of total expenditures)⁹ <i>Expenditure decentralization</i>	The degree to which expenditure responsibilities are devolved to the sub-national government level	Sub-national expenditures as a percent of total government expenditures	62%
Sub-national revenues (% of total revenues) <i>Revenue decentralization</i>	Degree to which revenue sources are devolved to the sub-national government level	Sub-national revenues as a percent of total government revenues	42%
Sub-national tax revenues (% of total revenues)	Degree to which <i>tax</i> revenue sources are devolved to the sub-national government level	Sub-national <i>tax</i> revenues as a percent of total government revenues	4%
Local fiscal autonomy (%)	Degree to which <i>local</i> governments have control over the fiscal resources at their disposal	Local own source revenues (taxes) as a percent of total local resources	22%
Vertical imbalance (%)¹⁰	Degree to which the sub-national governments rely on national government revenues to support their expenditures	Transfers to sub-national governments as a share of sub-national expenditures	68%
Sub-national expenditures (% of GDP)	Sub-national expenditures as a percentage of GDP		17%
Sub-national revenues (% of GDP)	Sub-national revenues as a percentage of GDP		17%

⁷ Fiscal Decentralization Indicators:

<http://www1.worldbank.org/publicsector/decentralization/fiscalindicators.htm>, accessed 11 August 2011.

⁸ These calculations are based on annual data from 1 April to 31 March (J2), South African Reserve Bank (SARB), Quarterly Bulletin No 260, June 2011(Kbp4).

⁹ Note that following the IMF's Government Finance Statistics (GFS) calculations of sub-national expenditures, "Current and Capital transfers to foreign governments, international organizations and other general government units" are excluded from the calculations. It would have been ideal to only exclude current and capital transfers to other levels of government (not transfers to foreign governments and international organizations), but the SARB produces only aggregate transfers. The General Government in South Africa consists of: (1) the national government which is made of all national government departments; when added to various extra-budgetary institutions such as the National Research Foundation and universities, together they form the *consolidated national government*; (2) the provincial government and its general departments; and finally (3) the local government. The combination of general government and public enterprises such as Eskom, the electricity public company, and Telkom, the communication company, is referred to as the *public sector* in South Africa (Black, Calitz and Steenekamp 2009).

¹⁰ Vertical fiscal balance is achieved when a close correspondence exists between the expenditure responsibilities assigned to each level of government and the fiscal resources available to them to finance these responsibilities, that is, its revenue raising powers. In other words, the revenue sources assigned to each level of government should match its expenditure responsibility. This is opposed to horizontal fiscal imbalance which occurs between sub-national governments within the same tier structure due to variations in their ability to mobilize revenues and variations in their expenditure needs and costs (Boex and Martinez-Vazquez 2001, Kelly 1998).

Source: Author's own calculations from South African Reserve Bank, Quarterly Bulletin No 260, June 2011(Kbp4 & Kbp6).

The South African Reserve Bank data (SARB 2011) specify that the share of sub-national government (provincial and local) expenditures in total government expenditures in 2010 was approximately 62 percent. In fact during the period 1999-2010, it averaged 62 percent, which is well above the international average for developed countries of around 32.68 percent during 1990-2000. This means that sub-national governments on average are responsible for 62 percent of expenditures in South Africa. In particular, the share of local government expenditures in total government expenditures averaged 23 percent for the period 1999-2010. These results imply that there is a clear trend toward expenditure decentralization in the country, with provinces and municipalities having considerable autonomy to make expenditure decisions.

On the revenue side, the share of sub-national government *tax* revenues in total government revenues averaged four percent for the period 1999-2010, with a figure of three percent in 2010. Specifically, during the same period, the local government tax revenue share was three percent on average, confirming that provincial government in fact raise very little own revenues and rely heavily on intergovernmental transfers. Furthermore, this four percent share of sub-national government *tax* revenue is well below the expenditure level of 62 percent, highlighting the limited revenue powers and significant expenditure responsibilities assigned to sub-national government in South Africa. This point is reinforced by a substantial vertical imbalance averaging 68 percent during the period 1999-2010.

In conclusion, it appears that if South Africa is willing to significantly decentralize expenditures to sub-national levels of government (thus pushing service delivery at levels of government closer to the people), it is nevertheless reluctant to devolve extensive revenue-raising powers.

2.3 Delineation of expenditure responsibilities, revenue assignment, and intergovernmental transfers to local governments in South Africa

After the 1996 Constitution and the 1998 Local Government Municipal Structures Act, local governments in South Africa were further divided into three tiers or categories namely, metropolitan, district, and local municipalities. Their main purpose was clearly defined in section 153 of the Constitution and was to “structure and manage their administration and budgeting and planning processes to give priority to the basic needs of the community, and to promote the social and economic development of the community, and participate in national and provincial development programmes.” In particular:

- Metropolitan municipalities (or category A) exclusively cover the large urban areas and are granted executive and legislative authority in these areas.
- Local municipalities (or category B) cover smaller and medium-size jurisdictions located primarily in urban areas. A category B municipality would share executive and legislative authority in its area with a category C municipality within whose area it falls.
- District municipalities (or category C) geographically cover several local or category B municipalities and have executive and legislative authority in an area that includes more than one municipality. Districts are responsible to coordinate integrated development planning for the entire district and are required to provide services on behalf of weak category B municipalities situated within the district boundaries, especially in rural areas (Bahl and Smoke 2003, Smoke 2000).

Following the local government elections of May 18th, 2011, the Municipal Demarcation Board (MDB)¹¹ changed the number and the geography of municipalities in South Africa. Currently, the local government structure consists of: eight metro municipalities, 44 district municipalities, and 226 local municipalities. The following table summarizes the local government structure in South Africa and the evolution of the number of municipalities since 1998.

Table 2: Local government structure in South Africa since 1993

Type and Category of Municipality	Type of Settlement	Interim Constitution 1993-1996	1996 Constitution- 2000	After Dec. 5 th 2000	After May 18 th 2011
Metropolitan (Category A)	Urban	-	-	6	8
Local (Category B)	Urban and Rural	-	-	231	226
District (Category C)	Rural	-	-	47	44
<i>Total</i>		<i>1200</i>	<i>843</i>	<i>284</i>	<i>278</i>

Source: Adapted from (Bahl and Smoke 2003); (Vaz 2004); Municipal Demarcation Board.

The fiscal decentralization provisions in the 1996 Constitution led to the devolution of substantial powers, functions, and duties to local governments in South Africa. The key service delivery municipal functions include water and sanitation services (potable water supply systems, domestic waste-water and sewage disposal), refuse removal, electricity, roads, and storm water management. This assignment of powers and expenditure functions considerably varies within and across categories of municipalities, with municipalities in large urban areas with greater ability and capacity to provide an extensive range of services and with some category B and C municipalities with limited ability to independently render few basic services (Smoke 2000).

In terms of revenue assignment, local governments are granted a number of own revenue sources by the Constitution in order to effectively carry out decentralized functions (section 229). They are mainly dependent on two own sources of revenue: rates on property and surcharges on fees for services provided by or on behalf of the municipality. They could also rely on other taxes authorized by national legislation with the exception of income tax, value-added tax, general sales tax, and customs duties. Overall, municipalities in South Africa are largely self-financing in that they raised a significant share of their revenue through the above-mentioned own sources of revenue. For example, during the 2008/09 and 2009/10 financial years, municipal own revenues amounted to 77 percent and 78 percent of total municipal operating revenue, respectively; although these aggregate figures do not reflect the variations across municipalities (National Treasury, Local Government Budgets and Expenditure Review: 2003/04 - 2009/10).

Additionally, the Constitution also entitles municipalities to an equitable share of national revenues to assist them in providing basic services to poor households (section 214 of the Constitution). The structure of the local government equitable share formula and its components are determined and updated each year in the Division Revenue Bill in its

¹¹ The Local Government Municipal Demarcation Act 27 of 1998 established the Municipal Demarcation Board (MDB) in charge of the determination of municipal boundaries in South Africa.

Annexure W1 to the Budget Review (Part 5).¹² Revenues raised by the national government are also transferred to municipalities through conditional and unconditional grants.

Overall, in the context of the Cooperative Government and Intergovernmental Relations, the national and provincial governments are required by law to “support and strengthen the capacity of municipalities to manage their own affairs, to exercise their powers and to perform their functions” (sections 40-41 and 154 of the Constitution). Additionally, the Constitution grants national and provincial governments oversight and control powers over municipalities.

3. Overview of challenges faced by local governments in South Africa

According to a report produced in 2009 by the department of Cooperative Governance and Traditional Affairs (CoGTA), the overall state of local government in South Africa is not satisfactory or promising to say the least (CoGTA 2009). However, it is important to keep in mind that there is a tremendous disparity within and across municipalities, economically, politically, and in terms of location (urban versus rural), topography, performance, and capacity (whether human resource, financial, and institutional).

In general, challenges faced by municipalities in South Africa mainly arise due to service delivery failures stemming from huge backlogs, inadequate revenue collection, corruption and fraud, poor financial management systems, and lack of high-skilled personnel.

Local governments in South Africa are also challenged by a difficult macroeconomic environment shaped by a fast growing population, a rapid urbanization, rising immigration levels (mostly unskilled), acute unemployment rates, and widespread poverty. According to the latest Quarterly Labor Force Survey (Quarter 2, 2011) published by Statistics South Africa (Stats SA), the unemployment rate increased by 0,7 of a percentage point between the first quarter of 2011(25,0%) and the second (25,7%). The 2011 mid-year population of South Africa is estimated at 50, 59 million with the life expectancy at birth for 2011 estimated at 54,9 years for males and 59,1 years for females (hereafter Stats SA). As of 2006, the proportion of the population living below USD\$ 2.50 (PPP) per day was 34.8 percent and in 2009, the proportion of urban population living in slums was 13.4 percent (UNDP 2010). Added to that, socio-economic inequalities and hardship inherited from the apartheid era have accentuated these challenges.

Furthermore, there have also been reported recurrent tensions between the municipal legislature on the one hand and the municipal administration on the other hand (headed by the municipal manager (MM hereafter), the chief financial officer (CFO hereafter) and other officials). In fact, municipalities are often plagued by poor relations between the council and the management where the lack of qualification, experience and skills of either one party would result in a mistrust of the other party’s abilities to fulfill its duties.¹³

As a reinforcing mechanism, these above-mentioned challenges take place within an environment characterized by weak monitoring, oversight, and weak application of checks

¹² Components of the local government equitable share formula include: the basic services, the development, the institutional support, the revenue-raising capacity correction, and the correction and stabilisation factor components (Division of Revenue Bill, National Budget 2011).

