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Taxation and the Unequal Reach of the State: Mapping State Capacity in Ecuador

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Even though the unequal reach of the state has become an important concern in the literature on developing democracies in Latin America, empirical measures of intracountry variation in state capacity are scarce. So far, attempts to develop valid measures of the reach of the state have often been hampered by inadequate data. Leveraging insights from national-level scholarship, this article proposes a tax-based measure to capture such intracountry variation. Drawing on a comprehensive data set of municipal finance and estimates of economic activity derived from nighttime lights, it maps state capacity in Ecuador. The article validates the measure on the basis of survey data collected by the Latin American Public Opinion Project. A multilevel analysis demonstrates that citizens tend to be more satisfied with the services provided by the state in municipalities with higher state capacity, which strengthens confidence that the measure picks up relevant differences.

Introduction

After two decades of neoliberal reforms, the return of the left in Latin America has renewed the focus on the state and its potential to improve the lives of citizens (Giraudy and Luna 2012; Kurtz 2013). So far, the track record of states in the region has not been good. Democratic as well as authoritarian states in Latin America have too often failed to provide an effective counterweight to the market, turned out to be unable to formulate and implement policies that lift marginalized citizens out of poverty, and displayed an alarming inability to curb criminal violence. The ineffectiveness of states calls for a renewed focus on the factors that impede states in the region from realizing their potential and challenges us to take a closer look at state performance in the region.

So far, the literature has tended to proceed from the assumption that state capacity is a national-level variable and that variation can primarily be observed between countries or over time. Yet, the literature on developing democracies highlights that the ability of states to play a meaningful role in the lives of citizens varies considerably within countries. Guillermo O'Donnell (1999) has proposed a conceptual map where blue, green, and brown zones, respectively, indicate declining state presence and performance. Decentralization and emerging empirical evidence about the unequal territorial performance of democratic institutions have put the reach of the state back on the agenda. Yet, the development of comparative measures that capture the "political topography" of the state (Boone 2003) is in its infancy.

In trying to come to a better understanding of the unequal reach of the state, scholarship is confronted with conceptual and empirical challenges. Even though the notion of strong and weak states is intuitively appealing, there is no consensus on how

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state capacity should be conceptualized, much less operationalized (Hendrix 2010; Soifer 2008). While the idea that “weak or failed states are the source of many of the world’s most serious problems” (Fukuyama 2005, xvii) has come to play a tremendous role in policy circles (Rabasa et al. 2007; U.S. Army/U.S. Marine Corps 2009), we are less clear on what it is about states that causes these problems. Francis Fukuyama (2013) argues that the way forward is to disaggregate capacity both functionally and geographically. Disaggregation will generate a more nuanced picture of state capacity and, ultimately, contribute to a better understanding of the implications of different institutional configurations. Moving in this direction is challenging, however, because the data needed are generally not available, especially for developing countries where unequal capacity is most severe.

This article contributes to this research agenda by developing a subnational measure of capacity, which relates the amount of direct taxes collected by local governments to economic activity in the same area. It leverages the global trend toward fiscal decentralization to shed light on the territorial reach of the state. Economic activity, for which subnational data are also often hard to obtain, can be sensed remotely through an analysis of nighttime light emissions.

The article draws on Ecuador, a middle-income country, to flesh out the proposed measure of subnational variation. Ecuador has an ethnically diverse population and the political and economic divisions between the three major regions—the highlands (Sierra), the coastal regions (Costa), and the Amazon basin (Amazonía)—have played a prominent role in politics. Ecuador was among the early decentralizers on the continent, and local governments wield considerable political and fiscal authority (Faust and Harbers 2012; Van Cott 2008). Indeed, in his seminal essay on the state, O’Donnell (1999) identifies Ecuador as particularly affected by territorial heterogeneity. Yet, because the political system is organized according to unitary, rather than federal, principles, this variation has so far been difficult to measure empirically.

At the national level, taxation is frequently used as a lens to capture state capacity (Lieberman 2002), and the development of tax authority is considered one of the key dimensions of state building (Diaz-Cayeros 2006; Levi 1988; Lieberman 2003). Drawing on insights from this national-level scholarship and the literature on decentralization, the article shows that taxation at the subnational level faces many of the same challenges as at the national level. Because citizens generally do not like to pay taxes, effective tax collection is conditional upon the ability of public agencies to monitor compliance and sanction evasion. Moreover, voluntary compliance with taxation is higher where the government succeeds in providing services to citizens (e.g., Alm, McClelland, and Schulze 1992; Alm, Sanchez, and De Juan 1995).

Taking municipal tax collection as the starting point for measuring state capacity implies a somewhat different conceptualization of the territorial reach of the state than has been customary. So far, it has generally been understood as the ability of central states to control and penetrate peripheries (e.g., Mann 1988). This article takes a more inclusive view of the state, recognizing local governments as integral parts of the public sector. Building on insights from the literature on the anthropology of the state (Migdal, Kohli, and Shue 1994, 16), the approach taken here asks not so much whether the central state dominates local territories, but to what extent effective state structures exist in these areas. This emphasis is motivated by the recent global trend toward decentralization, which has shifted vital state tasks, such as health and education, from the national to subnational governments. In Latin America as elsewhere, decentralization reforms have been associated with a substantial restructuring of government finances. The extractive power of the state, a key dimension of state capacity, is therefore no longer the exclusive domain of the center, and subnational governments

now collect a higher share of total government revenue than at any point in modern history.

The first section of the article describes the need for an intracountry measure of state capacity. The second section uses conceptual reasoning to make the case for taxation as a useful lens to study intracountry variation in state capacity. The indicator is then calculated for Ecuador on the basis of a comprehensive data set of municipal finances and data on economic activity derived from nighttime light emissions. The final section of the article demonstrates that the measure succeeds in picking up relevant differences by linking it to survey data on citizen satisfaction with public services collected by the Latin American Public Opinion Project (LAPOP).

