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Introduction

Flying into São Paulo on a clear day, one can easily understand why this city has been called the locomotive that pulls the rest of Brazil. With a population in excess of 15 million, it is the largest city of the Southern Hemisphere. From its center thrust impressive clusters of modern buildings; beyond them the metropolitan complex stretches as far as the eye can see. This is the foremost industrial center of Latin America, and a dominant presence in finance and trade. São Paulo is home to Brazil's automobile industry, and accounts for much of its manufacturing in sectors as diverse as computers, electrical and mechanical appliances, chemicals and pharmaceuticals, textiles, furniture, and processed foods. With about one-tenth of Brazil's population, the city generates one-third of the country's net national product. In addition to being an economic powerhouse, São Paulo is a force in culture and intellectual debate, the site of four universities, a medical school, and many important museums. In economics, politics, and the arts, writes Alves (2003), "São Paulo has become an exporter of ideas."

This is a birds'-eye view of the city, but on closer inspection São Paulo takes on a more variegated appearance. It can be seen that poor neighborhoods and ramshackle housing surround some of the high-rise commercial clusters. Consider the situation of Marta, a young woman who lives in one of these *favelas*. Her husband once held a steady job in a manufacturing firm, but lost it in the economic downturns of the 1980s and now ekes out a living as a security guard for a rich family. Marta herself takes in work as a seamstress, but she keeps an eye out for any opportunity that might come her way. She is pleased that her daughters are about to complete primary school, unlike their cousins in the countryside who dropped out. Still, she worries incessantly about the children's safety, especially since their route to school wends through territory claimed by rival gangs. Marta's aunt, a formidable nurse in a clinic not far away, continually impresses upon her the need for the children to be well educated, but in looking ahead, Marta finds herself wondering whether the girls would really benefit from secondary school.

The pros and cons of schooling are much debated among her friends, some pointing to success stories and others to children who wasted their education; they all complain, however, about the difficulties and costs of rearing children properly in São Paulo. Marta's friends are unanimous on one point: to have five or six children today, as was often done in their mothers' time, would be too exhausting even to contemplate.

In vignettes such as this, the positive and negative elements of urban life are thoroughly intermixed. Cities are the sites where diverse social and economic resources are concentrated, and that concentration can generate substantial economic benefits in the form of innovation and income growth (Jacobs, 1969; Glaeser, Kallal, Scheinkman, and Shleifer, 1992; Henderson, 2002). If cities could not offer such benefits, they would have little reason to exist, for the massing of production and population also generates many costs—heavy congestion, high rents, and stress on the capacities of government. In the nineteenth century, this opposition of benefits and costs was well understood. The cities of that time were likened to "satanic mills" where one could seize economic opportunity only at some risk to life and health. In much of today's popular writing on cities, however, the costs of city life tend to be vividly described while the economic benefits are left unmentioned.

Cities are also the sites of diverse forms of social interaction, whether on the staging grounds of neighborhoods, through personal social networks, or within local community associations. The multiple social worlds inhabited by city residents must profoundly influence their outlooks and perceptions of life's possibilities. In city life, many family productive and reproductive strategies are on display, with the consequences being acted out by local role models and reference groups. The poor are often brought into contact with the near-poor and sometimes with the rich; these social collisions can either stir ambitions or fan frustrations. The social embeddedness and multiple contexts of urban life (Granovetter, 1985) would thus appear to present demographic researchers with a very rich field for analysis.

Over the past two decades, researchers interested in high-income countries have moved to take up this analytic challenge, with much of the intellectual energy being provided by the powerful writings of Wilson (1987) and Coleman (1988, 1990) on the roles of neighborhoods and local context in the cities of the United States. But the cities of poor countries have seen no comparable surge in demographic research. Indeed, apart from the occasional study of migration, the mainstream literature has been all but silent on the demographic implications of urban life in developing countries. Not since Preston (1979) and United Nations (1980) has there been a rigorous, comprehensive assessment of urban demography in these countries.

As we will discuss, the U.S. literature has emphasized many of the themes that are of central importance to the cities of low-income countries: children's schooling, reproductive behavior among adolescents and adults, health, spatial segregation, and employment. It has also advanced important theories and mechanisms—

social learning, networks, collective socialization, and social capital among them—that have clear parallels in developing-country cities. Yet, at least to date, the theories and research strategies being vigorously pursued in the U.S. context have not been taken up elsewhere. On these grounds alone, a review of what is known about urban population dynamics would appear well overdue.

This chapter introduces some of the themes that will be explored in the chapters to follow, together with basic demographic information on the urban transformation. The chapter also describes the committee's charge, the main reasons for undertaking this study, and describes some of the major audiences for the report, with particular reference to the demographic research community.

THE DEMOGRAPHIC TRANSFORMATION

The neglect of urban research is nothing short of astonishing when considered in light of the demographic transformations now under way. The world's population passed 6 billion in 1999, and six of every seven people now reside in a low-income or middle-income country.[1] The global rate of population growth has declined over the past 20 years; in absolute terms, however, the world remains in the midst of an era of historically dramatic population increase. According to the latest United Nations (2002a) projections, even as the rate of population growth continues to decline, the world's total population will rise substantially. The total is expected to reach 8.27 billion in 2030, this being a net addition of 2.2 billion persons to the year 2000 population. Almost all of this growth will take place in the poor countries of the world, whose governments and economies are generally ill equipped to deal with it.

The Urban Future

As Figure 1-1 shows, over the next 30 years it is the world's cities that are expected to absorb these additional billions.[2] The total rural population is likely to undergo little net change over the period, declining by 30 percent in the high-income countries and increasing by an expected 3 percent in low- and middle-income countries. Relatively small changes are also expected for the cities of high-income countries, whose populations will rise from 0.9 billion in 2000 to 1 billion in 2030. Hence,

[1] In this report we take as synonymous the phrases *low- and middle-income countries*, *poor countries*, and *developing countries*, although we recognize that they differ in emphasis and shades of meaning. We follow the World Bank (2002b) in classifying a country as high-income if its gross national income per capita in the year 2000 exceeded $9,266 in the World Bank's estimation. We will also take the terms *urban areas*, *cities*, and *cities and towns* to be broadly synonymous, often employing the last of these to highlight the great size range of urban places.

[2] The great variety of definitions of "urban" used by national statistical agencies and deficiencies in the measures these agencies supply to the United Nations imply that the United Nations estimates and projections can be taken only as broadly indicative of levels and trends. Definitional and measurement issues are discussed at length in this report.

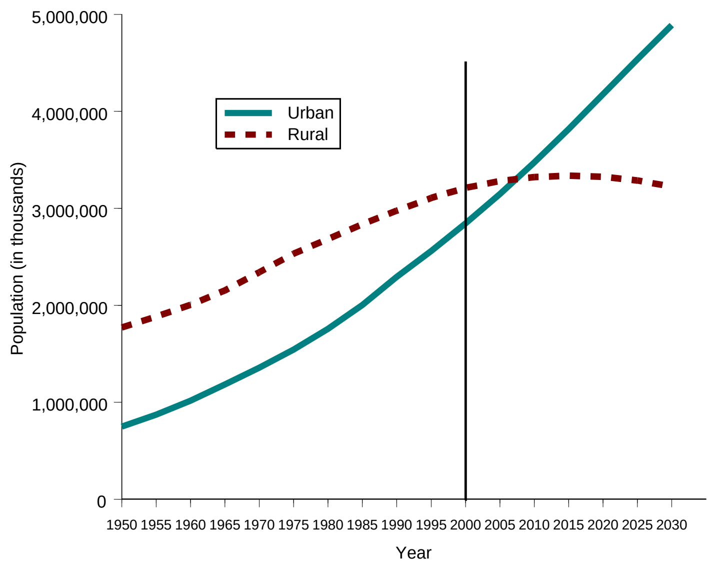

FIGURE 1-1 Estimated and projected urban and rural populations, world totals 1950–2030. Source: United Nations (2002a).

as can be seen in Figures 1-2 and 1-3, the net additions to the world's population will be found mainly in the cities and towns of poor countries. The prospects for the near future stand in stark contrast to what was seen during the period 1950 to 1975, when population growth was much more evenly divided between urban and rural areas.

The United Nations predicts that the total urban populations of Africa, Asia, and Latin America will double in size over the next 30 years, increasing from 1.9 billion in 2000 to 3.9 billion in 2030. These changes in totals will also be reflected in the urban percentages. In 1950 less than 20 percent of the population of poor countries lived in cities and towns. By 2030, that figure will have risen to nearly 60 percent. Rather soon, it appears, it will no longer be possible to speak of the developing world as being mainly rural. Both poverty and opportunity are assuming an urban character.

Each of the developing regions is expected to participate in this trend. As Figure 1-4 shows, a good deal of convergence is anticipated, but considerable differences will likely remain in levels of urbanization (the percentage of the population residing in urban areas) by geographic region. Between 1950 and 2000,

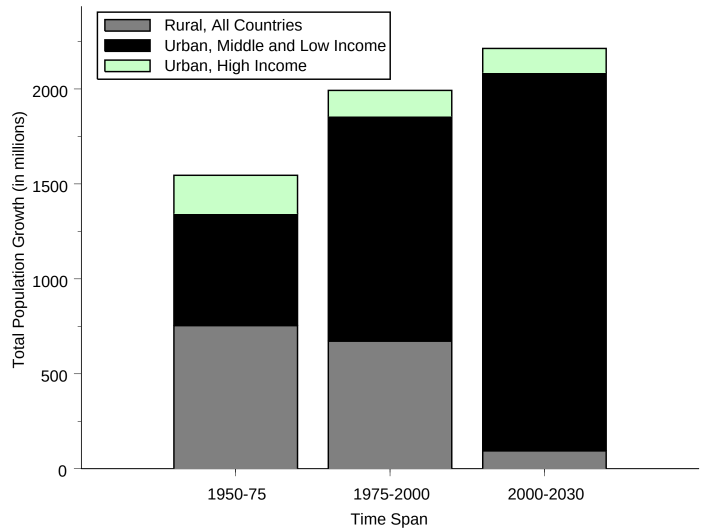

FIGURE 1-2 Distribution of world population growth by urban/rural and national income level. Estimates and projections for 1950–2030. SOURCE: United Nations (2002a).

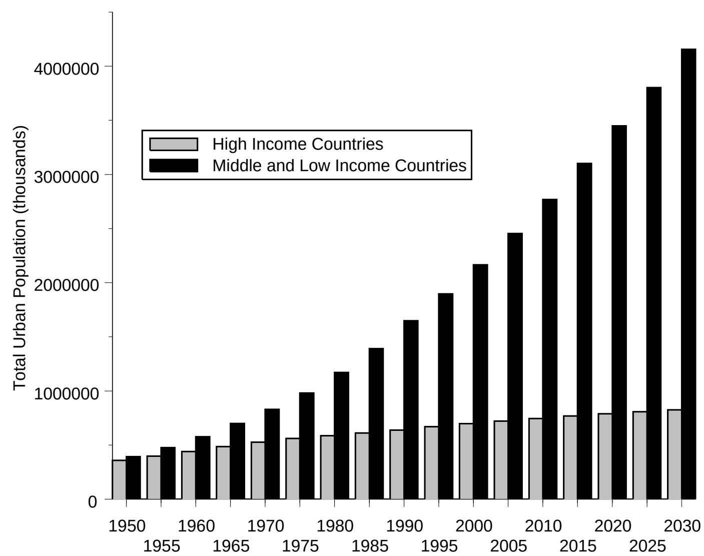

FIGURE 1-3 Growth of total urban population by national income level, 1950–2030. SOURCE: United Nations (2002a), World Bank (2001).

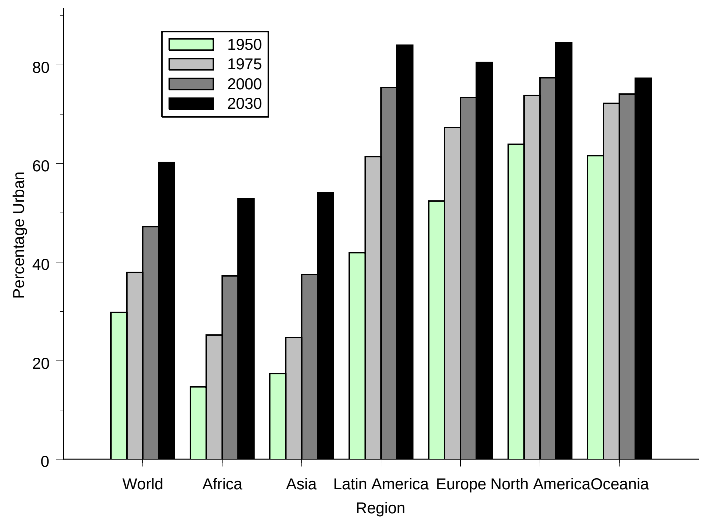

FIGURE 1-4 Estimated and projected percentage of population in urban areas, by region, 1950–2030. SOURCES: United Nations (2002a).

the urban share of the population in middle- and low- income countries rose from 20 to 42 percent, and it is projected to reach 57 percent in 2030.

Latin America is now highly urbanized: 75 percent of its population resides in cities, a figure rivaling the percentages of Europe and North America. Africa and Asia are much less urbanized, however, with less than 40 percent of their populations being urban. However, Asia will contribute the greatest absolute number of new urban residents over the next three decades. Although both Africa and Asia will become more urban than rural in the near future, they are not thought likely to attain the 60 percent level before 2030.

A Future of Megacities?

In popular writing on the cities of developing countries, it is the largest cities that receive the most attention. Perhaps it is only natural that cities the size of São Paulo, Bangkok, Lagos, and Cairo come readily to mind when urban populations are considered. Yet for the foreseeable future, the majority of urban residents will reside in much smaller settlements, that is, in small cities with 100,000 to 250,000 residents and in towns with populations of less than 100,000. Data on these cities and towns are scarce and grossly inadequate. No comprehensive, reliable, and up-to-date database exists for the cities under 100,000 in population, and as is discussed later, it is even difficult to find data in a usable form for cities under 750,000.

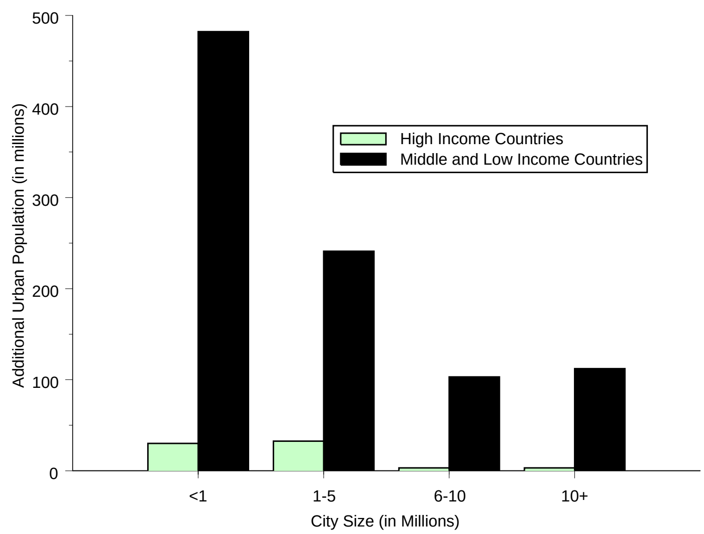

FIGURE 1-5 Net additions to urban population, by city size and national income level, 2000-2015. SOURCES: United Nations (2002a); World Bank (2001).

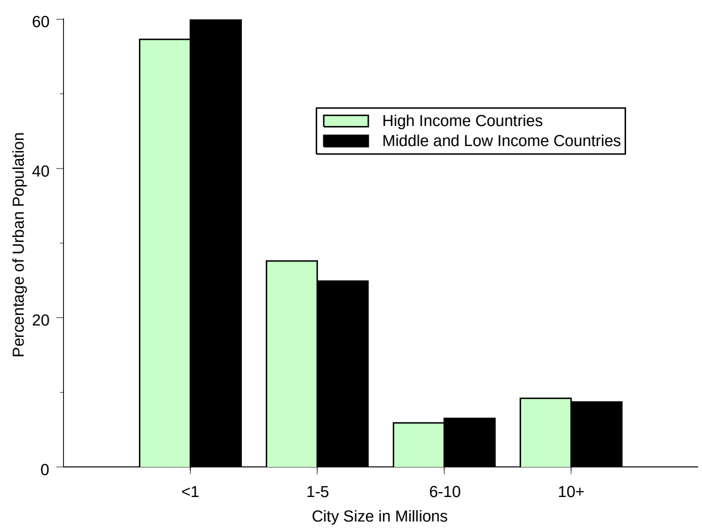

FIGURE 1-6 Projected distribution of urban residents in 2015 by city size for high-income countries, and for middle- and low-income countries. SOURCES: United Nations (2002b); World Bank (2001).

Despite these difficulties, some information on urban populations by size of city can be gleaned from United Nations (2002a). Figure 1-5 presents the United Nations predictions, showing the number of urban residents who will be added to cities of different sizes over the period 2000 to 2015. As can be seen, the lion's share of the increase will be absorbed by towns and cities with fewer than 1 million inhabitants. Figure 1-6 depicts the projected distribution (in 2015) of urban population by size of city. Towns and cities with population of under 1 million will then account for about 60 percent of the developing-country urban total. Cities from 1 to 5 million in size will house another 26 percent.

As a rule, smaller cities tend to grow more rapidly than do larger ones. This tendency is evident in regression analyses with controls for confounding factors, and in the trajectories followed by individual cities over time. To be sure, there is considerable unexplained variation in the relationship between city size and growth. Nevertheless, as will be discussed later, the negative association betweenthe two is sufficiently robust for the United Nations to have incorporated the relation in its forecasting methods.

We cannot recall a case in which a small city was the focus of an editorial lamenting rapid urban growth or the lack of public services. Nevertheless, the combined size of such cities makes them very significant presences in developing countries. As is shown throughout this report, smaller urban areas—especially those under 100,000 in population—are notably underserved by their governments, often lacking piped water, adequate waste disposal, and electricity. Indeed, they can exhibit levels of human capital, fertility, health, and child survival that are akin to those found in rural areas. The sheer scale of the challenges presented by very large cities should not cause the difficulties of these small cities to be overlooked.

We are by no means suggesting that large cities be neglected in policy and research. The scale on which resources are concentrated in these cities presents governments with needs that are of a qualitatively different order than those of small cities and towns. At the beginning of the twentieth century, there were only 16 cities in the world with populations of 1 million or more, and the vast majority of these cities were found in advanced industrial economies. Today the world contains more than 400 cities of this size, and three-quarters of them are found in low- and middle-income countries. For the residents of these cities, scale is a defining feature of social, economic, and political life. It has many positive aspects: when urban activity is appropriately organized and governed, scale can enable specialization, reduce the per capita costs of service provision, and allow economic and social diversity to flourish. In poor countries, however, which lack all manner of the necessary administrative and technical resources, the challenges presented by large cities can be daunting indeed.

In these countries, the proportion of the population residing in large cities is approaching the levels seen in rich countries. In the year 2000, about one-third of the national populations of rich countries lived in cities of at least 1 million residents. Although poor countries have not yet reached the one-third mark, they are moving toward it. In 1975, only 9 percent of the national populations of poor countries lived in such cities. By 2000, the total had risen to 15 percent, and it is expected to rise further, to 17 percent, by 2015.

