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# The impacts of external funding for district governments on tax collection and public goods provision in Ghana

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## Abstract

This paper analyzes district governments' revenue and expenditure data from 1994 to 2011, and investigates how the transfers from the central government to district governments affect district governments' internal revenue generation, how the impacts differ between poor and rich districts, who bear the burden of internal revenue generation, and how the difference in revenue in turn affects the provision of public goods in Ghana.

The results of our analysis suggest there is a large gap between poor and rich districts in their ability to raise internal revenue, and the gap has widened over the years. Poor districts rely on fees collected from market traders and the reliance on market fees increased, while rich districts have increased internal revenue from other sources such as royalties and business licenses. This suggests rich districts were able to develop tax bases in the private sector, while poor districts did not. As a result, poor market traders keep suffering from the burden of internal revenue generation in poor districts. We find that external revenue crowds out internal revenue only in rich districts, while it enhances internal revenue generation in poor districts. Rich district governments increase expenditures on personal, transportation, and general expenditures when total revenues increase. In contrast, increases in revenues do not lead to increases in expenditures in poor districts since they face severe financial constraints, and thus, increases in revenues do not result in the increase of expenditures. In both poor and rich districts, increased revenue weakly improves public goods provision.

## 1. Introduction

Many developing countries have decentralized political, administrative, and fiscal responsibilities from central to local governments. Ghana is not an exception. Since 1988, the government of Ghana has been implementing the decentralization of reforms (Dafflon and Madies 2012). Decentralization is expected to reduce poverty and increase welfare by improving service delivery, targeting public services to the poor better, and achieving more efficient redistribution, as local governments are expected to have better information on local conditions and local needs. Decentralization is also supposed to lead to improved accountability, checks and balances, higher responsiveness of the public sector, and greater participation of people in the public decision-making since it brings decision-making closer to people.

Does decentralization improve public services? The empirical evidence provides mixed results. Some studies find positive impacts of decentralization. Aslam and Yilmaz (2011) analyze the impact of decentralization reforms on the provision of services such as street paving, construction of water canals, sanitation sewer lines, and school facilities in Pakistan. They show the delivery of these services has improved after the decentralization reform. Faguet and Sánchez (2014) illustrate how decentralization had improved enrollment rates in public schools and access to public health services among the poor in Colombia. Faguet (2004) finds decentralization has increased public investments on education, water and sanitation, water management, agriculture, and urban development in Bolivia. In contrast, Steiner (2007) reviews empirical evidences in Uganda and concludes decentralization has not led to efficient service provisions in that country.

Why doesn't decentralization always improve public services in developing countries? Prior studies often report negative results. William (2016) shows that in Ghana district governments invest in development projects but many of them are never completed. As a result, up to 29 percent of local governments' capital expenditure is wasted. Yilmaz and Guner (2013) report the decentralization reform has also failed to improve accountability of local governments in Turkey. Bardhan (2002) points out that local governments often lack accountability, human capital, and administrative capacity and are susceptible to corruption and patronage. In the Philippines, the culture of patronage has facilitated elite capture in employment, procurement, and resource allocations (Yilmaz and Venugopal 2013).<sup>1</sup> Jütting et al. (2005) review studies from various countries and conclude that the administrative and institutional capacity of local governments is particularly limited in African countries, making it difficult for decentralization to yield intended outcomes in Africa.

Weak institutions are not the only reason why decentralization does not work in developing countries. Local governments need sufficient funding to provide public services. However,

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<sup>1</sup> Decentralization does not always lead to corruption. Fisman and Gatti (2002) conduct cross country analysis and show decentralization in government expenditure is strongly and significantly associated with lower corruption.

internal revenue is not enough to cover the cost of service delivery, especially if local governments have a weak tax base. Thus, local governments rely heavily on the transfers from the central government. The distribution of funds among local governments is a complex task. Brollo et al. (2013) examine the impact of additional government revenues on political corruption in Brazil. They find that larger transfers from the central government to municipal governments increase corruption cases. Mahieu and Yilmaz (2010) discuss how transfers from the central government to local governments are insufficient and unpredictable in Burkina Faso, while local governments have limited ability to raise tax revenue. Inadequate funding makes it difficult for local governments to provide public services.

Mogues and Benin (2012) use districts' revenue data from 1994 to 2001 in Ghana, and show external funding crowds out internal revenue of district governments. In other words, additional funding from the central government reduces local governments' incentive to collect internal revenue. In contrast, Masaki (2016) finds higher intergovernmental transfers lead to more local revenue generation in Tanzania, especially in rural areas. He argues that when the local governments' ability to raise internal revenue is weak, external transfers help local governments to finance tax collection activities and broaden the tax base. Caldeira and Rota-Graziosi (2014) also find positive effects of increased transfers from the central government on district governments' internal revenue generation in Benin.

The decentralization issues studied in prior papers are focus on public expenditure assignments, i.e., determining optimal levels of transfers from the central government to local governments. However, a few studies investigate internal revenue generation activities by local governments, and whether local tax collection systems are progressive. Tundiyiridam et al. (2016) argue that the taxation on real estate property is the most progressive way of internal revenue generation for district governments in Ghana, but only 30 percent of property owners pay property taxes. Biitir and Assiamah (2015) maintain that property taxes and business operating license fees are the most progressive source of internal revenue, and point out that internal revenue from these sources remains low in Ghana. Difficulty in assessing property values and business profits is identified as limiting factors that inhibit the collection of property taxes and business operating license fees. In contract, it is reported that the vast majority of market traders pay daily or monthly fees to local governments. Prichard and van den Boogaard (2017) conduct an interview with market traders in the poor northern region and find that 46 percent pay daily market fees, 20 percent pay monthly market rents for occupying formal market stalls, and 31 percent were paying both market fees and market rents. They argue that the amount of market fees collected is a significant proportion of revenue for traders, and traders often borrow money to pay the market fees.

The findings in these case studies suggest internal revenue generation systems can be regressive, depending on who bear the burden of internal revenue generation.

This paper analyzes districts' revenues and spending data from 1994 to 2011 in Ghana, and investigates how the transfers from the central government to local governments affect local governments' incentives to raise their own revenue, how the impacts differ between poor and rich districts, who bear the burden of internal revenue generation, and how the difference in revenue in turn affects the provision of public goods by district governments in Ghana.

The study closest to our paper is Mogues and Benin (2012) which shows external funding crowds out internal revenue of district governments in Ghana. This paper extends Mogues and Benin (2012) in some important ways. First, we extend the analysis to 2011, and illustrate that there is a large gap between poor and rich districts in their ability to raise internal revenue, and the gap has widened over the years. Second, we realize that poor districts and rich districts have developed distinctive tax bases. Poor districts keep relying on fees collected from market traders and the reliance on market fees increased over the years, while rich districts have increased internal revenue from other sources such as royalties and business licenses. It implies that rich districts were able to develop tax bases in the private sector, while poor districts did not. As a result, poor market traders suffer from the burden of internal revenue generation. Third, external funding crowds out internal revenue only in rich districts. In poor districts, external funding crowds in internal revenue instead. Fourth, spending patterns also differ between poor and rich districts. Rich district governments increase expenditures on personal, transportation, and general expenditures when total revenues increase. In contrast, poor district governments face severe financial constraints, and thus, increases in revenues do not result in the increase of expenditures. Finally, we investigate the effect of revenue on public goods provision, and show increased revenue weakly improves public goods provision both in poor and rich districts.

The results of this paper have strong policy implications. They imply that allocating more external funding to poor districts could be an effective policy intervention to close the gap between the poor and rich districts.

The paper is organized as follows: Section 2 describes data and local governments' financial system in Ghana, and Section 3 summarizes the empirical strategy. Section 4 shows results, and Section 5 concludes with policy recommendations.

## **2. Data and Local Public Finance System in Ghana**

The main dataset used in this paper is district governments' revenue and expenditure data from 1994 – 2011, collected by International Food Policy Research Institute (IFPRI) and International Centre for Tax and Development (ICTD). We have revenue and expenditure data at the sub-category level, but data availability varies across years. Table A.1 in the Appendix summarizes the availability of data for each category (and sub-category) for each year from 1994 to 2011. Note the number of districts changed over time in Ghana. From 1994 to 2004, there were 110 districts. For the dataset covering 2005 to 2011, there were 177 districts.

District governments' revenue consists of external and internal revenues. External revenue comprises (a) the District Assembly Common Fund (DACF), (b) transfers from the central government to support salaries of local government officials, (c) donor funds, (d) the Heavily Indebted Poor Countries (HIPC) fund, (e) school feeding, and (f) District Development Facility (DDF). The breakdown of external revenue is not available in most years, even though total external revenue is reported most years. For that reason, we use only total external revenue in our regressions in the analysis throughout the paper. We believe the total external revenue variable is correct (or do not have too much error) even though the breakdown is not reported. However, we need to be aware of the data limitation.