State Capacity Beyond the Central State

In Latin America, problems resulting from state weakness have been well documented since colonial times (Centeno 2003; Walker 1999). The literature on early state formation contains rich narratives about the difficulty of controlling the hinterland and the inadequate institutions inherited from the Iberians after the wars of independence. Yet, despite the rich evidence for territorial variation, state capacity has generally been treated as a national-level variable. As Huntington (1968, 1) famously argued, the “most important political distinction among countries concerns not their form of government but their degree of government.” Implicit in this assertion is the understanding of state capacity as a characteristic of central states. This center-centric conceptualization of state capacity was justified, at least in part, by political and economic realities. In Latin America during the era of Import Substitution Industrialization (ISI), the central state was arguably the most important arena of state action. The biggest threat to the ability of the state to implement policies for the common good was generally perceived to be captured by outside groups (e.g., Weyland 1998). The subsequent shift to market-oriented economic strategies not only redefined the role of the state in the economy, it was also associated with a transfer of authority from the national to the local level. Within-country variation in state capacity became an important theme in multiple research programs.

The first body of literature to highlight the need for a territorially nuanced understanding of the state was the work on the reconfiguration of the state in the aftermath of neoliberal reforms. A central theme in this literature was the retreat of the state from society, both functionally and geographically. O'Donnell (1999) has described the unequal territorial reach of the state as the spread of “brown zones,” in which the state is almost completely absent or largely irrelevant to citizens. While brown areas may not be entirely new, the “drastic manner in which neoliberal policies—balanced budgets, tight money, privatization—have been implemented across Latin America has significantly worsened the browning of the region” (O'Donnell 1993, 52). Yet, as a result of the center-centric approach to the public sector during ISI, there was no empirical baseline to which the increase in “browning” could be compared.

The transfer of responsibilities and resources to the local level created a rich literature on resulting patterns of subnational governance, which varied significantly between and within countries. In addition to well-documented success stories like Porto Alegre, the Ecuadorian village of Cotacachi won international recognition for participatory policymaking (Ortiz Crespo 2004; Van Cott 2008). In many other cases, however, decentralization perpetuated and arguably refueled clientelism (e.g., Fox 1994). One aspect of this is the emergence of subnational authoritarian enclaves, which have become one of the most important concerns in the literature on democratization (Gibson 2010; Giraudy 2013; Harbers and Ingram 2014).

Neoliberal reforms also coincided with a dramatic increase in crime and violence (Koonings and Kruijt 1999). The escalation of violence was seen—at least in part—as a result of the territorially uneven retreat of the state (Davis 2010). In the absence of effective state institutions, irregular armed actors, such as transnational crime organizations, established alternative systems of control (Espach et al. 2011; Maldonado Aranda 2013). These networks could be very effective in delivering valued public goods, like security. Jaffe (2012), for example, demonstrates that criminal organizations in parts of Jamaica have become legitimate systems of urban order precisely because they provide protection and conflict resolution where the state does not.

While variation in institutional performance was initially perceived as a problem primarily for areas directly affected, this view underestimates the degree to which local political dynamics are embedded in national patterns of governance. Because subnational boundaries tend to be even more permeable than national borders, poor local performance has repercussions beyond circumscribed areas. For Colombia, Eaton (2006) demonstrates that the inability of the Colombian state to uphold the rule of law in parts of the territory not only provided opportunities for armed groups to organize, it also left local governments vulnerable to capture. Weak state capacity in the periphery is therefore not a local issue but has substantial implications for the state as a whole. A failure of the state “in even the most remote parts of the country can affect the state in the capital city by denying state components there resources and support from the larger society” (Migdal, Kohli, and Shue 1994, 26). This highlights the need for measures of state capacity that can capture within-country differences.

A Subnational Measure of State Capacity

In developing a subnational measure of state capacity, the discussion below concentrates on the municipal level. It therefore seeks to occupy a middle position between the political science literature on the “politics of the periphery” (Gibson 2010), which has tended to focus on the provincial level, and the anthropological literature, which has generally studied neighborhoods or villages (e.g., Jaffe 2012). Focusing on the municipal level makes it possible to develop a relatively fine-grained map but still keep the administrative divisions of the state as units of analysis. To flesh out the implications of the unequal state capacity, the article draws on the conceptual map proposed by O’Donnell (1999). On this map, blue indicates zones of high state capacity, whereas green and brown zones indicate declining presence and performance. The daily lives of citizens and, more specifically, their interactions with the state vary considerably between the three zones. In blue zones, the state is represented by a variety of “ground-level state agents” (Migdal, Kohli, and Shue 1994, 15), such as tax collectors, teachers, librarians, health-care providers, policemen, and social workers. Citizens in blue zones have regular interactions with these state agents and a variety of public services are available to them. In green zones, basic services are provided, but overall the intensity of state-citizen interactions is lower. Contact between citizens and the state is reduced to an absolute minimum in brown zones. Schools and health clinics are likely to be relatively inaccessible and, in general, of poor quality. If citizens in these areas are confronted with hardship, they are unlikely to receive or even expect help from the state. Instead, they rely on local brokers or kinship networks to cope with the challenges of their daily lives (Auyero 2001). While the resources in these networks may, in part, be drawn from public coffers, they are dispersed in a personalized and clientelistic manner. O’Donnell’s conceptual map has been very influential in the literature on Latin America, because it systematizes insights from a wealth of

anthropological and ethnographic studies. Yet, we still lack a comparative measure to identify intracountry variation in the extent to which effective state structures exist.