THE TRANSFORMATION OF CITIES

São Paulo, now Latin America's second largest city and a megacity by any definition, had its origins as a minor commercial center. Although the story of São Paulo has unique elements, it can stand as an example of the changes under way in cities worldwide. In 1890, when Rio de Janeiro could boast a population of more than half a million, only 65,000 people lived in São Paulo. It was improvements in agriculture—widespread coffee cultivation in the region—that ushered in São Paulo's first era of prosperity. By the early 1900s, manufacturing had gained a foothold in the city, mainly in connection with the processing and marketing of coffee. Over the next half-century, industrialization began on a large scale, a development spurred by the collapse of world prices for coffee, which caused large landowners and major entrepreneurs to scramble for ways to diversify. By 1950 São Paulo had assumed its present position as the leading manufacturing center of Brazil. Industrialization then further accelerated, encouraged by the government's strategy of import substitution and the construction of a transportation system that made the city a central node. The city's rate of population growth in this era was truly spectacular—in the 1950s, São Paulo was one of the world's fastest-growing metropolitan areas. Although its growth rates subsequently declined, the population of the greater São Paulo metropolitan area is still increasing and is expected to exceed 20 million by 2015 (United Nations, 2001).

In this history are found several of the themes with which this report is concerned—the linkages of cities to their surrounding regions, the role of world markets, government development strategies and investments, and demographic transitions. In what follows we describe more systematically the principal themes that link the chapters of this volume.

Space and Measurement

As countries urbanize and proportionately more of their citizens find homes in cities, the need grows for spatially disaggregated data on the conditions of urban life. It is difficult to imagine how cities can be governed effectively without such data. But from what sources are spatially disaggregated data now available? National censuses can provide useful measures for small spatial units, but censuses are not often examined at such disaggregated levels. Few national surveys have samples sufficiently large to permit estimation at fine-grained spatial resolutions. To fill the gap, some countries have been making use of remotely sensed data and other measures organized in geographic information systems (GIS).

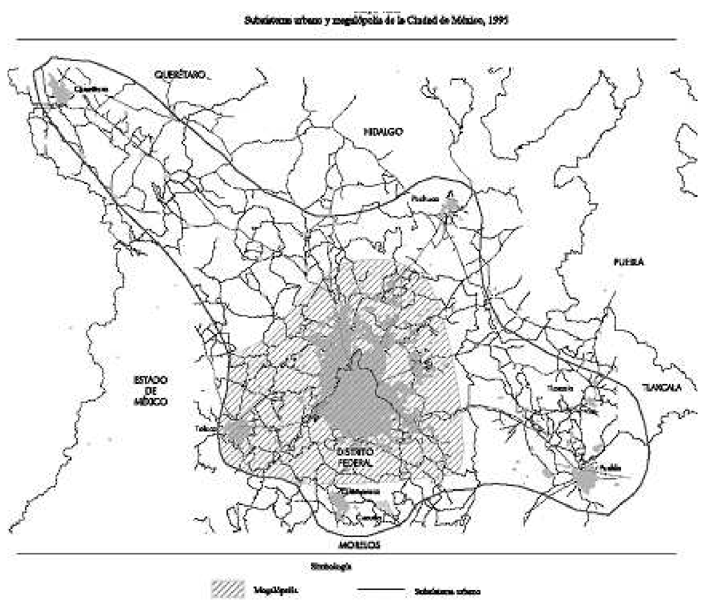

FIGURE 1-7 Mexico City Urban Subsystem, 1995. Source: Garza (2000), reprinted with permission. [NEEDS EDITING].

Such spatial detail could, in theory, provide a stronger basis for forecasts of city populations than now exists. We suspect, however, that the greatest value of spatially disaggregated data will lie in their potential to spark dialogue among urban units of government and groups of citizens. In Cape Town, South Africa, the metropolitan government is now displaying data drawn from a GIS on its Internet Web site, where residents can easily see how the provision of water and other services in their neighborhoods compares with that elsewhere in the city (for discussion, see Milne, 2001). This new technology has opened a channel through which poor groups might one day press government officials for greater equity in the provision of resources.

Spatial disaggregation may also enable progress to be made on a problem that has long bedeviled urban studies—how to define and measure the extent of a city. These measurement concerns are addressed later in the report, but to appreciate their implications, it may be useful to consider two examples here.

The extent of Mexico City is for some purposes defined to be the Federal District (*Distrito Federal*); for other purposes it takes in the Mexico City Metropolitan Area; and for still others it encompasses the large urban megalopolis centered on Mexico City but including the population of Toluca (see Figure 1-7). In the 2000 census, the population of the Federal District was estimated at 8.6 million, and that of the larger Mexico City Metropolitan Area at 17.9 million. The urban megalopo-

TABLE 1-1 Comparison of Two Estimates of Population Size and Growth in Four Extended Metropolitan Regions (EMR)[a]

	Bangkok		Jakarta		Manila		Taipei	
	1980	1990	1980	1990	1980	1990	1980	1990
Population								
Urban Agglomeration	4,723	5,901	5,985	7,650	5,955	7,968	2,217	2,711
Core	4,697	5,876	6,481	8,223	5,926	7,948	2,268	2,761
Inner Zone	1,947	2,706	5,413	7,676	2,820	4,107	3,070	4,035
Outer Zone	2,513	3,061			2,932	3,908	709	757
Whole EMR	9,157	11,643	11,894	15,899	11,678	15,963	6,047	7,553
1980–1990 Rate of Growth								
Urban Agglomeration		2.22		2.45		2.91		2.01
Core		2.23		2.38		2.93		1.96
Inner Zone		3.29		3.49		3.75		2.73
Outer Zone		1.97				2.87		0.65
Whole EMR		2.40		2.90		3.12		2.22

[a] Data on urban agglomeration from United Nations (2001); all other data from Jones (2002).

lis was estimated to contain 19.1 million residents.[3] Evidently, one's choice of city definition can double or halve the reported city population and wholly reconfigure its socioeconomic profile.

The benefits of disaggregating data in spatial dimensions can also be seen by considering four large metropolitan areas in Southeast Asia—Bangkok, Jakarta, Manila, and Taipei. Just how large are these large cities? How rapidly are they growing? Again the answers depend on how boundaries are drawn. Table 1-1 shows the urban agglomeration population estimates supplied by United Nations (2001) and compares them with more spatially refined estimates that distinguish among a city core, an inner zone of settlement, and an outer zone (from Jones, 2002). The core, inner, and outer zones together constitute an extended metropolitan region. If the extended region is taken to be the appropriate measure, the United Nations estimates of city population size are understated by half (Jones, 2002). In addition, rates of population growth differ a good deal among the core, inner, and outer zones, with the inner zones growing much more rapidly than the official urban agglomeration. If the city boundaries are drawn too tightly, important developments may be missed in the periurban areas lying just outside these boundaries (Jones, Tsay, and Bajracharya, 2000).

[3] A still more expansive conception would acknowledge the system of cities in which Mexico City participates, including Toluca, Puebla, Cuernavaca, Querétaro, and Pachuca, among which the flows of people, goods, and services are considerable. This polynuclear metropolitan region (or megalopolis) had a population of 23.2 million inhabitants in 2000, representing 24 percent of Mexico's total national population and 35 percent of its total urban population (Garza, 2000).

Socioeconomic Diversity Within Cities

Social, economic, and spatial diversity is a fact of life in cities, whether of the size of São Paulo or smaller. Almost all cities contain elite neighborhoods that are well served by schools, health facilities, and public utilities. Likewise, almost all contain desperately poor neighborhoods whose residents live in dilapidated housing and suffer from inadequate public services. In many countries in the developing world, at least one urban resident in four is thought to be living in absolute poverty (Hall and Pfeiffer, 2000). In the world's poorest countries, the conditions of life in slums and shantytowns can be extremely grim. Rural migrants to cities add another element of diversity; in many accounts they are said to be further swelling the slums.

A central theme of this report is the need to attend to the spatial aspects of diversity and inequality. As a country urbanizes, one naturally expects its cities to house a growing percentage of all poor citizens. To understand urban poverty, it is necessary to understand where within cities the poor live and to map the conditions of their neighborhoods. The analysis entails a study of spatial segregation, local social networks and social capital, and the localized features of government. Of course, not all urban inequality will be expressed spatially. As Caldeira (1999, 2000) reminds us for São Paulo, by establishing fortified enclaves the rich can quite effectively exclude the poor without putting them at any great distance. But the spatial aspects of segregation warrant close attention, not least because governments and nongovernmental organizations (NGOs) must often operate on a territorial basis.

Another aspect of urban diversity is more beneficial, or at least potentially so. Following the lead of Jacobs (1969), economists have been exploring the ways in which the diversity of economic activity in cities can stimulate innovation and productivity growth. At present, much of this literature is theoretical, but empirical studies are beginning to appear (e.g., Glaeser, Kallal, Scheinkman, and Shleifer, 1992; Moretti, 2000; Duranton and Puga, 2001; Henderson, Lee, and Lee, 2001; Henderson, 2002). These diversity effects are a form of what are termed "agglomeration economies," a phrase that refers to the productivity advantages stemming from the spatial concentration of production. The social theories mentioned earlier—concerning social learning and networks, reference groups, collective socialization, and the like—also emphasize the potential benefits of diversity, and in this respect closely parallel the economic theories. Space figures centrally in urban economic and social theory because proximity facilitates the gathering and exchange of information, lessens the costs of transport, and makes possible the exercise of some beneficial social controls.

Fertility and Reproductive Health

For developing countries there are surprisingly few careful studies of intra- and interurban differentials in fertility and reproductive health. As is well known, urban residents face many constraints and opportunities that influence their childbearing. They typically want fewer children than their rural counterparts, making the general level of demand for contraceptive services higher in urban than in rural areas. Urban couples are probably more apt to appreciate the advantages of having fewer but better-educated children, choosing to make greater investments in their children's schooling and adopting childrearing strategies that place heavier demands on parental time. What is it about urban environments that encourages such reproductive strategies?

The fertility implications of urban contexts were once prominent in demographic transition theory, a collection of ideas about demographic change that Van de Kaa (1996), Kirk (1996), and Mason (1997) have recently reappraised. Indeed, Notestein (1953) went so far as to suggest that urbanization be considered as something of a precondition for fertility decline. The historical record shows that fertility was lower in urban than in rural areas in many historical populations, although debate persists on the relationship of urbanization to fertility decline. The Princeton European Fertility Project examined marital fertility in Europe during the nineteenth and twentieth centuries, and found urban fertility to be lower than rural in almost every region and time period. Fertility was also found to be lower in larger than in smaller cities (Sharlin, 1986). A detailed study by Galloway, Hammel, and Lee (1994) for Prussia makes a strong case that here, urbanization was linked to fertility decline, in the sense that measures closely associated with urbanization (percentages of the adult population employed in banking, insurance, and communication) were found to have exerted substantial influence on the pace of fertility decline.[4]

In what ways might fertility behavior be distinctively urban? Broadly speaking, the distinctive features have to do with the benefits of new family reproductive strategies, the costs of executing these strategies, and the features of urban social life that shape the perception of benefits and costs. In considering whether to have fewer children, urban parents may well be influenced by the consequences they can observe in their own social networks and neighborhoods. If these networks and neighborhoods are homogeneous, they might not provide a sample of experience with sufficient range to demonstrate the implications of innovative reproductive decisions. In cities, however, local networks and information are likely to be more diverse than in the countryside, and this diversity can enrich the information

[4]These authors examined Prussian *kreise*—small administrative units—using fixed-effect regression methods. In addition to the banking, insurance, and communication, measures, they included the urbanization level of each *kreise*, but uncovered no additional effects of interest. Of course, there remains room for debate about the strength of the connection in historical Europe. Other empirical studies of the European experience have not found a close connection between urbanization and fertility decline (Lesthaeghe, 1977; Coale and Watkins, 1986).

available to parents and give them the necessary confidence to take innovative actions. The mechanisms are those highlighted in multilevel theories of social learning and diffusion (National Research Council, 2001). By limiting the variety of social role models and reference groups on view, the spatial segregation of the urban poor may have the effect of increasing uncertainties about new strategies, thereby prolonging dependence on traditional strategies of high fertility.

The costs of obtaining family planning, health, and related services also have an urban aspect. Certainly the private health sector is far more prominent in cities. It is itself highly diverse and heterogenous. In large cities, one finds sophisticated clinics and teaching hospitals that cater to the elite operating alongside an assortment of pharmacists and traditional healers. The physical *distance* to services is no doubt less in many cities than in rural areas, but whether urban services are of any higher *quality* once reached is highly debatable. As will be seen, the few careful comparisons that have been made between urban and rural services show the supposed urban advantage to have been much overstated, especially where the urban poor are concerned.

Many other features of social life in the city can have important reproductive health implications. In some cases, urban settings present young unmarried women with completely new behavioral options. The establishment of a garment manufacturing sector in Dhaka, for example, has created the opportunity for unmarried women to work outside the home in direct contact with men, a situation almost unimaginable a generation ago (Amin, Diamond, Haved, and Newby, 1998). This experience is likely to transform the attitudes and social confidence of young women, influencing the terms upon which they enter marriage, engage in childbearing, and make decisions about their children's schooling. Men and women in urban areas tend to marry later than their rural counterparts, and therefore appear more likely to have transitory partnerships and (perhaps) to begin sexual activity prior to marriage. Early and unprotected adolescent sex is a familiar urban concern. Cities also contain disproportionately more young migrants, many of whom have postponed marriage or engage in extramarital sex. Urban areas usually have higher levels of prostitution than rural areas and have exhibited greater prevalence of HIV/AIDS and other sexually transmitted diseases.

Health

Urban inequalities are perhaps most vividly expressed in measures of health. Since the mid-1980s, the long-assumed superiority of urban areas with respect to health and child survival has been called into question (Brockerhoff and Brennan, 1998). Debt crises and structural adjustment have led to retrenchments of many government subsidies, which had disproportionately benefited urban residents. Yet even as these funds have been cut, high rates of urban population growth have generally continued. Population growth has often taken the form of rapid, unplanned expansion of low-income settlements on the peripheries of large cities, where health and other public services are lacking. Although the urban poor may be better equipped with some services than the rural poor, many of the urban poor also lack clean and affordable water, adequate sanitation, and electricity (Hardoy, Mitlin, and Satterthwaite, 2001; Jonsson and Satterthwaite, 2000b). In the absence of such services, the spatial concentration of urban poverty hastens the circulation of communicable diseases.

Researchers have recently raised the possibility of a reemergence of the urban health penalties seen in the nineteenth century. They have stressed repeatedly the need to pay close attention to the malign influences of spatially concentrated poverty (Harpham, Lusty, and Vaughan, 1988; Tabibzadeh, Rossi-Espagnet, and Maxwell, 1989; Stephens, 1996). Where data exist, studies of urban slums and shantytowns have often revealed rates of morbidity and mortality similar to those in rural areas, and in some cases far higher. Perhaps it is not surprising, then, that neo-Malthusians have portrayed large cities as centers of poverty and social collapse (see, for example, Kennedy 1993 or Linden 1996).

Although they have not entirely neglected the topic, demographers have devoted insufficient attention to the study of intraurban differentials in health. Only a few studies with a demographic focus, such as that of Timaeus and Lush (1995), have explored in detail how negative spillovers, or "externalities," influence health conditions in spatially concentrated urban populations. No longitudinal study of which we are aware has linked health or health-seeking behaviors to measures of neighborhood social interaction, networks, and social capital. Nor have interurban health differences received adequate attention. As the conventional wisdom has it, health conditions are better for residents of large cities than for those in smaller cities, towns, and rural villages. Can this be true if an urban penalty is emerging?

Cities, Their Regions, and the International Economy

Spatially disaggregated data are needed to understand the influence of local contexts on fertility and health, and are of particular interest in zones where urban and rural activities are interpenetrating. In some geographic regions—the phenomenon has been examined most closely in Southeast Asia—rural economies and lifestyles appear to be undergoing a qualitative change, increasingly assuming characteristics that were formerly considered urban. More rural residents work outside agriculture; rural economies are increasingly diverse, mixing agriculture with cottage industries, industrial estates, and suburban development; and many rural residents are of course linked to city life through spells of migration and even through commuting. In some developing regions, one sees the emergence of megaurban areas in which it is difficult to say where a particular city begins and ends. The reconfiguration of urban space is manifested in the outward spread of urban activities, such as industry, shopping centers, suburban homes, and recreational facilities, which are penetrating what was once rural territory.

In short, the functions and roles of cities that connect them to surrounding territory are changing in ways that threaten the relevance of administrative boundaries (McGee, 1991). By shading and obscuring boundaries, such changes are causing researchers to question the value of urban/rural dichotomies, which appear increasingly simplistic. The interpenetration of activity is also forcing a reassessment of the essential nature of rurality, attracting new attention to measures of the remoteness of rural sites from the cities of their regions (Coombes and Raybould, 2001; Hugo, Champion, and Lattes, 2001).

Much as the economy of São Paulo evolved over the course of the last century, with its evolution punctuated by crises in the international markets, we can expect modern cities to be reshaped by global economic forces over the course of the century ahead. Newly globalized circuits of finance, trade, and information exchange are linking rich countries with some poor countries, and connecting some urban residents of poor countries to their counterparts elsewhere. Many poor countries are industrializing rapidly, while advanced economies are taking steps away from manufacturing into the sectors of finance, specialized services, and information technology.

These changes are forcing countries—and individual cities—to rethink their comparative advantages. To be competitive in global markets, cities are finding that they need to establish themselves as strategic nodes in international networks of exchange. Cities increasingly compete against each other, striving to present the image and provide the infrastructure demanded by international firms so as to attract greater foreign investment and generate new jobs. As they link themselves to global markets, cities are increasingly exposing their residents to the risks, as well as the benefits, of being more tightly integrated into world networks of finance, information, and production. But cities vary greatly in their exposure to such risks and benefits, and the implications depend on national contexts and levels of development.

International orientations are emerging so quickly, especially in the Asia Pacific region, that it is difficult to discern the full implications for demographic behavior. It is obvious that the benefits of globalization are being distributed in a highly uneven fashion. Very few African cities have benefited from direct foreign investment in manufacturing, whereas foreign capital has gone to a number of cities in Asia and Latin America. To the extent that some cities succeed in attracting foreign capital and to the extent that this capital is spatially concentrated (Douglass, 1997), new loci of economic activity can be expected to emerge, with some areas experiencing rapid growth while others decline. Because foreign direct investments is usually distributed unevenly across national landscapes, patterns of migration are likely to be reshaped. Wage rates and the returns to schooling for some categories of workers may also be affected. Furthermore, as large cities enter the international competition for resources, they may lay claim to quantities of physical capital that might otherwise have gone to smaller cities. The result may be a further widening of the gap between resource-poor small cities and large cities that are already better endowed with private capital and infrastructure. But all this is speculation: although powerful forces are afoot, we cannot yet say where they will lead.

Cities are a nation's gateways to international markets, and city populations can be among the first beneficiaries of the waves of technological change that stream through these markets. City residents can also find themselves among the first victims of price spikes and exchange rate crises. Engagement with these markets may well come at the price of urban economic volatility. Still, it is not a given that international economic shocks will have greater impacts on urban than rural residents. As will be discussed later, the political economy of crises can be exceedingly complex, making the spatial distribution of their effects difficult to predict (Fallon and Lucas, 2002).

Governance

A remarkable transformation is under way in developing-country cities that may be of first-order importance to policies in the areas of health and reproductive health. We refer to the phenomenon of decentralization, a process in which national governments are devolving some of their powers and revenue-raising authority to regional, state, and local units of government. The rate of change is astonishing, as is the diversity of countries in which these reforms are being undertaken.

The pace and variety of decentralization initiatives have occasioned an outpouring of research in political science, public finance, and urban administration. In these literatures it is recognized that a new cast of policy makers is being assembled, and that many on the staffs of local and regional governments will be issuing policies and monitoring implementation in areas in which they have little previous experience or expertise. As municipal and regional governments take up new responsibilities for service delivery in health and education, among other things, on what basis will they make their decisions? In decentralized systems, where will the technical expertise be located in such areas as family planning? How will information be conveyed from national ministries of health to such lower-tier governments, and how will it be returned to the ministries to guide their allocation of resources? What role can be envisioned for private national medical associations? Who will attend to the question of equity in reproductive health service delivery when services are arranged and monitored by different units of government? These are large and difficult questions, and of course they extend beyond health to touch on many roles and aspects of government.

