Chapter 2
Disconnected land, people and jobs

Even as Africa's cities are crowded with inhabitants — but not dense with capital — they are physically fragmented and dispersed. They develop as collections of small, scattered neighborhoods. Without adequate roads or transportation systems, commuting is slow and costly, so workers lack access to jobs in the larger urban area. Many people and firms are disconnected — from one another and from economic opportunity.

The lack of connections among neighborhoods means that — compared with developed and developing cities in other regions — African cities show both lower exposure and higher fragmentation in the intensity of how land is used near the city center.

- Low exposure means that people are disconnected from one another. At a set distance (usually 10 kilometers), they cannot interact with as many people as in a city with higher exposure.
- High fragmentation means that within a specified area, population varies widely, with scattered peaks rather than the clustered ones that can enhance scale economies. Fragmentation increases infrastructure costs and lengthens travel times between homes, jobs, and businesses.

There are several aspects to African cities' low exposure and high fragmentation. The first is the paucity of new building cover and volume near city centers. Although many African cities have tall buildings, there are patches of either undeveloped land or land developed with low building volume. The result is a lack of concentration of capital near the center, or infill on unbuilt parcels. Development tends to push the boundaries of the city outward (a type of development known as expansion).

African cities also suffer from a large number of "leapfrog patches" — small parcels of newly built land that do not border on or overlap existing development. Their isolation from existing development undermines city governments' efforts to provide the networked services that benefit from scale economies — and that undergird urban productivity.

The prevalence of expansion, particularly leapfrog, development is just one pattern that makes urban commuting challenging in African cities. Another is deficient transportation infrastructure. Traffic congestion cripples the economy in cities such as Nairobi, where the average journey-to-work time is one of the longest among 15 cities studied (IBM 2011).

Economically, the ideal city can be viewed as an efficient labor market, matching employers and job seekers through connections (Bertaud 2014). With matching, cities benefit because, by increasing the size of their labor force and its diversity, employers and job seekers are more likely to find an appropriate match that makes the best of workers' skills and aspirations. The typical African city fails in this matchmaker role. Its land use is fragmented and its transport infrastructure insufficient — so its residents lack access to jobs. The separation of formal housing areas from commercial and industrial areas, which makes commuting slow and costly, is made worse by emphasis on expansion development. The lack of connections within the city stymies agglomeration economies, keeping costs high and closing the doors of African cities to regional and global trade and investment. In short, because African cities are fragmented (disconnected) and their infrastructure inadequate, people are disconnected from people, and people are disconnected from jobs.

Disconnected land

Collections of small and fragmented neighborhoods

Nearly all African cities look like collections of small neighborhoods. Outside the high-density city core of a stylized African city, infrastructure is poor, specialization is low, and land has mixed uses — often unregulated and informal. New satellite towns develop in peri-urban areas, where land is cheaper. But because these new towns have few economic opportunities; lack social amenities (schools, markets); and are not well connected to the urban core, they do not become viable, supporting centers. Instead, they emerge as secondary, disconnected neighborhoods. Large and mushrooming informal settlements emerge along the few axes of connectivity, usually major arterial roads or rivers and canals. On the outskirts, the city's rural areas see construction in pockets of private investments (Huang 2016).

With cities physically dispersed, Africans in urban areas are disconnected from one another. Urban expansion has increasingly occurred as leapfrog patches that do not border or intersect with existing urban built-up areas, leading to high transportation costs and lower access to markets and other people in the city. Within the urban core, population densities vary widely across locations, reducing the chances for large sections of the population to interact with other groups in the city.

Cities exist because they reduce economic distance by concentrating, in a limited area, workforce, employers, capital, costly infrastructure, ideas, and buyers and sellers. Connected people and firms enjoy labor market pooling, savings in the transport of inputs, and technological and information spillovers (Cervero 2001). Disconnectedness reduces the opportunity to benefit from agglomeration, costing opportunities to learn from others and match needs.

Disconnectedness can stem from a combination of few people to interact with, long physical distances between people, and long travelling times to reach other people. The three factors depend on the dispersion of people and capital. The scale of interactions depends on the density of people in the city, distance depends on how close buildings are to one another, and time depends on infrastructure availability (figure 2.1). African cities lag in all three areas.

FIGURE 2.1

Three aspects of being connected

Scale
Potential for interaction

Distance
Contiguity of built-up area

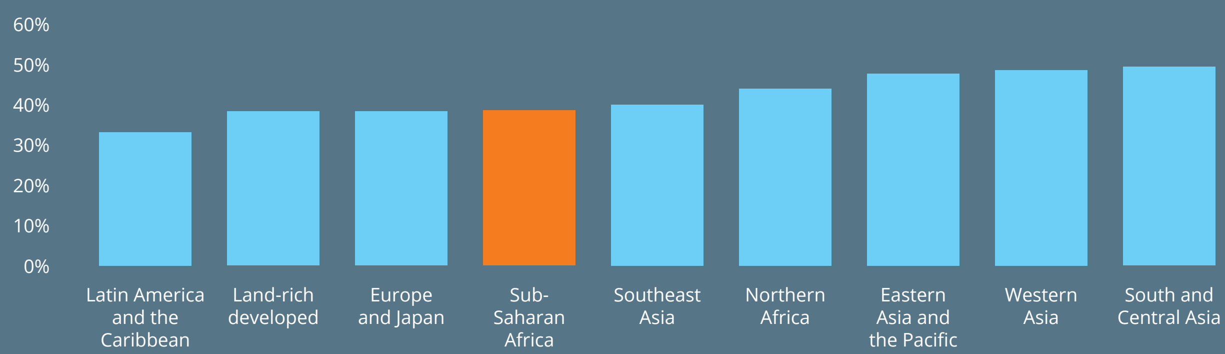
Time
Infrastructure to support interactions

Spatial fragmentation

On measures such as population density gradients or the share of open space surrounding built-up areas inside urban areas, African cities do not appear to be more spatially fragmented than cities in other regions (see chapter 1). The data, however, are unreliable: There is no comprehensive, up-to-date dataset on built-up fragmentation in cities. The latest data, for 2000 (Angel and others 2011), show that most African cities were on average similar to other cities of the world. The average openness index—the average share of open space in the walking distance circle around each built-up pixel in the city — is 39 percent for African cities, similar to the average in land-rich developed countries, Europe and Japan, and Southeast Asia (figure 2.2).

FIGURE 2.2

The average "openness index" of cities in Sub-Saharan Africa is not very different from the index of other regions



Source: Angel and others 2011.

Note: The openness index measures the average share of open space in the walking distance circle around each built-up pixel in a city.

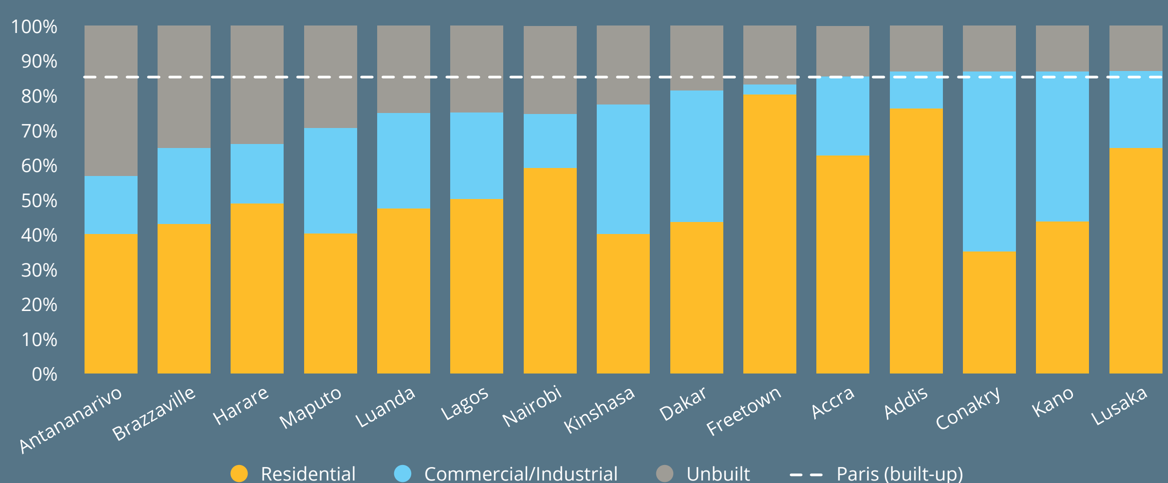
The average city footprint ratio — the ratio of the city footprint to the built-up area in the city — is 1.8 in African cities — similar to Latin America, North Africa, and Europe and Japan. Sub-Saharan Africa's cities thus do not appear to be more fragmented because they have more urbanized open space than cities elsewhere.

