Cities Transformed: Demographic Change and Its Implications in the Developing World

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Updating *Cities Transformed*

- In 2003, the U.S. National Research Council issued *Cities Transformed: Demographic Change and Its Implications in the Developing World*, Mark R. Montgomery, Richard Stren, Barney Cohen, and Holly E. Reed (eds.), Panel on Urban Population Dynamics, National Research Council, Washington DC: National Academies Press.
- Since then, there have been several notable developments—it is already time for an update.

What's New?

1. The United Nations Population Division has enlisted outside partners in cleaning and expanding its cities database.
2. UN-Habitat has made substantial progress in bringing empirical content to its measurement of urban poverty.
3. Remarkable strides have been made in linking remotely-sensed data to demographic data.
4. Climate change and other environmental issues have risen in prominence.

After providing some context, I'll focus mainly on the first and third of these.

Outline

Trends and New Directions in Economic Development

Cities Embedded in Globalized Networks

- Reductions in transport and communication costs enable faster exploitation of local comparative advantages and disequilibria
- As "gateways," cities are in first line of exposure to benefits, costs, and volatilities of world markets—rising urban inequality?
- Large cities important nodes in globalized networks
- In developing countries, some entrepreneurial cities deliberately positioning themselves in these networks
- Other cities stand apart from global circuits—smaller cities, African cities

Transformation of Political Economy: Decentralization

- Across the developing world, national governments are handing to lower-level tiers of government important functions, responsibilities, revenue-raising authority, and (sometimes) transferring revenues to them from the national coffers.
- Powerful notion of moving government "closer to the people," in theory improving responsiveness
- Highly variable implementation; some decentralization schemes strengthen national, weaken mid-level tiers
- Municipal and "state" governments increasingly important in setting policies and programs

Who Are the New Policy Actors?

- Policy "dialogue" must somehow include multiple levels of government
- How will multilateral aid agencies speak with so many actors?
- Within countries, richer and poorer regions—enormous differences across regions in revenue bases, public sector managerial and technical expertise. How will poorer regions fare in decentralized systems?
- Decentralization can strengthen resistance to national policies (e.g., contraception, safe abortion care in the Philippines). Local push-back.
- Obvious that corruption and waste will be reduced? Capture of local governments by local elites?

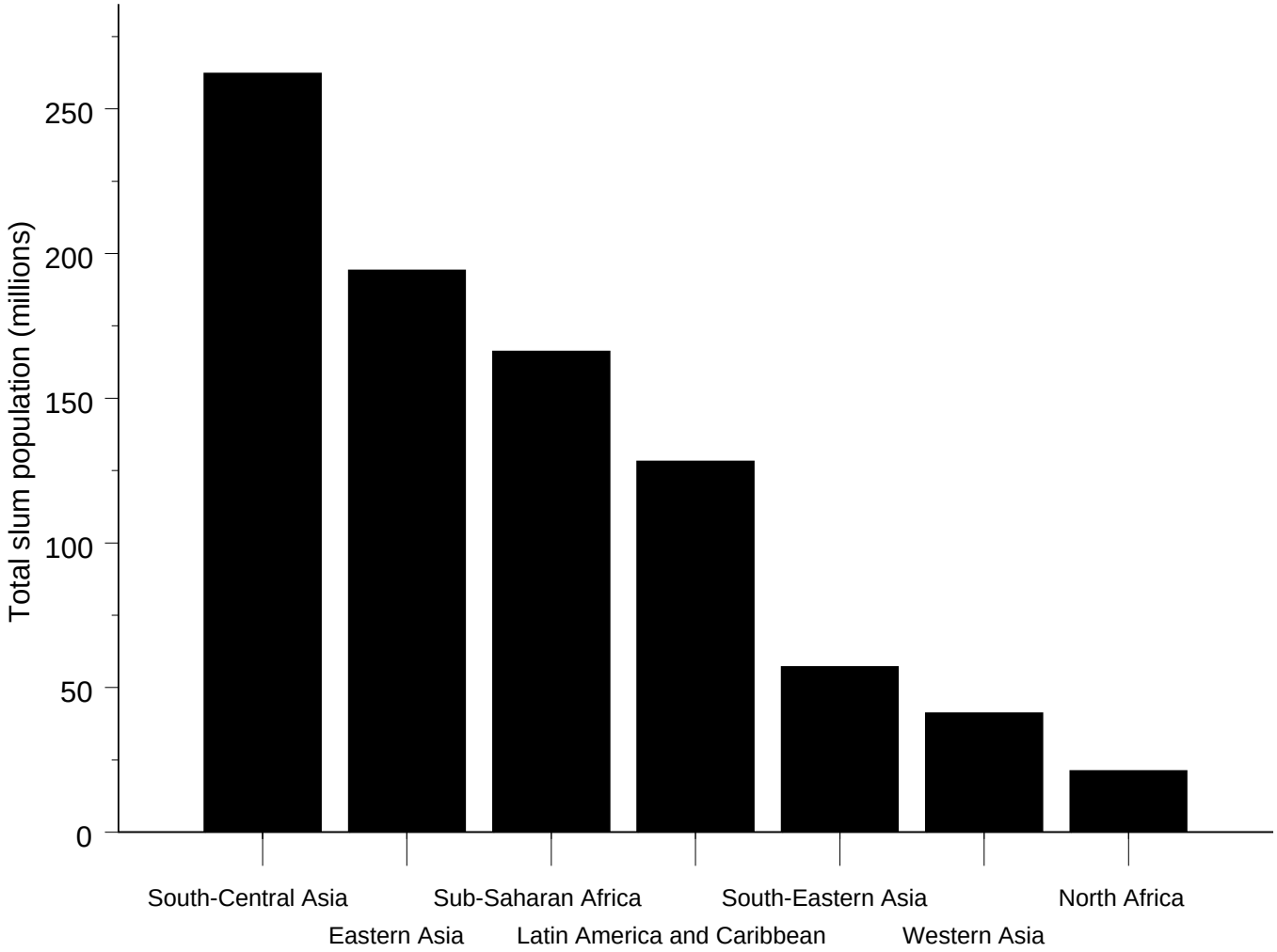
The Millennium Development Goals

Target 11

The United Nations Millennium Declaration specifies a target of achieving by 2020 "significant improvement in the lives of at least 100 million slum dwellers."

Yet UN-HABITAT estimates that there are *already* nearly 1 billion slum dwellers in developing countries.

Slum Dwellers: Current Estimates for Developing Countries



Other MDG Targets Relevant to Urban Areas

- Improve access to safe drinking water
- Reduce child mortality
- Reduce maternal mortality
- Make progress against HIV/AIDS, malaria, tuberculosis, other major diseases
- Reverse loss of environmental resources
- Eliminate gender gaps in schooling

Costs of Meeting the MDGs

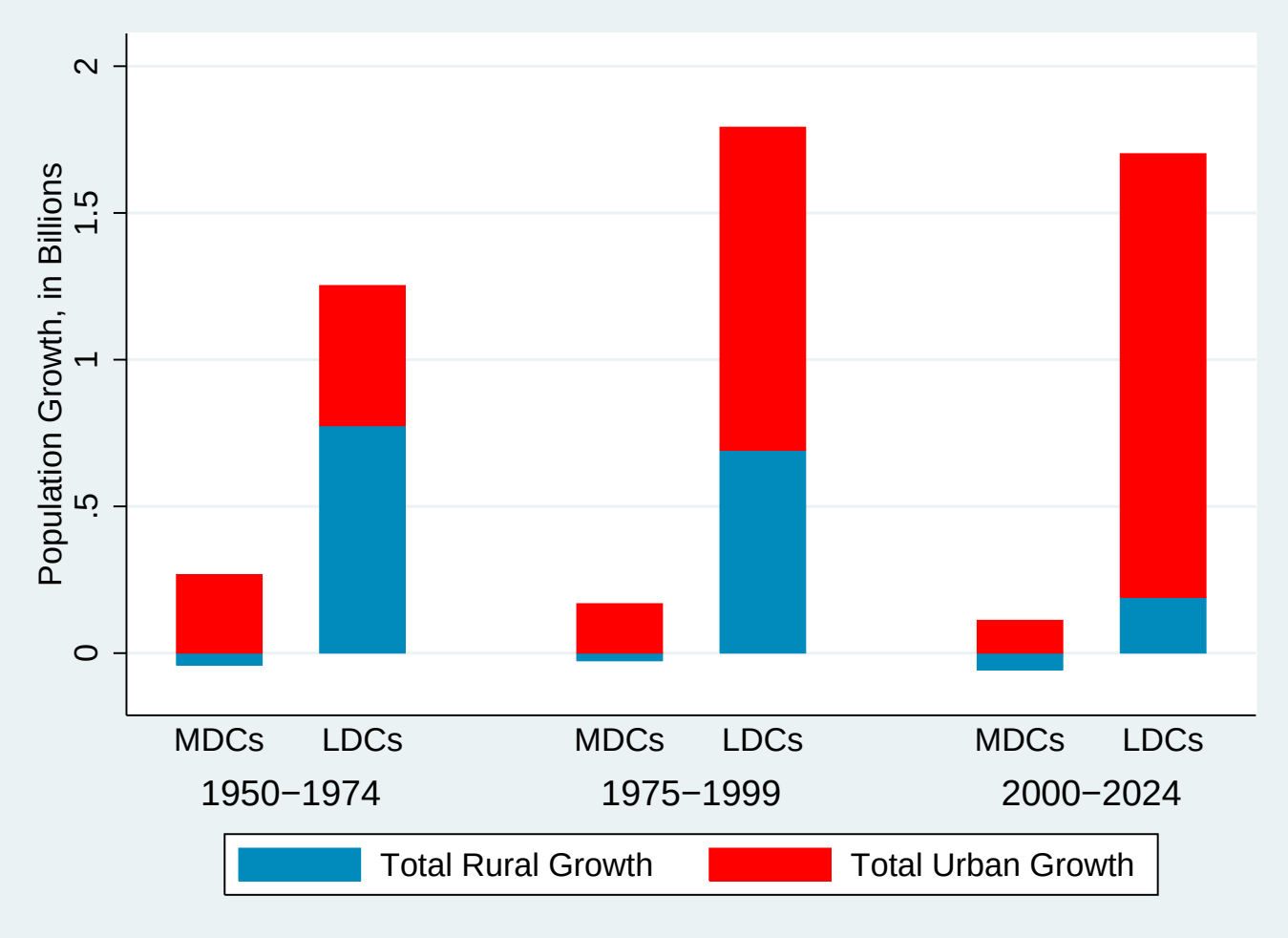
Lower Costs from Urbanization?

The unit costs of providing some public services—electricity, water, sanitation; modern curative health services—may be substantially reduced by the spatial concentration of consumers in urban areas. Hence, urbanization is central to the prospects for meeting the MDGs, even if its role is not always acknowledged.

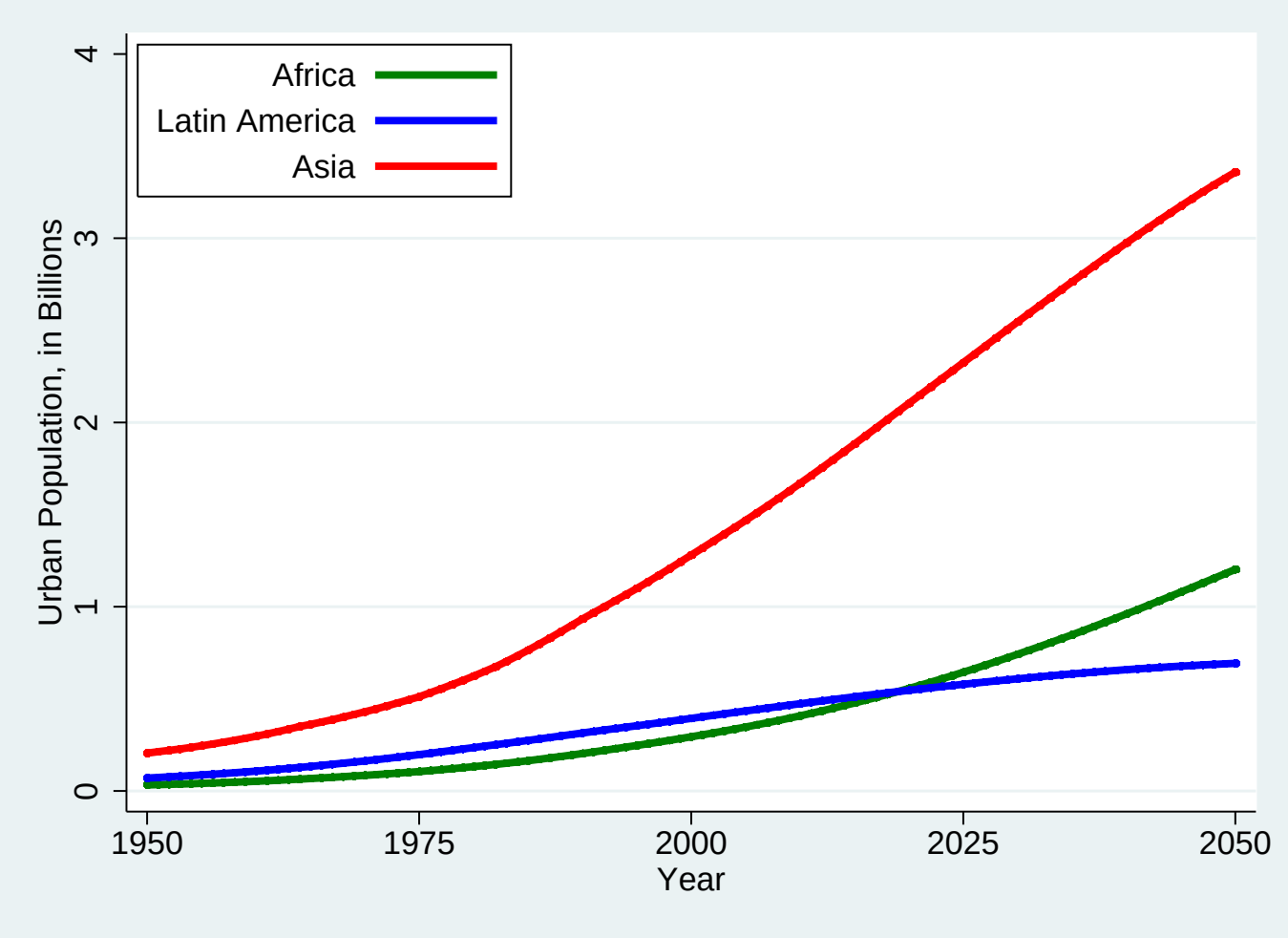
The Demography: An Urban Century Lies Ahead

Source of following figures: Author's calculations using provisional data from the UN Population Division.