THE COMMITTEE'S CHARGE

The transformations just reviewed suggest the need for a thorough reappraisal of what is new in the process of urbanization in developing countries, how demographic perspectives can enhance understanding of the process, and what policy revisions and initiatives are likely to be needed. At present, demographic researchers are ill positioned to shed light on these matters. Although vigorous programs of urban research are under way in other fields—including international health, political science, public finance, and, lately, economics—the lack of activity in demographic research circles has left these fields without the benefit of demographic insight. In economics, for instance, elegant theories have been fashioned to explain why large cities grow more slowly than small ones, evidently without taking lower fertility rates into account. And it can be argued that the low profile of urban demography has left important institutions without the resources they need to maintain the urban research infrastructure.

Reference was made earlier to Preston (1979) and United Nations (1980), which are the landmarks in urban demographic research. The world of research has changed in many ways since these reports were issued. Sample surveys are utilized far more today than was the case in the 1970s, and demographic theories have come to emphasize individual-level motives and behavior, paying decidedly less attention to the behavior of population aggregates. Relatively few demographers now work with census data for developing countries, and fewer still are able to use data on the populations of the individual cities of these countries. The great demographic resources of the modern era—the Demographic and Health Surveys (DHS), and the city population data in the United Nations' *Demographic Yearbook* and *World Urbanization Prospects*—are not themselves directly linkable because the necessary geographic identifiers have been expunged from the DHS public-use datasets, and the United Nations datasets have not been publicly available in computerized form. It is disconcerting to realize that as we enter the twenty-first century, the world of demographic research lacks the basic infrastructure to address the urban challenge ahead.

Recognizing the need for a major fresh inquiry, the National Research Council formed the Panel on Urban Population Dynamics. The panel's mandate was to develop greater understanding of the dynamics of urban population growth, as well as its causes and consequences, as a step toward helping governments better manage the environmental and social service problems that accompany the rapid growth of urban areas in poor countries. The panel focused on improving knowledge in six areas:

- Urban population dynamics and city growth
- Social and economic differentiation within and across cities
- Fertility and reproductive health in urban areas
- Mortality and morbidity in urban areas
- Demographic implications of a changing urban economy

- The challenge of urban governance

In each of these areas, the panel was charged with synthesizing results from existing and emerging research, as well as identifying new directions for research that are scientifically promising and have the potential to better integrate population and public policy.

STUDY SCOPE AND APPROACH

The panel's first concern was how to define the boundaries of its undertaking. Urbanization, itself the product of fundamental economic and technological change, arguably affects every aspect of social life (Davis, 1955). In reviewing developments from the onset of the industrial revolution to 1950, Bairoch (1988) maintains that there was really no aspect of the demography of cities that did not exhibit specifically urban traits. In sifting through priorities, the panel endeavored to isolate these distinctively urban features. We tried to locate the value added by an urban perspective on demographic behavior and policy. The dilemma throughout was to single out what is distinctive about urban environments without placing undue emphasis on urban/rural differences, which in some regions are beginning to fade.

To address its task, the panel reviewed existing literature and conducted a substantial amount of new data analysis. We relied heavily on a database created by linking individual DHS surveys with information on city population sizes taken from the United Nations' *Demographic Yearbook*, a publication that includes data for cities as small as 100,000 in population and all national capitals. (Chapter 4 reviews the many difficulties encountered in linking the survey and city data.) The linked DHS-United Nations database contains comparable measures for a broad range of demographic outcomes from as many as 90 surveys in more than 50 countries.

For the reasons mentioned above, the DHS surveys have not been systematically analyzed from an urban perspective. The advantages of these surveys lie in their breadth, their consistency, and the comparability of questions and methods across surveys, as well as in good (if incomplete) regional coverage. These surveys also suffer from significant disadvantages—their samples are generally too small to permit reliable description at the level of individual cities, to say nothing of analysis of socioeconomic variation within individual cities. Only through application of multivariate methods can one get a glimpse of this sort of variation.

In addressing its charge, the panel sought to confine its efforts to areas of the most pressing need. For example, we did not exhaustively review environmental problems in cities because recent and highly capable summaries are available elsewhere (see Hardoy, Mitlin, and Satterthwaite, 2001). Likewise, issues of housing are thoroughly examined in United Nations Centre for Human Settlements UNCHS (1996, 2001) and Malpezzi (1999). To make best use of its limited resources, the panel focused on the critical need for more detailed demographic analysis of intra- and interurban differentials in low- and middle-income countries. Although we could not conduct analyses at the level of neighborhoods, we developed a measure of relative urban poverty to explore the equity dimension of intracity variation. To determine the extent of intercity differentials, we analyzed the DHS-United Nations data by one measure of urban hierarchy—city population size—recognizing the urgent need for measures of governance and other city-specific characteristics.

ORGANIZATION OF THE REPORT

This remainder of this volume reports the results of the panel's work. We first develop a theoretical rationale for studying urban contexts, giving an overview of recent thought on the importance of local social and spatial environments (Chapter 2). The report proceeds to sketch the regional context in which change occurs and reviews the basic demography of urbanization and city growth (Chapters 3 and 4, respectively). Chapter 5 examines the social and economic diversity in urban conditions of life. Despite the material advantages offered by urban life, it is evident that many city residents are unable to avail themselves of these advantages—they lack adequate food, water, and shelter. Chapter 5 documents several dimensions of urban poverty and presents new findings on the extent of poverty and inequality by city size and by region. Chapters 6 and 7 then consider fertility and health, raising the question of whether there exist distinctively urban demographic regimes with distinctive implications for service delivery.

The demographic changes examined in these chapters are rooted in the urban economy, which generates resources and establishes some of the constraints and costs that affect demographic behavior, and in urban governance, which influences how those resources are distributed and conflicting demands resolved. A defining characteristic of cities and towns at the end of the twentieth century is their internal diversity; the management and mediation of difference is a central challenge in urban governance. Chapter 8 addresses the urban economy and its labor markets from a demographic perspective, and Chapter 9 examines the challenge of urban governance. Finally, Chapter 10 takes stock of what has been learned and offers some thoughts about the path forward.

4

Urban Population Dynamics: Models, Measures, and Forecasts

This chapter brings analytic tools to bear on the urban levels and trends described in the previous chapter. Our treatment of the issues is narrowly demographic, particularly at the outset, focusing on what might be termed the proximate causes of urban growth. Rural-to-urban migration is one of these proximate causes; of equal importance are the rates of urban and rural natural increase and the relative sizes of the urban and rural populations. Territorial reclassification must also be considered. In placing emphasis on this small set of demographic variables, we are mindful of their uncertain causal status. Rates of migration and natural increase are at once the cause and the consequence of larger social and economic forces. Even reclassification touches on economic, fiscal, and political concerns. In the chapters to follow, the socioeconomic content of the demographic variables will be explored in depth.

This chapter begins by describing the features of urban population dynamics that can be seen even with the simplest of analytic mechanisms. A model of urban and rural population growth is developed to show how an initial urban and rural population distribution, when subjected to fixed demographic rates, can produce a variety of demographic outcomes: annual increases in the total urban population, the share of those increases due to migration, rates of urban growth, levels of urbanization, and their rates of change. Using projections, we highlight several regularities that can help in understanding the empirical record.

The chapter then draws upon the Demographic and Health Surveys (DHS) for evidence on the main contributors to urban population growth—fertility, mortality, and migration—which act together to determine urban age composition. As will be seen, urban populations are much more concentrated in the productive and reproductive ages than are rural populations. Where age is concerned, urban populations are configured for higher potential economic productivity. With respect to the reproductive ages, however, these populations are configured in a way that enhances the potential for high fertility—although later marriage and greater contraceptive use generally keep this potential from being realized—and which raises the profile of reproductive health concerns and other diseases that affect young adults.

To shed light on the contribution of migration, we analyze the DHS data on recent moves, linking these data to measures of city size. This analysis exposes several weaknesses in the basic infrastructure of urban population research. First, because the DHS surveys are generally restricted to women of reproductive age, they reveal little about the situations of men and other migrants. Second, the geographic identifiers supplied with DHS datasets are so coarse that it is difficult to determine even the name of the city in which a survey respondent lives, unless that city happens to be the nation's capital. Third, the population of the city in question is available from United Nations sources if the city is a capital, but otherwise can be determined only for cities above 100,000 in size. Only "raw" estimates of city size, taken from the United Nations *Demographic Yearbooks*, are available for cities in the range of 100,000 to 750,000 population. The critical expertise of the United Nations Population Division, as expressed in its influential series *World Urbanization Prospects*, is focused only upon cities larger than this. In short, a rather mundane analysis task brings alarming research gaps into view.

The next section turns a critical eye on the two United Nations databases used in urban population research—the annual *Demographic Yearbooks* and the biennial *World Urbanization Prospects*. In this field, *World Urbanization Prospects* has assumed the role of a standard reference work; it is the authoritative, comprehensive source of urban population estimates and projections upon which most researchers and institutions rely. Because it assembles data over time, *World Urbanization Prospects* provides an especially rich set of materials on urban growth, with detailed time series for all of the world's large cities. But the occasional user of these data is apt to be misled by their attractive packaging, and may need to be reminded of the weaknesses and heterogeneities of the population series that are available to the United Nations and the difficulties it faces in adequately estimating and projecting urban populations.

The chapter then examines the record of urban population projections, an issue of fundamental importance that has attracted curiously little attention apart from the efforts of the United Nations and Brockerhoff (1999). As will be seen, the history of city size projections does not inspire confidence. The urban record of success is so thin that a recent authoritative assessment of national-level demographic projections (National Research Council, 2000) does not even consider the possibility of projecting the national populations of developing countries by conducting separate rural and urban projections. Evidently we are still some distance from being able to apply modern statistical techniques to urban population time series.

Having reviewed the aggregate databases, we turn to new developments in the area of spatially disaggregated geographic information systems (GIS). As a locus of several new technologies, GIS holds promise for restoring a spatial dimension to the (typically) aspatial data gathered through demographic surveys and related sources. There is at least the possibility that data collected according to GIS principles might strengthen the foundation for urban population projection. GIS technology is perhaps even more promising as a political device, that is, as a mechanism for fostering dialogue among the units of government that collect data, those that supply services, and the urban residents who wish to make use of such services. We document several of the encouraging efforts now under way. The chapter ends by presenting conclusions and recommendations, with emphasis on the infrastructure that will be needed to support urban research.

THE SIMPLE ANALYTICS

Five demographic indicators are required to sketch the main developments in an urban transition: the absolute annual increase in the urban population, the share of that increase attributable to migration, the urban growth rate, the level of urbanization, and the rate of urbanization. In the model presented below, all five indicators result from the repeated application of constant demographic rates to an initial population distribution.[1]

Key Concepts and Notation

To highlight the essentials, we abstract from the problem of reclassification and focus on a hypothetical country divided into rural and urban sectors that are fixed in geographical terms. Age dependence in fertility, mortality, and migration rates is initially ignored. The results thus obtained would generally continue to hold in an age-differentiated simulation (Rogers, 1995).

In this stylized representation, national population size in year t is denoted by P_t, the size of the urban population by U_t, and that of the rural population by R_t. Given the sizes of the rural and urban populations in a base year—R_0 and U_0 respectively—the totals U_t and R_t evolve in a manner determined by four demographic rates, each of which is expressed on a per annum basis:

n_u the rate of natural increase in the urban population, that is, the difference between urban birth and death rates;

n_r the rate of natural increase in the rural population;

$m_{r,u}$ the migration rate from rural to urban areas, expressed per rural resident; and

[1]For more detail on the equations and their derivation, please see Appendix B and United Nations (1974, 1998b).

$m_{u,r}$ the migration rate from urban to rural areas, expressed per urban resident.

As discussed in Appendix B, which presents more of the mathematical detail, from these simple ingredients the model can generate time paths for the five urban outcome measures mentioned above.

To proceed, we must define some terms. The *urban population increment* is the net addition to the urban population from year $t-1$ to year t, or

$$\Delta U_t = U_t - U_{t-1}.$$

We make use of an equivalent representation,

$$\Delta U_t = U_{t-1} \cdot (n_u - m_{u,r}) + R_{t-1} \cdot m_{r,u}, \tag{4.1}$$

in which the roles of the demographic rates and the population distribution are more clearly evident.[2] The *urban growth rate* is another measure of change in the total urban population over a single year; it is expressed not in absolute terms, but as a fraction of the initial urban population:

$$UGR_t = \frac{U_t - U_{t-1}}{U_{t-1}} = \frac{\Delta U_t}{U_{t-1}}.$$

This, too, can be given a useful alternative form:

$$UGR_t = n_u - m_{u,r} + \frac{R_{t-1}}{U_{t-1}} \cdot m_{r,u}. \tag{4.2}$$

The *migrant share* of urban growth, denoted MS_t, is the proportion of net urban growth that is due to migration from rural areas. The share can be written as

$$MS_t = \left(1 + \frac{U_{t-1}}{R_{t-1}} \cdot \frac{n_u - m_{u,r}}{m_{r,u}}\right)^{-1}. \tag{4.3}$$

As is evident in equations (4.2) and (4.3), the urban growth rate and the share of growth due to migration are determined by several constants—the rate of urban natural increase and rates of migration to and from urban areas—as well as a time-varying factor, U_{t-1}/R_{t-1}, the urban/rural population balance.

Because urban population increments, growth rates, and migrant shares are closely related, they are often discussed as a group. So, too, are the following measures, which concisely summarize levels and trends. The *level of urbanization* is simply the urban proportion (or percentage),

$$P_{u,t} = \frac{U_t}{P_t},$$

[2] A counterpart expression for the rural increment would include the term $n_r - m_{r,u}$. This term is generally positive. See, for instance, Oucho and Gould (1993) on net rural increase in sub-Saharan Africa.

and the *rate of urbanization* is the rate of growth in this proportion over time. It can be written as

$$\frac{\Delta P_{u,t}}{P_{u,t-1}} = \frac{U_t - U_{t-1}}{U_{t-1}} - \frac{P_t - P_{t-1}}{P_{t-1}},$$

which is the difference between the urban and national population growth rates.

Even a model as simple as this can help clarify otherwise puzzling and counterintuitive aspects of urban transitions. We use it to address several questions. First, if urban growth results from both migration and natural increase, which of these accounts for the greater share of growth? Should the migration share be regarded as a constant or as a time trend? How are urban growth rates linked to the rate of urbanization? Do national population growth rates translate directly into rates of urban growth (according to Preston [1979], a one-point decline in national growth reduces urban growth by the same amount), or can we anticipate a systematic change in the relationship between the rates as urbanization proceeds?

City Growth: Migration or Natural Increase?

Much of the concern surrounding urban growth has to do with the annual additions to their populations that cities must somehow absorb, and with the contribution to growth that is made by rural-to-urban migrants. As discussed earlier, demographers often find themselves emphasizing the role of urban natural increase (see United Nations, 1980; Chen, Valente, and Zlotnik, 1998), if only to counter the impression that migration must be the dominant factor. To disentangle migration from natural increase is more difficult than might be supposed; an analytic model is helpful in showing just where the problems lie.

As Rogers (1982) explains, to understand whether migration or natural increase is the dominant source of growth, one must first decide on terms. Much depends on whether one conceives of the problem in terms of *flows* or *stocks*. Flows are, by definition, short-term measures. Their empirical counterparts are found in the decompositions of intercensal urban growth that separate urban natural increase, on the one hand, from the sum of net migration and reclassification, on the other. According to such flow estimates—as discussed in Chapter 3—the share of migration in urban growth is in the neighborhood of 40 percent in most developing countries. Stocks, by contrast, are cumulative measures. If the migrant contribution is to be assessed in terms of stocks, the estimate should take into account not only the migrants themselves, but also their descendants. To understand the cumulative contribution of migration to urban growth, one would compare the size of an urban population with what it would have been in the absence of rural-to-urban migration (i.e., with $m_{r,u} = 0$) or with lower rates of migration than occurred. Of course, if migration is permitted cities will grow larger than they would otherwise, but the size of the difference is of interest.[3]

Because flows depend on stocks—for example, the flow of rural-to-urban migrants is $m_{r,u} \cdot R_{t-1}$, with R_{t-1} being the stock of rural population—one cannot cleanly separate them. For analytic purposes, it is preferable to distinguish *direct effects* from *feedback effects* and to focus attention on the implications of changes in the fundamental rates. Consider, then, the consequences of a change in n_u, the urban rate of natural increase. Returning to the migration share equation (4.3), we see that at time t, the direct effect of an increase in n_u is to reduce the share of migration in urban growth; that is as expected. Likewise, the direct effect of an increase in the rural-to-urban migration rate, $m_{r,u}$, is to increase the migration share, again as would be expected. In either case, the amount of change produced in the migration share depends on several factors, one of which is the urban/rural balance, U_{t-1}/R_{t-1}.

Once rates have changed, feedback effects come into play, and these effects exert further influence on the migrant share. Higher rates of urban natural increase, n_u, tip the population balance toward urban areas, causing U_{t-1}/R_{t-1} to rise with time. The more rapid population shift toward cities diminishes the relative size of the rural sector, and this, in turn, diminishes the relative contribution of rural migrants to city growth. The direct and feedback effects of n_u work in the same direction; through both routes, a higher rate of urban natural increase reduces the migrant share of urban growth.

Applying the same kind of analysis to the rural-to-urban migration rate, we find that an increase in $m_{r,u}$ generates feedbacks that work against the direct effect. As explained above, the direct effect is to increase the share of urban growth due to migrants; but with faster rural outmigration, the population balance begins to shift toward urban areas. Over time, this feedback acts to reduce the migrant share.

The opposition of forces can be seen in Figure 4-1, which shows the share of urban growth due to migration for values of $m_{r,u}$ ranging from 0.5 percent per annum to 3.0 percent.[4] Higher migration rates are associated initially, and through most of the projection period, with larger migrant shares. As feedback effects

[3]The flows-stocks perspective has often proven helpful; for instance, it was used by the National Research Council (1997) to analyze the full contribution of international migration to the population of the United States.

[4]All projections begin with an urban proportion of $P_{u,0} = .15$. For the other parameters of the projections, we have been guided by Livi Bacci (1997) for natural increase and by the United Nations (1980) and Chen, Valente, and Zlotnik (1998) for migration. Chen, Valente, and Zlotnik (1998) present regional estimates of $m_{r,u}$ that range from 0.5 percent (Africa in the 1980s) to 2.65 percent (Latin America in the 1970s). Earlier, the United Nations (1980) provided estimates ranging from 0.05 percent for Nepal in the 1960s to 3.7 percent for Venezuela in the 1950s. We restrict $m_{r,u}$ to lie between 0.5 and 3 percent. The reverse urban-to-rural migration rate, $m_{u,r}$, is set to 0.25 percent throughout.

