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The impact of intergovernmental transfers on local revenue generation in Africa

Evidence from Tanzania

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Abstract: Do intergovernmental transfers reduce revenues collected by local government authorities (LGAs)? There is already a well-established body of literature in public finance, which argues that intergovernmental grants 'crowd out' local revenues. Most existing studies, however, explore the fiscal implications of intergovernmental transfers in high-income countries where sound fiscal systems are taken for granted. In this paper, I explore the impact of intergovernmental transfers on local revenues in sub-Saharan Africa, a region where local fiscal capacity is limited and endogenously determined by financial support from international donors and the central government. I argue that in places where the existing capacity of LGAs to administer tax collection is weak and political costs of enforcing taxation are low—which are perennial features of many rural districts in Africa—intergovernmental transfers facilitate local revenue generation instead of undermining it. Analysing newly available quarterly fiscal data on local revenues in Tanzania, I show that intergovernmental grants improve the mobilization of local revenues, and also that the positive effect of fiscal transfers on local revenue collection is particularly pronounced in rural districts.

Keywords: public finance, intergovernmental grants, crowding out, sub-Saharan Africa, fiscal capacity, tax collection, local revenues, Tanzania
JEL classification: H29, H41, H71, H79

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1 Introduction

> *The power to tax lies at the heart of state development. A moment's reflection on the history of today's developed countries and the current situation of today's developing nations suggests that the acquisition of that power cannot be taken for granted.*
>
> –Besley and Persson (2013: 51)

Since the early 1990s, many African countries have experimented with decentralization, or the devolution of fiscal and administrative duties to local government authorities (LGAs) (Dafflon and Madies 2013). As part of this decentralization process, LGAs have increasingly assumed the role of raising own revenues to finance their budgets and providing basic public services to their citizens. Most subnational governments in Africa, however, lack institutional capacity to collect local taxes and instead rely heavily on grants from the central government to keep themselves afloat (Shah 2006). Critics argue that while financial transfers from the central government help finance the provision of public service delivery, they can also obviate the need for local revenue generation, which in turn undermines the fiscal autonomy of subnational governments. There is a well-established body of literature in public finance suggesting that intergovernmental transfers have "crowding-out" effects on the generation of revenues at the local level, whereby the inflow of external transfers can sap the incentive for LGAs to collect their own dues (Buettner and Wildasin 2006; Zhuravskaya 2000; Bradford and Oates 1971a, 1971b).

Empirical evidence for the hypothesized negative linkage between intergovernmental grants and local revenues mainly derives from studies in countries *where sound fiscal institutions are already in place*. In most African countries, the administrative and institutional capacity of local governments to collect taxes and provide public goods is very limited, particularly in rural areas where geographical vastness, poverty, and low population density all make it extremely difficult for LGAs to collect taxes (Fjeldstad et al. 2014). The generation of local revenues requires robust monitoring and enforcement systems and qualified staff, who

are costly to employ and maintain (Besley and Persson 2013). Furthermore, fiscal policy is highly centralized and politicized such that political interference with local tax collection is prevalent in the African context (Kasara 2007; Lambright 2014; PMORALG 2013; Fjeldstad 2001).

A central argument of this paper is that when the existing fiscal capacity of local governments is weak and the political costs of enforcing tax collection are low—which are perennial features of rural districts in Africa—intergovernmental transfers *facilitate* local revenue generation. I posit that not only can fiscal transfers help rural LGAs to finance tax collection efforts and broaden the tax base, they can also facilitate the provision of public goods, which in turn improves voluntary tax compliance. In urban areas, on the other hand, the marginal positive effect of central government grants on local revenue generation is lower due to the existence of (relatively) robust fiscal institutions and higher political costs associated with increasing a tax burden on urban taxpayers who already feel overly taxed compared to rural residents (Resnick 2012).

Tanzania is an ideal country to study the link between intergovernmental grants and local revenues in the African context for a number of reasons. First, intergovernmental transfers make up a large proportion of local government budgets in Tanzania like many other countries in the region. In FY2012/2013, for instance, 91% of the local budget was financed through transfers from the central government. This number lies on a par with corresponding numbers from other African countries, such as Lesotho (90%), Uganda (88%), and Ghana (69%) (Fjeldstad and Heggstad 2012: 5). Thus, Tanzania is a representative case of countries in the region. Furthermore, as reported by the International Monetary Fund (IMF), "Tanzania is now considered to have one of the best PFM [public financial management] systems in sub-Saharan Africa" (Nord et al. 2009: 5). Most district councils in Tanzania now have computerized budget and accounting systems, and the Prime Minister's Office Regional Administration and Local Government (PMORALG) has published quarterly fiscal data on district-level expenditures and revenues on its website, which allows researchers

to empirically test the linkage between intergovernmental transfers and local revenues.

One of the issues that complicates the identification of causal impact of intergovernmental transfers on local revenues is that the amount of central government grants that a given district receives is likely to be endogenous to the district's fiscal capacity. To alleviate this concern, I employ the instrumental variable (IV) estimation, utilizing exogenous variation in precipitation and temperature as instruments for intergovernmental transfers. These climate variables are valid instruments for intergovernmental transfers because the allocation of transfers is determined partly based on agricultural productivity, which is exogenously determined by precipitation and temperature. Although the same climate variables are likely to directly affect local revenues by changing the amount of agricultural taxes being collected at the local level, they should have no such direct effect once those agricultural revenues are excluded from our analysis. PMORALG's new fiscal data—which are highly granular and can be disaggregated by type of revenues—allow me to actually remove agricultural taxes from the bucket of total revenues, which can then be used as the dependent variable in my IV estimation.

My empirical analysis shows strong evidence that intergovernmental transfers help expand local revenues, and that this positive effect of transfers on local revenues is particularly pronounced in rural areas. These findings are important on their own right and have broader implications for state building and fiscal capacity in Africa. State-building entails efforts on the part of the state to generate its own revenues from its citizens. Governmental accountability derives from a social contract between the state and taxpayers, whereby the former is held accountable by the latter for its performance.[1] The same story can be told for local governments, which have become the key provider of public services in Africa. The conventional wisdom in public finance suggests that reliance on external grants may undermine the fiscal autonomy of local governments. This study shows that the relationship between transfers and local revenues defies this prediction in the context where the existing fiscal capacity is

[1]See, for instance, Tripp (2013); Atunbas and Thornton (2012); Gadenne (2012); Fjeldstad et al. (2010); Lund (2007); Iversen et al. (2006); Moss et al. (2006); and Hoffman and Gibson (2005).

low or almost non-existent, like in many rural district councils in Africa.

This paper is organized in the following manner. In the following section (Section 2), I review the existing literature on the fiscal implications of intergovernmental transfers. In particular, I highlight how the existing models in public finance fail to capture the issues of fiscal capacity, an essential asset that local governments need to mobilize local revenues. Section 3 describes the data used in my empirical evaluation of the causal link between transfers and local revenue generation in Tanzania. Section 4 presents the main findings of my econometric analysis. Section 5 concludes by discussing the policy implications of this study's core findings.

2 Theory

2.1 Intergovernmental Transfers and Local Revenue Generation

For the past two decades, African governments and international donors alike have encouraged decentralization as a means to promote development.[2] Many of the key responsibilities previously vested in the central government have been discharged to local governments, which now play the leading role in public service delivery. These decentralization efforts have been motivated partly by the idea that LGAs are more responsive to local needs than the central government because they stay in close touch with their own constituencies, although empirical support for this line of logic has been mixed at best (e.g., Brollo et al. 2013; Olken 2007; Reinikka and Svensson 2005; Crook 2003; Tendler 1997).

Critics argue that intergovernmental transfers erode local fiscal autonomy because they can serve as substitutes for local tax revenues (e.g., Mogues and Benin 2012; Buettner and Wildasin 2006; Zhuravskaya 2000; Bradford and Oates 1971a, 1971b). Bradford and Oates (1971a, 1971b) offer a formal theory of how grants may affect fiscal performance at the

[2]The World Bank, for instance, has embraced decentralization as a key element of its developmental strategy since the late 1990s and funded projects that promote various aspects of the decentralization process (IEG 2008).

local level. Under the assumption that public and private incomes are fungible, they claim that unconditional intergovernmental grants free up extra resources for local governments to benefit individual citizens in the form of a lump-sum tax reduction, thus crowding out efforts to mobilize local revenues.

