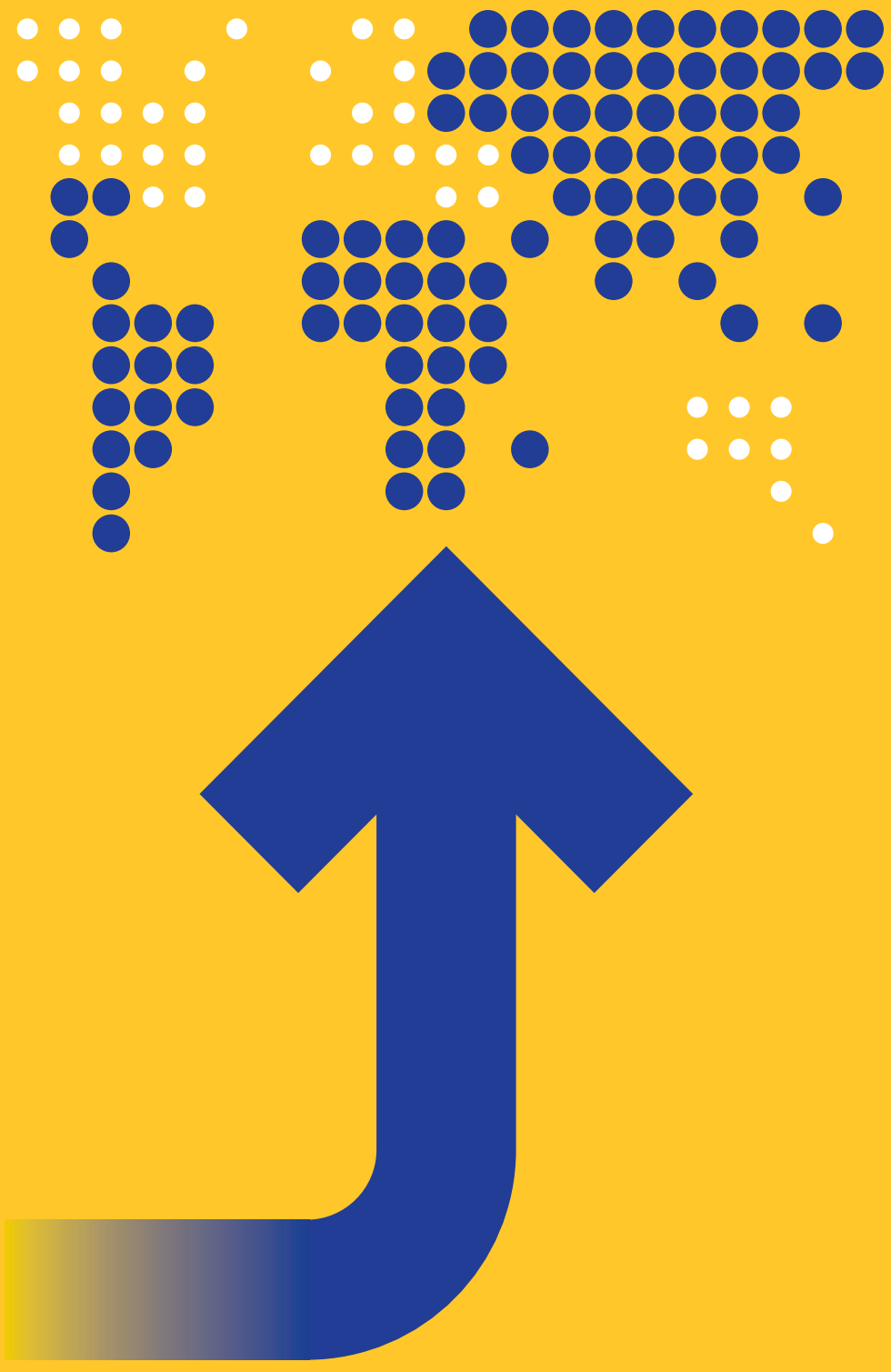

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2015 GLOBAL MEETING

Urbanization and Development from 2010 to 2050

Gregory K. Ingram

Background Paper

Emerging Markets Forum
A nonprofit initiative of the Centennial Group

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Urbanization and Development from 2010 to 2050

Gregory K. Ingram

Introduction

Half the world's population was urban by 2007, and two thirds is projected to be urban by 2050. Nearly 95 percent of this growth in global urban population will take place in developing countries. The rapid increase in the projected urban share of the population from 2010 to 2050 will be accompanied by proportionally larger increase in urbanized land area and by an absolute increase in urban populations far exceeding past experience for many developing countries. Urbanization, the hand-maiden of development, will have a profound impact on economic development and on the planet. The objectives of this paper are to outline key drivers of urbanization and of the success of cities, to identify important problems that stem from urban growth, and to outline policy responses that will improve urban outcomes—particularly those related to economic growth. The initial perspective is global, covering all regions and income groups, and then it focuses on developing countries.

One of the main drivers of urbanization is population growth. The UN global forecasts of urban population growth to 2050 for nine regional/income groups highlight the variability of urban growth across the nine groups, and identify Sub-Saharan Africa as a region that will have particularly high rates of urbanization. Forecast changes in dependency ratios for the nine regions indicate that decreases in dependency ratios are associated with high rates of urban growth, so the potential demographic dividend will accrue to those with the most rapidly growing urban populations. These demographic drivers of urbanization are unlikely to be altered much by policy interventions.

A brief review of the reasons why urbanization and economic development are strongly associated distinguishes between the economic parameters that can be influenced at the urban or metropolitan level and those that are controlled by the national government. The successful promotion of economic growth at the metropolitan level requires a supportive national fiscal, monetary, trade, and regulatory environment. But there is an asymmetry here. Urban areas can implement poor policies that slow their growth in the context of an excellent national policy framework—but inappropriate national economic policies will constrain the success of even the most outstanding policies at the urban level. Poor local policies can thwart good national policies, but good local policies cannot overcome bad national policies.

The next topics—governance, finance, housing for the poor, and environmental and other spillovers (including climate change)—address drivers of urban development whose success is much more determined by policies implemented at the municipal, city, or metropolitan level. To a great extent, the success or failure of initiatives in these areas rest with local policy makers. A final topic is the wild card of technical change, particularly advances in digital technology generally associated with smart cities. Local policy makers face decisions about these technologies and their implementation that will place their cities and metropolitan areas on technological paths that will be difficult to alter.

While urban areas come in many sizes, large metropolitan areas are particularly important economically and play an outsized role in innovation and culture. They also face sobering problems because their governance typically involves many municipal and local governments without a meaningful metropolitan-wide government. This puzzle has few easy answers, but good governance matters a lot in large metropolitan areas. As Ed Glaeser observed, "One way to understand the urban challenge is that people in cities need good government much more than people living in low-density areas" (Glaeser 2011, p. 594). The policy objective is not to retard urban growth or view it as uncontrollable, but to manage an effective transition to an urbanized society.

Major Driver: Growth in urban populations, 2010 to 2050

Forecasting population involves uncertainties that become greater over longer time horizons (to 2050) and

Forecasts make clear that Sub-Saharan Africa will experience profound urban growth by 2050—bringing with it many urban challenges.

for more spatially detailed areas (for example, disaggregating national forecasts into those for urban and rural areas). The numbers presented here are based on the 2014 projections by the United Nations Population Division. UN population projections are subject to much criticism from those who think they are too low (Haub, 2011) and those who think they are too high (Pearce, 2011), but they are widely used, and analysts are familiar with their strengths and weaknesses.

The UN projections of urban population (Table 1) are that all but 5.7 percent of the forecast increase in the world's urban population from 2010 to 2050 will be in less developed countries. Of the urban population growth in less developed countries, nearly a quarter will be in the least developed countries and over 70 percent in middle-income developing countries. Both groups of developing countries will face challenges: urban populations in the least developed countries will nearly quadruple, while those in the less developed group will nearly double. Moreover, these relative and absolute increases in urban populations between 2010 and 2050 are unprecedented.

The UN population projections are available for almost all countries, and nine country groups are used here (see Annex). East Asia is combined with the Pacific Island countries; Japan is separated from East Asia and combined with Europe; and Australia and New Zealand joined with North America in a land-rich high income group. These nine groups are reasonably uniform in terms of income, demographics, and urban development. Figure 1, displaying absolute increases in urban and total populations from 2010 to 2050, shows that the largest increase in total and urban population, over 800 million, is forecast for Sub-Saharan Africa, followed by South and Central Asia (includes India). East Asia (includes China) is third at 400 million. The increase in urban population exceeds that for total population (i.e., rural population declines) everywhere except Sub-Saharan and North Africa. The total population increase is negligible in East Asia and negative in Europe-plus-Japan. Figure 2 shows percentage increases, with Sub-Saharan Africa's urban population nearly quadrupling and several other groups nearly doubling their urban populations.

These forecasts make clear that Sub-Saharan Africa will experience profound urban growth by 2050—bringing with it many urban challenges. Estimates of current urban population levels in Sub-Saharan Africa have been questioned as being too high (Potts, 2012), but if actual urban population shares are lower than currently estimated, even higher urban population increases could be experienced than those being forecast now. Finally, among more developed countries, moderate urban growth occurs in the land-rich group comprised of North America, Australia, and New Zealand—with virtually no urban population growth forecast for Europe-plus-Japan. Urban population growth will produce larger cities, but proportionally. The best evidence available is that urban population growth

Table 1: Urban population projections

			Change		
Country Grouping	**2010 (thousands)**	**2050 (thousands)**	**Absolute (thousands)**	**Percent**	**Share of Increase**
Less developed (excluding least)	2,372,342	4,329,410	1,957,068	82.5	70.7
Least developed	242,073	895,701	653,628	270.0	23.6
Less developed total	2,614,415	5,225,111	2,610,697	99.9	94.3
More developed total	956,857	1,113,500	156,643	16.4	5.7
World total	3,571,272	6,338,611	2,767,339	77.5	100.0

Source: United Nations, World Urbanization Prospects, 2014 Revision

Among more developed countries, moderate urban growth occurs in the land-rich group comprised of North America, Australia, and New Zealand—with virtually no urban population growth forecast for Europe-plus-Japan.

Figure 1: Population change, urban and total, 2010 to 2050

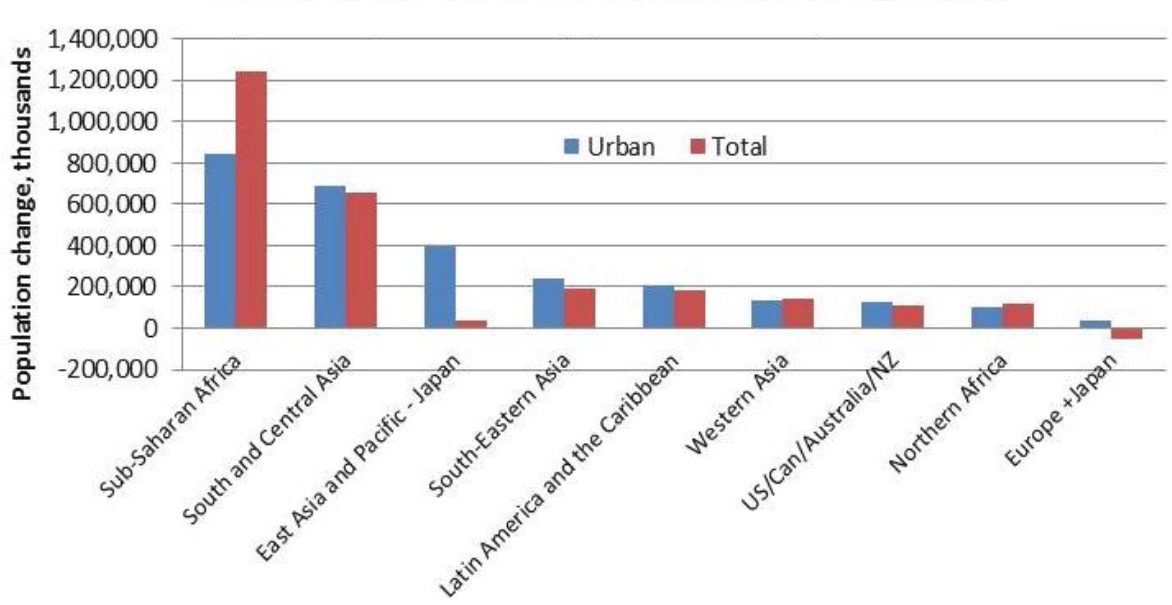
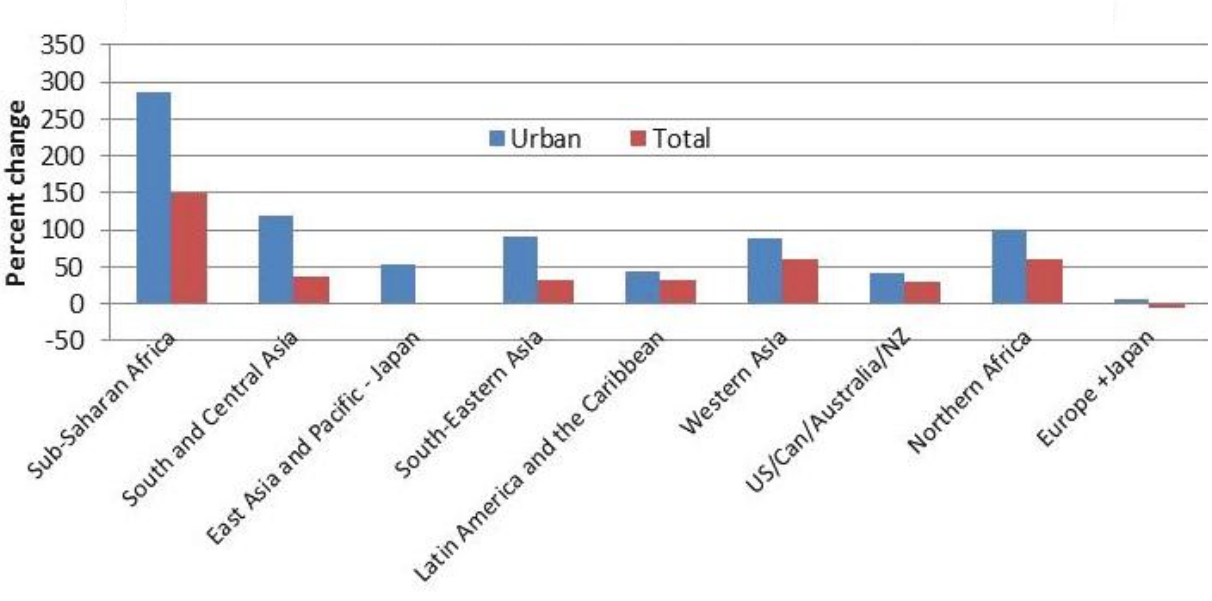


Figure 2: Percent change in population, urban and total, 2010 to 2050



From 2010 to 2050, dependency ratios will decline dramatically in Sub-Saharan Africa (mainly from decreasing child dependency) and increase dramatically in Europe-plus-Japan and in East Asia and the Pacific (mainly from increasing aging).