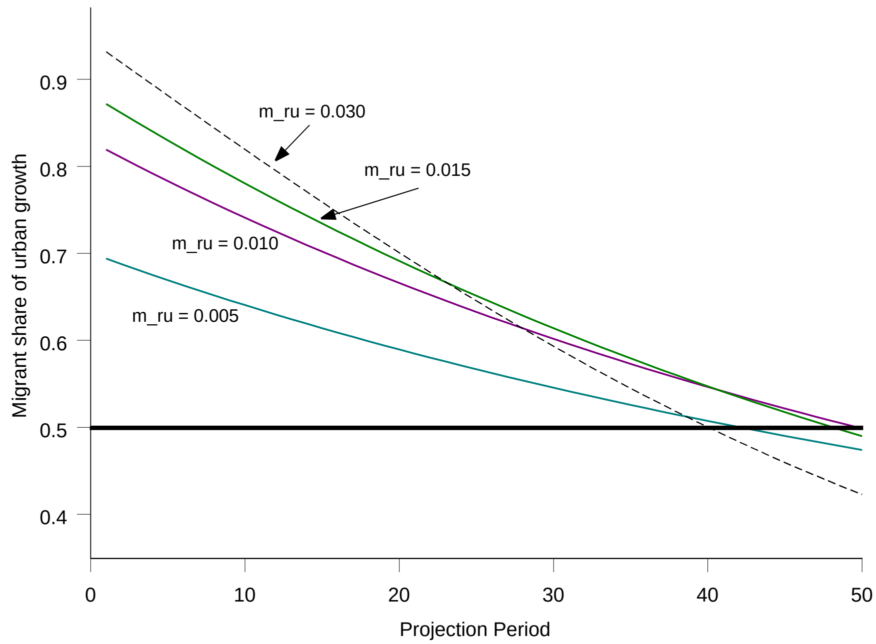

FIGURE 4-1 Declining migrant shares of urban growth

exert their influence, however, all these curves decline and show a tendency to converge.

The point at which the migrant share of growth reaches one-half has been termed the *cross-over point* by Keyfitz and Ledent (Rogers 1982, citing their papers). As can be seen in the curve with $m_{r,u} = 0.03$, depicted with a dashed line in Figure 4-1, very high rates of rural-to-urban migration can hasten the arrival of the cross-over and produce lower migrant shares thereafter than would be seen in a regime of lower migration rates. The apparent paradox is an expression of a feedback effect.

Urban Growth and the Rate of Urbanization

The rate of urban growth obeys a similar logic. Urban natural increase, n_u, has a positive direct effect on the rate of urban growth (see equation 4.2). The direct effect of the rural-to-urban migration rate, $m_{r,u}$, is also positive, but its strength varies with the urban/rural population balance. When $m_{r,u}$ rises, the rural sector begins to decline in relative importance, and the urban growth rate then falls. Over the long term, the urban growth rate will approach

$$\overline{UGR} = n_u - m_{u,r} + \frac{m_{r,u}}{b},$$

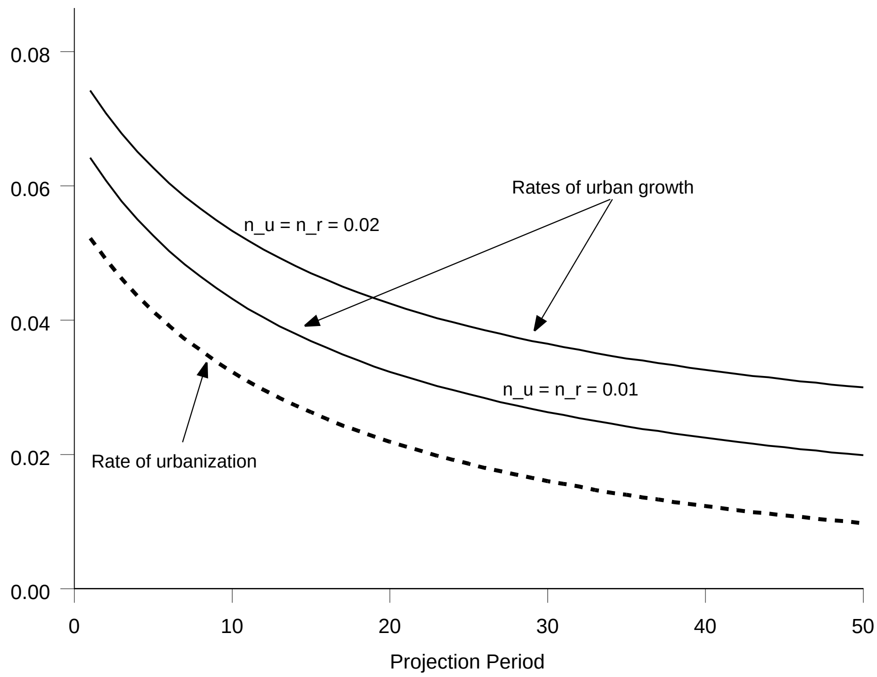

FIGURE 4-2 Rates of urban growth and urbanization

where b is the long-term urban/rural balance, that is, the value taken by U_t/R_t in the limit.[5]

As was shown earlier, high rates of natural increase have been a defining feature of the demographic regimes of many developing countries and distinguish their urban transitions from the Western historical experience. As just noted, a higher n_u produces more rapid urban growth; working indirectly through migration, a higher rural rate n_r also produces more rapid urban growth. Although they have powerful effects on the urban growth rate, n_u and n_r need not have any particular implications for the *rate of urbanization*. As can be seen in Appendix equation (B.6), if n_u and n_r happen to be equal, they can be scaled up or down without having any direct effect on the rate of urbanization. The projections depicted in Figure 4-2 illustrate the point. In this figure, the rates of natural increase are set to 2 percent (the upper curve) and 1 percent (the middle curve). These two curves exhibit high initial urban growth rates that are followed by growth rate declines. Meanwhile, the rate of urbanization—shown with the dashed line—remains wholly unaffected, adhering to the same trajectory whether the natural rates of increase are high or low.

[5]Of course, the rates must be such that the limit exists; see Appendix B.

If equality in urban and rural rates of natural increase appears to be a special case, consider United Nations (1980:Tables 10–12). The data presented here show that in the 1950s and 1960s, a number of developing countries had values of n_u and $n_r$that were roughly equal. In the 27 developing countries examined by the United Nations, fertility and mortality rates were lower in urban than in rural areas, but the differences between fertility and mortality were about the same in urban and rural areas.[6] When n_u is approximately equal to n_r, as in these cases, the rate of urbanization is all but entirely attributable to migration. If $n_u \neq n_r$ or if these rates change by different amounts, their effects will be expressed in the rate of urbanization, producing a different path of urbanization than that which appears in Figure 4-2. For example, countries with slower rates of urban than rural natural increase ($n_u < n_r$) will tend to have slower rates of urbanization, other things being equal.

Urban and National Population Growth

As noted in Appendix equation (B.5), national population growth rates can be written as a weighted average of the urban and rural rates of natural increase, with the weights being the proportions of urban and rural residents in the national total. In the fixed-rate analytic model—compare equations (B.2) and (B.5)—it is clear that the national and urban growth rates depend on n_u and n_r in much the same way, and this implies that national and urban growth will tend to be positively correlated.[7]

Figure 4-3 charts the relationship between the two rates of growth over the course of one projection.[8] The two rates are positively associated, as expected, although they are linked in a nonlinear fashion. At the outset of the projection (see the upper right portion of the figure), both the urban and national growth rates are high; as the country urbanizes, both rates fall. With increasing urbanization, the slope of the relationship between urban and national growth rates flattens.

One might well expect to see the main features of Figure 4-3 reproduced in empirical urban growth regressions. Indeed, demographers have uncovered strong regularities in the association between urban and national rates of growth. In one analysis using a sample of cities in both developing and developed countries (Preston, 1979; United Nations, 1980), a regression of urban growth rates on national

[6]The United Nations tables show that even in this era, rural rates of natural increase were often slightly higher than urban rates. It is not clear whether the generalization $n_u \approx n_r$ still stands. An inspection of recent data (United Nations, 2000:Tables 9 and 18) shows that in the 10 countries with data available for the 1990s (most of these 10 being in West Asia), the urban rate of natural increase falls well short of the rural rate. However, according to Visaria (1997), rates of natural increase in India are about the same in urban and rural areas.

[7]Of course, if $n_u = n_r$, the national growth rate would be invariant with the distribution of population between urban and rural areas. Positive correlations between urban and national rates of growth could still arise, but only in cross-national data.

[8]In this projection, $n_u = 0.01$, $n_r = 0.02$, and $m_{r,u} = 0.01$. Recall that $m_{u,r} = 0.0025$ in this and all other projections.

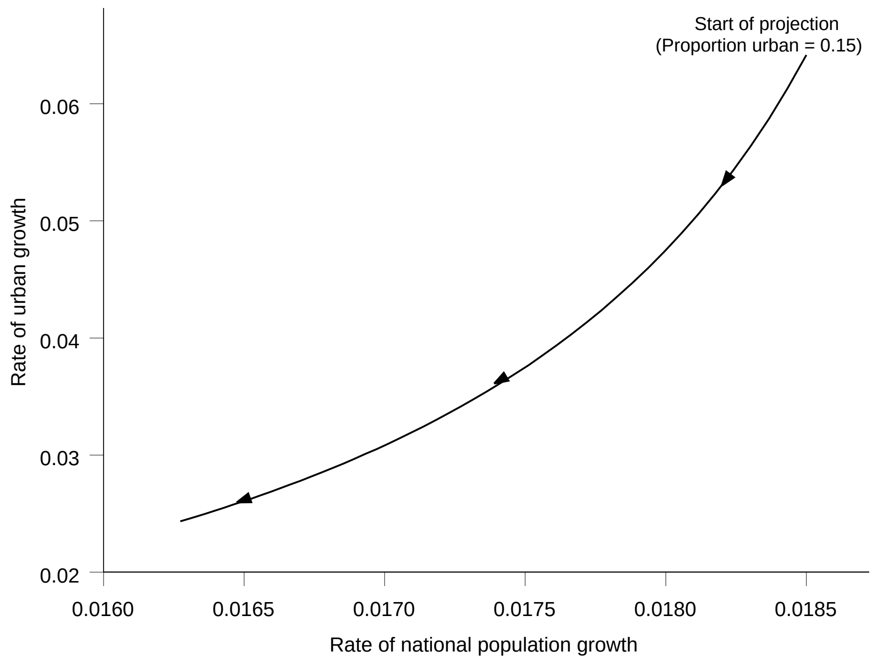

FIGURE 4-3 Rates of urban and national population growth, given $n_u < n_r$

growth rates yielded a coefficient for national growth that was very close to unity. The relationship was revisited by Brockerhoff (1999) with a sample limited to developing countries; his regression yielded a coefficient estimate of about 0.8. Such differences in regression coefficients are to be expected when the analysis samples differ in the average level of urbanization.[9] In this case, however, the countries in the Brockerhoff sample are less urbanized on average, leaving it doubtful that the lower coefficient estimate found by Brockerhoff is due to the changing curvature of Figure 4-3.

Note that when $n_u < n_r$, a higher rural-to-urban migration rate $m_{r,u}$ reduces the national population growth rate because it speeds the transfer of population to the urban sector where the natural rate of growth is lower. At the same time, a higher $m_{r,u}$ increases the rate of urban growth. Hence, changes in the migration rate would cause urban and national population growth rates to be *negatively* correlated, other things being held equal.

[9]In reaching these conclusions, both Preston (1979) and Brockerhoff (1999) use multivariate regression and include covariates other than national growth rates in their specifications. The initial level of urbanization, used in both analyses, proves to have a negative, strongly significant influence on the rate of urban growth. The link to the level of urbanization is implicit in Figure 4-3.

Migration and Urban Age Structure

As is well known, rural-to-urban migration rates are strongly influenced by age, and this age dependence is reflected in urban and rural age distributions. As will be documented shortly using DHS data, in urban populations proportionately more residents are found in the prime working and reproductive ages, and proportionately fewer residents are children. Such differences are attributable to lower urban fertility and the age selectivity of rural-to-urban migration. But the relationship between migration and urban age composition is more complicated than it might at first appear. In supplying cities with more young adults, rural-to-urban migration also tends to increase the urban crude birth rate, and higher fertility, in turn, partly offsets the direct effects of migration on age structure.

To further clarify the role of migration, we constructed an age-differentiated demographic simulation that makes use of model schedules of fertility, mortality, marriage, and migration. The approach is inspired by Rogers (1986) and draws upon demographic schedules developed by Rogers (1995), Coale and Trussell (1974), and Ewbank, de León, and Stoto (1983). Consider two hypothetical populations, one rural and the other urban, between which there is no migration. Both populations share the same (high) levels of mortality ($e_0 = 45$) and fertility ($TFR = 6.0$), and we assume that they have each attained stable age distributions. We then open the border between the two populations and allow for migration in both directions. We assume, however, that the rural-to-urban migration rates are higher.[10]

Figure 4-4 depicts the consequences. The first wave of rural-to-urban migrants increases the proportion of urban residents of reproductive age (shown on the right scale of the figure). As these new urban residents marry and bear children, the urban crude birth rate increases from its initial stable population value. Meanwhile the rural crude birth rate declines from its stable value; although there is migration in both directions, the schedules we have adopted ensure a net transfer of young adults to urban areas. Once the urban crude birth rates have been driven higher, the share of those aged 15–49 in the urban population begins to fall as the proportion of children rises (the latter proportion is not shown).

The inflation of urban crude birth rates is temporary; it subsides as the first cohorts of rural migrants work their way through the urban age distribution, and the urban and rural birth rates then approach each other. The urban crude birth rate remains higher than the rural rate, however, as a result of the continuing influence of rural-to-urban migration. All this occurs even though the rural and urban rates of fertility, marriage, and mortality are assumed to be equal at each age. The effects displayed in the figure are purely compositional. Even so, they serve as a reminder of one important role of rural-to-urban migration: it increases the share of the urban population in the reproductive ages.

[10]Initially, the urban share of the combined population is 15 percent; by the end of the projection, this share has risen to about 56 percent.

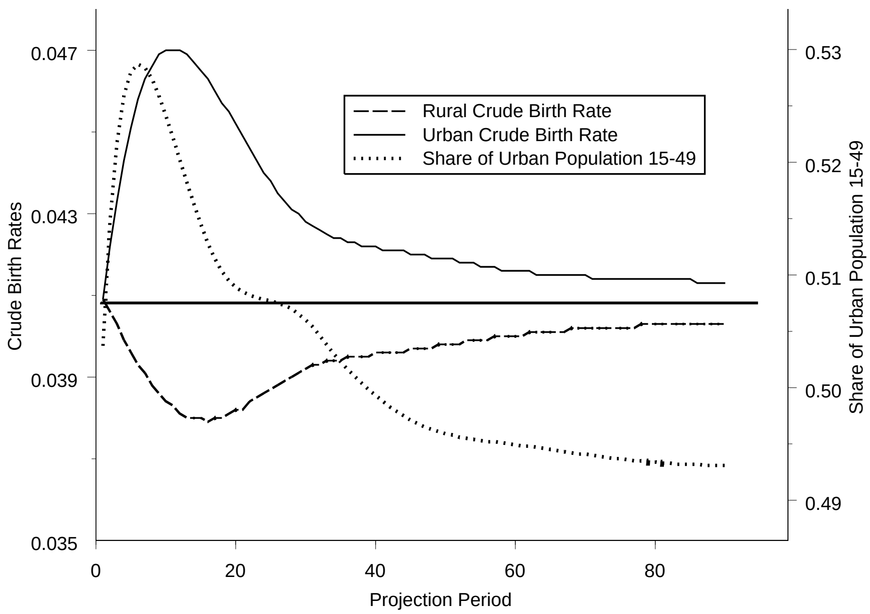

FIGURE 4-4 Changes in rural and urban crude birth rates and age structure with migration. Results from projections using model schedules.

The analytic models we have been using are based on assumptions of fixed demographic rates—whether these are aggregate rates of natural increase and migration in the simpler projection model, or the underlying schedules of the model with age structure. If such models are to help in sorting out the empirical record, care must be taken to separate the dynamic implications of fixed rates from the implications of changing rates. To appreciate this point, consider again the urban growth rate and the migrant share of that growth. In a fixed-rate regime, we would expect to see a decline in the urban growth rate with time as rural-to-urban migration diminishes in relative importance (equation 4.2). The migrant share of growth would also be expected to decline with time (equation 4.3). But when the demographic rates are changing, the forces that propel the trends may need to be reinterpreted. For example, the urban rate of natural increase, n_u, may fall due to reductions in urban fertility. If n_u falls, urban growth rates will also tend to fall, but the share of urban growth due to migration will tend to rise—an outcome not predicted by a fixed-rate model.

On balance, then, it is sensible to view empirical trends as resulting from a combination of fixed-rate dynamics and the dynamics stemming from demographic transitions. Without additional evidence, empirical time series provide ambiguous testimony as to the relative importance of these dynamic forces. The

BOX 4.1 Declining Growth Rates Experienced by Brazil's Six Largest Cities, in 1970–1996

São Paulo's average annual growth rate (UGR) fell from 4.36 percent in the 1970s to 1.42 percent during 1991–96. Annual growth in Rio de Janeiro also fell, from 2.41 to 0.75 percent (Lam and Dunn, 2001). Likewise, growth slowed in the next four of Brazil's largest cities. For all these cities combined—they contained nearly 40 million persons in 1996—the growth rate fell from 3.59 percent in the 1970s to to 1.29 percent by 1991–96, leaving the UGR at slightly more than one-third of its 1970s level. Reductions in fertility rates are believed to have played an important part in the UGR decline. Meanwhile, the city populations continued to grow in absolute terms even as their rates of growth waned. The annual population increments (ΔU_t) to these six large cities were on the order of 1 million persons in the 1970s, fell to about 600,000 persons in the 1980s, and fell further to some 500,000 persons in the 1990s.

	Total population (thousands)				Average annual growth rate		
City	1970	1980	1991	1996	1970–80	1980–91	1991–96
São Paulo	8,137	12,589	15,445	16,582	4.36	1.86	1.42
Rio de Janeiro	7,082	9,014	9,815	10,192	2.41	0.77	0.75
Belo Horizonte	1,606	2,540	3,436	3,803	4.59	2.75	2.03
Porto Alegre	1,531	2,231	3,028	3,245	3.77	2.78	1.39
Recife	1,793	2,347	2,920	3,088	2.69	1.99	1.12
Salvador	1,149	1,767	2,497	2,709	4.30	3.14	1.63
TOTAL	21,298	30,488	37,140	39,619	3.59	1.79	1.29

SOURCE: Lam and Dunn (2001)

ambiguity is evident in the empirical record of urban Brazil, described in Box 4.1. Here, over the course of three decades, one can see clear evidence of decline in the growth rates of the country's six largest cities. However, that decline can be variously interpreted: as the workings of a fixed-rate model, as the result of declines over time in urban fertility and rates of natural increase, or as a combination of both.

FERTILITY, MORTALITY, MIGRATION, AND URBAN AGE STRUCTURE

This section brings data from the DHS to bear on the demographic concepts outlined in the previous section. We preface the discussion with a note on how migrant shares of growth are usually calculated from aggregate census data. This aggregate procedure, which offers estimates of a component of urban growth that cannot be reliably obtained from sample surveys of the size usually fielded, has both weaknesses and strengths. We then present estimates from the DHS for recent migration, examine the place of urban-origin migrants among all migrants, and conduct an analysis of migration by the size of the destination city. Finally, estimates of urban and rural fertility and mortality are presented, and urban age structures are illustrated.

Migrant Shares as Calculated from Censuses

Methodological problems bedevil all attempts to determine the relative contributions of migration, natural increase, and reclassification to urban growth. When data are lacking on migration as such, the contribution migrants make to urban growth can be estimated only imprecisely. The usual "residual" method, which generated the findings of Chen, Valente, and Zlotnik (1998) described in the previous chapter, begins with a comparison of population counts in two censuses. The urban population of the second census is projected from that of the first making an allowance for intercensal mortality.[11] When the projected urban population is subtracted from the total counted in the second census, what remains is an estimate of the sum of net migration and territorial reclassification. Errors in the census data and in the assumptions are also embedded in this residual. Although errors are always a concern, the residual method gives at least a rough estimate of the relative contributions of natural increase, on the one hand, and migration

[11]Suppose that the two censuses are exactly a decade apart. Let $N_u^1(a)$ be the number of persons of age a recorded in the first census. Let $\mu_u(a)$ be the urban mortality hazard function. If all urban residents found in the first census remain urban, a decade later one would expect to find

$$P_u^2(a+10) = N_u^1(a)\exp\left(-\int_a^{a+10}\mu_u(x)dx\right)$$

survivors in urban areas. Let $N_u^2(a+10)$ represent the number of urbanites aged $a+10$ who were actually recorded in the second census. The difference $D_u(a+10) = N_u^2(a+10) - P_u^2(a+10)$ is then an estimate of the sum of net migration and reclassification for this age group. Net migration is the difference between the number of rural migrants, $M_{r,u}(a+10)$, who arrived between the censuses (and survived to the date of the second census) and the number of formerly urban residents, $M_{u,r}(a+10)$, who left. Any remainder in $D_u(a+10)$ is attributable to net reclassification. Summing $D_u(a+10)$ over all $a > 0$ yields a total for net migration and reclassification in the population above 10 years of age at the time of the second census.