Empirical evidence for the crowding-out effects of central government grants has been far from conclusive. Analyzing fiscal data of individual municipalities across the U.S. for the period between 1972 and 1997, Buettner and Wildasin (2006) find that increases in central government grants do indeed lead to reductions in locally raised revenues. Zhuravskaya (2000: 338) finds a similar pattern in Russia, showing that "any change in a local government's own revenues is almost entirely offset by an opposite change in shared revenues," indicating that intergovernmental transfers serve as almost perfect substitutes for local revenues. In contrast, a number of other studies demonstrate that intergovernmental transfers tend to be used for public spending instead of tax reliefs—a phenomenon known as "flypaper effects" (see Rosen 2005; Hines and Thaler 1995). For instance, Dahlberg et al. (2008) study fiscal data in Sweden and find that transfers from the central government do not reduce local tax revenues, but instead increase local spending. Furthermore, recent studies (e.g., Caldeira and Rota-Graziosi 2014; Zhang 2013; Skidmore 1999) find "crowding-in" effects of intergovernmental transfers, whereby grants *expand* local tax revenues. In short, the literature has not reached any consensus on the relationship between transfers and local revenues.

2.2 Low Fiscal Capacity and the Politicization of Local Taxation in Africa

Most African countries in some way or another have embarked on the process of fiscal decentralization after years of economic stagnation and crisis in the 1980s. One of the key issues in applying the existing theories of public finance to Africa is that they often treat *fiscal capacity* as given (or exogenously determined). Fiscal capacity is defined as the extractive capacity of a government to raise tax revenues "*given* the structure of the tax system and its

available powers of enforcement" (Besley and Persson 2013: 52). As Bahl (2000) highlights, local governments in low-income countries tend to suffer from the lack of fiscal capacity. Consequently, they are much more dependent on central governmental grants to finance their budgets than subnational governments in high-income countries (Bahl 2000: 2). Africa has performed particularly poorly compared to the rest of the world in terms of the level of local revenue generation.[3]

I argue that the impact of central government grants on local revenues is contingent on two key factors: (1) the existing level of fiscal capacity at the local level and (2) political costs associated with tax collection. A notoriously weak capacity of fiscal and administrative institutions is a large part of the story behind the low level of local revenues in Africa. Collecting local taxes and fees can be very costly if monitoring and enforcement systems are not well established. Due to the poor quality of fiscal institutions, the costs of revenue collection can sometimes exceed the actual amounts of revenues collected in some localities (McCluskey and Franzsen 2005: 50). Scott (2009: 7) notes that in East Africa local governments do not necessarily have skilled government employees who have the "financial literacy" to "manage public finances and maintain proper accounting procedures." The collection of local revenues is "often poor and many bills go unpaid because taxpayers cannot be identified or they resist payment because their housing conditions are very poor or basic services and infrastructure are not provided to their areas" (Fjeldstad et al. 2014: 5).

When existing fiscal institutions are weak, intergovernmental transfers are conducive to facilitating revenue collection efforts. I identify two causal mechanisms through which financial support from the central government can facilitate revenue collection at the local level. First, central government grants help pay for the direct costs of revenue collection. One of the key roles that intergovernmental grants play is to finance the administrative and operational costs of LGAs (Fjeldstad et al. 2010: 3). Indeed, a large share of intergovern-

[3]Fjeldstad et al. (2014: 7) report that "[w]ith the exception of South Africa, the total local revenues in African countries in 1999 did not exceed 1% of the GDP compared to 5.5% of GDP on average for developing countries in other regions."

mental transfers goes to personal emolument and recurrent spending: that is, the payment of salaries and other benefits for civil servants and other administrative costs, which also include the costs of hiring qualified staffs and experts to administer tax collection (Nyange et al. 2014: 10). Furthermore, in many African countries, some transfers are specifically earmarked for the capacity building of fiscal management and tax administration (Cochran et al. 2009). In short, given that most LGAs lack sound fiscal institutions, they often rely on external transfers to fulfill their revenue collection responsibilities.

Second, and perhaps more importantly, central government grants directly finance the provision of public services, which in turn promotes voluntary tax compliance (Caldeira and Rota-Graziosi 2014; Bodea and LeBas 2016). LGAs are often financially incapable of providing basic public services without support from the central government. In fact, a number of studies suggest that dissatisfaction with the quality of local public services saps citizens' willingness to pay taxes and fees (e.g., Bodea and LeBas 2016; Ali et al. 2013; Fjeldstad and Semboja 2001; Kjaer 2005). Fiscal transfers create what Caldeira and Rota-Graziosi (2014: 367) refer to as "a virtuous circle" where "central grants increase local public spending, which [in turn] improves private income and/or voluntary tax compliance, and consequently local own revenue."[4]

LGAs' efforts to raise local revenues, however, are constrained by the political costs of enforcing tax collection. The enforcement of local taxation is often at odds with the political interests of elected public officials who seek to minimize a tax burden on their constituencies to garner political support (Enemu 2000; Fjeldstad 2001). Fjeldstad and Heggstad (2012: 25) note that politicians often put "political pressure on the local tax administration to relax on revenue collection," especially during election years. While intergovernmental grants can improve the baseline capacity of LGAs to mobilize local revenues through directly financing the local tax administration and public service delivery, political costs may be too high for

[4]Although Caldeira and Rota-Graziosi's analysis is exclusively focused on unconditional fiscal transfers—or grants that are not earmarked for specific purposes set by the central government—one may extend this line of logic to other types of central grants.

subnational governments to scale up such revenue collection efforts. In sum, I posit that the degree to which central government grants "crowd in" local revenues is determined by the interplay of the existing fiscal capacity at the local level as well as the political sensitivity (or cost) of tax enforcement.

My theoretical framework has different implications for urban and rural areas in Africa in terms of how central government grants may affect local revenues. In particular, I expect the marginal positive effect of transfers on local revenue generation to be greater in rural areas where the existing fiscal capacity of local governments and the political costs of tax enforcement are both low compared to urban areas. Tax collection in rural areas is particularly daunting because the existing institutional and administrative capacity to enforce it is remarkably low, which leaves a large swath of income or various economic activities untaxed (PMORALG 2002). In many African countries, spatial inequalities in income and institutional capacity have resulted in stark disparities between urban and rural LGAs in terms of the amount of revenues collected at the local level (Fjeldstad et al. 2014). Intergovernmental grants alleviate these issues associated with tax collection in rural areas because such grants financially enable rural LGAs to not only overcome cost hurdles for tax enforcement, but also to provide basic public services to meet the demands of citizens, which is a *sine qua non* for promoting voluntary tax compliance.

The link between intergovernmental transfers and local revenue generation is more nuanced in urban areas. Since urban LGAs on average raise higher local revenues than rural counterparts, which leaves lower margins of revenue growth in the former, the extent to which external grants can help further expand the urban revenue base is likely limited. In addition, since urban LGAs tend to rely less on external grants to finance their budgets (due to their higher existing fiscal capacity), such grants have less impact on public service delivery and, hence, on local revenue expansion in urban areas. There are diminishing returns to inputs invested in service provision (Caldeira and Rota-Graziosi 2014).[5]

[5]Resnick (2014: S11) notes that "[t]he city's high tax base...mitigates the potential impact that any type of reduced inter-governmental transfers has on service delivery."