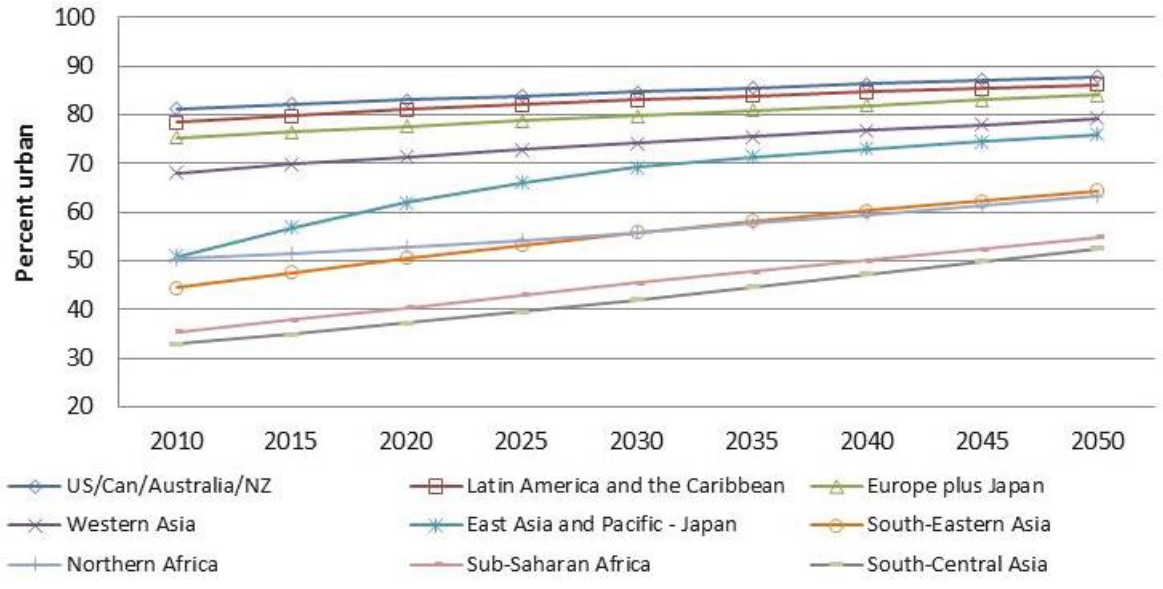
rates have not varied systematically with city size (Angel, 2012).

Differences across country groups are also evident in the percent of the population forecast to be urban, shown in Figure 3. Latin America continues to be more urbanized than Europe-plus-Japan, with Western Asia nearing 80 percent urban by 2050. East Asia urbanizes very rapidly, but with an essentially constant total population, while Sub-Saharan Africa and South and Central Asia exceed 50 percent urban before 2050. These latter two regions are urbanizing in the context of rapidly growing total populations, which underlie their large growth in urban populations. Overall, forecast urbanization rates show moderate convergence, from a high-to-low percent urbanized spread of 48 points in 2010 declining to 35 points in 2050.

Another key demographic attribute is the dependency ratio, which measures the ratio of children (0 through 14 years of age) plus elderly (65+ years old) to the population that is 15 through 64 years old. High dependency ratios result from high birth rates and high levels of child dependency, and/or from low birth rates and an aging population with high levels of aged dependency. High dependency ratios are normally a drag on economic growth, as a large share of economic resources must go to support the young and/or the old, often reducing saving and leaving fewer resources for investment. A declining dependency ratio creates a potential demographic dividend as the share of the working force in the population increases, and savings increase to sustain investment.

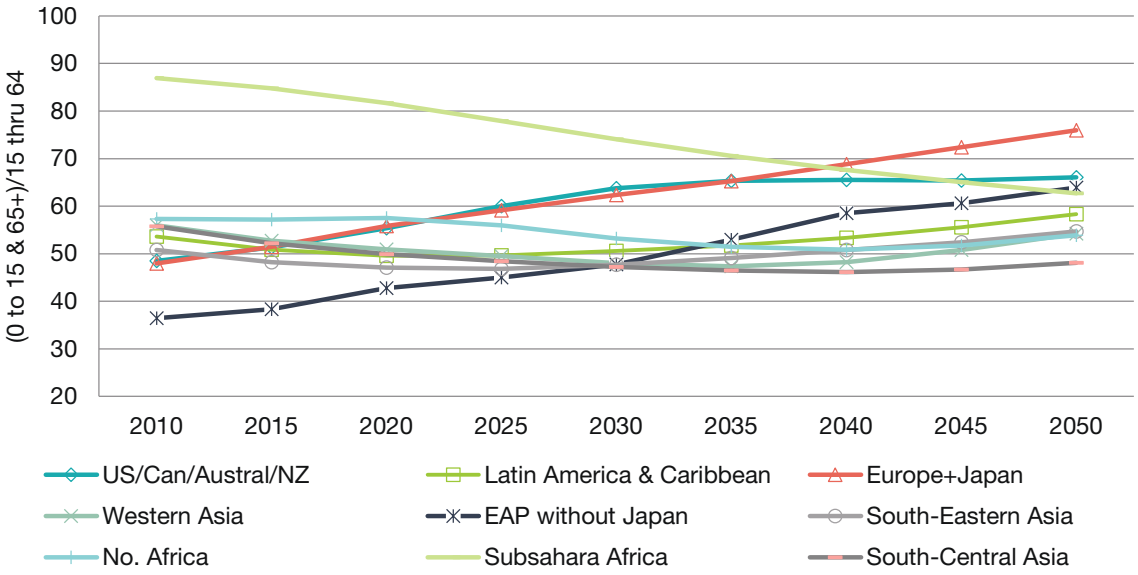
Dependency ratio time trends for nine country groups are displayed in Figure 4, which shows great variability across them. From 2010 to 2050, dependency ratios will decline dramatically in Sub-Saharan Africa (mainly from decreasing child dependency) and increase dramatically in Europe-plus-Japan and in East Asia and the Pacific (mainly from increasing aging). The North America-Australia-New Zealand group will experience an increased dependency ratio, but the increase attenuates in about 2035. The remaining groups see a decline and then an increase in

Figure 3: Percent urban by country group



Urban population densities have been declining over the past 100 years, and they are likely to continue to decrease in most high density regions over the coming decades.

Figure 4: Dependency ratios



dependency ratios mainly within the range of 50 to 60, with a mix of overall increases and decreases.

Figure 5 brings together the urban population growth forecasts with the changes in dependency ratios for the 2010 to 2050 period. Overall, there is an association between forecast high percentage increases in urban population and decreases in dependency ratios. This is good news for several developing country regions (but not East Asia) and particularly for Sub-Saharan Africa, whose very high forecast of urban population growth may be buoyed by a rapid decline in its dependency ratio.

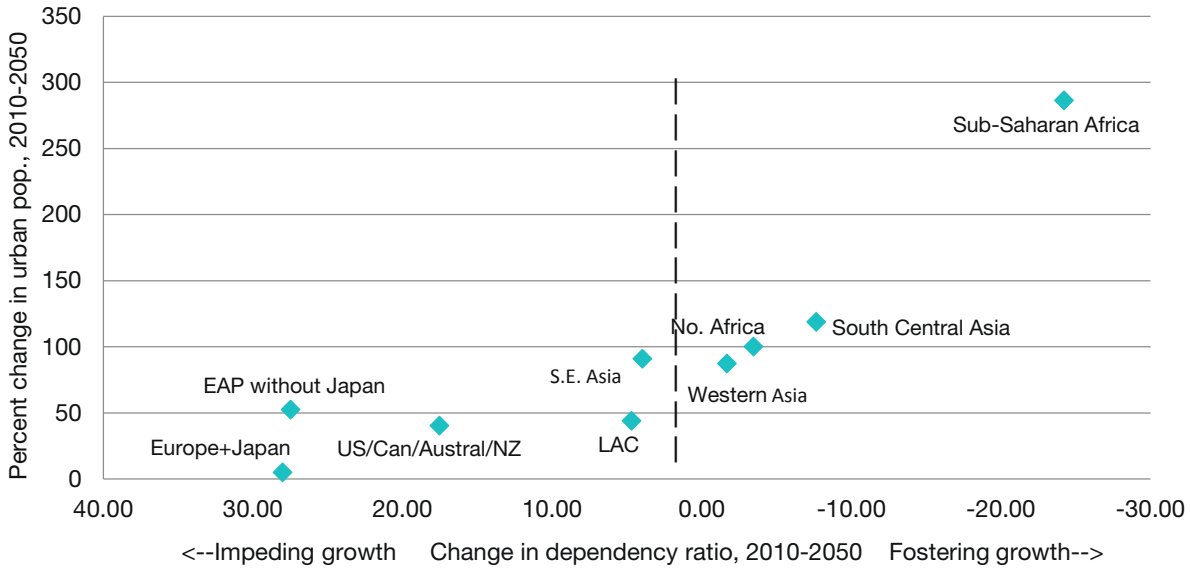
Major consequence: Growth in extent of urbanized areas

Because forecasts indicate that the urban populations of developing countries will double from 2010 to 2050 (table 1), the area of urbanized land will increase over this period to make room for the growing urban population. If urban population densities in 2050 were unchanged from 2010, a first estimate might be that urbanized areas will also double over this time frame. However, urban population densities vary across regions and are also inversely related to income levels. Moreover, urban population densities have been declining over the past 100 years, and they are likely to continue to decrease in most high density regions over the coming decades. Finally, the availability of satellite data allows the rough estimation of how much urban expansion will occur on agricultural lands. The extent of this expansion depends critically on what happens to urban population densities over the coming decades.

Data from satellites allows the measurement of developed urban land in cities and its differentiation from open or undeveloped land that is enclosed by developed urban land. Boundaries of urbanized areas (developed land plus enclosed undeveloped land) can now be defined based on the contiguity and extent of developed urban land so that areas of urbanized land can be defined in a comparable fashion across urbanized areas and countries. Shlomo Angel and his colleagues (Angel, 2012) have developed such measures, and their analysis underpins the summary

Analyses of 20 cities in the United States from 1910 to 2000, of 30 world cities over two centuries, and of a random sample of 120 large global cities from 1990 to 2000 all indicate that average urban densities have consistently decreased by about 2 percent per year.

Figure 5: Faster urban population growth is associated with declining dependency ratios



presented here. Comparable estimates of urbanized areas across all small and large cities in the world along with available census population data produce the average regional urban densities (persons per hectare of urbanized area) shown in Figure 6. The densities are higher in less developed regions—by as much as five times those of the land-rich more developed country region. Even among less developed regions, average densities vary by more than a factor of two.

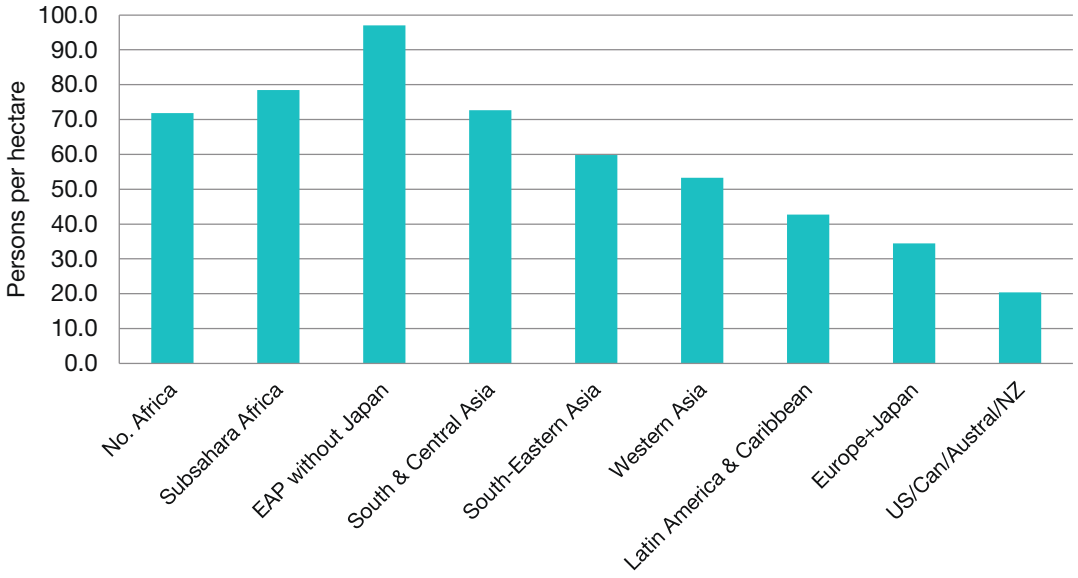
Analyses of 20 cities in the United States from 1910 to 2000, of 30 world cities over two centuries, and of a random sample of 120 large global cities from 1990 to 2000 all indicate that average urban densities have consistently decreased by about 2 percent per year (Angel, 2012). Two scenarios are used here to project the growth of urbanized areas. The first projects regional urban population densities unchanged from 2000, and the second projects densities that decline by 2 percent per year, the historic average. The results, in terms of the percent of all land area that is urbanized by region, are shown in Figure 7 for 2000 and for the two 2050 scenarios.

In the year 2000, across all regions, less than one percent of regional land area was urbanized—ranging from 0.12 percent in Sub-Saharan Africa to 0.85 percent in South-eastern Asia. In the constant density projections for 2050, global urban land area is twice that in 2000, and in the projections where urban population densities decrease by 2 percent annually, global urban land area is five times that in 2000. Taking developing countries alone, the urban area ratios are 2.5 and 7 times larger. Given the pervasive reductions in average urban population density observed in the last 100 years and the lack of success of policies that have tried to increase densities, the projections based on lower densities are likely to be a worst case scenario.

