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Fiscal decentralization and efficiency of public services delivery by local governments in Ghana

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Abstract: In this paper, we estimate the efficiency of Metropolitan, Municipal, and District Assemblies (MMDAs) in Ghana, and investigate the impact of fiscal decentralization on the efficiency of local public goods and services delivery by MMDAs. Using data from composite budgets of all 216 MMDAs, we employ both nonparametric and parametric frontier methods to carry out the study. The results with regard to our two indicators of fiscal decentralization indicate that fiscal autonomy proxied by MMDAs' internally generated funds as a share of their total revenue has a positive influence on the efficiency of MMDAs whilst vertical imbalance—a high share of central government grants in MMDAs' total expenditure—does not improve the delivery of local goods and services by MMDAs in Ghana. The findings indicate a clear signal to policy managers to prioritize support to MMDAs in the mobilization of internally generated revenue.

Key words: fiscal decentralization, efficiency, local government, frontier methods, Ghana

JEL classification: H71, H72, H75, H77

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1 Introduction

Decentralization has been on the rise in developing countries in recent years (Panizza 1999; Treisman 2006). Many developing countries around the world are devolving responsibilities to lower tiers of government because decentralization is seen as vital for the achievement of sustained economic growth and development (Bruno and Pleskovic 1996; Crook and Manor 1998). In many developing countries, especially in Latin America and Africa, the implementation of decentralization systems in the past decades has largely been motivated by political concerns. For instance, in Africa, the spread of multi-party political systems in the early 1990s created a demand for more local voice in decision-making. In addition, there has been an increased demand for improved, efficient, and high-quality service delivery, as well as better accountability, from local bureaucrats.

In this paper, we focus on fiscal decentralization. Fiscal decentralization involves the sharing of taxing and spending responsibilities between the central government and local government (Porcelli 2009). In other words, fiscal decentralization accords substantial revenue and expenditure autonomy to local governments, including the power to levy taxes and user charges.¹ The first- and second-generation theories of fiscal federalism have provided the theoretical foundation for discussions on fiscal decentralization issues. These theories focus on fiscal responsibility and the distribution of public-sector functions among various levels of (sub)national governments (Rodden 2016; Slavinskaitė et al. 2019). For instance, the first-generation theory seeks to associate the fiscal decentralization process with the degree of response from citizens and economic efficiency through an improvement in the linking of resource allocation with the needs of the people (Musgrave 1959; Oates 1972; Tiebout 1956). The second-generation theory, however, emphasizes how incentives to local governments and information about citizens can contribute to higher economic efficiency (Besley and Coate 2003; Lockwood 2002; Petchey and Levchenkova 2003; Wagner 2007; Weingast 1995). Regarding incentives to local governments, the literature on the second generation of fiscal federalism theory has shown that different sources of revenues affect the incentives of local governments differently. For instance, local governments that depend on own revenues such as taxes and fees have incentives to be more accountable, more efficient in the provision of public goods, and less corrupt (Ambrosio and Borgignon 2006; Careaga and Weingast 2003; Rodden 2003; Singh and Srinivasan 2006), whilst those that depend on central government transfers have less incentive to improve the efficiency of local government operations and evince a high incidence of corruption (Brollo et al. 2011; Gadenne 2013; Gervasoni 2010).

The fiscal federalism theories also stress the significance of fiscal decentralization in the efficient delivery of local public goods and services by local governments. Premised on the discussions above, the economic benefits of fiscal decentralization are realized through efficient resource allocation by local governments (Besley and Coate 2003; Lockwood 2002; Oates 1972; Tiebout 1956). Limited resources can be more efficiently allocated if the fiscal system is decentralized, since local governments have more accurate and detailed information on citizens, and therefore may know better how to maximize the benefits of the use of resources in their areas. Some studies (Bahl and Linn 1992; Prud'homme 1995; Tanzi 1995), however, mention budget overruns, corruption, competition for the tax base, and high business and trade costs as potential economic costs associated with fiscal decentralization.

¹ <https://www.worldbank.org/en/topic/communitydrivendevelopment/brief/Decentralization> (accessed 2 February 2021).

Given the important role of fiscal decentralization in improving the performance of local governments as well as the development outcomes of their constituencies, many studies have focused on the impact of fiscal decentralization on the efficiency of local government (Afonso and Fernandes 2008; Balaguer-Coll et al. 2007; Benito-Lopez et al. 2010; Boetti et al. 2012; DeBorger and Kerstens 1996; Marques et al. 2015; Monkam 2014; Moore et al. 2005; Narbón-Perpiñá and De Witte 2016; Stastna and Gregor 2011; Yusufany 2015). These studies combine parametric and non-parametric frontier approaches in the estimation and analysis of fiscal decentralization and local government efficiency. The choice of an input or output depends mainly on the availability of data but also on the institutional arrangement regarding the mandate of local governments in a particular country. However, studies in developing countries, particularly Sub-Saharan Africa (SSA), are lacking. Many countries, particularly in SSA, are implementing different forms of fiscal decentralization, whilst attempting also to improve the efficiency of the use of resources in the provision of public goods. Hence, shedding more light on the role of different forms of fiscal decentralization in improving the efficiency of local government would be useful to governments and policy-makers in SSA.

In this paper we focus on a developing SSA country, Ghana. Ghana started its current system of decentralization in 1988 under PNDC Law 207 and it was given a legal backing in Chapter 20 of 1992 4th Republican Constitution and with Act 462 (1993), which has been superseded by Act 936 (2016). The Constitution establishes the Metropolitan, Municipal, and District Assemblies (MMDAs) as the utmost political and administrative authority in the district. MMDAs provide a wide range of social services to their constituents, which include healthcare, education, water supply, waste management, feeder roads, street lighting, fire-fighting, and police protection (Ofei-Aboagye 2009). In terms of fiscal decentralization, the central government is mandated by the constitution to set aside not less than 5 per cent of total government revenue every fiscal year to the District Assemblies Common Fund (DACF) secretariat to be shared among MMDAs according to a formula approved by the Parliament of Ghana. Furthermore, the Constitution gives MMDAs the power to impose rates and also collect taxes and non-tax revenues like rates, licences, fees, and fines. Using frontier approaches, we examine the efficiency of local governments in Ghana and investigate the role of fiscal decentralization in improving local government efficiency. Using two proxies of fiscal decentralization extensively used in the literature—fiscal autonomy and vertical imbalance—we find that fiscal autonomy measured in terms of MMDAs’ internally generated funds (IGF) as a share of their total revenue seems to have a positive influence on the efficiency of MMDAs, whilst vertical imbalance—measured as a high share of central government grants in MMDAs’ total revenue—does not improve the efficiency of MMDAs in Ghana.

The rest of the paper is organized as follows: Section 2 provides a brief overview of fiscal decentralization in Ghana. Section 3 presents the methodology and description of the data. Discussion of the empirical findings is carried out in Section 4. Conclusions and policy implications of the paper are presented in Section 5.