Conceptually, scholarship on state capacity has drawn heavily on Mann's notion of infrastructural power (see Soifer 2008 for an excellent overview). Infrastructural power is defined as "the capacity of the state to actually penetrate civil society, and to implement logistically political decisions throughout the realm" (Mann 1988, 5). A prerequisite for the implication of political decisions are effective channels of communication, which have traditionally required the existence of physical infrastructure for travel. Herbst (2000) has highlighted the challenges involved in extending such infrastructure into sparsely populated territories. Without infrastructure, he argues, it is difficult, if not impossible, to build effective institutions (also Weber 1976). Yet, while channels of communication are a necessary condition, they are certainly not sufficient (Goodwin 2001).

To gauge state capacity, it is therefore important to try to get closer to the interactions between ground level state agents and citizens. One way to capture these interactions is to analyze the exercise of state power. An example of this is Giraudy's (2013) index of subnational patrimonialism. The measure, which she calculates for the provincial level in Argentina and Mexico, builds on the Weberian notion that a strong state requires a professional and autonomous bureaucracy. Where the state follows a patrimonial logic, public officials use their office for private gain and hiring is based on personal loyalty or kinship ties. The result is a bloated incompetent bureaucracy and, ultimately, inefficient service provision. Provinces in federations tend to have a substantial degree of autonomy, and the exercise of power is in part reflected in the laws and regulations provinces have laid down for matters such as transparency and finances. Giraudy leverages such differences in formal rules to capture variation. Subnational units in unitary countries like Ecuador, by contrast, have less leeway to design institutions and even though institutions formally look the same, they may function differently.

Taxation as a Lens

In light of these challenges, I propose measuring state capacity on the basis of a tax-based indicator, which relates the amount of taxes collected by local government to economic activity. The development of tax authority is generally considered one of the key dimensions of state building. North (1981), for instance, conceptualizes states as organizations "with a comparative advantage in violence, extending over a geographic area whose boundaries are determined by [their] power to tax constituents" (21). While "the threat of force can create a territorial unit, its consolidation only occurs when political authority becomes expressed in the capacity to tax" (Diaz-Cayeros 2006, 1). Indeed, it has been argued that successful extraction of revenue "makes it possible to determine *where* a state exists" (Levi 1988, 1–2, emphasis added). While a minimal degree of taxation thus indicates the existence of a state, the degree to which a state succeeds in levying taxes sheds light on state capacity. Through the lens of taxation, stateness can be understood as a continuous, rather than a binary variable.

The idea that taxation is the single most important indicator for state capacity is echoed by much of the literature. Herbst (2000, 113) argues that "there's no better measure of a state's reach than its ability to collect taxes." In her classic essay, Skocpol (1985) writes that a "state's means of raising and deploying financial resources tell us more than could any other single factor about its existing (and immediately potential) capacities to create or strengthen state organizations, to employ personnel, to coopt political support, to subsidize economic enterprises, and to fund social programs" (17).

This theoretical relationship between revenue generation and the ability to carry out other activities has been corroborated by empirical analyses of national-level data (Hendrix 2010).

A key activity of states is therefore the extraction of revenue from a society made up of citizens who do not like to pay. There are two complementary perspectives to understand why successful taxation reflects capacity. First, effective revenue collection is conditional upon the ability of public agencies to monitor compliance and sanction evasion. This, in turn, requires accurate public records about the tax base (e.g., cadastral maps and registers) as well as the administrative capacity to determine tax bills, monitor payments, audit returns, and process appeals. Successful taxation thus places a high administrative burden on the state. Patrimonial bureaucracies by and large do not live up to this challenge.

Second, citizens' willingness to comply with the state's demands for revenue is closely related to their experience with the state. The emergence of the tax regime is often conceptualized as a bargain struck between citizens and rulers (Bates and Lien 1985; McGuire and Olson 1996; Tilly 1985), where public goods provided by the state justify revenue collection. Even though citizens would prefer not to pay taxes, they comply because they value the services provided. Yet, the nature of the bargain is complicated by the fact that there is no direct *quid pro quo*. Citizens may not benefit directly from the services funded with their taxes. Rather, their contributions go into a pool of resources that finances government activity. If the state is ineffective and inefficient, a substantial amount of revenue will most likely not be put to productive use. To the extent that citizens feel the quantity and quality of public services do not correspond to the tax burden, they are less inclined to pay. The degree of voluntary compliance, in turn, limits the state's ability to extract revenue. In his analysis of taxation in Argentina and Chile, Bergman (2009) shows that the extractive capacity of the Argentine state is substantially lower, even though it invests more in enforcement. Because Argentines perceive their state to be ineffective, they are less willing to comply with the tax regime, despite the state's efforts to enforce it. In sum, citizens monitor state activity. If the state does not live up to its side of the bargain, citizens are less inclined to pay, resulting in higher rates of tax evasion and lower revenue collection.

This relationship also emerges from the anthropological literature. As outlined above, irregular governmental actors, such as criminal organizations, may serve as "protection rackets" just as effectively states (Tilly 1985). Yet, much like the state, they also expect something in return. There is an emerging literature on informal taxes, which are levied by nonstate actors for the provision of services such as security (e.g., Jaffe 2012; Vandekerckhove 2011). Citizens that already pay local strongmen are unlikely to pay the state to essentially provide the same service poorly.

There is a rich literature documenting differences in state capacity between countries and over time from the perspective of taxation (e.g., Karl 1997; Weyland 1998). Yet, tax-based indicators have generally not been leveraged for subnational analyses, even though tax collection by local governments faces essentially the same challenges as at the national level (Diaz-Cayeros 2006, ch. 2).¹ O'Donnell (1993) explicitly mentions ineffective tax collection as an indicator for the reach of the state. Moreover, decentralization has been associated with a substantial restructuring of public finances. Subnational governments in the region now collect a higher share of total government revenue than at any point in modern history (Daughters and Harper 2007; von Haldenwang et al. 2011).