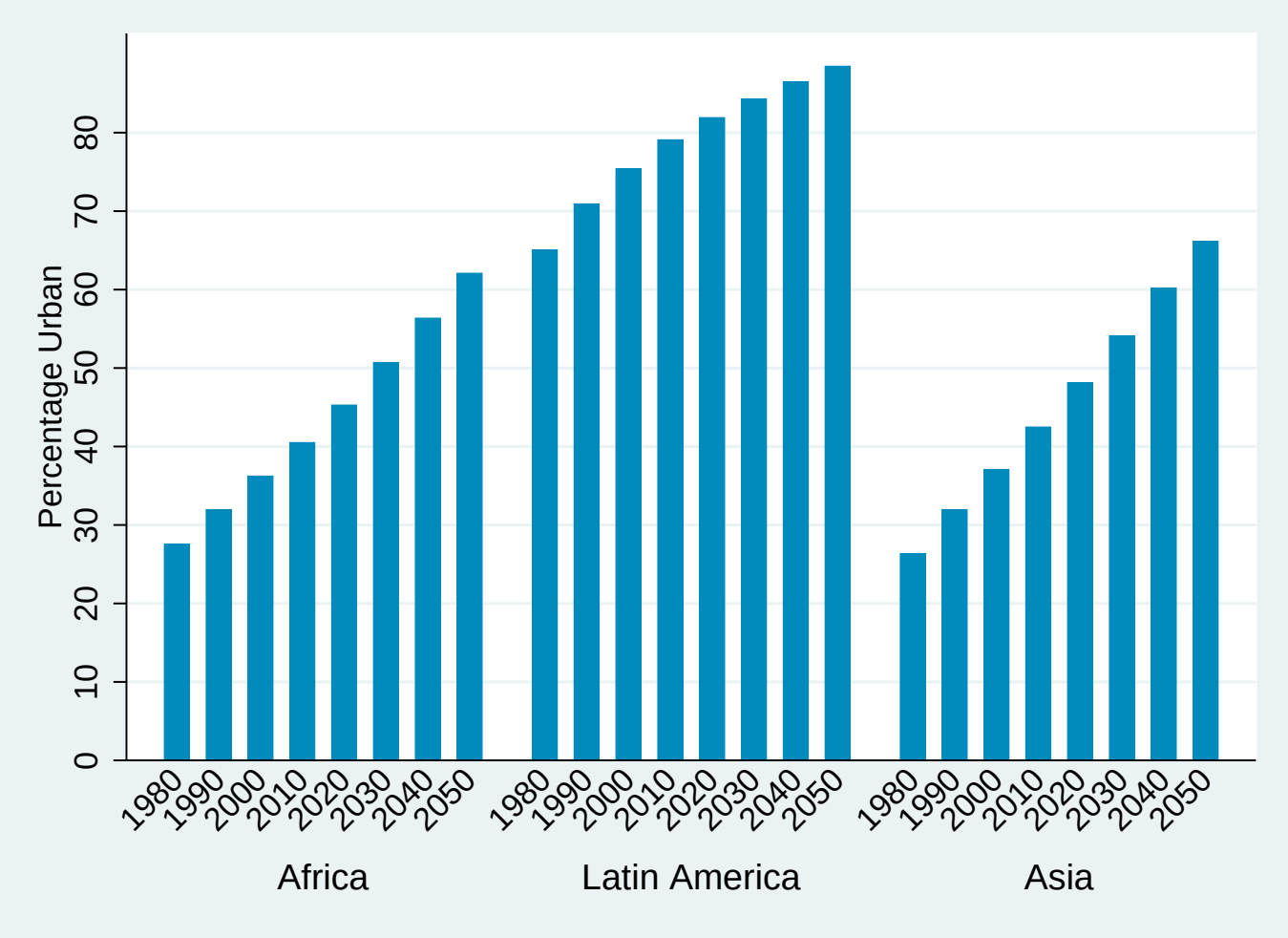
Urban Population Growth Worldwide, 1950–2025



Urban Population Size by Region, Developing Countries



Increasing Percentage Urban, LDCs

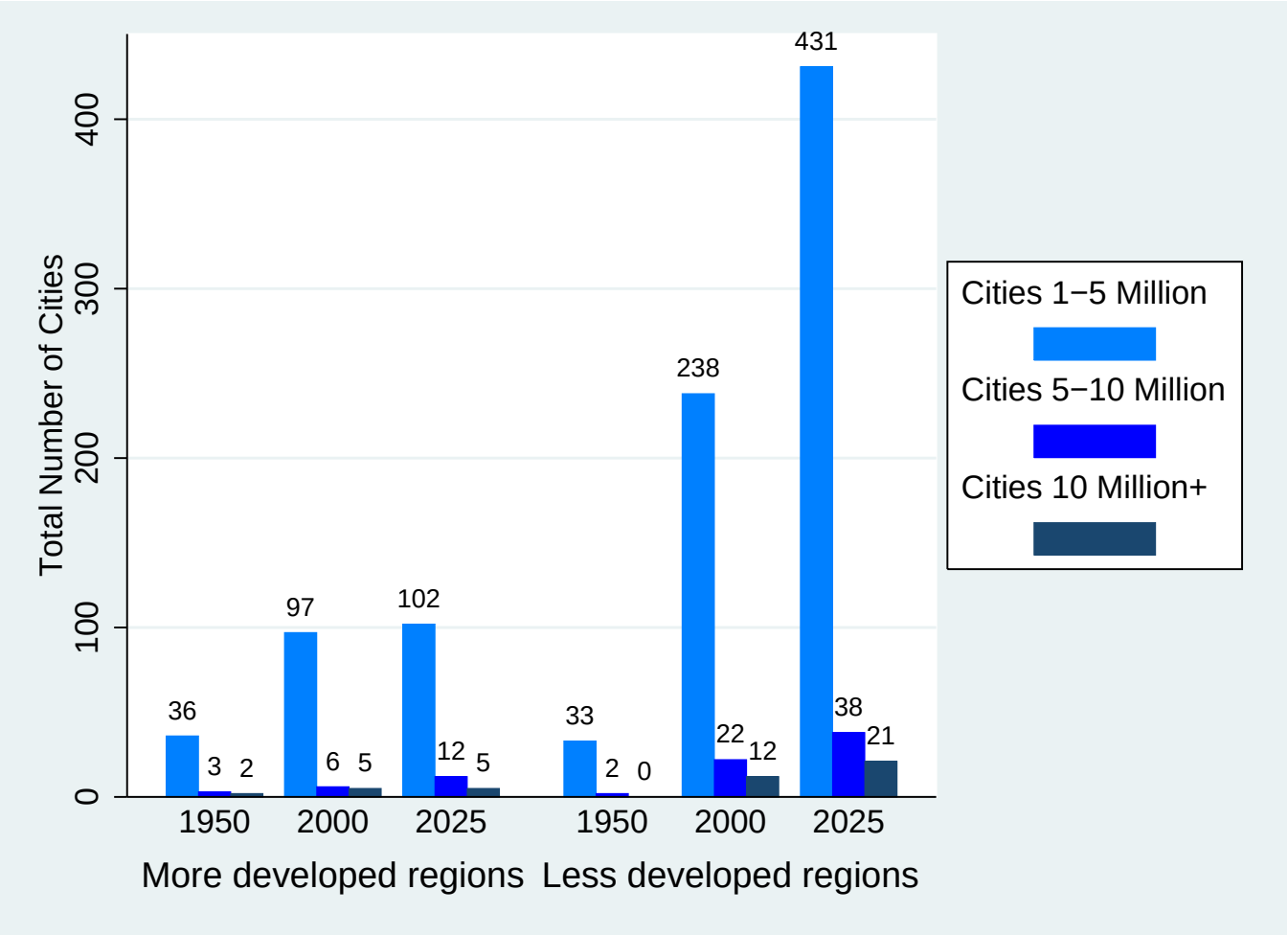


What's Distinctive About Today's Urban Transition?

Let's correct some common misunderstandings:

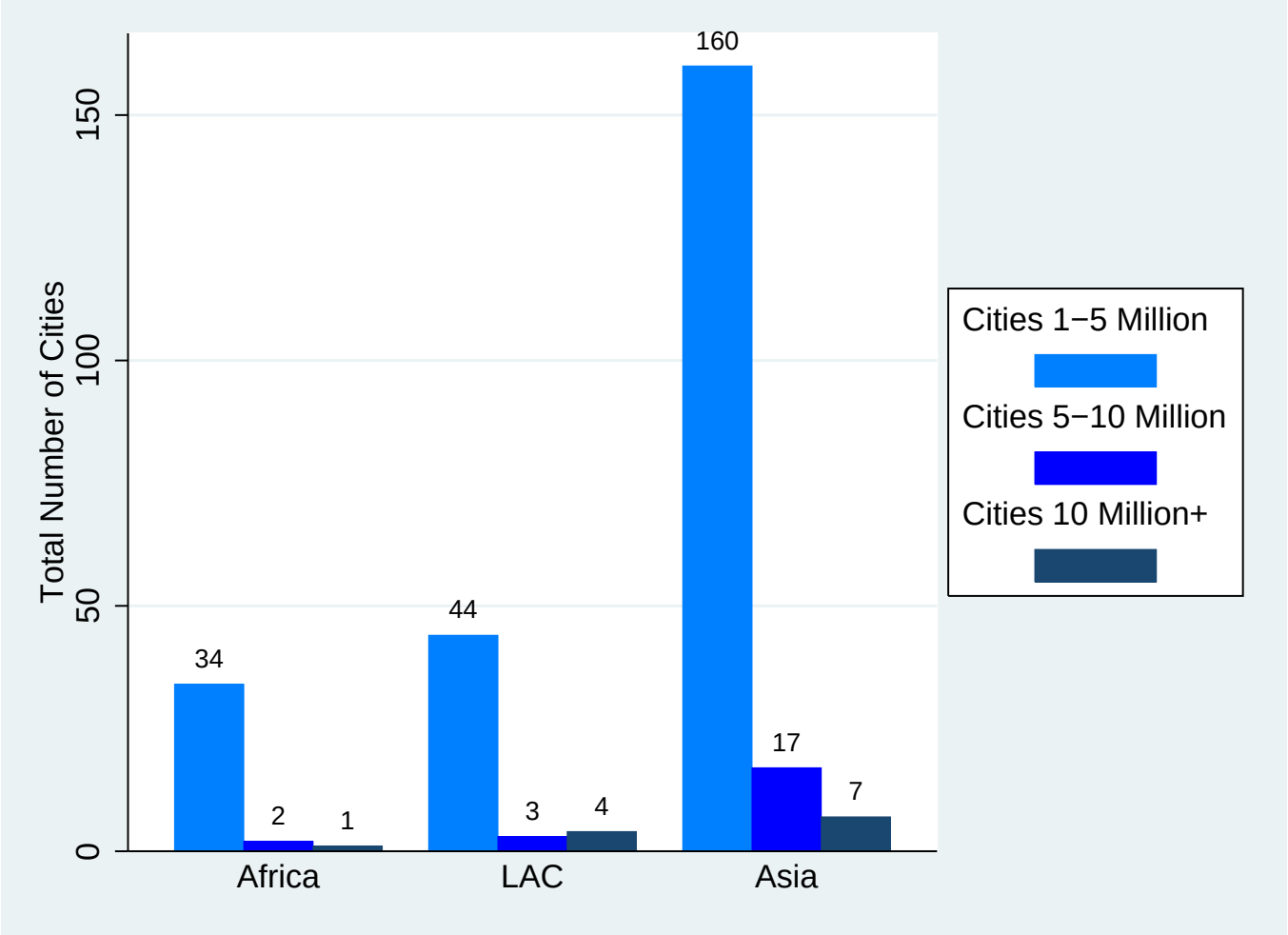
- Urban growth rates are higher than in comparable periods in the West—lower urban mortality, stubbornly high urban fertility in some cases, urban population momentum from past growth
- But the pace of urbanization—that is, the change in percentage urban over time—is not historically unusual. It is not correct to say that "urbanization" is proceeding faster than in the history of the West.
- Although information is limited, it is not obvious that rural-to-urban migration rates for today's LDCs are distinctively higher or lower.