As discussed by Mogues and Benin (2012), the District Assembly Common Fund (DACF) is the main vehicle for intergovernmental transfers in Ghana. The DACF is granted from the central government to district governments for the implementation of developmental projects. Priority development programs for the DACF include school feeding, sanitation and waste management, sanitation guards, and the national borehole program. The DACF is funded at a certain percentage of the national tax revenue. For 2016, parliament approved a 7.5% allocation of national tax revenue to the DACF.

The total amount transferred to district governments under the DACF is determined using a formula, and the formula varies across years.<sup>2</sup> The formula used in 1994, 2004, and 2014 is shown in Table 1. The formula consists of four factors: (1) equality, (2) need, (3) responsiveness, and (4) service pressures. The equality factor is a base sum distributed in equal amounts to all districts. The need factor takes into account the difference in the quality of public services across districts. Districts with poorer quality of services in health, education, roads, and water supply receive more funding so they can improve the services in these target areas. The responsiveness factor is intended to encourage internal revenue generation by district governments. The districts get rewarded if they increase internal revenue. However, weights assigned to the responsiveness factor dramatically reduced from 20 percent in 1994, to 2 percent in 2004, and 6 percent in 2014. The service pressure factor reflects the higher demand for public services in districts with higher population density.

The District Development Facility (DDF) is performance-based financial incentives given to district governments. It was introduced in 2009 to encourage district governments to improve administrative, organizational, and financial management.

Table 2 presents the summary statistics of revenues in 1995, 2001, and 2007.<sup>3</sup> All the values are adjusted using 2005 CPI, and we take consideration of the Cedi conversion that took place in 2007. All the numbers are in million Cedi.

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<sup>2</sup> Banful (2011) argues that even though the allocation of DACF follows a formula, DACF is allocated more to the districts where vote margins in the previous presidential election were lower, suggesting that swing districts were targeted.

<sup>3</sup> Akudugu and Oppong-Pepurah (2013) point out there is a wide difference between budgeted revenue or expenditure and the actual revenue or expenditure. We use the actual revenue or expenditure throughout the paper.

We divide districts into three groups by poverty rates. Throughout the paper, we will call the lowest quantile of districts in terms of poverty rates as “rich districts”, the highest quantile of districts in terms of poverty rates as “poor districts”. We apply the poverty rates of 2000 to all years until 2004, and the poverty rates of 2010 to all years from 2005.

External revenue is higher for the districts with the lowest poverty rates (rich districts) in 1995, but the mean external revenue is not significantly different between poor and rich districts in 2001 and 2007. Note external revenues are larger than internal revenues (IGF), and the difference between the external revenues and the total IGF has widened over years, in particular, external revenues grow drastically between 2001 and 2007.

The internal revenue (IGF) comprise the following: (a) royalties from mining and other natural resource extraction; (b) property tax; (c) fees and fines (mostly fees charged on market stalls); (d) business license fees; (e) rental income collected on district assembly-owned properties; (f) investment income such as dividends and interest earnings on financial capital; and (g) miscellaneous. IGF is mostly spent on recurrent expenditure such as personnel emoluments, travel and transport, and miscellaneous (Akudugu and Oppong-Peprah 2013).

Table 2 shows that poor districts (district governments with high poverty rates) have significantly smaller internal revenues from royalties, property tax, fees, and licenses, compared with rich districts (the districts with low poverty rates). Low levels of royalties and business license fees collected in poor districts reflect their weak tax base. Table A.2 in the Appendix summarizes the number of firms, the share of registered firms, and the share of firms in the mining sector in the business census collected in 2014. There are almost 5 times more firms in the districts with low poverty rates than in the districts with high poverty rates. Moreover, 38.2 percent of the firms in rich districts are registered with local governments compared to only 15.1 percent of firms in the poor districts. This is consistent with the hypothesis by Besley and Persson (2014) that tax collection increases as the economy develops. In addition, 0.13 percent of firms in the rich districts are in the mining sector while only 0.04 percent of firms in the poor districts are in the mining sector. Thus, there are a much fewer number of firms that pay royalties in the poor districts.

Table 2 illustrates that poor districts keep relying on fees collected from market traders, and the reliance on market fees increased over the years, while rich districts have increased internal revenue from other sources such as royalties and business licenses. In 1995, the market fees were 28.8 and 28.1 percent of internal revenue in the poor and rich districts respectively. However, it increased to 40.1 percent of internal revenue in the poor districts while it rose to 35.4 percent of internal revenue in the rich districts.

Table 3 presents revenues per capita. Column 1 shows external revenue per capita was not significantly different between poor and rich districts in 1995. In 2001 and 2007, external revenue per capita was higher among the poor districts than the rich districts. This may be due to the changes in the weights given to each factor in the formula in the DACF

allocations. As shown in Table 1, the weights for the responsiveness and service pressure factors were reduced over the years, which may have given advantages to poor districts that have weaker capacity to improve internal revenue and have lower population density. Internal revenues per capita, on the other hand, are larger among richer districts. The internal revenues per capita from royalties, property tax, fees and business licenses are significantly higher among the rich districts than the poor districts. The rental income per capita was also higher among the rich districts than the poor districts in 2001 and 2007. Note that the gap of internal revenues widened between the rich districts and the poor districts from 1995 to 2007. This indicates the rich districts were able to improve internal revenue while the poor districts had little improvement in raising internal revenue.

Table 4 presents the summary statistics of expenditures in 1995, 2001, and 2007. Expenditures for personal emolument and capital expenditures have the largest share among the sub-categories of expenditures. Similar to revenues, local governments with higher poverty rates have significantly smaller expenditures for most sub-categories of expenditures. Transportation, repair, and general expenditures are significantly higher in rich districts than the poor districts in all three years. Miscellaneous and capital expenditures are also higher among the rich districts than the poor districts, but the gap is not significantly different in some years.

Table 5 summarizes school-related achievements (section 1) and public goods provisions (section 2). Over time, the percentage of schools with drinking water improved from 40.5 percent to 62.7 percent on average in all districts. Similarly, the percentage of schools with seating places and writing places improved from 58.3 to 72.2 percent, and from 56.6 to 71.1 percent, respectively. The pupils-per-teacher ratio slightly increased, but the pupils-per-trained-teacher ratio increased significantly from 43.6 to 62.3. The increase may be due to population growth.

Local governments with higher poverty rates have higher pupils-per-teacher ratios and pupils-per-trained-teacher ratios, and they had fewer schools with drinking water, seating places, and writing places. But the gap seems to get narrower over years, especially for the percentage of seating places and writing places.

Some of public goods provision improved over time, but others did not (section 2). For example, the percentage of households with solid waste infrastructure increased on average from 2 to 6 percent from year 2000 to 2007. On the other hand, the percentage of households with piped water and liquid waste infrastructure declined over time. This might be due to increasing population. Poorer districts have lower access to public good provisions across years.

### **3. Estimation Strategy**

In this section, we describe estimation strategy.

#### **Impact of changes in external revenue on changes in internal revenue**



We employ the following growth model for analysis:

Regression Model (1)

$$\Delta[\ln(IGF_{it})] = \ln(EXT_{it-1})\delta + \ln(EXP_{it-1})\gamma + \Delta\ln(IGF_{it-1})\phi + R_i\lambda + D_t\tau + \alpha + \eta_i + \varepsilon_{it}$$

Where  $\Delta[\ln(IGF_{it})]$  represents the change in the log of internal revenue (IGF) or sub-category of IGF from the time  $t-1$  to the time  $t$ .  $EXT_{it-1}$  is the lagged external revenues for district  $i$ .  $EXP_{it-1}$  represents the vector of lagged expenditures at time  $t-1$ .  $D_t$  is the time effects.  $\eta_i + \varepsilon_{it}$  are error terms. This is analogous to the specification that Mogues and Benin (2012) use for their growth model.

Through this model, we investigate if external revenues have a growth effect on internal revenue generation. We employ this estimation method because this growth model can allow for the path-dependency of the growth of internal revenues. We apply a generalized method of moments (GMM) estimator for our regressions.

We use the total external revenues as the main independent variable. We do have the information on the sub-category of the external revenues such as DACF, donor, HIPC, and salary transfers. However, we only use the total external revenues, as some information on sub-categories is missing in some years. We include variables on lagged expenditures, specifically, we control for the expenditure on personal emolument, travelling and transportation, general expenses, maintenance and repairs, miscellaneous, and capital expenditure. Any time-invariant, districts-specific characteristics are controlled for with the district-level fixed effects  $R_i$ .

We further investigate the differential effect of the change in external revenues on internal revenues by the district's poverty rates. We estimate the differential effects by the following model:

Regression Model (2)

$$\Delta[\ln(IGF_{it})] = \ln(EXT_{it-1})\delta + \theta\ln(EXT_{it-1}) * Pov_i + \ln(EXP_{it-1})\gamma + \Delta\ln(IGF_{it-1})\phi + R_i\lambda + D_t\tau + \alpha + \eta_i + \varepsilon_{it}$$

where  $Pov$  is the poverty rate of the district  $i$ . Note we apply the poverty rate calculated using the 2000 population census and GLSS4 (1998) for 1994 to 2004, and the poverty rate calculated using the 2010 population census and GLSS6 (2012) after 2005. The poverty rate is dropped from the regressions with district-level fixed effects, but the interaction terms between external revenues and poverty rates remain.