This article therefore uses municipal revenue collection as a starting point. Exploring variation in capacity through the lens of taxation has conceptual implications, and it is important to acknowledge them explicitly. First, because taxation is an interaction

between citizens and the state, we can only observe state capacity in populated areas. Capacity in territories within the country that are uninhabited, such as swathes of the Amazon region, are not adequately captured by tax-based measures. While the military may monitor and control such areas with modern technology, the type of authority underlying territorial control there is very different from the one practiced in interactions with citizens.

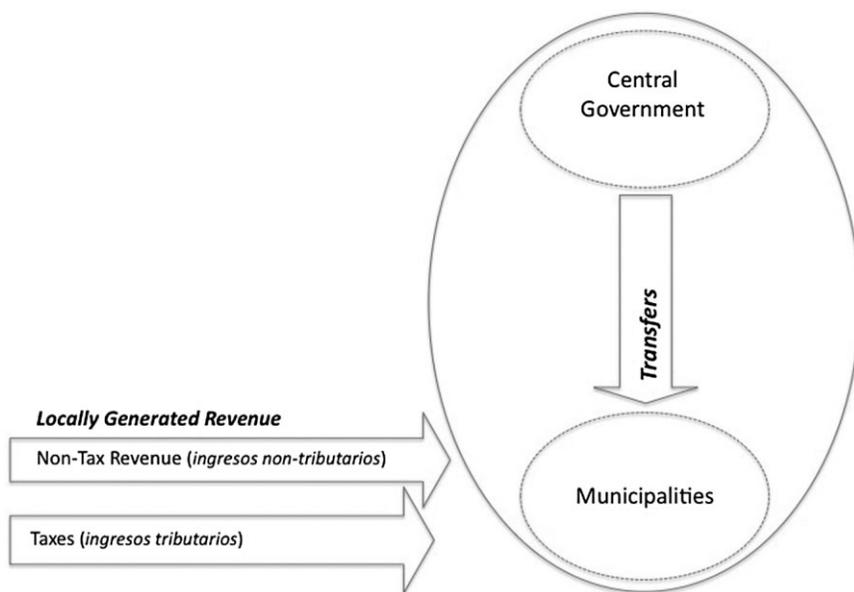
Second, focusing on municipal governments implies a somewhat different conceptualization of the territorial reach of the state than has been customary. So far, as outlined above, state capacity has generally been understood as a property of central states to control and penetrate peripheries. This article takes a more inclusive view of the state, recognizing local governments as integral parts of the public sector. It asks not so much whether the central state dominates local territories, but to what extent effective state structures exist in these areas. The motivation for this strategy is the recognition that organizations at the central and subnational levels form part of “the state” and that between the constituent organizations, there is a division of labor. In the field of tax collection, central and subnational governments do not compete with each other, but they have distinct spheres of competence. Subnational governments in Latin America are generally responsible for collecting specific kinds of revenue, such as property taxes (Diaz-Cayeros 2006; von Haldenwang et al. 2011), and the state as a whole relies on municipalities to collect revenue to fund specific tasks. Of course, municipalities’ tax bases differ substantially and transfers are needed to compensate poorer municipalities. However, relative to their tax base, local governments should collect the taxes for which they are responsible. In Ecuador, this cooperative nature is illustrated by a provision in the 2008 constitution that rewards municipalities for good performance with regard to revenue collection.²

One of the limitations of tax-based indicators in cross-national research is that—in addition to capacity—revenue collection is also influenced by ideological and political preferences. There is an important difference between the extractive potential of states and actual extraction rates (Fukuyama 2013, 353). A case in point is the USA, which substantially increased revenue during the two World Wars, but otherwise opted for comparatively low taxation. At the subnational level, however, the confounding influence of policy choices is much smaller. Because municipal governments are subject to the same tax regime, their authority to set tax policy is limited.

Taxation and Public Finance in Latin America

Despite advances in recent years (Cornia 2012), overall Latin American states have fared rather poorly with regard to tax collection. Even though nominal tax rates can be quite high, revenue is much lower than nominal rates would suggest, and inadequate revenue collection has often undermined the ability of the state to invest in vital public services. In 2009, the average tax/gross domestic product (GDP) ratio for Latin American countries was 19.2%, considerably below the Organisation for Economic Co-operation and Development (OECD) average of 36%.³ Moreover, compared to OECD countries, Latin American states rely more heavily on nontax revenue and indirect taxes, which are less demanding to collect (Bergman 2009; Castelletti 2008). In Ecuador, average revenue was 17% of GDP for the period between 1994 and 2008, the bulk of which was obtained through “easy revenue.” The central government has benefited significantly from rising oil prices, which accounted for more than one-third of total revenue (34.3%) between 1994 and 2008. Revenue generated by the Value Added Tax, also considered a less demanding source of revenue, accounted for 5.2% of GDP in 2008, compared to 4.3% for the more demanding income tax (Banco del Estado

FIGURE 1
Municipal Revenue Streams



2009, 32). Overall, revenue collection in Ecuador remains highly centralized, as the most lucrative revenue streams, such as oil, are the prerogative of the central government. Municipalities, which are the subnational level of government with the most far-reaching tax authority, benefit from the oil boom only indirectly through transfers. Between 1993 and 2008, revenue collected by municipalities increased by 276% (Banco del Estado 2009, 35, 38). This trend of increasing subnational revenue fits with the regional trend toward fiscal decentralization.

Figure 1 illustrates municipal revenue streams. Ecuadorian municipalities rely on two principal sources of income: transfers from the central government and locally collected revenue. Locally collected revenue accounts for about one-third of municipal budgets and can be divided into two types of money. The first category—nontax revenue—are fees and contributions obtained in return for specific services, such as trash collection or the provision of potable water. Given the direct quid pro quo, these are relatively easy to collect. The second source of locally collected revenue is tax revenue, defined as unrequited compulsory payments. Ecuadorian municipalities have tax authority for eight areas, the most lucrative of which is the property tax (Banco del Estado 2009).