African cities may be more fragmented than the global norm close to the city center. City centers have higher economic dynamism and are thus important spots for exchanging goods, services, and ideas. They also usually have the most valuable land in the city. When land is underutilized in the center, the city loses the opportunity to use some of its most productive land.

Not all land in the vicinity of the center needs to be built up; land can also be left empty for green spaces. In Paris, for example, 14 percent of the city center is unbuilt; in Singapore, about 20 percent of the land in the center is intentionally left undeveloped. In contrast, in cities like Antananarivo, Madagascar; Brazzaville, the Republic of the Congo; and Harare, Zimbabwe, noncontiguous built-up areas are scattered throughout the center, with more than 30 percent of land within 5 kilometers of the city center left unbuilt (figure 2.3).

FIGURE 2.3

Land within five kilometers of the central business district is often left unbuilt in Africa



Source: Data on Africa are from Antos, Lall, and Lozano-Gracia 2016; data on Paris are from Duranton and Puga 2015.

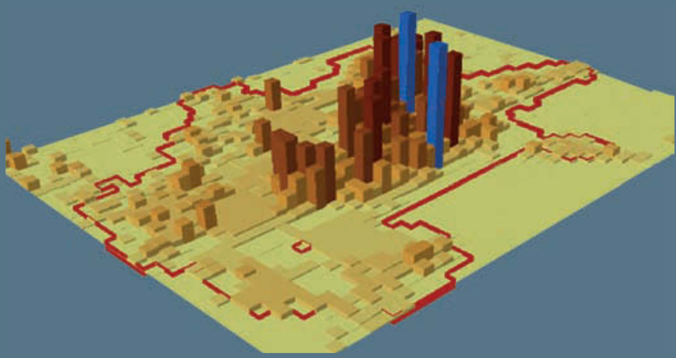
African cities are also characterized by lower exposure and higher fragmentation in the intensity of land occupation around the city center during the day. Controlling for differences in city population and country GDP per capita, African cities are about 33 percent less exposed than Asian cities and somewhat less exposed than Latin American cities, as measured by the de la Rocha and Puga index described in box 2.1.[12] They are also about 25 percent more fragmented near the city center than either Latin American or Asian cities (Henderson and Nigmatulina 2016).[13]

Lower exposure and higher fragmentation create scattered density peaks instead of clustered densities that could enhance scale economies. Henderson and Nigmatulina (2016) use Landscan (see box 2.1) to measure these and other aspects of the urban form in 265 cities in 70 countries in Africa, Asia, and Latin America. They find, for example, that Nairobi is more fragmented in the city center than Pune, India, with lower clustering of high-ambient densities (as evident from the smaller number of blue peaks in figure 2.4). Kampala, Uganda is more fragmented than Surat, India.

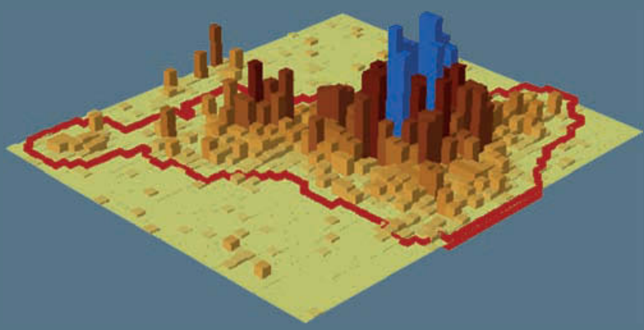
FIGURE 2.4

African cities are more fragmented in the center than comparably sized cities in India

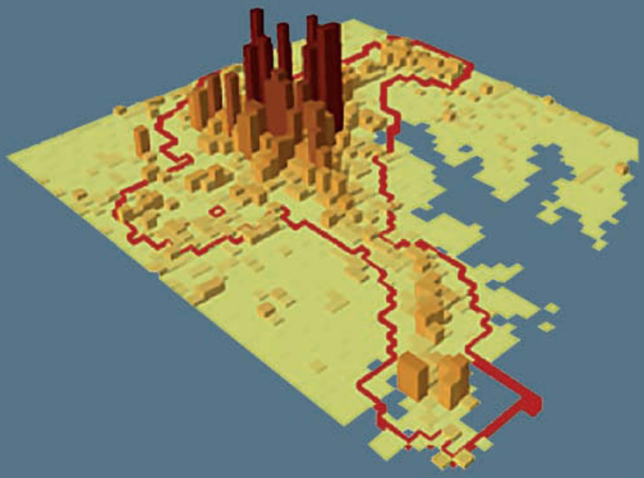
Nairobi (population 4.265 million)



Pune (population 5.574 million)



Kampala (population 2.423 million)



Surat (population 3.373 million)

0–364	2,295–4,041	9,777–13,984	27,748–39,955
365–1,032	4,042–6,734	13,985–19,534	39,956–53,912
1,033–2,294	6,735–9,776	19,535–27,747	53,913–71,973

Source: Henderson and Nigmatulina 2016.

BOX 2.1

Measuring fragmentation in urban form

- **Exposure**: The de la Roca and Puga (2016) index of population exposure measures potential interactions at the city level. It measures the exposure ("interaction") of an average person to other people working and living in a city within a certain radius. The Landscan data focus on the ambient population: where people live and work in a city over a 24-hour time period. The index is calculated by taking the sum of the ambient population within 5 or 10 kilometers from each 1 square kilometer cell within the city. The citywide measure is the sum of the exposure measures for every cell in the city, weighted by its share of the population. Using Landscan data from 2012, Henderson and Nigmatulina (2016) calculated this index for 263 cities in Africa, Asia, and Latin America.
- **Fragmentation**: The coefficient of variation of density of the ambient population near the city center is the standard deviation of all cells near the center normalized by the mean density of these cells. The index reported uses the 8 percent of urban area cells closest to the city center. Using Landscan data from 2012, Henderson and Nigmatulina (2016) calculated this coefficient.
- **Fragmented built-up area**: The fragmentation of built-up area is measured by the number and area of leapfrog patches, controlling for initial city built cover and population, population growth, and other factors. The analysis draws on Baruah (2015).

Why are some cities more fragmented than others? When population grows rapidly, cities struggle to provide infrastructure to new settlements. When land management and urban planning are weak and decentralized, new households tend to settle on the outskirts (where land is cheaper), in a scattered, fragmented manner. The intertwined effects of population size, rates of growth, affordability and availability of land, and land management and urban planning lead to different levels of fragmentation.

The persistence of institutions from colonial times may explain the development patterns of many African cities today. Former British colonial cities appear more fragmented than former French colonies; their development has been patchier, more scattered and strung out, with more open space (Baruah, Henderson, and Peng 2016).