### **Impact of changes in external revenue on changes in expenditure**

The growth model to evaluate the effect of changes in revenues on changes in expenditures is described as follows:

Regression Model (3)

$$\Delta[\ln(EXP_{it})] = \Delta\ln(EXT_{it})\delta + \Delta\ln(IGF_{it})\gamma + \Delta\ln(EXP_{it-1})\phi + R_i\lambda + D_t\tau + \alpha + \eta_i + \varepsilon_{it}$$

The main independent variables are the total internal revenues (IGF) and the external revenues. For the dependent variable, we use the expenditure data separately on personal emolument, travelling and transport, general expenses, maintenance and repairs, miscellaneous, and capital expenditure.

We also investigate the differential effect of district's poverty rates through the following model specification:

Regression Model (4)

$$\Delta[\ln(EXP_{it})] = \Delta\ln(EXT_{it})\delta + \Delta\ln(IGF_{it})\gamma + \varphi\Delta\ln(EXT_{it}) * Pov_i + \psi\Delta\ln(IGF_{it}) * Pov_i + \Delta\ln(EXP_{it-1})\phi + R_i\lambda + D_t\tau + \alpha + \eta_i + \varepsilon_{it}$$

### **Impact of changes in revenue on changes in the provision of public goods**

To estimate the effects of revenues on public goods, such as piped water and waste system, we use population census data from 2000 and 2010 and estimate the following model:

Regression Model (5)

$$Pub_{it} = \ln(EXT_{it})\delta + \ln(IGF_{it})\gamma + \ln(EXP_{it})\phi + X_{it}\lambda + \varepsilon_{it}$$

where  $Pub_{it}$  is the variable for public goods provision, such as piped water and waste system.  $X_{it}$  includes various district-level characteristics, such as urban rates, literacy rates, the percentages of Christian, Akan, and Ewe, percentages of market traders, population, population density, and rainfalls of the districts. We also interact the variables on revenues with poverty rates.

The growth model to evaluate the effects of changes in district government revenues on changes in educational investment is described as follows:

Regression Model (6)

$$\Delta[(Educ_{it})] = \Delta\ln(EXT_{it})\delta + \Delta\ln(IGF_{it})\gamma + R_i\lambda + D_t\tau + \alpha + \eta_i + \varepsilon_{it}$$

Where  $Educ_{it}$  represents the education-related outcomes, such as pupils-per-teacher ratios, pupils-per-trained-teacher ratios, percentages of schools with drinking water, schools with seating places, and schools with writing places. Unlike the first two research questions, we do not use the GMM estimator due to the insufficient observations. Instead, we use the OLS estimator.

For the differential effects by the district's poverty rates, we estimate:

Regression Model (7)

$$\Delta[(Educ_{it})] = \Delta\ln(EXT_{it})\delta + \Delta\ln(IGF_{it})\gamma + \varphi\Delta\ln(EXT_{it}) * Pov_i + \psi\Delta\ln(IGF_{it}) * Pov_i + R_i\lambda + D_t\tau + \alpha + \eta_i + \varepsilon_{it}$$

## 4. Results

### 1) Effect of External Revenues on Internal Revenues

We estimate the regression model (1) to evaluate how the changes in external revenue affect the changes in internal revenue. Overall, we find the external revenue from the previous year does not reduce the internal revenues significantly (Table 6 Panel A column 8). However, the increase in the external revenues significantly reduces the collection of internal revenues in two categories. i.e., fees from market traders and business licenses at the 10 percent significance level (Panel A columns 3 and 4). This result implies that, when external revenues are reduced, the district governments increase internal revenues by collecting more fees and fines from market traders.

Next, we estimate the regression model (2) and examine if rich and poor districts react to the change in external revenue differently. In general, local governments significantly reduce internal revenue when the external revenue increases (Panel B column 8). This reduction in internal revenue (as a response to increase external revenue) is especially apparent for market fees, fines and business licenses (Panel B columns 3 and 4).

However, district governments with high poverty rates increase internal revenue when external revenue increase, compared with other districts (Panel B columns 3, 4, and 8). Notice the coefficients of the cross effect of external revenue and poverty rates is positive. Our result supports the hypothesis by Masaki (2016) that higher intergovernmental transfers lead to more local revenue generation. When the local governments' ability to raise internal revenue is weak, external transfers help local governments to finance tax collection activities and broaden the tax base.

### 2) Effect of changes in revenue on changes in expenditure

We run the regression model (3) and investigate the effect of changes in revenues on changes in expenditure. Although our data on expenditure is not complete, we will use available expenditure data on personal emolument, travelling and transportation, general expenses, maintenance and repairs, miscellaneous, and capital expenditure for the analysis.

Panels A and B in Table 7 presents the effects of changes in total revenues (internal and external revenues combined) on expenditure. Overall, the total revenues increase the expenditures in personal emolument, travelling and transportation, and capital expenditures (Panel A columns 1, 2, and 6). Note William (2016) reports that up to 29 percent of local governments' capital expenditure is wasted as many of district governments' projects are never completed. We could consider the increase in capital expenditures as wasteful.

However, this does not apply to districts with high poverty rates. The regression results of the estimation of the model (4) is presented in Table 7, Panel B. Districts with high poverty rates do not increase the expenditure in these categories even if the total revenues increase. This is consistent with our earlier observation that districts with high poverty rates are severely financially-constrained. As we do not have the data for all categories of expenditure, we do not know if poor districts increase expenditure in other categories that we are not aware of.

We now look at the differential effects of changes in internal and external revenues on expenditure (Panel C and D). We find that district governments' expenditures do not respond to the changes in external revenue, except for capital expenditure (Table 7 Panel C columns 1 to 5). The rise in the external revenue increases the capital expenditure (Panel C column 6). Taken into account the results of William (2016), we could consider that an increase in external revenue leads to wasteful capital expenditure.

On the other hand, the increases in the internal revenues have significant and positive effects on various expenditures, including personal emolument, travelling and transportation, general expenses, miscellaneous, and capital expenditure (Panel C columns 1,2, 3, and 6). It may reflect the fact that district governments have better control on how they spend internal revenue.

We find that poor and rich district governments respond differently to the increase in internal revenue. In general, district governments increase expenditures, such as personal, transportation, and general expenditures when the internal revenue increases (Panel D columns 1 to 3), while local governments with high poverty rates do not react to the increases in the revenue in most cases.

Overall, consistent with the results from the section above on the effects of external revenues on internal revenues (Table 5), our regression results imply that local governments with high poverty rates face financial constraints, and the increase in revenues do not result in the increase in specific categories of expenditures.

### 3) Effect of changes in revenue on public goods provision

This section evaluates the effect of changes in revenue on public-good provisions by district governments, such as the access to piped water, and the waste management system. Table 8 shows the regression results of the model (5). An increase in revenue rises the percentage of households with access to piped water and liquid waste infrastructure (Panel A columns 1 and 3). Increased internal revenues in poor districts particularly improved the access to piped water and liquid waste infrastructure (Panel D columns 1 and 3).

The accesses to solid waste system improve with higher revenue only when poverty rates are controlled (Panel B column 2). Notice the coefficient of the poverty rates is positive for the provision of solid waste infrastructure in Panel B. It implies districts with higher poverty rates were able to improve the provision of solid waste infrastructure over years, but the cross effect with poverty rates is negative, suggesting that poor districts are not able to improve the provision of solid waste infrastructure as much as rich districts do as a

response to increased revenue. When we break revenue into internal and external revenue, we obtain consistent results. Panel D shows that both internal and external revenue increases positively impact the provision of solid waste infrastructure. The districts with higher poverty rates significantly increased the access to solid waste infrastructure. However, the cross effects of increased revenue and poverty rates are negative, suggesting poor districts are not able to improve the provision of solid waste infrastructure as much as rich districts do when both internal and external revenue increases.

Mabe and Kuusaana (2016) demonstrate local governments are finding it increasingly difficult to provide basic services to a growing population, due to budget constraints and the inability to raise the required local-level revenue. This may explain why increased budgets do not always translate into improved provision of public goods.

For investment on schools, we focus particularly on school-level data, such as pupils-per-teacher ratios, percentages of schools with drinking water, seating places, and writing places. Table 9 shows the regression results of the model (6). Overall, the increases in total revenue reduce pupils-per-trained-teacher ratio (Panel A column 2), but they also reduce other infrastructural parameters, such as schools with drinking water and writing places (Panel A columns 3 and 5). This result is not different by the poverty rates of the local districts (Panel B). It may be due to population pressure, and district governments' inability to accommodate increases in the number of school children.