Furthermore, the political costs of tax enforcement in urban areas are far greater than in rural areas because urban groups "can present a more credible threat of political unrest" to political leaders (Stasavage 2005: 344). Existing studies show strong evidence that policy makers in low-income countries exhibit a tendency to favor urban interests over rural counterparts.[6] Lipton (1971) and Bates (1981) both explain this urban bias as a function of the urban elites holding greater bargaining power to solicit policy concessions from the government. Urban residents are also better informed about the role and performance of their government authorities "due to greater average wealth, higher education, better access to the media as well as a stronger urban focus in media coverage" (Majumdar et al. 2004: 139). They leverage this information to pressure the government to adopt fiscal policy that better reflects urban interests. Rural residents often do not enjoy this informational advantage to press the government to heed their voices, thus yielding lesser political influence.

This imbalance between urban and rural residents in political salience and influence feeds into the calculus of fiscal policy in Africa. Expanding urban sources of local revenues is often not a politically viable option because doing so would instigate significant resistance from the urban elites. Take property tax, for instance. As Bahl and Bird (2008: 16) note, "the political costs of reliance on residential property taxes are so high that no government with access to politically 'cheaper' sources of finance will willingly do so." For this very reason, property taxes are very much underutilized in many African urban cities, while the academics argue that scaling up efforts to collect such untapped property taxes would significantly improve the fiscal health of urban district councils. In other cases, political leaders cut or abolish taxes to explicitly cater to the needs of urban residents. In Uganda, President Museveni removed the graduated tax, a type of income tax imposed on all adults, as part of his political campaign to appeal to urban voters whose support was critical to his political survival, although this policy significantly undermined the revenue-generating capacity of urban districts (Lambright 2014: S48).

[6]See Majumdar et al. (2004) for a review of the literature on the urban bias.

2.3 The Case of Tanzania

The process of fiscal decentralization has gained momentum in Tanzania since the government launched the Local Government Reform Program (LGRP) in the late 1990s. Before the program took off, the central government controlled all aspects of financial and human resources while leaving little role for local councils to play in planning and implementing fiscal policy. Partly driven by the increasing demand for more accountable and democratic systems at the local level, the LGRP has delegated many fiscal responsibilities previously vested in the central government to LGAs and made these sub-national government entities the main providers of basic public services.

One of the goals of the LGRP has been to "give LGAs wide discretionary powers and a strong financial base" because their own capacities to raise revenues are limited (Cochran et al. 2009: 19). Accordingly, the program has expanded the amount of central government grants allocated to local district councils. Sarzin and Raich (2012: 13) report that "[i]ntergovernmental transfers increased from 79 percent of total LGA revenues in 2001/02 to 93 percent in 2006/07 while own-source revenue decreased from 21 percent of total LGA revenues in 2001/02 to 7 percent in 2006/07."[7] Table 1 shows local government budgets for the period between FY2010/2011–FY2012/2013 in Tanzania. Locally raised revenues account for less than 10% of the local budget (Fjeldstad and Heggstad 2012). These transfers are allocated according to a formula-based mechanism, which takes into account various socio-economic factors such as the size of population, area, poverty, as well as access to health facilities (Boex and Martinez-Vazquez 2006).

One of the key factors in the low level of local revenue generation in Tanzania lies in the

[7]The sharp decline in the share of own revenues is mainly driven by two different factors. First, the amount of intergovernmental transfers increased not only as a portion of total local revenues but also in absolute amounts, which pushed the share of own revenues in total local revenues down. Second, as part of the nationwide tax reform, the government abolished the "head tax" as well as "nuisance taxes" while also limiting the produce cess "to a maximum of 5% (compared to rates as high as 20% in the past)" (Nyange et al. 2014). These measures not only simplified the local tax system but also narrowed the set of taxes that each LGA could tap into, pushing it to instead broaden the tax base for authorized local taxes and collect revenues in a more efficient and effective way.

Table 1: Local Government Revenue Sources (in billions of Tanzania shillings) for FY2010/2011–FY2012/2013$^{\alpha}$

Fiscal Year	2010/2011	2011/2012	2012/2013.
Total Revenues	2,251	2,439	2,988
Intergovernmental Transfers	2,084	2,243	2,733
Own Revenues	158	195	240
Intergovernmental Transfers as % of Total Revenues	92.59%	91.97%	91.47%
Own Revenues as % of Total Revenues	7.03%	8.02%	8.06%

α: Fiscal year in Tanzania starts on July 1 and ends on June 30.
Source: Author's calculations from PMORALG's financial data (`http://lginf.pmoralg.go.tz/lginformation/`)

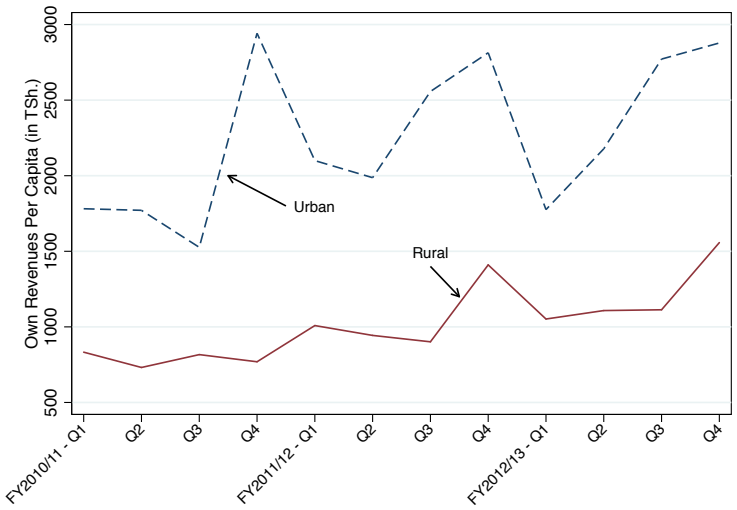
absence of sound fiscal institutions at the local level. There has been a perennial shortage of tax evaluators/collectors in the local tax administration. LGAs in Tanzania also lack the capacity to monitor and penalize tax evasion or non-compliance (Venugopal and Yilmaz 2010: 222). While the beneficiaries of public service are supposed to pay user charges, the level of compliance with the payment of such dues tends to be low due to the poor quality of services provided and inefficiency in the local tax administration (Fjeldstad and Heggstad 2012: 21–22). In fact, as Therkildsen (1993: 86) points out, local governments in Tanzania (and other countries in Anglophone East Africa) have historically suffered from a lack of legitimacy, whereby their constituencies view them as "corrupt, inefficient, a waste of time—and 'foreign'."

In Tanzania, like elsewhere in the region, the collection of local revenues has been particularly challenging in rural areas. Figure 1 shows district-level, local revenues per capita from FY2010/2011 to FY2012/2013. Urban district councils collect far greater revenues (both in absolute and per capita terms) than rural district councils because the former enjoy a broader tax base and higher administrative and institutional capacity than the latter (UNICEF 2012; World Bank 2006).[8] A large share of local revenues generated in urban district councils derives from taxes on business and corporate activities (e.g., service levy), while the agricultural produce cess is the predominant source of revenues for rural LGAs (see

[8] Aiko (2013) also shows that there is a high disparity between urban and rural areas in Tanzania in terms of the awareness of tax obligations where rural residents are less informed and thus less aware of their tax obligations than urban residents.

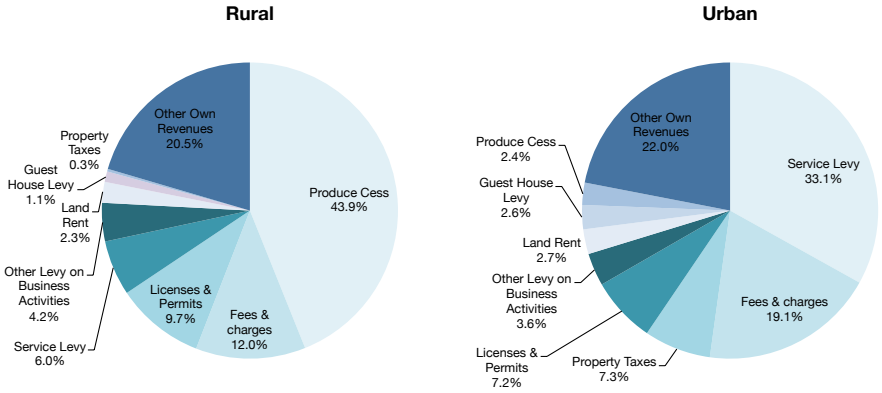
Figure 2). Nyange et al. (2014: iv) note that "[m]uch potential cess revenue goes uncollected" due to "limited human and institutional capacity at local level and widespread tax evasion, some of it likely featuring the collaboration of some local officials."

