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Toward a Spatial Measure of Twenty-First-Century Developmental State Capacity

ABSTRACT Building on existing efforts to theorize and measure state capacity, this paper proposes a spatial measure of equity promotion: developmental state capacity (DSC). We operationalize DSC as the spatial distribution and density of capability-enhancing infrastructure in a given territorial unit. Specifically, we develop a composite index of four types of local basic infrastructure: primary schools, community clinics, piped potable water, and electricity. Unlike territorial approaches or population-based development indicators, this index allows researchers to better understand and evaluate the state's role in human development by visualizing and examining the patterned spatial distribution and density of DSC. We illustrate the advantages of the measure through a case study of Johannesburg, South Africa. Using a unique data set, we calculate DSC index scores for over 600 administrative units. We then map the spatial distribution of DSC, identifying spatial clusters, and quantitatively and qualitatively explore the influence of demographic and political factors on its distribution. We conclude with directions for future research uses of the DSC index. KEYWORDS developmental state, state capacity, infrastructural provisioning, capabilities, Johannesburg

INTRODUCTION

Since the publication of Amartya Sen's *Development as Freedom* (1999), the capabilities approach has been central to academic and policy debates on development, inequality, and governance. In the development literature, this approach helped redefine development and revive interest in the state's developmental responsibilities and capacities. Against the dominant emphasis on economic growth, the capabilities approach centered on people's ability to take advantage of opportunities and exercise their rights in order, as Sen famously put it, to "lead the kind of lives they value—and have reason to value" (18).

Not only did the capabilities approach redefine development and inspire a series of measures for assessing developmental outcomes along these lines (e.g., Fukuda-Parr 2001, 2003; Sen 1994; ul Haq 2003), it also revived interest in the state's developmental role. If the classic "developmental state" literature focused on the role of states in promoting capitalist development and managing distributional conflicts (e.g., Evans 1992, 1995; Kohli 2004), the "twenty-first-century developmental state" has been tasked with equity promotion and redistribution (Evans 2010; Williams 2014, vom Hau 2012). By focusing on what people are

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able to be and do, proponents of the capabilities approach argue a society cannot "achieve justice and equality" and its members cannot exercise political or civil rights if they are "inhibited by extreme poverty, lack of education and ill health" (Nussbaum 2011:33). From this perspective the state must pursue equity by providing opportunities and capability-enhancing services, most notably health, education, and basic services (e.g., Evans 2010; Evans and Heller 2015; Gibson 2018).

Like economic growth, equity promotion requires various specific forms of state capacity. Delivering capability-enhancing services requires extractive and administrative capacity. Funds have to be raised, policies have to be designed, and goods and services have to be rolled out. These challenges have generally been conceptualized in terms of the presence of robust Weberian institutions having the infrastructural and authoritative power to reach into society to mobilize and deploy resources. For this reason, twenty-first-century developmental state capacity has been understood as having a specifically territorial dimension. Informed by theories of state infrastructural power (Mann 1984; O'Donnell 1993), recent work has conceptualized capacity as a distinct form of power *concentrated in and radiating from the center*, with material and organizational resources diminishing as they are deployed across the territory (e.g., Soifer 2008; Soifer and vom Hau 2008: vom Hau 2008). Cities in particular are contrasted to rural areas, and centers of political power are contrasted to peripheral territories, where intermediaries rule.

Our point of departure in this article is the recognition that while enhancing capabilities equitably requires resources and institutional capacity, it also has a distinctly *spatial* dimension (Shue 1988; Soifer and vom Hau 2008) that is neither predictable nor necessarily determined by the capacity of, or distance from the center in the territorial sense. In this article we propose a spatial index that measures twenty-first-century developmental state capacity (DSC). This composite index accounts for the density of basic infrastructure and services—education, health, and basic services (piped potable water and electricity)—and enables a granular view of their distribution. We contrast the *spatial* distribution of state capacity with broadly territorial conceptualizations to highlight local variation in state capacity within sub-national units, most importantly cities. We argue that measuring the spatial distribution and density of local infrastructural provisioning is key to evaluating the state's equity-promoting role. Through a case study of Johannesburg, we show that the index both reveals the spatial logic of service delivery and points to some of the factors that drive this differentiation before and after apartheid. We argue that the political rupture with apartheid in 1994 provides a particularly important test for when and how state capacity can redress inequalities.

Beyond this case, we see this index as adaptable for future research in different contexts. The index provides a platform for establishing linkages between the presence and reach of capability-enhancing infrastructure and developmental outcomes, and examining developmental state power and capacity in relation to different modalities of governance. The twenty-first-century DSC index builds a robust topography of developmental governance, citizenship, and inequality and has implications for understanding local governance of public goods (Ziblatt 2008) and the political pressures, constraints, and challenges states and societies face at the point of contact.

INFRASTRUCTURAL CAPACITY AND LOCAL SPATIAL VARIATION

Three basic insights about state capacity have direct implications for examining twenty-first-century developmental states and their capability-enhancing potential. First, developmental structures and infrastructure matter. As Evans (1995:77) argues, "Structures create the potential for action, playing out roles translates the potential into real effects." The presence of institutions and infrastructure themselves do not indicate successful development outcomes but are a crucial prerequisite and act as necessary access points for capability-enhancing service utilization (Quamruzzaman 2017). Second, state capacity is multidimensional and uneven. A state may exercise a high degree of repressive capacity yet lack the capacity to redistribute or ensure security among its citizens. "Islands" or domains of efficiency may exist in otherwise less capable states (Evans et al. 1985; Metz McDonnell 2017; Morgan and Orloff 2016). These differences across sectors may be driven, as Noy (2017) shows, by different political configurations and the strength of different stakeholders (both domestic and global), or by the relationship to and structure of society (Migdal 1988; Migdal, Kohli and Shue 1994). And third, just as functional capacities are uneven, capacity is not spatially uniform or homogeneous. The capacity of the state to regulate, extract, and redistribute varies across the territory (Mann 1984; O'Donnell 1993). For example, a state may exercise high legal capacity in the center but may be less capable of protecting its citizens and ensuring the rule of law in remote provinces (O'Donnell 1993, 2004). Examining newly democratizing contexts, O'Donnell (1993) argued that the state's presence and its ability to enforce its authority are largely concentrated in urban centers, whereas in more far-flung "brown areas" public legality is limited.

Recent scholarship on state capacity in the global South concerned with the state's presence and reach has been deeply shaped not only by O'Donnell's work, but also by Michael Mann's concept of "infrastructural power" (Soifer 2008; Soifer and vom Hau 2008, vom Hau 2008). Mann (1984) defines the state as a set of "political relations [which] radiate outwards from a center to cover a territorially demarcated area" (188), as such "infrastructural power" is the "power by the state to penetrate and centrally coordinate the activities of civil society through its own infrastructure" (190). This understanding of concentrated state power radiating unevenly from the center has informed empirical research on spatial variation in extractive capacity (Harbers 2015), coercive capacity (Goodwin 2001; Kalyvas 2006), social and spatial control (Schensul 2008), and the provisioning of public goods (Ziblatt 2008), among other dimensions.

In this article we join this effort to examine the infrastructural presence of the state but depart from recent literature in important ways. Conceptualizing state capacity as a territorial and radiating form of power has proven analytically useful for making sense of subnational variation, but still suffers from at least two problems. First, it elides the problem of the "last mile." That is, by presuming a certain level of state capacity over a given territory, the radiating view of state power fails to account for dynamics at play at the level of actual state–society interactions and the fact that these interactions may vary across different sectors. Second, the radiating view fails to recognize that state power is ultimately a relational dynamic and as a consequence can be highly uneven even within a legally bounded territory such as a province or a city.