Any expansion of urbanized land will occupy some land currently used in agriculture. Figure 8 shows estimates of the percentage of land cultivated in 2000 that would be transformed to urban use, based on the 2 percent decline in densities as the worst case. These decreases are large

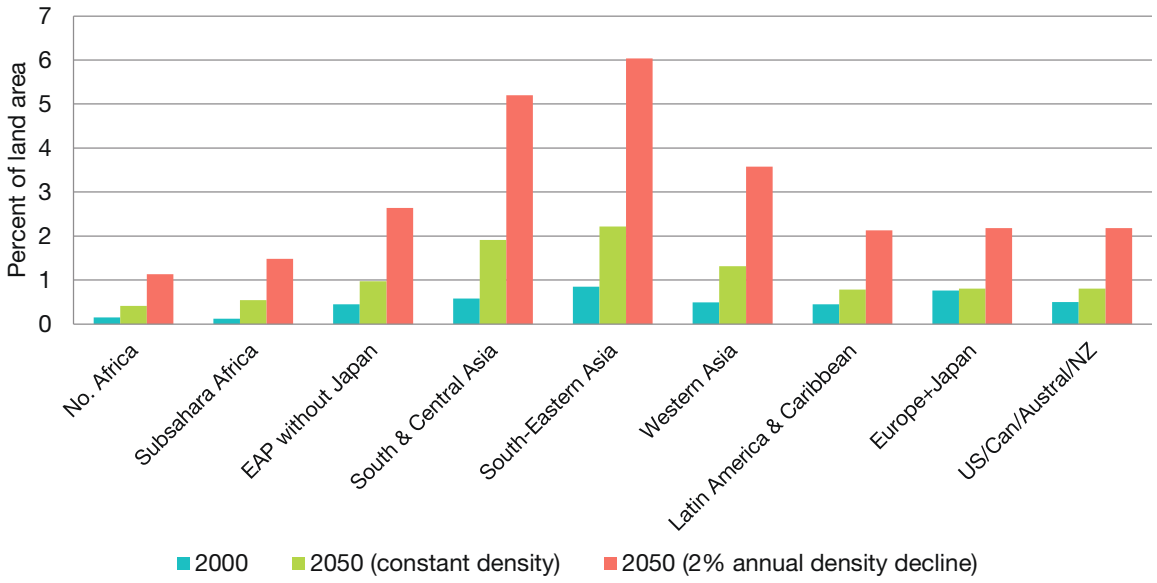
In the constant density projections for 2050, global urban land area is twice that in 2000, and in the projections where urban population densities decrease by 2 percent annually, global urban land area is five times that in 2000.

Figure 6: Average population density of urbanized area, 2000



Source: Angel 2012, calculated from table 10.2, p. 166

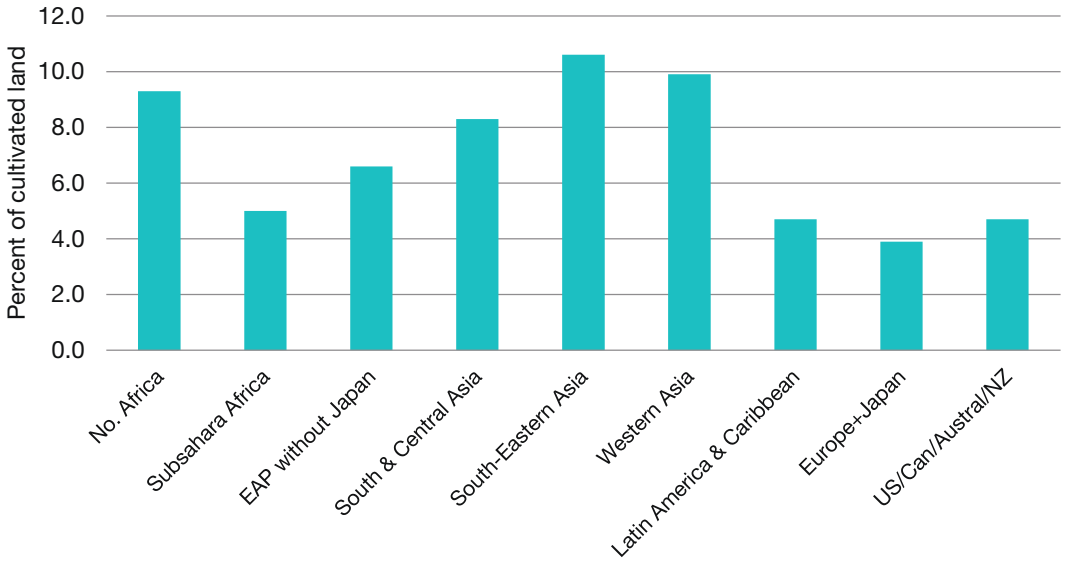
Figure 7: Urban land cover share of total land area, 2000 and 2050



Source: Angel 2012, calculated from table 10.2, p. 166 and table 15

One challenge of retaining farmland is that the value of urbanized land is typically a multiple of the value of cultivated land, so market forces will normally promote the development of cultivated land.

Figure 8: Percent of cultivated land lost with two percent annual urban density decline, 2000 to 2050



Source: Angel 2012, based on figure 16.12, p 281

and are not normally taken into account in projections of needs for additional agricultural land. The aggregate projection is that 7.9 percent, or 1.2 million square kilometers (half of the urban expansion total of 2.4 million), of land cultivated in 2000 will be lost to urban expansion, with one-third of the loss in more developed countries and two-thirds in developing countries.

This compares to projections by the Food and Agricultural Organization (FAO) that an additional 700,000 square kilometers of agricultural land will be needed by 2050 to meet food needs (FAO, 2012)—a projection that does not include the loss of agricultural land to urban expansion. Combining these forecasts indicates that about 1.9 million square kilometers of additional cultivated land will be needed by 2050 to maintain adequate food supplies. FAO's projection of the need for increased cultivated land assumes that 90 percent of the increase in food production needed by 2050 will come from higher yields and 10 percent from an increase in cultivated land area.

Because the loss in cultivated land area could be large, it makes sense for urban areas to try to guide growth in ways that preserve cultivated land. However, this will be difficult in many urban areas that have not even been able to control informal urban settlements. Taking a more active role in directing the course of future urban development, advocated in a later section in order to install infrastructure before development, could also be used to retain farmland. One challenge of retaining farmland is that the value of urbanized land is typically a multiple of the value of cultivated land, so market forces will normally promote the development of cultivated land. Some countries, notably China, have policies requiring no net loss in agricultural land from urban development, but the implementation of this standard has not been completely successful.

Urban Growth and Economic Strategies

Increased levels of urbanization have historically been strongly associated with increased levels of incomes, and

The evidence to date is that the labor market advantages of cities—access to specialized workers—will continue to be an important determinant of firm locations.

causation between urbanization and economic development likely runs in both directions. In developing countries, the productivity of urban workers is three to five times greater than that of rural workers. Productivity growth is also greater in cities, which thereby become even more productive over time. This higher productivity has several causes. First, cities are locationally efficient because they have low transport costs associated with bringing together inputs and workers. Second, cities have efficient labor markets, with more specialized workers available in greater numbers in larger cities. Third, cities exhibit economies of agglomeration, scale, and scope that facilitate communication, the transfer of knowledge, social interaction, and the supply of cultural amenities not available elsewhere. Finally, it is less costly for governments to provide infrastructure, education, and health services in cities than in rural areas, so urbanization also reduces the costs of local public goods.

Arrayed against these benefits are several disadvantages or costs of cities. First, higher land prices (rising with city size) in cities make housing and some other goods more expensive, so part of the higher wages in cities compensate for the higher cost of living in them. Second, various types of congestion and crowding slow traffic and increase some activity costs, offsetting urban advantages to some extent. Third, environmental costs and negative externalities result from the key feature of urbanization—their concentration of people and jobs in a small area; this leads also to the concentration of effluents (solid, liquid, and gas) in the same small area that produces high pollution levels. Finally, many cities exhibit social pathologies such as crime and insecurity.

Adding up the costs and benefits has led to increased urbanization and more very large cities. Empirical analysis indicates that benefits continue to exceed costs at all city sizes that we currently observe. There seems to be no universal critical city size where the costs of urban size begin to exceed the benefits.

Are these economic and productivity advantages of cities likely to continue over the foreseeable future? After all, the industrial base in many cities is declining and being replaced by a growing service sector (where production involves less movement of physical goods) and by work that involves more movement of knowledge and ideas, much of which can be done electronically. The evidence to date is that the labor market advantages of cities—access to specialized workers—will continue to be an important determinant of firm locations. Recent literature emphasizes that knowledge workers with advanced education are associated with urban economic growth (Glaeser, 2011). In addition, the advantages that cities have in facilitating interpersonal communication also become more important in knowledge-based economies.

This last point may be surprising because new technology is providing many ways to communicate other than by face-to-face meetings. However, the available evidence indicates that electronic and face-to-face communications are complements and not substitutes. That is, greater electronic communication is associated with more, and not less, face-to-face communication (Glaeser 2011). Having more modes of communication tends to increase overall communication, so face-to-face interactions increase along with electronic interactions. In addition, face-to-face communication is important for innovation and is reflected in the rise of innovation clusters such as Silicon Valley. Moreover, intercity business travel has been increasing while the cost of electronic communication has fallen. Finally, much consumption and social interaction involve face-to-face communication. The recent increase in United States middle class central city populations seems to be at least partly driven by consumption preferences.

What cities or metropolitan areas can do to promote economic growth is addressed in the following sections of this paper, and the topics include governance, public finance, housing the poor, and managing environmental externalities. One incentive prompting cities to take action is inter-city competition. Cities often compete with each

Metropolitan areas in developing countries face profound problems of horizontal fragmentation involving both jurisdictions and functions.

other for domestic and global investment and as potential locations for expanding enterprises. In order to attract foreign investment or footloose domestic investment, cities need to provide quality infrastructure services, security, environmental amenities, a well-educated and well-housed work force, and a predictable and sensible regulatory environment. Cities, municipalities, and metropolitan areas can take many steps to improve their local enabling environment to attract economic activities.

At the same time, there are many economic, monetary, fiscal, legal, and regulatory policies that are controlled by national governments, and that cities have little control over. The overall economic context of the nation in which urban areas are located plays an important role in determining their attractiveness to foreign investment, the overall growth rate of the country, and the city's own growth rate. Accordingly, national economic policy makers need to be cognizant of their role in supporting the economic growth of cities. Mayors and other local leaders can do little to counter the effects of national economic or legal policies—such as high inflation, trade barriers, unrealistic exchange rates, or unenforceable contracts—that make their cities uncompetitive in the global market. But when national policies support growth, local leaders have many ways to influence local development.

Urban Governance, Management, and Planning

In a nation with a clear hierarchy of governments, public finance posits that specific functional responsibilities should be assigned to different levels of governments, with local governments providing local services that have few spillovers beyond their borders, and national and provincial governments providing services that have spillovers or externalities (including economies of scale) while also handling macroeconomic stabilization and income redistribution (Musgrave 1959). In addition, expenditure responsibilities should be clearly assigned among different levels of government along with enough budgetary autonomy to fulfill these responsibilities. While providing general guidance, these principles are challenging to apply in developing countries with rapidly growing urban areas, weak local government capacity, and centralized national governments.

Within larger metropolitan areas, the challenges are particularly acute because such areas are normally clusters comprised of one or more cities and numerous municipalities, and the clusters expand to include more municipalities as urban areas grow. Except in a few cases, metropolitan areas in developing countries face profound problems of horizontal fragmentation involving both jurisdictions and functions. Jurisdictional fragmentation results when many local municipalities or other governments produce services in a single metropolitan area. In Mexico City, for example, local services are produced by two states, a federal district, and 50 local governments. Functional fragmentation results when services are produced by sectorally specialized parastatals, authorities, or commissions such as water and power companies or transit authorities. Such enterprises may provide services to most of the metropolitan area, but coordination among them—and between them and local governments—is often absent or poor. Moreover, planning and land use decisions are often made at the municipal or city level with little metropolitan-wide coordination. At the other extreme, a few large cities in developing countries, such as Johannesburg and Cape Town, have metropolitan governments that produce services on a metropolitan-wide basis, but they are rare.

In addition, metropolitan and urban areas also face vertical fragmentation problems. This results when governments at the central or provincial level directly produce or control the provision of local services. In some cases, central or provincial governments operate vertical programs that directly provide local services, often with little or no coordination with local efforts. In other cases, higher level regulatory constraints preclude local governments from altering programs—whose design is fixed nationally—to adapt them to local conditions. In both cases, local officials

Unlike demographics and urbanization (where governments have little policy influence), policy makers can take steps to improve the governance, management, and planning of their cities, particularly the large metropolitan areas that play a key role in economic growth.

have little control, lack responsibility for programs, and are therefore not locally accountable for program performance.

Vertical fragmentation is strongly related to the high degree of centralization of many governments in developing countries. Table 2 compares expenditures and tax revenues across a sample of less and more developed countries. It indicates that local governments in developing countries raise a lower share of all taxes and less revenue locally than is the case in more developed countries. As a result, local governments are often fiscally dependent on central and provincial governments for funds that take the form of transfer payments from higher level governments. The regulations and controls accompanying these transfer payments undermine local initiative and accountability.

Unlike demographics and urbanization (where governments have little policy influence), policy makers can take steps to improve the governance, management, and planning of their cities, particularly the large metropolitan areas that play a key role in economic growth. Remedies for the problems of horizontal and vertical fragmentation are related and have some congruence with the public finance principles noted in the introduction to this section, particularly that expenditure responsibilities should be clearly assigned among different levels of governments.

Since many metropolitan services have economies of scale and scope, e.g., most infrastructure and utilities, aspects of public safety, and others have important spillovers or externalities, e.g., waste disposal and sanitation, public health, developing capacity to supply services at the metropolitan level is a first best solution to horizontal fragmentation. The best way of doing this will vary with local needs and conditions and may involve establishing specialized authorities to manage and oversee services such as transit, traffic management, electric power, and sanitation. Such authorities will also need a metropolitan-wide commission or council of governments for oversight and coordination to reduce or prevent functional fragmentation. Integrating existing municipalities into a single metropolitan government may be a possibility, but powerful political forces normally oppose this, and it has happened rarely even in industrial countries.

Given the dramatic expansion of urban areas that will accompany the growth of urban populations, particular attention must be given to metropolitan-wide planning for such expansion. This will involve: (a) the identification of expansion areas that will minimize the urbanization of agricultural land, and (b) the coordination of infrastructure investments across sectors including transport, water and sanitation, electric power, and telecommunications. Land use planning that is integrated across these infrastructure sectors must be carried out at the metropolitan level to take advantage of economies of scale and related network effects. Development activities that do not involve large-scale systems effects or inter-jurisdictional spillovers can be handled at the city or municipal level, following the precepts of the provision of local public goods set forth in the public finance literature.