Constructing the Indicator

Tax-based indicators are generally ratio variables in order to standardize across units. Constructing such indicators is a two-step process, in which the relevant revenue streams for the numerator and the denominator must be determined. Drawing on a framework developed by Lieberman (2002) to assess the validity of tax-based indicators of state capacity, the following paragraphs explain the construction of the subnational measure.

The first step is to select streams of revenue that should be included in the numerator. Lieberman (2002) highlights the need to distinguish tax from nontax sources of revenue. While states may generate considerable resources through fees and contributions, such as road tolls or water fees, these nontax forms of revenue are relatively easy to collect. Because they are based on a direct exchange, they require less of the competences associated with capable states. Only direct taxes are therefore included in the numerator, which is constructed as the average amount of direct taxes collected by each municipality in the period from 2004 to 2008. The most important source of tax-based revenue at the municipal level is the property tax, which Lieberman describes as among the “most difficult to administer, most transparent and least required of any government revenue stream” (100). Municipalities in Ecuador levy taxes on urban and rural properties (*impuesto a predios rurales y urbanos*). They also collect the business asset tax (*impuesto a los activos totales*) and the vehicle tax. The average yearly amount of taxes collected per municipality is US\$991,542 with a standard deviation of US\$5,608,696.⁴

The second step is to convert the amount of direct taxes collected by each municipality into comparable units. Comparing the absolute amount of direct taxes across municipalities is not very meaningful, as this does not take into account differences in the tax base. In wealthy municipalities, there are more businesses, more houses, and more cars for municipalities to levy taxes on. In constructing the denominator, scholars therefore generally standardize using income measures such as GDP.⁵ This, however, raises the issue of data availability. While many countries collect data on economic activity at the national and provincial levels, they generally do not collect such information at lower levels of aggregation. This problem can be overcome, however, by using luminosity data as a proxy for economic activity.

Over the past decade, economists and geographers have started drawing on satellite images and remotely sensed data to measure socioeconomic indicators. Especially nighttime light emissions, which reflect the presence and intensity of light, provide valuable information about economic activity (e.g., Chen and Nordhaus 2011; Gleditsch and Weidmann 2012; Henderson, Storeygard, and Weil 2009; Sutton, Elvidge, and Ghosh 2007). The reasons why nighttime lights and economic activity correlate across time and space can be found on the producer and the consumer side of economic activity. First, the production of goods and services itself is closely associated with energy consumption and the use of artificial light. Moreover, the transportation of goods from factories and warehouses along artificially lit parking lots, highways, ports, and airports to markets and consumers requires energy and produces artificial light. Rural economic activity also involves light, but—as in urban areas—the intensity of the light varies with the intensity of economic activity. In the case of Ecuador, for instance, subsistence farming on communally owned land generates less light than commercial shrimp farms or corporate-owned greenhouses producing and packaging cut flowers for export. Because of the close link between energy consumption and economic activity, the former has been identified as a proxy for economic activity that often captures the informal sector more adequately than official data (e.g., Robles, Calderón, and Magaloni 2013). Second, lights indicate whether consumers have money to spend. Guayaquil’s boardwalk, the Malecón 2000, is brightly lit at night to draw visitors to its restaurants, bars, and shopping malls. However, even relatively modest rural dwellings, whose owners turn on the lights in the evenings and early mornings, or kiosks at rural bus stations, generate signatures that are picked up by satellites. An advantage of these images is that they capture lights generated through the official grid as well as privately owned generators.

Since the intensity of nighttime lights covaries with economic activity, satellite images can therefore provide valuable information in situations where the quality of official data is low, or where data are unavailable, such as at subnational scales. The current analysis uses raster data collected by the Defense Meteorological Satellite Program—Operational Linescan System. The National Geophysical Data Center of the National Oceanic and Atmospheric Administration has conducted image and data processing of these data to generate cloud-free composites for calendar years. Following Chen and Nordhaus (2011), economic activity data have been calculated on the basis of the stable lights image. Ephemeral events, such as fires and other background noise, have been removed, so that remaining lights reflect human activities. The data have a resolution of 30 arc second grids, and lights are represented by digital numbers from 1 to 63.⁶

Figure 2a provides an impression of nighttime lights in Ecuador. The concentrations of lights around the coastal city of Guayaquil and in the highlands surrounding Quito and Cuenca are clearly visible. In Figure 2b, light intensity values have been summed or integrated to generate a proxy for economic activity in a given municipality (see Sutton, Elvidge, and Ghosh 2007), with lighter shades indicating more economic activity.⁷ The mean value per municipality is 2,823, with a standard deviation of 5,892. In reporting these numbers, one of the disadvantages of using nighttime lights becomes apparent. Unlike conventional measures of GDP, luminosity data are not reported in currency, so that denominator and numerator are not in the same units (e.g., U.S. dollar). Yet, despite this limitation, luminosity data make it possible to construct a measure of state capacity that can communicate the relative strength of the state for different parts of the country, even though the measure does not lend itself readily to local–national comparisons.⁸