¹³ This was reported by Elsabé Rossouw, director of the Local Government Budget Analysis Data Management at the National Treasury, during an interview conducted on July 21st, 2011.

and balances by higher spheres of government, mainly the provincial departments responsible for local governments (DLGs) and the offices of the premiers (OTPs).

In this context, it is essential to empirically revise the productive or technical efficiency of municipalities and its determinants in South Africa. The results of such an exercise will contribute to the understanding of contributory external and internal factors influencing the effectiveness and capability of municipalities in the country and will therefore help inform policy decisions aimed at improving local service delivery. Specifically, given the substantial disparities within and across municipalities hitherto mentioned, it appears a point of departure toward improvement of the present system would be to reform the expenditure and revenue assignments under the current fiscal decentralization framework in order to reflect and accommodate disparities in jurisdictional needs and financial and functional capacities. Indeed, the “one size fits all” that characterizes the intergovernmental fiscal relations in the country devolves the same functions and powers of revenue collection to all municipalities irrespective of their size and functional capabilities. Consequently, an important challenge for South Africa would be to develop a comprehensive reform blueprint in its system of fiscal decentralization that would best fit its local government landscape (Bahl and Martinez-Vazquez 2006, UNDP 2005).

4. Literature review

One of the most important end results of a sound fiscal decentralization system would be the establishment of democratic and accountable municipalities closer to the people and equipped with substantial autonomy and resource to efficiently satisfy sub-national variations in the needs and preferences of their constituents. This pressure for efficiency, not only allocative, but technical or productive, in the provision of local government services is one of the greatest expectations of a sound fiscal decentralization process (UNDP 2010, Boex, Martinez-Vazquez and Timofeev 2004, Martinez-Vazquez 1998).¹⁴

4.1 Assessment of local government efficiency in the existing literature

This quest for efficiency in the provision of local public services however, has yet to generate a substantial body of literature. The scant empirical literature assessing the quality of local service delivery has primarily focused on productive or technical efficiency while very few studies have attempted to address allocative efficiency in service delivery (Smoke 2001).

In the literature, the measurement of the relative productive efficiency of a set of producers or decision-making units (hereafter DMUs) in general requires a variety of feasible and identical inputs and identical outputs used by these DMUs. In general, the best-performing DMUs in the set would have an efficiency score of one while the performance of others DMUs would vary between zero and one relative to this best performance (Murillo-Zamorano 2004, Ramanathan 2003).¹⁵

¹⁴ Allocative efficiency ensures as close as possible a match between public services and local needs and preferences while productive or technical efficiency ensures that the best possible or the maximum local public services (i.e. outputs) are provided at the lowest possible cost (i.e. inputs). This latter concept occurs on the production possibility frontier (PPF) where it is not possible to produce more of one good without producing less of another. Any production that occurs inside the PPF is inefficient (Black, Calitz and Steenekamp 2009, PREM Notes 2001).

¹⁵ The efficiency scores estimated will be *relative* to the best performing or the most efficient decision-making unit (s) (Ramanathan 2003).

Specifically, when assessing productive efficiency in local service delivery, most empirical studies in the existing literature have used total current expenditures as municipal inputs (i.e. resources used in the provision of local services). As a measure of municipal outputs, while some studies have aggregated various municipal services into a single measure of municipal performance, other studies have evaluated one specific local service.¹⁶

Most of these previous studies have used the nonparametric frontier model or Data Envelopment Analysis (DEA) technique to measure how efficiently a municipality would make use of the resources available (inputs) to generate a set of outputs. In a general frontier model, a production function frontier is estimated and efficiency scores are derived by measuring the relative distance of inefficient observations (located inside the frontier) from the observations located on the efficiency frontier which are considered as technically efficient (Murillo-Zamorano 2004, Farrell 1957).

Recently, in a study assessing the efficiency of Portuguese municipalities, Afonso and Fernandes (2008) for the most part adopted a similar methodology. In particular, they used per capita municipal expenditures as a measure of municipal inputs and as a measure of municipal outputs, they constructed a composite local government output indicator that globally assesses various municipal services such as social services, basic education, cultural services, sanitation, territory organization, and road infrastructures.

In 2010, Boetti, Piacenza and Turati conducted a similar study for Italian municipalities. They used measures of output indicators that are proxies for services and expenditure functions that are in general exclusively assigned to local governments in Italy. Such services include total length of municipal roads, amount of waste collected, total number of pupils enrolled in nursery, primary and secondary schools, and total number of people over age 75. With regard to measures of inputs, they departed from the existing literature in that they used *disaggregated* current expenditures in general administration, road maintenance and local mobility, garbage collection and disposal, education, elderly care and other social services, rather than a measure of current expenditure as a whole. They applied a parametric frontier model or Stochastic Frontier Analysis (SFA) approach in addition to the DEA technique to compute efficiency scores.

4.2 Assessment of the determinants of local government efficiency in the existing literature

Additionally, the literature on the determinants of technical efficiency in the provision of local public service has also been restricted. The majority of these studies have investigated the role played by various socio-economic, political, and geographical location variables in local efficiency (Boetti, Piacenza and Turati 2010, Afonso and Fernandes 2008). In particular, levels of education (of the adult population), large-scale population, level of commercial activity, and density of the urban structure in general have been found to be positively significant in explaining efficiency while per capita income, number of coalition parties, and level of unemployment have been found to reduce local productive efficiency.¹⁷ In regard to location, Loikkanen and Susiluoto (2005) found that municipalities located at the periphery tend to have a lower efficiency in their service provision.

¹⁶ See Afonso and Fernandes (2008) for a review of that literature.

¹⁷ For a review of literature in that regard, please refer to Afonso and Fernandes (2008).

On the other hand, few studies have attempted to examine the effects of fiscal decentralization on local government spending efficiency (Boetti, Piacenza and Turati 2010, Afonso and Fernandes 2008). The various measures of fiscal decentralization used in that literature have involved factors that have been found to have a positive impact on efficiency and factors that have negatively affected efficiency (Afonso and Fernandes 2008). Specifically, local tax rates were found to have a positive impact on efficiency in Belgian municipalities (De Borger and Kerstens 1996, Van den Eeckaut, Tulkens and Jamar 1993) while per capita tax revenues in Spain were found to have a negative impact (Balaguer-Coll, Prior-Jimenez and Vela-Bargues 2002). Overall, most of these studies found that grants reduced the spending efficiency of municipalities while the share of fees and charges in municipal income and the share of local investment in total expenditures seemed to improve local efficiency (Athanasopoulos and Triantis 1998).¹⁸

In 2008, Afonso and Fernandes (2008) found that socio-economic factors such as the level of education of the population, the purchasing power reflecting the impact of per capita income and the wealth of citizens, and the geographical distance to the main decision centers tend to influence the performance outcomes of municipalities in Portugal. They argued that inter-municipal competition represented by the geographical distance between a municipality and its capital of district would provide greater choice to mobile citizens to move across jurisdictions that would provide the level and quality of public services that they desire. As such, if a local government is inefficient in its provision of services or if it offers an unattractive basket of services at a variety of prices, households and firms would “vote with their feet” by relocating to jurisdictions that match their preferences. Consequently, inter-municipal competition would prevent local governments from being inefficient and is thus expected to be positively related to local spending efficiency (Boex, Martinez-Vazquez and Timofeev 2004, Tiebout 1956). This hypothesis was confirmed in Afonso and Fernandes’ (2008) study.

In terms the education, Afonso and Fernandes (2008) posited that the education level of local residents is extremely relevant in the local efficiency analysis in that it would provide citizens with the ability to pressure local officials to improve quality of services and to monitor their actions. They found that the level of education, whether secondary or tertiary, indeed contributed positively to increase efficiency.

Finally, to assess the influence of higher income levels and the wealth of citizens, Afonso and Fernandes (2008) made use of the municipal per capita purchasing power. The rationale for including this variable is that richer residents would tend to exercise greater pressure in their demands for efficient local services. In effect, richer residents who contribute more to local revenues would expect greater local government performance. Their results confirmed this prediction. Incidentally, these last two findings might not necessarily be verified in South Africa where recent service delivery protests were initiated by both groups with high levels of education and those with lower aggregate education and income levels.

Similarly to most previous studies, Afonso and Fernandes (2008) used the nonparametric Data Envelopment Analysis or DEA to explain the efficiency scores in a two-stage analysis. The rationale behind the use of two-stage or even three-stage analyses is that both non-discretionary and discretionary inputs jointly contribute to outputs and when using only the standard DEA technique, efficiency scores are calculated by taking account of only controllable or discretionary local inputs and outputs; therefore ruling out the role of non-

¹⁸ Most of the studies that examined the effects of grants on the local government spending efficiency found that they limited the efficiency of municipalities in the delivery of local public services (Loikkanen and Susiluoto 2005, Athanasopoulos and Triantis 1998, Balaguer-Coll, Prior-Jimenez and Vela-Bargues 2002, De Borger and Kerstens 1996, Van den Eeckaut, Tulkens and Jamar 1993).

discretionary inputs (Murillo-Zamorano 2004).¹⁹ As a result, the second-stage analysis is required to account for non-discretionary inputs, i.e. inputs outside the control of municipalities that might influence their productive efficiency. In the second-stage analysis, efficiency measures are usually explained by means of a censored normal Tobit regression model.

A more recent research based on Italian municipalities highlighted the importance of tax decentralization and the “electoral budget cycle” argument in assessing local spending efficiency (Boetti, Piacenza and Turati 2010). They measured tax decentralization as a share of current spending covered by own local taxes. Their research supports the traditional fiscal decentralization theory according to which with revenue autonomy, which requires control over “own” sources of revenue, local governments would match taxes paid with benefits received to the extent possible and be more accountable; thus improving both the efficiency and the effectiveness of public services (McLure 2007, Bird 2001). The authors’ findings are also in line with the “electoral budget cycle” argument which asserts that when closer to new elections, incumbent politicians tend to inefficiently increase spending to boost their chances to be re-elected. They also found that other factors such as age and gender of the mayor do not seem to have an effect on spending efficiency levels.