2 Overview of fiscal decentralization in Ghana

The local government system in Ghana has the Regional Coordinating Councils (RCCs) at the apex of its structure, with the Metropolitan, Municipal, and District Assemblies following in that order. A district is given Metropolitan status if it has a population of more than 250,000, Municipal status if it has a population of between 95,000 and 250,000, and District status if it has a population of 75,000–95,000. The decentralization system in Ghana is based on the principle of subsidiarity, which implies that public goods and services are provided at the lowest possible level of government, i.e. the lowest level that can provide efficient and accountable delivery of those goods

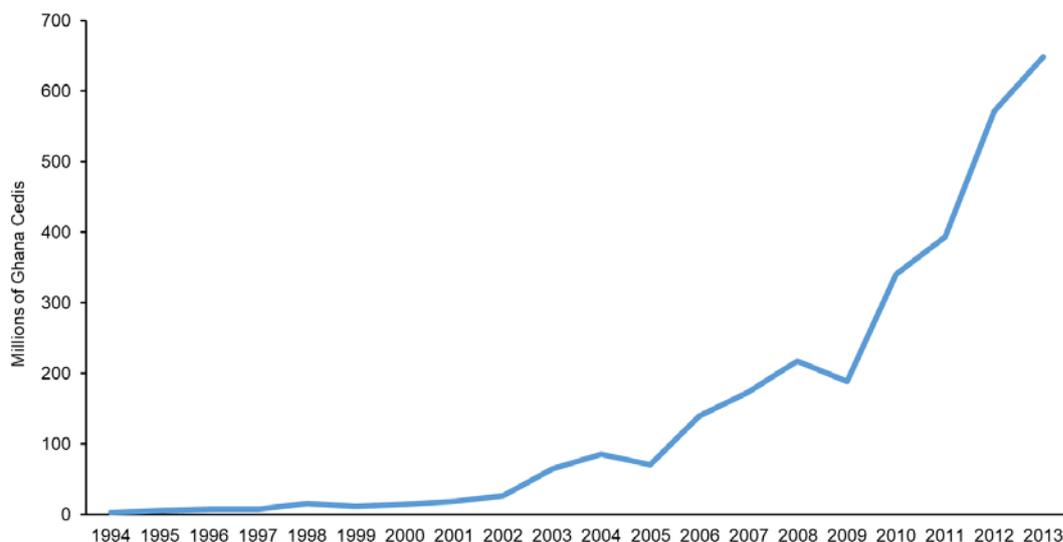
and services. In view of this, the 2009 intergovernmental fiscal decentralization framework specifies that the setting of national guidelines and standards in the form of policy directions is the sole responsibility of central government, whereas the RCCs are responsible for harmonizing, coordinating, monitoring, and evaluating government projects and programmes. The delivery of services to citizens is placed under the care of the MMDAs, since they are closest to the citizens.

There has in the past been some conflict over the provision of services between MMDAs and central government agencies operating at district level, such as Ghana Education Services (GES) and Ghana Health Services (GHS). However, the coming into force in 2011 of LI 1961 (Department of District Assemblies Instrument), which clearly specifies the services to be delivered by MMDAs and those to be provided by central government agencies at the district level, has removed much of the overlapping of assignments. For example, in education, MMDAs are responsible for schooling from pre-school to junior high school, while secondary and tertiary education is the sole responsibility of the central government through its agencies at local government level. In health, primary and environmental healthcare rests on the shoulders of MMDAs. For waste management (i.e. sanitation and waste collection), the MMDAs are the only government agency responsible, central government having none. In water provision, LI 1961 mandates the MMDAs to ensure the adequate supply of potable water for the whole district.

Another problem LI 1961 solved was the uncoordinated nature of budgeting and planning by the various government agencies operating at district level. Until 2011, the central administration of the District Assembly's budget conformed to the district's Annual Action Plan (AAP), which was derived from the district's Medium-Term Development Plan (MTDP), while the decentralized departments' budgets were aligned to the sector plans of their parent Ministries, Departments, and Agencies (MDAs). Since 2011, the MMDAs have been practising a composite budget system, whereby the budgets of all decentralized departments are brought into unison and under the control of the District Assembly.

As indicated earlier, one of the significant steps Ghana took towards the deepening of fiscal decentralization was the creation of the DACF through the Constitution to ensure that sufficient funds were readily available to MMDAs to aid their development. Between 1994 and 2013, a total of Ghs3 billion (US\$540 million) were allocated to and distributed between MMDAs from the DACF (Figure 1).

Figure 1: DACF yearly allocations to MMDAs, 1994–2013

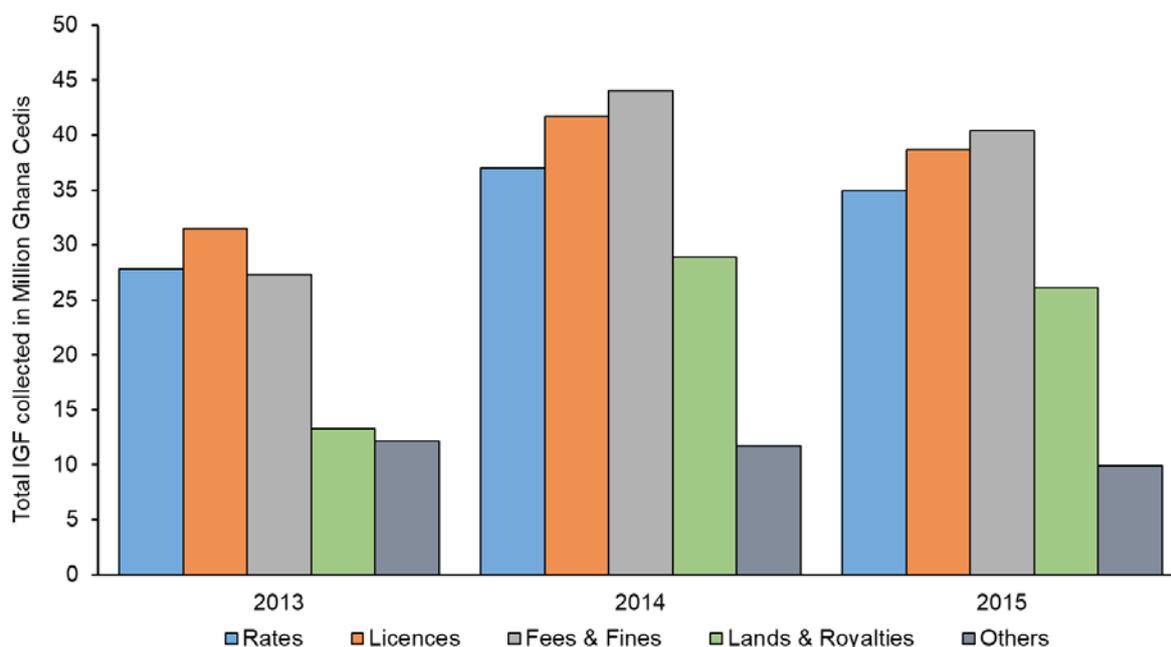


Source: authors' construction based on data from DACF yearly allocations.