Figure 1: The Level of Own Revenue Collection: Urban vs. Rural



Source: Author's construction based on PMORALG's financial data (`http://lginf.pmoralg.go.tz/lginformation/`)

Figure 2: The Sources of Own Revenues



Source: Author's construction based on PMORALG's financial data (`http://lginf.pmoralg.go.tz/lginformation/`)

3 Econometric Models

To empirically test the relationship between intergovernmental transfers and local tax revenues, I use district-level, quarterly data on local revenues and spending in Tanzania between FY2010/2011 and FY2012/2013, which are made available online by PMORALG. The first set of models estimates the impact of intergovernmental transfers on local revenues in the following equation, which is a simple Ordinary Least Squares (OLS) model:

$$\text{OWN REVENUE}_{i,t} = \beta_1 \text{ TRANSFER}_{i,t-1} + \gamma \mathbf{X}_{i,t} + \phi_i + \epsilon_{i,t} \tag{1}$$

where i and t index district i and quarter t, respectively; OWN REVENUE refers to the volume of local revenues per capita (log-transformed); TRANSFER denotes the size of intergovernmental transfers per capita (log-transformed); $\mathbf{X}_{i,t}$ includes all observable controls; and ϕ_i is a district-specific effect.[9] TRANSFER is lagged one period because its effect on local revenues is likely to operate with some temporal lag.

A battery of control variables are included to alleviate omitted variable bias. Intergovernmental transfers are allocated based on socio-economic factors, which, in turn, affect the level of local revenues (Boex and Martinez-Vazquez 2006). The subnational level of income is one such potential confounder. Following various other scholars (e.g., Shortland et al. 2013; Ghosh et al. 2010; Sutton et al. 2007), I use the district-level, annual sum of nighttime light per capita (as recorded in 2010, 2011, and 2012) as a proxy for the subnational level of income. In addition, geographical factors may play a role in determining the extent to which LGAs can tap into their own revenue sources. I expect that as the size of geographical areas that LGAs govern increases and the total length of roads in each district (given its size) decreases, the cost of administering revenue collection rises. Thus, I include the size

[9]In the calculation of OWN REVENUE, I exclude Local Government Capital Development Grants (LCDGs). Including the LCDGs in my analysis introduces issues of reverse causality because this particular type of grant is allocated based explicitly on LGAs' fiscal performance, which includes local revenue mobilization as one of the key criteria to qualify for the grant (PMORALG 2008: 7). The LGCDG accounts for roughly a 5% of the total transfers made during FY2010/11–FY2012/13. My empirical findings do not significantly change even if the LGCDG is included in the calculation of OWN REVENUE.

of land (in km^2, log-transformed) for each district (AREA) and the length of roads (in Km, log-transformed) as additional controls. Lastly, I also control for the share of presidential votes for the incumbent (SUPPORT) to capture electoral dynamics, which are known to affect the quality of public service (Rosenzweig 2015) (and, for that reason, the level of local taxes) as well as the flow of transfers (Allers and Ishemoi 2011).

Our OLS estimates of the effect of transfers on local revenues are likely to be biased because the flow of intergovernmental transfers is expected to be endogenous to local revenues. Simply lagging the level of transfers does not alleviate concerns with endogeneity or reverse causality because there are a number of potential unobservable variables that may be persistent over time, which would confound the relationship between the dependent variable and the lagged endogeneous variable (Bellemare et al., forthcoming). To alleviate concerns with endogeneity, I use the level of precipitation (in mm, log-transformed) and air temperature (in celsius, log-transformed) (which are referred to as PRECIP and TEMP in the models, respectively) as instruments for intergovernmental transfers.

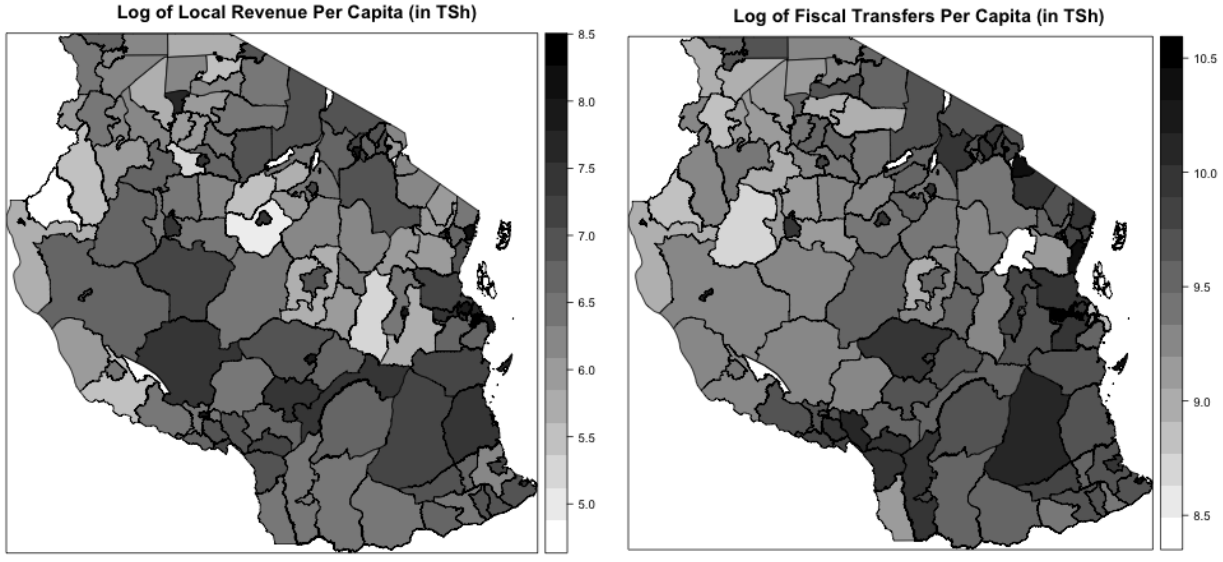
Sanoh (2015) shows that climate variables (e.g., precipitation) are exogenous shocks that impact both local revenues and the flow of intergovernmental transfers because they affect agricultural yields, which are a function of climate factors. The Government of Tanzania (GoT) indeed explicitly links the amount of transfer allocation to agricultural and climate factors (e.g., rainfall) (Tanzania Ministry of Finance 2011). I argue that these same climate variables should serve as valid instruments for OWN REVENUE *when all agricultural taxes are removed from our IV analysis*. Since the climate variables affect local revenues mainly through their direct impact on the amount of agricultural taxes collected at the local level (Sanoh 2015), removing the agricultural cess from OWN REVENUE ensures that they fulfill the exclusion restriction.[10] Figure 3 shows spatial variation in the quarterly average amount

[10]It is plausible that climate shocks (e.g., droughts) may significantly affect farmers' propensity or ability to pay taxes by changing their income levels (Burke et al. 2015; Fjeldstad and Semboja 2001). In my econometric analysis, I consider this possibility and run a robustness check to evaluate if my findings are sensitive to the incidence of such climate shocks (and their potential impact on rural income and local revenues). My main conclusions do not change when drought-afflicted districts are excluded from my analysis.

of local revenues and intergovernmental transfers per capita across districts for the period of FY2010/11–FY2012/13, and Figure 4 presents the monthly average level of precipitation and air temperature in each district for the same time period.