There remains a need to calculate something akin to $D_u(a)$ for the population aged 10 and under, and assumptions about urban fertility must be invoked to do so. United Nations (1980) explains the method, which relies on urban child-woman ratios. The key assumption is that the same fertility schedule applies to all women in urban areas, whether they are intercensal migrants or not. As will be seen in Chapter 6, there is some empirical justification for the assumption that, relatively soon upon arrival, rural-to-urban migrants exhibit about the same age-specific fertility rates as urban natives. But counterexamples doubtless exist, and the literature has not yet settled into consensus.

Another complication is that it is rather rare to have estimates of $\mu_u(a)$ that are actually derived from urban data. Generally the urban mortality curve must be calculated from national data that include the rural population, and assumptions about relative risks are required to extract an urban estimate. As explained in Chen, Valente, and Zlotnik (1998), the United Nations assumes that the rural mortality hazard function $\mu_r(a) = 1.25 \cdot \mu_u(a)$, that is, the rural hazard rate is assumed to be 25 percent higher than the urban at each age a. Taken together with estimates of urbanization, this proportionality assumption yields estimates of the urban mortality hazard. The United Nations (1980) describes some experiments in which rural mortality was assumed to be as much as 50 percent higher than urban. These experiments revealed that the decomposition of urban growth into natural increase and net migration is robust to variations in assumptions about the relative risks of mortality.

coupled with reclassification, on the other.[12] Migration data can be gathered by other means, such as through sample surveys, but it is difficult to imagine how survey interviewers could collect any meaningful information about reclassification from their respondents. In this limited sense, the aggregate census-based method delivers information that surveys cannot.

Migrants as Recorded in the Demographic and Health Surveys

Another way to gauge the contribution of migrants is to examine their numbers in relation to the urban population total, rather than in relation to urban growth.[13] Data from the DHS provide a measure akin to this, although it is restricted to an urban subpopulation. Using these surveys, one can examine the migration status of urban women of reproductive age. That men and other women are excluded is unfortunate, but the DHS surveys do not usually gather migration data for these groups.[14] Some DHS surveys collect month-by-month retrospective migration histories that cover the 5 years before the survey and occasionally go back further in time. Other surveys simply ask the woman how long she has resided in her current community and record the responses in terms of years of residence.[15] In what follows, we define recent migrants to be those women who moved to their current (urban) residence in the 5 years before the DHS survey.

Among urban women of reproductive age, recent migrants are a numerically important group. As Table 4-1 shows, nearly one urban woman in four in the age range 15–49 is a recent migrant.[16] The figure ranges from a low of 15.6 percent in the Latin American surveys to a high of 29.4 percent in the surveys from

[12]Scattered, order-of-magnitude estimates suggest that of the migration and reclassification total, about one-quarter is attributable to reclassification; see United Nations (1980:25) and Visaria (1997:Table 13.5).

[13]In the analytic model developed above, this measure could be expressed as $(R_{t-1}/U_{t-1}) \cdot m_{r,u}$.

[14]Census data from Mexico in 1990 showed that, compared with male migrants, female migrants were more heavily concentrated in the age groups 15–19 and 20–24. Migrants were slightly more likely to be married or in a consensual union than nonmigrants (De la Paz López, Izazola, and de León, 1993). The concentration of female migrants in the 15–24 age range is generally greater than is the case for males and is greatest for migrants moving to metropolitan areas rather than to urban areas in general (Hugo, 1993). See Recchini de Lattes and Mychaszula (1993), Findley and Diallo (1993), and Alvi and Wong (1993) for studies of the age and marital status of female migrants compared with nonmigrants.

[15]According to Demographic and Health Surveys (2001), the term “community” refers to the village, town, or city of residence.

[16]Here and throughout the volume, we report summaries of estimates derived from analyses of individual DHS surveys. The statistical models have been estimated with an allowance for unmeasured effects specific to sampling clusters, so that all discussions of statistical significance refer to robust standard errors. Sampling weights were not used at the estimation stage, but were applied to convert the estimates to representative summary values for each survey. In assembling the tables, we then average such survey-specific values. Survey results from countries that fielded more than one DHS survey are down-weighted in proportion to the number of surveys fielded. Hence, the unit described in the tables is the country.

TABLE 4-1 Percentages of Urban Women of Reproductive Age Who Are Recent Migrants, by Age and Region[a]

DHS Surveys in Region	N[b]	All Women	Women of Ages 15–19	20–24	25–29	30–34	35–39	40–44	45–49
North Africa	3	20.7	44.6	39.6	28.5	20.4	13.7	10.1	7.9
Sub-Saharan Africa	25	29.4	35.3	38.7	31.9	24.7	18.5	14.1	10.9
Southeast Asia	3	24.2	45.5	42.2	32.8	22.6	16.3	12.5	10.7
South, Central, West Asia	10	23.2	47.5	41.8	27.3	17.8	13.5	9.9	6.9
Latin America	11	15.6	21.2	21.3	16.8	13.2	9.5	8.4	8.0
TOTAL	52	24.5	35.8	35.9	27.7	20.6	15.2	11.8	9.3

[a] The age-specific entries are summaries of predicted values from a probit model. The table gives the average value of proportions estimated separately from each DHS survey with migration information. Estimates from countries with more than one such survey were down-weighted in proportion to the number of surveys fielded in the country.

[b] Number of countries with DHS survey information on migration.

sub-Saharan Africa.[17] As would be expected given the age pattern of migration, younger women are much more likely to be recent migrants. Some 36 percent of urban women under age 25 are recent migrants, as compared with only 9–12 percent of women in their 40s. Even this lower percentage might be judged high by providers of reproductive health and related services if migrants have special health needs or deficits in knowledge compared with urban natives. In any case, it is plain that migrants account for a substantial percentage of urban women at both ends of the reproductive age span.

Table 4-2 presents data on migrant status according to the population size of the city in which the woman resides.[18] A methodological note is in order here. Appendix C describes how the panel linked DHS survey records to United Nations data on city size. The linkage is very difficult to effect, involving approximations and a good measure of guesswork, because the DHS datasets do not include adequate spatial identifiers. In concluding this chapter we will return to the point, which has a bearing on how spatially coded urban data can be used in survey-based studies of individuals and families.

[17] Note that the "total" row of the table is dominated by estimates from sub-Saharan Africa and Latin America, where the greatest number of DHS surveys have been fielded. In no region of the developing world have all countries participated in the DHS program, and within regions some countries have fielded more surveys than others. Hence, the "total" row cannot be interpreted in terms of averages across the whole of the developing world.

[18] See Table C-3 for a list of cities in the population size range from 1–5 million whose countries have fielded a DHS survey. The cities over 5 million are, by region: *North Africa* Cairo; *sub-Saharan Africa* Lagos; *Southeast Asia* Bangkok, Jakarta, and Manila; *South, Central, and West Asia* Dhaka, Madras, Delhi, Calcutta, Mumbai, Krachi, Istanbul; and *Latin America* Rio de Janeiro, São Paulo, Mexico City, and Lima.

TABLE 4-2 Percentages of Urban Women of Reproductive Age Who Are Recent Migrants, by City Population Size and Region[a]

DHS Surveys in Region	City Population Size: Under 100,000	100,000 to 500,000	500,000 to 1 million	1 to 5 million	Over 5 million
North Africa	22.1	27.4	20.9	16.7	10.0
Sub-Saharan Africa	31.5	29.0	29.6	22.9	22.5
Southeast Asia	21.3	26.8	22.9	26.0	26.5
South, Central, West Asia	21.9	23.5	26.7	20.3	28.0
Latin America	17.9	16.6	16.8	14.1	9.0
TOTAL	25.5	24.8	23.8	19.6	22.0

[a] The entries in this table are summaries of age-standardized predictions from a probit model; they represent the migrant status of women aged 25–29. Also see notes to Table 4-1.

Returning to the question of migration, the results for the average DHS country, shown in the "total" row of Table 4-2, indicate that cities with 1 million or more residents have proportionately fewer migrants than smaller cities, although these differences are on the order of a few percentage points. In Latin America and sub-Saharan Africa, clearer evidence of a negative relationship emerges.[19] A negative relationship is also apparent in North Africa if one sets aside the smallest cities. There is little here to suggest that migrants are systematically overrepresented in the larger cities, and yet that would appear to be a common belief.

Most of the DHS surveys with data on migration also gather data on migrants' areas of origin, classified as city, town, or rural.[20] Table 4-3 shows that roughly equal percentages of urban migrants come from cities and rural areas, with smaller but still substantial percentages coming from towns. As can be seen, only about one in three urban migrants is of rural origin; the table shows that, taken together, cities and towns are far more important sources of urban migrants. When city size differences are examined (see Table 4-4), a somewhat mixed picture emerges. The percentage of migrants with city origins is generally higher in the larger cities of destination, but there are exceptions and irregularities in the evidence. In Latin America, the larger is the destination city, the greater is the share of city-origin migrants among all migrants. This pattern is also evident in North Africa, although it is less apparent in other regions.

[19] For similar findings in Mexico using a special migration survey, see Brambila Paz 1998.

[20] See Appendix C. In this context, "origin" refers to the nature of the area from which a migrant has most recently come, rather than to place of birth. Bilsborrow (1998) warns that survey respondents may describe their origin areas in terms that bias the urban percentages upward. The panel is not aware of any empirical assessments of such a bias.

TABLE 4-3 Type of Origin Area for Recent Urban Migrants, by Region[a]

DHS Surveys in Region	N[b]	Type of Origin Area		
		City	Town	Rural
North Africa	3	40.4	28.9	30.7
Sub-Saharan Africa	23	33.3	28.0	38.8
Southeast Asia	3	31.2	23.6	45.2
South, Central, West Asia	7	34.5	28.0	37.5
Latin America	9	38.7	31.8	29.6
TOTAL	45	34.9	28.5	36.6

[a] Towns are defined by the DHS as urban areas with fewer than 50,000 residents; cities are all urban areas larger than this. Also see notes to Table 4-1.
[b] Number of countries with DHS survey data on migrant origin.

TABLE 4-4 Type of Origin Area for Recent Urban Migrants, by Region and Population Size of Current Residence[a]

DHS Surveys in Region	Origin	City Size				
		Under 100,000	100,000 to 500,000	500,000 to 1 million	1 to 5 million	Over 5 million
North Africa	City	22.0	42.9	46.8	59.9	42.5
	Town	41.6	26.3	24.5	16.2	23.9
	Rural	36.4	30.8	28.7	23.9	33.6
Sub-Saharan Africa	City	28.0	36.3	40.1	30.0	35.6
	Town	31.1	27.5	30.1	32.7	47.2
	Rural	41.0	36.2	29.8	37.2	17.2
Southeast Asia	City	21.3	22.2	26.2	15.9	42.0
	Town	17.9	24.4	40.4	29.6	20.4
	Rural	60.7	53.4	33.4	54.5	37.6
South, Central, West Asia	City	24.7	38.7	39.1	23.7	12.0
	Town	30.4	28.1	25.5	30.9	57.6
	Rural	44.9	33.2	35.4	45.4	30.3
Latin America	City	36.6	46.5	40.3	38.2	60.7
	Town	26.5	27.9	38.9	33.2	26.8
	Rural	37.0	25.6	20.8	28.6	12.5
TOTAL	City	28.5	38.1	39.4	35.1	42.2
	Town	30.1	27.3	32.2	29.8	30.4
	Rural	41.4	34.6	28.4	35.1	27.4

[a] See notes to Tables 4-1 and 4-3.

TABLE 4-5 Total Fertility Rates, Rural and Urban Areas by Region[a]

DHS Surveys in Region	N[b]	Rural Fertility	Urban Fertility
North Africa	3	4.82	3.59
Sub-Saharan Africa	27	6.50	5.07
Southeast Asia	3	3.37	2.81
South, Central, West Asia	10	3.93	3.29
Latin America	13	5.49	3.36
TOTAL	56	5.55	4.16

[a] Calculated from ninety DHS surveys, with survey-specific results downweighted for countries with multiple surveys. The fertility estimates are derived from a Poisson model with a set of age dummies. The Poisson coefficients are then converted to estimated rates, using additional correction factors supplied by the DHS for the surveys restricted to ever-married women.

[b] Number of countries with survey information on fertility.

All of these findings cast doubt on the common view of migrants as predominantly rural folk. The DHS data also call into question the value of simplistic analytic models, such as ours, which treat the urban population as an undifferentiated mass. As these data show, considerable migration takes place *within* the urban sector, and the implications of circulation among towns and cities may be quite different from the implications of rural-to-urban migration.

Urban and Rural Levels of Fertility and Mortality

Unlike data on migration, which are available only for a subset of the DHS surveys, all of these surveys provide information on levels of fertility, infant mortality (deaths under age 1), and child mortality (deaths under age 5). Both fertility and mortality are examined later in this report (see Chapters 6 and 7, respectively), and the treatment of these data here is brief and introductory in nature. Table 4-5 provides estimates of total fertility rates (TFRs) for urban and rural women. This table confirms that urban and rural areas have quite different fertility rates. The widest gaps in fertility are seen in Latin America, where the difference is on the order of 2.2 children, and in sub-Saharan Africa, where urban women are estimated to have 1.4 fewer children than rural women over a reproductive lifetime. The urban/rural differences are smaller in the other regions, although still appreciable. Of course, much of this is due to urban/rural differences in socioeconomic composition, as will be seen in Chapter 6. But lower urban fertility is hardly a modern development—it is a well-documented feature of the European histori-

TABLE 4-6 Infant and Child Mortality, Rural and Urban Areas by Region

DHS Surveys in Region	N[c]	Infant Mortality[a] Rural	Infant Mortality[a] Urban	Child Mortality[b] Rural	Child Mortality[b] Urban
North Africa	3	73.8	45.8	88.5	50.3
Sub-Saharan Africa	27	101.7	81.0	153.6	122.0
Southeast Asia	3	49.7	30.4	60.6	36.8
South, Central, West Asia	10	69.7	54.2	84.6	62.2
Latin America	13	63.3	46.9	80.7	57.0
TOTAL	56	82.8	63.7	115.9	87.8

[a] Table entries are means of Kaplan-Meier estimates of ${}_1q_0$ derived from 90 DHS surveys, with survey-specific estimates downweighted for countries with multiple surveys.

[b] Kaplan-Meier estimates of ${}_5q_0$, from the same set of surveys.

[c] Number of countries with information on infant and child mortality.

cal record (Sharlin, 1986). Lower fertility is, and long has been, an indicator of urban-specific productive and reproductive family strategies.

Table 4-6 gives an overview of urban/rural differences in infant (${}_1q_0$) and child (${}_5q_0$) mortality levels. Here again we see sizable differences between urban and rural areas. That urban mortality falls below rural is unsurprising, perhaps, but it is worth remembering how recently this advantage has emerged and how tenuous it may be. Communicable diseases are a predominant cause of deaths in infancy and childhood, and if other things were equal, urban residents would be placed at greater risk by their spatial proximity and dependence on common resources such as water. After all, it was not until the late nineteenth and early twentieth centuries in the West that urban mortality levels fell below rural levels (Preston and van de Walle, 1978; Preston and Haines, 1991). The marked urban mortality advantage seen in Table 4-6 is thus a departure from the historical norm; it reflects advances in public health and scientific knowledge, and testifies to the ability of higher-income urbanites to purchase protection against disease. In Chapter 7 we return to the issue, asking whether poor urban residents can avail themselves of any similar protections.

Urban Age Structure

The fact that urban fertility rates are generally lower than rural, when combined with the influence of rural-to-urban migration, yields urban age profiles with a distinctive shape. The age composition of urban populations is illustrated in Figures 4-5 and 4-6 for Brazil (based on its 1996 DHS survey) and in Figures 4-7 and 4-8 for Ghana (based on its 1998–99 survey). For each country, the urban population pyramid is shown first; below that pyramid, the figures depict the urban

TABLE 4-7 Household Age Composition, Rural and Urban Areas by Region[a]

DHS Surveys in Region	N[b]	Percentages of Population					
		Aged 0–14		Aged 15–64		Aged 65+	
		Rural	Urban	Rural	Urban	Rural	Urban
North Africa	3	43.2	35.5	52.4	60.5	4.5	4.1
Sub-Saharan Africa	27	48.3	42.8	47.5	54.8	4.3	2.4
Southeast Asia	3	37.2	31.0	58.3	65.2	4.6	3.8
South, Central, West Asia	10	40.6	34.9	54.3	60.1	5.1	4.9
Latin America	12	43.4	35.9	51.8	59.6	4.8	4.5
TOTAL	55	44.9	38.8	50.5	57.7	4.5	3.5

[a] Calculated from the household rosters of DHS surveys, with survey-specific results downweighted for countries with multiple surveys.
[b] Number of countries with age data in the DHS household roster.

proportion at a given age in relation to the rural proportion at that age. Figures 4-6 and 4-8 reveal a relative deficit of children in the urban areas of Brazil and Ghana and a relative surplus of men and women in the working and reproductive ages.

As these illustrations suggest, urban populations are older than rural populations on average. Table 4-7 shows that, as in Brazil and Ghana, cities generally have lower percentages of children (those aged 0–14) in their populations, higher percentages of working-age and reproductive-age adults (aged 15–64), and slightly lower proportions of older adults (aged 65 and above).

Table 4-8 provides a further analysis of age structure in urban areas of different population size, focusing on the proportion of the household population in the working ages. As can be seen, there is a noticeable increase with city size in the working-age proportion, with the occasional exception of the largest city size category. These differences may well stem from the lower fertility rates characteristic of larger cities.