Indeed, urban sociologists have long argued that even *within* urban areas, where state capacity from a territorial perspective is presumed to be high, there is in fact significant variation across the urban space (Wacquant 2008). This insight can be traced to Weber's arguments about how medieval European cities were, in effect, spaces of social closure, marked by highly differentiated forms of citizenship. In the U.S. literature, moreover, there is now vast empirical support for the claim that neighborhood effects have long-term impacts on household well-being (Sampson, Morenoff, and Gannon-Rowley 2002). There is, in other words, a very strong and varied spatial dynamic to long-term inequality.

The comparative literature has generally claimed that neoliberal globalization exacerbates the already highly exclusionary spatial logics of the post-colonial city (Sassen 1991; Theodore, Peck, and Brenner 2011). Data limitations however have made it difficult to test these claims in cities of the global South. At the same time, efforts to measure state capacity spatially have largely focused on extractive and coercive capacity (for a review see Hanson and Sigman 2013; see also Enriquez and Centeno 2012; Soifer 2012), using taxation as an indicator of state capacity (e.g., Harbers 2015; Rogers and Weller 2014). Robust empirical support for spatial distribution of developmental capacity is hard to come by, and scholarship attentive to this dimension has often overlooked the uneven spatial density of public infrastructure and services, and its patterned distribution across the territory (Hendrix 2010; Soifer 2008). Innovative spatial work, however, has recently underscored just how variable the state's reach can be within urban areas (Schensul 2008) and how this can impact citizens' access to basic services (Bertorelli et al. 2017).

We argue that in order to develop a more robust understanding of the twenty-first-century developmental state we need to pay greater attention to capability-enhancing services spatially and link this to local developmental outcomes. Moreover, empirical research needs greater granularity, and in particular needs to move beyond the conventional preoccupation with broad *territorial* categories of core–periphery, rural–urban or sub-national variation. While these are significant, they provide little insight into the highly fragmented and differentiated spatial structures of urban areas. The goal of this article, then, is to focus on the spatial rather than just territorial dimension of state capacity and to address gaps in our empirical knowledge by measuring variation of capability-enhancing capacity within urban space.

CASE SELECTION, DATA, AND METHODS

We illustrate the application of our DSC index with the case of Johannesburg, South Africa. Given South Africa's history of apartheid and its deeply entrenched spatial and social inequality, combined with the initial developmental commitments of the African National Congress (ANC), this post-apartheid city represents an exceptional case with which to test our approach.

On the one hand, apartheid was nothing if not a form of organized, state-sanctioned spatial inequality. Colonial and apartheid policies resulted in near-perfect racial segregation within South Africa's major cities (Christopher 1988). The four state-defined racial groups—black, coloured, Indian, and white—were segregated into neighborhoods with different legally defined levels of service delivery. These ranged from what was in effect a highly generous welfare state for whites, to minimal services for non-whites in recognized, legal "townships," to areas of complete exclusion (informal settlements of mostly black residents).

On the other hand, state-sanctioned racial segregation required a high degree of state capacity. When the ANC came to power in 1994, it inherited a state bureaucracy that was highly Weberian (if incredibly repressive) and that had remarkable infrastructural reach. The taxation capacity of the South African state since apartheid (Lieberman 2003) and its redistributive capacity, as measured by the share of social expenditures in GDP (Seekings and Nattrass 2005), are the highest of all middle-income countries. Moreover, unlike cities in much of the global South, South African cities have a long history of developing their own institutional capacity (apartheid as a system was implemented locally), including significant autonomous revenue collection.

As part of its transformative mandate, the ANC explicitly committed to strengthening local government and improving the delivery of basic services. To that end, the ANC initially enacted redistributive policies and massive public investment programs designed specifically to address the spatial and social hierarchy that organized life in urban South Africa (Kracker-Selzer and Heller 2010; Schensul 2009; Schensul and Heller 2011), including the Reconstruction and Development Programme's Urban Development Strategy, which emphasized access to good infrastructure and services as key priorities of post-apartheid urban development (Mabin and Smit 1997). The focus on getting services into black townships was specifically justified both as a redistributive measure and as critical to "deracializing" the post-apartheid city. This unique combination of the inherited spatial inequality of the apartheid city and its exceptional transformative capacity makes Johannesburg an important test case.

To construct the index and examine its spatial variation, we draw on a unique geocoded data set that compiles census and municipal service delivery data at the "subplace" level, the smallest unit for which census data is reported. Specifically, we use aggregate demographic, socioeconomic, and housing data from the 2001 South African national census conducted by Statistics South Africa (StatsSA). As the second census carried out since South Africa's transition, this has the advantage of capturing the legacies of apartheid as well as some of the ANC's efforts to roll out infrastructure and services to historically deprived areas. We also use data collected in 2008 and 2009 from multiple municipal service-delivery agencies across Johannesburg by the Urban Transformation in South Africa project housed at Brown University. These municipal infrastructure data sets include geocoded data points for primary schools in 2001 and community clinics in 2009.[1] The resulting data set includes population, housing, and infrastructure-provision data for the 683 subplaces that constituted metropolitan Johannesburg in 2001. The project also developed extensive qualitative reports for six selected subplace communities based on fieldwork and 15 to 18 key respondent interviews in each community. These reports inform our analysis of variation across three subplaces within the city and our discussion. Before turning to our analysis, the following section describes the operationalization of the index.

OPERATIONALIZING TWENTY-FIRST-CENTURY DEVELOPMENTAL CAPACITY

Using the data described above and geographic information systems, we developed a composite index that incorporates measures of developmental capacity on four dimensions: education, health, sanitation, and electricity. Our index includes this basic government-provided infrastructure for three reasons. First, these services are key to enhancing individual capabilities. Second, unlike other welfare services such as cash transfers or old-age insurance, the usability of these very much depends on proximity (though not exclusively). A measure of the density of capability-enhancing infrastructure is a good indicator of the state's capacity to deliver services in a *specific* location. Third, we are interested in simplicity and portability. Following the logic used in developing the Human Development Index (HDI), building a comparative knowledge base about actually existing development demands simple and clean measures that synthesize information across various dimensions. Given the potential data variability across different contexts (e.g., how quality of teaching is assessed), we focused on indicators for which we were able to collect robust measures, specifically the location of capability-enhancing infrastructure.

DSC scores range from 0 to 1, where 0 means the total absence of infrastructural capacity across the components of the index, and 1 represents the combined highest observed levels of infrastructural capacity across the index components. To facilitate discussion and interpretation in the analysis, we convert index scores to a 0–100 scale by multiplying the estimated score by 100. We deem a particular service available and accessible if it is present in the locality of interest (in this case the subplaces of the South African census) or close by.

Developmental State Capacity (DSC) Index

Our DSC index is a basic additive measure composed of the school index, clinic index, electricity index, and water index (described below). Following the logic of the HDI, we give equal weight to each of the components:

$$\text{DSC index} = \frac{\text{school index} + \text{clinic index} + \text{electricity index} + \text{water index}}{4}$$

where $0 \leq \text{DSCI} \leq 1$.