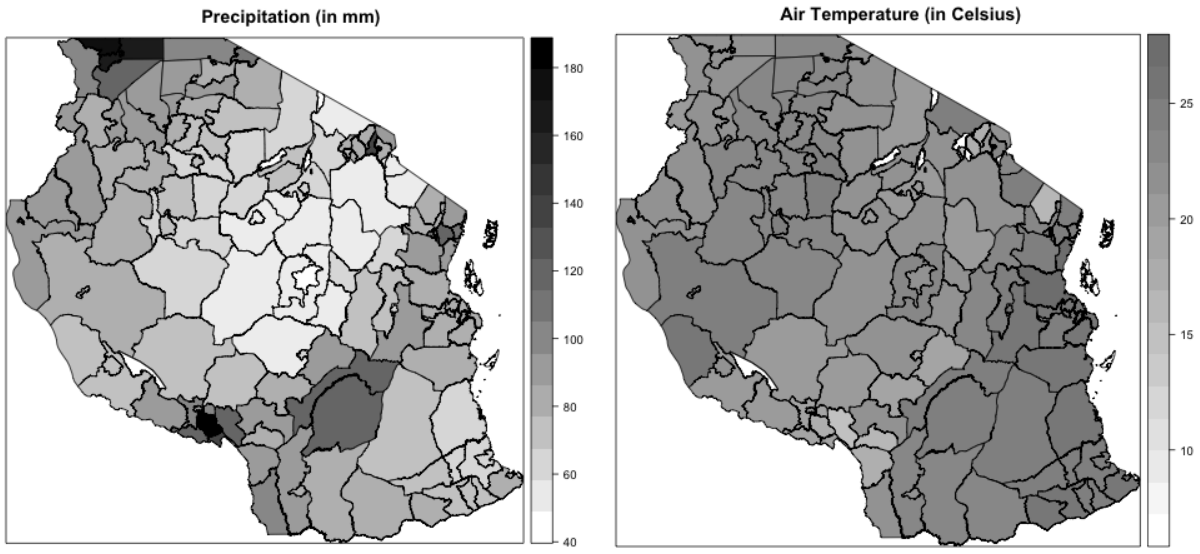
Additionally, I use distance (in km) from Dar es Salaam, a *de facto* capital of the country, as another instrument for central governmental grants (DISTANCE). Gisselquist et al. (2016) show that distance from the national capital is an exogenous variable that influences how much grant each district receives from the central government. The closer local communities are to the capital, the more they are expected to enjoy bargaining power to attract money from the center. There is no theoretical reason to believe, however, that distance itself affects the extent to which local governments can mobilize local revenues. The institutional and administrative capacity of local governments in collecting taxes should not be directly linked to how far they are from Dar es Salaam. Based on this line of logic, distance should meet the exclusion restriction. Table A-1 gives the descriptive statistics of all the variables described above.

Figure 3: Local Revenues and Intergovernmental Transfers at the District Level



Source: Author's own construction based on PMORALG's financial data (`http://lginf.pmoralg.go.tz/lginformation/`)

Figure 4: Precipitation and Air Temperature at the District Level



Source: Author's own construction based on the 'UDel' (University of Delaware) data set, a gridded monthly temperature and precipitation data set (Matsuura and Willmott 2015)

The second set of models explores the dynamic relationship between transfers and local revenues by introducing the lagged dependent variable in the right-hand side of the equation. A dynamic model may be more appropriate for this analysis because the level of tax revenue collection is likely to be highly persistent over time. It is reasonable to assume that the current level of local revenues depends on tax collection efforts made in the past, and the following equation captures this dynamic:

$$\text{OWN REVENUE}_{i,t} = \alpha_0 + \alpha_1 \text{OWN REVENUE}_{i,t-1} + \beta_1 \text{TRANSFER}_{i,t-1} + \gamma \mathbf{X}_{i,t} + \epsilon_{i,t} \tag{2}$$

Equation 2 produces biased estimates if there is residual autocorrelation (Keele and Kelly 2006) and/or if there are endogenous variables on the right-hand side of the equation. To account for these potential sources of bias, I employ both the Arellano-Bond (1991) difference Generalized Method of Moments (GMM) estimators and the Blundell-Bond (1998) system GMM estimators. The Arellano-Bond difference GMM estimators use lagged levels of the

endogenous regressors as instruments for their first-differences given the assumption that the lagged levels are correlated with the first-differences of the endogenous variables, but not with their error terms. If the correlation between the endogenous regressors and their first-differences is weak, however, the difference GMM estimators suffer from inefficiency (Blundell and Bond 1998). The system GMM estimation alleviates the issues of weak instruments by further exploiting both the lagged differences of the endogenous variables *and* the lagged levels of the equation as instruments; however, it imposes the additional moment restriction that the lagged levels are not correlated with the fixed effects, which is often an untenable assumption (Hahn and Hausman 2002). Given the advantages and disadvantages of each estimation strategy, I use both the difference and system GMM approaches to test the robustness of my findings. For each approach, I report results from the one-step and two-step GMM estimation.[11]

To show the validity of instruments, I report the p-value from the Hansen J test and the difference-in-Hansen test. The null hypothesis of the former test is the joint exogeneity of all instruments, while that of the latter is the joint exogeneity of additional instruments (e.g., GMM-type instruments for levels) used in the system GMM estimation (Murtin and Wacziarg 2014; Roodman 2009). As Roodman (2009) points out, the p-value associated with the Hansen tests becomes inflated (sometimes approaching 1.00) when there are too many instruments that overfit the endogenous variables. Since the number of time periods in my panel (T=12) is relatively large, my models would be subject to the problem of instrument proliferation if all lags are exploited as instruments. Following Roodman's (2009) suggestion, I restrict the maximum lag of GMM-style instruments to 2 to avoid the inclusion of too many instruments. I treat OWN REVENUE$_{t-1}$ and TRANSFER$_{t-1}$ as endogenous and generate the GMM-type instruments for these two variables.

[11]The two-step GMM estimators are said to be asymptotically efficient and robust to heteroskedasticity and cross-correlation although they are also criticized for introducing downward bias in standard errors. To correct for this potential bias, robust standard errors for two-step estimation are corrected for finite sample using Windmeijer's (2005) correction.

4 Estimation Results

Table 2 presents main results. I find that intergovernmental transfers increase local revenues, and that this effect seems to be more pronounced in rural district councils. Models 1–3 employ the pooled OLS regression while Models 4 and 5 include district-fixed effects. In Models 6–9, we use the climate variables to instrument TRANSFER, and Models 8 and 9 adopt the IV estimation that also accounts for district-fixed effects. The results from the first-stage regressions are presented in Table 3. The F test of the excluded instruments (PRECIP, TEMP, and DISTANCE) shows that they jointly have significant impact on the flow of intergovernmental transfers both in the subsamples of rural and urban LGAs.[12] The climate variables and distance are particularly strong predictors of transfer flows in the subsample of rural LGAs (see the first column in Table 3). The Hansen J test fails to reject the null hypothesis of the joint exogeneity of instruments except for Model 7 (p-value$<$0.01). Across all these models, the estimated effects of TRANSFER are positive and significant in the subsample of rural LGAs in Table 2. It is important to also note that these effects are consistently greater in magnitude in rural LGAs compared to urban LGAs. More substantively, our IV estimation shows that a 1% change in TRANSFER leads to roughly a 1.7% increase in OWN REVENUE in rural areas and a 0.8% increase in urban areas (based on Models 8 and 9).

Table 4 summarizes results from the difference and system GMM models.[13] I find a similar pattern as observed in Table 2. The Hansen J test fails to reject the null of the joint exogeneity of all instruments across Models 1–8 (p-value$>$0.10), which shows strong evidence that my instruments are valid. The difference-in-Hansen test also indicates that the GMM-type instruments for OWN REVENUE$_{t-1}$ and TRANSFER$_{t-1}$ are also valid (p-value$>$0.10).[14]

[12]Note that DISTANCE is not included as an instrument in Models 8 and 9 because these two models account for district-fixed effects and drop all variables that do not vary over time.

[13]The dependent variable in our GMM models does not include agricultural taxes so as to alleviate issues related to endogeneity. See my discussion on the issue of endogeneity in Section 3.

[14]It should be noted that in the subsample of urban districts, the N of Instruments exceeds the number of districts and is likely to inflate the p-value for the Hansen J test and the difference-in-Hansen test (Roodman 2007). Thus, the test results should be treated with caution.