Number of Cities of 1 Million or More

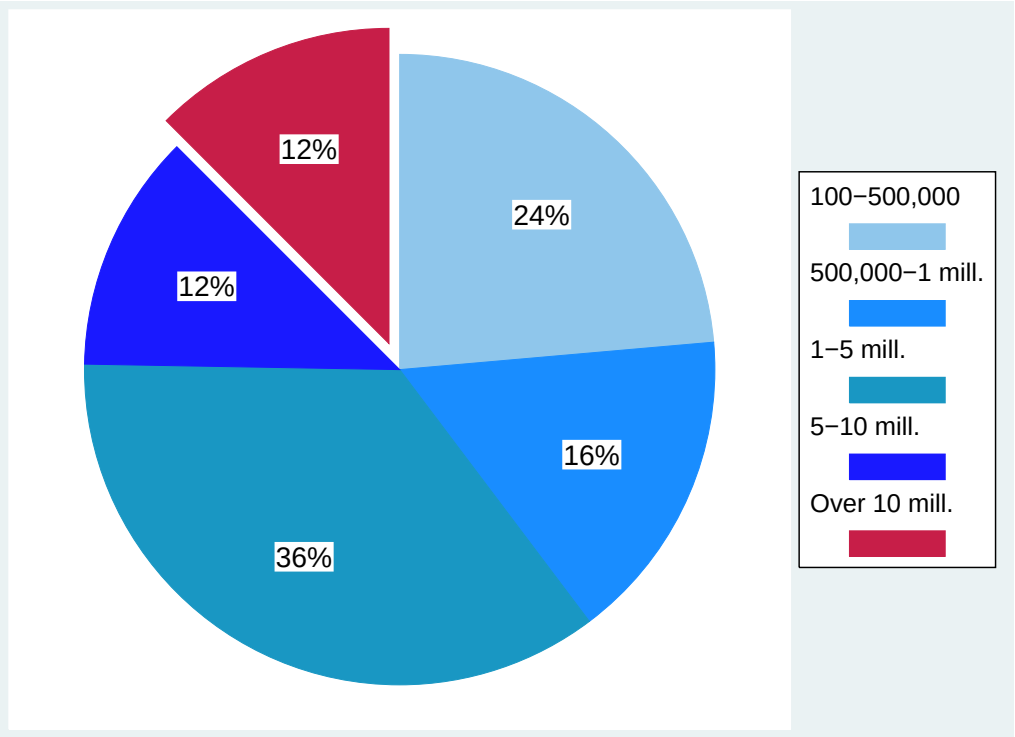


This *is* unprecedented! Preston (1980) termed it "urban gigantism".

LDC Cities of 1 Million or More, by Region in 2000

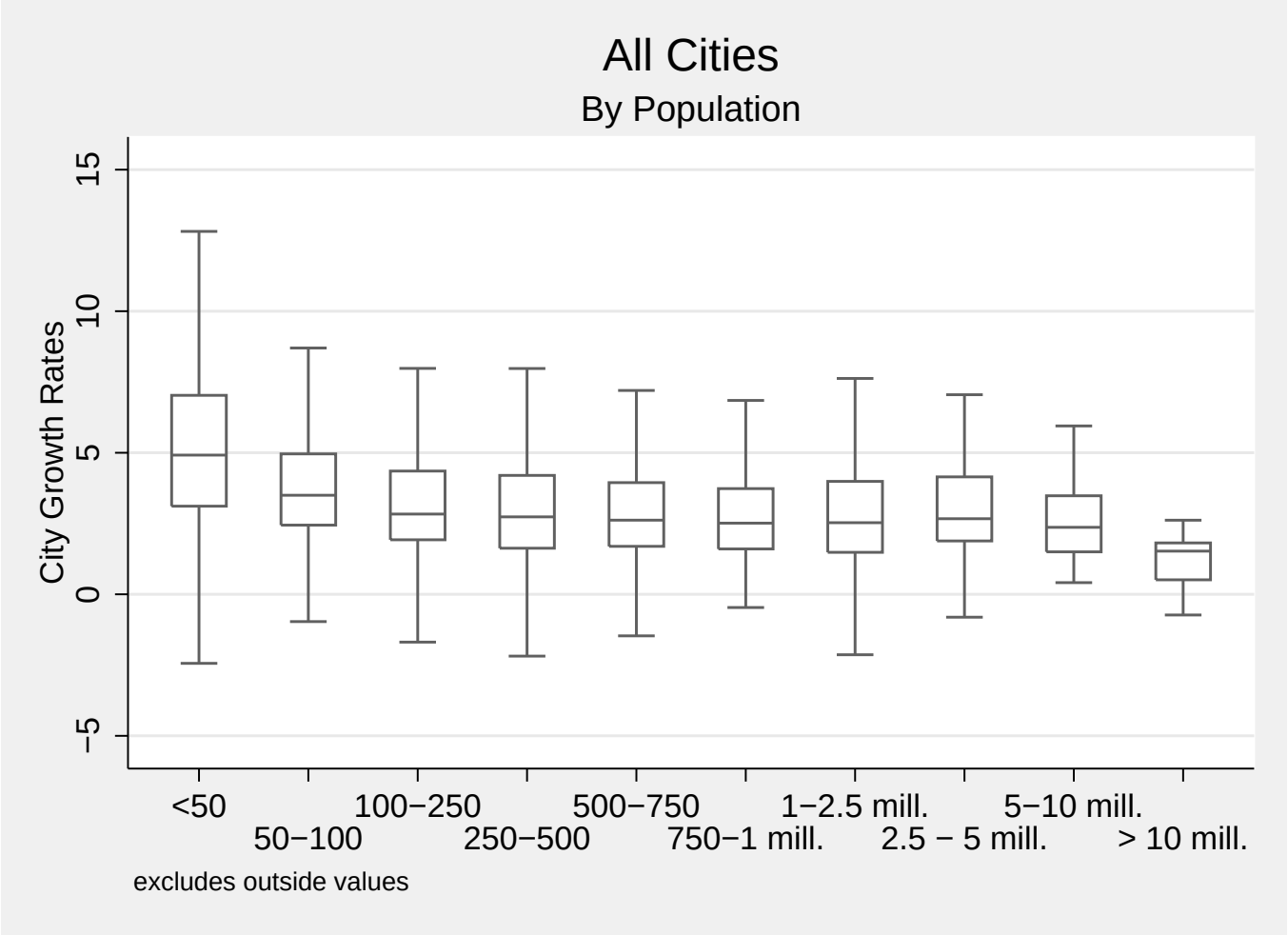


Distribution of LDC Urban Population by City Size

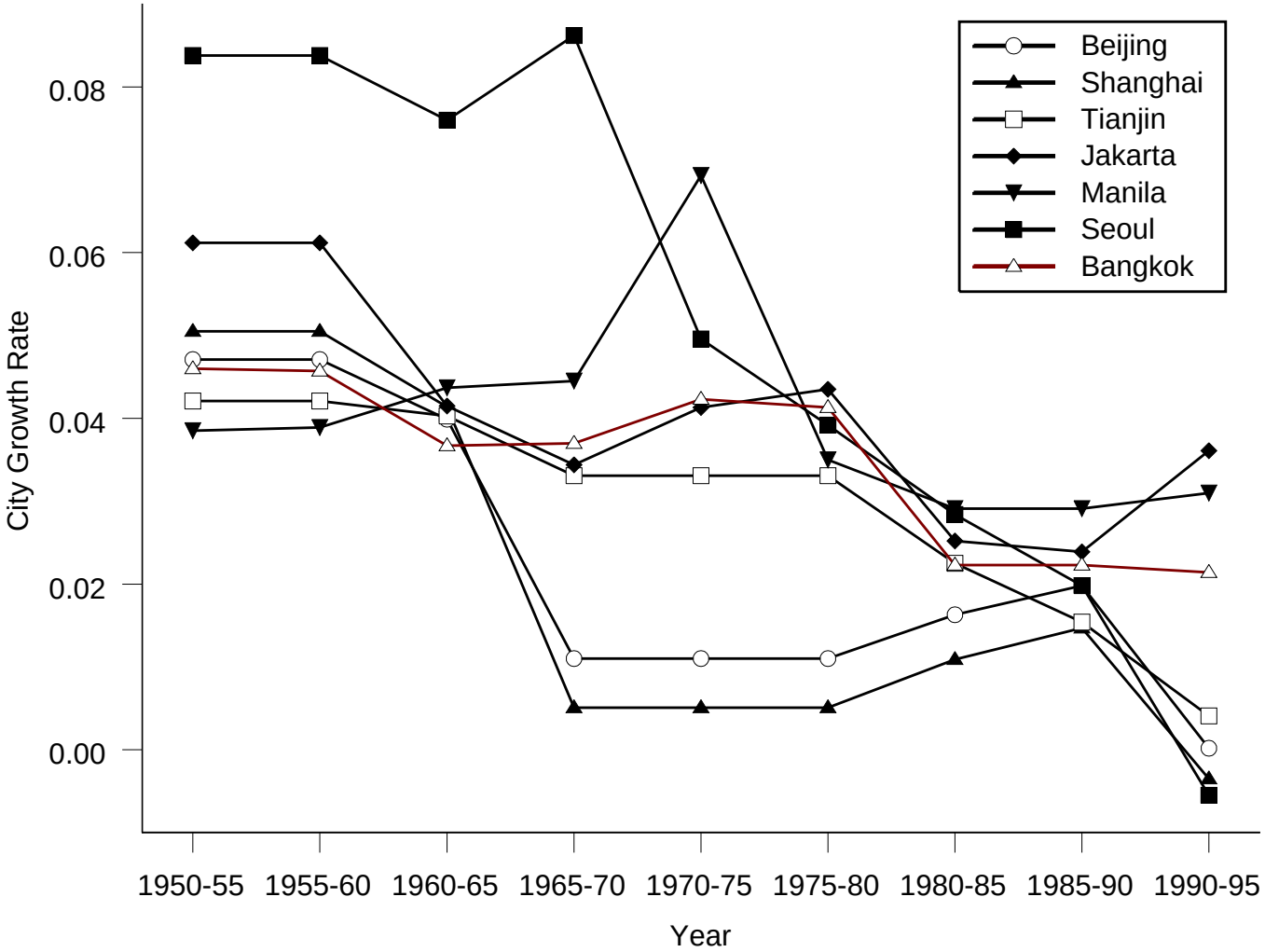


Still, among urban dwellers in cities of 100,000 and above, only 12 percent live in "mega-cities". Far larger percentages in smaller cities.