School Index (SI)

The SI captures what we call the effective number of primary schools (ENS) per capita for each subplace, normalized by the min-max method, so that $0 \leq \text{SI} \leq 1$:

$$\text{SI} = \frac{\text{PCENS} - \text{PCENS}_{\text{min}}}{\text{PCENS}_{\text{max}} - \text{PCENS}_{\text{min}}}$$

where PCENS is a territorial unit's ENS divided by its total population, and $\text{PCENS}_{\text{max}}$ and $\text{PCENS}_{\text{min}}$ are the highest and lowest values, respectively, documented across all territorial units in a metropolitan area.

To generate the ENS for each territorial unit, we use ArcGIS to match each geocoded primary school in the metropolitan area with a local territorial division, such as a district, block, or subplace. Then we generate a count variable of primary schools in each given territorial unit. To that we add the number of primary schools in each of its first-degree neighbors (bordering territorial units). We discount the numeric weight of schools in neighboring units by the linear distance between the territorial units' centroids:

$$\text{ENS} = x_i + x_{ij}\left(\frac{1}{1+d_j}\right) + \cdots + x_{ij}\left(\frac{1}{1+d_j}\right)$$

where x_i is a given unit, x_{ij} is a first-degree neighboring unit, and d_j is the distance in kilometers from the center of territorial unit x_i to neighboring unit x_{ij}. In other words, each school in a territorial unit counts as one school, but those outside it count as less than one, depending on distance.

Using the ENS rather than the number of schools in a territorial unit alone or simply counting all schools in the neighboring areas without weights allows us to account for the fact that schools (like other similar state infrastructure) may overflow a unit's boundaries and that many of a city's territorial subdivisions might have no schools, while accounting to some extent for cost of access. Residents of territorial units without public schools access them elsewhere, most likely in the neighboring areas. This is especially the case in urban areas where travel distances are shorter. This is a simple, if imperfect, approach in the absence of information such as physical geography, the distribution of the subplace population, and road networks, among other factors.

Clinic Index (CI)

The CI captures the effective number of community clinics (ENC) per capita for each subplace, normalized by the min-max method, so that $0 \leq \text{CI} \leq 1$.

$$\text{CI} = \frac{\text{PCENC} - \text{PCENC}_{\text{min}}}{\text{PCENC}_{\text{max}} - \text{PCENC}_{\text{min}}}$$

where PCENC is the ENC in the territorial unit divided by its total population, and $\text{PCENC}_{\text{max}}$ and $\text{PCENC}_{\text{min}}$ are the highest and lowest values, respectively, documented across all territorial units in a metropolitan area. The measurement of ENC follows the same steps and logic as the ENS, mapping each geocoded community clinic on a local map and counting the number of clinics in each territorial unit and, with less weight, those of its immediate neighbors.

Electricity and Piped Water Indices (EI and WI)

For each of these dimensions—electricity connections in the dwelling and potable water delivery to the dwelling via pipes—we calculated the proportion of households covered in each territorial unit. Specifically, we calculated the piped water measure using the 2001 census's count of households with access to piped water inside the dwelling (as opposed to other sources, including piped water in the yard or outside the house) divided by the total number of households in the subplace. In turn, to estimate the proportion of households with access to electricity, we used the 2001 census's count of households that indicated using electricity as their main type of energy for lighting (as opposed to gas, paraffin, candles, or other sources).

We calculated DSC scores for 606 of the 683 subplaces in Johannesburg. We excluded 77 subplaces with very small population (<150 inhabitants) or very low population density

(<100 inhabitants per km^2). Careful review of the excluded subplaces reveals that these are primarily industrial or business districts, vacant lots, and mining or agricultural lands. These subplaces have low population density and overall infrastructure because, in fact, they require little infrastructure. Sparsely populated industrial and business districts often contain infrastructure primarily placed there to serve neighboring areas. Table 1 presents summary statistics for all the subplaces in Johannesburg.

Before turning to our findings, we discuss the overall validity and reliability of the DSC index. Our conceptualization of developmental state capacity makes a theoretically informed assumption that states with dense levels of infrastructure across all of these dimensions exhibit, on average, greater state capacity. In focusing on existing state infrastructure in the areas of education, electricity, health, and sanitation, our goal was to develop a multidimensional composite measure of developmental state capacity able to reveal its spatial variation and patterning.

Because high capacity has certain institutional and material dimensions (e.g., Weberian bureaucracies, financial resources) that carry across different state activities, one might assume that if a state is relatively good at delivering one of these services it will be good and delivering the others. But we also recognize that the provision of different types of services poses very different challenges. Schools and clinics, for example, are delivered to specific areas and require land and transport access. Electricity and sanitation are delivered to households, but the construction of water supply systems and electric grids, so-called natural monopolies, have different economic and engineering demands. In addition, the overall capacity of the state will actually vary across agencies depending on varying organizational structures and political imperatives or pressures (e.g., the politics of schools are very different from the politics of clinics).

We view our four components as distinct dimensions of developmental state capacity rather than interchangeable indicators. In practice, the state does not always provide such distinct infrastructure in equal measures. As Table 2 shows, absolute levels of capability-enhancing infrastructure across the four dimensions are positively correlated. Yet population-relative levels of infrastructure are not always correlated across areas of infrastructure. Given our expectations about the particular demands of different types of capability-enhancing infrastructure and how these are tied up with the legacies of apartheid and as such deeply political, this variation is consistent with our expectations for Johannesburg.

Overall, however, it is clear that the index does capture an aggregate effect, that is state capacity. A strength of composite indices is their ability to summarize multidimensional concepts encompassing indicators with different measurement units. While the validity and reliability of any given composite measure is necessarily assessed across studies (OECD 2008), it is nevertheless important to assess this index's internal consistency reliability in the context of Johannesburg.[2] We tested our index using three measures of reliability: Cronbach's alpha (α = 0.54), McDonald's omega (ω = 0.65), and the greatest lower bound (glb = 0.83).[3] We place greater emphasis on ω and glb as measures of internal consistency reliability, but consider the implications of a low alpha for the interpretation of the multivariate analysis presented in the next section.[4] Collectively, the reliability measures indicate that the DSC index captures an acceptable degree of developmental state capacity, further

TABLE 1. Subplace-Level Descriptive Statistics of Johannesburg, South Africa, in 2001 and 2009.

	Mean	Min	Max	N	Year
Index Components					
Schools (effective number)	4.2	0	30.9	683	2001
Clinics (effective number)	0.8	0	4.4	683	2009
Electricity (% of households)	88.1	0	100	669	2001
Piped water (% of households)	63.5	0	100	669	2001
DSC Index (0–100 scale)	43.7	0.4	100	606	
Population					
Population size	4,719.2	0	131,662	683	2001
Population density (population/Km2)	3,777.3	0	106,462	683	2001
Racial Composition					
Black African (% population)	52.8	1.5	100	674	2001
Indian (% population)	5.7	0	94.3	674	2001
Coloured (% population)	6.3	0	94.3	674	2001
White (% population)	35.3	0	92.5	674	2001
Class Composition					
Household Income (% of below median)	40.5	0	100	672	2001
Historical Urban Growth					
Distance to CBD (Km)	15.0	0	41.1	683	2001

Source: South African 2001 census conducted by StatsSA. The healthcare facilities 2009 data is based on information collected from the South African National Department of Health. Index components are the authors' compilation based on this data.

TABLE 2. Pairwise Pearson correlations for DSC Index components.

	Unweighted	Weighted
Schools - Clinics	0.74***	0.78***
Schools - Water	0.29***	0.05
Schools - Electricity	0.53***	0.01
Clinics - Water	0.31***	−0.04
Clinics - Electricity	0.53***	−0.08
Water - Electricity	0.73***	0.63***
N	606	606

*** p<0.001, ** p<0.01, * p<0.05, + p<0.10

evidence of its validity. We now turn to the index scores and their spatial distribution across Johannesburg at the turn of the twenty-first century.