CORE ISSUES IN DEFINITION AND MEASUREMENT

The preceding section presented results by city size, which required that a linkage be made from DHS survey data on individuals to aggregate data from United Nations sources on the population sizes of cities. We have already mentioned the difficulties involved in establishing such a linkage; at this point we must assess the quality of the city population data themselves. They are derived from reports made by national statistical agencies to the United Nations, and therefore reflect the criteria applied by these agencies to define urban areas and delimit the boundaries

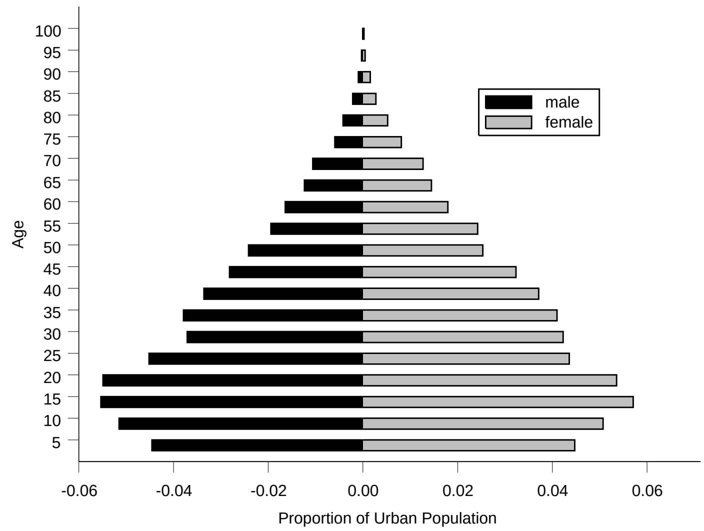

FIGURE 4-5 Population pyramid for urban Brazil, 1996

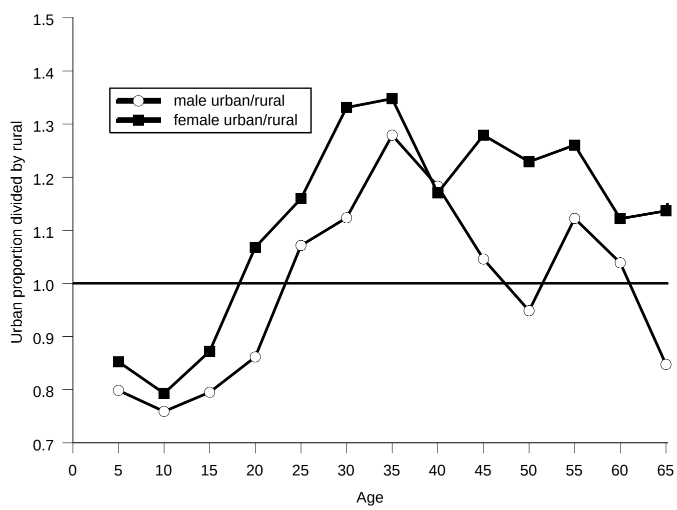

FIGURE 4-6 Urban relative to rural age composition, men and women by age, Brazil, 1996

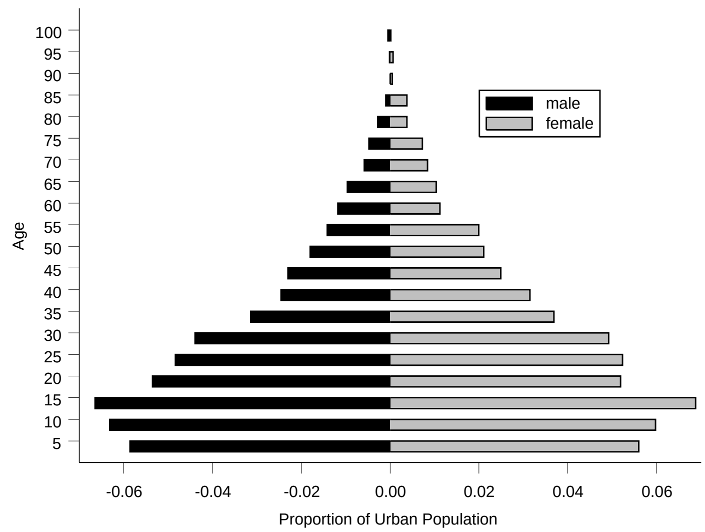

FIGURE 4-7 Population pyramid for urban Ghana, 1998–99

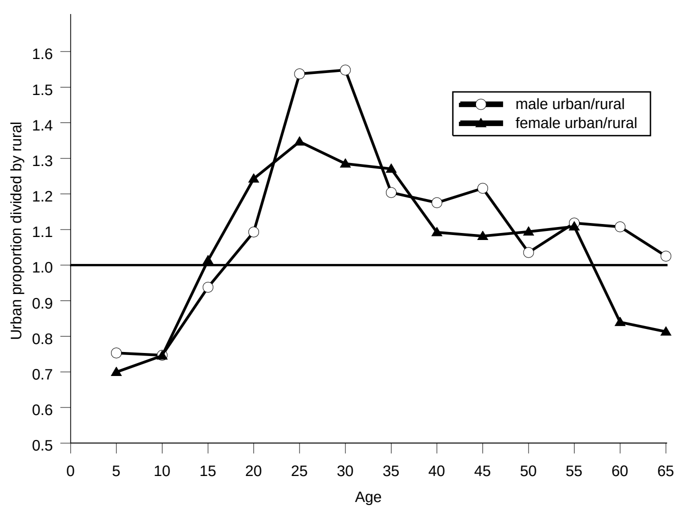

FIGURE 4-8 Urban relative to rural age composition, men and women by age, Ghana, 1998–99

TABLE 4-8 Percentages of Urban Population in the Working Ages (15–64), by Region and City Population Size

	City Population Size				
DHS Surveys in Region	Under 100,000	100,000 to 500,000	500,000 to 1 million	1 to 5 million	Over 5 million
North Africa	58.2	59.6	61.3	63.6	61.8
Sub-Saharan Africa	52.1	55.4	56.3	60.1	55.2
Southeast Asia	59.6	64.3	62.7	64.3	68.7
South, Central, West Asia	56.9	59.7	61.8	62.5	62.3
Latin America	56.1	59.4	61.0	61.9	64.7
TOTAL	54.5	58.1	59.6	61.7	63.9

of individual cities. The reports are usually (if not always) taken from national censuses, and thus depend on the regularity with which censuses are conducted and the completeness of population counts. What is known of the quality of such urban and city size data?

It was not until the nineteenth century that formal urban and rural classifications were introduced into the compilations of European population statistics. The systematic compilation of such data is still more recent. In 1948, shortly after its founding, the United Nations assembled information on the rural and urban populations of 58 countries with recent censuses (United Nations, 1949). By 1952, the United Nations *Demographic Yearbook* already contained rural and urban population counts for 160 countries and could offer an introductory chapter on urban/rural differentials (United Nations, 1953).

These early efforts paved the way for systematic international research on urbanization, and problems in standardizing urban definitions and measures were among the first issues to be studied (Davis, 1958; Gibbs and Davis, 1958; Davis, 1969). From the outset, researchers at the United Nations and elsewhere wrote frankly about the deficiencies of urban data. As they discovered, the difficulties in establishing concepts and improving measures could not be speedily overcome. Even by 1969, United Nations (1969:22)was forced to concede that "…at least a rough overview of world urbanization trends is now so much needed that tolerably usable results had to be preferred over more refined estimates obtainable only with much additional labor". This 1969 report presents estimates and projections of urban population according to national urban definitions, but contrasts them with results from a proposed alternative standard wherein urban areas are defined as agglomerations with populations of 20,000 or more. Noting the many interdependencies of rural and urban areas and the ambiguous status of much territory surrounding urban areas, the report also expresses concern over simplistic urban/rural classifications.

While compilations of urban data expanded, covering more nations and longer spans of time, methods for estimating and projecting urban populations were devised and then revised. By 1974 the United Nations had developed the urban/rural growth difference (URGD) method, now usually termed "the United Nations method," which continues to feature centrally in its estimates and projections (United Nations, 1974). The method (see Appendix D for more detailed discussion) is based on an extrapolation of differences between urban and rural growth rates, with the results expressed in terms of levels of urbanization. A method similar in spirit (if different in details) has been devised to project the populations of individual cities. In the late 1970s, the URGD method was modified so as to force a decline in projected urban/rural growth differences as the level of urbanization rises (United Nations, 1980), and the city projections were similarly revised.

Over the past three decades, while making such minor adjustments to its methods, the United Nations Population Division has continued to prepare estimates and projections of total urban and rural populations and of urban agglomerations, issuing reports and major updates on a biennial basis. The results are widely cited by researchers and journalists alike. At present, the United Nations provides the only comprehensive, international source of urban population data—all the more reason, then, to understand the data limitations.

Inconsistent Urban Definitions

No definition of urban places has been universally adopted by national governments, and it must be said that the prospects for consensus are dim. A great variety of national definitions is now in use. To briefly summarize current practice, in just over half of the 228 countries for which the United Nations Statistical Office compiles data, urban definitions are based on administrative considerations equating urban areas with the capitals of provinces or with areas under the jurisdiction of certain types of local authority. In less than a quarter of countries (22 percent) are urban areas distinguished mainly on the basis of population size and density; and in these countries, the lower limit at which a settlement is considered urban varies from 200 to 50,000 inhabitants. In 39 countries, including all of the successor states of the former Soviet Union and many Eastern European countries, explicit mention is made of socioeconomic criteria, such as the proportion of the labor force employed in nonagricultural activities and the availability of urban-type facilities (e.g., streets, water supply, sewerage systems, electric lighting). Some two dozen countries provide the United Nations with no explanation at all of their defining criteria.

A few examples will illustrate the variety of urban definitions in use. Some countries define urban residents as those people living within well-specified administrative boundaries—in *municipios* (as in El Salvador); municipality councils (as in Iraq); or places having a municipality or municipal corporation, a town committee, or a cantonment board (as in Bangladesh and Pakistan). In Angola, Argentina, and Ethiopia, urban areas are those localities with 2,000 inhabitants or more; in Benin, the threshold is set at 10,000 inhabitants. Botswana sets the threshold at 5,000 people but requires that 75 percent of economic activity be nonagricultural. In Cuba, places with as few as 2,000 inhabitants are considered urban, but even smaller places than this can qualify if they have paved streets, street lighting, piped water, sewerage, a medical center, and educational facilities (United Nations, 2001). As Hardoy, Mitlin, and Satterthwaite (2001) note, the percentage of the world's population living in urban areas could be increased or decreased by several percentage points if China, India, or a few other large countries were simply to adopt new urban definitions. It is not implausible to think that such changes might occur; as Box 4.2 shows, China made major revisions to its urban criteria in the 1980s.

What, then, are the prospects for a uniform international standard in urban definitions? Some researchers have defended current practice on the grounds that "national statistical offices are in the best position to distinguish between urban and rural-type areas in their own countries" (**?**United Nations, 1980). But in keeping with its earlier scientific reviews, as late as 1980 the United Nations (1980:5) was urging consideration of a four-fold classification distinguishing urban and rural places both inside and outside metropolitan regions—to no apparent effect. As one United Nations report drily observes (United Nations, 1969:9), "greater homogeneity of definition could be achieved in the unlikely event that forms of local government became more standardized throughout the world." If the probability of such an event appeared remote in 1969, it has now reached the vanishing point as developing countries decentralize their governments and establish wholly new municipal and regional entities.

The lack of an official consensus greatly constrains the efforts of the United Nations, but it need not deter all researchers. If nationally determined urban criteria were to be made fully and publicly available in the major urban datasets, published alongside population size and density data, researchers would be free to study the implications of applying alternative urban criteria. Many recent censuses contain detailed information on the percentages of population living in settlements in specified size ranges. Although these census data could be employed to develop a uniform standard for research, they have not yet been put to this use (Satterthwaite, 1996a). A number of regional databases could also support the development of a consensus standard. For instance, the GEOPOLIS database for sub-Saharan Africa has adopted a homogeneous definition of urban areas, counting as urban only those settlements with populations of more than 10,000 (Moriconi-Ebrard, 1994). Although such alternatives are promising, researchers will doubtless continue to rely on the United Nations data, with their heterogeneous urban criteria, for the forseeable future.

BOX 4.2 Changing Urban Definitions in China

China's current urban definition reflects both settlement patterns and administrative regulations for persons and places. China's urban concept has taken several forms over the last two decades (Zhang and Zhao, 1998). At present, four factors determine the size of the urban population and the urbanization level: the criteria for designating a settlement as urban; the physical and administrative boundaries of places so designated; the household registration (*hukou*) system; and the urban status of the unregistered or "floating" population.

The criteria for urban designation have changed over time, reflecting the prevailing urbanization policy, economic development, and political ideologies. The criteria focus on the administrative status of a settlement, the minimum absolute size of its resident population, and its occupational structure. The 1984 revisions in urban classification reduced the requirements for minimum population size and nonagricultural workforce share (Goldstein, 1990). These revisions increased both the number of cities and their populations. In further revisions since 1993, additional characteristics of settlements have been taken into account.

The Chinese urban system now consists of two main components: cities (*shi* or *chengshi*) and towns (*zhen*). The urban hierarchy is divided into three levels, roughly analogous to provinces, prefectures, and counties. Provincial status has been granted to four urban regions: Shanghai, Beijing, Tianjin, and Wuhan. Towns fall under the authority of counties. Territorial reorganization and annexation leave the number of counties in the municipal jurisdiction of each city far from standardized.

The Chinese government has long exerted influence over the growth of urban population; since 1954 it has sought to maintain control through the *hukou* system. This system divides the population into agricultural (*nongye renkou*) and nonagricultural (*fei nonye renkou*) categories, which among other things determine rights of access to public-sector subsidies (e.g., grain distributions). In the *hukou* system, there are two official indicators of urban population: the total population of cities and towns (TPCT) and their nonagricultural population (NPCT). TPCT counts as urban those who are living in a designated urban area under the administration of residents' committees for at least a year and absent from their former *hukou* registration place for over a year. NPCT, by contrast, counts as urban those living in a designated urban area who are engaged in nonagricultural work. A person's *hukou* status, defined administratively as "agricultural" or "nonagricultural," need not reflect his actual occupation.

Differences in urban definitions mainly affect the status of smaller towns and cities, those settlements that might be classified as either rural or urban. In cross-national comparisons, one can skirt much of the problem by focusing not on a country's total urban population, but on the urban population that resides in settlements above a given size. In following this line of reasoning, we are led away from the national estimates and toward the United Nations' city-level estimates and projections.

City-Level Population Data

At present, the United Nations offers two sources of data on city population size—one gathered by its Statistical Office and the other prepared by the Population Division. The more extensive data, processed by the Statistical Office, are found in the annual *Demographic Yearbook*. Every year since 1955, this publication has recorded the population sizes of capital cities and all cities of 100,000 or more population according to the most recent official data. The population counts are themselves taken from national or municipal censuses.[21] The *Demographic Yearbook* presents only the most recently reported census results and estimates. For countries that do not regularly conduct censuses, do not tabulate population at the level of cities, or do not report their data to the UN, the figures may refer to counts taken years or even decades earlier. For such countries, city population data are available only at isolated or irregularly spaced points in time.

The second major source of data, the biennial *World Urbanization Prospects* volumes (the most recent edition is United Nations, 2002a), presents population estimates and projections at regular five-year intervals for urban agglomerations of 750,000 population and above; it includes all capital cities irrespective of size. In preparing *World Urbanization Prospects*, the United Nations Population Division evidently draws its raw materials from the same population counts that are published in the *Demographic Yearbook*, which it then extrapolates to cover years for which census counts are unavailable.[22] Curve-fitting techniques akin to the URGD method are used to form city estimates and projections, involving city population growth rates (where they are available) and growth rates of the total population, with further adjustments made (it seems) on the basis of country-specific factors. Appendix D describes these procedures in more detail.

[21]In addition to census counts, estimates of city population based on sample surveys and other sources are presented in the *Demographic Yearbook*. According to United Nations (2000:44), data drawn from sources other than a census or complete survey are potentially unreliable.

[22]The data files and empirical methods used by the Population Division are not publicly accessible, so we can only speculate about the details of their procedures. The panel's understanding is that the Population Division gives considerable attention to the possibility of errors and cross-country differences in reporting.

It is not clear just why the *World Urbanization Prospects* estimates and projections are limited to cities of 750,000 and above, with exceptions for capitals.[23] Perhaps the URGD approach has proven unreliable when applied to smaller cities. The exclusion of smaller cities is unfortunate given the United Nations' projection that over the next few decades, roughly half of the urban population of developing countries will be found in cities of 500,000 population and below (recall Chapter 1, and see United Nations 1998b: 27).

City boundaries

As noted in Chapter 1, the delineation of city boundaries affects both population counts and growth rates. Indeed, cities such as Buenos Aires, Mexico City, London, and Tokyo can correctly be said to be declining or expanding in population, depending on how their boundaries are defined. In the United Nations publications, urban population counts are reported for several types of boundaries or city concepts:

City proper: the inhabitants residing within the formal administrative boundaries of the city.

Urban agglomeration: the population found within the contours of a contiguous territory inhabited at urban levels of residential density, without regard to administrative boundaries.

Metropolitan area: the most expansive of the measures. It includes the territory covered by the urban agglomeration, but also incorporates lower-density settlements, including areas that might otherwise be designated as rural when under the direct influence of the city through networks of transport and communication. That, at any rate, is the principle; in practice, metropolitan regions can be defined as large administrative entities that include rural areas even if these areas have no particular city linkages.

The United Nations (2000:43–45) provides further discussion of these urban concepts.

In *World Urbanization Prospects*, the urban agglomeration is the preferred unit for which urban estimates and projections should be prepared. Unfortunately, as noted by the United Nations (1998b:34–35, 37, 55–80), when countries do not

[23] According to United Nations (1998b:34), it is the responsibility of the Population Division to "monitor the size of all of the world's cities once they reach 100,000 as recorded by a population census or other reliable observational procedure." As recently as 1985, the populations of all cities of 100,000 population and above were estimated, although they were not listed city by city in the annexes of the report. (The 1985 report includes a size category of under 100,000, but the estimates for this smallest size class may have been derived by subtracting the total of the other size classes from the estimated all-urban total.) United Nations (2001) provides estimates by city size class that include all urban areas under 500,000 population, but gives city-specific estimates only for urban agglomerations of 750,000 population and above.

report their city populations in terms of agglomerations or when their reporting criteria vary over time, the United Nations' estimates and projections cannot be interpreted in terms of urban agglomerations as such. In these cases, the *World Urbanization Prospects* estimates often represent the size of the city proper; occasionally, they represent metropolitan areas rather than urban agglomerations.

Examples

The figures that follow illustrate some of the difficulties of interpretation that surround the United Nations' city population estimates. Because the estimates that attract most attention are those published in *World Urbanization Prospects*, these are emphasized in the discussion.

Figures 4-9 and 4-10 present the full data series available to the panel for the Egyptian cities of Cairo and Shubra-El-Khema. The line of connected points is taken from the *World Urbanization Prospects* (United Nations, 2001) dataset. The points marked by boxes are estimates of the population size of the city proper, as presented in various years of the *Demographic Yearbook*. (Egypt does not publish estimates for the agglomeration of Cairo.) Figure 4-9 thus conforms to expectations: it shows that the *World Urbanization Prospects* estimates, which refer to the urban agglomeration of Cairo, lie well above the various *Demographic Yearbook* estimates for the city proper.

It is then disconcerting to discover that for Shubra-El-Khema, the *World Urbanization Prospects* estimates are very close to those published in the *Demographic Yearbook* for the city proper; a larger gap would have been expected if the *World Urbanization Prospects* estimates faithfully represented urban agglomerations. The United Nations (1998b:62) provides the explanation, indicating that whereas the *World Urbanization Prospects* estimate for Cairo refers to the urban agglomeration, its estimate for Shubra-El-Khema refers to the city proper. Although listed in the tables as if it were a physically separate entity, Shubra-El-Khema actually lies within the greater Cairo metropolitan area, and perhaps this is why its population is reported in terms of the city proper (no rationale is stated explicitly).