One cause of vertical fragmentation is that central and provincial governments do not believe that city and municipal governments have the technical capacity to deliver services, or they believe that local governments will be captured by elites or special interest groups. Accordingly,

Table 2: Fiscal Decentralization—International comparisons for the 2000s

	Subnational government expednitures		Subnational government taxes	
Region	**Percent of total government expenditure**	**Percent of GDP**	**Percent of total taxes**	**Percent of GDP**
Developing Countries	18.8 [16]	5.1 [20]	11.4 [16]	2.3 [20]
Industrial Countries	27.8 [26]	13.9 [26]	22.7 [24]	6.4 [25]

Note: The number of countries in each group is shown in brackets
Source: Bahl and Linn, 2014, p.10

There is an overall positive relation between high rates of urban growth and a lack of safety and insecurity, with Sub-Saharan Africa having both the highest (worst) index and the greatest increases in urban population.

strengthening the capacity of local governments to deliver services directly, or ensuring that metropolitan-wide authorities are technically competent, is a necessary step in reducing fragmentation. Metropolitan-wide authorities may also directly assume responsibility for services produced by central or provincial governments. Because few metropolitan authorities will be subject to competitive forces, mechanisms need to be developed to make local or metropolitan-wide service providers accountable to their clients or customers. This involves ensuring that municipal service managers are elected or required to meet performance targets, can be replaced by elected officials, or report to a metropolitan council of governments whose members are responsible to their constituents.

Low levels of crime and insecurity are an important aspect of the quality of life in urban areas, and one that local policy makers can influence. Of course, measuring crime and insecurity is difficult for a number of reasons. The data on criminal activity almost always understates actual levels because many crimes are not reported, and under-reporting is often higher in jurisdictions that are less safe. Many perceive large cities as particularly crime-ridden, but this view is not always correct. In the United States, for example, where measures of criminal activity are compiled in the Uniform Crime Reports, rates of violent crime per 100,000 persons in 2012 (the latest year available) were nearly a quarter higher in medium sized cities (populations of 500,000 to 1 million) than in cities with populations over a million, while property crime rates in medium sized cities were nearly 50 percent higher than in the largest cities (United States Dept. of Justice, 2015, Table 16).

Given the high rates of urban growth forecast for the coming decades, to what extent are high rates of urban growth forecast to occur in areas that are insecure? The Global Peace Index produced by the Institute for Economics and Peace (IES, 2015) combines three indices: ongoing conflict; societal safety and security, and militarization. The second of these combines measures of crime, political instability, and terrorism—making it a good measure of local crime and insecurity—and has data available for 162 countries (IES, 2015, Table 32, p. 115). Averages of the country data were aggregated into the country groups used in this paper, and are displayed in Figure 9. There is an overall positive relation between high rates of urban growth and a lack of safety and insecurity, with Sub-Saharan Africa having both the highest (worst) index and the greatest increases in urban population.

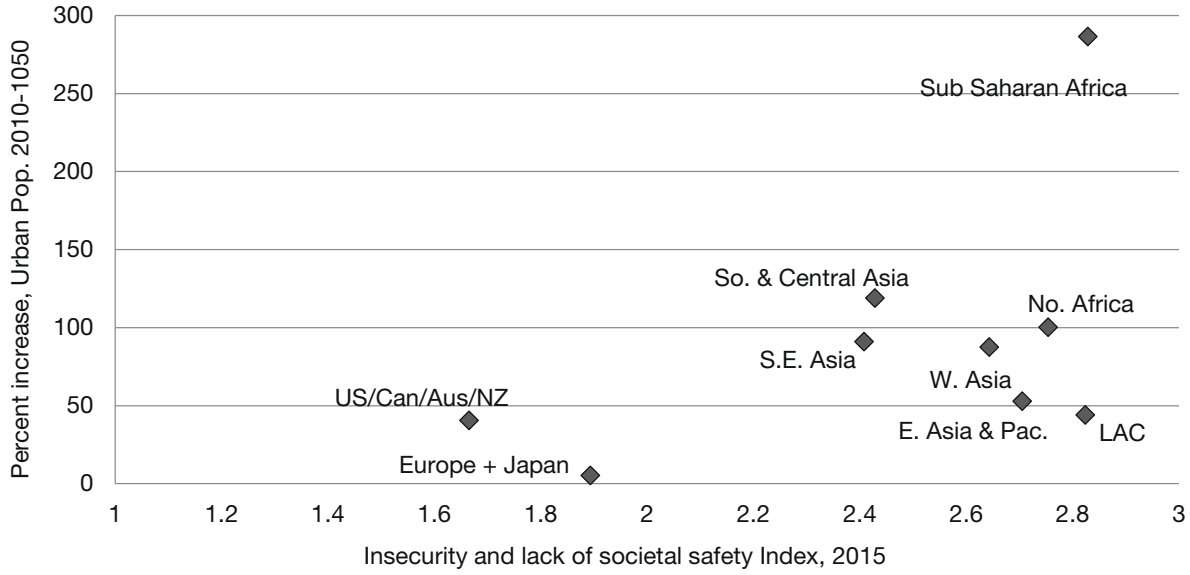
Figure 9 reflects today's measures of crime and insecurity, and it would be more useful to project what future trends in these indices might be. This is virtually impossible except for demographics. Projections presented earlier show that Sub -Saharan Africa is the only region that will experience a decrease in dependency ratios as its currently very young population grows older and birth rates decline. One aspect of the aging of its young population is that the share of the population between 15 and 25 will increase in the coming decades. This age group normally has the highest rates of criminal activity. Accordingly, increased rates of criminal activity will potentially accompany the demographic transition in Sub-Saharan Africa. Addressing this issue requires competent governance—both to address issues of crime and security, and to facilitate and enable economic growth needed to gainfully employ rapidly growing urban populations. If this is not done, the demographic dividend could turn into a demographic dystopia (Glaeser, 2013).

Urban Finance

The principles of public finance noted at the beginning of the previous section state that different levels of government should have enough budgetary autonomy to fulfill their expenditure responsibilities. This is a major issue in metropolitan areas and municipalities in most developing countries. As indicated in table 2 above, local governments typically have been assigned few tax instruments, and a small proportion of local expenditures are raised from local levies that are under the control of local governments. In addition, local tax systems often perform poorly.

In many countries, central governments have had little enthusiasm to transfer more taxing authority to local governments.

Figure 9: Forecast urban growth and current insecurity



Source: Institute of Economics and Peace, Global Peace Index 2015, Table 32

In many countries, central governments have had little enthusiasm to transfer more taxing authority to local governments. One sensible reason is that central governments may be able to raise revenues more efficiently (with lower collection costs) than local governments. However, political considerations are also often important. Having local governments be more independent of central and provincial governments makes them potential rival centers of political power, particularly if municipal and city officials are locally elected. While there has been a move away from appointing mayors centrally to having them elected in Latin America, in many regions the central or provincial government still appoints major municipal officials. This, along with centralized revenue collection and the funding of local governments through intergovernmental transfers, makes local governments extensions of higher levels of government and reduces local accountability. Of course, many local officials also find this arrangement comfortable, as they do not face the challenge of having to raise local taxes, and they bear little local responsibility or accountability for programs and policies designed by higher level governments. But local accountability is a necessary part of the incentive system needed to promote efficient local service provision and the financing needed to sustain urban development. Taxing local citizens to fund local services gives them a real incentive to engage with and oversee local services.

User fees and benefit charges are a most attractive source of revenue at the local level that create appropriate incentives for both suppliers and users of services. User fees are most easily implemented in public utilities and transport where a fee-for-service regime is common, but it is important to set the fees at an appropriate level. Fees that are below costs promote overuse of services—a serious problem in electric power and water where subsidized rates undermine end-user efficiency and stimulate demand for services and hence for more investment. Latin America's electricity tariffs are about 75 percent of OECD tariff levels and do not cover full costs, while in other regions power tariffs range from a third to a half of OECD levels

While not inherently effective local taxes (as is the property tax), raising revenue from taxes on retail sales, business activity, motor vehicles, and even income can work well in large metropolitan areas where the rate of leakage (going outside the area to avoid the tax) is low.

(Ingram and Fay, 2008). Low fees also create the need for subsidies. Recent estimates are that Sub-Saharan Africa governments spent $4.1 billion annually (0.7 percent of GDP) on power and water subsidies (Foster and Briceno-Garmendia 2010). While subsidies are often defended on social welfare grounds, their beneficiaries are predominantly the non-poor who have access to regular services while the poor are left with higher-cost, non-regular suppliers. Subsidies also lead to soft budget constraints that dull fiscal discipline. Applying user fees and setting them at levels that cover costs is a goal that metropolitan and municipal governments should move toward.

Benefit charges in the form of betterment fees levied on the increase in property values associated with infrastructure services also have promise, although they are more difficult to implement than user charges. Bogotá has used betterment levies since the 1930s to finance infrastructure, including roads, water and sewer, and more recently sidewalks and public parks (Borrero et al., 2011). In the 1960s, betterment levies accounted for 16 percent of the total revenue in Bogotá and 45 percent in Medellín. Their betterment charges took into account taxpayers' capacities to pay and the benefit produced by the project (such as travel savings, real estate value increases, and quality of life improvements). Betterment levies based on land value increments related to mass rail transit investments have been used in East Asia and are now spreading to other regions.

The property tax is an inherently attractive local tax because properties benefit from local services, and properties are immovable. However, local property tax systems often have low tax rates, low yields, and many exemptions. For example, in many cities illegal residential developments are not taxed because residents do not hold title to the land. Property taxes have relatively high collection costs because parcel descriptions must be registered, market valuations updated, and taxes are paid once or twice per year.

Because the property tax is an effective local tax and already exists in most metropolitan and municipal areas in developing countries, its performance should be improved. There is much room to raise revenue with the property tax. In the 2000s, property tax revenue was 2.12 percent of GDP in OECD countries and 0.6 percent of GDP in developing countries (Bahl and Martinez-Vazquez, 2008). Technological improvements, such as mass appraisal (using statistical techniques) and computer based mapping (using satellite images) are reducing administrative costs (McCluskey and Franzsen, 2013). Some countries are experimenting with simpler area-based systems that levy the tax on land area, built area, and per parcel rather than on an estimated market value. The ongoing improvement of slums and regularization of illegal or informal settlements will add to the revenue base.

Other taxes have also been successfully used at the local level. Many jurisdictions tax real estate transfers, though such taxes are less efficient and more distorting than property taxes. While not inherently effective local taxes (as is the property tax), raising revenue from taxes on retail sales, business activity, motor vehicles, and even income can work well in large metropolitan areas where the rate of leakage (going outside the area to avoid the tax) is low.

In addition to paying the annual operating costs of urban services, funds are also needed to finance investments for additional physical infrastructure needed to accommodate both the overall doubling of urban population and the increased demand stemming from household income growth in developing countries by 2050. By relating existing infrastructure stocks to income levels across countries, it is possible to project national infrastructure investment and maintenance expenditures as a share of country GDP. Order of magnitude estimates of national infrastructure investment and maintenance expenses as a percentage of GDP for countries whose GDP is growing at 5 percent per year are shown in Table 3. These national estimates are similar in magnitude to infrastructure shares of government

When urban infrastructure is long-lived, it is equitable to fund it over time from public or private debt or from international aid and other transfers.

Table 3: National infrastructure investment and maintenance related to GDP (assumes 5 percent annual GDP growth rate)

		Percent of national GDP			2012 USD billions		
Country income group	**Aggregate GDP, 2012 USD, billions**	**Invest-ment**	**Mainte-nance**	**Total**	**Invest-ment**	**Mainte-nance**	**Total**
Low	561	2.7	1.7	4.5	15	10	25
Lower-middle	5043	3.5	2.4	5.9	177	121	298
Upper-middle	17492	2.2	1.5	3.7	385	262	647
Developing total	23111	2.5	1.7	4.2	578	393	971

Source: Ingram, Liu, and Brandt 2013, p. 343; World Development Indicators, 2014

investment that range from 2 to 8 percent (Arslanalp, et al., 2011). In translating these to urban amounts, analysis indicates that a country's quantity of physical infrastructure stocks has little relation to its urbanization level, but is strongly related to GDP (Ingram, Liu, and Brandt, 2013). Accordingly, the share of national infrastructure investment and maintenance needed to support the growth of cities is likely to be proportional to cities' shares of national GDP. For example, if cities produce 60 percent of a lower-middle income country's GDP that was growing at 5 percent per annum, a rough estimate of required funds for annual infrastructure investment and maintenance in that country's cities would be 60 percent of 5.9 percent (or about 3.6 percent) of GDP per annum. The investment amounts increase with country GDP growth rates.

When urban infrastructure is long-lived, it is equitable to fund it over time from public or private debt or from international aid and other transfers. For a metropolitan area or municipality, intergovernmental transfers are an attractive source of investment funds because they do not make present or future claims on the local economy, though as noted earlier, they often come with conditions set by higher levels of government.

A variety of options exist for local borrowing. Municipal development funds in some middle-income countries have helped to develop both local government loan facilities and local urban government capacity to access loan financing, often with some reliance on external aid (Kharas and Linn 2013). Some middle income countries, such as Mexico, Brazil, South Africa, India, and the Philippines, now have municipal bonds (Martell and Guess, 2006). While mostly domestic, some municipal bonds have been sold directly on international markets. Bogotá became the first Colombian city to issue international bonds in 2001, and they had no sovereign guarantee (Trelles Zabala, 2004). The risks of general obligation bonds or those for non-revenue generating projects can be lowered by avoiding foreign exchange risks, e.g., issuing bonds in local currency; by utilizing third party guarantees or insurance; and by establishing a national fiscal responsibility framework with required prudential conditions such as maximum debt service ratios or use of credit rating agencies. The risks associated with bonds used to finance privately operated projects can be reduced by taking steps to (1) require that the project operator is legally separated from the local government; (2) assure that tariffs will be adjusted to maintain a minimum debt service ratio; (3) include a clause to prohibit the government from building directly competing investments; and (4) include performance standards that allow the government to change management or call in the credit if standards are not met (Ingram, Liu, and Brandt 2013).

Official development assistance (ODA) and lending from the International Bank for Reconstruction and Development (IBRD) and International Development Association (IDA) are an important source of infrastructure investment funds in developing countries. IBRD/IDA commitments for

Private investment in infrastructure has been a growing source of infrastructure finance over the past 25 years.