Baruah and Henderson (2016) regress fragmentation on a dummy variable for anglophone cities and control for time-invariant geographic features, population growth, and time-varying country and city characteristics. Their results consistently show that anglophone cities are more fragmented than other cities in Africa. All other things equal, compared to French cities, they have a sprawl index 25 percent higher, about 50 percent more leapfrog patches, and about 40 percent more area dedicated to leapfrog development.

The findings suggest that the different development paths followed by anglophone and francophone cities are linked with the colonial legacy. Three hypotheses on why this might be need to be studied:

- Legal systems and governance structures have persisted and are more integrated in former French colonies than elsewhere, enabling governments to implement urban plans and enforce land use regulations. The French tended to reject customary land management, establishing a state monopoly on land markets and management systems. In contrast, the British established a dual mandate with a dual local government structure: Different laws governed the colonists' plantations (or townships) and land held under indigenous or customary titles (Baruah, Henderson, and Peng 2016). If francophone cities remained more centralized, their procedures for allocating land use (for example) might be more standard across the city. In contrast, decentralization in anglophone cities may have allowed local governments to assign land under various local rules.

- In addition to being more centralized, legal systems in francophone countries were more prescriptive. Procedures to assign land as well as zoning were well defined, possibly resulting in standard procedures for permitting new construction and stricter zoning regulations. Land use in anglophone cities may have been more haphazard, driven by the interests of local governments.
- The training of francophone urban planners — through scholarships and education in French polytechnic schools — may have induced greater conformity and led to compact, centralized plans.

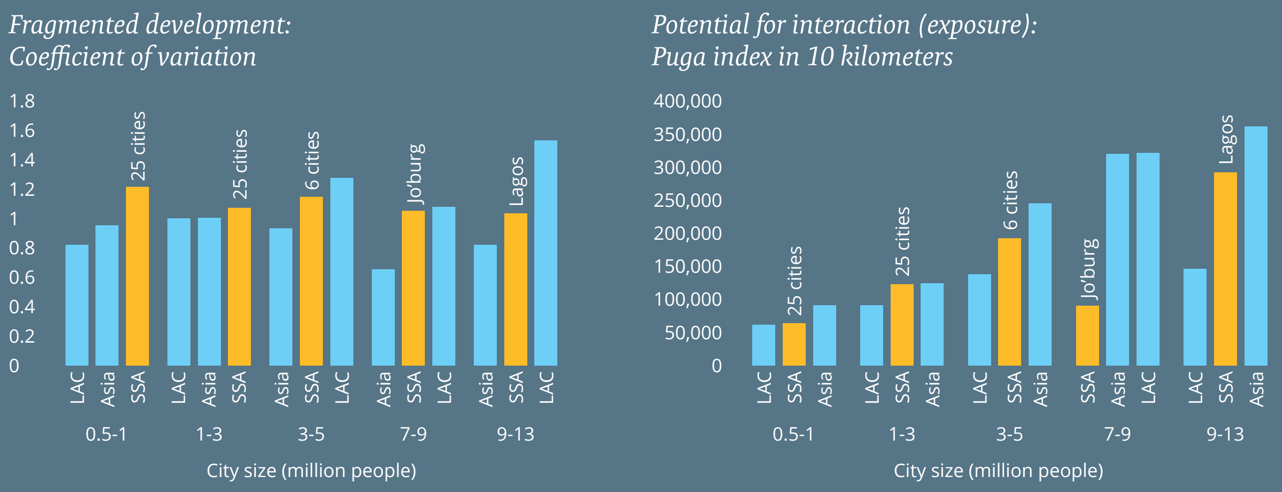
People not connected to people: High fragmentation, low exposure, little potential for interaction

Urban Africans have little connectivity in their neighborhoods, as shown by the low exposure and high fragmentation in the intensity of land occupation. They also have less potential for interaction, as the dense population near the city center quickly diminishes with distance. People living outside the center have very few neighbors to interact with: The Puga index at 10 kilometers is much lower in African cities than in Asian cities of similar size (see box 2.1). African cities in the sample are mostly small and medium-size, with fewer than 3 million inhabitants. Johannesburg's exposure is about one-fourth that of similar-size cities in Latin America and Asia (figure 2.5, left-hand panel).

African cities are more fragmented in the intensity of land use near the city center. Development in the city center is often fragmented, with low exposure punctured by random towers (Huang 2016). The coefficient of variation of densities within the 8 percent of pixels closest to the city center captures this pattern. Small and medium-size cities, such as Addis Ababa, Ethiopia; Antananarivo, Madagascar; and Bujumbura, Burundi are more fragmented than comparable cities in Asia and Latin America (figure 2.5, right-hand panel).

FIGURE 2.5

Urban people in Africa have less potential for interaction than urban people in other regions



Source: Data from Henderson and Nigmatulina 2016.

Note: LAC = Latin America and the Caribbean; SSA = Sub-Saharan Africa.

A physically fragmented city, with much empty space between built-up areas, raises the costs of providing services such as road networks, sewerage systems, and schools (Squires 2002). It increases air pollution, creates losses of natural land, and fragments the ecosystem (Johnson 2001). Conversely, the clustering associated with nonfragmented development makes cities potentially more productive and welfare enhancing.

Harari (2014) analyzes 400 Indian cities. She finds that compact (nonfragmented) cities are associated with higher population density, higher welfare, and higher concentration of productive establishments. A one standard deviation deterioration in city form is associated with 0.9 standard deviation decline in population density and a welfare loss equivalent to a 5 percent decrease in income.

Leapfrog development increased in many African cities between 2000 and 2010, sowing the seeds for fragmentation. Regardless of their size, these patches increase the costs of providing network infrastructure. Among 21 African cities studied, only in Windhoek, Namibia did the share of total new fragments fall between the 1990s and 2000s. The number of leapfrog patches per square kilometer of footprint fell in only four cities: Windhoek; Addis Ababa; Lusaka, Zambia; and Ouagadougou, Burkina Faso. Cities such as Maputo, Mozambique; Nyala, Sudan; and Nairobi are becoming increasingly fragmented. In Maputo, for instance, 51 percent of the patches created between 2000 and 2010 were leapfrogged. In 2010, there were 95 new patches per square kilometer of land in the city (figure 2.6).

FIGURE 2.6

African cities are becoming more fragmented

Share of new leapfrog fragments in total new fragments (percent)

Source: Baruah 2015. Note: Share of new leapfrog fragments of new development with the alternatives being infill and extension.

People not connected to jobs

Lack of transportation infrastructure

African cities are allocating little land to roads. In a sample of 30 cities around the world, the 8 African cities rank in the bottom 12 spots for road density, including Kigali (19th), Addis Ababa (24th), and Nairobi (27th). African cities devote less than 16 percent of their land to roads (figure 2.7); cities in developed countries usually allocate more than 20 percent. Lower infrastructure provision, coupled with low affordability of motorized transportation (see chapter 3), makes it difficult to access locations across the city. Low affordability increases the number of people who must walk; low road provision increases congestion and pollution.

Roads tend to be concentrated in the city center, providing little accessibility for people on the periphery. Cities with well-developed transportation infrastructure, like Paris, devote a larger share of land to roads throughout the city, providing the connectivity required for compact development. These cities still follow a monocentric model, but their population densities and the share of roads decline more gradually.

Kigali, Rwanda and Nairobi dedicate a large share of land in the city center to roads, but the share of built-up area falls steeply as the share of roads almost disappears, as it does in all four cities in map 2.1: the share of land for built-up areas (in orange) goes hand in hand with the share of roads (in dark blue).

African cities are usually serviced by radial arterial roads emanating from the center, sometimes with concentric ring roads. From a spatial planning perspective, a radial-ring structure is less efficient than a grid structure, which allows for scalability and easy orientation and provides alternative routes and thus enhanced travel efficiency. Increasingly, African cities are adopting the grid structure, especially for expansion areas or new satellite development, as in, for example, Bahir Dar, Ethiopia and Ouagadougou, both of which have adopted a scalable grid modular unit at the neighborhood level, with a clear hierarchy for roads, amenities, and services.