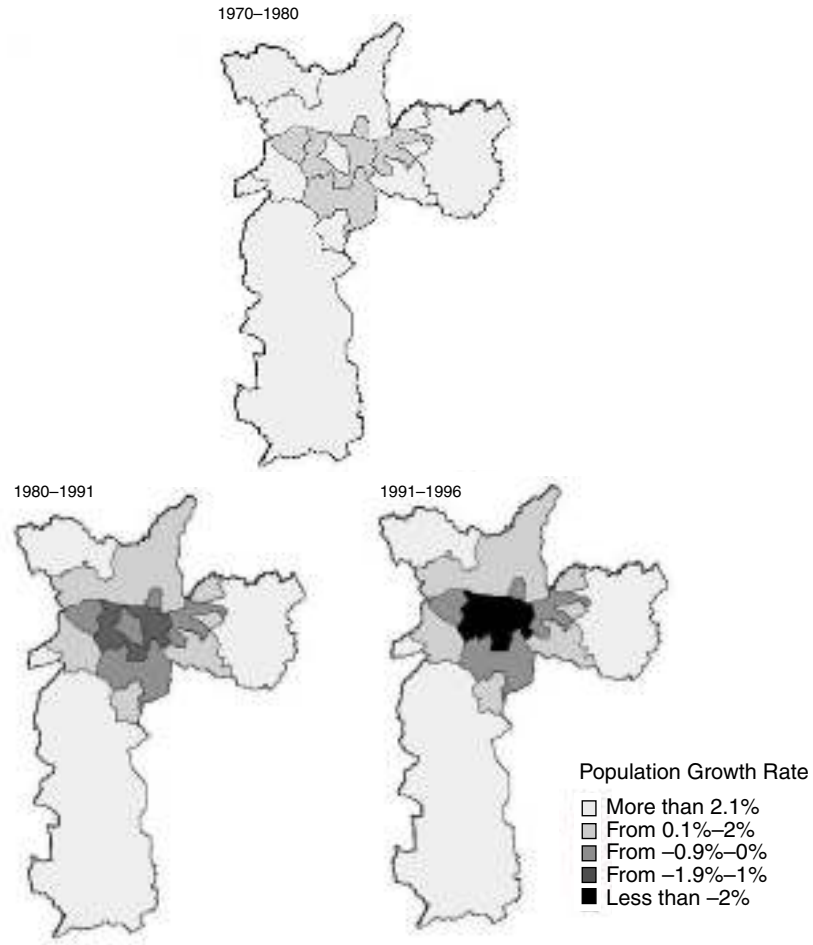
Larger LDC Cities Tend to Grow Slower



As a City Becomes Larger, Its Growth Rate Slows



Growth Rates Change *Within* Urban Areas: São Paulo



Reflections and Critical Questions

Intellectual Engagement: Social Scientists and Policy-Makers Lag

Are Social Scientists and Policy-Makers Paying Attention?

- Urbanization trends in LDCs in the making for decades.
- Yet demographers have hardly begun to grapple with issues (examine 2007 Population Association of America program).
- Fitful attention on the part of economists (compare *World Development Report* 1999/2000 with more recent *WDR*s).
- Aid agencies still focused far more on rural poverty than urban.

Why the Lag in Response to a Large, Obvious Trend?

- Emphasis from 1970s on eliminating "urban bias," focusing on absolute poverty in rural areas.
- Availability of Green Revolution technology—nothing quite comparable for urban economies.
- Lack of training in urban economics, demography, sociology.
- Except, of course, for "Chicago School" sociologists—from the late 1980s, outpouring of work on urban neighborhood effects, social capital, social networks, stimulated by William Julius Wilson and like-minded researchers. But the research agenda almost entirely domestic!

On the Agenda for Demographers

Longstanding Conceptual and Measurement Difficulties

- What *is* an urban place? Simplest definition: A set of contiguous areas each with population density above a given threshold d, with a total population of p or more.
- Across national statistical systems, great variety of definitions employed, affecting mainly the status of smaller places—cities and towns under 50,000 population. Hence, urban percentages are not rigorously comparable.
- Cities evolve in their spatial extents over time—not a fixed set of contiguous areas.
- United Nations distinguishes three "statistical concepts" associated with spatial extent—city proper, urban agglomeration, metropolitan region.

Migration versus Urban Natural Increase

For urban areas with fixed boundaries—a single city, or all cities in a country—the urban population growth rate can be written as

$$g_t = \underbrace{n_u}_{\text{natural urban growth}} \underbrace{- m_{u,r} + \frac{R_{t-1}}{U_{t-1}} \cdot m_{r,u}}_{\text{net migration}}.$$

United Nations Population Division studies distinguish natural urban growth—the difference between urban birth and death rates—from a residual that combines net migration with spatial expansion.

The 60/40 Rule

- The United Nations rule-of-thumb: In developing countries, about 60 percent of the urban growth rate is due to natural growth. The remaining 40 percent is due to migration and spatial expansion.
- Similar rule applies to countries followed over time: 60 percent figure cited in *Handbook of Indian Urbanization* (2005:32) for four decades from 1961 to 2001.
- China the great exception to the 60/40 rule—low fertility, migration tightly controlled, then unleashed. Population of "floating migrants" estimated at 100–250 million.

Keep Urban Natural Increase in Mind

- Policies of discouraging rural-to-urban migration often punitive, welfare-reducing in short run, ineffective in long run.
- More enlightened regional development policies promising, but seldom produce rapid changes in pace and spatial distribution of population growth.
- But urban voluntary family planning programs have proven effectiveness against a major component of city growth. This simple point is almost universally ignored.

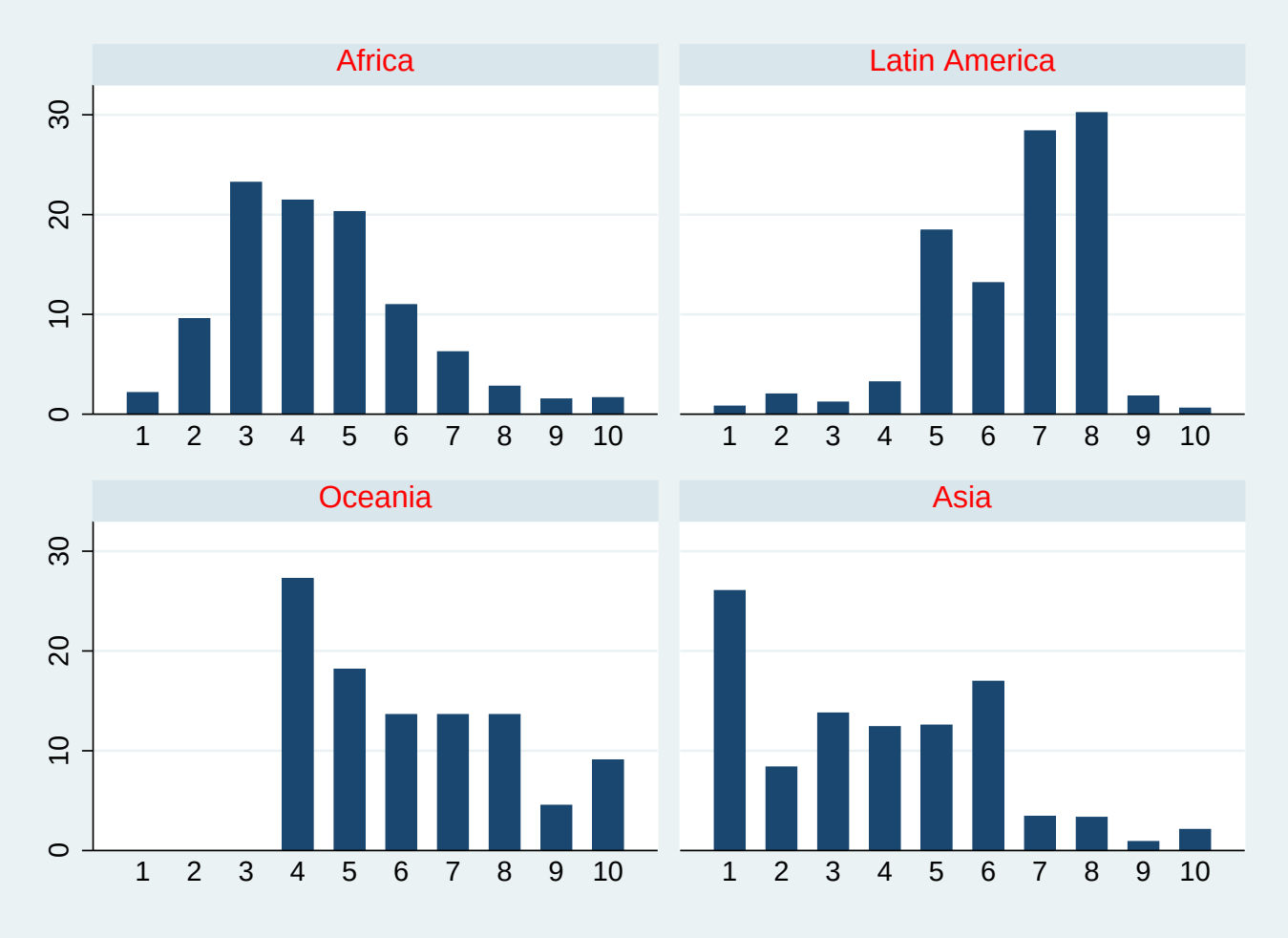
The United Nations Cities Database

- Panel data: City population counts for individual cities over time, reported at irregular intervals.
- The UN monitors all cities of 100,000 population and above; when a given city crosses this threshold, the Population Division endeavors to reconstruct its history.
- Member countries asked to provide data on urban agglomerations—but UN often receives data in other units, the city proper and the metropolitan area.
- Where possible, these data are adjusted to conform to agglomeration concept—but this is not always possible.

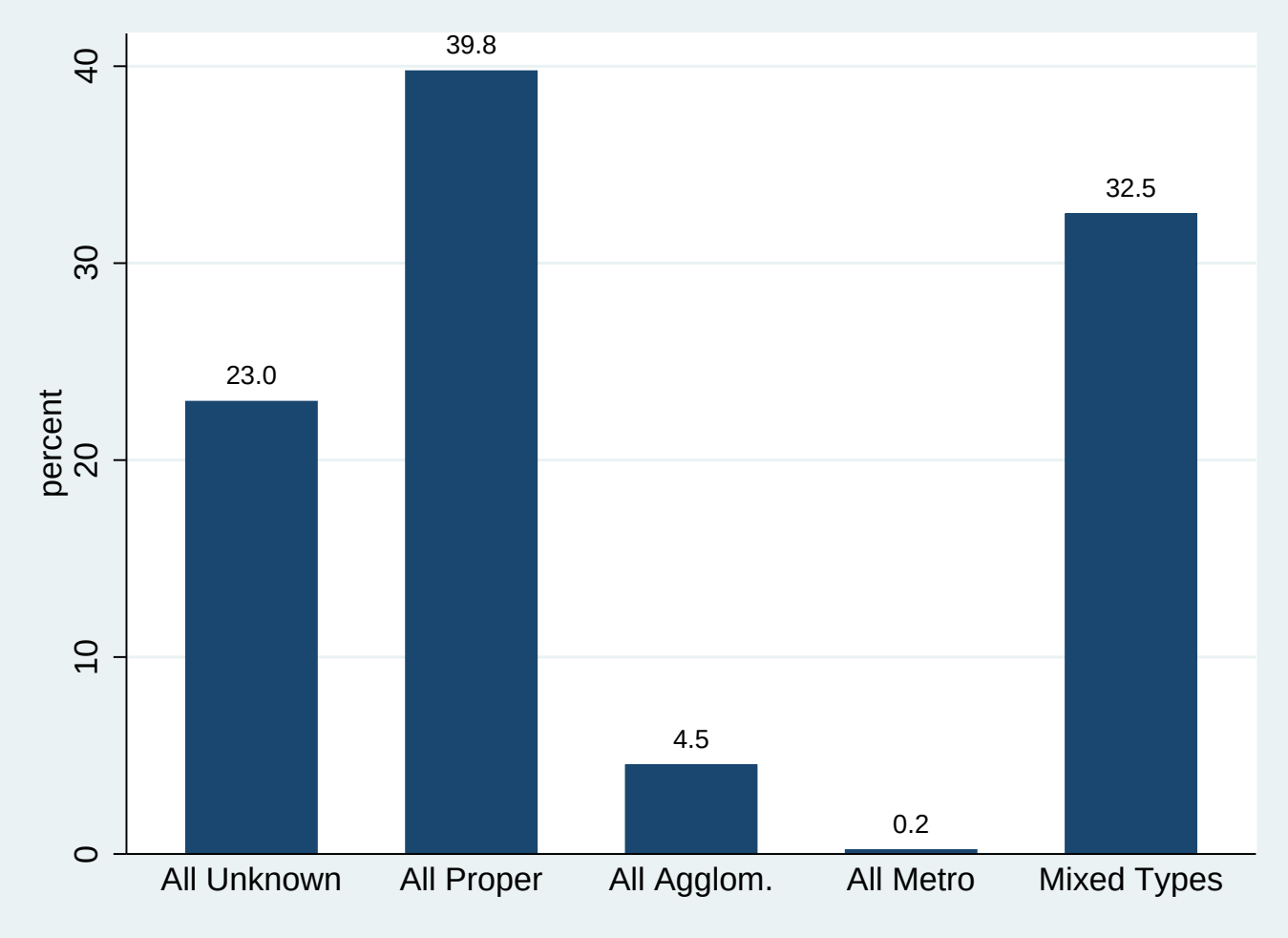
Strategy for Improving the Cities Database

1. Bring spatial content to a currently aspatial database.
   - Short-term goal: Vigorously clean and update the city data, include basic spatial identifiers, and explore spatial factors influencing growth.
   - Long-term goal: Assemble a geographic database using the smallest available geographic "building blocks" to which population data can be attached.
2. Closer scrutiny of smaller cities and towns, where a large percentage of urban residents live, and to areas on the peripheries of large cities or lying between cities that are likely to fuse with these urban populations.
3. Remote-sensing methods deployed as measurement, detection, and monitoring tools.