A CARTOGRAPHY OF DEVELOPMENTAL STATE CAPACITY IN JOHANNESBURG

First, we examine a thematic map of the city, created using ArcMap, that visualizes the geographic distribution of DSC across the city. Second, we use hotspot analysis, a spatial statistical method that uses the Getis-Ord (2010) Gi* statistic, to identify statistically significant spatial clusters of high or low state capacity. Third, we examine the relationship between the index and population size and density as well as subplace racial and class composition and distance from the central business district (CBD). This analysis interrogates whether the observed spatial distribution of DSC is simply a reflection of demographic and historical factors. Lastly, to further contextualize and examine variation in our index scores, we zoom in on three subplaces.

State presence is weakest in the densely populated Goldev subplace, whose score is 0.4 out of 100. In 2001, 99.4 percent of Goldev's 7,763 inhabitants were black African. No community clinics are located there or in its immediate neighbors. The ENS is 1.3. Despite its density and large population, less than 1 percent of households in the subplace have access to electricity or piped water.

The DSC index is highest in BraamPark, a small and densely populated mixed residential subplace within greater Braamfontein in central Johannesburg, which is home to the City Council and the University of Witwatersrand. In 2001, 266 people lived in BraamPark, 95 percent of them black African. This subplace's ENS and ENC are 14.9 and 2.7, respectively. This subplace also has universal access to electricity and piped water. Consistent with the urban literature, this comparison between extreme DSC index scores reveals sizeable and significant variations in DSC across the city.

Figure 1 reveals the patterned geographic distribution of the DSC index across Johannesburg. This thematic map assigns each subplace a hue in a color scale according to its index score decile. Higher deciles are represented by darker hues. The patterns visible in this map are consistent with the racial logic that undergirded colonial and apartheid urban planning policies. The 1923 Natives (Urban Areas) Act, also known as the Pass Laws, officially segmented and segregated urban South Africa. In the case of Johannesburg, the center "towns" were reserved for whites, while the peripheries were set apart as "dormitory communities" for black African workers. In 1950, the Group Areas Act further entrenched this racial segregation by carving cities into "white," "coloured," "Indian," and "African" areas. It also amplified the effects of residential and occupational segregation by devolving many administrative functions to "group areas," which became responsible for generating their own tax revenue and funding local development, infrastructure, and basic services (Beavon 2004; Kracker-Selzer 2012). These policies created an asymmetrical spatial distribution in social infrastructure investment, compounding the inequalities between the wealthier white group areas with their richer tax bases and the poorer non-white areas, particularly black African subplaces.

The map shows several pockets of high DSC across the city, with higher scores primarily concentrated in central Johannesburg and the predominantly white northern suburbs.

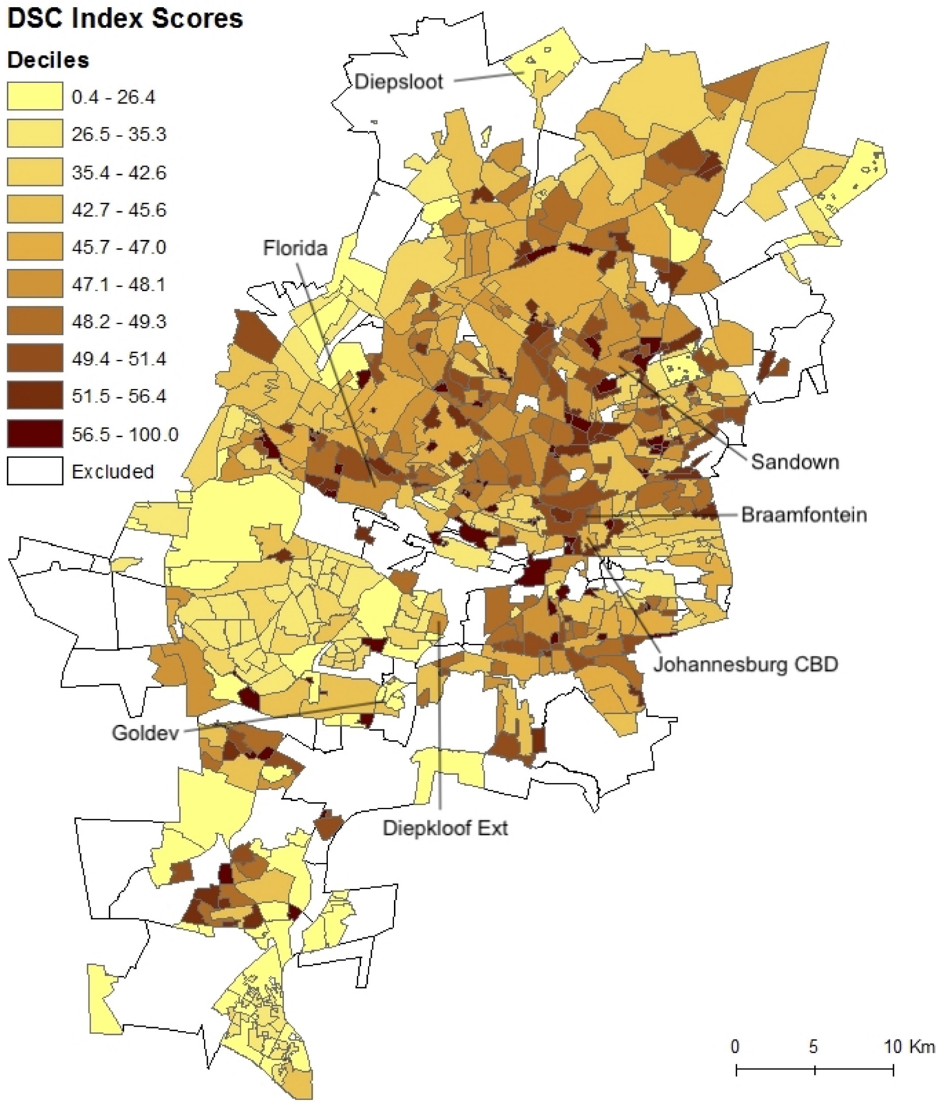

FIGURE 1. Geographic distribution of subplace-level Developmental State Capacity by DSC Index deciles in Johannesburg, South Africa.

Other, smaller pockets of high DSC are scattered around the city. Concentrations of low DSC appear in the city's southern tip and in its southwest region, which encompasses greater Soweto, a historically black area of Johannesburg. We see a wider range of variation in southern Johannesburg below the mining corridor, which cuts east to west across the midsection of the city. In contrast, despite some variation, levels of DSC are above the median in central and northern Johannesburg. This analysis evinces a patterned spatial distribution of capability-enhancing infrastructure and suggests clusters of high and low capacity.

There is clearly a historical and built-environment dynamic at work that reflects the spatial logic of apartheid. The areas that concentrate most state infrastructure in absolute terms are those that have been most historically central to Johannesburg's economic trajectory. Johannesburg was first and foremost a mining town, and the colonial logic of mining produced a stark pattern of capital–labor relations. On one side we have Soweto, the largest contiguous area of black settlements in Johannesburg, strategically located just south of the mining belt. Soweto housed relatively skilled black labor essential to the mining and industrial economy. Despite concentrating a large number of schools, clinics, and households with access to electricity, Soweto's DSC scores are, on average, lower than those in central and northern Johannesburg when we account for population size. This is consistent with the historically minimal levels of investment that Soweto received under apartheid.