The second case we consider is that of Brazil. Here, according to the *Demographic Yearbook* (United Nations, 1998a:301, footnote 13), city population sizes are recorded in terms of the populations of "*municipios* which may contain rural areas as well as urban centre[s]." This description is ambiguous—it is suggestive of both administrative and metropolitan area definitions. The units issue is complicated by *World Urbanization Prospects* (United Nations 1998b: 58), which declares that different Brazilian cities employ different reporting schemes. São Paulo, for instance, is said to record its population data in terms of the metropolitan area, whereas Brasília is said to use the city proper concept. A comparison of the *Yearbook* and *Prospects* estimates for São Paulo injects further confusion: Figure 4-11 shows a marked difference between these estimates, with the *Prospects*

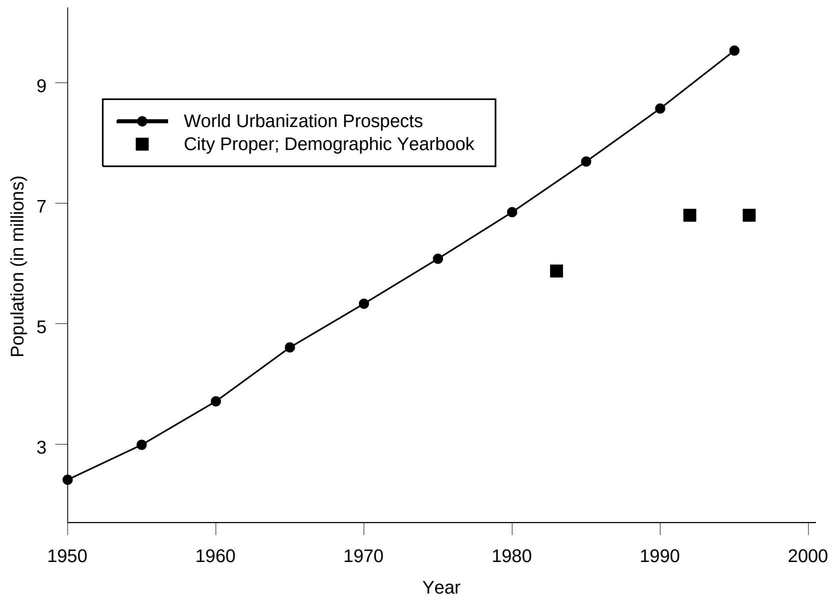

FIGURE 4-9 Cairo: United Nations population estimates

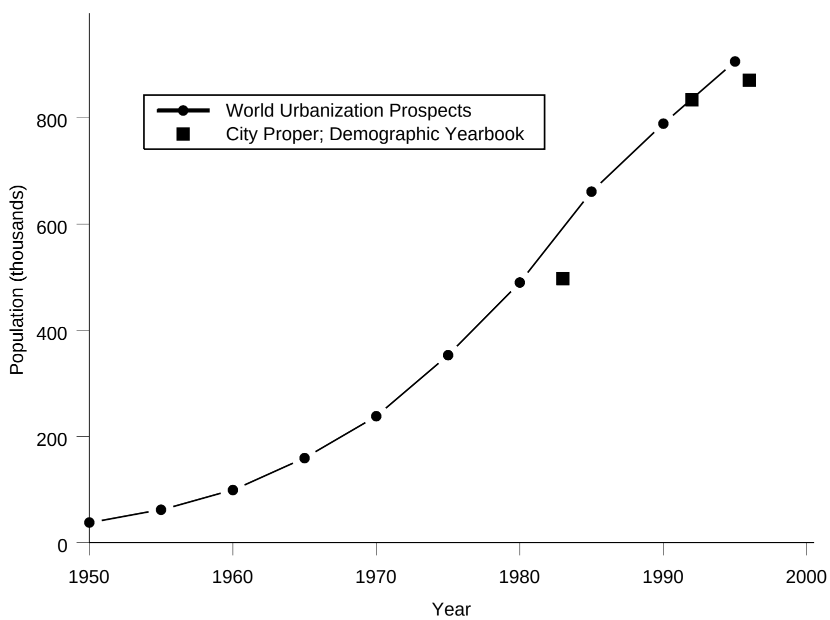

FIGURE 4-10 Shubra-El-Khema: United Nations population estimates

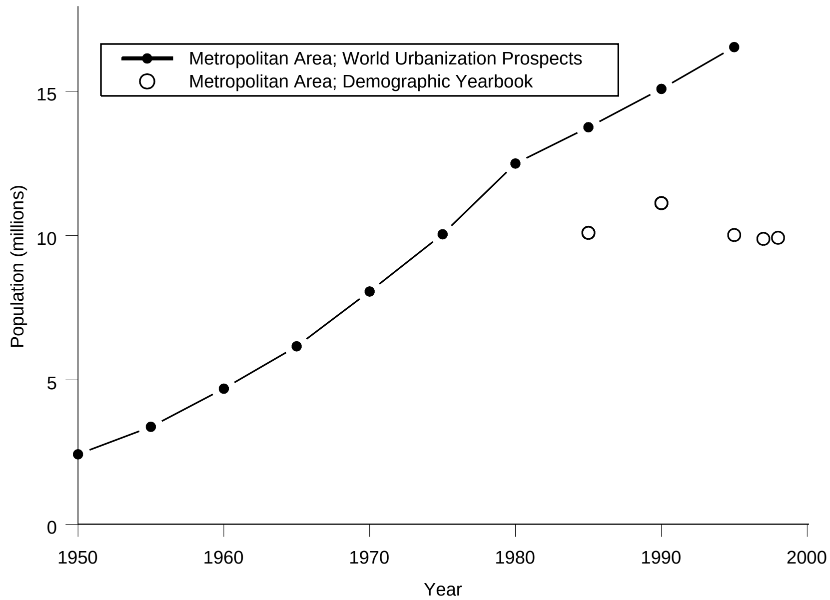

FIGURE 4-11 São Paulo: United Nations population estimates

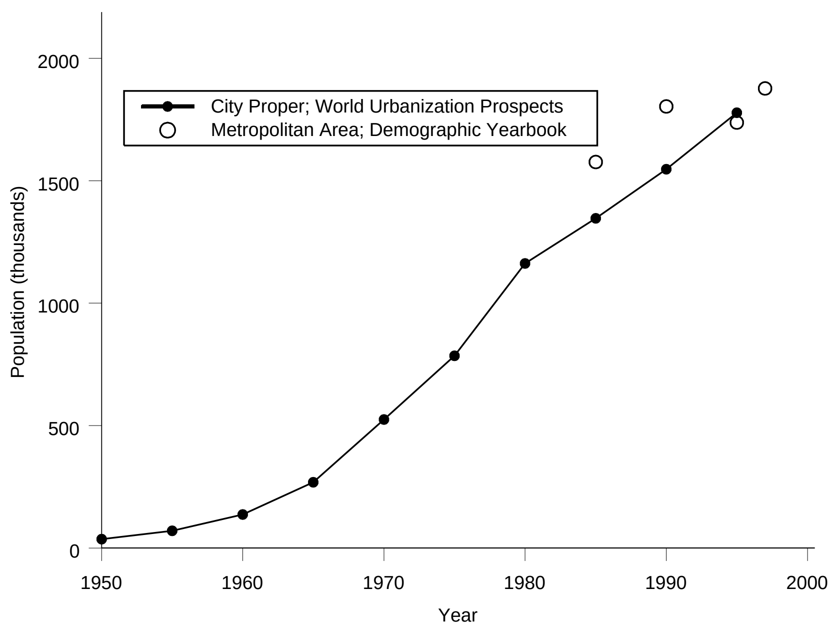

FIGURE 4-12 Brasília: United Nations population estimates

figure exceeding that of the *Yearbook* by more than a million persons. It is not obvious how discrepancies of this size can be resolved. If both estimates refer to the population of the metropolitan area, the metropolitan measure used by *Prospects* must be considerably more expansive. For Brasília (Figure 4-12), the *Yearbook* counts are higher than the extrapolated values of *Prospects* in the mid-1980s and 1990, as expected given the difference in urban concepts, but this gap unexpectedly closes in the mid-1990s.

Finally (see Figures 4-13 and 4-14), a city such as Niamey, the capital of Niger, has had too small a population to be included in the main estimates and projections series of *World Urbanization Prospects*. Nevertheless, because Niamey is a capital city, its population is estimated using techniques similar to those applied to larger cities. In Kitwe, Zambia—a small city in Zambia's Copper Belt, but not a national capital—only the *Demographic Yearbook* population counts are available.

Evidently, there is a great deal of heterogeneity in the nature of the United Nations' city population estimates. The fundamental problem is the variety of units used to report city populations to the United Nations; as noted, the city proper, the urban agglomeration, and the metropolitan area are all used, and some countries employ two of these measures. The units problem is explicitly acknowledged in the footnotes and technical appendices of the United Nations publications, but is not much appreciated, we suspect, by the casual user.

Further interpretive difficulties may arise from applying the URGD method—involving simple extrapolation and projection assumptions—to these heterogeneous data series. Although the broad outlines of the URGD method are known from the United Nations publications, the details of its application to city populations have not been placed in the public domain. Hence, little is known about the potential gains that might result from more sophisticated statistical modeling. In the panel's view, it is doubtful that more sophisticated methods could surmount the many measurement errors and other problems, stemming mainly from differing units, that plague the raw data series. Nevertheless, rigorous research on alternative projection methods is in order.

PROJECTING URBAN POPULATIONS

A first issue with regard to urban projections is to identify the populations of interest: projections can be applied to national urban poulations, to the populations of individual cities, and to metropolitan subregions and even neighborhoods. Such diversity calls for the use of diverse techniques and data sources; and there are interrelationships that need to be considered. As national populations grow, especially in conjunction with economic growth, the number, spatial location, and size distribution of cities can be expected to evolve. As individual cities grow, they often become more diverse internally, and their neighborhoods and subareas can take divergent paths. The smaller is the unit to be examined, the greater are the demands placed on data and methods to achieve any given level of forecast

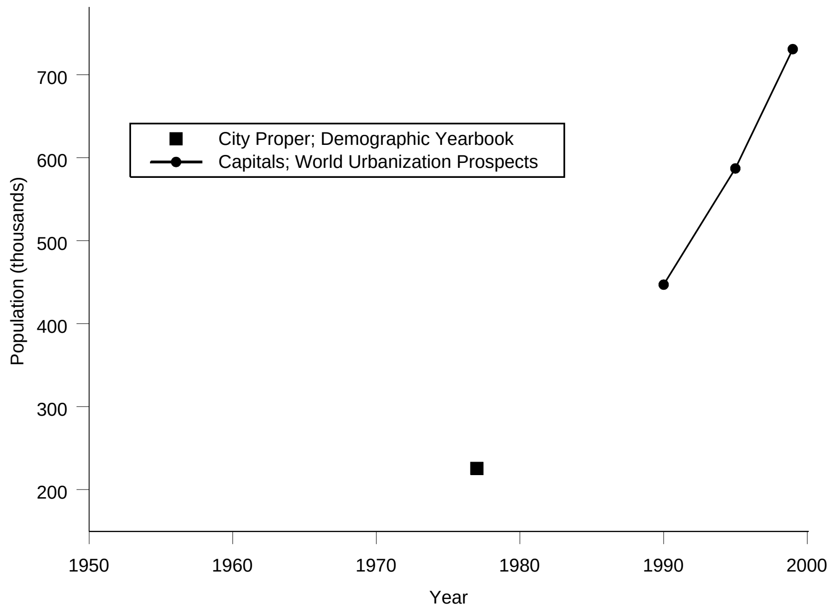

FIGURE 4-13 Niamey, Niger: United Nations population estimates

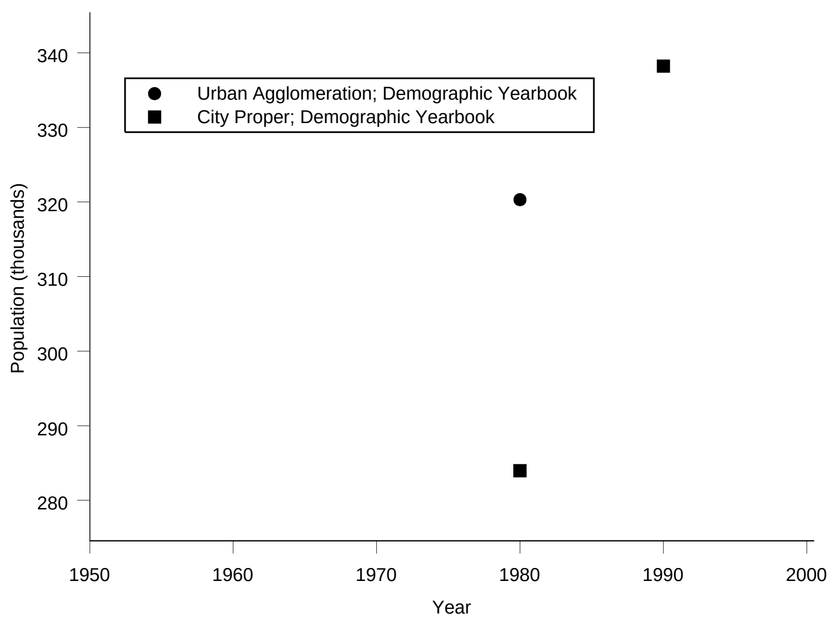

FIGURE 4-14 Kitwe, Zambia: United Nations population estimates

accuracy. Indeed, at the submetropolitan level, it may be that the greater part of the benefit to be derived from forecasts lies in the processes that are bound up in their generation—the gathering, collating, and reconciling of diverse sources of disaggregated poulation and socioeconomic data. But some measure of accuracy is required to sustain the exercise and to give sensible guidance to city planners.

Even for the largest units—consider the total urban population of the developing world—demographic forecasts have been found to exhibit substantial error after the fact. The United Nations' 1999 projection of the urban population for the year 2000 is fully 12.4 percent below the level of its 1980 projection. As Brockerhoff (1999) shows, the United Nations projections of total urban populations have tended to be overestimates. Although the United Nations has also had to revise downward its projections of national populations, these reductions have been small by comparison with the urban reductions. For instance, the projected total populations of developing countries were reduced by just 2 percent in the 1996 projection relative to the 1980 projection (Brockerhoff, 1999).

It is easy to find examples of projections at the city level that proved to be wildly in error. For instance, United Nations projections of the population of Lagos for the year 2000 have fluctuated with each successive update of *World Urbanization Prospects*. The *1994 Revision* indicated that the year 2000 population of Lagos would be 13.46 million; the *1996 Revision* slashed about 3 million from that total, reducing the forecast to 10.47 million; and the *1999 Revision* added these people back, raising the projected total to 13.43 in 2000. After finally being granted access to more recent Nigerian data, United Nations (2002a) again cut the year 2000 population of Lagos, which it found in retrospect to have been only 8.67 million. Although Lagos can hardly be considered a fair test case—most demographers would be skeptical of the accuracy of any data available for this city—gyrations of this magnitude are worrisome.

Error is to be expected in any forecast, no matter how sophisticated and well-grounded in the data. The question is whether the level of error is tolerable given the purposes for which a forecast is required. Unfortunately, population forecasts are often understood differently by demographers and non-demographers. To demographers, forecasts and projections are devices for extrapolating the logical implications of *current* demographic forces by simple mathematical or (less often) statistical means. Economic, social, and environmental considerations are not generally factored into the forecasting equations. The process of urbanization is exceedingly complex, involving feedbacks and counterpressures on many social, political, spatial, and economic fronts—and these are too varied to be incorporated in formal projection models. However, non-demographers often assume that population forecasts are based on professional judgments about the full range of socioeconomic and environmental influences. This interpretation may be encouraged by the presentation of high, low, and medium projection variants, a demographic practice that might suggest that medium projections represent consensus views.

Clearly mindful of the difficulties, the United Nations has generally advanced only the most modest of claims for its city size projections. United Nations (1980:45) warns:

> Projection of city populations is fraught with hazards. ... There are more than 1,600 cities in the data set, and it is obviously impossible to predict precisely the demographic future of most of them. ... In most cases, national and local planners will have access to more detailed information about a particular place and could supply more reliable information about its prospects.

With reference to Mexico City, whose population was to rise to 31 million by the turn of the century according to the 1980 projection, United Nations (1980:57) observes:

> Whether such size can actually be attained is, of course, questionable. It has been noted, for example, that population growth at Mexico City theatens to destroy tree cover that is necessary to prevent erosion and flooding. Water-supply also appears to be a potentially constraining factor in this case. Natural or social limits to growth could be encountered well before a size of 31 million is reached, or of 26 million for São Paulo, and so on down the line.

In the event, neither São Paulo nor Mexico City reached the sizes predicted for them in the 1980 United Nations projections. The year 2000 Mexican census recorded a population of 18.1 million for Mexico City, and São Paulo's population is reckoned at 17.9 million for the same year.[24]

Are these isolated cases that illustrate the inevitable errors of any projection, or are the United Nations projections assembled in a way that somehow tends to impart an upward bias to the projections for large cities? Because the United Nations does not place its city projection materials and methods fully in the public domain, we cannot say whether particular assumptions or data errors might produce systematic biases. But the United Nations cannot be accused of neglecting the possibility of error. As discussed in Appendix D, the Population Division has imposed a number of restrictions in an effort to rein in its projected city growth rates.

Nevertheless, the record of projections gives considerable cause for concern. Table 4-9 reports Mean Percentage Errors (MPEs) and Mean Absolute Percentage Errors (MAPEs) for 169 countries and territories whose boundaries have not changed substantially over the past 20 years (i.e., it excludes countries in the former Soviet Union). The MPE is positive if projections are too high on average, and negative when they are too low. As such, the MPE is a measure of bias. By

[24] Of course, it is possible that the projected massive population increases spurred government action to deter growth in these cities in factor of growth in smaller cities.

contrast, the MAPE is always positive and is usually taken to be a measure of imprecision.

As is evident from the positive values for MPEs in the first three columns of Table 4-9, urban projections have been too high more often than too low. This is partly attributable to the fact that fertility has declined in many places more rapidly than was expected. At the global level, the forecasts of the urban population in 2000 that were made 20 years ago were approximately 14 percent too high; forecasts made 10 years ago were approximately 17 percent too high; and forecasts made 5 years ago were nearly perfect, this last being due to the fortuitous cancelling-out of roughly equal numbers of high and low errors. The general pattern is much as expected, in that projections typically are more accurate with shorter projection periods.

The inclusion of China in the calculations makes a considerable difference to the results. Urbanization trends in China, which is home to 30 percent of the urban population of Asia, have fluctuated greatly over the years. These fluctuations stem both from historical events, such as the Cultural Revolution and its aftermath that retarded or even reversed urbanization in China, and from several revisions (since 1983) in the official criteria defining cities and towns (Box 4.2). If the Chinese data are set aside, a more consistent pattern is revealed in which projections over shorter periods are more accurate.

Table 4-9 also shows that there has been considerable diversity in the quality of urban projections by geographic region, level of economic development, and size of country. The UN urban projections have been most reliable for OECD countries, on average, and least reliable for countries in sub-Saharan Africa and for other high-income countries, many of which are quite small. UN projections also tend to be better for larger countries than for smaller countries, perhaps because larger countries tend to receive more attention.

Similarly, focusing on the largest countries in each developing region and the largest city in each, Brockerhoff (1999) compares two projections for the year 2000—one taken from the 1980 United Nations projections (United Nations, 1980) and the other from the 1996 projections (United Nations, 1998b). He finds that the 1996 projections of city size were far lower, implying that they had had to be revised substantially downward. Among all cities of 750,000 or more residents whose populations were projected in 1980, the median reduction in projected city size was 15.1 percentage points. Upward revisions in the projections were far less common than downward revisions.

Such forecast errors stem from several sources. The baseline data can be absent or unreliable. Censuses may well undercount urban populations: crowded cities with their mobile populations present a challenge to census takers in every part of the world. Recent censuses in Indonesia and Pakistan are believed to have seriously undercounted the populations of Jakarta and Karachi (Jones, 2002). As demographers incorporate the results of recent census rounds, they often find that their estimates of urban populations at earlier points in time need to be revised.