FIGURE 2.7

Paved roads occupy a smaller share of urban land in Africa than elsewhere — and usually drop off abruptly beyond the city center

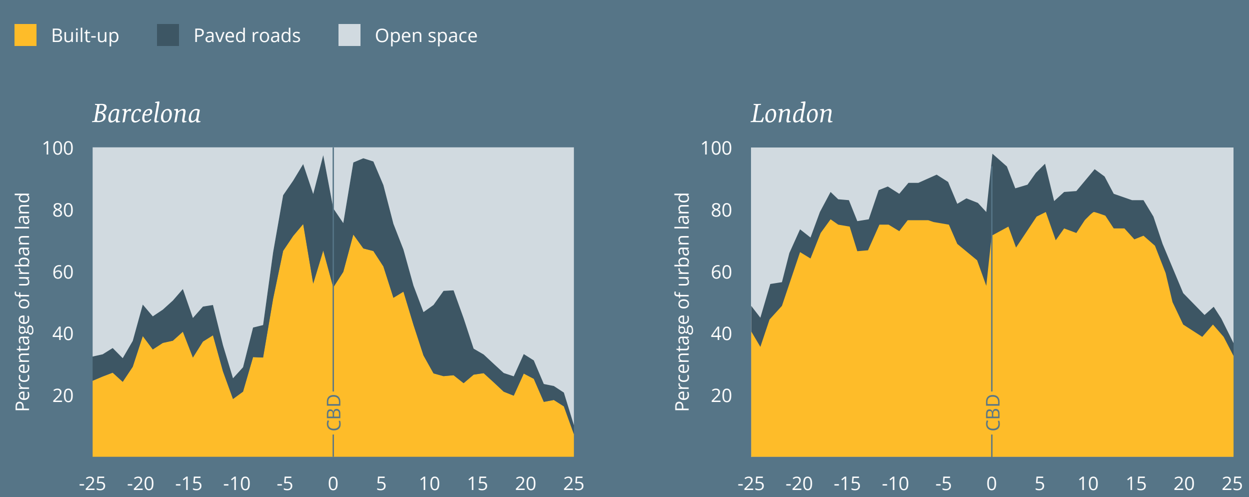
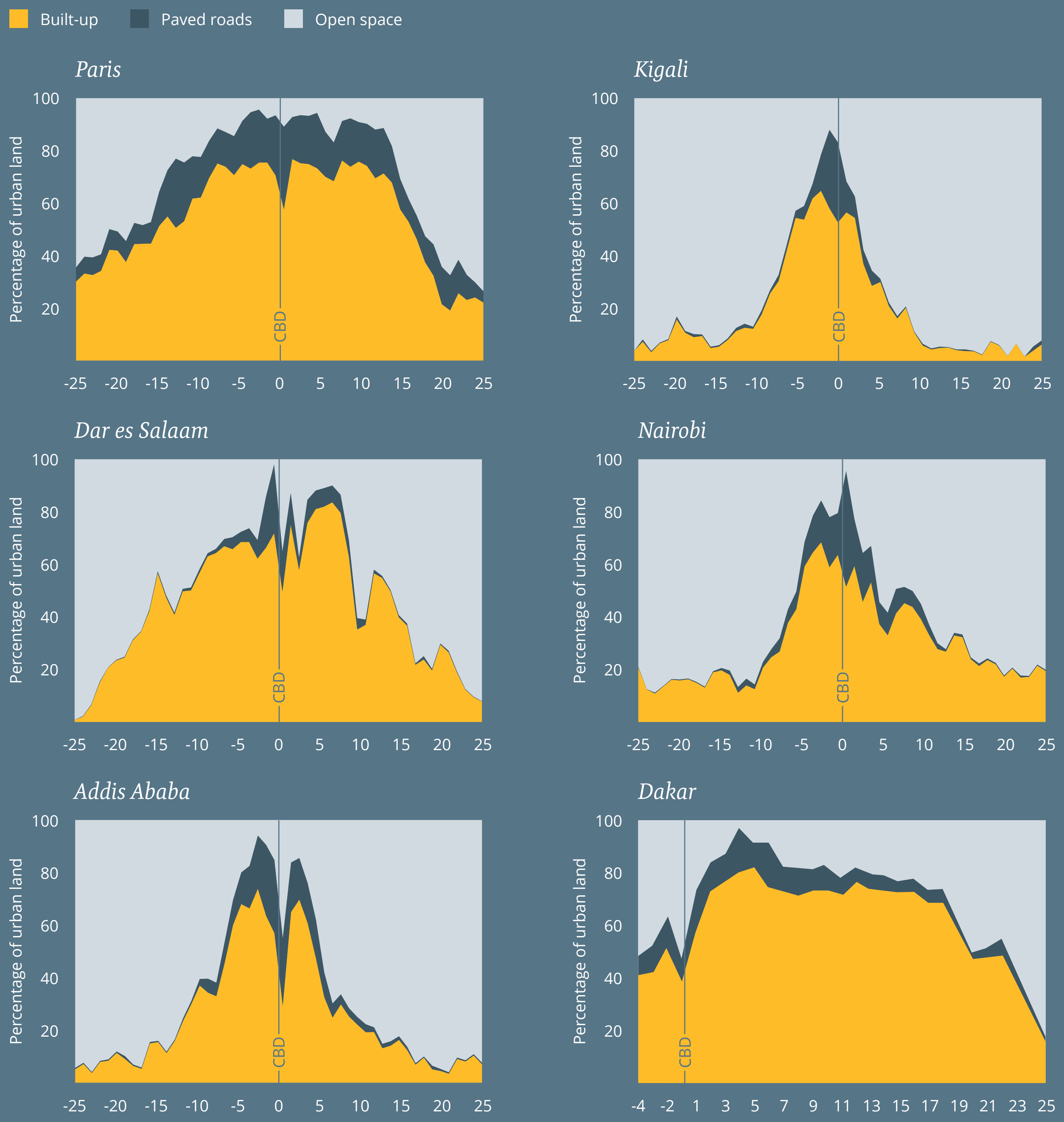


FIGURE 2.7 *(cont.)*

Paved roads occupy a smaller share of urban land in Africa than elsewhere — and usually drop off abruptly beyond the city center