Similarly to Afonso and Fernandes (2008) and previous studies, Boetti, Piacenza and Turati (2010) used the DEA-VRS (Variable Returns to Scale) technique combined with a second-stage Tobit censored model to identify the determinants of municipal efficiency performances. However, they assessed the robustness of their results by using the parametric Stochastic Frontier Analysis or SFA approach. The advantage of this approach over the DEA technique relies on the fact that the local efficiency scores are estimated *conditionally* to the influence of exogenous factors, i.e. factors outside the control of municipalities that might also impact on output performance (Murillo-Zamorano 2004). Indeed, these factors enter directly in the frontier model in a single-stage estimation procedure.

5. Analysis of the efficiency performance of local municipalities in South Africa

After December 2000 local government elections in South Africa, municipalities were classified into seven groups: municipalities A, B1, B2, B3, B4, C1 and C2 (see table below). This system of categorization was established to highlight the great disparity within and across municipalities in terms of the conditions and challenges they face in fulfilling their service delivery obligations as outlined in sections 152 and 153 of the 1996 Constitution.²⁰ As a result, municipalities within the same cluster would share similar challenges in terms of revenue mobilization, urbanization, immigration, unemployment, poverty, and human resource and institutional capacity (CoGTA 2009).

In this context, it appears essential to disaggregate the efficiency analysis following this typology in order to account for these wide disparities. As a result, this paper analyses the

¹⁹ According to Afonso and Fernandes (2008), *discretionary inputs* are those inputs whose quantities can be changed at the will of municipalities. The standard DEA model takes into consideration only these inputs while ignoring local socio-economic and demographic factors that are relevant in explaining performance outputs but are not within the control of municipalities.

²⁰ Section 152 of the Constitution states that the objects of local government are: “**a.** to provide democratic and accountable government for local communities; **b.** to ensure the provision of services to communities in a sustainable manner; **c.** to promote social and economic development; **d.** to promote a safe and healthy environment; and **e.** to encourage the involvement of communities and community organisations in the matters of local government.”

relative production efficiency of 231 South African local municipalities in 2007 within each of the four municipal clusters, namely: B1; B2; B3, and B4.

As defined in section 155 of the Constitution, local municipalities (category B) would share executive and legislative authority with a district municipality (category C) within whose area it falls; with the district municipality encompassing more than one local municipality. Additionally, sections 156 and 229 of the Constitution and the 1998 Local Government Municipal Structures Act (sections 83, 84) stipulate that powers and functions may be divided by the national legislation and provinces between the district and local municipalities within the area of the district municipality. De facto, this resulted in an asymmetric and unclear division of functional competencies between district and local municipalities. According to the Financial and Fiscal Commission (2011), district municipalities are in general only authorized to provide water and sanitation services, while metropolitan and local municipalities are authorized to provide all four basic services, water, sanitation, electricity and refuse removal.

For this reason, the analysis of local efficiency will exclude district municipalities (i.e. municipalities C1 and C2). Additionally, as explained in detail in the subsequent sections, metropolitan municipalities (i.e. municipalities A) are also excluded from the study because the MDB's capacity assessment is not done at the metropolitan municipality level and therefore data useful for this paper are not collected at that level.

Table 3: Classification of municipalities in South Africa

Category	Description
A	Metropolitan Municipalities: Large urban complexes with populations over 1 million and accounting for 56 percent of all municipal expenditure in the country
B1	Local Municipalities with large budgets and containing secondary cities
B2	Local Municipalities with a large town as a core
B3	Local Municipalities with small towns, with relatively small population and significant proportion of urban population but with no large town as a core
B4	Local Municipalities which are mainly rural with communal tenure and with, at most, one or two small towns in their area
C1	District Municipalities which are not water service authorities
C2	District Municipalities which are water service authorities

Source: Adapted from (CoGTA 2009).

5.1 Input and output measures of local service delivery in South Africa

The most recent and comprehensive socio-economic and demographic data in South Africa is reported by Stats SA's 2007 Community Survey. This fact restricts the local efficiency analysis in this paper to the year 2007 and to the demarcations of municipal boundaries prevailing during that year. Municipal data is reported by the Stats SA's Non-Financial Census (NFC) of municipalities. The National Treasury's local government budget database (preliminary in-year figures) and the MDB's Capacity Assessment both provide municipal financial data and other municipal-related data such as the qualification of the municipal administration's managers.

This paper focuses on analyzing the productive or technical efficiency of municipal service delivery and its determinants in South Africa. While allocative efficiency ensures as

close as possible a match between public services and local needs and preferences, productive or technical efficiency on the other hand ensures that the best possible or the maximum local public services (i.e. outputs) are provided at the lowest possible cost (i.e. inputs) (Black, Calitz and Steenekamp 2009, PREM Notes 2001).

Following Boetti, Piacenza and Turati (2010), the municipal outputs that are selected in this paper are proxies for the main basic services that local governments are mandated to provide under Schedules 4B and 5B of the Constitution, that is, water, sanitation, electricity and refuse removal. Additionally, total population per municipality is used as a proxy for the administrative services generally provided by municipalities (Boetti, Piacenza and Turati 2010). In particular, municipal outputs are represented in this paper by:

- the number of consumer units receiving water (inside the yard, less than 200m from yard, and more than 200m from yard),
- the number of consumer units receiving sewerage and sanitation (flush toilet connected to a public sewerage system, flush toilet connected to septic tank, bucket system, ventilated improved pit latrine toilet, and other),
- the number of consumer units receiving solid waste management,²¹
- the number of consumer units receiving electricity and,
- the total population per municipality.

These municipal output measures were obtained from the 2007 Non-financial Census (NFC) of municipalities, an annual survey conducted by Stats SA. It provides a measure of the level of local basic services or municipal outputs which are represented by the number of “consumer units” with access to these services.

It is important to note that the 2007 Community Survey also collected information about the number of “households” with access to water, toilet facilities, refuse removal services, and electricity. However, the NFC of municipalities is a better source for the measure of municipal outputs as a consumer unit encompasses households, businesses and other sectors to which municipalities provides basic services (Financial and Fiscal Commission 2011). Consequently, the paper will focus on municipal outputs provided by the NFC. However, the analysis will make use of the measures of municipal output collected from the 2007 Community Survey in order to check the robustness of local efficiency scores. Additionally, as above-mentioned, while in the NFC the questionnaire was administered at the municipality level; in the 2007 Community Survey, it was administered at the household level. The former therefore represents the supply side of local basic service delivery while the latter represents the demand side of local basic services.

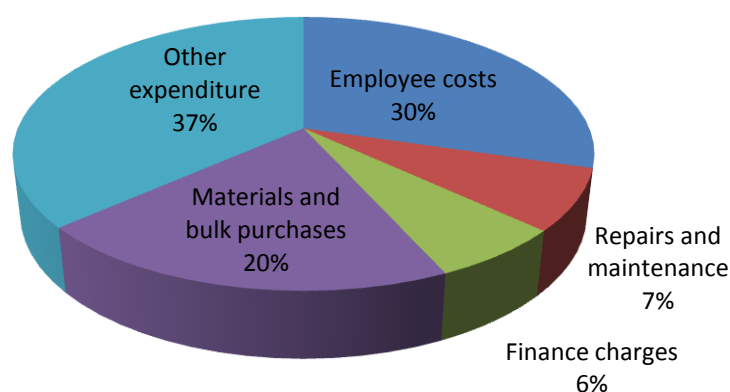
The municipal input indicator is represented by total municipal operating or current expenditures published by the National Treasury local government budget database. The composition of municipal operating or current expenditures in South Africa for 2007/08 is shown in the figure below. The bulk of operating expenditures of all municipalities for 2007/08 falls under the category “other expenditure” (37 percent) which unfortunately is not disaggregated further but is likely to include municipal administration costs important for providing services. The other two largest components of municipal operating expenditures are “employee costs” (30 percent) and “material and bulk purchases” (20 percent) which both

²¹ Waste management (or refuse removal) refers to the collection, treatment and disposal of waste (Statistics South Africa’s 2007 Non-financial Census of municipalities).

represent input costs (labor, material and capital costs) that are necessary to provide services. Repair and maintenance and finance charges amount to only seven percent and six percent respectively, of the total operating expenditures during the same financial year.

Following the Financial and Fiscal Commission (2011) and Boetti, Piacenza and Turati (2010), the paper focuses on municipal operating expenditure not only to strengthen the connection between spending and the chosen measures of municipal outputs, but also because operating expenditures result in the immediate provision of municipal outputs unlike capital expenditures which mainly finance long-term infrastructure projects.

Figure 4: Composition of municipal operating expenditures in South Africa (%), 2007/08



Source: National Treasury, Local Government Budgets and Expenditure Review: 2003/04 - 2009/10.

The table below provides the summary statistics of the measures of municipal outputs and input used in the empirical analysis in this paper. The definition of all variables used in the analysis and the data sources are presented in table A in the appendix.

Table 4 highlights substantial variations that exist within and across the four categories of local municipalities that are the focus of this paper. In particular, local municipalities with large budgets and containing secondary cities (i.e. B1 municipalities) showed the highest standard deviations in all measures of municipal input and outputs. Additionally, B1 municipalities are the ones with the highest total operating expenditures on average in 2007, the largest population, and the highest number of consumer units receiving water, electricity, sewerage and sanitation, and solid waste management on average during the same year.

Table 4: Summary statistics of municipal input and outputs for 2007/08, by municipal category

pdgcategory	Variable	No of Obs.	Mean	Std. Dev.	Min	Max
B1	TotalOpEx	19	799,368	462,680	243,962	1,851,599
	totalpop	21	392,058	188,346	124,351	752,906
	cuwater	21	83,419	51,817	19,238	191,047
	cuelec	21	76,019	60,263	21,550	235,491
	cusan	21	72,287	44,291	24,800	149,861
	cuwaste	21	64,328	42,602	24,800	182,686

B2	TotalOpEx	24	188,797	124,634	3,291	523,934
	totalpop	29	140,902	94,133	32,840	444,830
	cuwater	29	19,422	13,301	0	48,086
	cuelec	29	22,570	11,394	8,544	53,004
	cusan	29	17,887	13,763	0	53,609
	cuwaste	29	20,435	11,841	0	48,086
B3	TotalOpEx	80	68,394	66,923	-16,481	435,155
	totalpop	111	55,480	53,162	5,156	385,413
	cuwater	111	10,462	11,415	0	95,281
	cuelec	111	10,013	9,504	776	71,663
	cusan	111	9,916	11,104	0	95,281
	cuwaste	111	9,171	6,742	478	38,752
B4	TotalOpEx	49	52,962	55,830	1,867	300,489
	totalpop	70	185,421	105,679	39,401	602,819
	cuwater	69	14,843	28,749	0	120,000
	cuelec	69	17,185	22,559	0	92,946
	cusan	69	9,335	20,306	0	107,537
	cuwaste	69	6,598	13,080	0	63,799

5.2 Potential determinants of efficiency performance in local service delivery in South Africa

From the previous literature on local government efficiency described in section four, from the 2011 Financial and Fiscal Commission report and the 2009 CoGTA report, various factors have been identified that would likely have an impact on the technical efficiency of municipalities in the South African context. The potential determinants of spending efficiency identified here are limited to those for which a quantifiable measure is readily available.