Furthermore, a new funding source, the District Development Facility (DDF), was instituted in 2011 to provide additional financial support to MMDAs as a way of bringing balance between the functions allocated to MMDAs and the financial resources available to them.

Aside from transfers from central government, the Local Government Act (Act 936 of 2016) gives MMDAs the power to collect rates, fees, fines, licences, and other miscellaneous revenues. These powers are listed in schedules 8–12 of Act 936. MMDAs are rating authorities within their jurisdictions; they are the only government agency at district level that has the power to impose rates on movable and unmovable properties. However, IGF, as this revenue source is referred to, are mostly inconsistent and unreliable. The three most important sources of IGF are property rates, licences, and fees and fines (Figure 2).

Figure 2: Amount of IGF collected by source, 2013–15 (in millions of Ghanaian cedis)

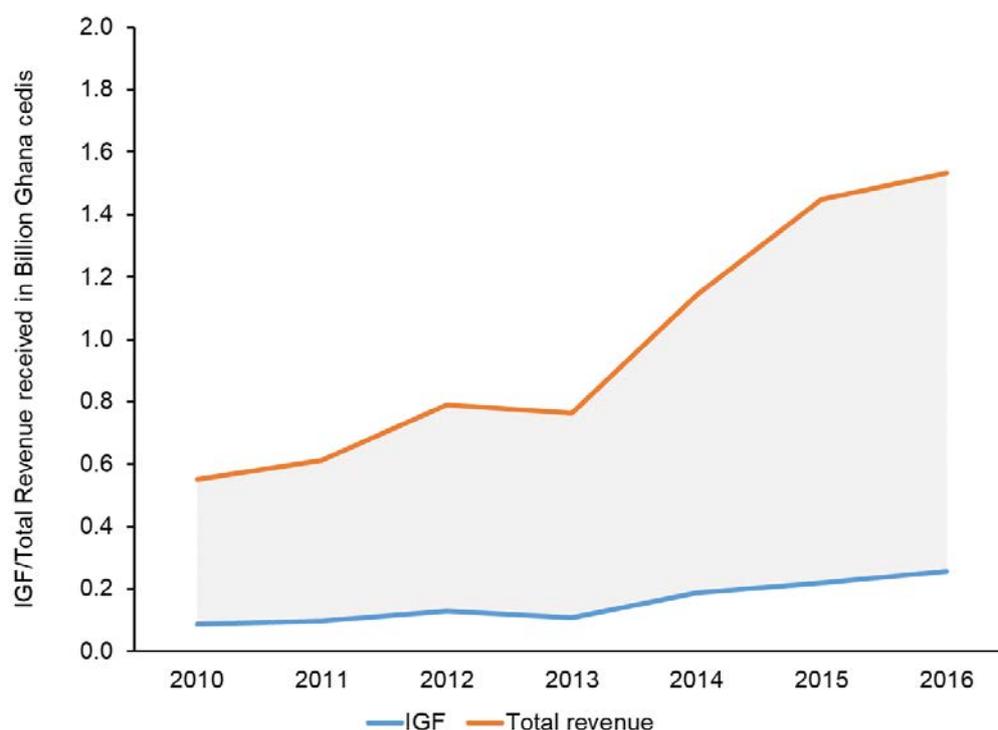


Source: authors' construction based on data from the composite budgets of MMDAs.

Nevertheless, MMDAs in Ghana rely heavily on central government for their budgets. In 2014, the percentage of IGF in total revenue was averagely 21 per cent. This means that close to 80 per cent of MMDAs' expenditures are funded by the central government and/or donor partners. Although, the growth rate of MMDAs' total revenue² has been increasing, the growth rate of total IGF for MMDAs has remained relatively flat over the years (see Figure 3). Consequently, the gap between total revenue and IGF of MMDAs has been widening, resulting in a fall in the ratio of IGF to total revenue over the years.

² Total revenue includes central government transfers, IGF, and donor funds/aid.

Figure 3: Total revenue, grants, and IGF receipts, 2010–16



Source: authors' construction based on data from the Auditor General's report on MMDAs.

3 Methodology and data

This study utilizes both nonparametric (data envelopment analysis, DEA) and parametric (stochastic frontier analysis, SFA) methods to measure and explain the relative efficiency of local service delivery by MMDAs in Ghana for the year 2013. We apply a second-stage Tobit regression to efficiency scores obtained by DEA while with SFA we use the single-stage approach of Battese and Coelli (1995) to explain the impact of fiscal decentralization on the efficiency of local service delivery by MMDAs in Ghana.

3.1 DEA model

DEA is a nonparametric approach to the measurement of efficiency where efficiency scores of decision-making units (DMUs) are evaluated by estimating production frontiers and comparing efficiency scores with the estimated frontiers through the use of linear programming techniques for observed data (see Charnes et al. 1978; Farrell 1957). The model developed by Charnes et al. (1978) is referred to as the CCR model and is an input-oriented³ measure of efficiency that assumes constant returns to scale, the convexity of the set of feasible input and output combinations, and strong disposability of inputs and outputs. DEA defines a frontier envelopment surface for all sample observations, with those DMUs lying on the frontier considered efficient, and those lying outside the frontier classified as inefficient. Inefficiency scores are then calculated for each DMU by comparing each DMU with a single referent DMU. DEA also measures the degree of

³ The idea behind input orientation is to investigate by how much input can be reduced without changing or altering the quantities of output produced.

inefficiency of the inefficient DMUs compared with the best-practice units. The best-practice units are assigned an efficiency score of 1, the less efficient DMUs a score between 0 and 1.

Using expenditures on assets, compensation of employees, and goods and services, plus total land coverage area to represent our capital, labour, material, and land inputs, respectively, and MMDA Composite Output Indicator (COI) as the output, our DEA model can be given as:

$$\begin{aligned}
 & \text{Min}_{\lambda, \rho} \rho \\
 \text{Subject to: } & -y_i + Y^1 \lambda \geq 0 \\
 & x_i \rho - X^1 \lambda \geq 0 \\
 & \lambda \geq 0
 \end{aligned} \tag{1}$$

where y_i is a 1×1 vector of output indicator for the i th MMDA; x_i is a 4×1 vector of input indicators for the i th MMDA; Y is a 216×1 vector of output indicators for all 216 MMDAs; X is a 216×4 matrix of inputs for all 216 MMDAs; λ is a 216×1 vector of weights; and ρ is the measure of efficiency for the i th MMDA, which should be less than or equal to 1.

This means that $(1 - \rho)$ represents the proportion of inputs that should be reduced for the i th MMDA.

