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http://dx.doi.org/10.1016/j.worlddev.2014.08.022

Rainfall Shocks, Local Revenues, and Intergovernmental Transfer in Mali

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Summary. — This paper explores the implications of rainfall shocks for municipal tax revenues and intergovernmental transfers in Mali. I found that exogenous phenomena such as weather, not under the control of local actors, could affect the way de facto decentralization plays out by influencing the fiscal capacity of local governments. In a panel data of 692 municipalities from 2000 to 2008, I found that rainfall shocks, through the fluctuations they induce in agricultural incomes, affect revenue collection of local governments, and in turn drive further revenues local governments receive through transfer by the central government.
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Key words — taxes, rainfall, decentralization, intergovernmental transfer, income shocks

1. INTRODUCTION

In the context of global human-induced climate change, inter-annual patterns of temperature and precipitation are expected to change in the coming decades (Stern, 2006; IPCC, 2012). Because of its presumed weak adaptive capacity, sub-Saharan Africa is likely to experience a more pronounced negative effect than other regions. While recent research has advanced our understanding of the direct effect of climate change on agriculture, education, health, and conflict (Deschenes & Greenstone, 2007; Hsiang, Meng, & Cane, 2011; Maccini & Yang, 2009; Schlenker & Roberts, 2009), there is a need for further research to quantify the potential indirect effect it may have on public finances and existing public policies.

In recent years, the phenomenon of political and fiscal decentralization has gained increasing attention from development policy-makers. Within this field, there has been an increasing focus on the possible linkages between fiscal variables and development outcomes. Additionally, while the public finance literature on taxation is vast, there is little known about taxes in the specific context of developing countries particularly at local levels. Most papers have looked at the determinants of tax compliance in developed countries rather than in developing ones due to lack of reliable data about developing countries (Slemrod & Yitzhaki, 2002). What we do know is that, because of information and enforcement constraints, it is difficult for developing countries to levy taxes on subsistence farmers and laborers in all-cash economies.[1] Therefore, it remains an empirical question as to why widespread differences in tax revenue performances are observed among local authorities and what are the implications of these.

The question of what determines local tax revenues is important for several reasons. First, rural agricultural districts are vulnerable to weather-induced crop or income losses with immediate and lagged effects on productions. From a public policy standpoint, it is important to clarify the magnitudes and implications of these losses. To achieve a sustainable level of social service funding in Sub-Saharan Africa, countries, regions, districts, and municipalities must be able to increase tax revenues from an expanding tax base. Given that the agricultural sector is still the largest employer and contributor to the gross domestic product (GDP) in this region,[2] raising tax revenues will depend on the dynamism of that agricultural sector, which in turn means growth in agricultural revenues or income at the individual and community levels. Because a small tax base and low tax compliance limit the capacity of local governments to provide sustainable financing for services, it is vital to know the effect of random weather fluctuations on fiscal outcomes. Second, understanding the relationship between agriculture and taxation can help governments to incorporate weather into the design of policies (e.g., insurance schemes) aimed at directly stabilizing rural agricultural income or indirectly increasing local authorities' revenues or capacities to provide public goods.

In this paper, I use a unique, local-level panel dataset primarily to estimate the effect of municipal[3] household income shock on tax revenues. I use variation in rainfall as an instrument for income to estimate its impact on tax revenues. Although randomized experiments would have been the perfect solution to omitted variable bias, the exogeneity of rainfall overcomes this issue and identifies the true causal effect. Rainfall is a good instrument for income, particularly in rural areas that largely depend on rain-fed agriculture, assuming the relative absence of irrigation in a country such as Mali. Variations in rainfall allow me to identify both the causal effect of income shock on tax revenues and the subsequent effect that such shocks have, as reflected in central government transfers from 2000 to 2008.

I find that rainfall shocks have a significant effect on the level of tax revenues collected. For example, one standard deviation in annual rainfall corresponds to an approximately 8% decrease in annual tax revenues for farming municipalities. Furthermore, for every one FCFA[4] that the municipality fails to raise from taxes due to lack of rain, it loses approximately six FCFA from central government transfers. I explore the mechanism using proxy income measures at district levels,

and I find that rainfall significantly affects the probability that a district is food-insecure and faces income difficulties. An annual rainfall that is 1% below the mean historical district rainfall increases the probability of the district encountering food or income difficulties by 0.3%. Among the crops grown in Mali, only the yield of millet (the main staple) is significantly related to rainfall shocks. A 1% increase in annual rainfall relative to the mean historical district rainfall increases both millet production and yield by approximately 0.5%. This statistic is important because millet represents 40% of the total cereal production in Mali.

I also investigate whether the presence of physical infrastructure (paved roads, electricity) and the sizes of the municipalities affect government distribution amid rainfall uncertainty. I find that the presence of physical infrastructure does not significantly mediate the effect of rainfall through tax revenues on government transfers. Neither is the effect of rainfall mediated by the size of a municipality, which is measured by the number of municipal counselors and personnel. Lastly, I find that there is a cyclical negative mechanism taking root because, when decreased rainfall leads to decreased revenue for some municipalities, the government bestows lower transfers on these affected municipalities, which again affects the level of tax revenues.