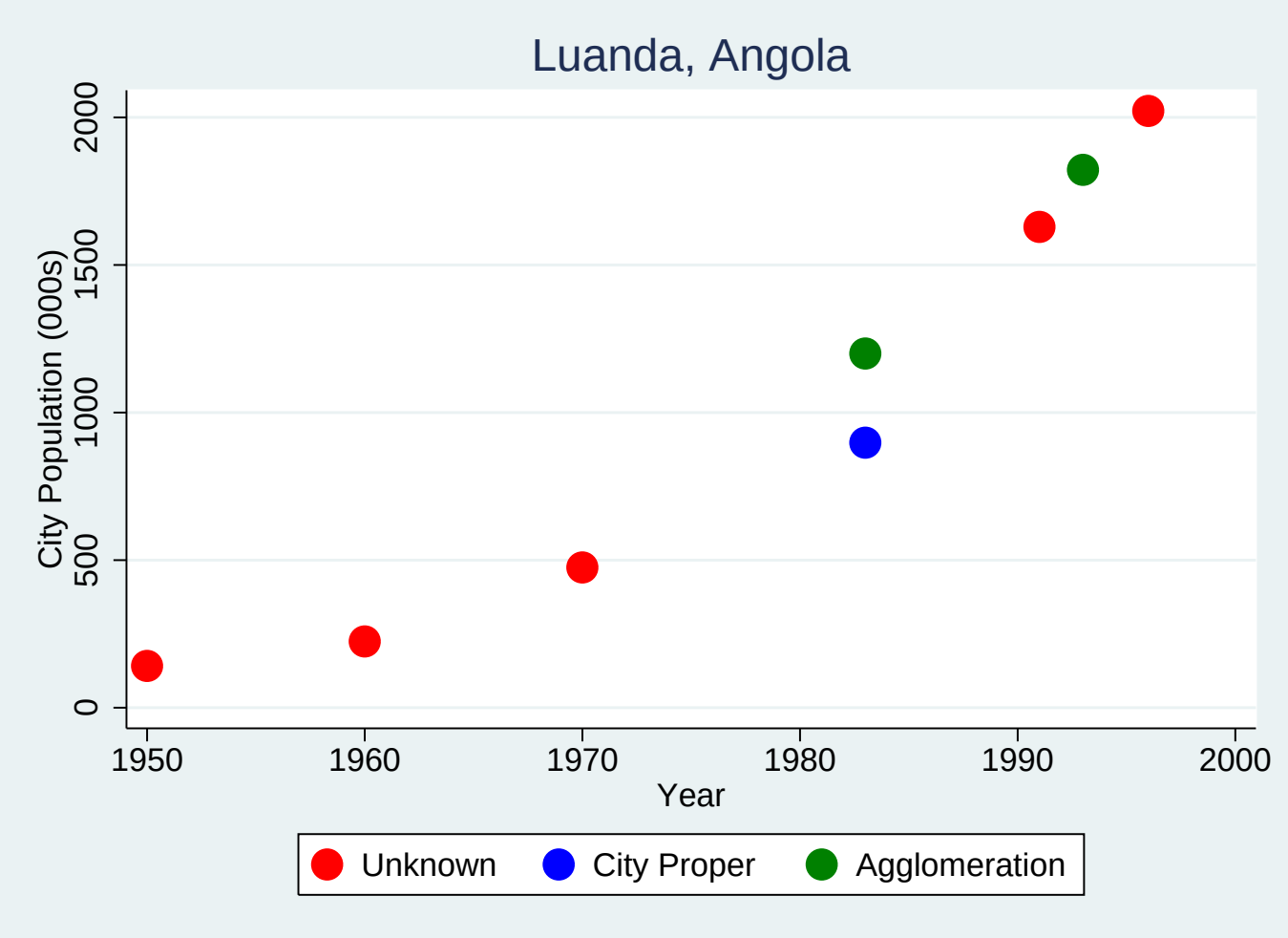
Multiple Records on Some 3,300 Cities in LDCs



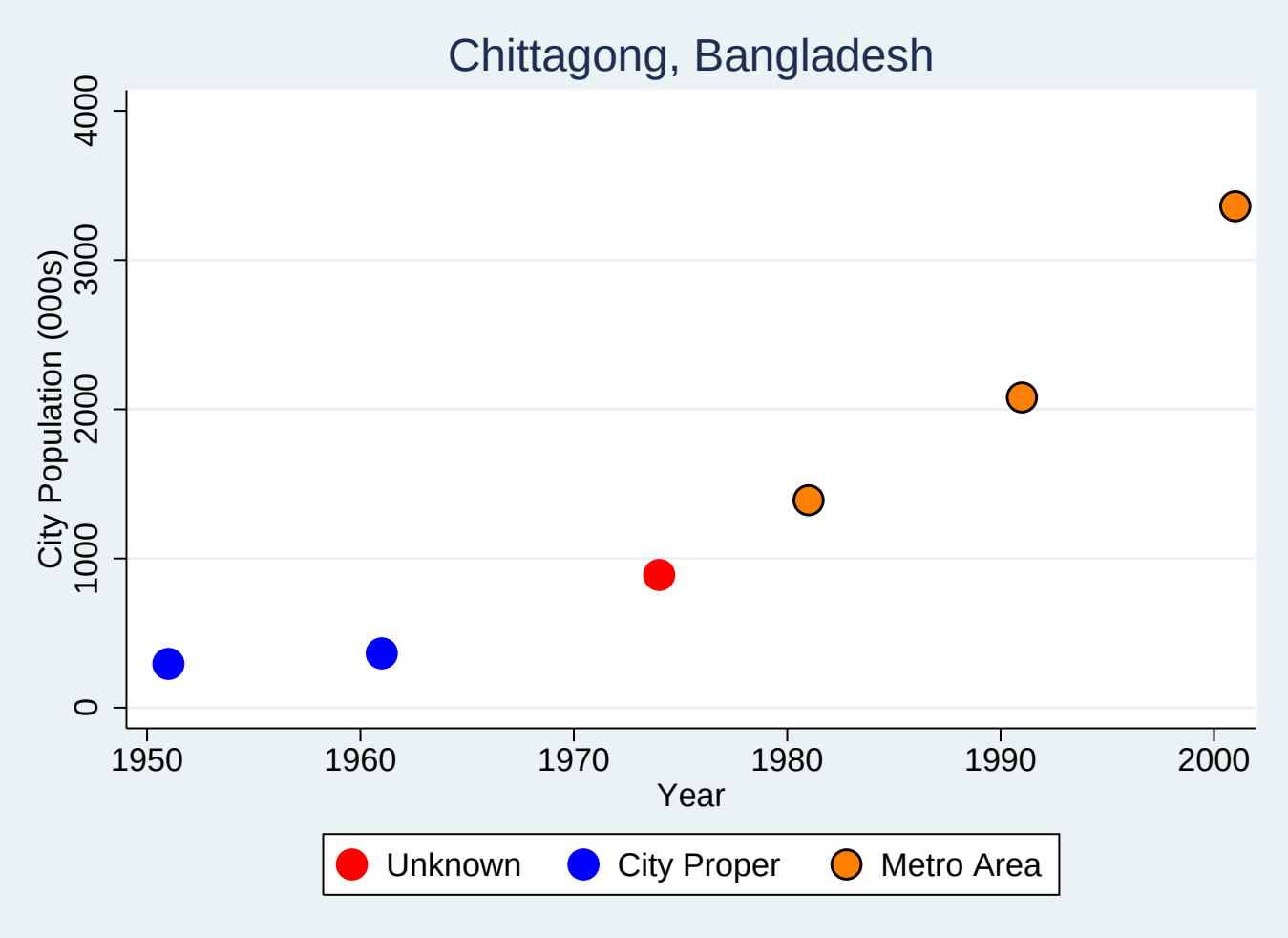
For One City, Statistical Concept Can Vary