We will estimate the variable returns to scale version of DEA (VRS-DEA) proposed by Banker et al. (1984) by relaxing the assumption of constant returns to scale. We execute this by imposing a convexity assumption (i.e. $\prod^1 \lambda = 1$) on equation (2) because MMDAs in Ghana do not operate under full scale. Thus our VRS-DEA model will be given as

$$\begin{aligned}
 & \text{Min}_{\lambda, \rho} \rho \\
 \text{Subject to: } & -q_i + Q^1 \lambda \geq 0 \tag{2} \\
 & x_i \rho - X^1 \lambda \geq 0 \\
 & \prod^1 \lambda = 1, \lambda \geq 0
 \end{aligned}$$

We then solve the above linear programming in equation (8) using the Benchmarking package (Bogetoft and Otto 2015) in R to obtain an optimal set $(\lambda^*; \rho^*)$ for each of the 216 MMDAs, where λ^* is the optimal vector of activity and ρ^* is a vector of technical efficiency measured such that it satisfies $0 < \rho^* \leq 1$. The constraint $\prod^1 \lambda = 1$ ensures that MMDAs of identical sizes are evaluated against inefficient MMDAs; it is also an indication that we are estimating a VRS-DEA.

The Tobit regression model

To investigate the relationship between fiscal decentralization and the efficient delivery of local services, we regress our efficiency estimates from the VRS-DEA estimation on a vector of covariates including fiscal decentralization in a second-stage regression model. We opt for the Tobit regression model for our second-stage regression because of the structure of our dependent variable. That is, our dependent variable takes only values ranging from 0 to 1 (i.e. $0 < \rho^* \leq 1$). Our Tobit regression model is given as

$$\rho_i^* = \beta FD_i + \alpha Z_i + \varepsilon_i \quad (3)$$

where ρ_i^* is technical efficiency estimated for the i th MMDA and FD_i is the measure of fiscal decentralization for the i th MMDA, which is our variable of interest. Z_i is a matrix of control variables that may influence the technical efficiency of MMDAs in Ghana. These include effective district administration (*foat*), ‘perceived’ competency of MMDAs (*com*), per capita grant (*grant*), incidence of poverty (*poim*), average years of education (*edys*), and total district population (*pop*). ε_i is a normally distributed vector of error terms with mean zero and a constant variance, such that $\varepsilon_i \approx N(0, \sigma_\varepsilon^2)$. β and α are a vector of coefficients to be estimated.

Choosing an appropriate fiscal decentralization measure in any empirical research requires a lot of work (Bird 2000). Also, according to Ebel and Yilmaz (2002), the choice of fiscal decentralization variable is relevant as it can influence the validity of the empirical results of the research. They therefore recommend that the institutional settings of the country under study must be considered. Any measure of fiscal decentralization must consequently take into account the depth of revenue autonomy of local governments. In view of the above, we measure fiscal decentralization using two proxies: fiscal autonomy and vertical imbalance. Fiscal autonomy is the share of IGF in MMDAs’ total revenue, while vertical imbalance is a high share of central government transfers in MMDAs’ total revenue.

A number of studies largely following from discussions on the second-generation theory of fiscal federalism (DeBorger and Kerstens 1996; Pöschl and Weingast 2013; Timmons 2005; Van den Eeckaut et al. 1993) have shown that increasing the fiscal autonomy of local authorities has a positive impact on the efficient delivery of public services. For instance, local governments that depend on taxes and fees are motivated to show that they are accountable to the people in order to ensure compliance with tax payments and fees. High fiscal autonomy may result in better control over budgets and expenditures and accountability from public officials, thereby improving the efficient use of resources. However, a local government with a higher share of government grants in total revenue or expenditures (high vertical imbalance) will have less incentive to use these ‘unearned’ resources prudently (Brollo et al. 2011; Gadenne 2013; Gervasoni 2010). Given that government grants are an external source of revenue for local governments, citizens in that jurisdiction would have very little motivation to check how money was spent. This implies that local government will be inefficient in the allocation of resources and that accountability to residents will be minimal. Therefore, we expect fiscal autonomy to have a positive association with the efficiency of local service delivery, whereas vertical imbalance is expected to have a negative relationship with the efficiency of local service provision. Since the two variables measure fiscal decentralization in opposite directions,⁴ to check for the robustness of our empirical results we run a baseline model with each measure of fiscal decentralization entering in a separate regression model.

Most MMDAs in Ghana derive the majority of their funding from intergovernmental transfers such as the DACF and the DDF. These transfers are mostly associated with the famous ‘flypaper’ effect, which states that local governments are likely to spend a higher ratio of government grants than income generated via taxes and fees (Mueller 2003). This is because the consequences of any inefficient spending by local governments are endured by a larger population and thus local officials do not feel accountable to their populace (DeBorger and Kerstens 1996; Geys and Moesen

⁴ Indeed, the correlation between the two variables was significantly strong and negative, i.e. $r = -1$.

2008; Kalb 2010). We therefore assume that grants are a drag on efficiency and thus expect grants to be negatively associated with efficiency of local service delivery by MMDAs in Ghana.

Good administrative practices include accountability, efficiency, and the delivery of basic community goods and services. The effectiveness of administrative work can thus bring about the right matching of costs and preferences. We therefore expect a positive relationship between the efficiency of local service delivery by MMDAs and effective district administration. Residents' perception of the activities of MMDAs is crucial to the efficient delivery of local services. This is because erroneous perceptions about local government activities are likely to crowd out local participation by residents (Zulkifli et al. 2016). Therefore, we include the perceived competence of MMDAs in our Tobit model and expect a positive relationship with efficiency.

A local government that has a higher proportion of its population living below the poverty line may have very little assessment of the implementation of MMDA projects by the people, who will therefore be unable to demand accountability from public officials. Furthermore, poor households will find it difficult to honour their tax obligations, which will result in low fiscal capacity for the MMDAs. With low accountability from residents and little fiscal capacity, MMDAs' delivery of local public goods and services will be inefficient (Afonso and Fernandes 2008). We therefore hypothesize that a high incidence of poverty will have a negative effect on local government efficiency.

Highly educated residents are much more likely to participate in local politics, form pressure groups, and use the media to demand value for money for projects from local officials (Mueller 1989). In contrast, uneducated or less educated residents have a low likelihood of forming interest groups to put pressure on local officials to use funds in an effective and efficient manner. Including average years of schooling to represent education, we therefore predict a positive relationship with efficiency (DeBorger and Kerstens 1996; Van den Eeckaut et al. 1993).

Finally, we assume that a large population is likely to require more goods and services and thus that local governments will enjoy economies of scale. This will induce the efficient delivery of public goods and services to residents (Loikkanen and Susilouto 2005). We therefore determine a priori that population size will have a positive impact on efficiency.

3.2 The SFA model

SFA is a parametric approach to efficiency measurement where efficiency scores of DMUs are calculated by estimating a production function using the econometric approach. This is done by imposing a functional form to describe the production process (Aigner and Chu 1968; Aigner et al. 1977; Meeusen and van den Broeck 1977). In estimating our SFA, we define production to mean minimizing inputs to produce a given level of output. Again, using the same set of inputs and outputs, our SFA model will be given as

$$Y_i = F(X_i)TE_i e^{\theta_i} \quad (4)$$

where Y_i is our MMDA composite output indicator; X_i 's are inputs, which include capital (*cap*), labour (*lab*), material (*mat*), and land (*lan*). Applying natural logs to both sides of equation (4) gives

$$y_i = f(x_i) + \ln TE_i + \ln e^{\theta_i} \quad (5)$$

where $y_i = \ln(Y)$, $f(x_i) = \ln(F(X))$, $TE_i = e^{-\mu}$ = technical efficiency. Consequently, equation (5) will now be given as

$$y_i = f(x_i) + \vartheta_i - \mu_i \quad (6)$$

The next step is to find a suitable functional form of the production function for estimating equation (6). We opt for the CD specification, since it best describes our data set. Our test for the appropriate functional form failed to reject the CD at the 5 per cent level, as shown in Table 1.