The estimated effects of TRANSFER are once again all positive and significant for the subsample of rural LGAs while the effects are positive but do not reach statistical significance at the conventional level for the subsample of urban LGAs.

Table 2: The Effect of Intergovernmental Transfers on Own Revenue Generation

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Model	Pooled	Pooled	Pooled	FE	FE	IV	IV	IV+FE	IV+FE
DV	All	All	All	All	All	Excl. Ag. Taxes	Excl. Ag. Taxes	Excl. Ag. Taxes	Excl. Ag. Taxes
Subsample	All	Rural	Urban	Rural	Urban	Rural	Urban	Rural	Urban
TRANSFER_{t-1}	0.290***	0.487***	0.115	0.266***	0.134**	1.408***	-0.435	1.734***	0.802***
	(0.070)	(0.075)	(0.076)	(0.076)	(0.054)	(0.317)	(0.384)	(0.337)	(0.296)
LIGHT	0.084***	0.039	0.520***			0.028	0.816***		
	(0.025)	(0.025)	(0.145)			(0.031)	(0.167)		
AREA	-0.153**	0.016	0.005			0.079	-0.134		
	(0.068)	(0.084)	(0.109)			(0.104)	(0.175)		
ROAD	-0.020	0.000	-0.098			-0.083	-0.052		
	(0.120)	(0.116)	(0.250)			(0.163)	(0.310)		
SUPPORT	-0.182	-0.113	-0.775			-0.597	-0.403		
	(0.480)	(0.402)	(1.006)			(0.504)	(1.005)		
District Fixed Effects	No	No	No	Yes	Yes	No	No	Yes	Yes
N	1,367	987	380	987	380	949	365	949	365

Notes: Standard errors are clustered by district and reported in parentheses. *** p<0.01, ** p<0.05, * p<0.1.
Sources: Author's estimation based on PMORALG's financial data (`http://lginf.pmoralg.go.tz/lginformation/`), the 'UDel' precipitation and temperature dataset Matsuura and Willmott (2015), the National Oceanographic and Atmospheric Agency's (NOAA) nighttime light dataset, the Socioeconomic Data and Applications Center's (SEDAC) Global Roads Open Access Data Set (Version 1), the National Electoral Commission of Tanzania, and Global Administrative Unit Layers (GAUL) (`ftp://128.239.103.87/boundaries/GAUL/byCountry_wo_adm2_duplicates/`).

Table 3: First-Stage Regression Results for Models 6–9 in Table 2

	(6)	(7)	(8)	(9)
Model	IV	IV	IV+FE	IV+FE
Subsample	Rural	Urban	Rural	Urban
PRECIP_{t-1}	0.023	-0.053	0.028	-0.049
	(0.021)	(0.034)	(0.019)	(0.051)
PRECIP_{t-2}	0.031	-0.009	0.035*	-0.014
	(0.020)	(0.027)	(0.018)	(0.034)
PRECIP_{t-3}	0.035**	0.002	0.037**	0.012
	(0.016)	(0.021)	(0.015)	(0.049)
PRECIP_{t-4}	0.036**	0.014	0.047***	0.022
	(0.015)	(0.029)	(0.015)	(0.046)
TEMP_{t-1}	0.392	1.593**	0.715*	0.800
	(0.346)	(0.707)	(0.375)	(1.775)
TEMP_{t-2}	-0.952***	-2.043**	-0.484	-2.615
	(0.347)	(0.795)	(0.408)	(1.919)
TEMP_{t-3}	1.052***	2.144***	1.413***	1.262
	(0.325)	(0.661)	(0.363)	(1.863)
TEMP_{t-4}	-0.684**	-1.999**	-0.198	-2.725*
	(0.309)	(0.753)	(0.367)	(1.516)
DISTANCE	-0.001***	0.000		
	(0.000)	(0.000)		
LIGHT	0.007	0.096		
	(0.016)	(0.065)		
AREA	-0.076*	-0.253***		
	(0.043)	(0.088)		
ROAD	-0.018	0.132		
	(0.062)	(0.158)		
SUPPORT	0.086	2.136***		
	(0.251)	(0.553)		
F test of excluded instruments (*p*-value)	0.000	0.000	0.000	0.001
Kleibergen-Paap LM test (*p*-value)	0.000	0.012	0.001	0.011
Hansen J test (*p*-value)	0.188	0.009	0.129	0.610

Notes: See Table 2.
Sources: See Table 2.

I subject my findings to a number of different robustness tests. The first test addresses concerns with the quality of the quarterly fiscal data published by PMORALG. It is plausible that this data suffers from measurement or data imputation errors because the reporting of

Table 4: Results from GMM Estimation

Models	(1) Diff. GMM One-Step	(2) Diff GMM One-Step	(3) Diff. GMM Two-Step	(4) Diff. GMM Two-Step	(5) Sys. GMM One-Step	(6) Sys. GMM One-Step	(7) Sys. GMM Two-Step	(8) Sys. GMM Two-Step
Subsample	Rural	Urban	Rural	Urban	Rural	Urban	Rural	Urban
TRANSFER_{t-1}	0.422***	0.132	0.479***	0.147	0.356***	0.121	0.309***	0.172
	(0.149)	(0.153)	(0.177)	(0.240)	(0.093)	(0.078)	(0.104)	(0.130)
LIGHT					0.025	0.262	-0.028	0.028
					(0.121)	(0.159)	(0.109)	(0.340)
AREA					-0.194	-0.102	-0.176	2.034
					(0.349)	(0.235)	(0.385)	(2.375)
ROAD					0.307	-0.215	0.354	-3.108
					(0.555)	(0.349)	(0.644)	(3.442)
SUPPORT					-2.844*	-0.671	-2.709	-1.260
					(1.699)	(1.282)	(1.938)	(5.370)
OWN REVENUE_{t-1}	0.202**	0.210*	0.250***	0.230	0.117	0.125	0.149	0.177
	(0.078)	(0.118)	(0.083)	(0.158)	(0.079)	(0.092)	(0.096)	(0.145)
AR1 (p-value)	0.000	0.000	0.000	0.008	0.000	0.000	0.000	0.006
AR2 (p-value)	0.062	0.648	0.114	0.625	0.170	0.921	0.217	0.598
Hansen J test (p-value)	0.106	0.780	0.106	0.780	0.186	1.000	0.186	1.000
Diff. in Hansen test (p-value)					0.646	1.000	0.646	1.000
N of Instruments	46	46	46	46	68	68	68	68
N of LGAs	94	37	94	37	87	37	87	37
N	791	295	791	295	932	355	932	355

Notes: Robust standard errors are reported in parentheses. For two-step results, robust standard errors are corrected for finite sample using Windmeijer's (2005) correction. GMM-style instruments are used in combination with the external instruments. *** p<0.01, ** p<0.05, * p<0.1.
Sources: See Table 2.

fiscal performance at the subnational level on the quarterly basis is a fairly recent endeavor that LGAs have undertaken only in the past few years. While there is no effective way to confirm the accuracy of the data itself, I attempt to reduce the noise in the data that derives from measurement or reporting errors by using the *annual* data on local revenues and intergovernmental transfers. Aggregating the quarterly data to the annual level certainly is not a panacea for data quality issues but it at least ensures that my findings are not an artifact of measurement errors associated with the quarterly data, which can be alleviated by aggregation. My main conclusions remain intact if the annual aggregate fiscal data are used instead of the quarterly fiscal data (see Table A-2).

I also include quarterly dummies to account for the cyclical patterns of tax collection efforts. Some taxes (e.g., civil service levy) are collected on a quarterly basis while other types of taxes (e.g., business license fees, land rent, property tax) are collected only annually. This cyclical nature of local tax collection may also be correlated with the timing of central grant transfers whereby temporal dynamics can potentially be a confounder. I replicate Models 1–9 in Table 2 with quarterly dummies to check if my main findings remain robust to controlling for temporal dynamics. My results do not change significantly after controlling for such temporal or cyclical dynamics (see Table A-3).