The main independent variables of interest may be grouped into four categories: fiscal autonomy, institutional capacity, socio-economic factors, and political factors.

Fiscal autonomy is measured as local taxes and service charges as a percentage of total revenue. This measure is also used to reflect the level of revenue decentralization. According to the traditional fiscal decentralization theory, a greater fiscal autonomy is expected to allow sub-national government officials to not only provide a level of services in accordance with the tastes and preferences of their citizens but also to better match expenditures with revenue needs (*correspondence principle*). This link between expenditure and the price of public goods is essential to achieve efficiency because it would equalize the benefit per unit of service with the cost per unit of service. As a corollary, it should impose fiscal responsibility at the margin on sub-national governments.²² Furthermore, it is expected to increase accountability of sub-national governments with their citizens in that those paying taxes will demand accountability for service delivery and will monitor municipal performance.

²² In economics, a resource allocation mechanism is efficient when marginal (social) benefit is equal to marginal (social) cost. In general, over consumption of public goods is a common characteristic of lack of correspondence and fiscal autonomy.

Additionally, a dummy variable equal to one if a municipality has the powers and functions allocated to provide *all* four basic services (i.e. water, electricity, sewerage and sanitation, and solid waste management) is used as a measure of expenditure decentralization.

The institutional capacity of municipalities in South Africa is assessed by the job vacancy in local government and the education level of the municipal managers (MMs), the chief financial officers (CFOs), and the managers for technical services (TSMs).

Specifically, a higher proportion of job vacancy within a municipality should reflect its difficulty to attract qualified and experienced personnel or staff and it is thus bound to impact the day-to-day functioning of the municipality and therefore its efficiency in service delivery. Two measures of job vacancy are used: the percentage of vacant posts to total posts in Section 57 of the Local Government Municipal Systems Act (No. 32 of 2000) which refers to the positions of MMs, CFOs, and other managers who are politically appointed for a period of five years; and the percentage of vacant posts to total posts in the organogram, which refers other permanent positions within the municipality.

With reference to the education level of MMs and CFOs, it is important to note that the municipal administration coordinates and implements the work of the municipality. The top management of a municipality's administration consists of the MM, the CFO, and other senior managers and officials. The MM is also the accounting officer of the municipality (Municipal Finance Management Act No. 56 of 2003, sections 60-79; Municipal Structures Act section 82(a) (b)). The elected council, on the other hand, approves policies and by-laws, passes the municipal budget every year, and oversees the work of the municipal administration. In general, the level of education among the local government officials in South Africa is characterized by stark variations. To hold the office of a councilor, there is in general no minimum education requirement. Councilors have therefore on average very low levels of education, which would undermine their role as overseers of the work of the MM and department heads, the latter having in average attained higher levels of education. This situation often creates tensions between councilors and the top management of a municipality's administration. The focus here is on education levels of MMs, CFOs, and Managers for technical services because they are responsible for doing the work of the municipality and implementing all programs approved by the council. As a result, highly qualified and experienced technical and management professionals in a municipality should be positively related to efficiency in service delivery.

From the previous literature on local government efficiency, socio-economic factors such as income and average education levels of citizens are expected to be positively related to efficiency in that they give the citizenry ability and skills to be effective and active participants in a representative democracy and in public decision-making processes. As such, they should be able to pressure local government officials and monitor their performance. Similarly, the presence of Ratepayers Associations or Taxpayers Associations in the municipality or the district as a proxy for citizen participation in decision-making and involvement in the matters of local government, especially in oversight and monitoring, is expected to have the same effect.

Additionally, population growth, as a proxy for economies of scale that might be realized when providing local public services to a larger population is likely to increase municipal efficiency in service delivery. Population growth is measured as the percentage change in population of a municipality from 2001 to 2007.

The political leadership of a municipality, as measured by the percentage of council seats held by the majority party, might also play a role in its spending efficiency (Financial and

Fiscal Commission 2011); however its impact could go either way depending on the strength of opposition parties present in the municipality. For example, political tensions between political parties within the municipal council may negatively affect service delivery; similarly, a high percentage of council seats held by the majority party may produce similar results due to a lack of democratic checks and balances provided by a healthy opposition party. Additionally, a political party with a strong majority experiencing very little factionalism and interference in decision-making might prove efficient in service delivery (CoGTA 2009).

Finally, the number of consumer units receiving *free* water, electricity, sewerage and sanitation, and solid waste management from a municipality would add financial pressure on a municipality and is expected to be associated with lower levels of spending efficiency.

The summary statistics and the definition of all variables used in the empirical analysis are presented in table A and table B of the appendix.

Overall, the outcomes of this research will contribute to improving general knowledge of the different factors that influence the productive efficiency of municipalities in South Africa and to developing effective policy reforms and strategies in order to equip municipal governments to meet their social and economic development agenda.

6. Empirical methodology: the non-parametric Data Envelopment Analysis (DEA) and the parametric Stochastic Frontier Analysis (SFA)

The analysis of the productive or technical efficiency of local governments in South Africa and the factors that may potentially determine the efficiency levels and thus define the optimal characteristics of an efficient provision of local public services, relies on two frontier techniques: the parametric and the non-parametric frontier methods. The fundamental idea behind these frontier methods is to calculate or estimate an efficient frontier function against which the performance of decision making units (DMUs), in this case, South African municipalities, is measured. A production frontier reflects the maximum output attainable by a given sets of inputs and existing production technologies. Technical efficiency is defined in terms of a maximum level of output produced from a given set of inputs (output orientation) or of a minimum amount of inputs used to produce a given level of output (input orientation)²³ (Kokkinou 2009).

In particular, in the non-parametric approach or the Data Envelopment Analysis (DEA), the functional form of the efficient production frontier is not pre-established, that is, the functional relationship between inputs and outputs (or the production function) needs not to be predefined, but is calculated via a mathematical programming model or an econometric technique applied to a sample of observed data. From this sample of observed data, a frontier envelopment surface is defined and the DMUs that lie on that surface are termed productively efficient and are assigned a value or an efficiency score of one. Alternatively, the DMUs that do not lie on that surface are considered as productively inefficient and an inefficiency score of less than one will then be calculated for each one of them. On the other hand, with the stochastic parametric frontiers (SFA), the functional form of the efficient frontier is pre-

²³ With the input orientation of an efficiency measure, an inefficient DMU is one that can produce the same level of output as an efficient DMU *with less input*. With the output orientation of an efficiency measure, an inefficient DMU is one that, compare to an efficient DMU, produces a lower level of output using the same amount of inputs (Financial and Fiscal Commission 2011).

defined or imposed a priori, and the parameters of the frontier function are estimated by means of econometric techniques (Murillo-Zamorano 2004, Ramanathan 2003).

More specifically, stochastic frontier procedures model a general production function, known as a stochastic production frontier, where it is assumed that a DMU might potentially produce less than the best or maximum level of output due to two factors: (a) a factor of random shocks or external events (exogenous factors) affecting the production function and represented by a factor v which is, in general, assumed to be normally distributed over the observations; and (b) a degree of inefficiency which is represented by a factor μ strictly positive and for which various distributions have been proposed such as normal mean distribution, exponential distribution, and normal truncated distribution.²⁴

In summary, unlike stochastic frontier techniques which allow for a clear distinction between the effects of random noise and the effects of inefficiency, the DEA technique does not take into consideration the usual random noise or rather considers random noise as part of the efficiency score, assuming that all deviations from the efficient production frontier are under the control of the DMU. The main disadvantage of the non-parametric Data Envelopment Analysis most cited in the literature is this above-mentioned deterministic nature. Additionally, the DEA technique compares how well a DMU is doing compared to other DMUs in the set but not compared to a theoretical maximum.

Boetti, Piacenza and Turati (2010), Kokkinou (2009), Afonso and Fernandes (2008), and Murillo-Zamorano (2004) provide a comprehensive overview of the mathematical foundations of the non-parametric Data Envelopment Analysis (DEA) and the parametric Stochastic Frontier Analysis (SFA) models used in the present study.

Initially, the analysis will focus on estimating the level of technical efficiency for all municipalities using both techniques. Subsequently, efficiency scores are explained in a second stage analysis with the potential explanatory factors described in section 5.2 above. In the DEA, efficiency measures are explained by means of a censored normal Tobit regression model in the second stage analysis. In the SFA, the local efficiency scores are estimated *conditionally* to the influence of exogenous factors, i.e. factors outside the control of municipalities that also impact on output performance would enter directly in the frontier model in a single-stage estimation procedure. Both techniques are used to check the robustness of the results.

The use of the DEA as mathematical linear programming technique for measuring the performance efficiency of DMUs originated from Charnes, Cooper and Rhodes (1978). These authors defined the performance efficiency of a DMU among a set of DMUs as the ratio of the linear weighted sum of outputs to the linear weighted sum of inputs (all inputs and outputs being positive), where the weights for each DMU are determined by means of mathematical programming with the assumption of constant returns to scale (CRS) and subject to the condition that the efficiency of every DMU be less than or equal to unity (i.e. no DMU can operate beyond the production possibility set) and that the weights are

²⁴ In other words, stochastic frontier procedures assume that observed deviations from the production frontier could arise from two sources reflected by the introduction of two error terms or disturbances in the specification of the production frontier model: first, the “inefficiency” term, u , which is a one-sided, non-negative error term measuring technical inefficiency of production and second, a two-sided error term, v , measuring all exogenous factors outside the DMU’s control that can explain deviations from the production frontier such as socio-economic and demographic factors and political factors (Kokkinou 2009, Murillo-Zamorano 2004).

nonnegative (Ramanathan 2003, Lee and Ji 2010). This is called the CCR/CRS DEA model; with CCR standing for Charnes, Cooper and Rhodes (1978). The basic linear programming technique they proposed to envelop observed input-output data is as follows:

Assuming there are n DMUs (in this case, the DMUs are the municipalities), each one with m inputs and s outputs, the efficiency score of DMU₀ relative to other DMUs is obtained by solving the following linear programming model:

$$\text{Min } \theta_0$$

Subject to:

$$\begin{aligned} \theta_0 x_{i0} - \sum_{j=1}^n \lambda_j x_{ij} &\geq 0; & i = 1, \dots, m \\ -y_{r0} + \sum_{j=1}^n \lambda_j y_{rj} &\geq 0; & r = 1, \dots, s \\ \lambda_j &\geq 0; & j = 1, \dots, n \end{aligned} \quad (1)$$

Where θ_0 is the technical efficiency score of DMU₀ with inputs x_{i0} and outputs y_{r0} that satisfies $\theta_0 \leq 1$, which measures the distance between a DMU and the efficient frontier. A DMU or municipality is efficient when $\theta = 1$, which means that the municipality is located on the frontier. On the other hand, a municipality is inefficient when $\theta < 1$, which means that it is located inside the frontier. The first constraint states that weighted combination of inputs of all DMUs must be less than or equal to the input for the reference DMU₀ multiplied by its efficiency. The second constraint states that weighted combination of outputs of all DMUs must be greater than or equal to the output of the reference DMU₀. λ_j represents the weights of the DMUs (Hormazábal and Wyngard 2007).