Table 1: LR test for the stochastic production function and efficiency model

Null	Chisq.	Pr(>chi)	Decision
A CD function is appropriate	15.97	0.1005	Failed to reject H_0
No inefficiency effects	34.96	0.0000	Reject H_0

Source: authors' construction.

Therefore, our stochastic production function will be given as

$$y_i = \beta_0 + \sum_{m=1}^4 \beta_m x_{mi} + D_{di} + \vartheta_i - \mu_i \quad (7)$$

where x_{mi} is the natural log of the m th input variable for the i th MMDA, y_i is the natural log of COI for the i th MMDA and β 's are parameters to be determined. To account for heterogeneity in our specification, we introduce MMDA-specific dummies D_{di} for metropolitan and municipal assemblies. ϑ_i is an identically and independently distributed random variable with mean zero and a constant variance, i.e. $\vartheta_i \approx N(0, \sigma_\vartheta^2)$, whose distribution is not dependent on the distribution of μ_i . μ_i is a one-sided normal distribution truncated at zero that satisfies $\mu_i \geq 0$ and measures technical efficiency.

The inefficiency component of the error term (μ_i) is thus specified as

$$\mu_i = \gamma FD_i + \delta Z_i + \Omega_i \quad (8)$$

where FD_i is our fiscal decentralization variables and Z_i is a matrix of control variables that are expected to impact the efficiency of MMDAs in Ghana. We include the same control variables as in the Tobit model. Equation (8) is estimated simultaneously by using maximum likelihood techniques (Battese and Coelli 1995).

3.3 Description and source of data

Inputs

MMDAs in Ghana run a composite budgeting system where the budgets of all departments within the district's jurisdiction are brought together as one budget for the whole district. MMDAs' budgets are normally classified under three expenditure categories: compensation of employees, assets, and goods and services. Compensation of employees covers all expenditures on labour inputs, assets is made up of all expenditures on capital investment undertaken by the district, and goods and services includes all spending on office materials and petty expenses incurred in the day-to-day running of the assembly. Consequently, we draw three of our inputs (labour, capital, and material inputs) from the composite budgets of the various MMDAs, since the expenditures on these items represent the value of these inputs. Our inputs therefore include MMDAs' per capita actual expenditure on compensation of employees to represent labour inputs; MMDAs' per capita actual expenditure on assets to represent capital inputs; and MMDAs' per capita actual expenditure on goods and services to represent material inputs. We rely on actual spending figures on the compensation of employees, assets, and goods and services. Lastly, we use the total land

coverage area of an MMDA to denote land inputs (see summary statistics of input variables in Table A1 in the Appendix).

Outputs (MMDA composite output indicator, COI)

Following from the literature and country context, the measurement of local governments' performance is based on the provision of four key services: education, health, water, and waste management. Accordingly, we measure MMDAs' output in education as the net enrolment rate in basic education. Output in health is evaluated by the percentage of births that are delivered by skilled personnel in an MMDA. MMDAs' output in water provision is measured as the number of residents who have access to clean and reliable water sources for drinking. Lastly, we measure MMDAs' output in waste management as the percentage of solid waste collected.

Following from the studies by Afonso and Fernandes (2008) and Yusufany (2015), we construct a composite index of MMDAs' performance using their outputs in education, health, water, and waste management to represent our output. Our COI is a simple average of all the output indicators. First, all the output indicators are set to a common scale of 0 to 100 per cent. Then, for each MMDA, we add all the output indicators and divide by the total number of output indicators to obtain a single output indicator. The COI is given by

$$COI_i(Q_i) = \frac{\sum_{j=1}^n y_{ji}}{N} \quad (9)$$

where Q_i is the district composite output indicator for the i th district, y_{ji} is the j th output indicator for the i th district, and N the total number of output indicators. The average composite score for MMDAs in the delivery of local services in education, health, water provision, and waste management was 50.69. The results expressed as regional rankings are similar to the findings of the 2014 District League Table (DLT) produced jointly by UNICEF-Ghana and Centre Democratic Development (CDD) Ghana.⁵

All our data for the computation of outputs came from official government sources, including the Ministry of Finance and Economic Planning (MoFEP), Ghana Health Services (GHS), Ministry of Education (MoE), and Ghana Statistical Services (GSS). All the inputs with the exception of total land coverage were sourced from composite budgets of the various MMDAs, published on MoFEP's website. The total land coverage area of a district was extracted from the district analytical reports published by GSS.

Inefficiency variables

Data on variables used in computing our fiscal decentralization variables, fiscal autonomy and vertical imbalance, were sourced from the composite budgets of all 216 MMDAs. They include total IGF and revenue⁶ for the computation of fiscal autonomy; and statutory grants (i.e. DACF and DDF) and total expenditure for the calculation of vertical imbalance. Fiscal autonomy was measured as the share of IGF in total revenue. For the average MMDA in Ghana, only 12 per cent of its total revenue is generated internally. The second fiscal decentralization variable, vertical

⁵ The DLT measures the average level of development in all 216 districts in Ghana. It does not measure the performance of DAs but rather consolidates social accountability between the government and its citizens for development. The DLT is a simple ranking tool which measures the average state of development of each district in education, health, sanitation, water, security, and governance.

⁶ Total revenues comprise IGF, central government transfers, and donor funds.

imbalance, was measured as the share of central government grants in total expenditure. About 88 per cent of MMDAs' expenditure was in the form of grants from central government.

Grants are measured per capita and are calculated as the total of statutory grants divided by the total district population. The data were sourced from the district composite budgets. We use the performance measures from the 2013 Functional Organizational Assessment Tool (FOAT)⁷ to measure effective district administration. The data were extracted from the Local Government Services' Annual Report (Ghana Local Government Service 2019). The perceived competence of MMDAs is measured as a percentage of residents who view their MMDA as competent in delivering basic services. We sourced these data from the 2013 Ghana Living Standard Survey (GLSS) conducted by GSS (Ghana Statistical Service 2014). We measure level of education as the total number of years of schooling. These data were also sourced from the 2013 GLSS. Incidence of poverty is defined as the percentage of residents who live below the poverty line. The data on the incidence of poverty were obtained from the 2015 Ghana Poverty Mapping report (Ghana Statistical Service 2015). Finally, the total population of a district is defined as the total number of residents in an MMDA according to the GSS. The data on total population were sourced from the GSS. Summary statistics of all the variables are presented in Table A1 in the Appendix.

4 Discussion of empirical findings

In this section, we first discuss the efficiency estimates for both measures of MMDA efficiency, that is the non-parametric DEA and the parametric SFA. After this, we discuss the estimation results of the effect of fiscal decentralization on the productive efficiency of MMDAs in Ghana.