Panels C and D of Table 9 look at the differential effects of internal and external revenues. The increase in the external revenues indeed translates into the increase in the educational investment in terms of pupils-per-trained-teacher ratios (Panel C column 2). This suggests external revenues may have been used to increase the trained teachers effectively. On the other hand, the increase in the external revenues reduces the percentage of schools with drinking water and schools with writing places (Panel C columns 3 and 5). It may be that external revenues are used to strengthen the human capital but not the infrastructure.

The rise in the internal revenue increases the percentage of schools with drinking water (Panel C column 3). Although it slightly reduces the percentage of seating places (Panel C column 4), it might be that internal revenues are used to improve the infrastructure.

In general, the increase in external revenues reduces the percentage of schools with drinking water (Panels C and D columns 3). It is hard to interpret this result but it may be districts which enjoyed increased external revenue have issues of wasted expenditures.

## **5. Conclusion and Policy Recommendation**

The analytical results of this paper suggest there is a large gap between poor and rich districts in their ability to raise internal revenue, and the gap has widened over the years. Poor districts keep relying on fees collected from market traders, and the reliance on market fees increased, while rich districts have increased internal revenue from other sources such as royalties and business licenses. This suggests rich districts were able to develop tax

bases in the private sector, while poor districts did not. Consequently, poor market traders suffer from the burden of internal revenue generation. It implies the local taxation system is rather regressive.

We find that external revenue crowds out internal revenue only in rich districts, while it enhances internal revenue generation in poor districts (crowding in effects). It implies allocating more external funding to poor districts could be an effective policy intervention to close the gap between the poor and rich districts.

Biitie and Assiamah (2015) point out that assessment of property rates and business operating license fees have been identified as the limiting factors that inhibit the revenue potential of local governments in Ghana. They propose to introduce computer-based applications to monitor the collection of property rates and business operating license fees in one district in Ghana. Tundyiridam, Alhassan and Abdulai (2016) evaluate the contribution of property taxes on internal revenue. They suggest that more property tax could be collected if the compliance of taxpayers improves. They attribute the low compliance among taxpayers to the low level of trust in district governments. The results of these studies indicate the importance of capacity building in enhancing local governments' ability to raise internal revenue, and shifting to more progressive taxation systems.

The fundamental cause of the low level of internal revenue in poor districts is its limited tax base, which can be solved through the development of the private sector. Thus, policy interventions that are aimed at the promotion of the private sector is most effective in the long run. It is important to increase internal revenue from business license and other fees from the private sector, but the taxation system has to be designed to encourage private sector firms to grow in poor areas.

We find increased revenue does not always translate into better provision of public goods, especially in the education sector. It may be due to limited capacity of district governments or wasteful expenditure. Reinikka and Svensson (2004) report that schools in Uganda receive only 13 percent of transfers from the central government, as the bulk of the transfers are captured by local government officials. We need to find out how much of the revenue allocated to schools actually make it to schools in Ghana. Public access to information may be an effective policy intervention to improve the accountability of local governments. Reinikka and Svensson (2003) shows public access to information reduces capture and corruption of public funds in Uganda.

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**Table 1: Formula weights for criteria for District Assemblies Common Fund (DACF) allocation (%) in 2014**

Factor	Weights (%)		
	1994	2004	2014
A. Equality	<b>30</b>	<b>60</b>	<b>45</b>
B. Need	<b>35</b>	<b>35</b>	<b>45</b>
Population size	5		
GDP	30		
Health			
Health facility / population		5	9
Health professional / population		10	8
Education			
Education facility / population		5	10
Trained teacher / pupil		5	8
Road (tarred roads coverage)		5	5
Water (percentage of population with access to clean and potable water)		5	5
C. Responsiveness (revenue improvement)	<b>20</b>	<b>2</b>	<b>6</b>
D. Service pressure (population density)	<b>15</b>	<b>3</b>	<b>4</b>
Total	<b>100</b>	<b>100</b>	<b>100</b>

Source: <http://www.commonfund.gov.gh/>

**Table 2: Summary statistics of revenues (N=110)**

	External	Internal Revenues (IGF)							
	Revenues	Total	Royalties	Property tax	Fees	Licenses	Rent	Investment	Misc.
<i>Panel A: Year=1995</i>									
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Districts with lowest poverty rates	908.3***	591.9***	97.0***	90.0***	166.6***	68.8**	10.6	39.0*	125.1
Districts with medium poverty rates	585.9	160.9	37.4	30.5	40.5	16.7	3.8	25.5	13.4
Districts with highest poverty rates	560.9	79.7	9.1	6.9	33.1	10.8	7.5	9.3	6.5
Mean	687.3	281.1	48.5	45.1	80.9	32.5	7.2	24.9	50.7
<i>Panel B: Year=2001</i>									
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Districts with lowest poverty rates	1024.9	666.5**	177.8**	45.7***	236.0**	122.7**	27.9**	23.5	39.2
Districts with medium poverty rates	554.8	148.0	21.4	25.0***	49.5	16.7	5.0	7.2	24.2
Districts with highest poverty rates	676.3	109.8	12.1	3.8	34.5	8.3	3.6	9.8	41.3
Mean	752.7	309.9	71.0	24.8	107.3	49.6	12.0	13.5	34.7
<i>Panel C: Year=2007</i>									
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Districts with lowest poverty rates	2928.9	1156.2**	228.6***	79.2***	409.9**	300.8**	69.3	5.0	71.6**
Districts with medium poverty rates	2192.2	233.8	45.1	64.9**	48.9	35.4	9.7	4.2	28.9
Districts with highest poverty rates	2370.2	131.9	14.8	16.5	52.9	13.3	5.0	6.3	28.6
Mean	2500.4	504.5	96.1	53.3	170.7	115.9	28.3	5.3	43.6

Notes: The data is from IFPRI and ICTD. We test the difference of each variable between the districts with the highest poverty rates and with the lowest/medium poverty rates. \*\*\* p<0.01, \*\* p<0.05, \* p<0.1

**Table 3: Summary statistics of revenues per capita (N=110)**

	External	Internal Revenues (IGF)							
	Revenues	Total	Royalties	Property tax	Fees	Licenses	Rent	Investment	Misc.
<i>Panel A: Year=1995</i>									
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Districts with lowest poverty rates	5.13	1.87***	0.42***	0.38***	0.53***	0.21***	0.09	0.12	0.15
Districts with medium poverty rates	4.55	1.14**	0.25*	0.21***	0.29	0.12	0.02	0.19	0.1
Districts with highest poverty rates	5.03	0.61	0.07	0.05	0.25	0.08	0.05	0.08	0.06
Mean	4.90	1.22	0.25	0.23	0.36	0.14	0.05	0.13	0.1
<i>Panel B: Year=2001</i>									
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Districts with lowest poverty rates	4.70**	1.77***	0.39***	0.24***	0.59***	0.24***	0.09***	0.08	0.17
Districts with medium poverty rates	4.07***	1.05	0.15	0.19***	0.35	0.12	0.04	0.05	0.16
Districts with highest poverty rates	5.85	0.76	0.09	0.03	0.26	0.07	0.03	0.08	0.22
Mean	4.86	1.2	0.21	0.15	0.4	0.14	0.05	0.07	0.18
<i>Panel C: Year=2007</i>									
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Districts with lowest poverty rates	16.67**	3.57***	0.75***	0.63**	1.03***	0.56***	0.10*	0.03**	0.49
Districts with medium poverty rates	19.88	1.98	0.35	0.57*	0.42	0.28	0.07	0.03*	0.28
Districts with highest poverty rates	24.13	1.40	0.16	0.2	0.54	0.14	0.05	0.07	0.31
Mean	20.31	2.30	0.42	0.47	0.67	0.33	0.08	0.05	0.36

Notes: The data is from IFPRI and ICTD. We test the difference of each variable between the districts with the highest poverty rates and with the lowest/medium poverty rates. \*\*\* p<0.01, \*\* p<0.05, \* p<0.1

**Table 4: Summary statistics of expenditures (N=110)**

	Expenditures					
	Personal	Transport	General	Repairs	Misc.	Capital
<i>Panel A: Year=1995</i>						
	(1)	(2)	(3)	(4)	(5)	(6)
Districts with lowest poverty rates	214.2**	101.9***	64.8**	36.1*	71.5***	949.1***
Districts with medium poverty rates	67.3	35.3	21.7	15.0	22.0	574.5
Districts with highest poverty rates	51.2	28.8	13.9	7.8	18.5	490.8
Mean	112.6	55.8	33.8	19.8	37.7	674.8
<i>Panel B: Year=2001</i>						
	(1)	(2)	(3)	(4)	(5)	(6)
Districts with lowest poverty rates	397.0**	120.9***	80.5***	27.3***	239.7	714.0
Districts with medium poverty rates	177.1	46.0	25.5	6.1	34.8	416.1
Districts with highest poverty rates	139.2	28.7	18.3	5.2	31.8	485.0
Mean	239.2	65.7	41.8	13.0	103.4	541.6
<i>Panel C: Year=2007</i>						
	(1)	(2)	(3)	(4)	(5)	(6)
Districts with lowest poverty rates	610.2*	192.9***	159.0**	69.4*	513.6	312.8*
Districts with medium poverty rates	224.3	59.8	43.3	8.2	48.0	65.3
Districts with highest poverty rates	267.2	38.5	31.7	11.7	39.2	29.7
Mean	370.5	97.3	78.4	30.6	202.8	175.9