On the other side of the mining belt we find a dense pole of infrastructural development in the CBD—the command center of the mining-finance complex that dominated the apartheid economy (Fine 2018). The dark areas scattered to the north of the CBD are the various privileged white neighborhoods, more or less clustered around the transport corridor that connects Johannesburg via the National Highway to the new enclave of business activity, Sandton, that grew rapidly toward the end of apartheid. The low-DSC subplaces (light yellow) outside central Johannesburg, the northern suburbs, and greater Soweto tend to be either informal settlements created by land invasions or resettlement areas created by waves of eviction (including Diepsloot, discussed below).

Taking Figure 1 as preliminary evidence of DSC clusters, we conducted a hot-spot analysis to determine whether the observed clusters of low and high state capacity are statistically significant. That is, we examine whether the spatial distribution of state capacity at the subplace level in Johannesburg is significantly different from a random distribution. Here, a hotspot is a statistically significant spatial cluster of subplaces with high index scores, and a cold spot is a spatial cluster of subplaces with low scores. Figure 2 provides statistical support for the spatial patterns discussed in the preceding section, showing two statistically significant hotspots (one encompassing the CBD and north-central white suburbs and another south of the CBD) and two cold clusters of low state capacity, in greater Soweto and the southern tip of the city.

Next, we examine various factors that could explain variation in the DSC component measures. We model the effect of population size, population density, racial composition, class composition, and distance from the CBD on the subplace-level DSC index scores using an ordinary least squares regression model. We begin with factors that would reflect an ideal-typical developmental state that delivers services on the basis of efficiency, namely population size and population density. Population density matters because it makes service delivery more cost-effective with respect to clinics and schools, as well as the bulk infrastructure costs of delivering electricity and water. Absolute population matters for more pragmatic reasons. In South Africa, subplaces are neighborhoods and not just census categories; highly populated neighborhoods would attract the attention of policymakers more readily than sparsely populated neighborhoods. Socio-historical factors, which in this context means the apartheid logic of racially differentiated delivery, is captured through percentages of black African population in subplaces, percentages of households with incomes below the median, and measures of distance from the CBD. Apartheid cities grew out from the center, so we should expect core areas to be more developed than peripheral areas.

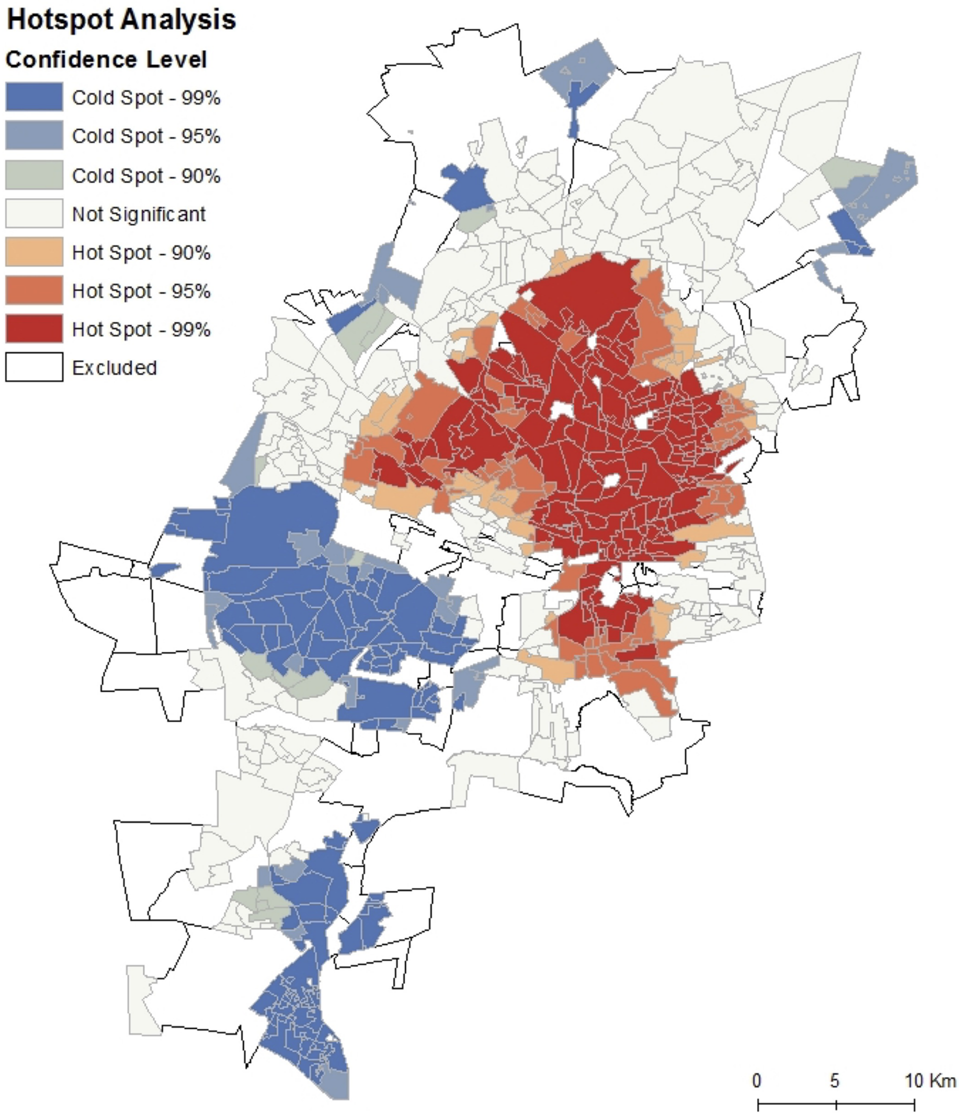

FIGURE 2. Hot Spot Analysis of Developmental State Capacity, based on subplace-level DSC Index, in Johannesburg, South Africa.

A simple measure of linear distance between the central point of the CBD subplace and each of the other subplaces within the city's borders is an indicator of the legacy of outward growth of the city and its capability-enhancing infrastructure.

Model 1 in Table 3 presents the results for a limited model that includes only population size and density. In a developmental state driven purely by an efficiency logic, the spatial distribution of DSC should almost exclusively reflect the distribution of both the population's density and magnitude. This model accounts for close to 20 percent of the observed variance in DSC index. However, the coefficients do not move in the direction we would expect based on an ideal-typical developmental state. The coefficient for population size is negative and

TABLE 3. Multivariate linear regression (OLS) model for determinants of the Developmental State Capacity Index (DSCI)

	Model 1	Model 2	Model 3	Model 4
Population (log of)	−4.691***	−2.678***	−2.635***	−2.484***
	(0.492)	(0.434)	(0.398)	(0.386)
Population density (log of)	−0.297	−0.086	−0.108	0.382
	(0.541)	(0.485)	(0.445)	(0.438)
Black African (% of population)		−0.155***	−0.015	0.140***
		(0.017)	(0.021)	(0.031)
Coloured (% of population)		0.071*	0.122***	0.061*
		(0.030)	(0.028)	(0.029)
Indian (% of population)		0.086**	0.116***	0.082**
		(0.030)	(0.028)	(0.027)
Household income (% below median)			−0.277***	0.042
			(0.026)	(0.056)
Black African x Household income				−0.005***
				(0.001)
Distance to CBD (in Km)		−0.398***	−0.361***	−0.255***
		(0.055)	(0.051)	(0.052)
Constant	82.152***	77.686***	80.384***	65.514***
	(3.706)	(3.327)	(3.067)	(3.766)
N	606	606	606	606
R2	0.20	0.45	0.53	0.56

Note: Standard errors in parentheses
*** p<0.001, ** p<0.01, * p<0.05, + p<0.10

statistically significant, so that as the population grows, index scores drop, *ceteris paribus.* The effect of population density as a predictor of developmental state capacity is inconclusive.