My IV estimation rests on the assumption that the climate variables affect local revenues only through their impact on central grants. However, it is possible that if there are strong income shocks driven by significant climate events (e.g., droughts), these shocks may also affect farmers' ability or propensity to pay taxes (Aikaeli 2010). If this proposition holds true, the climate variables do not meet the exclusion restriction.[15] To ensure that my findings are not sensitive to these significant climate events in my data, I replicate my IV estimation reported in Model 8 in Table 2 but exclude those rural districts that experienced droughts in the current or previous fiscal year, where such rainfall shocks may have significantly undermined farmers' income.[16] My findings again remain robust to the exclusion of drought-afflicted districts (see Table A-4).

Lastly, I examine if my findings are sensitive to the N of Instruments used in the GMM estimation. As highlighted above, if the N of Instruments is too many, the diagnostic tests like the Hansen J test or the difference-in-Hansen test fail (Roodman 2009).[17] The parameter estimates also suffer from bias as "[s]imply by being numerous, instruments can overfit instrumented variables, failing to expunge their endogenous components and biasing coefficient estimates towards those from non-instrumenting estimators" (Roodman 2009: 139). To evaluate the sensitivity of my findings, I replicate Models 1–8 in Table 4 using (1) a single lag of the endogenous variables (OWN REVENUE$_{t-1}$ and TRANSFER$_{t-1}$) and (2) a full set of lags. The results from these re-defined GMM models are akin to what I find in Table 4 (see Table A-5).

Figure 5 summarizes my main findings from all the models presented in Tables 2 and 4. One clear pattern that emerges in the figure is that the effects of TRANSFER are almost

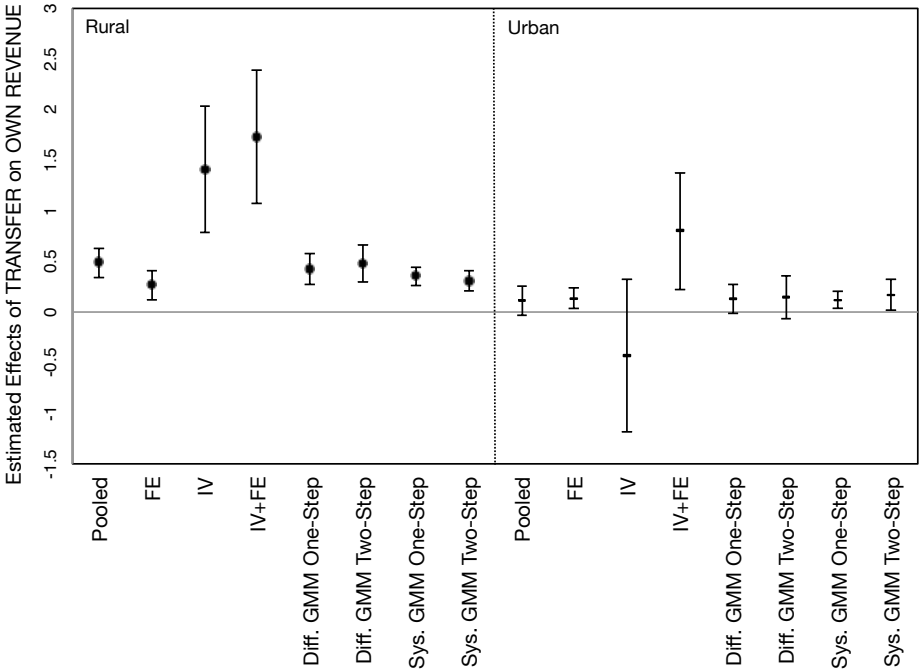
[15] In 2008/09 and 2010/11, droughts hit farmers and patoralists in Northern Tanzania (and elsewhere in East Africa) (Goldman et al. 2016).

[16] I follow Burke et al. (2015) in defining a drought as a rainfall realization below a certain quantile of a historical rainfall distribution in a given district. I use the 5%, 15%, 25%, and 35% quantiles as thresholds to determine the events of droughts. The historical rainfall distribution was derived from district-level rainfall data for the period between 1900 and 2014 (for which rainfall data are available).

[17] While there is no consensus on what constitutes the optimal number of instruments, "a rule of thumb is to keep the N of Instruments below the number of cross-section units in a panel" (Heckelman and Wilson 2014: 446).

always *positive*, regardless of whether it is in rural or urban LGAs. Furthermore, rural LGAs seem to enjoy a greater dividend from intergovernmental transfers in generating their own revenues. In almost all the models that I test, the estimated effects of TRANSFER in rural areas are at least twice as large (in magnitude) as the corresponding effects in urban districts. These findings are consistent with my prediction that transfers have greater positive impact on revenue generation in rural areas whose existing fiscal capacity and political costs of tax enforcement are much lower compared to urban areas.

Figure 5: The Estimated Effects of TRANSFER on OWN REVENUE: Rural and Urban LGAs in Comparison



Notes: Author's own construction. The figure is generated based on the results in Tables 2 and 4. The vertical bars correspond to the 95% confidence intervals around each estimated effect of TRANSFER on OWN REVENUE.
Sources: See Table 2.

5 Conclusion

For the past two decades, international donors have praised efforts towards fiscal decentralization as one of the key policy prescriptions to address issues related to poor public service provision and poverty in Africa. Some real progress has been made in this area with many key responsibilities of the central government (e.g., providing public service, collecting taxes) devolved to lower tiers of the political system. However, most LGAs are still financially weak and rely excessively on support from the central government to finance their budgets. Various scholars claim that such intergovernmental transfers may obviate the need for local revenue generation and thus undermine the fiscal autonomy of LGAs (e.g., Mogues and Benin 2012; Buettner and Wildasin 2006; Zhuravskaya 2000). Although there has been some empirical support for the potential "crowding-out" effects of fiscal transfers, however, most of the existing studies are focused on developed countries where sound fiscal capacity already exists at the local level. In fact, few scholarly efforts have been made to empirically test the fiscal implications of intergovernmental transfers in the context of low-income countries—and Africa, in particular.

I argue that intergovernmental transfers play an integral role in facilitating the mobilization of local revenues in Africa where local governments lack the internal capacity to raise their own revenues. LGAs are financially weak and cannot hire qualified staff or purchase equipment necessary for the collection of taxes and fees. They also rely on financial transfers from the central government to provide public services, which, in turn, generates further local revenues through promoting voluntary tax compliance. Using quarterly fiscal data on local government revenues and expenditures in Tanzania, my empirical findings demonstrate that intergovernmental transfers actually *increase* local revenues, which runs directly counter to the hypothesized "crowding-out" effects of financial transfers, and that this positive effect is more pronounced in rural districts.

The issues of fiscal capacity are largely ignored in the existing literature on intergovernmental transfers and local revenues. Scholars often take for granted the capacity of local

governments to extract revenues if they want to do so. In Africa, intergovernmental transfers account for a significant proportion of the local budget, in which case the functionality of the local tax administration also depends crucially on financial support from the center. Without financial support from the central government, LGAs cannot maintain and/or improve their fiscal systems and are thus unable to expand the tax base. While some claim that intergovernmental transfers undermine the fiscal autonomy of local governments, it should be emphasized that these transfers may also provide LGAs with strong incentives to generate more local revenues, through improving their capability to deliver public services and also strengthening their institutional capacity to collect taxes/fees.

Attributing the low level of local revenue collection efforts in Africa to over-reliance on the central government misplaces the fundamental cause of the problem in a symptom of the problem itself. Scholars and policy makers alike often paint a bleak picture that the central government's efforts to help LGAs financially come at the cost of reducing incentives for local revenue mobilization. In many African countries, however, LGAs have never developed the fiscal capacity to effectively raise their own revenues. Endowing LGAs with financial capacities to respond to the needs of their constituencies is essential in improving government accountability as well as establishing citizens' trust in local governments. In this respect, central grants can play an essential role in improving the fiscal capacity and autonomy of LGAs. Thus, my empirical findings call for a more nuanced analysis of the relationship between intergovernmental grants and local revenues by shedding light on the potential positive effect of such grants on the fiscal capacity of local governments.