Notes: The data is from IFPRI and ICTD. We test the difference of each variable between the districts with the highest poverty rates and with the lowest/medium poverty rates. \*\*\* p<0.01, \*\* p<0.05, \* p<0.1

**Table 5: Summary statistics of education and public goods provision (N=110)**

Section 1: Education	Pupils Per Teacher Ratio	Pupils Per Trained Teacher Ratio	% of Schools with Drinking Water	Seating Places	Writing Places
<i>Panel A: Year=2001</i>	(1)	(2)	(3)	(4)	(5)
Districts with lowest poverty rates	25.92***	36.05***	43.57	0.67***	0.66***
Districts with medium poverty rates	25.78***	38.41***	40.92	0.60***	0.59***
Districts with highest poverty rates	35.17	56.75	35.53	0.48	0.45
Mean	28.90	43.62	40.05	0.58	0.57
<i>Panel B: Year=2007</i>					
Districts with lowest poverty rates	28.46***	51.11***	71.31***	0.76**	0.77**
Districts with medium poverty rates	27.69***	55.24***	60.76	0.71	0.69
Districts with highest poverty rates	32.56	81.08	55.97	0.69	0.68
Mean	29.54	62.31	62.74	0.72	0.71

  

Section 2: Public Goods	% HH with piped water	% HH with solid waste infrastructure	% HH with liquid waste infrastructure
<i>Panel A: Year=2000</i>	(1)	(2)	(3)
Districts with lowest poverty rates	0.35***	0.03	0.22***
Districts with medium poverty rates	0.22	0.02	0.12
Districts with highest poverty rates	0.19	0.02	0.10
Mean	0.26	0.02	0.15
<i>Panel B: Year=2007</i>	(1)	(2)	(3)
Districts with lowest poverty rates	0.30***	0.08	0.13***
Districts with medium poverty rates	0.20**	0.04	0.07
Districts with highest poverty rates	0.12	0.05	0.06
Mean	0.21	0.06	0.09

Notes: T-test of the difference of each variable between the districts with the highest poverty rates and with the lowest/medium poverty rates. \*\*\* p<0.01, \*\* p<0.05, \* p<0.1

**Table 6: Effect of External Revenue on Internal Revenue**

Difference between t and (t-1)	Rates	Lands	Fees	Licenses	Rental	Invest	Misc.	IGF Total
<i>Panel A: External revenues</i>	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Log (External Revenue), t-1	-0.022 (0.061)	-0.100 (0.071)	-0.045* (0.026)	-0.056* (0.032)	-0.094 (0.074)	0.046 (0.104)	0.093 (0.112)	-0.039 (0.029)
N	793	727	794	794	729	685	711	809
<i>Panel B: External revenues* Poverty rate</i>	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Log (External Revenue), t-1	0.116 (0.168)	-0.369* (0.200)	-0.206*** (0.072)	-0.206** (0.089)	-0.173 (0.203)	-0.030 (0.274)	-0.010 (0.302)	-0.243*** (0.077)
Log (External Revenue), t-1 * Poverty rate	-0.298 (0.337)	0.574 (0.399)	0.347** (0.144)	0.322* (0.178)	0.168 (0.403)	0.151 (0.510)	0.221 (0.602)	0.450*** (0.158)
N	793	727	794	794	729	685	711	809

Notes: GMM estimator. Covariates include the lagged dependent variables sand lagged expenditure (logged).

**Table 7: Effect of Revenue on Expenditure**

	Personal (1)	Transport (2)	General (3)	Repairs (4)	Misc. (5)	Capital (6)
<i>Panel A: Total revenues</i>						
Difference (log (Total Revenue))	28.274* (15.552)	9.553** (4.840)	4.397 (7.242)	-0.359 (7.503)	-3.417 (10.430)	284.929*** (35.557)
N	823	823	823	821	819	755
<i>Panel B: Total revenues * Poverty rate</i>						
Difference (log (Total Revenue))	99.381** (41.611)	21.672* (12.977)	17.224 (19.445)	0.709 (20.751)	15.221 (27.811)	328.736*** (100.551)
Difference (log (Total Revenue)) * Poverty rate	-166.882* (90.594)	-28.556 (28.338)	-30.155 (42.467)	-2.146 (44.760)	-43.195 (60.818)	-99.284 (213.412)
N	823	823	823	821	819	755
<i>Panel C: Internal &amp; External revenues</i>						
Difference (log (Total IGF))	71.490*** (19.104)	18.083*** (5.921)	15.982* (8.936)	10.549 (9.231)	24.825* (12.872)	90.725** (45.812)
Difference (log (External revenue))	4.929 (8.870)	1.979 (2.769)	0.743 (4.174)	-0.631 (4.280)	-6.014 (5.985)	99.203*** (20.493)
N	823	823	823	821	819	755
<i>Panel D: Internal &amp; External revenues * Poverty rate</i>						
Difference (log (Total IGF))	194.689*** (43.269)	33.202** (13.514)	42.660** (20.580)	28.676 (21.336)	33.688 (29.281)	159.183 (114.696)
Difference (log (External revenue))	4.189 (24.593)	2.841 (7.725)	1.153 (11.663)	-2.837 (12.090)	-8.414 (16.705)	130.695** (58.384)
Difference (log (Total IGF)) * Poverty rate	-300.365*** (94.891)	-37.523 (29.712)	-64.557 (44.946)	-43.502 (46.768)	-20.528 (64.270)	-163.814 (237.476)
Difference (log (External revenue)) * Poverty rate	-3.503 (51.830)	-2.690 (16.303)	-2.059 (24.603)	4.341 (25.431)	5.219 (35.255)	-72.066 (119.306)
N	823	823	823	821	819	755

Notes: GMM estimator. Covariates include the lagged dependent variables.



**Table 8: Effect of Revenue on Public Goods Provision**

	% of HH with piped water (1)	% HH with solid waste infrastructure (2)	% HH with liquid waste infrastructure (3)
<i>Panel A: Total revenues</i>			
Log (lagged total revenues)	0.050* (0.026)	-0.005 (0.011)	0.054*** (0.018)
Poverty rate	-0.117 (0.125)	-0.047 (0.055)	0.015 (0.088)
N	156	156	156
r2	0.501	0.749	0.769
<i>Panel B: Total revenues * Poverty rate</i>			
Log (lagged total revenues)	0.004 (0.053)	0.065*** (0.018)	0.000 (0.036)
Poverty rate	-1.083 (0.993)	1.430*** (0.345)	-1.142 (0.676)
Log (lagged total revenues)*Poverty rate	0.131 (0.134)	-0.200*** (0.046)	0.157* (0.091)
N	156	156	156
r2	0.517	0.847	0.791
<i>Panel C: Internal &amp; External revenues</i>			
Log (lagged total IGF)	0.016 (0.040)	-0.005 (0.017)	0.030 (0.027)
Log (lagged external revenue)	0.036 (0.022)	-0.002 (0.009)	0.046*** (0.015)
Poverty rate	-0.102 (0.129)	-0.052 (0.056)	0.031 (0.088)
N	156	156	156
r2	0.491	0.748	0.774
<i>Panel D: Internal &amp; External revenues * Poverty rate</i>			
Log (lagged total IGF)	-0.086 (0.058)	0.043** (0.021)	-0.047 (0.039)
Log (lagged external revenue)	-0.001 (0.043)	0.053*** (0.015)	0.018 (0.029)
Poverty rate	-1.804* (0.986)	1.558*** (0.349)	-1.262* (0.663)
Log (lagged total IGF) * Poverty rate	0.275** (0.126)	-0.105** (0.045)	0.208** (0.085)
Log (lagged external revenue) *Poverty rate	0.051 (0.120)	-0.150*** (0.042)	0.039 (0.080)
N	156	156	156
r2	0.576	0.860	0.820

Notes: OLS estimator. Covariates include lagged expenditure variables (logged), urban rate, literacy rate, % of Christian, % of Akan, % of Ewe, % of traders, population, population density, and rainfall.