In Model 2 in Table 3, we include racial composition and distance from the CBD, both of which capture historical legacies. Model 3 includes an indicator for subplace class composition. Finally, Model 4 adds an interaction term between subplace racial composition and class composition, specifically between percentage black African and percentage of households with incomes below the median, capturing the relationship between race and class in the city. The full model accounts for 56 percent of the observed variance in index scores, increasing model fit by nearly 23 percentage points relative to Model 1.

Our results provide two important insights into developmental state capacity in Johannesburg. First, all else equal, class composition and distance from the CBD are both negative and statistically significant. Controlling for other factors, as the proportion of lower-income households increases, state capacity decreases. Notably, this model predicts a nearly 20-point index gap between an almost exclusively lower-income subplace and an exclusively higher-income subplace. Second, race and class seem to work together in the patterned distribution of DSC across Johannesburg. As Model 4 indicates, all else equal, the negative effect of lower-income populations is much more marked as the proportion of the black African population grows. At the same time, *ceteris paribus*, relatively well-to-do subplaces with varying proportions of black African residents exhibit greater concentration of capability-enhancing infrastructure than similar but homogeneously white subplaces. However, it is important to remember that in Johannesburg percentage black African and percentage of households with lower income show a strong positive correlation. The coefficients, and their significance, for population and density further emphasize that the racialized class logic of apartheid is so pronounced that it seemingly swamps any efficiency gains associated with density.

This exploratory analysis supports existing findings that a racial logic has historically underpinned urban planning in South African cities, shaping the spatial distribution of urban livability in favor of their white inhabitants (Kracker-Selzer 2012). At the same time, with the inclusion of racial composition, class composition, and distance to the CBD, this analysis also indicates that the spatial distribution of DSC does not perfectly mirror the geographic distribution of racial groups. Moreover, as Figure 3 reveals, regression residuals are spatially clustered around southern Johannesburg. In particular, this model underpredicts the observed scores in the historical black African townships of Soweto. Though the observed scores in Soweto are still on average lower than in the areas north of the mining corridor, they are nonetheless higher than expected given the demographic characteristics. We believe this reflects the political significance of Soweto and its connection to the ANC leadership since apartheid (something we return to in the case studies below).

The degree to which our index captures the legacy of apartheid is underscored by how it picks up the complex positioning of the coloured and Indian populations. These populations served as a critical intermediary class under apartheid. Often mediating between blacks and whites as shop owners and landlords, they tended to live in crowded but well-serviced subplaces usually located spatially between black and white subplaces, a pattern also documented for Durban (Schensul and Heller 2011) and Cape Town (Kracker-Selzer 2012). Because they were not as wealthy as whites, they depended more on public services provided by the state, such as schools and health clinics. This is why, as we show in Figure 4, areas with high concentrations of Indians and coloureds (above 60%) have similar and, at times, higher DSCs than white areas, which are generally not as dependent on public schools and clinics.

The observed and predicted trendlines for a higher-income subplace and a lower-income subplace as the proportion of the population that is black African grows are equally telling. Assuming a hypothetical subplace where 80 percent of the population lives below the median income, as the proportion of black Africans grows, the predicted DSC index falls markedly. By contrast, as the proportion of black Africans grows in a hypothetical subplace where all the population lives above the median income, the predicted DSC rises. These are virtually mirror lines. This captures both legacy effects and a new trend of upward mobility for blacks from the middle and upper class. With apartheid-era barriers to residence gone, and with the growth of middle-class jobs for blacks, many are transitioning into new, non-black neighborhoods. For the black lower middle classes, this means moving into intermediate neighborhoods (such as the area of Florida, discussed below). Thus, as we can see

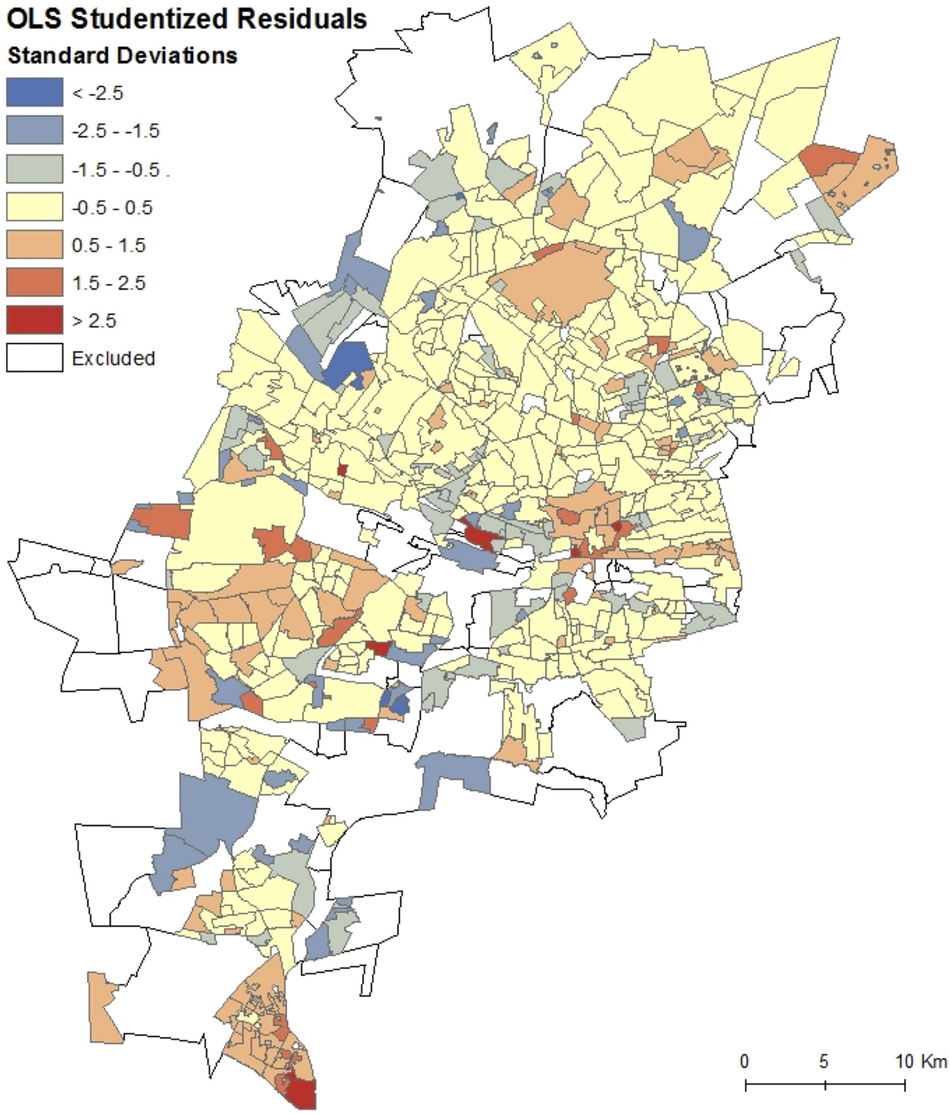

FIGURE 3. Geographic distribution of subplace-level studentized residuals for regression Model 4 in Table 3.

from Figure 4, where blacks are 15 to 40 percent of the population, the DSC stabilizes in the 50 range, just above the mean. A smaller group of upper-middle-class blacks, mostly professionals with advanced degrees or business people that have benefitted from the ANC's black economic empowerment policies, have moved into exclusive white neighborhoods, hence the sudden upward spike in the DSC when blacks are less than 15% of the population. This aligns with the findings reported in an earlier paper that found black professionals and politicians increasingly concentrated in white enclaves, using the same data set (Kracker-Selzer and Heller 2010).