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Appendix A Descriptive Statistics and Data Sources

Table A-1: Descriptive Statistics

Variable Names	Description	N	Mean	Std. Dev.	Min	Max	Sources
OWN REVENUE	Log of own revenues per capita (in TSh)	1367	6.671	0.933	3.054	9.325	A
TRANSFER	Log of transfers per capita (in TSh)	1367	9.533	0.579	6.180	14.316	A
LIGHT	Log of (1+nighttime light) per capita	1367	-7.076	2.062	-13.149	-4.226	B
DISTANCE	Distance from Dar es Salaam (in km)	1367	546.200	275.675	0.000	1084.776	C
AREA	The size of area (in km^2)	1367	8.183	1.388	4.149	10.824	C
ROAD	Log of road length (in km)	1367	6.199	0.889	2.941	8.271	D
SUPPORT	Share of presidential votes for the incumbent	1367	0.659	0.125	0.311	0.916	E
PRECIP	Log of precipitation (in mm)	1350	3.820	1.527	-4.094	5.946	F
TEMP	Log of temperature (in celsius)	1356	3.096	0.166	1.512	3.370	F

Sources:
A: PMORALG (`http://lginf.pmoralg.go.tz/lginformation/`)
B: The National Oceanographic and Atmospheric Agency (NOAA) (`http://ngdc.noaa.gov/eog/dmsp/downloadV4composites.html`)
C: Computed based on Global Administrative Unit Layers (GAUL) (`ftp://128.239.103.87/boundaries/GAUL/byCountry_wo_adm2_duplicates/`)
D: The Socioeconomic Data and Applications Center (SEDAC) (`http://sedac.ciesin.columbia.edu/data/set/groads-global-roads-open-access-v1`)
E: The National Electoral Commission of Tanzania
F: The 'UDel' temperature and precipitation dataset Matsuura and Willmott (2015)

Appendix B Robustness Tests

Table A-2: The Effect of Intergovernmental Transfers on Local Revenue Generation Using Annual Fiscal Data

	(1)	(2)	(3)	(4)
Models	Pooled	Pooled	IV	IV
Subsample	Rural	Urban	Rural	Urban
$TRANSFERS_{t-1}$	0.781***	0.190	1.454***	-1.063
	(0.166)	(0.284)	(0.485)	(0.941)
LIGHT	0.057**	0.503***	0.049	0.835***
	(0.027)	(0.149)	(0.039)	(0.218)
AREA	0.071	0.053	0.055	-0.293
	(0.095)	(0.139)	(0.123)	(0.308)
ROAD	0.033	-0.152	-0.084	-0.028
	(0.117)	(0.246)	(0.168)	(0.400)
SUPPORT	-0.594	-0.887	-0.899*	0.616
	(0.443)	(1.046)	(0.537)	(1.335)
N	190	74	188	74

Notes: The dependent variable here is the annual total amount of local revenues generated by each district and TRANSFER denotes the annual sum of intergovernmental transfers that each LGA received. For the IV estimation, I used the lagged annual average levels of precipitation and air temperature as instruments. All the other variables are averaged by year. Standard errors are clustered by districts and reported in parentheses. *** p<0.01, ** p<0.05, * p<0.1.
Sources: See Table 2.

Table A-3: The Effect of Intergovernmental Transfers on Local Revenue Generation, with Quarterly Dummies

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Model	Pooled	Pooled	Pooled	FE	FE	IV	IV	IV+FE	IV+FE
DV	All	All	All	All	All	Excl. Ag. Taxes	Excl. Ag. Taxes	Excl. Ag. Taxes	Excl. Ag. Taxes
Subsample	All	Rural	Urban	Rural	Urban	Rural	Urban	Rural	Urban
$TRANSFER_{t-1}$	0.198***	0.309***	0.110**	0.223***	0.108**	1.195***	-0.728*	0.635**	0.405
	(0.046)	(0.067)	(0.049)	(0.071)	(0.049)	(0.307)	(0.416)	(0.279)	(0.315)
LIGHT	0.034	0.017	0.418***			0.035	0.831***		
	(0.024)	(0.024)	(0.105)			(0.030)	(0.174)		
AREA	-0.190***	-0.011	-0.009			0.049	-0.203		
	(0.068)	(0.084)	(0.124)			(0.100)	(0.193)		
ROAD	-0.031	-0.018	-0.141			-0.087	-0.020		
	(0.127)	(0.123)	(0.274)			(0.160)	(0.338)		
SUPPORT	-0.163	-0.030	-0.706			-0.453	0.121		
	(0.491)	(0.412)	(1.124)			(0.512)	(1.041)		
District Fixed Effects	No	No	No	Yes	Yes	No	No	Yes	Yes
Quarterly Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	1,367	987	380	987	380	949	365	949	365

Notes: Standard errors are clustered by district and reported in parentheses. *** p<0.01, ** p<0.05, * p<0.1.
Sources: See Table 2.

Table A-4: Replication of IV+FE Estimation without Districts Affected by Droughts

	(1)	(2)	(3)	(4)
Models	IV+FE	IV+FE	IV+FE	IV+FE
Subsample	≥5% quantile	≥15% quantile	≥25% quantile	≥35% quantile
TRANSFER_{t-1}	1.736***	1.310***	0.912***	0.696***
	(0.341)	(0.256)	(0.236)	(0.207)
N of LGAs	94	94	94	91
N	911	810	668	505

Notes: In these regressions, I replicate Model 8 in Table 2 but exclude those LGAs that experienced droughts in the current or previous fiscal year. A drought is defined as a district-year rainfall level below the 5%, 15%, 25%, and 35% quantiles of the district rainfall distribution for Models 1 through 4, respectively. *** p<0.01, ** p<0.05, * p<0.1.
Sources: See Table 2.

Table A-5: Results from GMM Estimation, Varying Instrument Set

Models	(1) Diff. GMM One-Step	(2) Diff GMM One-Step	(3) Diff. GMM Two-Step	(4) Diff. GMM Two-Step	(5) Sys. GMM One-Step	(6) Sys. GMM One-Step	(7) Sys. GMM Two-Step	(8) Sys. GMM Two-Step
Subsample	Rural	Urban	Rural	Urban	Rural	Urban	Rural	Urban
Lag 1 Only								
TRANSFER_{t-1}	0.702***	0.168	0.578***	0.172	0.339***	0.118	0.311***	0.097
	(0.152)	(0.167)	(0.186)	(0.232)	(0.090)	(0.086)	(0.102)	(0.117)
AR1 (p-value)	0.000	0.000	0.000	0.009	0.000	0.000	0.000	0.004
AR2 (p-value)	0.128	0.547	0.081	0.480	0.251	0.942	0.275	0.961
Hansen J test (p-value)	0.200	0.167	0.200	0.167	0.113	0.887	0.113	0.887
Diff. in Hansen test (p-value)					0.669	1.000	0.669	1.000
N of Instruments	28	28	28	28	50	50	50	50
Full instrument set								
TRANSFER_{t-1}	0.125	0.207***	0.106	0.268***	0.301***	0.160**	0.274**	0.194
	(0.118)	(0.074)	(0.118)	(0.068)	(0.100)	(0.062)	(0.115)	(0.144)
AR1 (p-value)	0.000	0.000	0.000	0.004	0.000	0.000	0.000	0.010
AR2 (p-value)	0.082	0.621	0.203	0.787	0.200	0.912	0.328	0.843
Hansen J test (p-value)	0.914	1.000	0.914	1.000	0.999	1.000	0.999	1.000
Diff. in Hansen test (p-value)					1.000	1.000	1.000	1.000
N of Instruments	118	118	118	118	140	140	140	140
N of LGA	94	36	94	36	94	37	94	37
N	791	295	791	295	932	355	932	355

Notes: Robust standard errors are reported in parentheses. For two-step results, robust standard errors are corrected for finite sample using Windmeijer's (2005) correction. GMM-style instruments are used in combination with the external instruments. *** p<0.01, ** p<0.05, * p<0.1.
Sources: See Table 2.