**Table 9: Effect of Revenue on Educational Outcomes**

	Pupils Per Teacher Ratio (1)	Pupils Per Trained Teacher Ratio (2)	% of Schools with Drinking Water (3)	% of Seating Places (4)	% of Writing Places (5)
<i>Panel A: Total revenues</i>					
Difference (log (total revenue))	0.230 (0.319)	-2.068* (1.058)	-1.850** (0.808)	-0.010 (0.012)	-0.021* (0.011)
N	551	551	551	551	551
r2	0.191	0.607	0.216	0.522	0.523
<i>Panel B: Total revenues * Poverty rate</i>					
Difference (log (total revenue))	-0.662 (1.083)	-1.776 (4.271)	-2.907 (2.241)	-0.008 (0.031)	-0.035 (0.026)
Difference (log (total revenue)) * Poverty rate	1.702 (2.416)	-0.560 (7.343)	2.011 (3.699)	-0.003 (0.046)	0.028 (0.036)
N	551	551	551	551	551
r2	0.194	0.607	0.216	0.522	0.523
<i>Panel C: Internal &amp; External revenues</i>					
Difference (log (total IGF))	-0.525 (0.343)	1.850 (1.268)	2.852*** (1.008)	-0.018* (0.009)	-0.006 (0.008)
Difference (log (external revenue))	0.110 (0.313)	-2.489*** (0.578)	-2.208*** (0.785)	-0.005 (0.009)	-0.016* (0.008)
N	551	551	551	551	551
r2	0.194	0.608	0.227	0.525	0.523
<i>Panel D: Internal &amp; External revenues * Poverty rate</i>					
Difference (log (total IGF))	0.549 (0.772)	4.669 (3.610)	4.713 (2.969)	-0.000 (0.026)	0.010 (0.020)
Difference (log (external revenue))	0.161 (1.222)	-2.606 (1.957)	-4.596** (2.197)	-0.001 (0.023)	-0.029 (0.019)
Difference (log (total IGF)) * Poverty rate	-2.298 (1.561)	-5.992 (6.371)	-3.585 (5.501)	-0.039 (0.049)	-0.031 (0.039)
Difference (log (external revenue)) * Poverty rate	-0.139 (2.811)	0.122 (3.985)	4.558 (3.680)	-0.008 (0.037)	0.026 (0.027)
N	551	551	551	551	551
r2	0.197	0.608	0.229	0.526	0.523

Notes: OLS estimator with district-year fixed effects. Covariates include the lagged dependent variable.

## Appendix

**Table A.1: Data Availability (number of districts)**

	1994	1995	1996	1997	1998	1999	2000	2001	2002
<b>Internal Revenue</b>									
Rates	110	109	98	110	104	99	109	110	110
Lands	104	102	92	107	101	96	105	107	105
Fees	110	109	98	110	104	99	109	110	110
Licenses	110	109	98	110	104	99	109	110	110
rental	108	102	95	106	100	89	106	108	108
Invest	107	94	91	109	102	95	105	106	104
Misc.	104	105	94	105	102	95	103	105	106
IGF Total	110	109	98	110	104	99	109	110	110
<b>External Revenue</b>									
Government transfers to support primarily salaries (actual revenues)	109	0	0	0	0	0	0	0	0
DACF Funds (actual revenues)	110	0	0	0	0	0	0	0	0
Donor Funds (actual)	70	0	0	0	0	0	0	0	0
HIPC (actual)	90	0	0	0	0	0	0	0	0
School feeding (actual)	0	0	0	0	0	0	0	0	0
DACF_MP	0	0	0	0	0	0	0	0	0
DDF	0	0	0	0	0	0	0	0	0
Grants Total	110	109	98	110	104	98	108	110	108
<b>Expenditure</b>									
Personal Emolument	107	109	98	110	104	100	108	109	108
Travelling and Transport	107	109	98	110	104	100	108	109	108
General Expenses	107	109	98	110	104	100	108	109	108
Maintenance and Repairs	106	109	98	110	104	100	108	109	108
Misc.	107	109	98	110	104	99	108	109	108
Capital expenditures	107	109	98	110	104	100	108	107	108

	2003	2004	2005	2006	2007	2008	2009	2010	2011
<b>Internal Revenue</b>									
Rates	109	110	41	140	138	98	39	31	158
Lands	106	104	41	134	134	93	33	25	153
Fees	109	110	41	140	139	100	39	31	159
Licenses	109	110	41	140	139	100	39	30	159
rental	108	108	40	127	130	91	33	28	150
Invest	103	107	36	125	126	90	28	27	128
Misc.	103	104	41	135	130	95	38	30	148
<b>IGF Total</b>	<b>109</b>	<b>110</b>	<b>41</b>	<b>140</b>	<b>139</b>	<b>101</b>	<b>170</b>	<b>170</b>	<b>172</b>
<b>External Revenue</b>									
Government transfers to support primarily salaries (actual revenues)	105	109	0	0	0	40	127	77	149
DACF Funds (actual revenues)	94	110	0	0	0	46	161	89	170
Donor Funds (actual)	52	70	0	0	0	36	139	61	124
HIPC (actual)	52	90	0	0	0	39	102	58	128
School feeding (actual)	0	0	0	0	0	0	49	67	95
DACF_MP	0	0	0	0	0	39	149	87	164
DDF	0	0	0	0	0	0	50	54	111
<b>Grants Total</b>	<b>105</b>	<b>110</b>	<b>41</b>	<b>139</b>	<b>136</b>	<b>88</b>	<b>166</b>	<b>90</b>	<b>170</b>
<b>Expenditure</b>									
Personal Emolument	107	110	41	140	139	101	41	31	0
Travelling and Transport	107	110	41	140	139	100	41	31	0
General Expenses	107	110	41	140	139	100	41	31	0
Maintenance and Repairs	107	110	41	140	137	99	40	31	0
Misc.	107	110	41	140	139	100	41	31	0
Capital expenditures	107	110	29	71	80	42	19	25	0

Table A.2: Number of firms, proportion of registered firms and proportion of firms in the mining sector in 2015

	Number of firms	Share of registered firms	Share of firms involved in mining
Districts with lowest poverty rates	405,090	38.2%	0.13%
Districts with medium poverty rates	149,879	27.1%	0.03%
Districts with highest poverty rates	83,265	15.1%	0.04%

**Table A.3: Effect of External Revenue on Internal Revenue (Full Specification)**

<b>Panel A: External revenues</b>								
Difference between t and (t-1)	Rates	Lands	Fees	Licenses	Rental	Invest	Misc.	IGF Total
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Log (External Revenue), t-1	-0.022 (0.061)	-0.100 (0.071)	-0.045* (0.026)	-0.056* (0.032)	-0.094 (0.074)	0.046 (0.104)	0.093 (0.112)	-0.039 (0.029)
Log (Expenditure - Personal), t-1	0.223** (0.105)	0.052 (0.126)	0.087** (0.043)	0.169*** (0.054)	-0.100 (0.125)	0.175 (0.172)	0.032 (0.190)	0.127*** (0.048)
Log (Expenditure - Transport), t-1	-0.024 (0.122)	-0.129 (0.144)	0.117** (0.053)	-0.067 (0.064)	-0.063 (0.148)	-0.273 (0.186)	-0.064 (0.219)	-0.141** (0.059)
Log (Expenditure - General), t-1	-0.378*** (0.128)	-0.176 (0.153)	-0.251*** (0.056)	-0.149** (0.068)	-0.013 (0.155)	-0.239 (0.209)	0.081 (0.232)	-0.264*** (0.061)
Log (Expenditure - Repairs), t-1	-0.052 (0.065)	-0.060 (0.075)	-0.045* (0.028)	-0.025 (0.034)	-0.061 (0.079)	0.013 (0.100)	0.097 (0.119)	-0.030 (0.031)
Log (Expenditure - Misc.), t-1	-0.066 (0.069)	-0.055 (0.082)	-0.021 (0.030)	-0.035 (0.037)	-0.003 (0.083)	0.042 (0.108)	-0.324*** (0.125)	-0.124*** (0.034)
Log (Expenditure - Capital), t-1	-0.017 (0.057)	0.000 (0.068)	0.009 (0.024)	-0.031 (0.030)	-0.062 (0.069)	-0.072 (0.089)	-0.048 (0.102)	-0.041 (0.026)
Lagged dependent variable	-0.240*** (0.035)	-0.280*** (0.035)	-0.018 (0.038)	-0.174*** (0.037)	-0.271*** (0.032)	-0.211*** (0.037)	-0.360*** (0.036)	-0.160*** (0.038)
Constant	0.857 (0.607)	1.816** (0.794)	0.399 (0.250)	0.683** (0.323)	2.013*** (0.755)	0.911 (1.146)	0.415 (1.193)	1.802*** (0.282)
N	793	727	794	794	729	685	711	809