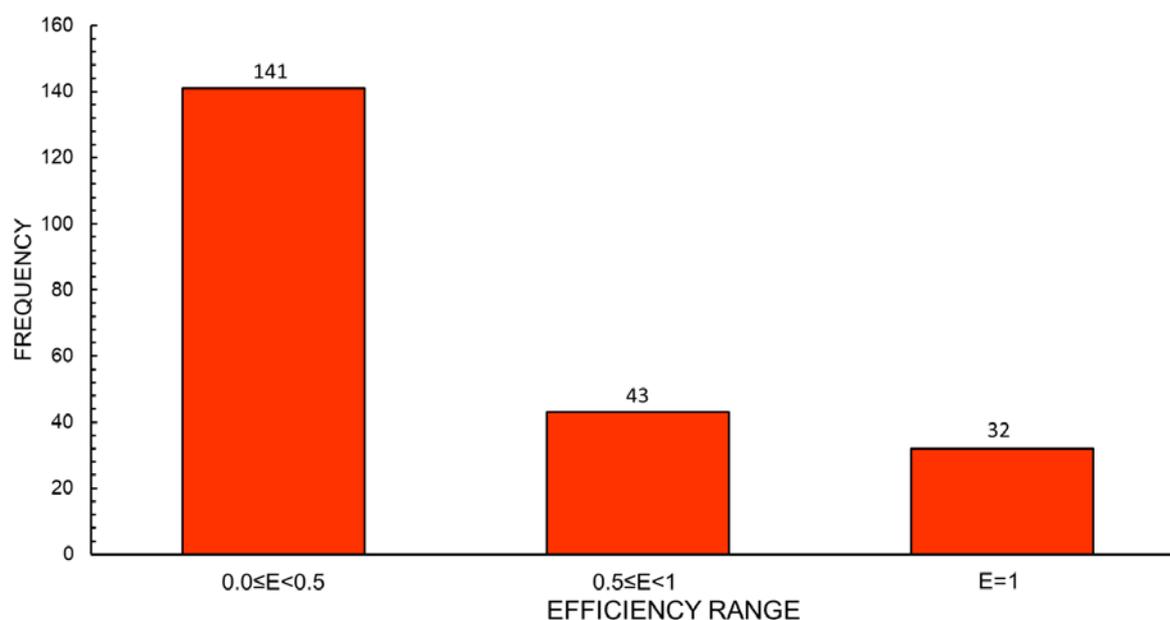
4.1 DEA efficiency estimates

Using our inputs and output, we estimated an input-oriented VRS-DEA model. Each variable is mean normalized to ensure that the data set is of an equal magnitude and unit of measurement. This is done to avoid any scaling issues that may be associated with the data set.

Figure 4 presents the frequency distribution of DEA efficiency scores for all 216 MMDAs in Ghana. A total of 32 MMDAs, which represents about 15 per cent of the sample, were found to be operating on the frontier, with an efficiency score of 1 (i.e. $E = 1$). That is, these MMDAs were found to be technically efficient and thus combined their inputs effectively. About 65 per cent of the MMDAs (141) obtained an efficiency score between 0 and 0.5. This indicates that the majority of MMDAs could theoretically reduce their inputs by between 50 per cent and 100 per cent without decreasing their current output levels. The other 43 MMDAs, corresponding to approximately 20 per cent, obtained an efficiency score ranging from 0.5 to 1. On average, therefore, MMDAs in Ghana could theoretically reduce their inputs by approximately 55 per cent and still be able to provide their current level of service to their constituents.

⁷ FOAT is a grant-based assessment programme that has been implemented by the government agency responsible for administrative decentralization to quantify the efficiency of the use of resources. FOAT assesses MMDAs and gives each MMDA a score based on its permissible duties (political, legal, fiscal, and administrative) and other obligations.

Figure 4: Frequency distribution of DEA efficiency scores



Source: authors' construction.

Municipal assemblies had higher efficiency scores than Metropolitan and District Assemblies in that order, as shown in Table 2. The difference in rankings can be attributed to the disparities between the fiscal capacities of MMDAs. Municipal Assemblies are mostly urban and peri-urban and therefore capable of mobilizing huge internal resources.

Table 2: Summary statistics of DEA efficiency scores by district type

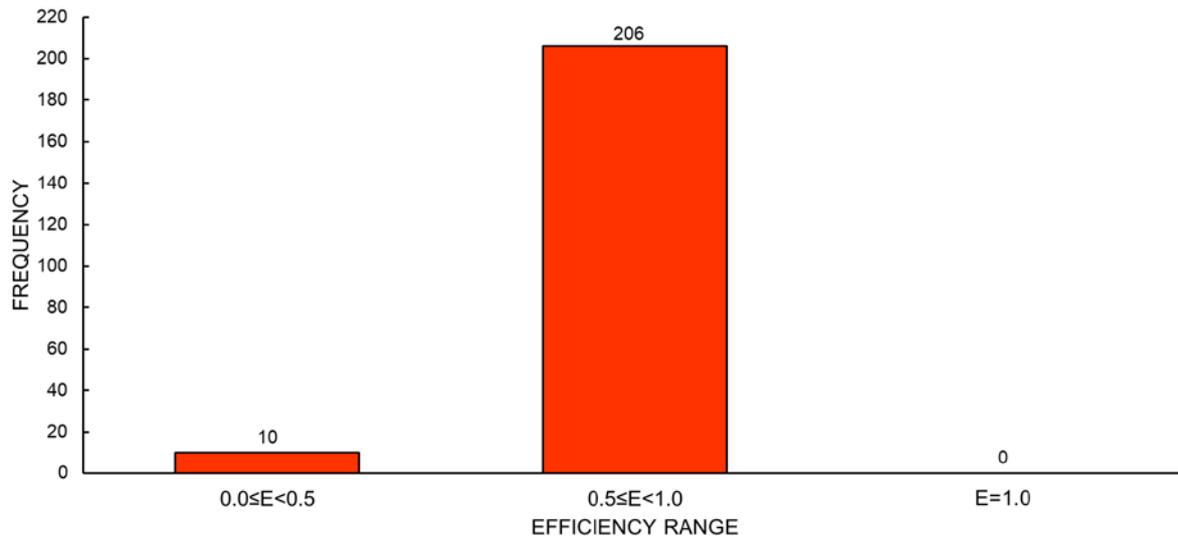
Assembly type	Mean	Std. Dev.	Min.	Max.
District assemblies	42.98	0.2996	5.25	100.00
Municipal assemblies	51.08	0.2842	9.07	100.00
Metropolitan assemblies	49.01	0.4033	12.90	100.00

Source: authors' construction.

4.2 SFA efficiency estimates

Using the same inputs and output, we estimated the SFA model. The frequency distribution of SFA efficiency scores is shown in Figure 5. In contrast to the DEA efficiency estimates, the majority of MMDAs had an efficiency score ranging between 0.5 and 1, a minority of the Assemblies having an efficiency of between 0 and 0.5, and none obtaining a perfect efficiency score of 1. This means that the majority of the MMDAs, according to the SFA method, could theoretically reduce their inputs by between approximately 0 and 50 per cent and still be able to produce their current level of goods and services. On average, MMDAs in Ghana could reduce their inputs by some 26 per cent and still provide the services they are presently producing (i.e. the overall average efficiency score was 74.4 per cent).