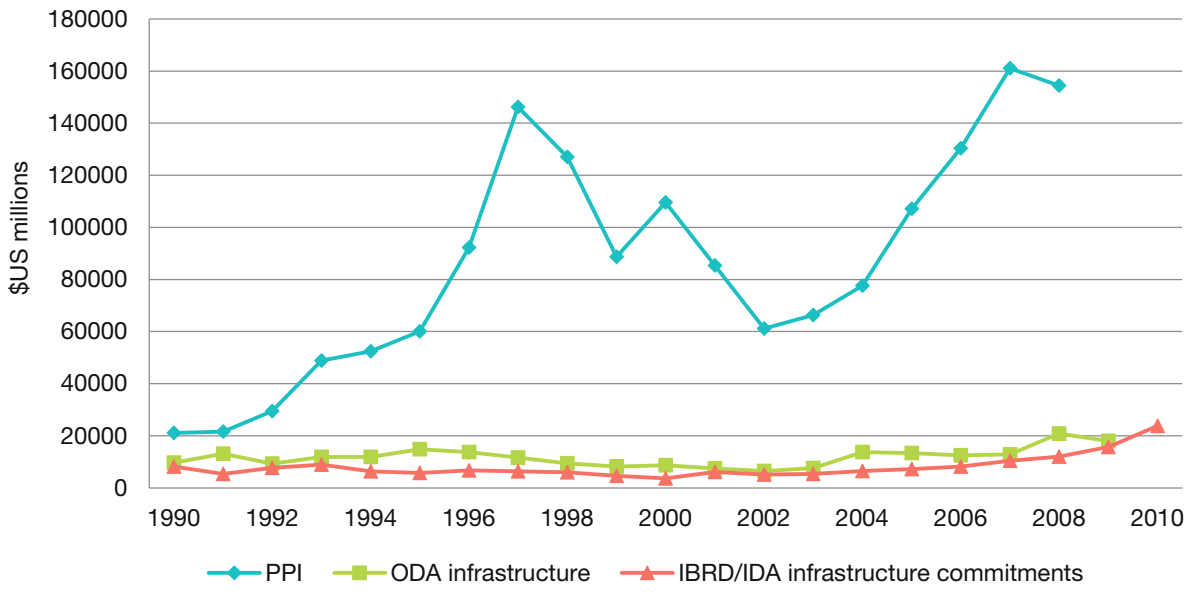
infrastructure trended down in the 1990s and then grew in the 2000s (Figure 10). ODA and World Bank commitments for infrastructure each are recently in the range of $20 billion per year (Figure 10). ODA's concessional financing exceeds the current infrastructure investment forecast for low income countries in Table 3. However, low income countries receive only about a quarter of total ODA.

Private investment in infrastructure has been a growing source of infrastructure finance over the past 25 years. Private participation in infrastructure (PPI) in the form of direct investments, leases, and operating contracts revived in the late 1980s, grew rapidly in the 1990s, and became less regionally concentrated in the early 2000s. Figure 10 shows that the dollar value of private participation in infrastructure has been as volatile as ODA and World Bank funding in relative terms—both varying by a factor of three or four in the past 15 years. PPI grew rapidly in the 1990s until the East Asian crisis of 1997, decreased, and then rebounded with a pause for the 2008 financial crisis. ODA commitments are not countercyclical but follow a pattern similar to that of PPI—with both peaking in the mid-90s, bottoming in 2002, and rising again through 2012.

The striking fact from Figure 10 is that PPI commitments have been four to six times larger than combined ODA and World Bank funding for infrastructure since 2006 and are now a major element of infrastructure finance. PPI's peak value of $195 billion in 2012 is about 35 percent of the $562 billion (= $177 + $385) of new infrastructure investment forecast for 2012 (Table 3) for lower-middle and upper-middle income countries—who are the primary recipients of PPI. In 2012, PPI and development assistance to infrastructure together were about 40 percent of the total new infrastructure investment forecast for all developing countries in Table 3. These are national numbers, but PPI and development assistance are poised to play a key role in financing the infrastructure investment needs of rapidly growing cities in the coming decades.

In considering PPI projects, municipal and metropolitan areas can benefit from lessons of experience. First, PPI projects are more successful when carried out under a

Figure 10: Private participation in infrastructure dwarfs development assistance



Source: World Bank Annual Reports; PPIAF database; OECD QWIDS database

While income redistribution is the major responsibility of the national government, metropolitan and local governments have an important role to play in housing the poor.

clear national program or policy (often using model concession documents) rather than in an opportunistic way. Second, most municipal governments lack sufficient institutional capacity to negotiate PPI agreements, and benefit from assistance from multilateral development banks or from a national public- private partnership unit that helps to facilitate and manage infrastructure investments. Third, legal constraints, such as not allowing arbitration for contract disputes between the government and private firms, may need to be addressed. Fourth, a lack of bankable projects and the generally poor business climate is a frequent impediment in the lowest- income countries. Finally, decentralization of revenue and investment responsibilities can complicate PPI because decentralization replaces a central national agency with many local agencies; local municipalities often lack the technical expertise to implement projects; and a lack of coordination among neighboring municipalities may also lead to policy incoherence between municipalities, particularly for water supply and sanitation (Ingram, Liu, and Brandt 2013).

Urban Housing and the Poor

Although urban and metropolitan areas have little control over the international trade practices, monetary and fiscal policy, and macroeconomic programs that strongly influence national rates of economic growth, they do have great influence over their local enabling environments that facilitate local economic development and support businesses and enterprises. They also have great influence over their local housing markets and the extent to which those markets provide adequate and affordable housing for low income households. While income redistribution is the major responsibility of the national government, metropolitan and local governments have an important role to play in housing the poor.

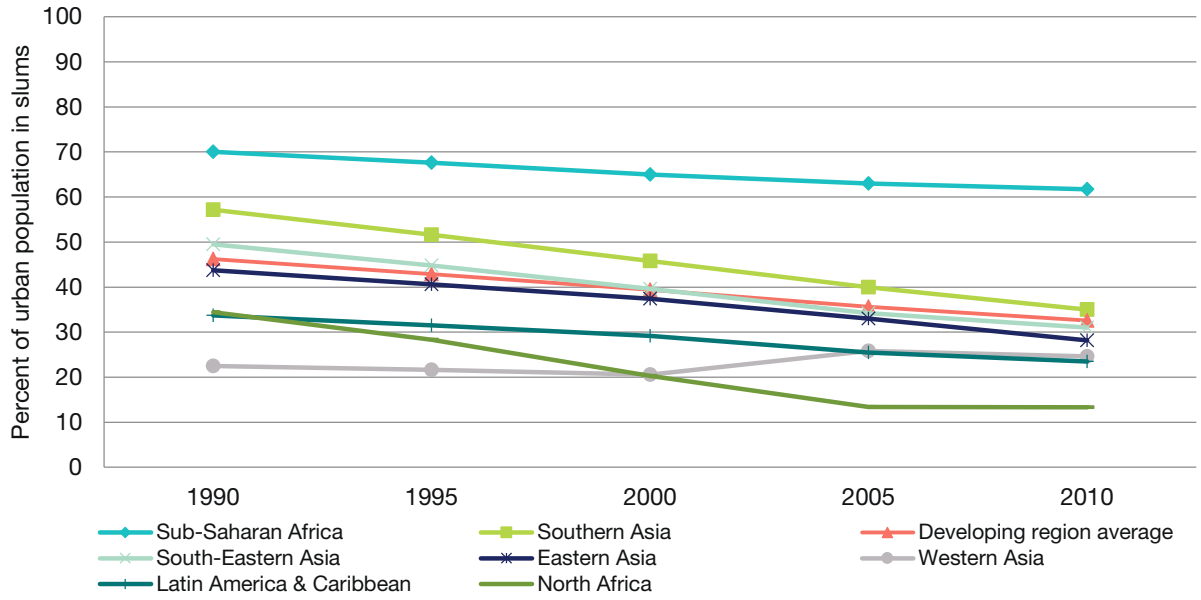
A key issue for the urban poor is access to adequate and affordable housing. This especially includes access to public services for urban housing (such as water, sanitation, and electricity) in sites that are suitable for development. It also includes access to public transportation so low income workers can commute to jobs. Access to employment is a growing issue in the supply of affordable housing. Several metropolitan areas have provided reasonably affordable housing in locations at their peripheries that are poorly served by transit. In several cases, such housing developments have remained empty because their locations make it impossible for low income workers to get to jobs. These outcomes remind us that housing markets are intimately related to labor markets in metropolitan areas, and that the labor market linkages of residential location are very important to the poor

In addition, housing occupancy should be protected by a legal system that defines property rights and provides security of tenure. Local governments should also have sufficient planning capacity to influence the location of growth along with appropriate standards and regulations for construction. Finally, as markets mature, housing finance can be an important factor in the maintenance and sustainability of housing markets, but formal housing finance will be relevant to the poor in only a few developing countries by 2050. These points are elaborated in the following paragraphs.

How is housing adequacy defined? A dwelling unit is counted as inadequate (or a slum dwelling) if it lacks one or more of the following: (a) access to improved water; (b) access to improved sanitation; (c) sufficient living area (not more than three persons per room); (d) durability/quality of structure; and (e) tenure security (UN HABITAT, 2012). Lack of access to improved sanitation is the most frequent reason units are identified as slum dwellings. These criteria have been used to measure the extent of slums or inadequate housing in urban areas, and Figure 11 shows how the percent of urban population living in slums has changed by groups of developing countries over the past two decades. By 2010, on average a third of the urban population in developing countries resided in slums, down from 46 percent in 1990. The shares are particularly high in Sub-Saharan Africa, followed by Southern Asia. While

Slum housing often originates by illegal means—via squatting on public land, invading private land, or (most frequently) illegally developing private land—and few households in slums have legal ownership or formal titles to the land under their dwellings.

Figure 11: Percent of urban population living in slums



Source: UN-HABITAT 2013, State of the World's Cities 2012-2013, p. 151

the percentages have generally declined from 1990 to the present, the rate of decline in Sub-Saharan Africa is less than average, and in 2010 over 60 percent of that region's urban population lived in slums. This slow decline is a concern given that Sub-Saharan Africa will experience the largest increase in urban population by 2050.

Governments in developing countries have used a variety of approaches to deal with slums. Slum housing often originates by illegal means—via squatting on public land, invading private land, or (most frequently) illegally developing private land—and few households in slums have legal ownership or formal titles to the land under their dwellings. Because of the lack of formal tenure or illegal occupancy, the early and first response of many governments was to bulldoze slums without making any arrangements to house those displaced. A combination of citizen outrage and the spread of elected national and local governments has made slum eradication a rarity in recent decades, although insecure tenure is still common and sufficient to classify a dwelling as a slum. The second approach was to implement public housing programs that provided dwellings and sites and services projects that provided modest structures on small lots served by infrastructure. These costly interventions required large subsidies that prevented them from being replicable (Mayo and Gross, 1987). They often were located near the urban periphery where land was inexpensive but poorly accessible by transit.

The security of tenure in developing countries is often a continuum, varying from having no rights in a development that is a recent invasion, to having some acquired rights based on occupancy for several years, to having a bill of sale for a lot purchased from its original legal owner but in an illegal development, to having legal title. Theoretical models predict that households with insecure tenure (and therefore facing some probability of eviction or some difficulty in selling property without a title) will invest less in their dwellings and be able to sell their units for less than those with secure titles (Brueckner and Lall 2015). Empirical work in the Philippines (Jimenez, 1984) and Vietnam (Kim, 2004) bears this out, showing that units with

Since the 1990s, many countries have implemented upgrading programs that regularize slums in situ by providing infrastructure services, improve dwellings, and enhance tenure security.

insecure titles rent for about 15 percent less than those with formal titles, with larger discounts for owners. Other studies in Peru (Field 2005) and in Argentina (Galiani and Schargrodsky 2010) found that dwelling occupants who gained formal title increased their expenditures on housing improvements. Dwellings with formal titles typically have higher prices than those without (Mattingly, 2013), and in many countries public infrastructure services can only be provided to dwellings with formal titles.

Much stronger claims have been made for the benefits of tenure security, namely that formalizing property rights will trigger economic development in developing countries and eradicate poverty (de Soto, 2000). de Soto argued that land titling and registration would enable households to access formal credit, allowing them to unlock the equity in their homes and use it to finance housing and business investment. Many found this reasoning compelling, and Peru implemented a titling program that distributed nearly 1.6 million freehold titles between 1996 and 2006. Average costs per title were $64 per household, and lot values increased by about a quarter. Subsequent evaluations of the effects of the programs found scant evidence that households receiving formal titles utilized more formal credit (Deininger and Feder 2009; Field and Torrero 2006). Banks were more interested in steady borrower incomes than in formal titles when making loans. Moreover, many low income households who have irregular incomes do not want to put their homes at risk as collateral for a bank loan. Peru's economy did reasonably well from 2000 to 2010, but little evidence causally links its performance to the titling program. The value of titling in Peru is best reflected in the impressive average 25 percent increase in prices of lots receiving titles.

Since the 1990s, many countries have implemented upgrading programs that regularize slums in situ by providing infrastructure services, improve dwellings, and enhance tenure security. These programs provide infrastructure services including sidewalks, drainage, and street lighting as well as regularizing titles and assisting households to stabilize their structures. Brazil initiated its Favela-Bairro program in 1994 that invested in infrastructure, community facilities, public spaces, and housing consolidation. Costs averaged between $3,500 and $5,000 per household at that time, with half the costs attributable to paving, drainage, and sewerage. Given these high costs, only a few eligible neighborhoods were selected for participation, and the financial costs of the program have made it impossible to scale up. Only a small percentage of participating households have received formal titles because of ongoing bureaucratic complexity (Fernandes 2011). Benefit-cost analyses of Brazil's upgrading programs used the increase in the value of dwellings as the benefit measure and reported an average economic rate of return of 42 percent (Cuenin 2010). Although the programs have attractive economic rates of return, their financial cost is very high to governments because the households who realize the benefits typically have not shared in the costs. Making these programs more self-financing is necessary but must overcome popular resistance in many countries.

Non-governmental organizations have also been engaged in slum upgrading programs that are more community-based. In the Asia region, the Asian Coalition for Community Action (ACCA) Program, being carried out in 230 cities, is an innovative effort comprising several coordinated and community-initiated activities designed to provide housing and infrastructure in low-income urban areas. The program provides a modest community grant for small scale infrastructure; a loan to the community for a larger housing project; architectural and planning assistance for local housing and infrastructure; and help to the community in acquiring formal land title via purchase, long term lease, or a land grant. A major element of the ACCA program is to mobilize community savings that are made part of a larger City Development Fund and to base activities on community priorities (Buckley and Kalergis 2013).