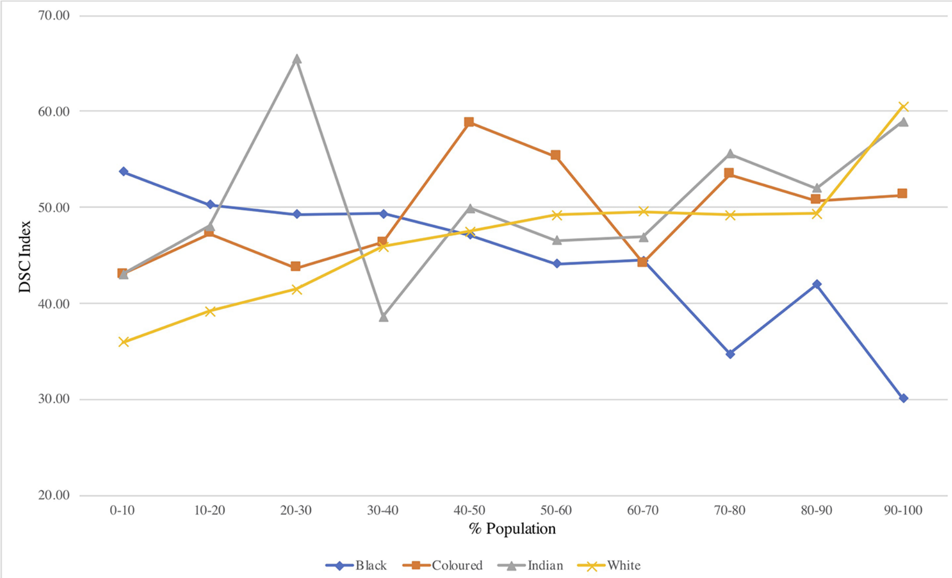

FIGURE 4. Average subplace-level Developmental State Capacity (DSC) Index by the proportion of the population that is Black, Coloured, Indian, or White.

Source: South African 2001 census conducted by StatsSA and authors' compilation.

The DSC Up Close

By zooming in to three subplaces with varying levels of state capacity—Florida, Diepsloot, and Diepkloof Extension—we highlight the DSC index's ability to capture local racial and economic legacies and complex political dynamics. As Table 4 shows, Florida, a historically white but increasingly diverse working-class area, and Diepkloof Extension, a middle/upper-middle-class, predominantly black subplace, both have an index score of 48.1 (within the top decile) despite their very different histories and demographic characteristics.

The state's interest in delivering services and meeting the needs of Florida's residents dates back to the late 1880s, when the subplace was established as an almost exclusively white dormitory town for mine workers. As a white dormitory community, Florida enjoyed adequate housing stock made up of state-built homes and flats, and a concentration of capability-enhancing infrastructure. In contrast to the most exclusive white areas, this working-class white area required significant local state investment in schools and clinics, which explains why it received more attention from the apartheid state, which was famously interested in building a robust welfare state for its white population. After apartheid, Florida's good housing stock made it especially attractive to an upwardly mobile coloured population. Today, Florida's population is racially mixed: 50 percent white, 24 percent coloured, 20 percent black African, and 6 percent Indian. Over 76 percent of the households in Florida have incomes above Johannesburg's median.

In contrast, Diepkloof Extension, which forms part of the Diepmeadow Township in Soweto, was built in three phases, beginning in the 1950s, to accommodate the forced removal of people from the Western Areas. When it was first established, like the rest of Soweto, this subplace lacked electricity as well as health and education infrastructure as a result

TABLE 4. Up and close DSC Index scores, actually existing state infrastructure, and socio-demographic characteristics of Florida, Diepkloof Extension, and Diepsloot.

	Florida	Diepkloof Ext	Diepsloot SP
DSC Index	48.1	48.1	16.4
Index Components			
Schools (ENS)	7.6	11.1	2.9
Clinics (ENC)	2.0	1.0	2.0
Piped Water (%)	87.6	81.1	19.9
Electricity (%)	99.0	99.5	44.4
Population			
Population size	15,287	6,838	47,485
Population density (population/Km2)	2,717	5,691	5,642
Racial Composition			
Black African (%)	20.5	99.9	99.7
Coloured (%)	23.7	0	0.3
Indian (%)	5.9	0	0
White (%)	49.9	0.1	0
Class Composition			
Household Income (% below median)	23.1	17.7	79.1
Historical Urban Growth			
Distance to CBD (Km)	13.1	10.3	30.1

Source: South African 2001 census conducted by StatsSA. The healthcare facilities 2009 data is based on information collected from the South African National Department of Health. Index components are the authors' compilation based on this data.

of poor state investment (Beavon 2004; Kracker-Selzer 2012). However, by 2001, we find virtually universal access to electricity, over 80 percent coverage in piped water, 11 schools, and one clinic (effective numbers). The transformation of Diepkloof Extension in this regard points to the politically motivated, deliberate efforts of the post-apartheid state to direct services to black residents, especially politically active, middle- and upper-middle-class enclaves (over 82 percent of household incomes are above the median). Indeed, Diepkloof Extension was home to much of the ANCs leadership, and beginning in the 1970s it served as a center of anti-apartheid mobilization. Though it has always been and remains primarily black, it is set apart from other predominantly black subplaces by a strong middle-class population that has strong political ties to the state (Harrison and Harrison 2014).

Both Florida and Diepkloof Extension reveal the importance of historical and political context for developmental state capacity. They further show that population size and density are not necessarily the primary determinants of the location of state-provided capability-enhancing environments. Florida has over twice the population of Diepkloof Extension but is half as densely populated.

Our third subplace, Diepsloot, is a densely populated predominantly black subplace and one of the most underserved subplaces in Johannesburg. It houses over 40,000 people, but with a score of 16.4, it is in the lowest decile. Diepsloot was established officially during the Rand Provision Administration in 1995 as part of a state effort to provide temporary housing for black migrant labor evicted from other townships, including Honeydew, Sevenfontein, and Alexandria. Though the ANC stressed access to good infrastructure and services as a key priority of post-apartheid urban development (Mabin and Smit 1997), programs like the Reconstruction and Development Programme neglected informal settlements like Diepsloot, despite the need. As Huchzermeyer, Karam, and Maina (2014:157) have shown, in contrast to its efforts to close the service delivery gap in settled townships such as Soweto the ANC did not develop a policy for informal settlement rehabilitation until 2013. With its temporary-to-permanent character and its almost exclusively lower-income (79 percent of household incomes are below the median) black African and informal population, Diepsloot marks a severe gap in developmental state capacity. This is especially evidenced in poor access to electricity and piped water. Yet, Diepsloot has access to nearly three schools and two clinics (effective number).

Diepsloot is an example of and reflects persistent state neglect of informal settlements. The difference in DSC between Diepkloof Extension and Diepsloot again reveals how important local political pressures and political configurations are for developmental state capacity and the delivery of capability-enhancing services. This comparison further shows that racial composition alone is not the primary determinant of the location of state capability-enhancing services in the post-apartheid state.