Figure 5: Frequency distribution of SFA efficiency scores



Source: authors' construction.

Metropolitan Assemblies had relatively higher efficiency scores than Municipal and District Assemblies in that order, as shown in Table 3.

Table 3: Summary statistics of SFA efficiency scores by region

Assembly type	Mean	Std. Dev.	Min.	Max.
District assemblies	72.61	0.14	39.73	97.94
Municipal assemblies	78.86	0.12	55.07	97.53
Metropolitan assemblies	79.10	0.14	61.39	93.90

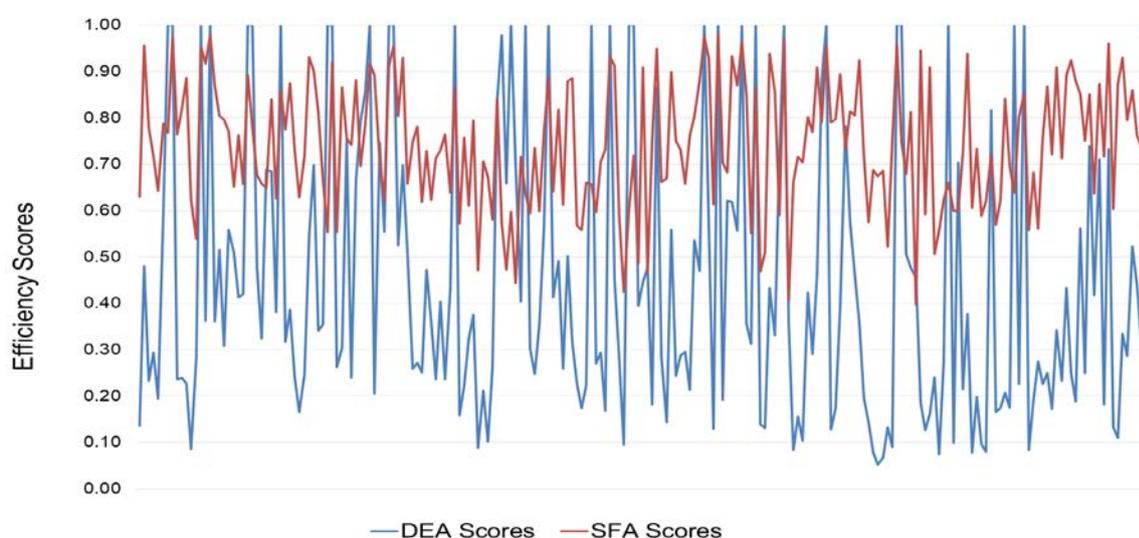
Source: authors' construction.

Comparing the two approaches, it can be seen that the efficiency scores obtained by the SFA method were higher than those obtained by DEA, with a fairly weak rank correlation between the two approaches.⁸ Also, as shown in Figure 6, the SFA efficiency scores showed less variability than the DEA efficiency scores.⁹ Lawanson and Novignon (2017) corroborate our findings when they measure the efficiency of health systems in SSA.

⁸ The rank correlation between the two approaches is close to 40 per cent ($r = 0.42$).

⁹ This can also be confirmed by their standard deviations. The SFA had a standard deviation of 0.14, while that of the DEA was 0.30.

Figure 6: Variability between DEA and SFA efficiency scores



Source: authors' construction.

4.3 Fiscal decentralization and efficiency of MMDAs in Ghana

The second objective of this paper was to investigate the effect fiscal decentralization has on the efficiency of MMDAs in Ghana. The Tobit regression and SFA estimates are presented in Tables 4 and 5, respectively.

Table 4: Results of Tobit regression model

Variables	Model 1 estimates	Model 2 estimates	Model 3 estimates	Model 4 estimates
Constant	0.2635*** (0.0531)	0.9227 (1.9914)	3.7678*** (0.6697)	3.8671* (2.1216)
logfd_1	0.1028*** (0.0236)	0.0629** (0.0276)		
logfd_2			-0.7370*** (0.1496)	-0.5919*** (0.1697)
Logfoat		0.4713 (0.4096)		0.4141 (0.4062)
Loggrant		-0.1270** (0.0523)		-0.1288** (0.0507)
logCom		0.0463 (0.4358)		0.0672 (0.0590)
Logedyrs		0.1100 (0.1896)		0.0446 (0.1878)
Logpoin		-0.0959*** (0.0337)		-0.0844** (0.0331)
Logpop		-0.2033*** (0.0595)		-0.2091*** (0.0590)
Variance parameters				
logSigma	-1.1091*** (0.0547)	-1.1618*** (0.0546)	-1.1215*** (0.0546)	-1.1769*** (0.0545)
log-likelihood	-96.4361	-85.6884	-93.1795	-82.0253
Obs.	216	216	216	216

Note: *, ** and *** denote significance at 10%, 5%, and 1%, respectively. Standard errors are in parentheses.

Source: authors' construction.

From the Tobit model (Table 4), both measures of fiscal decentralization, fiscal autonomy (fd_1) and vertical imbalance (fd_2), have their expected signs and are statistically significant at 5 per cent. The SFA model also has the expected signs for fiscal decentralization but only vertical imbalance is significant at 5 per cent. The results suggest that a higher shares of IGF in total MMDA revenue promotes the efficiency of MMDAs in Ghana. However, a higher share of central government transfers in total local government expenditure results in a decline in efficiency in the delivery of public goods and services by MMDAs. This may be due to the inconsistent and untimely releases of central government grants (i.e. DACF, DDF), which delay local government projects, culminating in wastefulness of resources.

Table 5: Estimation results of SFA model

Independent variable	Model 1 estimates	Model 2 estimates	Model 3 estimates	Model 4 estimates
Production frontier				
Constant	3.8885*** (0.2292)	3.8277*** (0.2667)	4.1544*** (0.3556)	3.8885*** (0.2265)
Logcap	-0.0041 (0.0109)	0.0076 (0.0104)	-0.007 (0.0127)	0.0093 (0.0097)
Loglab	0.0319*** (0.0122)	0.0305*** (0.0115)	0.0311*** (0.0104)	0.0328*** (0.0111)
Logmat	0.0236** (0.0101)	0.0098 (0.0129)	0.0149 (0.0134)	0.0005 (0.0117)
Logland	-0.0712*** (0.0145)	-0.0439*** (0.0133)	-0.0718*** (0.0118)	-0.0393*** (0.0133)
mun_d	0.1056*** (0.0300)	0.0851 (0.0307)	0.0998*** (0.0305)	0.0678** (0.0309)
met_d	0.0617 (0.0773)	0.0745 (0.0777)	0.0608 (0.0707)	0.0513 (0.0728)
Inefficiency model				
logfd_1	-0.0156 (0.0437)	-0.0146 (0.0295)		
logfd_2			0.0620*** (0.0213)	0.4693** (0.1830)
Logfoat		-0.2240 (0.1873)		-0.5774** (0.2294)
Loggrant		0.0693 (0.0502)		0.0379 (0.0504)
LogCom			-0.1410** (0.0590)	-0.1529*** (0.0532)
Logpoin			0.1014** (0.0419)	0.0773** (0.0378)
Logedyrs		-0.1716 (0.1864)		-0.1480 (0.1881)
Logpop			0.1505*** (0.0522)	0.1197** (0.0509)
Variance parameters				
SigmaSq	0.0997*** (0.0236)	0.0527*** (0.0104)	0.0542*** (0.0120)	0.0489*** (0.0089)
Gamma	0.9175*** (0.0551)	0.9518*** (0.0445)	0.9719*** (0.0617)	0.9675*** (0.0325)
Loglikelihood	53.1632	66.2958	55.4677	70.2998

Note: *, ** and *** denote significance at 10%, 5%, and 1%, respectively. Standard errors are in parentheses.