TABLE 4-9 Mean Percentage Error (MPE) and Mean Absolute Percentage Error (MAPE) in Urban Population Projections for the Year 2000, by Length of Forecast, Region, Level of Development, and Size of Country.[a]

	MPE[b]			MAPE[c]		
	20 years[d]	10 years[e]	5 years[f]	20 years	10 years	5 years
Region						
East Asia and Pacific	0.039	0.267	-0.028	0.113	0.289	0.043
EAP excluding China	0.184	0.098	-0.004	0.295	0.166	0.053
Europe	0.140	0.130	0.088	0.140	0.130	0.088
Latin America and Carib.	0.198	0.054	-0.009	0.226	0.075	0.021
Middle East and North Africa	0.133	0.068	0.085	0.245	0.123	0.105
South Asia	0.272	0.197	0.027	0.291	0.197	0.070
Sub-Saharan Africa	0.218	0.234	0.055	0.382	0.274	0.097
OECD	0.068	-0.024	-0.018	0.110	0.048	0.020
Other High-Income	-0.183	-0.102	-0.056	0.334	0.199	0.072
Level of Development						
Low	0.231	0.183	0.032	0.312	0.199	0.080
Lower Middle	0.069	0.261	-0.013	0.115	0.283	0.049
LMI excluding China	0.256	0.099	0.037	0.279	0.161	0.066
Upper Middle	0.128	0.089	0.008	0.199	0.115	0.026
High	0.060	-0.027	-0.019	0.117	0.053	0.022
Size of Country						
0–2 million	0.074	0.063	0.030	0.528	0.268	0.169
2–10 million	0.120	0.098	0.019	0.282	0.199	0.082
10–50 million	0.216	0.108	0.027	0.329	0.163	0.070
50 + million	0.124	0.192	0.001	0.168	0.208	0.049
50 + million excluding China	0.189	0.126	0.018	0.227	0.149	0.054
World	0.141	0.171	0.007	0.206	0.199	0.055
Excluding China	0.190	0.120	0.020	0.257	0.156	0.060

[a] Based on 169 countries and territories whose boundaries have not changed substantially over the last 20 years. Excludes former Soviet Union. All figures are weighted by population size.

[b] MPE = Mean Percentage Error. Positive error associated with projections being too high and negative error with projections being too low.

[c] MAPE = Mean Absolute Percentage Error.

[d] 20 Year comparison based on comparing 1980 projections for the year 2000 in United Nations (1980) with “actual” data in United Nations (2002a,b).

[e] 10 Year comparison based on comparing 1990 projections for the year 2000 in United Nations (1991) with actual data in United Nations (2002a,b).

[f] 5 Year comparison based on comparing 1996 projections for the year 2000 in United Nations (1998b) with “actual” data in United Nations (2002a,b).

Also, as noted above, total population growth in developing countries has been slower than projected, as a result, it appears, of fertility declines that were more rapid than anticipated. Many economic and social changes have taken place that simply could not have been foreseen 20 years ago.

We conclude that urban and city size projections must be treated with a good deal of caution. It appears that projections at higher levels of aggregation (such as total urban populations) have been slightly more reliable. Regionally aggregated data may benefit to a certain extent from the cross-cancellation of country-level errors. Nevertheless, the urban future is highly uncertain even for some regions. The United Nations projection for Africa, for example, is that by 2025, the continent will have become predominantly urban. This is a reasonable extrapolation of current trends, but of course one wonders whether the decoupling of urbanization from economic growth in Africa and the economic crises plaguing the continent's cities will again cause the level of urbanization to fall short of the prediction.

STATISTICAL SYSTEMS FOR DISAGGREGATED DATA

Evidently, the aggregate databases on city size and growth are in need of substantial repair. But the United Nations demographers cannot be charged with this task: although they have great expertise and a store of critical knowledge, they must depend on the figures contributed by national statistical agencies. What factors are likely to motivate these agencies to rethink and reform their procedures and give them the means to do so?

One thinks first of the role of national censuses. Censuses are large and often politically charged undertakings, and although they are regularly fielded in some developing countries, in others they are held irregularly, and in some the census-taking enterprise appears to have ground to a halt. In any case, not all statistical agencies will process census data into the small spatial units that are needed for accurate counts of city populations and informative assessments of socioeconomic conditions within cities. At the local level, planning is further hindered by limited information about local land markets. Most large cities lack sufficient, accurate, and current data on patterns of land conversion and infrastructure deployment. Urban maps are not infrequently 20 to 30 years out of date, lacking any information on newly emerging periurban areas.

We cannot hope to understand the motivations and constraints of national and local statistical agencies, but we can point to two developments that may be encouraging. The first is the move toward governmental decentralization that is occurring in many countries of the developing world, which places new responsibilities in the hands of municipal and regional governmental units. In the national debates that accompany decentralization, the appropriate role for information in the processes of governance is often discussed. For instance, as noted in Chapter 2, national budget allocations to regions can be based on regional population sizes and indicators of poverty, and similar criteria can be applied to the transfers from regional to municipal levels of government. The need for information exchange and feedback among units of government is often recognized in the national debates, although what is likely to come of the insight is generally less than clear.

The second development, not unrelated to the first, is the rise of civil society and the recognition that when they can be assembled, proper socioeconomic maps can be powerful political tools. A city map of differences in service delivery or health conditions can give residents a means of assessing their relative standing and staking claims to resources. For example, maps of Accra and São Paulo showing differentials in health status, mortality rates, and environmental conditions among city districts produced considerable local debate—and some policy change—in both of these cities (Stephens, Akerman, Avle, Maia, Campanareio, Doe, and Tetteh, 1997). Maps highlighting the city neighborhoods with far-above-average mortality rates or unusual concentrations of environmental health problems both inform and help mobilize the inhabitants of these areas and the politicians who represent them.

Assembling such maps is a daunting task, however. In most large cities, each municipal agency or department maintains its own database, often organizing the data in an idiosyncratic manner and rarely sharing them with other agencies. Computerization of data is still relatively uncommon. Many city agencies continue to rely on paper files and paper maps, which may be stored in formats and at scales that all but prohibit comparison, collation, and revision (Bernhardsen, 1999). There are almost no examples of fully integrated databases for the constituent parts of large metropolitan regions. At best one finds data of reasonable quality for the central areas of the city, with little comparable information for the outlying areas.

Looking to the skies for help, some countries have seen remotely sensed and geocoded data as an alternative to data gathered on the ground. Here there are encouraging technical developments. Sutton (2000), for example, has made estimates of intraurban population density based on measures of light intensity; total city populations were estimated by measuring the areal extent of the city in the imagery. These remotely sensed data alone were found to be strongly correlated with census population counts, and the use of ancilliary socioeconomic information further strengthened the correlation. Methods such as these have good potential to improve estimates of the spatial extent of city populations. They can be used to inform "smart interpolation" programs that can improve on existing maps and other population data in areas where good census data are unavailable. The possibilities are attracting considerable research interest—Weeks (2002) provides a guide to some of the very recent technical developments.

The essential principle of geographic information systems (GIS) is that when information is systematically geocoded, it becomes possible to integrate data from highly diverse sources. Many recent GIS applications draw information from maps, satellite images, videos taken from low-flying aircraft, statistical data from tables, photographs, and other sources. When such data are overlaid, they permit cities to to be described and their socioeconomic conditions monitored more quickly and accurately than was previously possible. Geocoded data can assist governance in many ways, such as planning for infrastructure and transportation, tracking crime and improving law enforcement planning, allowing comparisons of program effectiveness across jurisdictions, strengthening taxation bases and record keeping, facilitating site selection for services, and promoting better evacuation plans in the event of emergencies (O'Looney, 2000). Under ideal circumstances, common databases can help instill habits of cooperation among the units of local, regional and even national governments, or at least among their technical departments.

GIS technology is still in its early stages of development in most poor countries, and even where the enterprise is under way it tends to be a single-office operation, usually located in a planning or engineering department. And, of course, the usefulness of GIS technology is dependent on the availability of appropriate GIS-coded data. But encouraging initiatives can be seen in a number of developing countries.

Qatar At the forefront of geographic information technology in the developing world stands Qatar, whose GIS activities began in 1988. The country is now completely covered by a high-resolution, digital topographic database, which draws together images, estimates of land elevation, and information on streets, buildings, zoning, land use, soils, and urban utilities (Tosta, 1997). These data are meant to be available to all government agencies with a need for them. In one successful application, the availability of digital parcel and building records for the entire country allowed the Central Statistical Organization to conduct an extremely comprehensive housing and population census in a single day.

To be sure, Qatar's situation must be very nearly unique. Factors favoring the country's advanced use of GIS technology include its small geographical size, high-level political support for GIS initiatives (including the authority to mandate and enforce uniform standards), outstanding technical leadership, and adequate funding (Tosta, 1997).

African Initiatives Many African governments keep substantial amounts of data in the form of maps. The major sources of spatial data are the national mapping agencies; many municipal authorities also gather spatial data with particular attention to cadastral records. Efforts are under way in a number of African countries to create digital databases through the conversion of such maps. In Botswana, for example, the Department of Town and Regional Planning has developed a digital database to monitor land-use compliance in Gaborone. Lesotho's Mapping Agency is engaged in a large-scale digital mapping exercise for its urban areas. In most countries, however, metadata—the sets of organized spatial data and information about those data (e.g., where the data are located, how and by whom they were collected and maintained, how they can be accessed, and what their major characteristics are)—remain in a rudimentary form.

In Lagos, GIS technology has been deployed effectively to resolve conflicts over land use. The goverment owns large portions of land in certain sections of the city, and residents are supposed to pay "ground rents." But owing to the multiple claims on many parcels and a history of poor record keeping, the government has been collecting only 5 to 10 percent of the rents it is due. To improve collection rates, a Land Information System is being developed that will provide access to all documents for each parcel of government-owned land. The geographic boundaries of each parcel have been derived from digital orthophotos in conjunction with various legal plot maps that have been digitized. Ref?

India Although circumstances in India would appear to strongly favor GIS advances, the country's spatial data infrastructure remains curiously limited. The great Survey of India, which dates to the mid-eighteenth century, has covered the entire country with rigorous cartographic surveys. India is also the birthplace of the IRS (Indian Remote Sensing) series of satellites, which provide high-resolution remote sensing data to global markets. And India is home to a remarkable software industry. Why, then, has use of GIS technology not progressed further?

Most Indian government agencies simply do not understand the value of their data for government functions or for the private sector. Much as in African countries, enormous quantities of valuable material are stored in paper form and seldom computerized. Security concerns have led to restrictions on access to maps, as well as aerial photographs. Despite these obstacles, a number of diverse GIS initiatives are under way in some of India's largest cities; examples are described in Box 4.3.

Malaysia Since the mid-1980s, several federal and state land agencies have explored GIS technology and developed stand-alone systems with valuable information. But these systems have not been integrated across agencies. In an effort to draw the information together, the Malaysian government is developing a National Land Information System, which will provide access to spatial data for all levels of government, the commercial sector, the nonprofit sector, academia, and the general public. The private sector is being encouraged to contribute by adding products and services (Mahid Bin Mohamed, 1998).

Other Applications Elsewhere around the world, GIS technology is being applied in innovative ways to improve urban management. The Kuwaiti Ministry of Public Works has launched a large-scale computerized management system to assist in the maintenance roadways, bridges, sanitary and storm sewers, and street rights-of-way. The Water Authority of Jordan has employed GIS technology to

BOX 4.3 GIS Initiatives Across India

Greater Mumbai Remote sensing and GIS are much involved in land-use planning, with indicators ranging from soil type to air pollution. Maps have been produced on decadal population growth, population distribution, employment, the distribution of socioeconomic facilities, agriculture and forest land uses, and traffic patterns. These maps have illuminated spatial and temporal trends in each settlement within the Mumbai Metropolitan Region. GIS technology has also been used to assess alternative locations for a proposed second international airport and for a solid waste disposal site, and it is assisting in the preparation of a rehabilitation and resettlement program for encroachments at Bandra-Kurla Complex, site of a planned international finance and business center. The government is using GIS technology to map features related to fire hazards and risk assessment, as well as service delivery.

Perhaps the most interesting development in Mumbai is that a proposed land-use plan for the metropolitan region has been transferred to village maps. Citizens and other concerned groups are thereby able to understand the implications of the proposed land-use plan and to file objections and suggestions.

Hyderabad The Center for Resource Education initiated a project on spatial mapping of industrial estates and environmental hazardous sites in or near residential areas. The maps depict the contribution of each industry to pollution, show the likely environmental impact, and indicate monitoring points. Hyderabad has also been developing a GIS-based integrated emergency response management system for Hyderabad City. The project incorporates maps depicting land use, road networks (including travel time estimates), and the location and number of fire and police stations and water filling points.

Chennai City (Madras) A GIS database has been developed for road networks. With this database priorities can be assigned to road improvements in the context of an integrated transportation information system.

Bangalore The Bangalore Development Authority has used GIS applications for route planning and tracking of 200 (and eventually 2,000) private buses. The Global Positioning System is used to monitor the location of the buses and to generate appropriate bills based on distance traveled.

restructure the water supply network in Amman. This project has involved a complete redesign of the water supply system in the city's congested, densely populated core. In Dhaka, GIS technology has been applied to the problem of drainage in Dhaka City. A digital elevation model was established for the catchment area; inundation maps were then produced, and various flooding scenarios of the past were simulated. Use of this technology, found to be cost-effective, has enabled the government to develop sustainable flood alleviation schemes.

The Future of GIS

Although the above are all promising developments, each involves substantial costs, ranging from those of personnel and training to those of purchasing and converting maps. GIS entails much more than technology, and because it requires cooperation among units and levels of government that have little experience in this regard, it may be perceived as threatening. Effective use of the technology requires both new organizational structures and experienced staff. The few case studies available do not demonstrate that the novel techniques and ways of thinking about information and interrelated services made possible by GIS will necessarily make successful transitions from the technical staffs of engineering and planning departments to the broader (and more powerful) realms of government. But clearly this is a development that bears watching, and one that may well bring new energies to bear on the collection of spatially disaggregated data.

CONCLUSIONS AND RECOMMENDATIONS

This chapter has addressed a wide range of issues, touching on both methods and substance. In concluding, we pass rather lightly over the empirical findings presented earlier in the chapter and emphasize implications for the infrastructure needed to support urban population research.

Findings

The analytic models examined in this chapter highlight a point that is often overlooked: urban growth rates and the migrant shares of growth will both tend to be high when a country is in its initial stages of urbanization; both will then tend to decline as the level of urbanization rises. The linkages of urban natural increase to the rate of urbanization can also be misperceived. If urban natural increase happens to equal rural natural increase, rural-to-urban migration will be the dominant factor in urbanization. This is the argument of United Nations (1980). Although there was evidence of equal rates of natural increase in the 1950s and 1960s, it is unclear whether equality in the rates persists. If it does not, differences in the rates of natural increase will also exert an important influence on the rate of urbanization. Migration has a distinctive role to play in affecting urban age structures—together with lower urban fertility, it confers upon city age distributions a distinctive shape in which greater proportions of the population are found in the productive and reproductive ages. Hence, other things being held equal, rural-to-urban migration will tend to inflate urban fertility rates. Moving back one link in the chain, we find that rural natural increase, working through migration, exerts an influence on urban fertility. The interlinkages of urban and rural populations are as clearly evident in analytic models as in empirical studies.

Using data from the DHS, we have found that among urban women of reproductive age, nearly one woman in four is a recent migrant, having moved to her current city or town less than half a decade earlier. In studies of urban change, the term "migrant" calls up the image of a rural-to-urban migrant. The DHS data show, however, that most urban migrants come from other towns and cities; only about one migrant in three arrives directly from a rural area. It appears that the common view of migrants needs to be tempered by empirical realities. Researchers need to consider more carefully the implications of migration within the urban sector. There is little evidence to support another common perception—that migrants are more prevalent in the populations of large than small cities. For women, at least, the DHS data do not confirm this supposition.

Turning to the aggregate data sources on urban and city populations, we underscored a familiar point, one that is mentioned in many scientific reviews of urbanization: countries define urban areas in a great variety of ways. This definitional heterogeneity is of concern mainly with respect to small settlements, but because these are so numerous, differences in definition can have a large impact on the urban totals reported at national levels. In an ideal world, it might be thought desirable for countries to adopt a common definition, but this is unlikely to occur.

How damaging is the absence of consensus? As discussed in Chapter 2, the theories that animate contemporary urban research are increasingly dismissive of simple rural/urban dichotomies, and point toward richer conceptualizations involving centrality, communication, and relational networks. These theoretical developments would appear to be leading away from simple prescriptions and definitions of urban areas. As discussed earlier, however, the measurement of such concepts is still in the early stages, and much remains to be learned about their value for empirical research, planning, and policy making. Furthermore, as can be seen throughout this report, simple urban and rural classifications retain considerable explanatory power. It is probably unwise to set such useful measures aside while better ones are being developed. In any case, because much of the international heterogeneity in definition applies to smaller settlements, analyses based on cities above a certain size (e.g., 100,000 population) can escape many of the difficulties.

Unfortunately, the United Nations estimates of city size, as presented in *World Urbanization Prospects*, are more heterogeneous and subject to measurement error than is commonly realized. We reviewed several cases and found that only the most attentive and dogged researcher would be likely to understand the idiosyncracies of the city population data. As discussed below, if the United Nations were to make its data and methods publicly available, a wider community of researchers could assist in improving measures and methods. Much the same can be said of the United Nations projections, which have often proved to be so far off the mark that consideration of alternative projection methods is now badly needed.

Implications for Urban Research Infrastructure

As countries urbanize, the proliferation of cities and increases in average city sizes heighten the need for adequate urban population data. There is, first, a need for acceptable estimates of city population size. Second, and especially for the larger cities, there is a greater need for intracity data, which are required both for understanding social and economic diversity and for extending services. Spatial information is essential in both of these areas, for not even city sizes can be determined without good information on city boundaries. The potential for use of spatially collected data is perhaps even greater within cities.

The difficulty is to determine where among the many local, national, and international statistical systems there exists a combination of motivation and resources sufficient to generate such spatially disaggregated data. Of course, the major burden of responsibility must rest with the national statistical agencies themselves, but international researchers and agencies can make a contribution through focused research and coordination. The panel is hopeful that GIS and related new technologies will bring new energy and ideas to the problem, but sustained efforts and international technical assistance will clearly be required.

The panel's impression is that where city and urban population data for developing countries are concerned, most demographers believe the United Nations Population Division will somehow take care of things. Yet the Population Division is but one small group of expert professionals with many responsibilities extending beyond the maintenance of urban databases. If the panel understands correctly, the Population Division manages to assemble its urban estimates and projections with very few resources, evidently dedicating less than the equivalent of a single full-time staffer to the task. The United Nations Statistical Office likewise has many responsibilities. It is would be unrealistic to suppose that these units are about to receive major new infusions of funds and personnel.

Yet the status quo is a precarious arrangement. It places responsibility for urban databases essential to the demographic field on the shoulders of a very few individuals. If city and urban population data series are to be adequately and critically reviewed on an ongoing basis and if alternative forecasting methods are to be explored in any depth, a way must be found to bring greater resources to bear. More researchers, especially from the countries that contribute the data series, need to be involved, and more methodological perspectives taken into account. In the panel's view, on which we elaborate in this volume's concluding chapter, the best way to attract more resources to the problem is to place the United Nations data and methods in the public domain, giving the Population Division the task of coordinating full-scale critical reviews.

There is an urgent need for review of the empirical basis for city and urban population projections. United Nations projections of the populations of large cities have displayed a tendency toward upward bias. Total urban populations have also been projected to grow at rates that, in retrospect, were much too rapid. Although the United Nations has taken special care to restrain projections of city and urban population growth, it appears that these efforts have been insufficient. If the United Nations were to place its sources and methods fully in the public domain, the problems that produce such projection errors might be diagnosed more effectively.

Where the Demographic and Health Surveys program is concerned, the problem on which this chapter has shed light is the lack of adequate spatial identifiers in the datasets released for public use. The problem, as we understand it, is that disclosure of the spatial locations of sampling clusters might compromise respondent privacy and threaten the exposure of confidential information. These are important concerns. Surely they can be addressed with a well-designed permissions policy giving researchers access to the spatial information on the condition that adequate protections are in place. If disclosure of the fine spatial detail appears to put privacy and confidentiality at risk, there would be some value to simpler schemes in which city names would be released, but not the precise locations of the sampling clusters. A means also needs to be devised to describe the locations of rural sampling clusters without compromising the interests of rural respondents. Some spatial detail would be desirable, and it may be that indicators of distance to nearby cities would suffice to measure concepts of rural "remoteness." In a world that is increasingly urban and in which rural areas are coming under the influence of city economies and societies, it is difficult to imagine a next generation of research that does not attend more closely to the implications of space.

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