The model (1) above is an input minimization DEA program where the weighted sum of inputs is maximized and where the goal is to produce the observed outputs with minimum inputs. The output maximization DEA program maximizes the weighted sum of outputs and aims to maximize output production subject to a given level of inputs.

Given that the assumption of constant returns to scale (CRS), where DMUs operate at their optimal scale, has often been considered over restrictive in the literature, the CCR model was initially modified in 1984 by Banker, Charnes and Cooper (1984) to incorporate an additional convexity constraint that would account for variable returns to scale (VRS). This modified DEA model was called the BCC DEA model. Specifically, the convexity constraint $\sum_{j=1}^n \lambda_j = 1$ was imposed on the model (1) above to ensure that DMUs operating at different return to scale are considered efficient.

In this paper, the efficiency performance of municipalities in South Africa will be computed using a two-stage, input-oriented DEA-VRS. A second stage Tobit regression will then analyze the determinants of the DEA-VRS efficiency scores of municipalities.

The basic stochastic parametric frontier (SFA) model proposed in this paper focuses on a cost frontier model linear in logs and developed by Kumbhakar and Lovell (2000), where it is assumed that there is no variability in input prices:

$$\ln(c_i) = \beta_0 + \sum_{j=1}^k \beta_j \ln(q_{ji}) + v_i + \mu_i \quad \text{with } i = 1, \dots, n \text{ and } k \text{ inputs}$$

where c_i is the cost, q_i is the output, v_i is the random shock term which is assumed to be independently distributed over the observations, and μ_i is the degree of technical efficiency which is assumed to be independently distributed with truncation point at zero.

This paper analyses the relative production efficiency of the 231 local municipalities in South Africa for 2007 within each of the four local municipality clusters, namely: B1; B2; B3, and B4. It is important to disaggregate the analysis following this typology in order to take into account the fact that municipalities within each cluster share similar spatial characteristics, similar institution size, similar budget, and similar socio-economic characteristics.

Additionally, as above-mentioned, district municipalities are excluded from the analysis because they are generally allowed to provide only water and sanitation (Financial and Fiscal Commission 2011). The metropolitan municipalities are also excluded because the Municipal Demarcation Board's capacity assessment is not done at the metropolitan municipality level and therefore data useful in this paper is not collected at that level.

7. Empirical results

7.1 Local efficiency scores in South Africa

The table 5 below summarizes the DEA-VRS input-oriented efficiency scores for all local municipalities in South Africa for which data is available. It shows that in 2007, approximately 7.6 percent of local municipalities were efficient relative to others with an efficiency score equal to one. The average efficiency score across all municipalities was 0.173 which suggests that on average, municipalities in South Africa could have theoretically achieved the same level of output or basic services provided with about 83 percent fewer inputs.²⁵ In other words, in 2007, local municipalities could have theoretically extensively improved their efficiency performance without necessarily increasing their operating expenditures. However, as aforementioned, these figure masks variations within and across municipalities.

When comparing the average efficiency scores within each municipal category (in table 6), it can be observed that B1 municipalities have the highest scores although accompanied with the lowest number of municipalities, and B3 municipalities have the lowest efficiency scores. This suggests that on average, B1 and B3 municipalities could have theoretically achieved the same level of output with about 16 percent and 80 percent fewer resources respectively; the difference between the most efficient and the least efficient municipalities being quite substantial. In other words, in 2007, local municipalities with small towns, with relatively small population and significant proportion of urban population but with no large town as a core (i.e. B3 municipalities) could have theoretically improved their efficiency performance to a great extent (i.e. 80 percent) without necessarily increasing their operating expenditures.

The complete DEA efficiency scores for all municipalities in each cluster and for which data is available in 2007 are presented in tables C1-C4 of the appendix.

²⁵ 83 percent is obtained from $((1-0.173)*100)$

Table 5: VRS-INPUT Oriented DEA Efficiency scores for all local municipalities for 2007

Local Municipality Category	No. of Mun.	Efficient Municipalities Efficiency Scores (VRS_TE) = 1	% of Efficient Municipalities	Average Efficiency Scores RTS(VRS) ORT(IN) STAGE(2)
ALL	170	Aganang LIM352 Buffalo City EC125 Bushbuckridge MP325 King Sabata Dalindyebo EC157 Koukamma EC109 Lekwa-Teemane NW396 Mangaung FS172 Mbombela MP322 Mquma EC122 Msunduzi KZN225 Thembisile MP315 Thulamela LIM343 Ubuhlebezwe KZN434 (13)	7.64%	.173

Table 6: VRS-INPUT Oriented DEA Efficiency scores by type of municipalities for 2007

Local Municipality Category	No. of Mun.	Efficient Municipalities Efficiency Scores (VRS_TE) = 1	% of Efficient Municipalities	Average Efficiency Scores RTS(VRS) ORT(IN) STAGE(2)
B1	19	Buffalo City EC125 City Of Matlosana NW403 Drakenstein WC023 Madibeng NW372 Mangaung FS172 Matjhabeng FS184 Mbombela MP322 Msunduzi KZN225 Stellenbosch WC024 (9)	47.36%	.838
B2	24	Hibiscus Coast KZN216 King Sabata Dalindyebo EC157 Mafikeng NW383 Moqhaka FS201 Mossel Bay WC043 Msukaligwa MP302 Oudtshoorn WC045 Randfontein GT482 (8)	33.33%	.625
B3	79	Abaqulusi KZN263 Amahlathi EC124	10.12%	.201

		Koukamma EC109 Lekwa-Teemane NW396 Maluti A Phofung FS194 Matatiele EC441 Mkhondo MP303 Ngwathe FS203 (8)		
B4	48	Aganang LIM352 Bushbuckridge MP325 Greater Tzaneen LIM333 Mnquma EC122 Msinga KZN244 Nongoma KZN265 Thembisile MP315 Thulamela LIM343 Ubuhlebezwe KZN434 (9)	18.75%	.377

The results presented above refer to the DEA efficiency scores that were calculated using as municipal outputs, the number of consumer units to which the basic service is delivered and which receive a bill if the service is billed. This represents the supply side of basic local service delivery by municipalities. In order to check the robustness of the findings, the number of households receiving basic local services is also used as measure of municipal output. This measure represents the demand side of basic local services and is collected in the Stats SA 2007 Community Survey.

Compared to the DEA efficiency scores from the supply side, B3 and B4 municipalities appear to have higher efficiency scores on average in 2007. The least efficient municipalities are now B2 municipalities with an average efficiency score of 0.219 which suggests that on average, B2 municipalities in South Africa could have theoretically provided the same level of basic services with about 78 percent fewer inputs in 2007. B3 municipalities, on the other hand, could have theoretically provided the same level of output with about 70 percent fewer resources during that same year.

Overall, the results point to significant differences in the DEA efficiency scores whether we consider the supply side or the demand side of the basic local service delivery. The detailed results are presented in table D of the appendix.²⁶

[SFA results not yet reported]

7.2 Determinants of local efficiency performance in South Africa

The table below presents the results of the analysis of the potential determinants of local productive efficiency using the censored normal Tobit regression model. This specific model is used given that there is a right-censoring in the dependent variable, i.e. the DEA-VRS efficiency scores. In this second stage analysis, the Tobit regression model was run on all

²⁶ The complete DEA efficiency scores using the 2007 Community Survey, for all municipalities in each cluster and for which data is available in 2007, are available upon request.

local municipalities because there were not enough observations to estimate a separate regression for each municipal category.

Table 7: Determinants of local efficiency performance in South Africa

	(1)	(2)
	ALLMunip	
VARIABLES	model	sigma
FiscalAut	0.003*	
	(0.002)	
power_func	0.199	
	(0.126)	
FisAut_power	-0.005**	
	(0.002)	
FisAut_HE	-0.001	
	(0.001)	
perc57vacant	-0.002*	
	(0.001)	
percorgavacant	-0.000	
	(0.001)	
popgrowth	-0.000	
	(0.001)	
MMqual	0.170***	
	(0.061)	
FMqual	0.039	
	(0.059)	
TSqual	-0.015	
	(0.081)	
percnoschooling	-0.002	
	(0.010)	
percgrade12	0.015	
	(0.012)	
perchigher	0.061	
	(0.044)	
percnoincome	-0.019	
	(0.021)	
perc12800zar	-0.006	
	(0.005)	
perc12801zar	-0.121***	
	(0.042)	
freewater	0.000***	
	(0.000)	
freeelec	0.000	
	(0.000)	
freesan	0.000**	
	(0.000)	
freewaste	-0.000**	
	(0.000)	
Constant	0.147	0.212***
	(0.171)	(0.015)
Observations	109	109

Standard errors in parentheses
 *** p<0.01, ** p<0.05, * p<0.1

The positive impact of fiscal autonomy on municipal performance efficiency confirms the traditional fiscal decentralization theory according to which a greater fiscal autonomy is expected to allow sub-national government officials to better match expenditures with revenue needs and increase their accountability in terms of spending.

An additional fiscal decentralization variable measuring the level of expenditure decentralization was introduced in the analysis, the dummy *power_func* which is equal to one for municipalities that have the powers and the functions allocated to provide *all four* basic local services: water, electricity, sewerage and sanitation, and solid waste management.