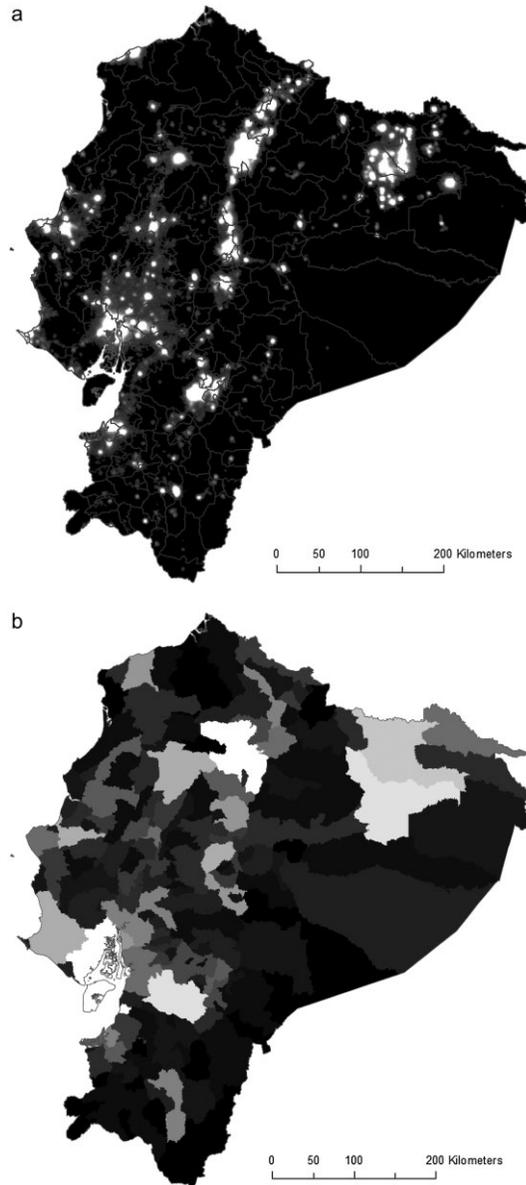
A New Map of the State

Drawing on municipal tax data and nighttime lights, state capacity can now be calculated for all 218 (out of 220) municipalities for which information is available. Figure 3 maps the data, with darker shades indicating higher tax to economic activity ratios and thus higher state capacity. As outlined above, tax-based indicators can only be applied to populated areas, because the rationale for the indicator lies in the interactions between citizens and the state. In Figure 3 areas that were unpopulated in 2010, according to estimates provided by the Gridded Population of the World Dataset, are therefore indicated in white.⁹ A first visual inspection suggests that there is considerable intracountry variation. The mean score is 194 with a standard deviation of 245. The map provides an opportunity to explore how capacity is distributed across the country.

Calculating the average state capacity score by province highlights considerable regional differences. The average municipal score in the highland province Pichincha, surrounding the capital Quito, is 576, considerably higher than the national average of 194. By contrast, average scores for the three southernmost provinces Zamora Chinchipe (179), Loja (174), and El Oro (134) are below the national average.

The literature on state building in the developing world has drawn heavily on the experience of early colonial states, where European settlers tended to establish themselves in clearly demarcated areas and sought to extend their authority from there. During colonial times, the pattern was one of “state authority concentrated around certain geographical zones and often practically disappearing in less accessible frontiers” (Centeno 2003, 11). The notion that metropolitan areas, especially capital cities, are zones of high capacity, whereas the state is weak in outlying areas still resonates in the emerging literature on the unequal reach of the state (Buhaug 2010). A look at the

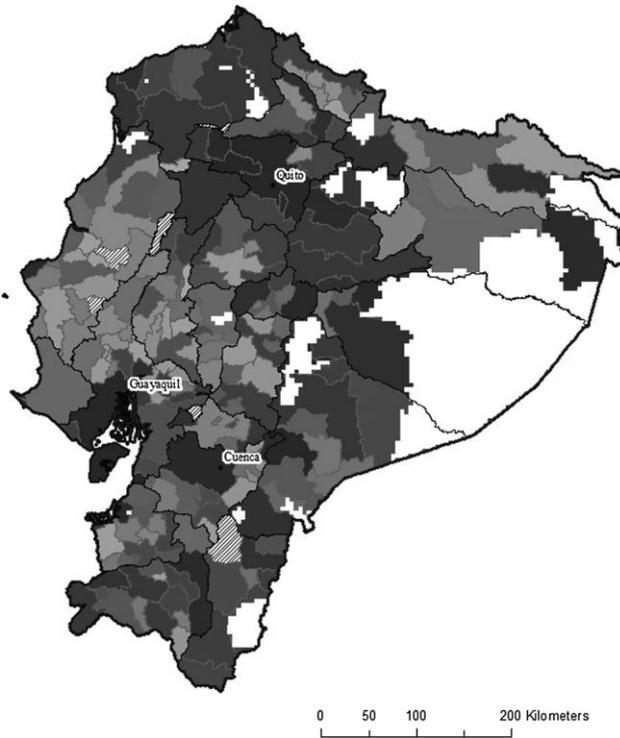
FIGURE 2
Estimating Economic Activity Using Luminosity Data. (a) Stable Lights Image; (b) Economic Activity per Municipality



Note: All maps were drawn with ArcGIS10. In Panel a, satellite images were obtained from the Defense Meteorological Satellite Program. Municipal and provincial boundaries were traced on the basis of data provided by Ecuador's Instituto Nacional de Estadística y Censos. In Panel b, lighter shades indicate more stable nighttime lights, and thus more economic activity.

map suggests that there are indeed several clusters of high capacity surrounding the three major cities: Quito, Guayaquil, and Cuenca. This suggests an urban bias in the performance of state institutions, without supporting the notion that the state is strongest in the capital.

FIGURE 3
Mapping State Capacity



Note: Darker shades indicate higher state capacity. Striped areas reflect missing data and “zonas no delimitadas.” White areas were unpopulated in 2010. Municipal boundaries are indicated by lighter shades, whereas provincial boundaries are drawn in black.