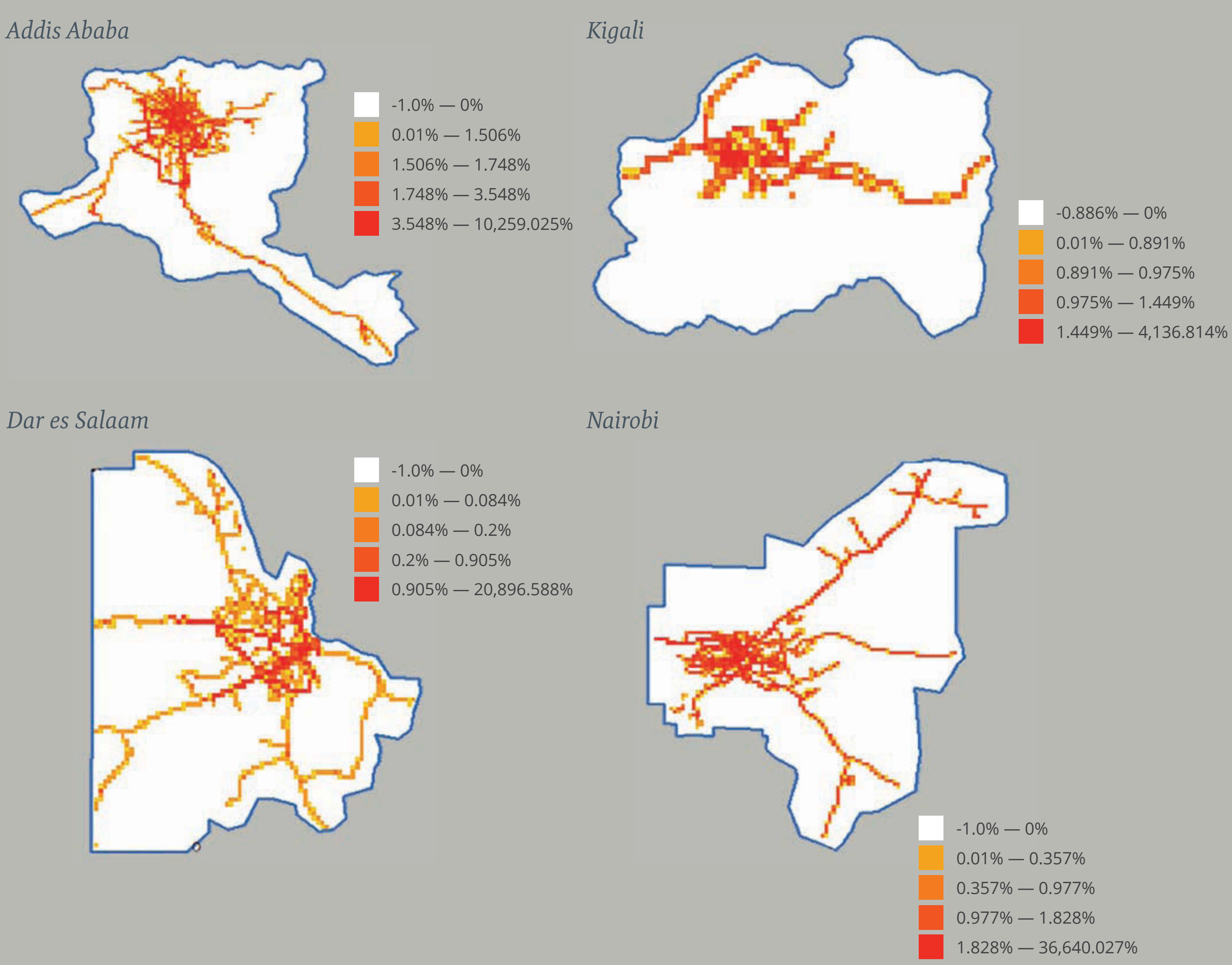
Source: Data from Antos, Lall, and Lozano-Gracia 2016 and Felkner, Lall, and Lee 2016.

Note: CBD = Central Business District. The data for African cities come from very high-resolution (< 1m) imagery using a semiautomated supervised classification approach (leveraging both textural and spectral data). The images are circa 2012 for Nairobi and Kigali, circa 2013 for Dar es Salam, circa 2014 for Dakar, and circa 2011 for Addis Ababa. The European data come from the Urban Atlas, published by the European Environment Agency (EEA) (http://www.eea.europa.eu/data-and-maps/data/urban-atlas). The layers in this atlas were created in 2010, based on 2005–07 imagery. The central business district was identified using the location of the oldest building as a proxy (or a government building if necessary).

Investments in infrastructure shape how land is used. Roads and transit systems affect commuting costs and times differently across the city, incentivizing densification in some corridors and allowing households to locate farther from the city center. In the four cities in map 2.1, investments in road infrastructure increased population density by 17–37 percent within a 1 square kilometer of the road (Felkner, Lall, and Lee 2016).

MAP 2.1

Change in land used by paved roads across four African cities



Source: Felkner, Lall, and Lee 2016.

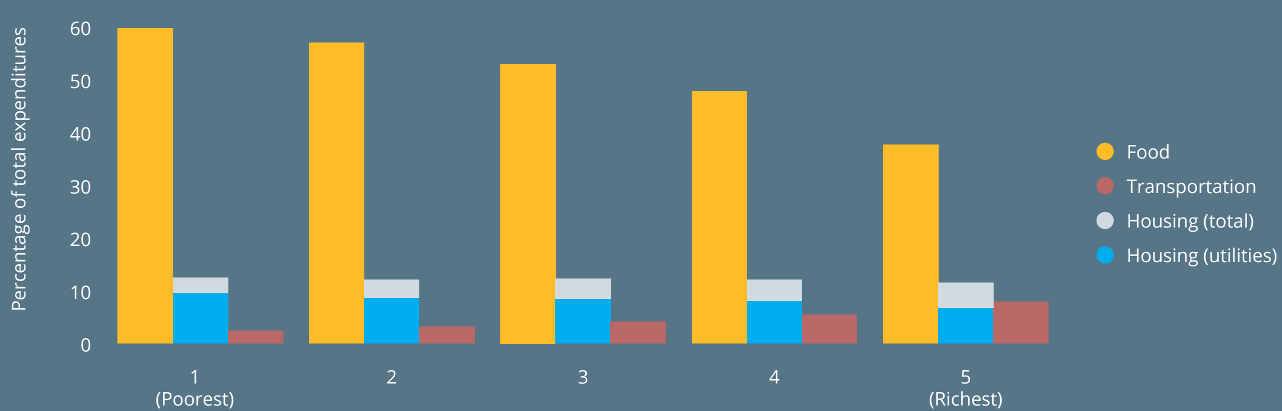
Lack of money for transportation

Sub-Saharan Africa is urbanizing rapidly, but it is doing so at low per capita incomes, limiting the funds available for transportation. In 2013, it was roughly 37 percent urbanized, and income per capita was a little over $1,000 in 2005 dollars. Latin America and the Caribbean reached 40 percent urbanization in 1950, with a per capita income of $1,860. The Middle East and North Africa reached the threshold in 1968, when per capita incomes was $1,800; East Asia and Pacific reached it in 1994, when per capita income was $3,620 (WDI 2015).

With lower incomes, urban residents in Sub-Saharan Africa's cities spend a large share of their budgets on food, leaving little for transportation, housing, or other basic items. Food accounts for 60 percent of total expenditures for the bottom 20 percent of Sub-Saharan Africa's urban households and 35 percent even for the wealthiest quintile (figure 2.8). Transportation expenditures are very low, at 3–8 percent of total spending (Lozano-Gracia and Young 2014). The small monetary share reflects the fact that most commuting involves walking, trips for which people in Asia and Latin American cities would use cars, scooters, or public transit.

FIGURE 2.8

Urban Africans spend a large share of their budgets on food



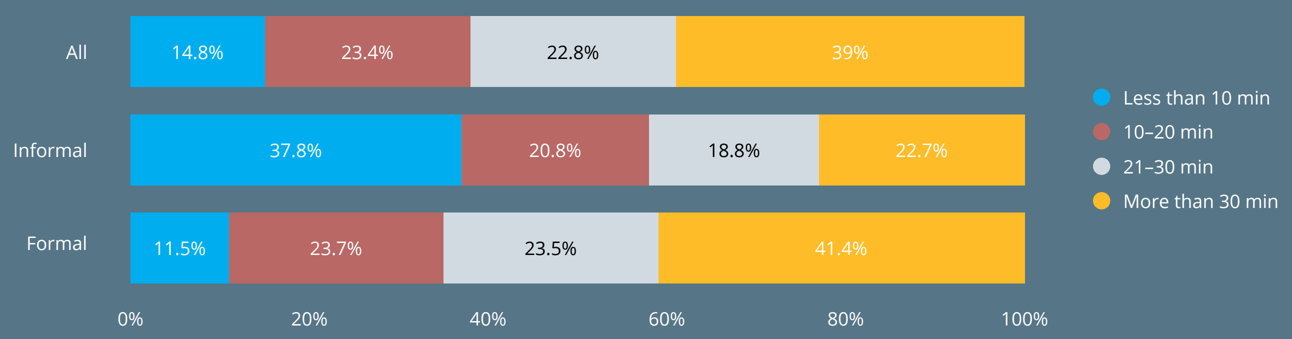
Source: Lozano-Gracia and Young 2014. Note: Data are from 20 countries.