This explanatory variable is found to have no significant impact on local efficiency. However the interaction term between this dummy variable and the fiscal autonomy appears to have a negative and significant impact on efficiency. This result implies that as the fiscal autonomy increases, municipalities that have the powers and the functions allocated to provide *all four* basic services will see a decrease in their efficiency compared to municipalities that have the powers and the functions allocated to provide *some of the four* basic services. This result is puzzling because according to the traditional fiscal decentralization theory, devolution of powers and expenditure responsibilities along with the capacity to raise revenue would lead to an efficient provision of local public goods. This puzzling result is probably influenced by the wide disparities across local municipalities in their ability to raise revenues.

The results also show a significant and negative effect of the vacancy rate in Section 57 on efficiency. This confirms the premise that a higher proportion of job vacancy within a municipality would reflect its difficulty to attract qualified and experienced MMs, CFOs, and other managers and it is thus bound to impact the day-to-day functioning of the municipality and therefore its efficiency in service delivery. On the other hand, the vacancy rate within the organogram is found to have no significant effect on local efficiency.

Another important factor that seems to have a positive effect on efficiency is the education level of municipal managers (MMs) who are the top management of a municipality's administration and also the accounting officers of the municipality. The results show that if a MM holds a postgraduate degree (whether Honours, Masters, or PHD degree), the efficiency score of the municipality he/she is managing would be 0.170 higher than a municipality headed by a MM with no postgraduate degree. However, the education level of CFOs, and managers for technical services appear to have no significant impact on efficiency.

Similarly, the education level of the citizens does not appear to significantly affect efficiency levels. The same result holds when the fiscal autonomy was interacted with the percentage of population with higher education. The aim of this explanatory variable was to control for the fact that efficient provision of public goods would depend not only on the degree of fiscal decentralization (measured here by revenue autonomy) but also on an institutional environment that provides oversight and monitoring. In this specific case, highly educated citizens should possess the ability and skills to be effective and active participants in a representative democracy and in public decision-making processes and as such, they should be able to pressure local government officials and monitor their performance to ensure an efficient provision of services. Where income is posited to have similar effects, the findings nonetheless show that the higher the percentage of the population with a gross monthly income greater than 12800ZAR, the lower the efficiency levels. This result may probably be ascribed to the presence of Ratepayers Associations in some municipalities which higher income individuals would tend to form and whose aim is to incite unhappy rate payers to not

pay their taxes and user fees in an attempt to force municipalities to provide services. This Catch-22 would reduce municipal revenues and thus their efficiency levels. Unfortunately, this potential effect of effect the presence of Ratepayers Associations could not be teased out due to the fact that data on the number and location of Ratepayers Associations in South Africa could not be collected.

Finally, it appears that the number of consumer units receiving free water and sanitation in local municipalities are also important in improving local efficiency; this result may probably be explained by the fact that although they put added pressure on local municipalities, they nonetheless would allow poor household who receive them to be more productive and pay for these services in the future. The number of consumer units receiving free provision of solid waste management however seems to have a negative and significant impact on efficiency the while the number of consumer units receiving free electricity does not appear to have an impact.

[SFA results not yet reported and political variable still being compiled]

8. Preliminary conclusion and policy recommendations

The results of the DEA-VRS input-oriented efficiency scores for local municipalities in South Africa show that in 2007, approximately 7.6 percent of local municipalities were efficient with an efficiency score equal to one. The average efficiency scores across all municipalities was 0.173 which suggests that on average, municipalities in South Africa could have theoretically achieved the same level of output or basic services provided with about 83 percent fewer inputs. To account for wide variations within and across municipalities, the DEA efficiency scores were computed for each of the four municipal clusters, namely B1; B2; B3, and B4.

When comparing the average efficiency scores within each municipal category, it was found that B1 municipalities have the highest scores although accompanied with the lowest number of municipalities, and B3 municipalities have the lowest efficiency scores. In order words, on average, B1 and B3 municipalities could have theoretically achieved the same level of basic services with about 16 percent and 80 percent fewer resources respectively; the difference between the most efficient and the least efficient municipalities being quite substantial. The results also show that B4 municipalities could have theoretically achieved the same level of basic services with about 62 percent fewer operating expenditures. These findings raise concerns over the future of local municipalities in South Africa, especially B3 and B4 municipalities, about their capability to efficiently deliver on expected outcomes on a sustainable basis.

Overall, the results point to significant differences in the DEA efficiency scores whether the supply side or the demand side of the basic local service delivery is considered. From the demand side, B3 and B4 municipalities appear to have higher efficiency scores on average in 2007 compared to the same municipalities in the supply side. From the demand side, the least efficient municipalities are now B2 municipalities with an average efficiency score of 0.219 which suggests that on average, B2 municipalities in South Africa could have theoretically provided the same level of basic services with about 78 percent fewer inputs in 2007. B3 municipalities, on the other hand, could have theoretically provided the same level of output with about 70 percent fewer resources during that same year.

In order to identify the potential factors that may influence the productive efficiency of local municipalities in South Africa, a censored normal Tobit regression model was performed. The model was run on all local municipalities because there were not enough observations to estimate a separate regression for each municipal category.

In general, the results show that it appears crucial to improve the second pillar of fiscal decentralization by assigning greater revenue autonomy to local municipalities in South Africa while taking into account wide disparities across municipalities in their abilities to raise revenues. A corollary result would be to improve the allocation of local municipalities' equitable share of national revenue, especially transfer allocations to B3 and B4 municipalities.

Additionally, it appears critical to increase the number and skill levels of the top management of a municipality's administration, that is, municipal managers, chief financial officers, and managers for technical services. Associated with this result would be the necessity to devise incentive mechanisms to attract managers in secondary cities and rural areas in the country.

Overall, given the substantial disparities within and across municipalities, it appears essential to reform the expenditure and revenue assignments under the current fiscal decentralization framework in order to reflect and accommodate disparities in jurisdictional needs and financial and functional capacities.

9. References

Afonso, Antonio, and Sonia Fernandes. "Assessing and explaining the relative efficiency of local government." *The Journal of Socio-Economics* 37 (2008): 1946–1979.

Athanassopoulos, A., and K. Triantis. "Assessing aggregate cost efficiency and the related policy implications for Greek local municipalities." *INFOR* 36 3 (1998): 66–83.

Bahl, Roy, and Jorge Martinez-Vazquez. "Sequencing Fiscal Decentralization." World Bank Policy Research Working Paper 3914, Andrew Young School of Policy Studies, Georgia State University, Atlanta, Georgia, 2006.

Bahl, Roy, and Paul Smoke. *Restructuring Local Government Finance in Developing Countries: Lessons from South Africa*. Cheltenham, UK and Northampton, MA: Edward Elgar, 2003.

Balaguer-Coll, M, D. Prior-Jimenez, and J. Vela-Bargues. *Efficiency and Quality in Local Government Management. The Case of Spanish Local Authorities*. WP 2002/2, Universitat Autònoma de Barcelona, 2002.

Banker, R. D., A. Charnes, and W. W. Cooper. "Some Models for Estimating Technical and Scale Inefficiencies in Data Envelopment Analysis." *Management Science* 30, no. 9 (September 1984): 1078-1092.

Bird, Richard. *Subnational Revenues: Realities and Prospects*. Monograph, Atlanta: Andrew Young School of Policy Studies, Georgia State University, 2001.

Black, Philip, Estian Calitz, and Tjaart Steenekamp. *Public Economics, Fourth Edition*. Cape Town: Oxford University Press Southern Africa, 2009.

Boetti, Lorenzo, Massimiliano Piacenza, and Gilberto Turati. "Decentralization and Local Governments' Performance: How Does Fiscal Autonomy Affect Spending Efficiency?" *66th Congress of the International Institute of Public Finance (IIPF)*. Uppsala, Sweden, 2010.

Boex, Jamie, and Jorge Martinez-Vazquez. *The Design of Equalization Grants: Theory and Applications*. World Bank Institute / Georgia State University, 2001.

Boex, Jamie, Jorge Martinez-Vazquez, and Andrei Timofeev. *Subnational Government Structure and Intergovernmental Fiscal Relations: An Overlooked Dimension of Decentralization*. ISP Working Paper Number 04-01, Atlanta: Andrew Young School of Policy Studies, Georgia State University, 2004.

Charnes, A. W. W. Cooper, and E. Rhodes. "Measuring the efficiency of decision making units." *European Journal of Operational Research* 2, no. 6 (November 1978): 429-444.

CoGTA. "State of Local Government in South Africa, Overview Report." Working Documents, Department of Cooperative Governance and Traditional Affairs, 2009.

De Borger, B., and K. Kerstens. "Cost efficiency of Belgian local governments: a comparative analysis of FDH, DEA, and econometric approaches." *Regional Science and Urban Economics* 26 (1996): 145–170.

De Villiers, Bertus (Ed). *Review of provinces and local governments in South Africa: Constitutional foundations and practice*. Johannesburg, South Africa: Konrad-Adenauer-Stiftung, 2008.

Farrell, M. J. "The Measurement of Productive Efficiency." *Journal of the Royal Statistical Society. Series A (General)* 120, no. 3 (1957): 253-290.

Financial and Fiscal Commission. *Submission for the 2012/13 Division of Revenue*. Technical Report (Chapter 8), Financial and Fiscal Commission (FCC): For an Equitable Sharing of National Revenue, 2011.

Hormazábal, Raúl Sanhueza, and Hugh Rudnick Van de Wyngard. "Frontier methodologies for the determination of efficiencies in distribution costs." *Ingeniare. Revista chilena de ingeniería* 15, no. 3 (2007): 220-226.

Kelly, Roy. *Intergovernmental Revenue Allocation, Theory and Practice: Application to Nepal*. Development Discussion Paper No. 624, Harvard Institute for International Development, Harvard University, 1998.

Kokkinou, Aikaterini. *Stochastic frontier analysis: Empirical evidence on Greek productivity*. Glasgow, United Kingdom: University of Glasgow, United Kingdom, 2009.

Kumbhakar, S.C., and C.A.K. Lovell. *Stochastic Frontier analysis*. Cambridge: Cambridge University Press, Cambridge, 2000.

Lee, Choonjoo, and Yong-bae Ji. "Data Envelopment Analysis." *The Stata Journal* 10, no. 2 (2010): 267-280.

Loikkanen, H., and I. Susiluoto. "Cost efficiency of Finnish municipalities in basic service provision 1994–2002." Paper prepared for the 45th Congress of the European Regional Science Association in Amsterdam, the Netherlands, 23-27 August, 2005.

Martinez-Vazquez, Jorge. *The Assignment of Expenditure Responsibilities*. Monograph, Atlanta: Andrew Young School of Policy Studies, Georgia State University, 1998.