Citizens and State Capacity: Validating the Indicator with Survey Data

So far, the article has employed conceptual reasoning or “content validation” to make the case for taxation as a useful lens to study variation in state capacity (Adcock and Collier 2001). To validate the measure with empirical evidence, this section links the indicator to individual-level survey data. The basic argument underlying this approach is that citizens in areas with high state capacity should be more satisfied with the quality of services the state provides for them. As outlined above, citizens’ willingness to comply with the state’s demands for revenue is related to their experience with the state. Of course, in attitudinal data, variance at the individual level is generally far larger than at the contextual level. Nevertheless, if the indicator picks up relevant differences in state capacity, we should observe a systematic link between satisfaction with services and the proposed measure.

To investigate whether this is indeed the case, I draw on data from the Latin American Public Opinion Project (LAPOP). For the 2012 round of surveys, LAPOP adopted a new design to make samples representative at the municipal level. This makes it possible to use multilevel modeling techniques and thus to identify and estimate not only individual but also contextual effects in subnational analyses. For Ecuador, respondents were drawn from 50 of the 220 municipalities.¹⁰

The questionnaire includes items that capture satisfaction with the condition of streets, roads, and highways; the quality of public schools; the quality of public health and medical services; and with the services provided by the municipality. The dependent variable in the analysis is a scale constructed from the standardized responses to these four items multiplied by 100, with higher scores reflecting higher satisfaction with services (see Appendix A in the supplementary materials on the author's Web site for descriptive statistics and data sources). An exploration of the data reveals that there is significant variance at the contextual level, with an intraclass correlation of 11%. While the lion's share of variation is at the individual level, as is to be expected in such data, the clustering is an indication that mean satisfaction with services varies across municipalities (Steenbergen and Jones 2002).

The main independent variable of interest is of course state capacity. Four additional municipal-level variables that might affect service provision are also included. These are (1) poverty, measured as the percentage of the population with unsatisfied basic needs; (2) economic activity, captured by the luminosity data; (3) population density; and (4) the percentage of the population that self-identifies as indigenous. In addition to contextual variables, the literature on public opinion in Latin America and beyond has shown that demographic, socioeconomic and political variables at the individual level influence access to services and color evaluations of institutional performance (Anderson and Tverdova 2003; Hakhverdian and Mayne 2012; Montalvo 2009; Seligson 2002). While these variables are not the main focus of the analysis, they are included as controls.

Table 1 reports the results of multilevel mixed effects models. At the individual level, the analysis shows that female gender, efficacy, and a vote for president Correa in the previous election are positively associated with satisfaction, while the size of the city or village where the respondent lives, ethnic self-identification as black, and interest in politics are negatively related to the dependent variable.¹¹

For the purpose of this article, however, the findings at the contextual level are most relevant. Overall, the results strengthen confidence that the indicator picks up relevant differences in state capacity between municipalities. Across models, state capacity is significantly and positively associated with the dependent variable, when controlling for poverty, economic activity, population density, and indigenous population. The intraclass correlation in all models decreases from 11% to 8%, which indicates that state capacity accounts for almost 30% of the variance at the contextual level.¹² This supports the claim that the indicator can be considered a valid measure of state capacity.

Conclusion

Drawing on a data set of municipal tax collection in Ecuador and an analysis of nighttime lights, this article develops a measure of state capacity that is sensitive to subnational variation but that, at the same time, can be calculated on the basis of existing data. It leverages the global trend toward fiscal decentralization, which has been associated with (donor-funded) efforts to collect data on local government finances. Economic activity, for which subnational data are often hard to obtain, can be sensed remotely through an analysis of nighttime lights. While the first part of the article employs conceptual reasoning, the final part validates the indicator empirically. Using survey data from LAPOP, it demonstrates that citizens in municipalities with high scores on the indicator are more satisfied with public services than citizens in municipalities with low scores. Fukuyama (2013) recently argues that disaggregating capacity both functionally and geographically can lead to a better understanding of the

TABLE 1
Satisfaction with Public Services

	Model 1	Model 2	Model 3	Model 4
Contextual variables				
State capacity	0.026** (0.013)	0.024* (0.013)	0.027** (0.011)	0.026*** (0.010)
Poverty	-0.011 (0.294)			
Economic activity		0.009 (0.037)		
Population density			-1.132 (7.964)	0.016 (0.182)
Indigenous population				
Individual-level controls				
Size of city or village	-3.465** (1.59)	-3.52** (1.586)	-3.433** (1.570)	-3.443** (1.568)
where respondent lives				
Indigenous	-9.131 (22.575)	-9.118 (22.568)	-9.168 (22.568)	-9.3 (22.629)
White	-12.961 (21.407)	-13.009 (21.402)	-12.961 (21.402)	-12.924 (21.41)
Mestizo	-19.793 (20.620)	-19.816 (20.614)	-19.78 (20.615)	-19.781 (20.617)
Black	-39.028* (22.982)	-39.016* (22.959)	-39.036* (22.96)	-39.008* (22.967)
Mulatto	-28.922 (22.717)	-28.917 (22.709)	-28.926 (22.709)	-28.876 (22.721)
Female	7.406** (3.674)	7.411** (3.674)	7.413** (3.674)	7.403** (3.674)
Household income	-0.409 (0.605)	-0.404 (0.603)	-0.408 (0.602)	-0.408 (0.603)
Years of education	0.096 (0.502)	0.099 (0.501)	0.095 (0.501)	0.093 (0.503)
Age	-0.041 (0.134)	-0.041 (0.134)	-0.042 (0.134)	-0.042 (0.134)
Efficacy	5.57*** (0.951)	5.558*** (0.952)	5.578*** (0.952)	5.572*** (0.951)
Interest in politics	-5.994*** (2.103)	-5.984*** (2.103)	-5.985*** (2.102)	-5.996*** (2.103)
Voted for incumbent	7.948** (3.87)	7.948** (3.87)	7.946** (3.87)	7.943** (3.870)
Constant	-14.915 (29.36)	-15.832 (25.022)	-15.342 (24.992)	5.082 (24.315)
N (Individuals)	1,110	1,110	1,110	1,110
N (Municipalities)	50	50	50	50
Variance (municipal-level)	324.636 (113.296)	323.999 (113.154)	324.263 (113.222)	324.16 (113.313)
Variance (individual)	3,618.163 (157.176)	3,618.164 (157.175)	3,618.211 (157.178)	3,618.283 (157.189)
Log likelihood	-6,145.513	-6,145.485	-6,145.503	-6,145.51

Note: LAPOP data. Standard errors are in parentheses. Two-tailed tests of statistical significance.
* $p \leq 0.10$; ** $p \leq 0.05$; *** $p \leq 0.01$.

implications of different institutional configurations. In closing, I would like to highlight how the measure contributes to this research agenda.