High out-of-pocket commuting costs disproportionately affect the disadvantaged (poor, young, unskilled) by creating a spatial mismatch. Physical segregation of unskilled workers from job opportunities leads to high commuting and job search costs, which partially explain higher unemployment rates and lower average wages. In Addis Ababa, for example, a randomized experiment to provide young residents in peripheral neighborhoods with a nonfungible transit subsidy that could be used to search for employment in the city center increased employment (26 percent versus a mean of 19 percent) and led to better-quality jobs (more formal, less likely to be part time, and usually better paying) within four months (Franklin 2015). Within the control group, the employed were more likely to have part-time, informal, and local jobs requiring less commuting — a pattern repeated in Kigali (figure 2.9).

Travel budgets in Europe and the United States display a remarkable regularity (about 10–15 percent of personal expenditures) (box 2.2). Monetary travel budgets in Japan are lower and closer to African averages (about 7 percent), because many Japanese use public transit rather than cars (Schafer and Victor 2000).

FIGURE 2.9

In Kigali, workers in the informal sector have shorter commutes



Source: NISR and MPSL 2013.

BOX 2.2

Is there a constant travel time budget? The Zahavi conjecture

Zahavi (1973, 1974; later with Talvitie) observed that daily urban travel times in the United States and Europe were similar, despite wide differences in transportation infrastructure; geography; and the incomes, cultural norms, and habits of residents of different cities. Zahavi found that these average travel times are nearly constant for individual cities over time and similar over space for different cities, at about one hour a day. He concluded that travel times are therefore spatially transposable, leading to the idea of a predictable travel time budget. He also observed the regularity of a "travel monetary budget."

This observation led to the formulation of an assumption, known as the Zahavi conjecture, that postulates that decreases in travel time caused by increases in transportation speeds (switching from slower to faster transportation modes) are entirely reinvested in more trips and longer travelled distances. If the conjecture is accurate, it means that there is a natural travel time budget that, combined with average travel speeds in an urban area, constrains the distances that can be travelled and hence the space of accessibility. It is this space of accessibility that urban dwellers seek to maximize given transportation constraints. This reasoning appears to be compatible and may even explain urban areas' growth through sprawl and increased travelled distances.

Looking at a large variety of settlements (cities and countries), Schafer and Victor (2000) find some empirical evidence to support these regularities, in particular for the travel time budget, which they estimate at about 1.1 hours a day (box figure 2.2.1). The travel monetary budget displays slightly less regularity; it depends on the motorization rate but tends to converge beyond a certain rate. Schafer (2000) shows that travel monetary budgets were virtually constant, oscillating between 10 and 15 percent, for a panel of six developed countries from 1970 to 2004. *(continued overleaf).*

BOX 2.2 *(cont.)*

Is there a constant travel time budget? The Zahavi conjecture

BOX FIGURE 2.2.1

Average per capita daily travel times in selected cities

Source: Schafer and Victor 2000; Schäfer and others 2009.

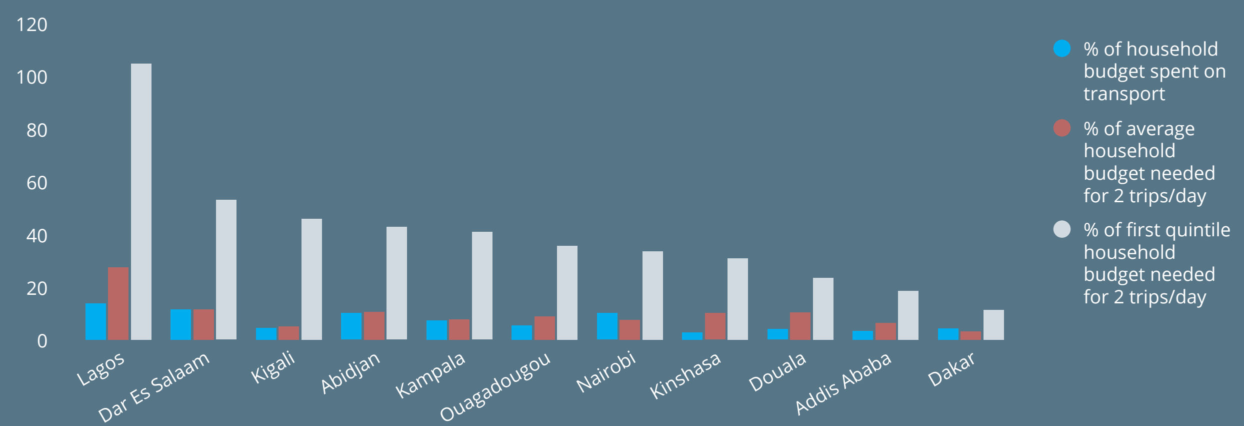
Zahavi himself did not believe that there was a fundamental law that would lead to constant travel times over time, irrespective of local conditions. When developing the unified mechanism of travel model (Zahavi 1981), he linked travel time budgets to the motorization rate (equivalent to an average speed in the urban area). He did find that there is a speed beyond which travel time budgets converge and become nearly insensitive to future speed increases. His modeling found that threshold to be about 10 kilometers an hour, which would correspond to a speed at which a large share of travelers no longer walk for all trips. Before that threshold is reached, travel time budgets can exceed one hour and decrease strongly with any increase in travel speeds. This subtlety of Zahavi's modeling, which is rarely appreciated, may explain some findings for African cities in which travel time budgets appear higher than elsewhere.

The cost of collective motorized urban transportation, which dominated in Africa by informal minibuses, is high relative to household budgets in Sub-Saharan Africa's major cities, rendering it largely unaffordable on a daily basis, especially for the poorest (Kumar and Barrett 2008). In 8 out of 11 cities studied, the average household could not afford one round-trip a day using the minibus network. Figure 2.10 shows actual average budget shares on transport and then what these shares would be for first the average households and then a poor household if they made two trips a day using the minibus network.

These potential budget shares show wide variation. In Dakar, a round-trip commute costs only 3.1 percent of the average household's total expenditures. For most of the other cities, it costs 5.1–27.5 percent. For the bottom quintile, the situation is even worse. Excluding Dakar, the poorest households in these cities would need to spend an average of about 19 percent of their budget to afford a round-trip motorized commute. For the poorest quintile, the figure is 53 percent in Dar es Salaam and more than 100 percent in Lagos.

FIGURE 2.10

The typical household in many African cities cannot afford public transport fares



Source: Kumar and Barrett 2008.

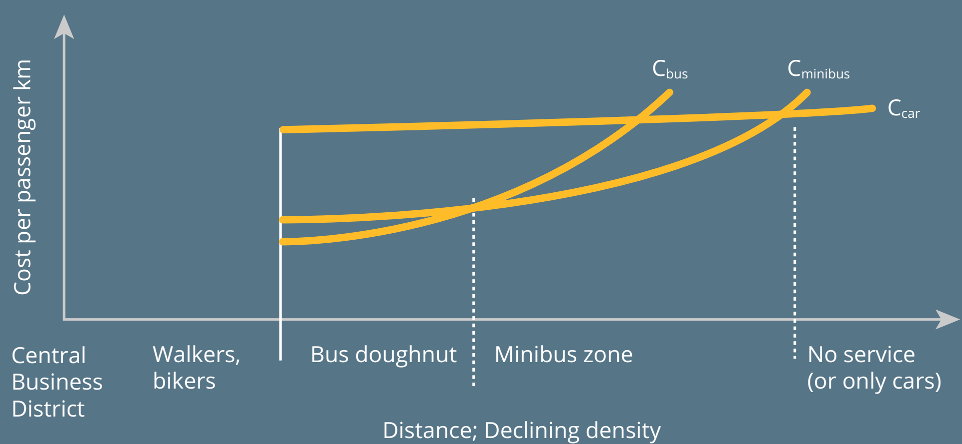
The World Bank (2015b) conducted comprehensive travel demand surveys in Nigeria in Abuja (2013), Kano (2012), and Lagos (2009, 2012). They revealed that low-income households in these cities spend 49, 40, and 33 percent, respectively, of their household budgets on public transport; the average household spent 31, 32, and 24 percent, respectively; and middle- and upper-income households spent 18, 19, and 10 percent, respectively. These high costs relative to household budgets lead to travel patterns dominated by walking, greatly limiting access to economic opportunities.