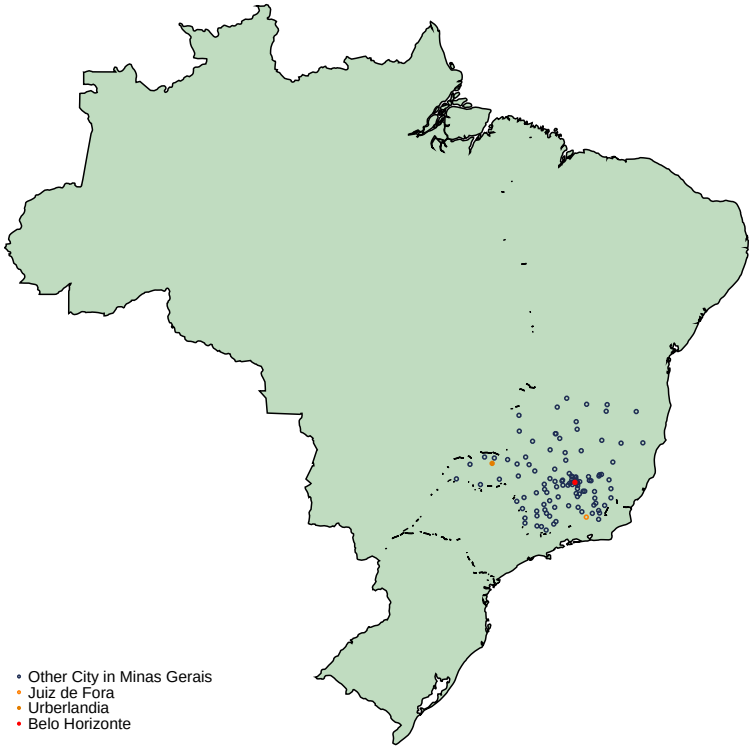
City Growth Histories: Luanda, Angola

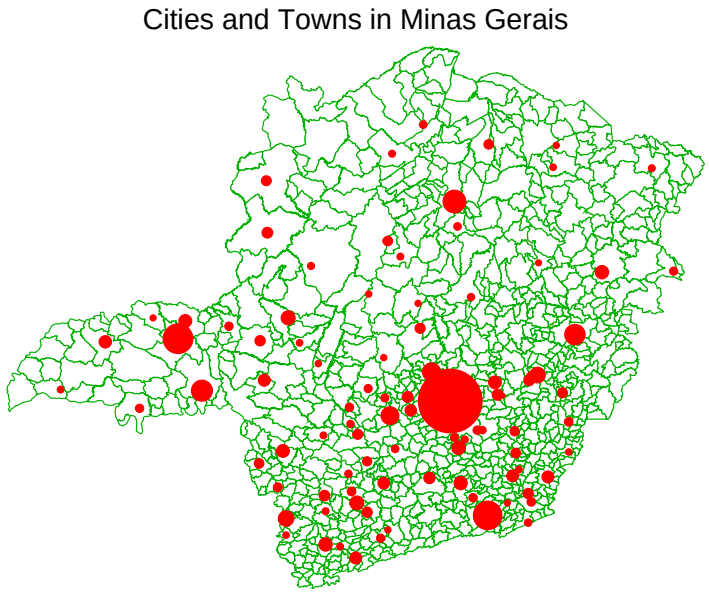


Chittagong, Bangladesh

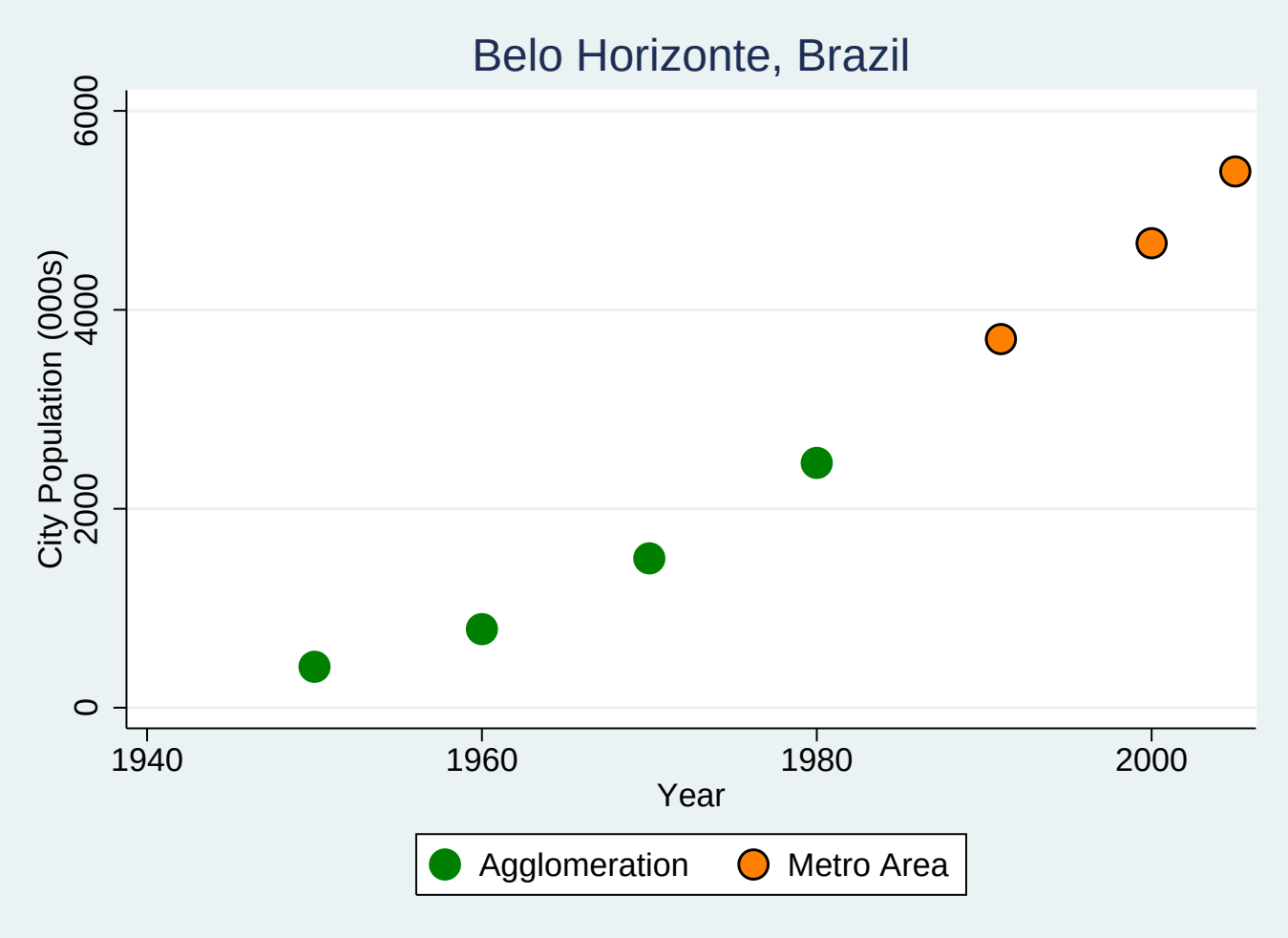


Situating Cities Spatially: A Brazilian Example

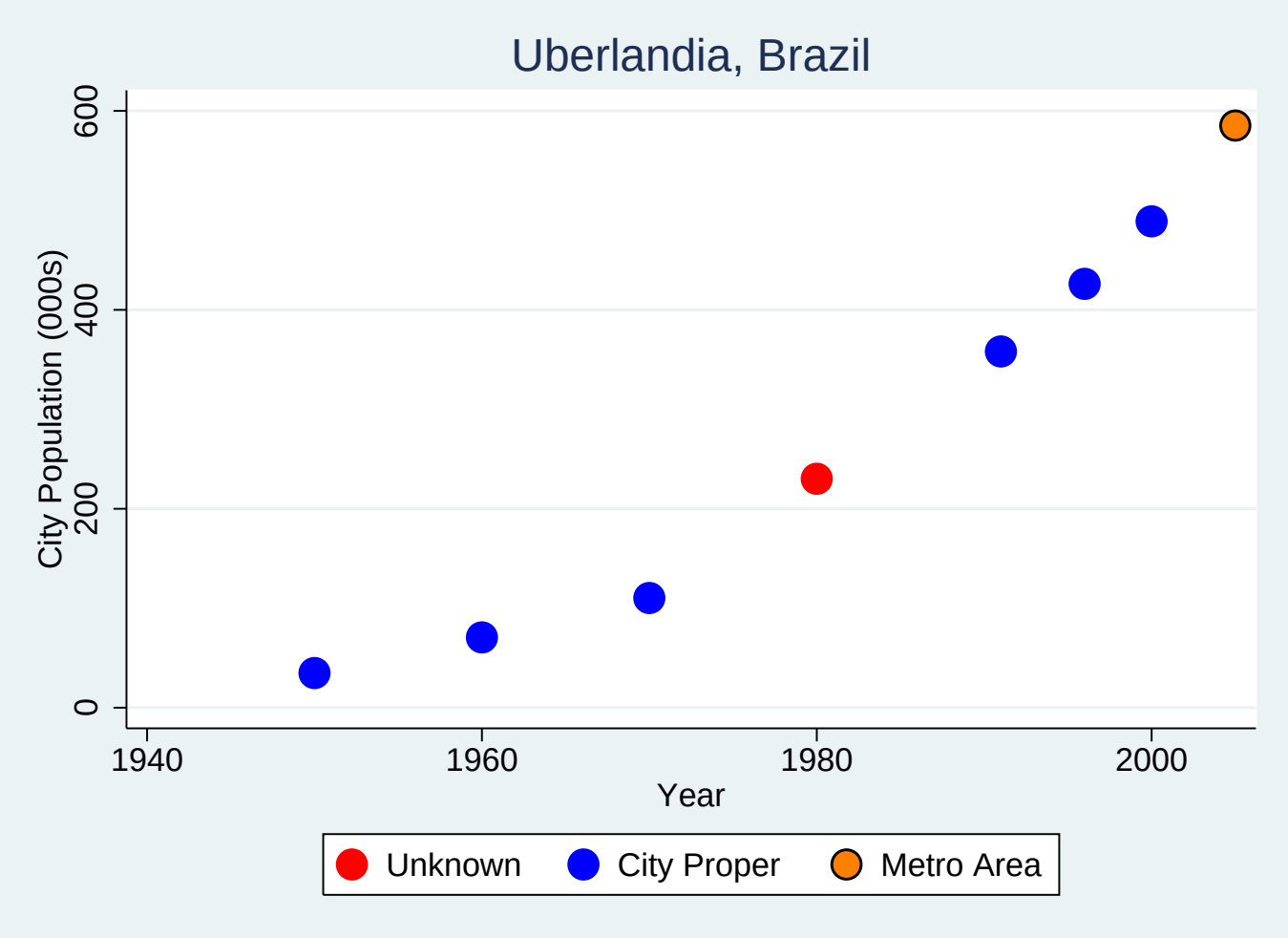




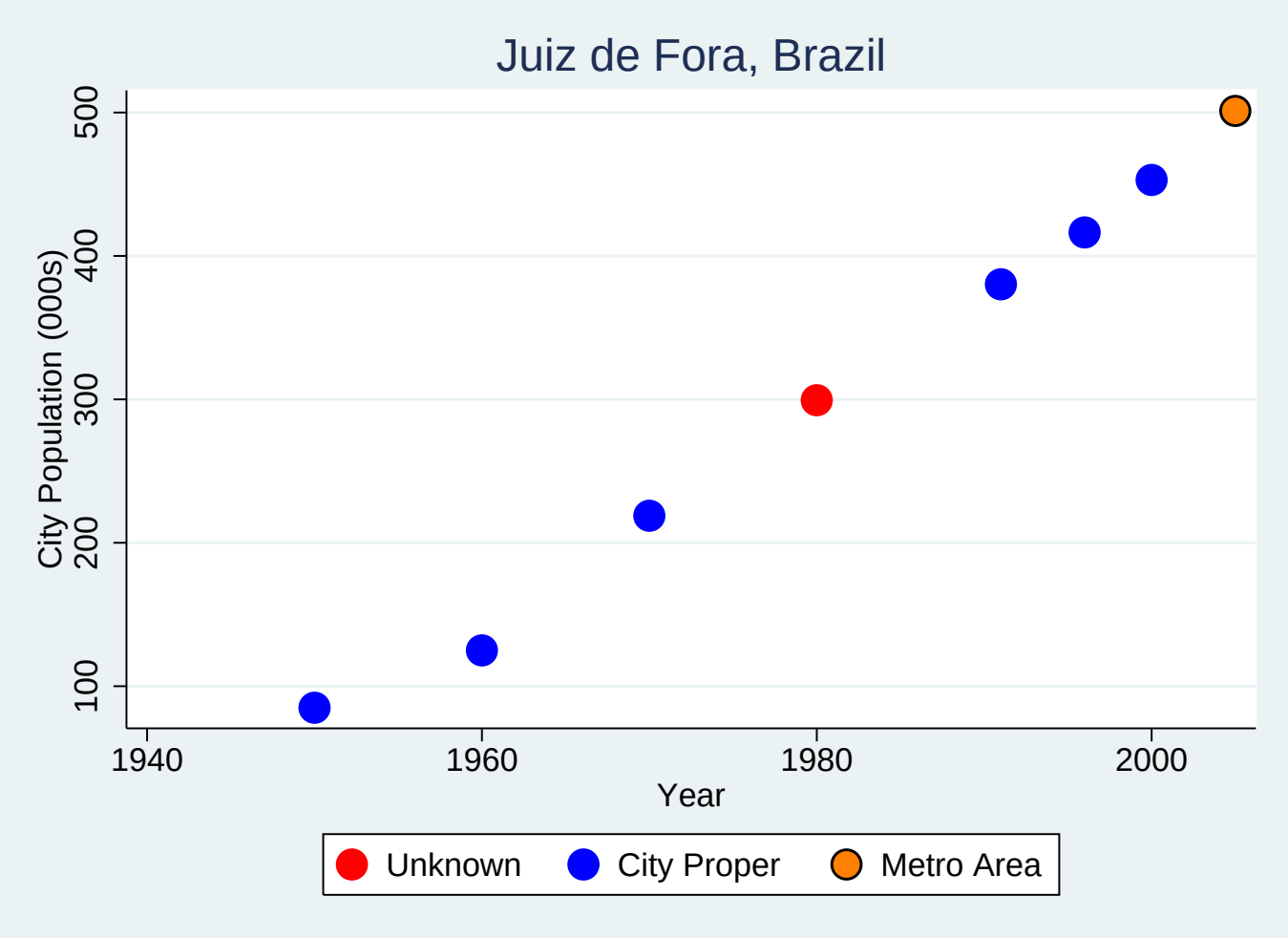
Three Cities in Minas Gerais: Belo Horizonte



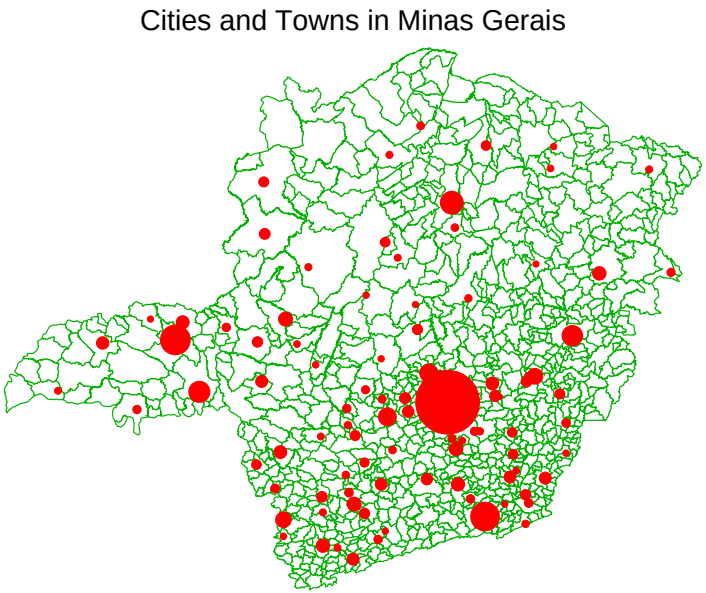
Uberlandia (western part of the state)



Juiz de Fora (southeastern part)



Explore Spatial and Economic Linkages Among Cities



In Sum: A Large Data-Sharing and Research Agenda

UN Population Division Seeks Partners

- Much data cleaning needed; city time-series must be scrutinized by local and international experts
- How to gather (and store) spatially disaggregated data from national censuses?
- A fully-detailed geographic database would incorporate geo-coded data on geographic features (elevation, slope, distance to coastline) and socioeconomic connections.
- Multiple views (night-lights, Landsat, radar imagery) of a city's spatial extent. Specialized expertise needed here.

Forecasting City Size and Growth

The Science Behind the UN's City and Urban Forecasts

The Population Division relies on simplistic methods that have not been updated in nearly 30 years, despite well-documented and substantial forecast errors. A high-priority area for research—new work would be welcomed by the Division.

Urban Population Forecast Errors for the Year 2000

	Mean Percentage Forecast Errors		
	1980–2000	1990–2000	1995–2000
Region			
East Asia and Pacific	3.9	26.7	-2.8
EAP excluding China	18.4	9.8	-0.4
Latin America and Carib.	19.8	5.4	-0.9
Middle East and North Africa	13.3	6.8	8.5
South Asia	27.2	19.7	2.7
Sub-Saharan Africa	21.8	23.4	5.5
Level of Development			
Low	23.1	18.3	3.2
Lower Middle	6.9	26.1	-1.3
Lower Middle excluding China	25.6	9.9	3.7
Upper Middle	12.8	8.9	0.8

Figures show population-weighted averages of $\left(U^f_{t,2000}/U_{2000} - 1\right) \cdot 100$ with $U^f_{t,2000}$ the UN forecast made in year $t = 1980, 1990, 1995$ of a country's total urban population in the year 2000, and U_{2000} the actual population in 2000.