First, the measure can communicate relative state capacity in different parts of a country. This enables subnational comparative research on the causes and consequences of the reach of the state. In conjunction with LAPOP's new sample design, for instance, the indicator facilitates analyses of how citizen engagement, trust in institutions, and support for democracy are influenced by state capacity.

Second, the measure can be adapted for country-level comparative research. More specifically, it can help put arguments about differences in institutional heterogeneity across countries on a firmer empirical basis. O'Donnell (1999) identifies the Andean countries as particularly affected by institutional heterogeneity, with Costa Rica, Chile, and Uruguay at the other end of the continuum. This article shows that the standard deviation for state capacity in Ecuador is indeed high compared to the mean, which confirms O'Donnell's expectation. In this light, the indicator provides an opportunity to map variation in state capacity across countries more systematically. Scores on the measure are sensitive to country-specific institutional frameworks and whether a particular ratio is high is only meaningful in relation to the tax authority wielded by the subnational level of government in a given country. Therefore, comparing the extent of intracountry variation across countries requires standardization, and this may be done, for instance, through a simple coefficient of variability.¹³

In addition to national-level comparisons, the measure can also guide case selection in small-N subnational research. As Snyder (2001, 96) points out, "comparing similar subnational units across distinct national units may be a more powerful strategy for making valid causal inferences than comparing national units." Scores on the state capacity measure are one dimension along which similar units may be identified, for instance, by selecting low-capacity areas from two countries. More generally, the indicator promises to be an important contribution to future work on subnational variation in state capacity.

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Notes

1. For an exception, see Avellaneda (2009).
2. One objection that might be raised against emphasizing cooperation between central and local governments is that their capacity to extract revenue in a given territory might differ,

with the central government succeeding where the local government has failed. Even though hard evidence is difficult to come by, this seems unlikely. For Argentina, Gervasoni (2010) shows that provincial governments with weak tax links were subsidized by the central government with taxes levied elsewhere.

3. See <http://www.latameconomy.org/en/lac-fiscal-initiative/revenue-statistics-in-latin-america/trends-in-tax-to-gdp-ratios/> and <http://www.oecd.org/dataoecd/18/23/35471773.pdf> (both accessed October 1, 2012).
4. Data on municipal finances are available through a 2009 report by Ecuador's Banco del Estado, which gathered the data with support from the German Technical Cooperation (GTZ).
5. An alternative approach to standardization in cross-national research is to analyze the composition of revenue, as weak states rely more heavily on nontax income (Lieberman 2002). Because municipal governments are subject to the same tax regime, this approach is less appropriate subnationally.
6. The image used ("F162008_v4b_stable_lights.avg_vis.tif") is available at <http://www.ngdc.noaa.gov/dmsp/downloadV4composites.html> (accessed October 10, 2012). Shapefiles containing municipal and provincial boundaries were obtained from Ecuador's Instituto Nacional de Estadística y Censos (http://inec.gob.ec/estadisticas/?option=com_content&view=article&id=165; accessed May 10, 2012).
7. While it is not possible to validate the measure on the basis of official municipal data, because they do not exist, at the provincial level the correlation between the lights proxy and official data is 0.94, indicating that both tap into the same phenomenon. Data about provincial economic output have been obtained from Ecuador's Central Bank (<http://www.bce.fin.ec/frame.php?CNT=ARB0000175>, accessed October 15, 2012). The most recent year for which official data are available is 2007. Luminosity data for the same year have been derived from image "F162007_v4b_stable_lights.avg_vis.tif" (<http://www.ngdc.noaa.gov/dmsp/downloadV4composites.html>; accessed October 18, 2012).
8. Note that this would be true regardless of the indicator used for economic activity. Ecuadorian municipalities are subject to the same institutional framework, which grants them authority to levy certain taxes. Whether a particular ratio is high is only meaningful in relation to the tax authority wielded by that level of government. Comparing specific scores across countries requires prior standardization.
9. Data on population estimates are available via the GPW Web site (<http://sedac.ciesin.columbia.edu/data/collection/gpw-v3>; accessed May 15, 2013). These data are provided with a resolution of 2.5 arc-minute grid cells, which equal approximately 5×5 km at the equator. Most unpopulated areas are administratively part of a municipality.
10. A concern is the time lag between the collection of the survey data in 2012 and the tax and luminosity data (2004–2008). However, as state capacity is generally considered a slowly changing variable (Kurtz 2013), it is unlikely that dramatic changes would have occurred over the course of a few years.
11. All quantitative analyses were conducted with Stata 10 (StataCorp, College Station, TX). The size of the place is measured here as an individual-level variable because most municipalities contain urban as well as rural areas. The intraclass correlation for this variable is 40%.
12. The intraclass correlation remains at 11% if only the individual controls are included.
13. The coefficient of variability is obtained by dividing the standard deviation by the mean and then multiplying the obtained ratio by 100. While the standard deviation tends to take higher values where the mean is larger, dividing the standard deviation by the mean corrects for this bias.

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