McLure, Charles E. *The Tax Assignment Problem: Conceptual and Administrative Considerations in Achieving Subnational Fiscal Autonomy*. Working Paper, Stanford, California: Hoover Institution, Institute for Policy Research, Stanford University, 2007.

Murillo-Zamorano, Luis R. "Economic Efficiency and Frontier Techniques." *Journal of Economic Surveys* 18, no. 1 (February 2004): 33-77.

PREM Notes. *Decentralization and governance: does decentralization improve public service delivery?* PREM Notes, Number 55, World Bank, Poverty Reduction and Economic Management (PREM) Network, 2001.

Ramanathan, Ramu. *An Introduction to Data Envelopment Analysis: A tool for Performance Measurement*. New Delhi, Thousand Oaks, London: Sage Publications, 2003.

SARB. *Quarterly Bulletin No 260*. Database, Download information from XLSX data files, J2 (Annually - 1 April to 31 March), Kbp4 & Kbp6, South African Reserve Bank, 2011.

Smoke, Paul. *Fiscal Decentralization in Developing Countries: A Review of Current Concepts and Practice*. Democracy, Governance and Human Rights, Programme Paper Number 2, Geneva, Switzerland: United Nations Research Institute for Social Development (UNRISD), 2001.

—. "Fiscal Decentralization in East and Southern Africa: A Selective Review of Experience and Thoughts on Moving Forward." *Conference on Fiscal Decentralization*. Washington, DC: International Monetary Fund, 2000.

Tiebout, Charles. "A pure theory of local expenditures." *Journal of Political Economy* 64, no. 5 (1956): 416–424.

UNDP. *Fiscal Decentralization in Transition Economies: Case Studies from the Balkans and Caucasus*. Bratislava: United Nations Development Programme, Regional Centre, Bratislava, Slovakia, 2005.

UNDP. *Millennium Development Goals (MDGs), Country Report 2010*. South Africa: United Nations Development Programme (UNDP), 2010.

Van den Eeckaut, P., H. Tulkens, and M.-A. Jamar. "Cost efficiency in Belgian municipalities." In *The Measurement of Productive Efficiency: Techniques and Applications*, by H. Fried and C. Lovell, 300–334. New York: Oxford University Press, 1993.

Vaz, Peter. *Local Government Financial Reform: Toward a Sustainable System of Local Government*. Task Order, Groenkloof, Pretoria: United States Agency for International Development, 2004.

Appendix

Table A: Variable definitions and data Source

Variable name	Variable label	Data source
<i>Input</i>		
TotalOpEx	Total Operating Expenditure(in R'000) for Financial Year 2007/08	National Treasury, Local Government Budgets and Expenditure Review (preliminary in-year figures)
<i>Outputs</i>		
totalpop	Total Population per municipality from 2007 CS	2007 Community Survey, Statistics South Africa
cuwater	Number of Consumer Units receiving water from municipality	2007 Non-Financial Census of Municipalities, Statistics South Africa (P9115 Unit data 2007)
cuelec	Number of Consumer Units receiving electricity from municipality	
cusan	Number of Consumer Units receiving sanitation from municipality	
cuwaste	Number of Consumer Units receiving waste mgmt from municipality	
HHelec	Number of Households with access to Electricity (for lightning)	
HHwater	Number of Households with access to clean water (piped water)	
HHrefuse	Number of Households with access to adequate refuse removal service	2007 Community Survey, Statistics South Africa
HHsanit	Number of Households with access to toilet facilities	
<i>Fiscal Autonomy/level of Fiscal Decentralization</i>		
FiscalAut	Share of local <i>OWN</i> sources of Revenue (taxes & service charges) in total revenue	National Treasury, Local Government Budgets and Expenditure Review (preliminary in-year figures)
power_func	Dummy Variable = 1 if the municipality has the powers and functions allocated to provide <i>all</i> four basic services: water, electricity, sewerage and sanitation, and solid waste management	2007 Non-Financial Census of Municipalities, Statistics South Africa (P9115 Unit data 2007)
<i>Institutional Capacity</i>		
perc57vacant	Percentage of vacant posts of total posts in Section 57	2007 Non-Financial Census of Municipalities, Statistics South Africa (P9115 Unit data 2007)
percorgavacant	Percentage of vacant posts of total posts in the Organogram	
MMqual	Dummy variable =1 if the Municipal Manager (MM) has a postgraduate degree	Municipal Demarcation Board Capacity Assessment Database 2007/08
FMqual	Dummy variable =1 if the Financial Manager (FM) has a postgraduate degree	
TSqual	Dummy variable =1 if the Manager for Technical Service	

	has a postgraduate degree	
Socio-economic Factors		
percnoschooling	Percentage of the Population with NO Schooling	2007 Community Survey, Statistics South Africa
percsomesec	Percentage of the Population with Some Secondary education	
percgrade12	Percentage of the Population with Secondary education	
perchigher	Percentage of the Population with Higher education	
percnoincome	Percentage of the municipality population with no	
	income	
perc12800zar	Percentage of the Population with a gross monthly income of	
	less than or equal to 12800 ZAR	
perc12801zar	Percentage of the Population with a gross monthly income of	
	more than 12800 ZAR	
popgrowth	Population growth per municipality between 2001	
	and 2007, in Percentage	
Political Factors		
	Percentage of council seats held by the majority party after the 2006 local government elections	The Independent Electoral Commission
Others		
freewater, freelec, freesan, freewaste	Number of Consumer Units receiving <i>free</i> water, electricity, sewerage and sanitation, and solid waste management from municipality	2007 Non-Financial Census of Municipalities, Statistics South Africa (P9115 Unit data 2007)

Table B: Descriptive statistics of the determinants of municipal productive efficiency

Variable	No. of Obs	Mean	Std. Dev.	Min	Max
FiscalAut	161	48.5	24.9	0.2	97.8
popgrowth	231	2.0	18.1	-45.0	69.0
perc57vacant	228	15.9	20.5	0.0	100
percorgavacant	164	18.5	26.0	0.0	100
MMqual	231	0.2	0.4	0	1
FMqual	231	0.1	0.4	0	1
TSqual	231	0.1	0.2	0	1
percnoschooling	231	8.1	3.7	1.7	25.0
percsomesec	231	20.1	4.7	8.2	34.0
percgrade12	231	7.7	3.5	1.7	19.8
perchigher	231	3.3	2.0	0.5	11.6
percnoincome	231	1.9	1.0	0.1	5.3
perc12800zar	231	20.3	4.9	8.8	43.6

perc12801zar	231	1.5	1.1	0.1	5.4
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Table C: Detailed VRS-INPUT Oriented DEA Efficiency scores, by category of municipalities in 2007

Table C1: DEA efficiency scores for 2007, B1 Municipalities

	dmu_no	Municipality	CRS_TE	VRS_TE	SCALE	RTS
1	KZN282	Umhlatuze	0.44	0.44	1.00	irs
2	WC044	George	0.50	0.56	0.89	irs
3	NW402	Tlokwe	0.53	0.69	0.78	irs
4	MP312	Emalahleni (Mp)	0.67	0.69	0.97	drs
5	KZN252	Newcastle	0.69	0.70	0.99	drs
6	NC091	Sol Plaatje	0.69	0.72	0.97	irs
7	MP313	Steve Tshwete	0.69	0.75	0.92	irs
8	LIM354	Polokwane	0.69	0.76	0.90	drs
9	NW373	Rustenburg	0.66	0.79	0.83	drs
10	MP307	Govan Mbeki	0.82	0.82	1.00	irs
11	EC125	Buffalo City	0.70	1	0.70	drs
12	FS172	Mangaung	1	1	1	-
13	FS184	Matjhabeng	1	1	1	-
14	KZN225	Msunduzi	0.98	1	0.98	drs
15	MP322	Mbombela	1	1	1	-
16	NW372	Madibeng	1	1	1	-
17	NW403	City Of Matlosana	1	1	1	-
18	WC023	Drakenstein	1	1	1	drs
19	WC024	Stellenbosch	1	1	1	-

Note: "irs" = the municipality is on the increasing returns to scale portion of the VRS frontier;

"drs" = the municipality is on the decreasing returns to scale portion of the VRS frontier.

CRS indicates that output will change by the same proportion as inputs are changed, for example, a doubling of all inputs will double output; VRS indicates that production technology may exhibit increasing, constant and decreasing returns to scale.

Table C2: DEA efficiency scores for 2007, B2 Municipalities

	dmu_no	Municipality	CRS_TE	VRS_TE	SCALE	RTS
1	KZN222	Umngeni	0.03	0.04	0.74	irs
2	GT422	Midvaal	0.06	0.07	0.84	drs
3	WC048	Knysna	0.09	0.18	0.48	drs
4	WC025	Breede Valley	0.07	0.19	0.36	drs
5	KZN292	Kwa Dukuza	0.07	0.22	0.30	drs
6	MP314	Highlands	0.26	0.26	0.99	drs
7	FS204	Metsimaholo	0.10	0.35	0.29	drs
8	KZN212	Umdoni	0.28	0.38	0.74	drs
9	EC104	Makana	0.19	0.43	0.45	drs
10	FS192	Dihlabeng	0.14	0.54	0.27	drs
11	NC083	//Khara Hais	0.14	0.59	0.24	drs
12	KZN433	Greater Kokstad	0.52	0.59	0.89	irs
13	WC014	Saldanha Bay	0.24	0.63	0.38	drs

14	KZN232	Emnambithi	0.17	0.72	0.24	drs
15	GT483	Westonaria	0.25	0.87	0.29	drs
16	EC134	Lukanji	0.19	0.97	0.19	drs
17	EC157	King Sabata Dalindyebo	1.00	1	1.00	-
18	FS201	Moqhaka	0.34	1	0.34	drs
19	GT482	Randfontein	0.47	1	0.47	drs
20	KZN216	Hibiscus Coast	0.22	1	0.22	drs
21	MP302	Msukaligwa	0.18	1	0.18	drs
22	NW383	Mafikeng	0.34	1	0.34	drs
23	WC043	Mossel Bay	0.15	1	0.15	drs
24	WC045	Oudtshoorn	1.00	1	1.00	-