The preceding comments on housing adequacy raise points that also affect housing affordability. A key cause of informal or illegal settlements in many countries is that the

In addition to minimum lot sizes that are too large to be afforded by low income households, cities in developing countries also need to consider other policies they may have in place that make land costlier or else reduce development densities.

least cost dwelling that meets existing standards for formal housing (relating to lot size, building materials, and size) is unaffordable to low income households. As a result, low income households construct dwellings in informal or illegal settlements that are below minimum formal standards, often in areas that are ecologically fragile or distant from existing infrastructure services and transport. The illegal status and below-standard buildings prevent authorities from providing infrastructure services at the time that the communities are being built. The construction quality and size of dwellings are improved through progressive construction. Services and regularization are eventually provided, often years after the community is developed. However, retrofitting developed communities with infrastructure costs three to four times more than installing infrastructure in advance of development, and it can be an engineering challenge.

The policy implications of this situation are clear, particularly when cities are expecting huge increases in urban population: Cities and metropolitan areas need to get ahead of growth by identifying areas for development and reserving rights of way for a grid of arterial streets and core infrastructure services. Installing basic infrastructure before communities are developed is much less costly than the inevitable ex-post retrofitting. This is particularly true for arterial roads and major streets that are virtually impossible to retrofit because obtaining rights of way would require displacing many households. By providing serviced land in advance of development, metropolitan areas can also influence the direction of development and help to guide it away from prime agricultural land. Some basic planning capacity, along with infrastructure investment in advance of development, is critical if rapidly growing urban areas are to avoid being overwhelmed by informal settlements.

Getting ahead of development with designated rights of way and the installation of infrastructure before development raises questions about how low income households will pay for these features. One rule is that households should pay for private goods and the community should pay for public goods. This means that the cost of arterial rights of way and trunk infrastructure should be paid for at the city or metropolitan level, and that households would bear the cost of service provided at the lot level. Because low income households often have irregular incomes and often initiate and expand their dwellings by progressive construction—spreading out costs over time—a similar extended payment scheme would need to be used for infrastructure service. Paying for new development in this fashion also requires revisiting how the retrofitting of services in existing low income neighborhoods is funded. As noted above, households in neighborhoods being regularized typically do not pay for the retrofitted installation of services. If this practice continues, it provides a strong incentive for households to continue to develop illegal settlements and wait for subsidies rather than pay a fair share of the costs of infrastructure provided for serviced lots.

In addition to minimum lot sizes that are too large to be afforded by low income households, cities in developing countries also need to consider other policies they may have in place that make land costlier or else reduce development densities. Greenbelts are in the first category: by constraining the supply of land they drive up land prices, a result associated with the greenbelts around several Korean cities. The second category includes restrictions on building density such as limits on the ratio of built area to lot size. This ratio is commonly known as a floor area ratio (FAR) or floor space index (FSI), and selected values of the floor area ratio for several cities are in Table 4. These ratios are particularly low in cities in India, with Mumbai being well-known for its height restrictions. Among cities in developed countries, the range is particularly large, from around 3 in Venice and Paris to 20 in Tokyo. Empirical analysis carried out on Indian cities indicates that cities that have low floor area ratios have larger urban footprints or developed areas (Brueckner and Lall 2015). This increases the demand for land and raises its price. The low FAR in Sao Paulo is a standard entitlement that can be increased in some areas by purchasing rights to increased density,

Housing mortgages are an important policy instrument in high income countries that promote access to housing, provide finance for the housing construction industry, and play an important role in building household wealth.

Table 4: Floor Area Ratio (FAR) limits in central business districts

City	FAR upper limit
Sao Paulo, Brazil	1
Mumbai, India	1.33
Chennai, India	1.5
Delhi, India	1.2 to 3.5
Amsterdam, Netherlands	1.9
Venice, Italy	2.4
Paris, France	3
Shanghai, China	8
Vancouver, Canada	8
San Francisco, United States	9
Chicago, United States	12
Hong Kong SAR, China	12
Los Angeles, United States	13
New York, United States	15
Denver, United States	17
Tokyo, Japan	20
Singapore	12 to 25

Source: Brueckner and Lall, 2015

called Certificates of Additional Construction Potential (CEPAC), on the open market. Other zoning regulations pertaining to road width, building setbacks, and slow approval processes also take a toll, estimated to raise housing costs by about 14 percent in Malaysia (Malpezzi and Mayo, 1997).

Housing mortgages are an important policy instrument in high income countries that promote access to housing, provide finance for the housing construction industry, and play an important role in building household wealth. Equity in the family home is the largest component of household wealth for all but top income earners in OECD countries. However, in developing countries mortgages are relatively rare, and are not very relevant to low income households. This may change as incomes increase, particularly in upper middle income countries. There is a large variation in the depth and penetration of mortgages across countries. Current analysis indicates that mortgage markets are associated with higher levels of GDP per capita, more developed financial systems, low inflation, and the efficiency of contractual arrangements. Sources of long term funding, such as stock markets, are also associated with mortgage market development, whereas government subsidies and support are not (Badev, et al., 2014).

Environment, Externalities, and Climate Change

Concerns about the urban environment are not new. The severe air quality problems experienced in Chinese and Indian cities today are redolent of London's severe air quality problems in 1952 (known as the "Great Smog"). In mid-19th century England, death rates in cities were 5.6 per thousand higher than in rural areas, largely due to environmental causes. Following large investments in water supply and sanitation that improved environmental conditions, the urban-rural difference in death rates disappeared in England by 1920 (Williamson 1990). In developing countries today, child mortality rates are now typically lower in urban than in rural areas, while the evidence on rural-urban

Urban population growth increases a city's need for clean water, and some cities today are close to exhausting their water resources.

differences in adult life expectancy is inconclusive (Leon 2008). The current urban advantage in child mortality is thought to be related less to the environment and more to the greater urban availability of health services including vaccination—testimony to the advantage cities have in delivering public services.

Urbanization embodies many benefits but is also associated with both (a) increased local costs from negative externalities and (b) spillovers that go beyond urban areas. The local costs, such as congestion and local air pollution, are borne mainly by urban residents themselves, and many of their solutions lay within the realm of urban or metropolitan governments whose citizens are directly affected. Addressing these local environmental issues is a key strategy to enhance the competitiveness of cities in attracting and retaining economic activity. There is an important role here for national standards to avoid having cities within the same country pursue the urban equivalent of beggar-my-neighbor policies. For example, for air or water quality pollution, it is appropriate for pollution standards to be set nationally and for urban areas to then decide locally how to reduce emissions to meet national standards most effectively. For mobile sources, such as vehicular emissions, national standards for emissions are appropriate and cost effective.

Other spillovers can have an incidence that goes well beyond urban boundaries. For example, increases in urban populations beget even larger increases in the urbanized land areas of metropolitan areas. Some of this new urban development is likely to take place on farm land (Figure 8), as discussed earlier, and this has raised concerns in many countries (most notably China, with its farmland preservation policy) about food security or environmental sustainability. Urban population growth increases a city's need for clean water, and some cities today are close to exhausting their water resources—a serious problem in drought-stricken São Paulo, Brazil in early 2015, for example. Providing increasing amounts of water normally involves diverting water from other uses, and this can have negative consequences for agriculture, forests, plants, waterfowl, and other wildlife. Growing cities in dry regions are likely to need to conserve and recycle water, and cities in general will need to transport water from more distant sources as needs increase. To pay for this and to encourage water conservation, cities need to charge more for its use; current tariffs in developing countries typically pay less than half of supply costs.

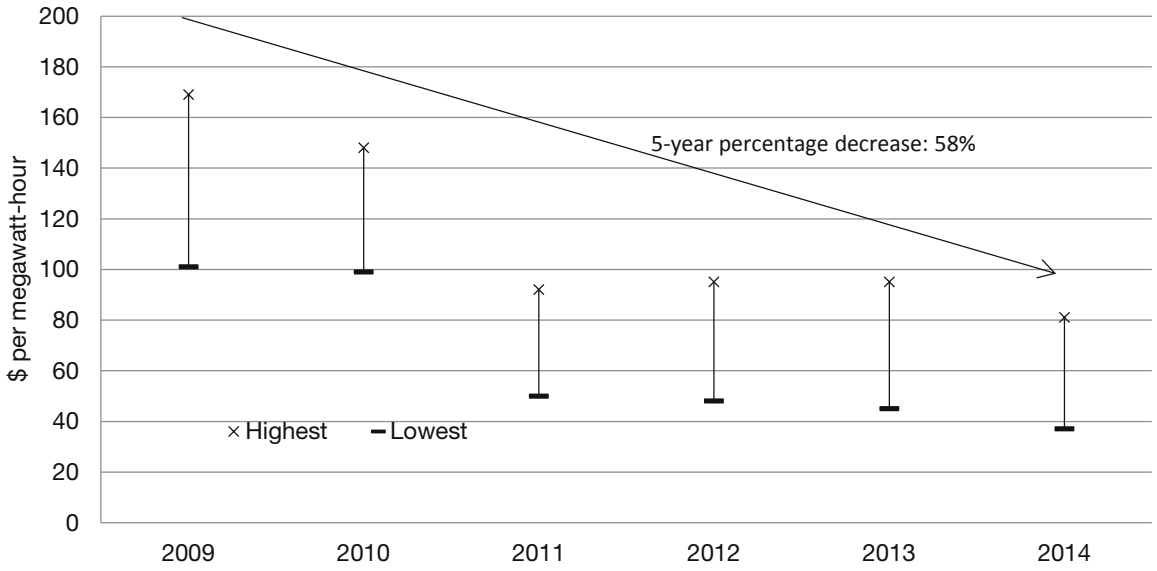
Larger urban populations produce more solid and liquid waste and more gaseous emissions—some of which are likely to affect non-urban populations that are downwind or downstream from cities.

While large urban areas are often efficient in their use of natural resources, the spatial concentration of population and the associated concentrations of emissions and effluent produce high pollutant concentrations that impair health. The challenges in controlling pollution are less technological than economic. In many cases, green technology is costlier, but its economic return is positive when one accounts for the widespread health and other environmental benefits. However, these benefits typically do not accrue to the enterprise that pays for the green technology. Accordingly, promoting green technology involves the use of either regulatory control or economic incentives, the classic means of managing such externalities. Handling these issues well in large metropolitan areas will require solutions to the problems of horizontal fragmentation addressed as a governance and management issue earlier.

While technological solutions to pollution problems are relatively well known, in many cases the costs of newer green technologies have been decreasing. Figures 12a and 12b illustrate the dramatic reductions in the levelized cost of energy (a measure of full lifetime financial costs excluding subsidies) experienced by wind and solar photovoltaic (PV) power generation in the past six years. Typical fossil fuel generation costs range between $40 and $140 per megawatt-hour, so wind energy is now cost-competitive with conventional generation, and solar is rapidly becoming so. With the rapid cost reductions in the past six years,

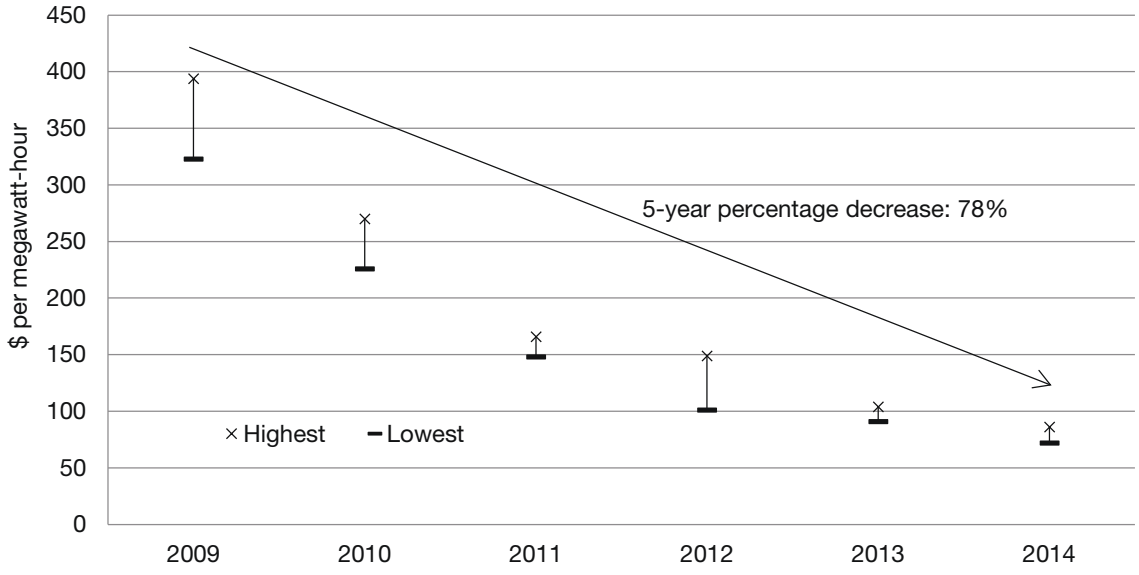
While large urban areas are often efficient in their use of natural resources, the spatial concentration of population and the associated concentrations of emissions and effluent produce high pollutant concentrations that impair health.