How Ambitious Should Forecasts Be?

Some twenty-five years ago, in *Patterns of Rural and Urban Population Growth*, the United Nations warned,

> *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.*

Referring to Mexico City, whose population was to rise to 31 million by the turn of the century according to the 1980 projection, the United Nations cautioned,

> *Whether such size can actually be attained is, of course, questionable. It has been noted, for example, that population growth at Mexico City threatens 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.*

An Outpouring of New Data

All good points—and yet:

To an extent that probably could not have been foreseen in the early 1980s, several streams of new data—on demographic behavior as well as land cover, water supply, and environment—have emerged over the past decades. These new materials may well support more informed and credible city population estimates and projections than the experts of 1980 could have envisioned.

Using Urban Fertility, Mortality, and Migration Data

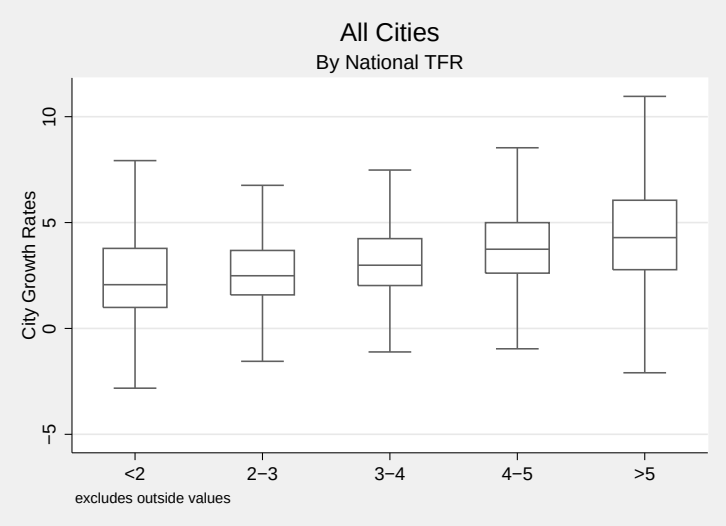
- The UN city and urban projection methods do not incorporate a wealth of information on urban fertility rates, mortality rates, and migration—despite the UN's own finding that 60 percent of urban growth is due to natural increase.
- Over 200 easily-accessible demographic surveys of developing countries since the mid-1970s.
- When linked to the UN's cities database, these surveys provide a basis for panel-data models of city growth.
- Great potential for Bayesian and other probabilistic forecasting methods.

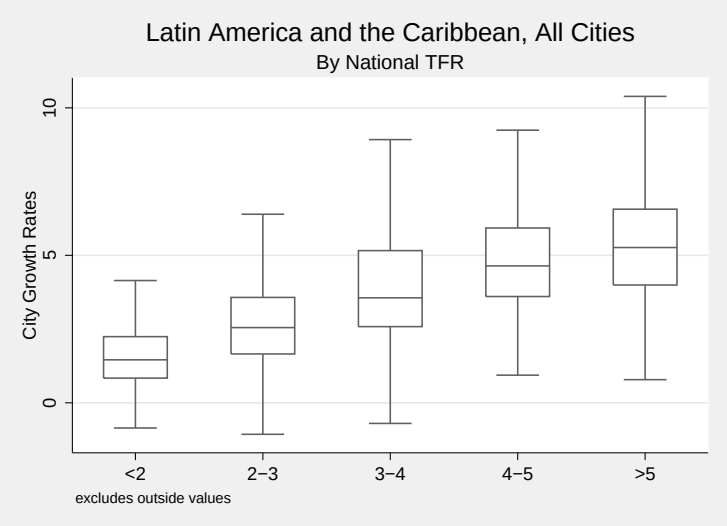
But How to Link Survey Respondents to Their Cities?

DHS and MICS Surveys

- Only about half of recent surveys in the DHS program, and even fewer in the MICS, have sampling cluster coordinates.
- These surveys do not identify the city or town in which the cluster resides, unless it happens to be the national capital! Nor do they provide the names of former places of residence for migrants. This longstanding serious weakness—fixable at trivial cost—must be addressed.

City Growth Rates by National Total Fertility Rates





Models for Cross-Section, Time-Series (Panel) Data

- A variety of such models can be applied to the cities database, each including explanatory variables.
- These would include urban total fertility rates and mortality rates (whether estimated nationally or for the region in which the city resides) as well as city-specific variables.
- Time-varying explanatory variables would need to be forecast.
- In contrast to deterministic forecasts, those based on models can be expressed in probabilistic terms, with confidence bands placed on city growth forecasts.
- Linkages among cities: Models of spatial error correlation and dependence.

A Basic City Growth Regression Model

A simple city growth model might take the form

$$g_{i,t} = \alpha + \beta \mathrm{TFR}_t + \delta q_t + v_{i,t}$$

with the i subscript representing city and t representing time. Here $g_{i,t}$ is the city population growth rate, TFR_t is the total fertility rate at the national level, and q_t is the national child mortality rate.

Specifying the Growth Rate Disturbance Term

Random or Fixed Effects

In this specification,

$$v_{i,t} = u_i + \epsilon_{i,t}$$

containing a term u_i that is specific to city i and which persists over time, with any remaining uncorrelated period-to-period variation relegated to $\epsilon_{i,t}$. A more elaborate specification is

$$v_{i,t} = u_i + \epsilon_{i,t} \text{ with } \epsilon_{i,t} = \rho\epsilon_{i,t-1} + w_{i,t}$$

containing persistent city-specific influences on growth u_i as well as temporary effects $\epsilon_{i,t}$ whose influence fades away over time (assuming $|\rho| < 1$).

Longitudinal City Growth Regression Models

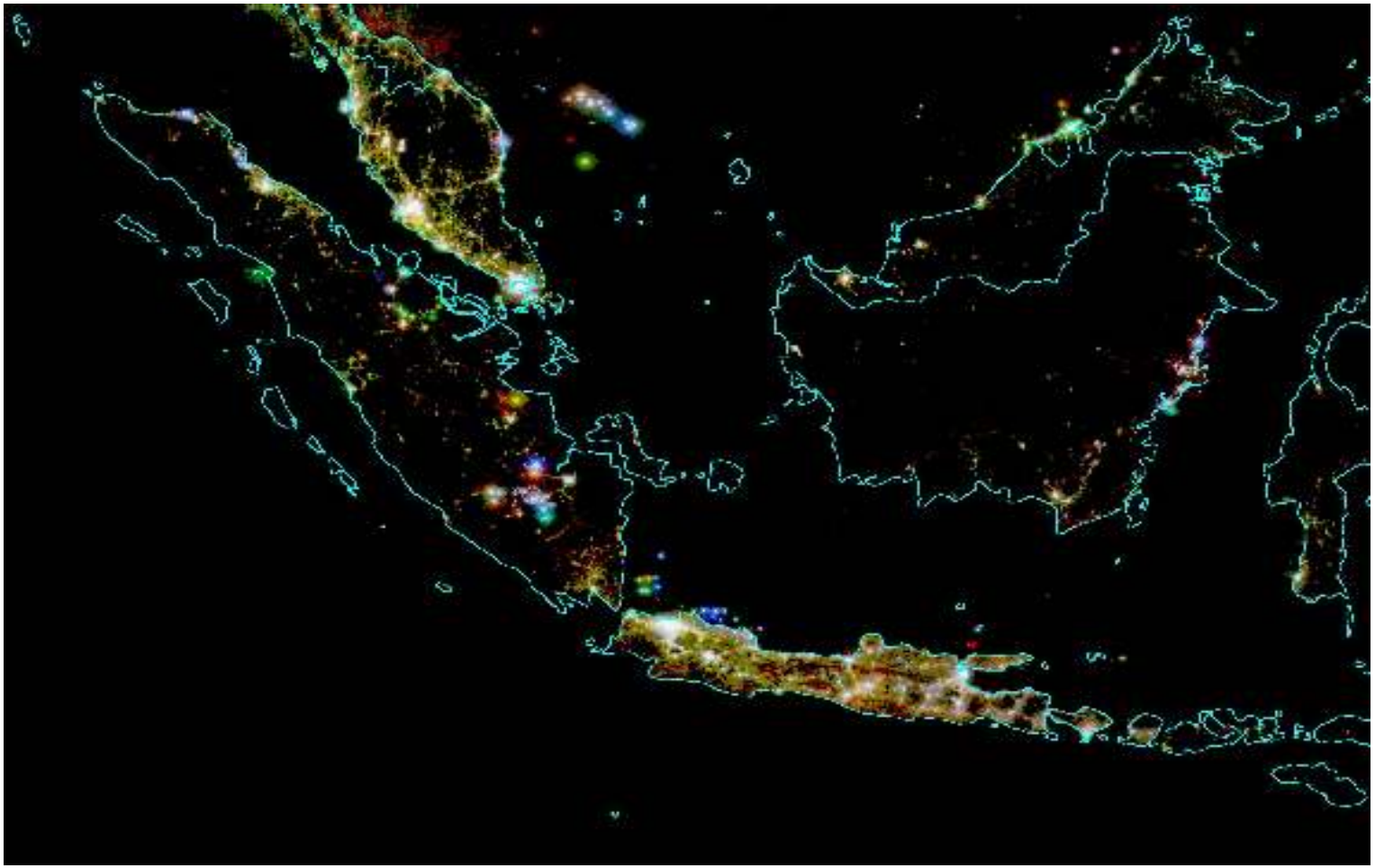
	OLS	Random Effects	Fixed Effects
Total Fertility Rate	0.602	0.685	0.887
(Z statistic)	(19.97)	(20.34)	(17.68)
Child Mortality Rate	-0.004	-0.005	-0.007
	(-5.53)	(-5.54)	(-4.49)
Constant	1.757	1.464	0.802
	(22.01)	(16.54)	(7.25)
Standard deviation of city effects σ_u		1.184	1.907
		(27.71)	
σ_ϵ	2.662	2.394	2.381
		(107.08)	
log-likelihood	-18624	-18446	-16568

NOTE: Fertility and mortality data are *national* rather than the preferred urban data.

Why Consider Bayesian Methods?

- Allows informed judgement to be brought to bear via specifications of prior distributions.
- Approach does not force cities to obey a common model—each city's parameters can be unique.
- Estimates and forecasts emerge naturally in probabilistic terms, so that confidence bands can be placed on city growth forecasts
- Measurement errors can be incorporated.
- Spatial error correlation and dependence can also be explored.

Combining Demographic with Remotely-Sensed Data



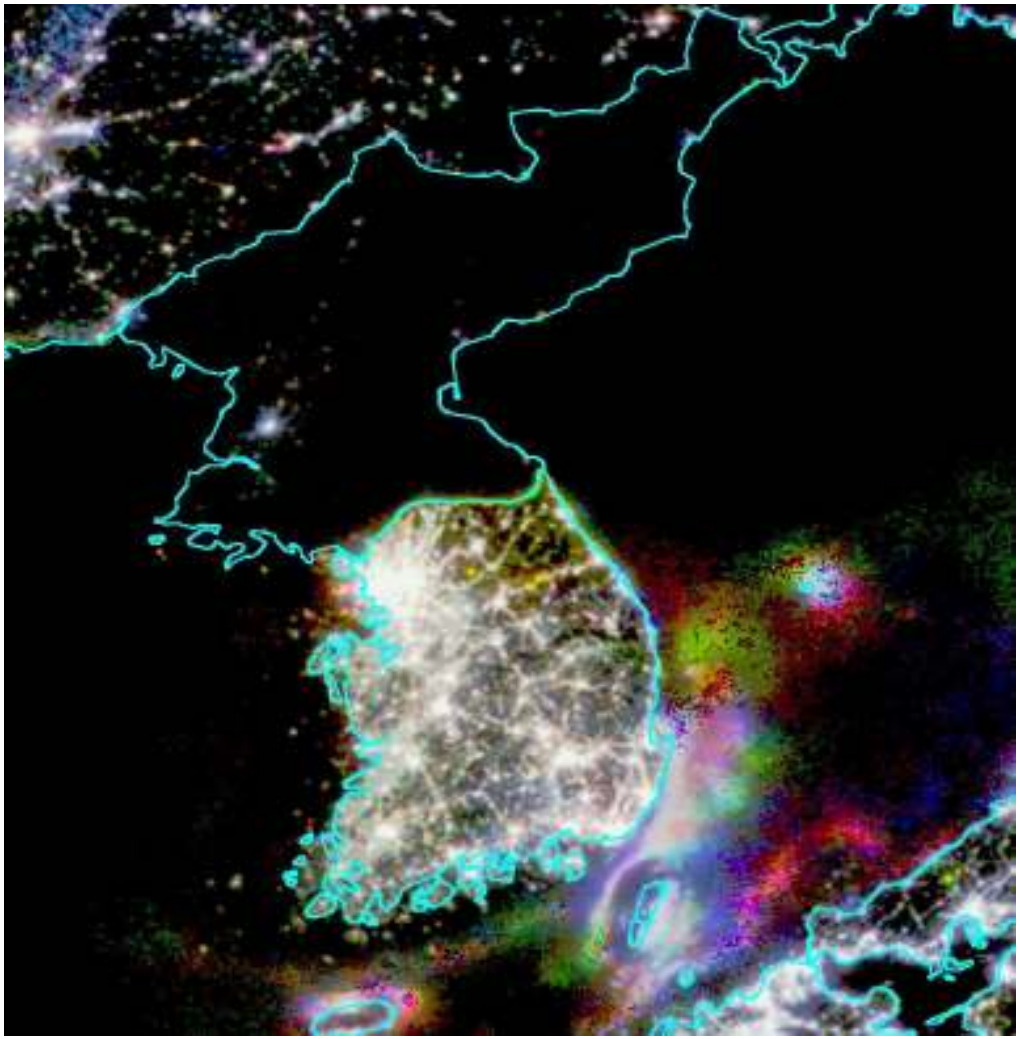
Source: Elvidge (2006)