**Panel B: External revenues\* Poverty rate**

Difference between t and (t-1)	Rates	Lands	Fees	Licenses	Rental	Invest	Misc.	IGF Total
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Log (External Revenue), t-1	0.116 (0.168)	-0.369* (0.200)	-0.206*** (0.072)	-0.206** (0.089)	-0.173 (0.203)	-0.030 (0.274)	-0.010 (0.302)	-0.243*** (0.077)
Log (External Revenue), t-1 * Poverty rate	-0.298 (0.337)	0.574 (0.399)	0.347** (0.144)	0.322* (0.178)	0.168 (0.403)	0.151 (0.510)	0.221 (0.602)	0.450*** (0.158)
Log (Expenditure - Personal), t-1	0.218** (0.105)	0.059 (0.127)	0.090** (0.043)	0.175*** (0.054)	-0.097 (0.126)	0.176 (0.172)	0.037 (0.192)	0.128*** (0.048)
Log (Expenditure - Transport), t-1	-0.022 (0.122)	-0.130 (0.144)	0.116** (0.053)	-0.068 (0.064)	-0.062 (0.148)	-0.275 (0.186)	-0.064 (0.219)	-0.140** (0.059)
Log (Expenditure - General), t-1	-0.383*** (0.128)	-0.174 (0.153)	-0.247*** (0.056)	-0.140** (0.068)	-0.010 (0.155)	-0.238 (0.210)	0.088 (0.233)	-0.255*** (0.061)
Log (Expenditure - Repairs), t-1	-0.049 (0.065)	-0.066 (0.075)	-0.049* (0.028)	-0.030 (0.034)	-0.062 (0.079)	0.012 (0.100)	0.094 (0.119)	-0.034 (0.031)
Log (Expenditure - Misc.), t-1	-0.065 (0.069)	-0.054 (0.082)	-0.022 (0.030)	-0.037 (0.037)	-0.003 (0.083)	0.043 (0.108)	-0.324*** (0.125)	-0.124*** (0.034)
Log (Expenditure - Capital), t-1	-0.019 (0.057)	0.006 (0.068)	0.013 (0.024)	-0.028 (0.030)	-0.060 (0.069)	-0.070 (0.089)	-0.046 (0.102)	-0.039 (0.026)
Lagged dependent variable	-0.242*** (0.035)	-0.280*** (0.035)	-0.013 (0.038)	-0.172*** (0.037)	-0.272*** (0.032)	-0.211*** (0.037)	-0.359*** (0.036)	-0.153*** (0.038)
Constant	0.828 (0.607)	1.901** (0.796)	0.450* (0.251)	0.701** (0.323)	2.018*** (0.756)	0.960 (1.156)	0.430 (1.195)	1.842*** (0.282)
N	793	727	794	794	729	685	711	809

Notes: GMM estimator. The corresponding table is Table 6.



**Table A.4: Effect of Revenue on Expenditure (Full Specification)**

Difference between t and (t-1)	<b>Panel A: Total revenues</b>					
	Personal (1)	Transport (2)	General (3)	Repairs (4)	Misc. (5)	Capital (6)
Difference (log (total revenue))	28.274* (15.552)	9.553** (4.840)	4.397 (7.242)	-0.359 (7.503)	-3.417 (10.430)	284.929*** (35.557)
Lagged dependent variable	-0.547*** (0.032)	-0.485*** (0.030)	-0.622*** (0.059)	-0.445*** (0.114)	1.091*** (0.035)	-0.148*** (0.037)
Constant	42.270*** (8.255)	8.781*** (2.559)	12.123*** (3.836)	4.983 (3.912)	-13.767** (5.503)	154.940*** (19.198)
N	823	823	823	821	819	755

  

	<b>Panel B: Total revenues * Poverty rate</b>					
	Personal (1)	Transport (2)	General (3)	Repairs (4)	Misc. (5)	Capital (6)
Difference (log (total revenue))	99.381** (41.611)	21.672* (12.977)	17.224 (19.445)	0.709 (20.751)	15.221 (27.811)	328.736*** (100.551)
Difference (log (total revenue)) * Poverty rate	-166.882* (90.594)	-28.556 (28.338)	-30.155 (42.467)	-2.146 (44.760)	-43.195 (60.818)	-99.284 (213.412)
Lagged dependent variable	-0.548*** (0.032)	-0.484*** (0.030)	-0.621*** (0.059)	-0.446*** (0.114)	1.091*** (0.035)	-0.148*** (0.037)
Constant	43.535*** (8.279)	8.990*** (2.570)	12.344*** (3.852)	4.982 (3.925)	-13.458** (5.524)	155.417*** (19.242)
N	823	823	823	821	819	755

**Panel C: Internal & External revenues**

Difference between t and (t-1)	Personal (1)	Transport (2)	General (3)	Repairs (4)	Misc. (5)	Capital (6)
Difference (log (total IGF))	71.490*** (19.104)	18.083*** (5.921)	15.982* (8.936)	10.549 (9.231)	24.825* (12.872)	90.725** (45.812)
Difference (log (external revenue))	4.929 (8.870)	1.979 (2.769)	0.743 (4.174)	-0.631 (4.280)	-6.014 (5.985)	99.203*** (20.493)
Lagged dependent variable	-0.550*** (0.032)	-0.486*** (0.030)	-0.617*** (0.059)	-0.443*** (0.114)	1.093*** (0.035)	-0.148*** (0.038)
Constant	40.891*** (8.127)	8.607*** (2.527)	11.600*** (3.808)	4.407 (3.886)	-14.851*** (5.455)	171.018*** (19.303)
N	823	823	823	821	819	755

**Panel D: Internal & External revenues \* Poverty rate**

Difference between t and (t-1)	Personal (1)	Transport (2)	General (3)	Repairs (4)	Misc. (5)	Capital (6)
Difference (log (total IGF))	194.689*** (43.269)	33.202** (13.514)	42.660** (20.580)	28.676 (21.336)	33.688 (29.281)	159.183 (114.696)
Difference (log (external revenue))	4.189 (24.593)	2.841 (7.725)	1.153 (11.663)	-2.837 (12.090)	-8.414 (16.705)	130.695** (58.384)
Difference (log (total IGF)) * Poverty rate	-300.365*** (94.891)	-37.523 (29.712)	-64.557 (44.946)	-43.502 (46.768)	-20.528 (64.270)	-163.814 (237.476)
Difference (log (external revenue)) * Poverty rate	-3.503 (51.830)	-2.690 (16.303)	-2.059 (24.603)	4.341 (25.431)	5.219 (35.255)	-72.066 (119.306)
Lagged dependent variable	-0.549*** (0.032)	-0.485*** (0.030)	-0.610*** (0.059)	-0.435*** (0.114)	1.093*** (0.035)	-0.148*** (0.038)
Constant	41.485*** (8.088)	8.712*** (2.532)	11.683*** (3.816)	4.402 (3.897)	-14.875*** (5.476)	171.686*** (19.338)

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N	823	823	823	821	819	755
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Notes: GMM estimator. The corresponding table is Table 7.

**Table A.5: Effect of Revenue on Public Goods Provision (Full Specification)**

	Panel A: Total revenues			Panel B: Total revenues * Poverty rate		
	% of HH with piped water	% HH with solid waste infrastructure	% HH with liquid waste infrastructure	% of HH with piped water	% HH with solid waste infrastructure	% HH with liquid waste infrastructure
	(1)	(2)	(3)	(1)	(2)	(3)
log (total revenue)	0.050*	-0.005	0.054***	0.004	0.065***	0.000
	(0.026)	(0.011)	(0.018)	(0.053)	(0.018)	(0.036)
Poverty rate	-0.117	-0.047	0.015	-1.083	1.430***	-1.142
	(0.125)	(0.055)	(0.088)	(0.993)	(0.345)	(0.676)
Log (total revenues)				0.131	-0.200***	0.157*
* Poverty rate				(0.134)	(0.046)	(0.091)
Log (Expenditure - Personal)	-0.006	0.004	-0.034**	-0.008	0.006	-0.036***
	(0.018)	(0.008)	(0.013)	(0.018)	(0.006)	(0.012)
Log (Expenditure - Transport)	0.025	-0.019	0.025	0.036	-0.036***	0.038*
	(0.026)	(0.012)	(0.019)	(0.029)	(0.010)	(0.020)
Log (Expenditure - General)	0.013	0.010	-0.032	-0.002	0.032***	-0.049**
	(0.029)	(0.013)	(0.020)	(0.032)	(0.011)	(0.022)
Log (Expenditure - Repairs)	-0.022	-0.003	-0.002	-0.022	-0.004	-0.002
	(0.018)	(0.008)	(0.013)	(0.018)	(0.006)	(0.012)
Log (Expenditure - Misc.)	-0.018	0.001	-0.014	-0.009	-0.014*	-0.003
	(0.020)	(0.009)	(0.014)	(0.022)	(0.008)	(0.015)
Log (Expenditure - Capital)	-0.002	-0.002	0.003	0.003	-0.009***	0.009
	(0.007)	(0.003)	(0.005)	(0.009)	(0.003)	(0.006)
Urban rate	-0.315	0.212*	-0.499**	-0.353	0.270***	-0.544***
	(0.259)	(0.113)	(0.182)	(0.262)	(0.091)	(0.178)
Literacy rate	-0.270	0.039	0.009	-0.318	0.112	-0.048
	(0.397)	(0.174)	(0.279)	(0.400)	(0.139)	(0.272)
% of Christian	0.233	0.059	0.075	0.019	0.387**	-0.181
	(0.485)	(0.212)	(0.341)	(0.532)	(0.185)	(0.362)
% of Akan	0.066	-0.000	0.029	0.055	0.018	0.015
	(0.047)	(0.021)	(0.033)	(0.049)	(0.017)	(0.033)
% of Ewe	0.242	-0.087	0.022	0.318	-0.204**	0.114