Figure 12a: Wind levelized cost of energy, range over time



Source: Lazard, Levelized Cost of Energy Analysis (Version 8.0), 2014

Figure 12b: Solar PV levelized cost of energy, range over time (utility-scale crystalline solar PV)



Source: Lazard, Levelized Cost of Energy Analysis (Version 8.0), 2014

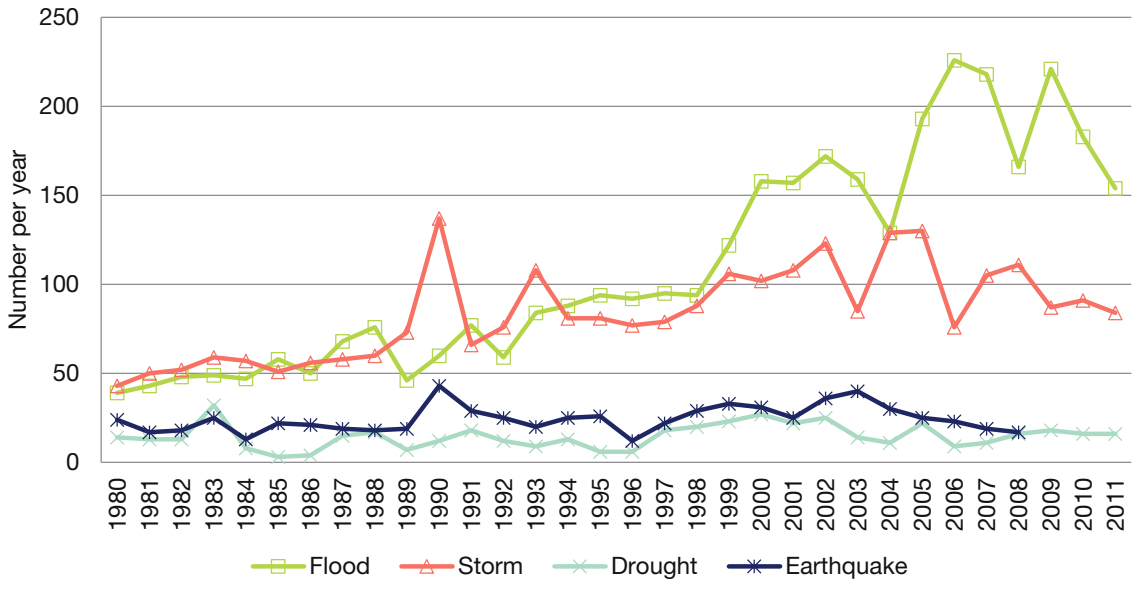
Cities not only produce negative environmental impacts for non-urban dwellers, they also suffer negative impacts from the ultimate environmental externality—climate change.

it is difficult to forecast what wind and solar costs will be in 2020, let alone 2050. Historically, dramatic cost reductions (such as those in Figures 12a and b) occur in new technologies and not in mature technologies. At current financial costs (and ignoring their environmental benefits), these technologies have great potential to increase their share of generation and to contribute to the reduction of carbon dioxide and other emissions from urban energy use. Rooftop solar panels could supply most urban household power needs in developing countries where per household energy use is lower than in OECD countries (Andrews, et al. 2011). However, when utilized in larger generation centers, wind and solar technologies need larger land areas per kilowatt hour than conventional technologies, and may require new distribution networks to deliver power to customers. In addition, because wind and solar are dependent on meteorology and daylight, their widespread use is dependent on improvements in energy storage technology.

Cities not only produce negative environmental impacts for non-urban dwellers, they also suffer negative impacts from the ultimate environmental externality—climate change. The impacts that cities in developing countries will experience include higher temperatures, more extreme weather events, a rise in ocean levels, and changes in precipitation that can be related to both more droughts and more flooding. Does the record support these expectations? Figure 13 shows the frequency of natural disasters over the 30 years from 1980 to 2010. The frequency of floods has increased three to four-fold—rather regularly and with a growing annual variation. The frequency of storms has doubled but with no obvious increase in the most recent decade. Because flooding has increased more than storms and storms likely cause flooding, the severity of storms seems to have increased. The frequency of droughts shows no change, nor has that of earthquakes. The lack of a trend in earthquakes is reassuring because there is no obvious link between them and climate change.

Sea level rise is another concomitant of climate change that will affect cities. About 600 million people and two thirds of the cities in the world with populations over 5

Figure 13: Global frequency of natural disasters



Source: EM-DAT, UN Office of Disaster Risk Reduction

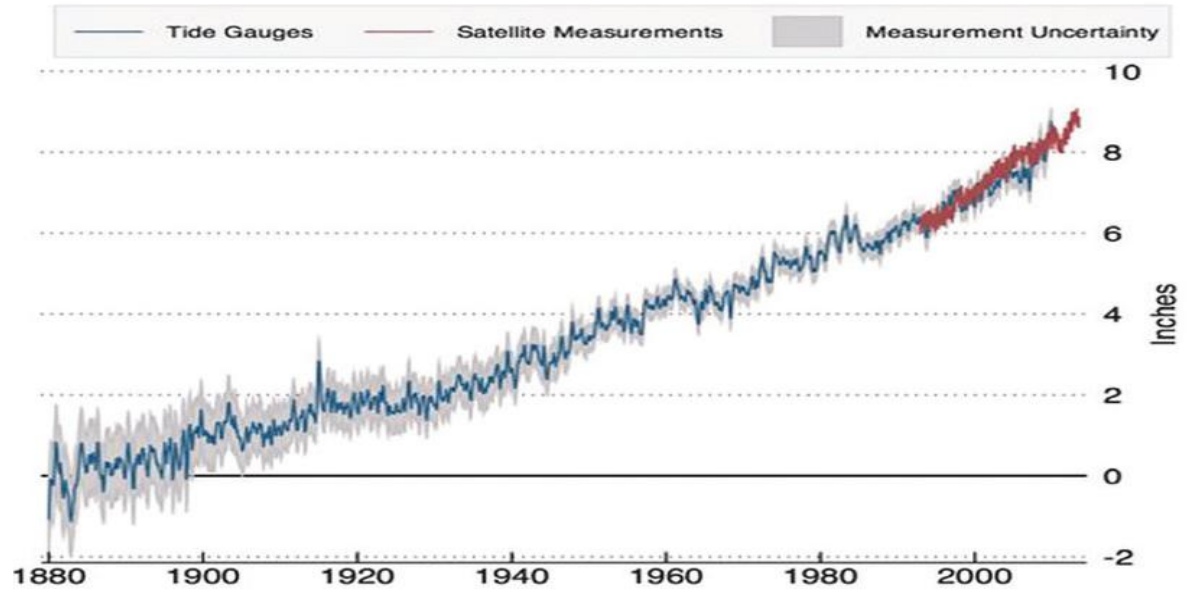
Sea level rise is exacerbated by land subsidence, which often happens in river deltas—many of which are the sites of large cities.

million are located on land less than 10 meters above sea level. Particularly vulnerable are cities in low-lying countries such as Bangladesh and Vietnam, and in coastal areas in China, India, Indonesia, and the Philippines. Average global sea levels changed very little over the 2,000 years up to the 19th century and have been rising at an increasing rate since the late 1800s (Figure 14). The average increase from 1993 to 2010 was about 3.2 millimeters per year, twice the rate earlier in the 20th century. The rise in level varies by location, with the western Pacific rising more than the eastern Pacific, for example. About a third of the recent sea level rise is from thermal expansion (as ocean waters warm) and the balance about equal parts from the melting of land-based glaciers and ice caps and from the melting of ice sheets on Greenland and Antarctica (IPCC 2013). Sea level rise is also exacerbated by land subsidence, which often happens in river deltas—many of which are the sites of large cities.

Projecting sea level rise has many uncertainties, and the actual measurements of sea level rise made over the past two decades have been at the high end of past Intergovernmental Panel on Climate Change (IPCC) forecasts. Current high range forecasts, based on a bottom-up addition of increases by source (process-based forecasts), are that sea levels will rise by between 0.3 and 1.0 meter by 2100 (IPCC 2013). Forecasts based on statistical approaches that relate sea level rise to increases in surface temperatures produce projected sea level rise by 2100 roughly twice those of the process forecasts, but there is a lack of scientific consensus about them. The greatest uncertainties relate to the melting of the Greenland and Antarctic ice sheets, which if fully melted would raise ocean levels by 67 meters (Greenland, 7 m.; East Antarctica, 55 m.; and West Antarctica, 5 m.). No one is envisioning the complete melting of these ice sheets any time soon, but modest forecast errors about their melting rates dramatically affect current projections.

Sea level rise will have its largest direct impacts on cities that are located in coastal zones, particularly those in locations experiencing subsidence. The obvious threat

Figure 14: Historic sea level rise, 1880-2013



Source: Derived from IPCC 2013

If adaptation is efficient, the annual costs of climate change are projected to be in the range of 0.1 to 1.0 percent of global world product by 2100.

is more frequent flooding and even submergence during extreme events. A recent example was the coastal flooding in New Orleans in 2005 associated with Hurricane Katrina, which caused 1,833 deaths and property losses of $151 billion (in 2015 dollars). A less obvious threat is saltwater intrusion into groundwater, which pollutes fresh water supplies. This is a particular threat to island populations that typically rely on fresh groundwater. Because much summer river flow stems from the melting of glaciers and ice caps, their shrinking will also compromise seasonal river flows and water supplies for countless cities, including many that are not on or near the coast. As ice and snowpack disappear, summer river flows will decline, greatly reducing water for irrigated agriculture and for urban water supplies.

How should cities adapt to these threats associated with climate change? One obvious conclusion is that many adaptive responses cannot be pursued by individual municipalities acting alone. Protection from coastal surges and threats to water supplies will require action at the metropolitan, regional, or higher level. Seawalls only work if they have no gaps, and stabilizing water supplies for urban areas by building reservoirs and aqueducts is subject to large economies of scale. The development of governance and effective planning capacity at the metropolitan level, which is desirable for many services, becomes an absolute necessity to deal with the major threats of climate change for urban areas.

The costs of adaptation vary with the speed required for adequate response. If the threats increase at a slow rate, similar to the depreciation rate of existing physical assets, then the cost of adaptation will not be much larger than that of regular ongoing investment. And in some cases, the best adaptive response may be to retreat. If adaptation is efficient, the annual costs of climate change are projected to be in the range of 0.1 to 1.0 percent of global world product by 2100 (Mendelsohn 2011). But if the change happens quickly or is not well planned for, it will create large losses through reduction in services and destruction of existing productive assets. With respect to urban development and infrastructure investment, it is most important to have a forecast of the likely threats posed by climate change and to take account of the threats as new development decisions are made and existing physical assets are maintained. This will require coordination and planning at the metropolitan, regional, or national level.

In addition to adaptation, cities can also contribute to mitigation by reducing emissions of greenhouse gases. While urban emissions are a large share of total emissions, measurement issues have led to much uncertainty about the precise magnitude of urban emissions, making it difficult to compare emission rates across cities or metropolitan areas. First, there is a lack of agreement about how to define urban area boundaries in a consistent way to measure emissions across cities. And second, while most inventories include territorial emissions released within urban boundaries (production-based emissions), there is an ongoing debate about whether and how to include emissions that are embodied in the energy, material, and goods produced outside urban areas but consumed within their borders (consumption-based emissions)—as well as emissions from air travel and shipping. Most historical inventories of urban emissions use territorial or production-based definitions, but the lack of common standards makes comparison of emissions across cities problematic. Progress is being made both at the conceptual level (Ramaswami, 2013) and in defining new standards (World Resources Institute, 2014), but consistently defined and comparable emissions data across cities is scarce.

Although the data pose difficulties, several findings based on imperfect data are likely to endure. The urban share of total national GHG emissions is large, ranging from 40 to 70 percent of production-based emissions and 60 to 70 percent of consumption-based emissions. Per capita urban emissions in industrial countries are typically less than the national average, while in developing countries the reverse is normal. This likely stems from the large concentrations of manufacturing in cities in developing countries relative to those in industrial countries (Dodman,

The concept of a smart city involves integrating the information technology revolution with the city, and it is particularly focused on digital technology, the collection and analysis of data, and making machinery, and systems more intelligent.

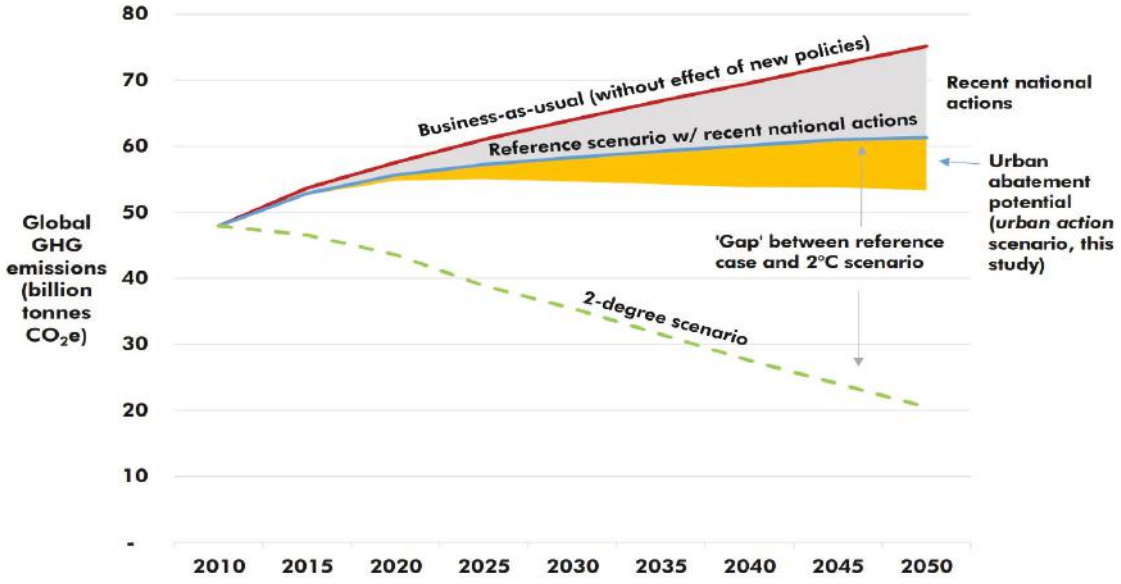
2009). Urban emissions vary a great deal across cities and are related to a number of urban attributes including the sectoral composition of industry, population size and density, income, prevailing climate, transit usage, and urban form (Marcotullio, et al, 2013).

Most mitigation programs to date have focused on national policies and programs and have not considered actions at the city level. A recent study (Erickson and Tempest, 2014), represents a careful attempt to estimate reductions in greenhouse gases that could be achieved by additional efforts at the city or metropolitan level. They focus mainly on emission reductions that could be obtained from enhanced energy efficiency standards for new buildings, energy retrofits for existing buildings, improved efficiency for lighting and appliances, and better transport energy efficiency and transit usage in cities. A summary of the results is shown in Figure 15, which indicates that these urban initiatives would reduce the emissions gap (by 10 percent in 2030 and 15 percent in 2050) between existing policies and those needed to achieve the two degree warming target.

Technology and the City

The concept of a smart city involves integrating the information technology revolution with the city, and it is particularly focused on digital technology, the collection and analysis of data, and making machinery, and systems more intelligent. This integration is likely to have large effects that will take three forms. First, it will increase the operating efficiency of existing urban systems through better monitoring of real time data and use of more intelligent equipment. Examples would be better traffic control with smoother flows and fewer motor vehicle accidents, improved public security, lessened demand for electricity at peak periods by using smart meters and appliances, and better emergency service performance—all based on the use of real time data to adjust key parameters of current systems. Second, this integration is likely to transform some existing systems. Examples would be having autonomous

Figure 15: The potential for urban actions to reduce the emissions gap



Source: Erickson and Tempest, 2014, Figure 7 on page 12

Cities that have an underlying technology vision or plan that emphasizes productivity and connectivity have done better than cities that have only responded to initiatives from private suppliers.

driverless cars displace traditional taxi service (Uber is a pre-cursor of such change), or having distributed generation from solar panels reduce reliance on the current power generation and distribution system. Third, such integration will produce other effects that are unexpected or difficult to predict. Examples might be a dramatic weakening of the links between workplace and residential locations that could further accelerate low density development.