The prevalence of minibuses rather than larger vehicles increases the monetary costs of transportation, contributing to its unaffordability for a large segment of the population in African cities; starting from the central business district and traveling outward, travel per passenger-kilometer can be provided at lower cost by bus than minibus and by minibus than car (figure 2.11).

The cost per passenger kilometer increases with distance from the central business district because density declines (Eskeland and Lall 2015). The increase is steeper (more convex) for buses than for minibuses because they have more seats to fill. They have to spend more than minibuses to be sufficiently frequent and close to demand. Cars have the flattest curve, because they carry only a few passengers.

FIGURE 2.11

Scale economies in vehicle size should lead to the provision of collective transportation through large vehicles toward the city center and smaller ones as distance to the city center increases



Source: Eskeland and Lall 2015.

Note: The dotted lines indicate a change in the most cost effective means of transport. The 'bus doughnut' corresponds to the dense urban area served competitively by buses.

Larger vehicles are more efficient if they can be filled; where population density falls, they may not be efficient. The size of the vehicle that can operate cost effectively declines with the distance from the center. Travel costs therefore increase more than proportionally with distance from the city center (Eskeland and Lall 2015). If the prices of transportation reflect the costs, larger buses leveraging scale economies could significantly reduce transportation costs for users in African cities.

The percentage of trips made by foot is very high in major African cities, largely because of the high cost of bus trips. The figure is 30–45 percent in Nairobi, Lagos, and Addis Ababa and nearly 70 percent in Dar es Salaam (figure 2.12).

Generously assuming that pedestrians can travel at an average of 4 kilometers an hour in a straight line, a large share of city residents can access opportunities only within a 50 square kilometer area of where they live by walking for an hour — a problem in metropolises that often cover more than 1,000 square kilometers. Such a catchment area would cover only about 7 percent of Nairobi's core city, for example.

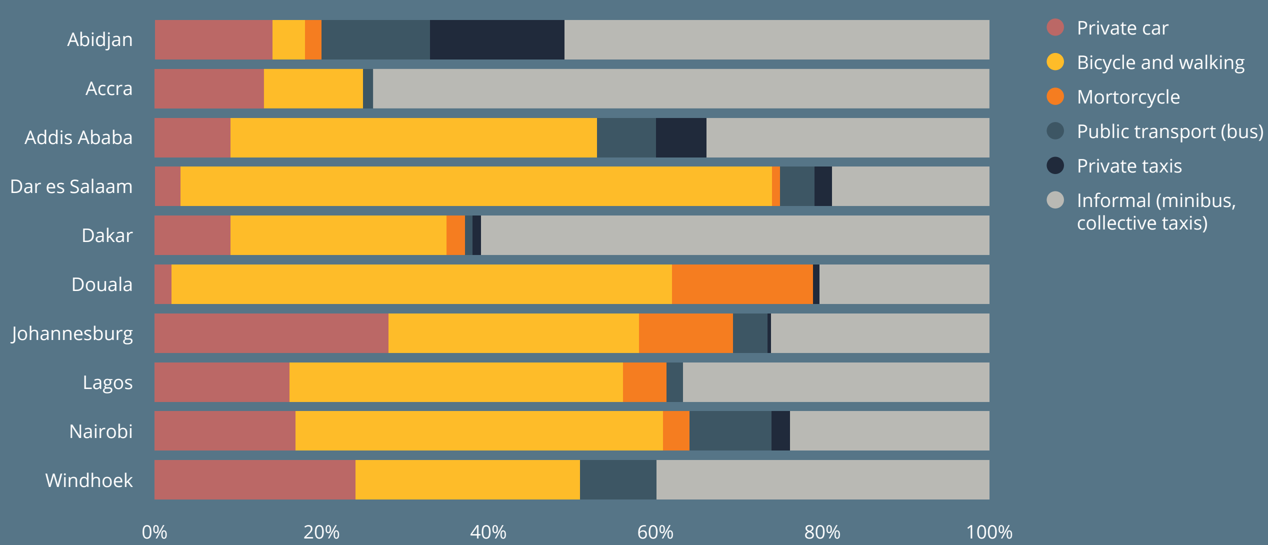
In Dar es Salaam, households travel only small distances to get to work: Household heads' average commuting distance is less than 6 kilometers, and other adults travel no more than 4 kilometers on average (World Bank 2015c). These figures indicate that Dar es Salaam, although a city of more than 5 million people, functions as a set of villages with extremely local labor markets.

In Durban, South Africa, labor markets do not appear to be as fragmented, with most people traveling 30–40 minutes from home to work; commuting modes are also more diverse than in Dar es Salaam. A third of Durban's population uses minibuses as the main mode of transportation, and almost 30 percent use private vehicles. A still considerable 21 percent walk to work.

Another striking feature of African cities is that collective transportation is primarily informal. *Matatus* in Nairobi and Kampala, *cars rapides* (or *ndiaga ndiaye*)

FIGURE 2.12

A very large share of trips in African cities are made by foot



Source: International Association of Public Transport 2010.

in Dakar, *dala dalas* in Dar es Salaam, *tro* in Accra, and *gbaka* in Abidjan are all informal (and often colorful) minibuses. Collectively, they are the main form of motorized collective transportation in most African cities. The service they provide is highly valued, as demonstrated by their large share of trips. However, because public or collective transportation is informal, the networks are mostly reactive: They accompany the growth of the city rather than structure it. In contrast, in many developed country cities (Paris, London, Barcelona), transportation helps determine the structure of the city (Brooks and Lutz 2013).

Inaccessible employment

For cities to act as integrated labor markets and match jobs seekers and employers, they need to make employment accessible. African cities are failing to do so. Activities are scattered instead of clustered, because capital is misallocated. Fragmentation prevents labor market pooling — leaving workers with access to few jobs, keeping productivity low, and locking cities into the nontradable sector. Such a climate does not reward workers for investing in their human capital or facilitate the accumulation of the soft skills they need to succeed.