Source: authors' construction.

These findings corroborate the empirical results of Boetti et al. (2012) for Europe and Monkam (2014) for SSA.

Furthermore, per capita grant had a negative and statistically significant effect on the efficiency of MMDAs in Ghana in our Tobit model, but was insignificant in the SFA model, although it also had a negative effect on efficiency. This suggests that local officials may not feel accountable to their residents when their expenditures are financed through central government grants. These results reiterate the negative effects of over-reliance on central government funds on the efficiency of local governments in many empirical studies (e.g. DeBorger and Kerstens 1996; Yusufyan 2015).

Population size had a negative relationship with efficiency and was significant at 1 per cent in both the Tobit and SFA models. This means that the larger the population, the more inefficiencies the MMDA exhibits, whereas a small population promotes the efficient delivery of public goods and services by MMDAs in Ghana. This result is in line with the findings of Loikkanen and Susilouto (2005) but is in sharp contrast with the findings of Afonso and Fernandes (2008).

Meanwhile, poverty incidence had a negative and significant relationship with the efficiency of MMDAs. An MMDA that has a larger share of its residents living below the poverty line is likely to allocate resources inefficiently. FOAT had its expected sign but was not significant in the Tobit model; it was significant at 5 per cent in only the fourth of the SFA models. This means that high marks in the 2013 FOAT assessment may have a positive effect on the efficiency of MMDAs. MMDAs with higher scores in the assessment operate within enabling standards and laws and are more likely to be open to public accountability and criticism. This may result in the right matching of costs and residents' preferences by local officials, leading to efficiency in local public service provision.

Lastly, the perceived competence of MMDAs was also insignificant in the Tobit model, although it had the expected sign. In the SFA model, it had a positive and significant effect on the efficiency of local public services delivery by MMDAs in Ghana. If residents recognize their assemblies as proficient in delivery on their mandate, then collection of taxes becomes easy as residents are likely to oblige without evading. This will in turn increase MMDAs' share of IGF in total revenue (high fiscal autonomy), which will result in efficient delivery of local public goods and services.

Average years of schooling had a positive but insignificant impact on MMDAs efficiency in all our Tobit and SFA models and therefore we cannot infer much about its impact on the efficiency of local service delivery by MMDAs in Ghana.

5 Conclusions and policy implications

In this paper, we estimate the efficiency of MMDAs in Ghana and also investigate the impact of fiscal decentralization on the delivery of local public goods and services by MMDAs. Following from the literature and country context, we use compensation on assets, employees, goods and services, and land area as input variables and an MMDA composite output indicator based on provision of key services such as education, health, water, and waste management as output. We then employ both nonparametric DEA and parametric SFA to carry out our analysis. The findings show that Municipal and Metropolitan Assemblies seem to be more efficient than District Assemblies. The results with regard to our two indicators of fiscal decentralization indicate that fiscal autonomy (proxied by MMDAs' internally generated funds (IGF) as a share of their total revenue) has a positive influence on the efficiency of MMDAs, whilst vertical imbalance (a high share of central government grants in MMDAs' total expenditure) does not improve the delivery

of local goods and services by MMDAs in Ghana. These findings are consistent with the theories of fiscal federalism, which largely views own resources from taxes and fees as superior to government grants as a source of revenue for local governments in terms of efficiency in the delivery of local goods and services. Effective district administration and perceived competence of local governments were found to drive efficiency, while high per capita grant, high incidence of poverty, and large population size were each found to have a negative influence on the efficiency of MMDAs.

These findings offer an insight into the operations of local governments in Ghana and, to a great extent, SSA countries in general. There is a need for central governments to encourage and support local governments to increase their internal revenue mobilization effort so as to raise the share of IGF in total revenue. As can be seen in the case of Ghana, the share of IGF has been stagnant over the years, whilst government transfers have been increasing. This is clearly not a good sign as it leads to a decline in the effective delivery of public goods and services by MMDAs. However, smaller local governments, particularly District Assemblies that cannot raise enough IGF, would need to be supported with government grants. In addition, MMDAs must work to earn the trust of residents within their jurisdiction by being accountable for the utilization of both IGF and central government grants. MMDAs can achieve this by making conscious efforts to engage residents in their planning activities.

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Appendix

Table A1: Summary statistics of variables

Variable	Obs.	Mean	Std. dev.	Min.	Max.
Output indicators					
Net enrolment rate (<i>ner</i>)	216	63.63	16.99	19.90	100.00
Delivery by skilled staff (<i>deskill</i>)	216	52.31	25.06	10.10	100.00
Waste collection (<i>waste</i>)	216	7.09	11.57	0.40	77.10
Improved water sources (<i>water</i>)	216	79.74	15.55	34.00	99.70
Input variables					
Labour (<i>lab</i>)	216	10.74	16.32	0.11	144.92
Material (<i>mat</i>)	216	11.14	12.61	0.01	82.55
Capital (<i>cap</i>)	216	17.80	28.99	0.03	306.93
Land (<i>land</i>)	216	1169.21	1252.02	12.30	8340.10
Inefficiency variables					
Fiscal autonomy (<i>fd_1</i>)	216	11.86	11.79	0.12	69.61
Vertical imbalance (<i>fd_2</i>)	216	88.14	11.79	30.27	99.88
FOAT	216	92.13	4.68	70.00	99.00
Per capita grant (<i>grant</i>)	216	13.34	11.39	1.54	134.48
Average years of education (<i>edysrs</i>)	216	8.90	1.17	4.67	12.01
Perceived competence (<i>com</i>)	216	60.21	17.49	8.65	100.00
Poverty incidence (<i>poin</i>)	216	30.94	20.75	1.30	92.4
Population (<i>pop</i>)	216	135,702.75	186,042.98	22,286.00	1,869,476.00

Source: authors' construction.

Table A2: Correlation matrix of DEA and SFA efficiency scores

	DEA	SFA Model 4
Pearson's Product Moment		
DEA	1	0.3894
SFA model 4	0.3894	1
Spearman rank		
DEA	1	0.4221
SFA model 4	0.4221	1

Source: authors' construction.