Along with likely benefits come risks, such as a potentially large erosion of privacy as public or private entities accumulate large amounts of personal data. Moreover, given the strength of network effects and scale economies, these smart systems may not be offered in a competitive setting but be overseen by a few large firms in an oligopolistic setting, so that potential gains could be curtailed by high prices of services. Finally, because they are highly integrated, the systems themselves are likely to have increased performance risks, and they would need to be reliable (lack internal errors), robust and redundant to component failure, and resistant to hacking.

There is a futuristic aspect to this topic that makes it seem irrelevant to cities in less developed countries. However, developing countries are surprisingly engaged with intelligent urban systems. In conjunction with IBM, Rio de Janeiro has been operating a facility since 2010 that coordinates the activities of 30 city agencies in a large Center of Operations with 600 staff that receives data from countless sensors and video cameras in the city. Other countries have been constructing new green cities as platforms for new smart technology. These efforts include Songdo in Korea, the Tianjin eco-city in China, Masdar in the United Arab Emirates, and Konza Techno City in Kenya. Shortly after taking office in 2014, Prime Minister Modi of India announced an initiative to create 100 smart cities in India by 2020.

It is impossible to make accurate predictions about how technology will transform cities in the coming decades, but some trends are likely. Consider transportation as an example. Advanced Driver Assistance Systems that include some collision avoidance capability are already available on the market and will enhance highway safety. Autonomous vehicles are still in the development stage but may be marketed within this decade. They have the ability to link to surrounding vehicles, enabling them to avoid accidents and to travel more closely together, akin to vehicle trains that would increase flow rates on existing roadways. Such vehicles also free up the driver's attention from driving and allow more productive use to be made of auto-based commute time—thereby reducing the time cost of travel. Autonomous vehicles also potentially will be a boon to the elderly who are no longer competent to drive, enabling them to remain mobile while continuing to live in areas lacking transit service—with likely impacts on urban housing markets. Autonomous vehicles also have the potential to disrupt taxi service (noted earlier), allow more efficient use of parking, and to dramatically reduce private vehicle ownership if users find it cheaper to hire autonomous vehicle services than to purchase such a vehicle outright. An interesting feature of these technologies is that they are mostly imbedded in the vehicle and are much less dependent on guideways imbedded in existing roads—which was the technology foreseen in forecasts made four decades ago. Imbedding much of the technology in the vehicle means that most of the cost of autonomous vehicles will be included in vehicle prices that are normally paid by vehicle users from private funds, as opposed to being infrastructure costs that are normally funded from public budgets.

While it is still early days, experience to date with smart city technology provides several lessons. Cities that have an underlying technology vision or plan that emphasizes productivity and connectivity have done better than cities that have only responded to initiatives from private suppliers. Open access to broadband and data, along with wide collaboration, including at the neighborhood level, have promoted inclusivity and citizen support for new technology. New projects need to be reviewed to ensure that they are building in new technology and thereby avoid costly

One of the most important consequences of the doubling of urban populations is that by 2050 the areas of urbanized land in developing countries will be from two and a half to seven times larger than in 2000.

retrofitting. Demonstration projects that target particular areas or problems are a good initial step before scaling technology to the city or metropolitan level. Finally, a public-private network of smart city advocates can educate the public about the promise and reality of smart city technology (Puentes and Tomer, 2014).

Smart city technologies can be implemented in a centralized top-down or a decentralized bottom-up mode. The top-down approach normally involves a single large vendor that installs the sensors needed to make a system intelligent and also provides the central control and management system. A full blown example of this is the Operations Control Center in Rio de Janeiro that is based on IBM software and systems. Such single vendor operations often use proprietary systems, and the vendor controls and analyzes most of the data. At the other extreme is an operation with open data that is web-oriented and encourages individuals and firms to provide software solutions and applications. For example, the Massachusetts Department of Transportation has a special web page that provides access to many of its data bases that developers of smart phone applications or other tools can use in their work (MassDOT 2015).

The implications of these two approaches can be very different in terms of data availability and the protection of privacy. Many observers have a preference for bottom-up decentralized systems because they claim that such an approach produces more innovation and lowers smart technology costs (Townsend 2013). In fact, cities and metropolitan areas may use a top-down approach for some systems where engineering efficiency is paramount and a bottom-up approach where consumer service is more critical. The key point is that cities need to recognize the existence of the alternative approaches and to consider their benefits and costs when choosing technologies because it may be costly to shift from one technological path to another.

Conclusion

In the next 40 years, developing countries are projected to see their urban populations double, an increase of about 2.6 billion people. One of the most important consequences of this doubling of urban populations is that by 2050 the areas of urbanized land in developing countries will be from two and a half to seven times larger than in 2000. Managing this expansion well and in a cost-effective manner will require cities and metropolitan areas to develop the capacity to plan the general directions of urban growth at the city and metropolitan level. This will involve setting aside rights of way for a grid of major arterial roads and trunk infrastructure. In addition, because installing infrastructure before the development of residential areas is much less costly than retrofitting it after development, residential infrastructure services should be put in place before development. Paying for this upfront investment would best be done by spreading payments over time as a part of regular user charges or through betterment levies that may be part of a property tax system. To increase the accessibility of infrastructure services, a substantial share of the funding of investment costs must be borne by beneficiaries because the costs are too great to be covered by municipal revenues alone, and many of the services are private goods that directly benefit households and increase the value of their properties.

To sustain this urban growth and have it contribute to economic development will require supportive policies at the national, provincial, and local levels. National economic policy makers need to facilitate growth by pursuing macroeconomic policies that maintain stability and support private activity. Both national and provincial governments need to enable cities and metropolitan areas to manage their public finances, spending, and regulations in ways that promote growth. They also need to empower local officials to make decisions about services in an institutional setting where local officials are accountable to local citizens for their actions. While these steps are all necessary to set the stage for effective management in municipal, city,

Addressing externalities and environmental issues well requires appropriate assignment of the responsibility for their management by different levels of government.

and metropolitan areas, they are not sufficient for success at the local level. Municipalities, cities, and metropolitan areas also need to implement appropriate policies within their own domains.

For example, helping to increase the availability of infrastructure services is a major element of an affordable housing program. Lack of water and sanitation services are the most common features that make housing inadequate, and it is virtually impossible for households to remedy these deficiencies on their own. Many urban areas will also need to revisit their minimum lot sizes and building codes to make their minimum housing standards more affordable. The designation of arterial streets in advance of planning will provide a grid with sufficient capacity to accommodate transit, which will become ever more necessary as the urbanized limits of metropolitan areas expand. The alternative to providing infrastructure services and reforming regulatory requirements is likely to be a profound growth in informal and substandard housing that will be much more costly to serve in the longer run.

Allowing users to pay for the investment costs of infrastructure over time requires a source of longer term financing for infrastructure investment. Developing countries have a number of viable alternatives to consider. First, overseas development assistance and loans from development banks can play an important role, particularly for the least developed countries. Second, the availability of private investment through PPI initiatives has grown steadily over the past two decades and now is a substantial fraction of total infrastructure finance that is available for mostly middle income developing countries. PPI has been used mainly for telecoms and electric power, while development banks and aid agencies have been more active in water, sanitation, and transport—although there is much overlap. Middle income developing countries have also been establishing municipal development funds, markets in municipal bonds, and in some cases have issued bonds sold on international markets that have been rated by international rating agencies. Because of their costs of issuance, directly issuing bonds will likely only be feasible for large borrowers such as large utility companies or metropolitan organizations.

Addressing externalities and environmental issues well requires appropriate assignment of the responsibility for their management by different levels of government. Some crowding and congestion problems can be managed at the municipal or city level, but metropolitan transit or transport authorities will need to manage inter-jurisdictional issues in transportation. Other infrastructure services including water supply, sanitation, and waste disposal often require inter-jurisdictional coordination, especially for the supply of bulk water, because of scale economies and literal spillovers across jurisdictional boundaries. Air pollution almost always needs to be managed at the broader scale of a metropolitan area because of the long distance transport of pollutants. In managing pollution, it usually makes sense to distinguish between the standards set for pollutant levels, e.g., particulate parts per million, and the standards set for emissions, e.g., kilograms per hour of particulates from a smokestack. Standards for maximum pollutant concentrations are often based on health considerations and are best set at the national level. Because achieving mandated pollutant levels in a metropolitan area depends on the physical location of emitters and local meteorological conditions, it normally is efficient to set emissions levels from point sources at the metropolitan level. Managing the urban response to climate change also normally cannot be done at the municipal or city level because the scale of the problem inherently eclipses city boundaries. Plans for adaptation will almost always involve an area of analysis that involves a coastal zone, a storm water drainage area, or a river basin.

The implication of the observations made here about preparing for future expansion of urbanized areas by laying out a grid for arterial roads and core infrastructure, installing infrastructure before development, managing environmental challenges, and preparing for the effects of climate change is that metropolitan areas in developing

If economic growth and improved governance are not achieved, Africa's demographic advantage could become a liability fueled by unmet expectations in an ever more globalized world.

countries need to develop a basic capacity for planning at the metropolitan level in order to deal adequately with urban growth and related challenges in the next few decades. These metropolitan level plans will need to provide a metropolitan-wide framework for the implementation of infrastructure investments by constituent cities, municipalities, utilities, and metropolitan authorities. While metropolitan-wide governments would be a sensible approach to manage these issues, they have proven to be very difficult to put in place where there are long-standing cities and municipalities. Metropolitan-wide authorities or commissions with representatives from constituent governments providing oversight and coordination are more likely to be a feasible way to address metropolitan-wide problems.

Of the nine regions that have been used here as a basis for projections and analysis, Sub-Saharan Africa stands out as facing the most difficult urban development challenges up to 2050. This region is projected to have the largest percentage (a quadrupling) and absolute (around 800 million) growth in urban population from 2010 to 2050. This region also currently has the greatest share of its urban population (over 60 percent) living in slums and has been making slow progress in reducing that share. The one important advantage possessed by Sub-Saharan Africa relative to other regions is demographic—it will experience a very large decline in its dependency ratio that should help to support and maintain a high rate of economic growth. Achieving this outcome will require effective macroeconomic policies as well as sensible management of urbanization. If economic growth and improved governance are not achieved, Africa's demographic advantage could become a liability fueled by unmet expectations in an ever more globalized world.

Appendix 1: Classification of countries into nine groups

This classification is a variation on the country groups used in World Population Prospects: The 2012 Revision produced by the UN Department of Economic and Social Affairs Population Division.

Sub-Saharan Africa

Angola
Benin
Botswana
Burkina Faso
Burundi
Cameroon
Cape Verde
Central African Republic
Chad
Comoros
Congo
Côte d'Ivoire
Democratic Republic
Djibouti
Equatorial Guinea
Eritrea
Ethiopia
Gabon
Gambia
Ghana
Guinea
Guinea-Bissau
Kenya
Lesotho
Liberia
Madagascar
Malawi
Mali
Mauritania
Mauritius
Mayotte
Mozambique
Namibia
Niger
Nigeria
of Tanzania
of the Congo
Réunion
Rwanda
Saint Helena
São Tomé and Príncipe
Senegal
Seychelles
Sierra Leone
Somalia
South Africa
South Sudan
Swaziland
Togo
Uganda
United Republic
Zambia
Zimbabwe

Northern Africa

Algeria
Egypt
Libyan Arab Jamahiriya
Morocco
Sudan
Tunisia
Western Sahara

East Asia and Pacific excluding Japan

East Asia

China
China, Hong Kong SAR
China, Macao SAR
Democratic People's Republic of Korea
Mongolia
Republic of Korea

Pacific

American Samoa
Cook Islands
Fiji
French Polynesia
Guam
Kiribati
Marshall Islands
Micronesia
Nauru
New Caledonia
Niue
Northern Mariana Islands
Palau
Papua New Guinea
Samoa
Solomon Islands
Tokelau
Tonga
Tuvalu
Vanuatu
Wallis and Futuna Islands

South-Central Asia

Kazakhstan
Kyrgyzstan
Tajikistan
Turkmenistan
Uzbekistan
Afghanistan
Bangladesh
Bhutan
India
Iran (Islamic Republic of)
Maldives
Nepal
Pakistan
Sri Lanka

South-Eastern Asia

Brunei Darussalam
Cambodia
Indonesia
Lao People's Democratic Republic
Malaysia
Myanmar
Philippines
Singapore
Thailand
Timor-Leste
Viet Nam

Western Asia

Armenia
Azerbaijan
Bahrain
Cyprus
Georgia
Iraq
Israel
Jordan
Kuwait
Lebanon
Oman
Qatar
Saudi Arabia
State of Palestine
Syrian Arab Republic
Turkey
United Arab Emirates
Yemen

Europe plus Japan

Albania
Andorra
Austria
Belarus
Belgium
Bosnia and Herzegovina
Bulgaria
Channel Islands
Croatia
Czech Republic
Denmark
Estonia
Faeroe Islands
Finland
France
Germany
Gibraltar*
Greece
Holy See
Hungary
Iceland
Ireland
Ireland
Isle of Man
Italy
Japan
Latvia
Liechtenstein
Lithuania
Luxembourg
Malta
Monaco
Montenegro
Netherlands
Norway
Poland
Portugal
Republic of Macedonia
Republic of Moldova
Romania
Russian Federation
San Marino
Serbia
Slovakia
Slovenia
Spain
Sweden
Switzerland
Ukraine
United Kingdom

Latin America and the Carribean

Anguilla
Antigua and Barbuda
Argentina
Aruba
Bahamas
Barbados
Belize
Bolivia
Brazil
British Virgin Islands
Caribbean Netherlands
Cayman Islands
Chile
Colombia
Costa Rica
Cuba
Curaçao
Dominica
Dominican Republic
Ecuador
El Salvador
Falkland Islands
French Guiana
Grenada
Guadeloupe
Guatemala
Guyana
Haiti
Honduras
Jamaica
Mexico
Nicaragua
Panama
Paraguay
Peru
Suriname
Uruguay
Venezuela

Western Asia

Australia
Canada
New Zealand
United States of America

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