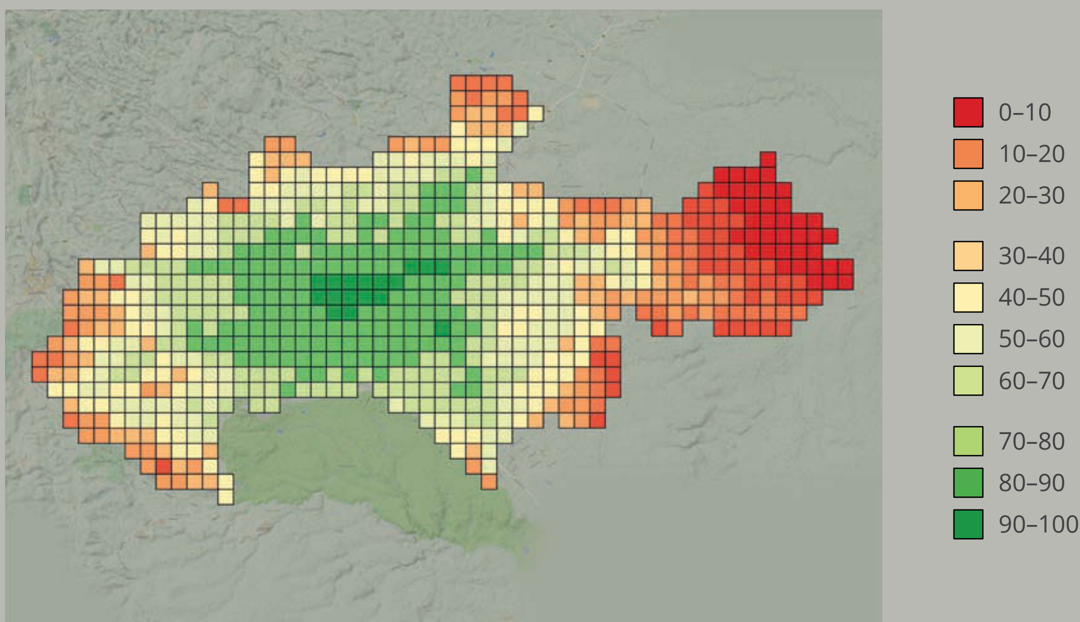
Mobility is essentially a derived demand, meaning that it is desired not for itself but because it can provide access to other goods and services. Cities' matchmaking function is to provide employers with candidates who seek their needs and for job seekers to find employment opportunities that suit their talents and aspirations; it is an important reason why cities are more productive than the rest of an economy (World Bank 2015a). Employment accessibility can be commonly defined as the number or share of jobs that can be reached within a given time.

Avner and Lall (2016) study access to formal jobs in Nairobi. They find that accessibility is much higher for car users than for users of *matatus* (privately owned minibuses). Indeed, map 2.2 suggests that Nairobi is a city built for car owners, who can reach about 90 percent of jobs within an hour, But car use accounts for only 13 percent of trips for all purposes; 28 percent of trips are made with *matatus* and 41 percent are

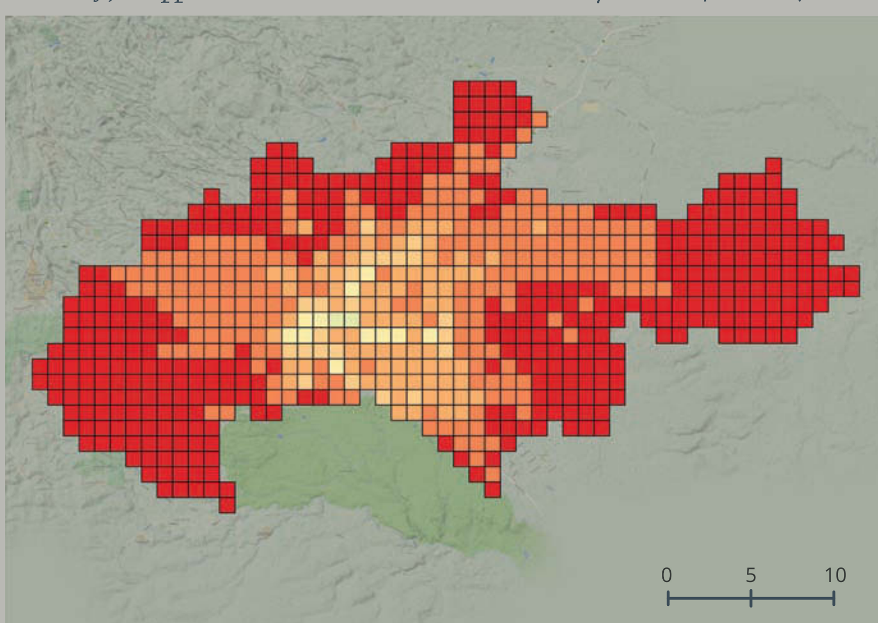
MAP 2.2

Most job opportunities in Nairobi are inaccessible to people without cars

Shares of job opportunities accessible within an hour by car



Shares of job opportunities accessible within an hour by matatu (minibus)



Source: Avner and Lall 2016.

made on foot (JICA 2013, 2014). A central resident can access only 20 percent of all jobs within an hour using the *matatu* network.

In contrast, in 2013, a resident of London could reach 2.5 million jobs (54 percent of all jobs in Greater London) within 45 minutes of the city center using the public transit network (TfL 2014). From any location in the urban area, the average number of jobs accessible within 45 minutes using transit in Greater London in 2013 was a little under a million (21.6 percent of all jobs). By comparison, in Nairobi, matatu users' had access to only 5.8 percent of all jobs within 45 minutes.

These figures do not account for the distribution of residents throughout the urban areas. As people tend to settle in denser patterns in zones that benefit from greater employment accessibility, residents' location affects the outcome (table 2.1).[10]

Table 2.1 Accessibility to formal jobs in Nairobi

	Cars		Matatus + walking	Walking only
Maximum travel time (minutes)	Uncongested	Congested	Congested	
30	57%	31%	4%	3%
45	85%	58%	10%	7%
60	96%	77%	20%	11%

Source: Avner and Lall 2016.

Heavy congestion, high rates of walking, informal collective transportation, and the spatial distribution of jobs and residents lead to low employment accessibility in Nairobi and the misallocation of labor. Matatu users on average can access only 4 percent of jobs within 30 minutes, 10 percent within 45 minutes, and 20 percent within 60 minutes. These figures are very low: In metropolitan Buenos Aires, equivalent accessibility figures using public transportation are 7 percent, 18 percent, and 34 percent for the same time thresholds (Peralta Quiros 2015). In Ugandan cities, 70 percent of work trips are on foot (Uganda Bureau of Statistics 2010), with the average share of jobs reachable within one hour standing at just 19 percent (Bernard 2016).[11]

The early deployment of collective transportation systems preserves an option value (Henry 1974) by limiting urban-form irreversibility. Early deployment also reduces the need for transportation infrastructure. Rode and others (2014) show that although the upfront costs of collective transportation infrastructure are on the same order of magnitude as — or even higher than — the costs of high-capacity highways, collective transportation has the edge when cost estimates take carrying capacity into account (table 2.2). Compact cities (associated with collective transportation) also mitigate the impacts of higher oil prices.

Table 2.2 Estimated capital costs of building various types of transportation infrastructure

Type of infrastructure	Capacity (pers/h/d)	Capital costs (dollars per kilometer)	Capital costs/ capacity (dollars)
Dual-lane highway	2,000	10–20 million	5,000–10,000
Urban street (car use only)	800	2–5 million	2,500–7,000
Bike path (2m)	3,500	100,000	30
Pedestrian walkway/ pavement (2m)	4,500	100,000	20
Commuter rail	20,000–40,000	40–80 million	2,000
Metro rail	20,000–70,000	40–350 million	2,000–5,000
Light rail	10,000–30,000	10–25 million	800–1,000
Bus rapid transit	5,000–40,000	1–10 million	200–250
Bus lane	10,000	1–5 million	300–500

Source: Rode and others 2014, based on Rode and Gipp 2011, Litman 2009, Wright 2002, and Brilon 1994.

High transportation costs, crippling congestion, and slow commuting speeds have prevented African cities from acting as matchmakers and fostering agglomeration economies through firm clustering. Such mixed land-use patterns — with jobs and people dispersed throughout urban areas — penalize large-scale transit systems, which need high ridership to function efficiently.

African cities are locked into low-level equilibria that are unkind to their residents and unproductive for firms. Coordination mechanisms are needed to harness the forces of urbanization through kinder, more efficient development trajectories (chapter 6).

These coordination mechanisms can take many forms. All, however, include synchronized action on land use and transportation infrastructure. Whatever shape a city assumes — and various urban forms are consistent with more productive and inclusive cities — leaders must think very carefully about the long-term consequences of their decisions. Given the high inertia and path dependencies of urban areas, these decision makers are building their cities for decades and possibly centuries to come.

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