	(0.261)	(0.114)	(0.184)	(0.273)	(0.095)	(0.186)
% of traders	3.380*	-2.589***	5.195***	3.543**	-2.837***	5.390***
	(1.664)	(0.728)	(1.169)	(1.673)	(0.581)	(1.138)
Population	0.000	0.000**	0.000**	0.000	0.000	0.000***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Population	-0.000	-0.000***	-0.000***	-0.000	-0.000**	-0.000***
density	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Rainfall	-0.000	0.000	-0.000**	-0.000	-0.000	-0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Constant	-0.314	0.177	-0.150	0.049	-0.378**	0.284
	(0.367)	(0.161)	(0.258)	(0.522)	(0.181)	(0.355)
N	156	156	156	156	156	156
r2	0.501	0.749	0.769	0.517	0.847	0.791

	<b>Panel C: Internal &amp; External revenues</b>			<b>Panel D: Internal &amp; External revenues * Poverty rate</b>		
	% of HH with piped water	% HH with solid waste infrastructure	% HH with liquid waste infrastructure	% of HH with piped water	% HH with solid waste infrastructure	% HH with liquid waste infrastructure
	(1)	(2)	(3)	(1)	(2)	(3)
log	0.016	-0.005	0.030	-0.086	0.043**	-0.047
(Total IGF)	(0.040)	(0.017)	(0.027)	(0.058)	(0.021)	(0.039)
Log (External revenues)	0.036	-0.002	0.046***	-0.001	0.053***	0.018
(0.022)	(0.009)	(0.015)	(0.043)	(0.015)	(0.029)	
Poverty rate	-0.102	-0.052	0.031	-1.804*	1.558***	-1.262*
(0.129)	(0.056)	(0.088)	(0.986)	(0.349)	(0.663)	
Log (IGF)				0.275**	-0.105**	0.208**
* Poverty rate				(0.126)	(0.045)	(0.085)
Log (External revenue)				0.051	-0.150***	0.039
* Poverty rate				(0.120)	(0.042)	(0.080)
Log (Expenditure - Personal)	-0.006	0.004	-0.036**	0.000	0.003	-0.032**
(0.019)	(0.008)	(0.013)	(0.019)	(0.007)	(0.013)	
Log (Expenditure - Transport)	0.022	-0.018	0.018	0.029	-0.038***	0.024
(0.030)	(0.013)	(0.020)	(0.032)	(0.011)	(0.022)	
Log (Expenditure - General)	0.011	0.011	-0.040*	0.009	0.027**	-0.041*
(0.033)	(0.014)	(0.023)	(0.034)	(0.012)	(0.023)	
Log (Expenditure - Repairs)	-0.022	-0.003	-0.002	-0.023	-0.003	-0.002
(0.019)	(0.008)	(0.013)	(0.018)	(0.006)	(0.012)	
Log (Expenditure - Misc.)	-0.018	0.001	-0.019	0.005	-0.019**	-0.001
(0.023)	(0.010)	(0.016)	(0.025)	(0.009)	(0.017)	
Log (Expenditure - Capital)	-0.003	-0.001	0.002	0.006	-0.010***	0.009
(0.007)	(0.003)	(0.005)	(0.009)	(0.003)	(0.006)	
Urban rate	-0.299	0.222*	-0.529**	-0.152	0.224**	-0.418**
(0.295)	(0.128)	(0.203)	(0.297)	(0.105)	(0.200)	
Literacy rate	-0.231	0.022	0.064	0.053	0.011	0.278
(0.414)	(0.180)	(0.285)	(0.433)	(0.154)	(0.292)	
% of Christian	0.259	0.058	0.047	0.247	0.287	0.037
(0.508)	(0.220)	(0.349)	(0.526)	(0.186)	(0.354)	
% of Akan	0.075	-0.002	0.042	0.077	0.016	0.043

	(0.050)	(0.021)	(0.034)	(0.050)	(0.018)	(0.034)
% of Ewe	0.249	-0.093	0.059	0.204	-0.162	0.026
	(0.280)	(0.121)	(0.192)	(0.280)	(0.099)	(0.188)
% of traders	3.528*	-2.668***	5.568***	3.120*	-2.554***	5.260***
	(1.837)	(0.797)	(1.263)	(1.748)	(0.619)	(1.176)
Population	0.000	0.000**	0.000**	0.000	0.000	0.000***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Population density	-0.000	-0.000***	-0.000***	-0.000	-0.000**	-0.000***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Rainfall	-0.000	0.000	-0.000**	-0.000	-0.000	-0.000**
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Constant	-0.318	0.183	-0.174	0.166	-0.388**	0.194
	(0.382)	(0.166)	(0.263)	(0.510)	(0.181)	(0.343)
N	156	156	156	156	156	156
r <sup>2</sup>	0.491	0.748	0.774	0.576	0.860	0.820

Notes: OLS estimator. The corresponding table is Table 8.

**Table A.6: Effect of Revenue on Educational Outcomes (Full Specification)**

			Panel A: Total revenues					Panel B: Total revenues * Poverty rate				
Difference between t and (t-1)			Pupils Per Teacher Ratio	Pupils Per Trained Teacher Ratio	% of Schools with Drinking Water	% of Seating Places	% of Writing Places	Pupils Per Teacher Ratio	Pupils Per Trained Teacher Ratio	% of Schools with Drinking Water	% of Seating Places	% of Writing Places
			(1)	(2)	(3)	(4)	(5)	(1)	(2)	(3)	(4)	(5)
Difference (log (Total Revenues))			0.230 (0.319)	-2.068* (1.058)	-1.850** (0.808)	-0.010 (0.012)	-0.021* (0.011)	-0.662 (1.083)	-1.776 (4.271)	-2.907 (2.241)	-0.008 (0.031)	-0.035 (0.026)
Difference (log (total revenue))*Poverty rate								1.702 (2.416)	-0.560 (7.343)	2.011 (3.699)	-0.003 (0.046)	0.028 (0.036)
Lagged dependent variable			-0.476*** (0.063)	-1.182*** (0.084)	-0.471*** (0.047)	-0.831*** (0.042)	-0.830*** (0.036)	-0.482*** (0.066)	-1.182*** (0.084)	-0.472*** (0.047)	-0.831*** (0.042)	-0.831*** (0.036)
Constant			13.906*** (1.903)	66.509*** (4.391)	24.364*** (2.158)	0.622*** (0.031)	0.596*** (0.026)	14.106*** (1.972)	66.503*** (4.338)	24.434*** (2.166)	0.622*** (0.031)	0.597*** (0.026)
N			551	551	551	551	551	551	551	551	551	551
r2			0.191	0.607	0.216	0.522	0.523	0.194	0.607	0.216	0.522	0.523



Panel C: Internal &amp; External revenues

Panel D: Internal &amp; External revenues \* Poverty rate

Difference between t and (t-1)	Panel C: Internal & External revenues					Panel D: Internal & External revenues * Poverty rate				
	Pupils Per Teacher Ratio (1)	Pupils Per Trained Teacher Ratio (2)	% of Schools with Drinking Water (3)	% of Seating Places (4)	% of Writing Places (5)	Pupils Per Teacher Ratio (1)	Pupils Per Trained Teacher Ratio (2)	% of Schools with Drinking Water (3)	% of Seating Places (4)	% of Writing Places (5)
Difference (log (Total IGF))	-0.525 (0.343)	1.850 (1.268)	2.852*** (1.008)	-0.018* (0.009)	-0.006 (0.008)	0.549 (0.772)	4.669 (3.610)	4.713 (2.969)	-0.000 (0.026)	0.000 (0.008)
Difference (log (External revenue))	0.110 (0.313)	-2.489*** (0.578)	-2.208*** (0.785)	-0.005 (0.009)	-0.016* (0.008)	0.161 (1.222)	-2.606 (1.957)	-4.596** (2.197)	-0.001 (0.023)	-0.001 (0.008)
Difference (log (Total IGF)) * Poverty rate						-2.298 (1.561)	-5.992 (6.371)	-3.585 (5.501)	-0.039 (0.049)	-0.039 (0.049)
Difference (log (External revenue)) * Poverty rate						-0.139 (2.811)	0.122 (3.985)	4.558 (3.680)	-0.008 (0.037)	-0.008 (0.037)
Lagged dependent variable	-0.476*** (0.063)	-1.184*** (0.084)	-0.474*** (0.046)	-0.832*** (0.042)	-0.829*** (0.036)	-0.475*** (0.066)	-1.184*** (0.084)	-0.475*** (0.046)	-0.831*** (0.042)	-0.831*** (0.042)
Constant	13.966*** (1.909)	66.572*** (4.437)	24.362*** (2.131)	0.624*** (0.031)	0.595*** (0.026)	13.963*** (1.982)	66.590*** (4.442)	24.442*** (2.132)	0.624*** (0.031)	0.595*** (0.026)
N	551	551	551	551	551	551	551	551	551	551
r2	0.194	0.608	0.227	0.525	0.523	0.197	0.608	0.229	0.526	0.523

Notes: OLS estimator with district-year fixed effects. The corresponding table is Table 9.