Table C3: DEA efficiency scores for 2007, B3 Municipalities

	dmu_no	Municipality	CRS_TE	VRS_TE	SCALE	RTS
1	EC102	Blue Crane Route	0.0003	0.0003	0.7795	irs
2	WC033	Cape Agulhas	0.0004	0.0004	0.8670	irs
3	WC041	Kannaland	0.0004	0.0005	0.7533	irs
4	WC034	Swellendam	0.0004	0.0006	0.6959	irs
5	NC085	Tsantsabane	0.0007	0.0008	0.8536	irs
6	KZN223	Mooi Mphofana	0.0010	0.0010	0.9607	irs
7	EC144	Gariep	0.0009	0.0011	0.8161	irs
8	KZN253	Utrecht	0.0008	0.0012	0.7090	irs
9	FS182	Tokologo	0.0009	0.0012	0.7491	irs
10	NC086	Kgatelopele	0.0008	0.0013	0.6552	irs
11	FS171	Naledi (Fs)	0.0013	0.0013	0.9788	irs
12	WC051	Laingsburg	0.0003	0.0018	0.1572	irs
13	KZN432	Kwa Sani	0.0008	0.0019	0.4353	irs
14	EC128	Nxuba	0.0013	0.0019	0.6543	irs
15	EC133	Inkwanca	0.0013	0.0020	0.6272	irs
16	EC107	Baviaans	0.0009	0.0020	0.4252	irs
17	WC052	Prince Albert	0.0006	0.0023	0.2552	irs
18	EC103	Ikwezi	0.0009	0.0026	0.3512	irs
19	NC081	Mier	0.0006	0.0027	0.2236	irs
20	EC132	Tsolwana	0.0032	0.0033	0.9731	irs
21	NC077	Siyathemba	0.0032	0.0052	0.6132	irs
22	WC042	Langeberg	0.0003	0.0104	0.0288	drs
23	WC053	Beaufort West	0.0004	0.0106	0.0396	drs
24	FS195	Phumelela	0.0008	0.0115	0.0683	drs
25	EC106 Su	nday'S River Valley	0.0009	0.0123	0.0726	drs
26	WC047	Plettenberg Bay	0.0003	0.0204	0.0128	drs
27	FS161	Letsemeng	0.0010	0.0210	0.0468	drs
28	MP306	Dipaleseng	0.0008	0.0231	0.0344	drs
29	WC013	Bergrivier	0.0005	0.0271	0.0175	drs
30	WC011	Matzikama	0.0005	0.0311	0.0160	drs
31	NW401	Ventersdorp	0.0015	0.0332	0.0447	drs
32	EC108	Kouga	0.0003	0.0365	0.0086	drs
33	MP311	Delmas	0.0005	0.0383	0.0134	drs
34	EC101	Camdeboo	0.0009	0.0417	0.0217	drs

35	FS183	Tswelopele	-91.2000	0.0466	-1950.0000	irs
36	NW395	Molopo	0.0432	0.0476	0.9091	irs
37	FS162	Kopanong	0.0005	0.0542	0.0086	drs
38	EC143	Maletswai	0.0008	0.0595	0.0131	drs
39	NW393	Mamusa	0.0023	0.0648	0.0357	drs
40	FS163	Mohokare	0.0014	0.0656	0.0215	drs
41	LIM366	Bela Bela	0.0006	0.0801	0.0073	drs
42	NC082	Kai! Garib	0.0009	0.0819	0.0112	drs
43	NC062	Nama Khoi	0.0008	0.0867	0.0093	drs
44	GT423	Lesedi	0.0003	0.0885	0.0039	drs
45	MP323	Umjindi	0.0007	0.0909	0.0074	drs
46	WC022	Witzenberg	0.0004	0.0930	0.0047	drs
47	FS173	Mantsopa	0.0008	0.1033	0.0075	drs
48	LIM341	Musina	0.0006	0.1098	0.0059	drs
49	WC015	Swartland	0.0005	0.1123	0.0045	drs
50	KZN273	The Big 5 False Bay	0.0032	0.1259	0.0256	drs
51	EC131	Inxuba Yethemba	.	0.1317	.	irs
52	KZN275	Mtubatuba	0.0021	0.1329	0.0158	drs
53	MP321	Thaba Chweu	0.0006	0.1446	0.0044	drs
54	KZN226	Mkhambathini	0.0024	0.1496	0.0159	drs
55	FS205	Mafube	0.0008	0.1616	0.0048	drs
56	MP305	Lekwa	0.0006	0.1620	0.0035	drs
57	FS181	Masilonyana	0.0007	0.1628	0.0041	drs
58	EC105	Ndlambe	0.0008	0.1788	0.0042	drs
59	KZN285	Mthonjaneni	0.0028	0.1806	0.0155	drs
60	EC138	Sakhisizwe	0.0023	0.1857	0.0122	drs
61	NC452	Ga-Segonyana	0.0008	0.1922	0.0040	drs
62	NW392	Naledi (Nw)	0.0023	0.2082	0.0109	drs
63	FS193	Nketoana	0.0012	0.2243	0.0055	drs
64	FS185	Nala	0.0010	0.2469	0.0040	drs
65	NW404	Maquassi Hills	0.0012	0.2610	0.0044	drs
66	MP304	Seme	0.0011	0.2980	0.0037	drs
67	NC092	Dikgatlong	0.0022	0.4197	0.0053	drs
68	KZN214	Umuziwabantu	0.0033	0.4744	0.0069	drs
69	FS191	Setsoto	0.0008	0.7537	0.0010	drs
70	KZN261	Edumbe	0.0066	0.7844	0.0084	drs
71	EC127	Nkonkobe	0.0025	0.8200	0.0031	drs
72	EC109	Koukamma	0.0044	1	0.0044	drs
73	EC124	Amahlathi	0.0025	1	0.0025	drs
74	EC441	Matatiele	0.0054	1	0.0054	drs
75	FS194	Maluti A Phofung	0.0009	1	0.0009	drs
76	FS203	Ngwathe	0.0006	1	0.0006	drs
77	KZN263	Abaqulusi	0.0040	1	0.0040	drs
78	MP303	Mkhondo	0.0012	1	0.0012	drs
79	NW396	Lekwa-Teemane	1	1	1	-

Table C4: DEA efficiency scores for 2007, B4 Municipalities

	dmu_no	Municipality	CRS_TE	VRS_TE	SCALE	RTS
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1	EC135	Intsika Yethu	0.03	0.03	0.94	irs
2	KZN284	Umlalazi	0.03	0.04	0.67	drs
3	KZN227	Richmond	0.01	0.04	0.35	irs
4	EC156	Mhlontlo	0.05	0.05	0.99	irs
5	KZN294	Maphumulo	0.03	0.05	0.62	irs
6	EC137	Engcobo	0.04	0.06	0.79	irs
7	KZN431	Ingwe	0.04	0.06	0.66	irs
8	KZN281	Mbonambi	0.04	0.06	0.68	irs
9	KZN213	Umzumbe	0.06	0.07	0.95	irs
10	KZN272	Jozini	0.07	0.07	0.98	irs
11	EC126	Ngqushwa	0.03	0.08	0.44	irs
12	KZN293	Ndwedwe	0.06	0.08	0.78	irs
13	KZN274	Hlabisa	0.08	0.08	0.89	irs
14	EC152	Ntabankulu	0.07	0.09	0.76	irs
15	EC136	Emalahleni (Ec)	0.06	0.10	0.64	irs
16	KZN211	Vulamehlo	0.05	0.10	0.45	irs
17	EC442	Umzimvubu	0.06	0.12	0.49	drs
18	KZN224	Impendle	0.03	0.12	0.23	irs
19	KZN435	Umzimkhulu	0.09	0.13	0.71	drs
20	KZN235	Okhahlamba	0.10	0.14	0.70	drs
21	EC141	Elundini	0.09	0.14	0.66	drs
22	KZN271	Umhlabuyalingana	0.13	0.16	0.83	irs
23	EC142	Senqu	0.11	0.16	0.71	drs
24	KZN215	Ezingoleni	0.07	0.17	0.39	irs
25	KZN291	èNdongakusuka	0.12	0.20	0.59	drs
26	MP324	Nkomazi	0.03	0.24	0.11	drs
27	KZN221	Umshwathi	0.14	0.27	0.51	drs
28	KZN233	Indaka	0.20	0.28	0.70	drs
29	KZN262	Uphongolo	0.18	0.28	0.63	drs
30	KZN254	Dannhauser	0.22	0.29	0.73	drs
31	EC121	Mbhashe	0.09	0.38	0.23	drs
32	EC153	Qaukeni	0.05	0.41	0.12	drs
33	LIM475	Greater Tubatse	0.04	0.44	0.09	drs
34	EC151	Mbizana	0.08	0.45	0.17	drs
35	MP301	Albert Luthuli	0.28	0.46	0.60	drs
36	EC155	Nyandeni	0.07	0.64	0.11	drs
37	MP316	Dr J.S. Moroka	0.19	0.67	0.29	drs
38	EC154	Port St Johns	0.92	0.92	1.00	irs
39	LIM331	Greater Giyani	0.37	0.97	0.38	drs
40	EC122	Mnquma	0.50	1	0.50	drs
41	KZN244	Msinga	1	1	1	-
42	KZN265	Nongoma	1	1	1	-
43	KZN434	Ubuhlebezwe	1	1	1	-
44	LIM333	Greater Tzaneen	0.06	1	0.06	drs
45	LIM343	Thulamela	0.43	1	0.43	drs
46	LIM352	Aganang	1	1	1	-
47	MP315	Thembisile	0.39	1	0.39	drs
48	MP325	Bushbuckridge	0.11	1	0.11	drs

Table D: VRS-INPUT Oriented DEA Efficiency scores by type of municipalities for 2007, using 2007 Community Survey outputs

Local Municipality Category	No. of Mun.	Efficient Municipalities Efficiency Scores (VRS_TE) = 1	% of Efficient Municipalities	Average Efficiency Scores RTS(VRS) ORT(IN) STAGE(2)
ALL	170	Buffalo City King Sabata Dalindyebo Mangaung Matjhabeng Moqhaka Thulamela Bushbuckridge Lekwa-Teemane (8)	4.70%	.132 (86.8%)
B1	19	Buffalo City Mangaung Matjhabeng Mbombela Stellenbosch (5)	26.31%	.748 (25.2%)
B2	24	King Sabata Dalindyebo Moqhaka (2)	8.33%	.219 (78.1%)
B3	79	Nkonkobe Matatiele Masilonyana Nala Maluti A Phofung Ngwathe Abaqulusi Lekwa-Teemane (8)	10.12%	.331 (66.9 %)
B4	48	Mnquma Port St Johns Msinga Nongoma èNdongakusuka Thulamela Aganang Nkomazi Bushbuckridge (9)	18.75%	.514 (48.6 %)