DISCUSSION: STATE CAPACITY IN THE POST-APARTHEID CITY

In summarizing our findings, we first underscore that the distribution of the DSC paints a picture of the variability of state capacity even in a territorially contiguous area of governance, defined by a high-capacity local state. Which neighborhood of Johannesburg you live in strongly affects your access to basic services and hence your basic capabilities.

Our analysis moreover suggests distinct socio-structural, historical, and political dimensions of state capacity. First, the spatial distribution of capability-enhancing services is very much an artifact of the geography of the apartheid city. The north–south divide, the concentration of higher per capita levels of capability-enhancing infrastructure in the CBD and the northern suburbs, the minimal but evident investment in greater Soweto south of the mining belt, and the dramatic neglect of informal areas that were outside the regulated spaces of the apartheid, are all deep imprints of apartheid economy. These legacies are hardly immutable.

Though our data set was constructed to capture this legacy, even as early as 2001 for electricity, water, and schools and by 2009 for clinics, these historical sources of inequality seem to have begun to blur slightly under South Africa's new democratic dispensation. A high-capacity state combined with an explicit popular mandate has seen service levels improve in some historically black areas, namely those with greater socioeconomic resources. In other words, the patterns of change and reproduction appear to follow a stratified racial pattern. For example, Soweto might over time become an area of high capacity, building on already existing infrastructure and ongoing state investment. In 2003, Soweto received 35 percent of the city capital budget for 2003/2004 (Harrison and Harrison 2014:300).

This is not the result of a generic expansion of state capacity, but rather a politically conditioned one. As a stronghold of the anti-apartheid movement and with high concentrations of ANC leaders, in the post-apartheid period Soweto became a pet project of the ANC mayor, Amos Masondo (Harrison and Harrison 2014). More broadly, townships in general have received greater attention than informal settlements, reflecting a larger pattern in the South African political economy of the ANC state being relatively responsive to organized sectors of the black working class while neglecting the informal sector (Seekings and Nattrass 2005). The case of Diepsloot is a reminder that in spatial terms state capacity is uneven.

CONCLUSION

The twenty-first-century developmental state has shifted decisively from its twentieth-century focus on mobilizing capital and nurturing an export-oriented bourgeoisie. As such, the tasks of the twenty-first-century developmental state are far more complex and demanding than providing material support to export-oriented industrialization (Williams 2014). In this article we join recent efforts to understand the twenty-first-century developmental state (Haggard 2018; Williams 2014) by developing a spatial measure of capability-enhancing capacity.

Contra territorial analyses of state capacity that presume radiating forms of power marked by clear gradations across politico-administrative territorial units, our index allows researchers to visualize and analyze the local spatial variation in the distribution of capability-enhancing public infrastructure. That is, the DSC index accounts for the density of basic infrastructure—education, health, and piped potable water and electricity—and enables a granular view of its distribution even within territorially contiguous areas of governance, like cities. By showing the spatial distribution of capability-enhancing public infrastructure our measure also differs from other well-known development indicators, most notably the HDI, which measures opportunities once accessed and thus is unable to distinguish the role of the state from that of private enterprises and community self-provisioning initiatives. By highlighting public infrastructure rather than population characteristics in terms of health, education, and socioeconomic status, our index focuses explicitly on the state's capacity to support the expansion of capabilities.

To show the advantage of our approach we used the case of Johannesburg, South Africa. Using data from the 2001 South African national census, the Johannesburg municipal infrastructure data set, and Johannesburg community reports, we calculated the DSC scores for over 600 administrative territorial units. We then mapped the spatial distribution of DSC, identifying spatial clusters, and quantitatively and qualitatively explored the influence of demographic and political factors on its distribution. These descriptive findings are not meant to be exhaustive but rather to demonstrate what we believe to be a fruitful and promising approach to the study of twenty-first-century developmental state capacity.

This case study has clear limitations. Our data shed light on only a particular dimension of developmental state capacity. There are other important welfare functions, such as cash transfers and labor market policies, that we do not consider, and while we measure proximity to basic services, which is critical in its own right, our measures to not capture many qualitative aspects of these services (e.g., the quality of teaching in schools or the quality of healthcare). More ambitious efforts to measure the efficacy of state-led capability enhancement will require new sources of data. Despite these limitations, our index does present a robust picture of the spatial distribution of measurable and meaningful attributes of state capacity.

The approach presented here has a number of implications for research and policy evaluation and should be of interest not only to development scholars but also to policymakers and citizens concerned with state developmental performance accountability. Just as we cannot assume welfare provision from welfare spending, we cannot presume the existence of service infrastructure from the state's bureaucratic capacity. A state may pledge to invest in redistributive, capacity-enhancing service provision and have the bureaucratic capacity to do so, but what, where, and how this developmental state infrastructure is distributed are empirical questions. Our approach, thus, compliments and strengthens approaches that privilege the state's bureaucratic capacity in conceptualizing developmental state capacity by examining the spatial distribution and density of actually existing infrastructural capacity.

Given its simplicity, researchers could estimate this index across contexts for small-*N* or large-*N* comparative research, as well as for single-case studies. On the one hand, our index can be used as a dependent variable. This entails investigating what factors might explain changes in the density of capability-enhancing infrastructure over time or variations across territorial units, following a subnational comparative study logic (Snyder 2001). As we have done here in only an exploratory fashion, explaining variations in the index as an outcome variable might entail analyzing the effect of race, class, history, or politics, among other factors, on the spatial distribution of developmental state capacity. On the other hand, researchers may choose to adopt our index as an explanatory variable for various outcomes of interest. For example, our index can be introduced to help explain changes in the HDI over time, investigating the effect of lagged changes in capability-enhancing infrastructure in any given territorial unit on its HDI.

In our view, this spatial measure of state capability-enhancing capacity strengthens the empirical and conceptual understanding of development and serves as a tool for evaluating states' developmental and redistributive work. In particular, because our index moves beyond broad *territorial* categories of core–periphery, rural–urban or sub-national variation this approach can raise interesting questions and highlight areas for future research on local urban development and its politics. This approach can be productively combined with approaches that take seriously the complexity and local dynamics that mediate how states proactively work toward redressing inequality or are complicit in reproducing or producing new forms and spaces of inequality. States may claim to engage in political projects aimed at equity promotion, or purport to distribute services in a purely technocratic fashion. However, actually existing infrastructural investments and density are often driven by more complex political dynamics, and local service provision is often a result of civil society–state relations and negotiations. Thus, local political contexts and state–society relations can also take center stage with this approach. ■

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NOTES

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1. Geocoded information on clinics for 2001 was unavailable at the time of data collection in Johannesburg. Given public investment in post-apartheid South Africa, we expect the number of clinics to have increased, or remained constant, since 2001. This may result in a less marked infrastructural gap between subplaces than was seen in 2001.

2. Although applying reliability measures beyond narrow psychometric scales is not always desirable (Peters 2014), these can yield a strict lower bound to reliability for multidimensional indices (Lucke 2005).

3. Methodologists have seriously questioned alpha's reliability as a measure of internal consistency reliability and encouraged the use of omega and glb instead (Cho 2016; Dunn, Baguley, and Brunsden 2014; Peters 2014; Sijtsma 2008; Yang and Green 2011). In addition to being sensitive to the number of items, alpha makes highly constraining assumptions, such as tau-equivalence, seldom met in realistic conditions. Omega and glb are based on less restrictive models that are more accurate in realistic conditions (Trizano-Hermosilla and Alvarado 2016).

4. Because of shared statistical assumptions, a low alpha means larger standard errors in the regression (Henson 2001).