The outline of this paper is as follows: In Section 2, I review the literature on the determinants of tax revenues and fiscal transfers. In Section 3, I provide a background on taxation and fiscal transfers in Mali. In Section 4, I describe the conceptual framework of the model. In Section 5, I outline the empirical strategy used in this study. In Section 6, I describe the data. I present my results with interpretations in Section 7, and, in Section 8, I conclude with the policy implications of the results.

2. RELATED LITERATURE

A wide array of literature has sought to link taxation to development. At the macro level, a number of empirical studies have examined the determinants of tax revenues in developing countries (Gupta, 2007; Leuthold, 1991). More specifically, Saeid (2008) has studied the level and composition of tax revenue in developing countries by using unbalanced panel data. Khattry and Rao (2002) have investigated the tax revenue implications of trade liberalization, whereas Ghura (1998) and Tanzi and Davoodi (2000) have focused on the effect of economic policies and corruption on tax revenues. For studies focusing mainly on Sub-Saharan Africa, Stotsky and Woldemariam (1997) used a panel data of 43 countries from 1990 to 1995 to measure the determinants of tax shares and tax efforts. They found that countries with a relatively high tax share tend to have a relatively high index of tax effort. Ghura (1998) studied 39 Sub-Saharan African countries from 1985 to 1996 and found that tax revenue performance is affected by economic policies and corruption. He demonstrated that revenue rises with declining inflation, the implementation of structural reforms, rising human capital, and declining corruption. Agbeyegbe, Stotsky, and WoldeMariam (2006), using a panel of 22 countries in Sub-Saharan Africa from 1980 to 1996, performed a Generalized Method of Moment regression to show that trade liberalization positively affects tax revenue, although the result is sensitive to the measure used as a proxy for trade liberalization. Bird, Martinez-Vazquez, and Torgler (2008) found that, if taxpayers perceive that their interests are properly represented in political institutions and that the governance is good, then their willingness to contribute by paying taxes increases.

At the local level, multiple empirical studies have also examined the specific effects of political, fiscal, administrative, geographic, and socio-economic factors on revenue generation. Allers, de Haan, and Sterks (2001) and Solé-Ollé (2006) have analyzed the effect of partisan politics and electoral competition on tax revenue generation. De Mello (2002) has measured the effect of local public spending in Brazil on local, per capita tax revenue growth. Tewodaj, Benin, and Cudjoe (2009) evaluated the impact of government transfers on local tax revenues in Ghana. Fjeldstad (2001) found that differences in revenue performance among local authorities are due to variations in the degree of coercion involved in tax enforcement.

In parallel, there has been a surge in empirical evidence that intergovernmental transfers to sub-national entities can be explained by some political factors in addition to the normative principles of equity and efficiency (Barkan & Chege, 1989; Khemani, 2007, 2010; Miguel & Zaidi, 2003; Porto & Sanguinetti, 2001). These studies have found that a government's central distribution of investment for public goods is at times politically motivated. More recently, Branoah (2011), for example, found that in Ghana there is a tendency to allocate more funds to incumbents' districts and that there is an election-cycle effect in the governmental disbursements. Caldeira (2012) found evidence that political considerations influence the horizontal allocation of fiscal transfers in Senegal.

I add to this bourgeoning literature by examining tax revenue performance and intergovernmental transfers in the context of exogenous rainfall shocks. Although different aspects of tax revenues have been analyzed at both the macro and micro levels, to the best of my knowledge, no empirical study has evaluated the effect of income shock instrumented by rainfall on taxes and its implication for government transfers in a developing country context. The paper is most similar in methodology to the recent paper by Brückner (2012) which looks at the effect of exogenous international commodity price and rainfall shocks on value-added tax, income tax, and trade tax at macro level in Sub Saharan Africa. Adding to the existing work, this study aims to provide, within the context of decentralization, additional insights into the functioning of local governments, especially in relation to tax revenue performance, public goods delivery, and the distribution incentive problems faced by central governments.

3. BACKGROUND

(a) *Malian local government and taxation*

Mali is an ideal country in which to study the effect of rainfall variation on tax revenue outcomes for two reasons: First, the country is sufficiently large to encompass many geographic zones, ranging from desert to wet savannah. Second, since 1998, Mali has been working on and has now completed a decentralization process that led to the creation of 705 municipalities. Until the military coup of April 2012, Mali was seen as one of the most successful stories of democratization and decentralization in Africa. Starting in the late 1990s, the country established local, government-endowed municipalities with autonomy and distinct responsibilities which they are authorized to enforce. In every municipality, council members are directly elected to the local government by a proportional vote. The first elections of municipal council-members took place in 1998–99.

Although these council-members are elected by a proportional vote, they themselves elect a mayor of the municipality. Because decentralization was intended to bring decision-making