Much Work Underway on Urban Remote Sensing

Active Research Interest

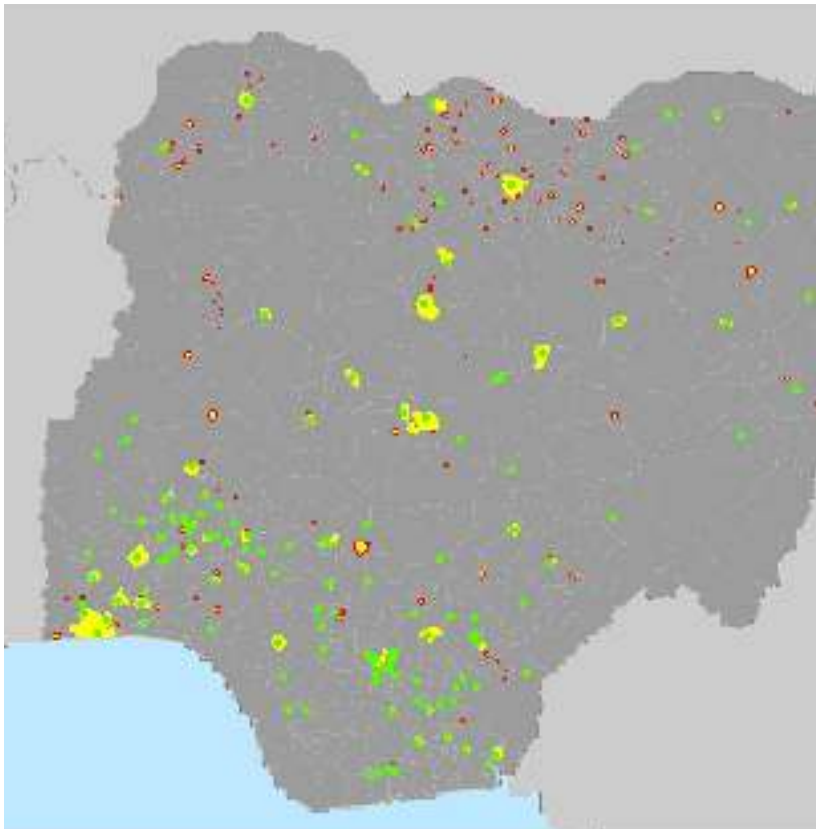
- Several conferences on new methods for detecting urban spatial extents, change, and internal features using remote-sensing methods. Dominated by physicists and earth scientists; social sciences under-represented.
- Models of spatial spread of LDC urban areas need attention.
- Imagery insufficient—must be matched with geo-coded population data (typically from censuses). Can't expect technological fixes without on-the-ground socioeconomic data.
- U.S. under-investing in its fleet of satellites focused on Earth observation. This program is facing serious risks over the next decade as current satellites age and begin to fail.

Night-Lights Reveal Large SES Differences



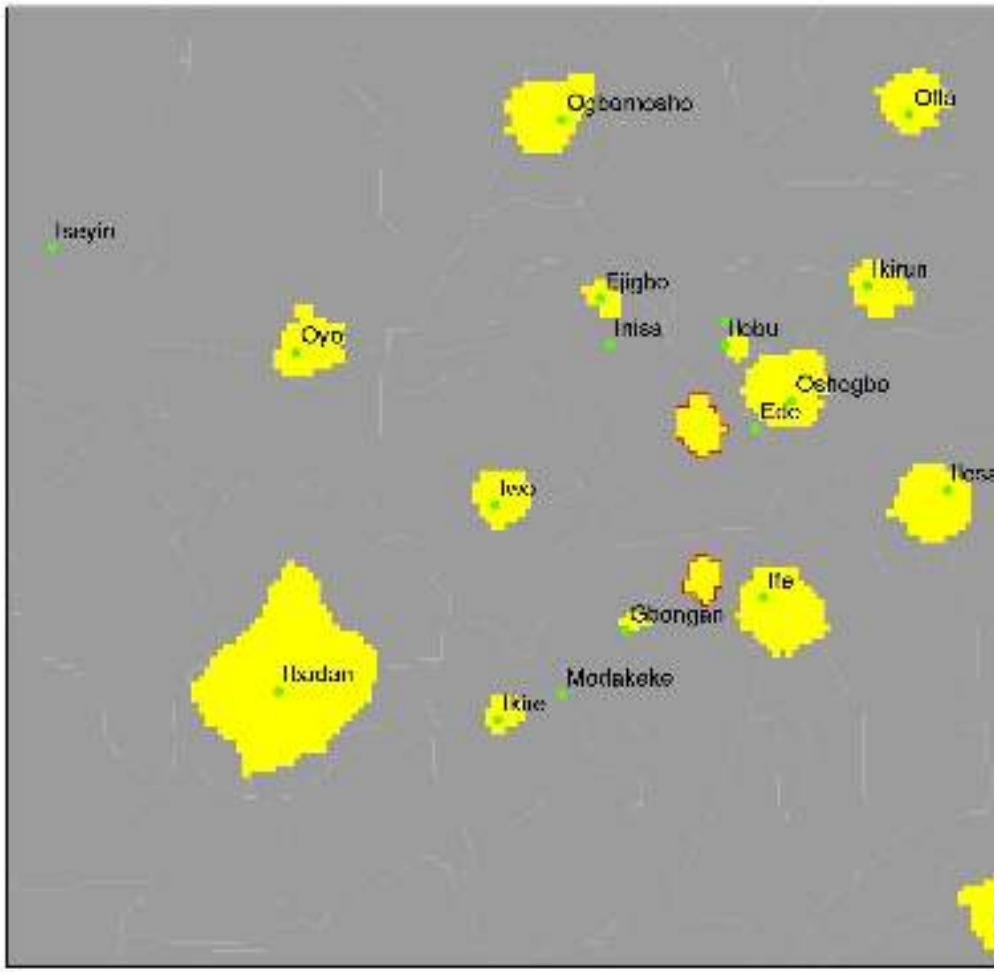
Elvidge(2006)

Reconcile Census and Remotely-Sensed Data: Nigeria

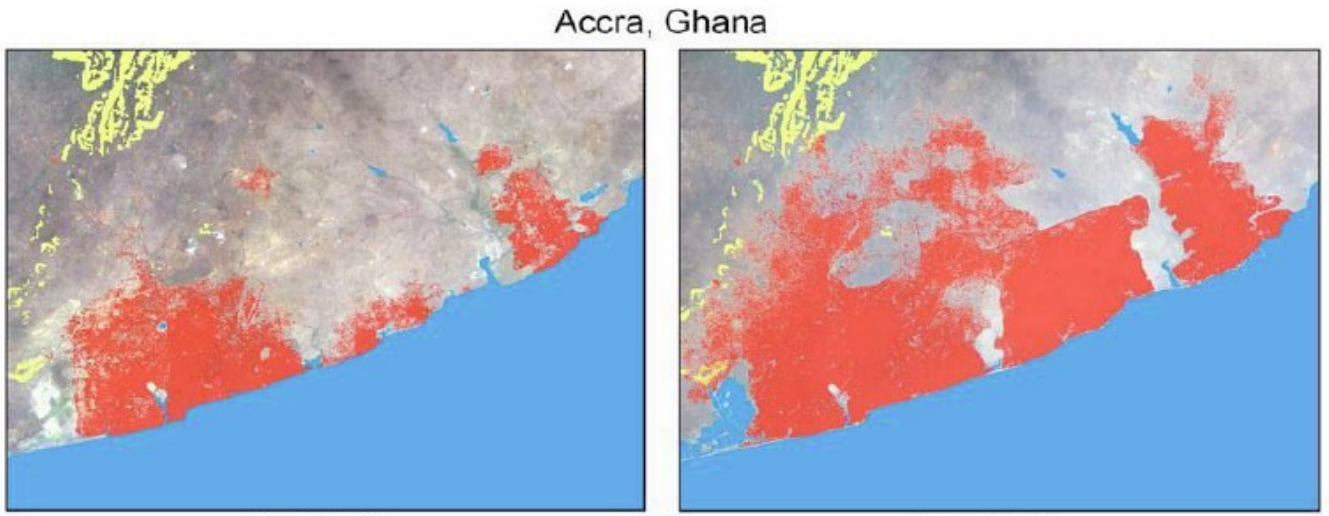


Green—in census but not detected in lights; red/yellow—lights but no census (Balk et al., 2006).

Need to Reconcile Data, continued



Forecasting Spatial Spread? Landsat Images of Accra



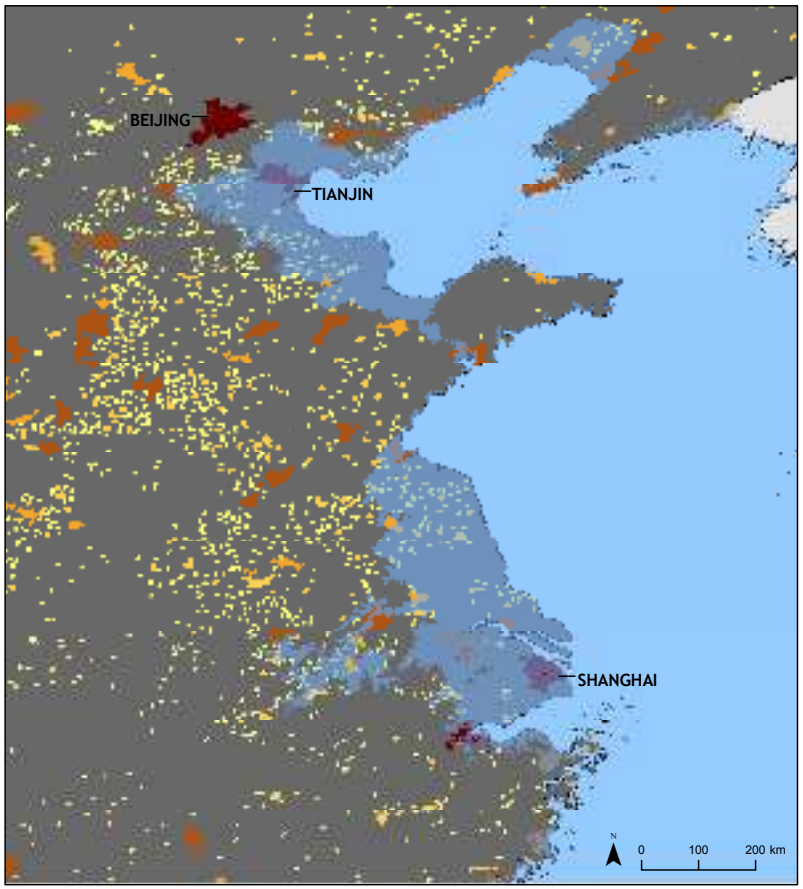
Measure	T_1	T_2	Annual % Change
Population	1,882,990	2,789,380	2.67%
Built-Up Area (sq km)	133.35	344.26	6.56%
Average Density (persons / sq km)	14,120.39	8,102.64	-3.66%
Built-Up Area per Person (sq m)	70.82	123.42	3.79%
Average Slope of Built-Up Area (%)	3.11	3.11	0.01%
Maximum Slope of Built-Up Area (%)	12.28	12.28	0.00%
The Buildable Perimeter (%)	0.71	0.73	0.15%
The Contiguity Index	0.69	0.80	1.01%
The Compactness Index	0.68	0.61	-0.75%
Per Capita Gross Domestic Product	$1,325.50	$1,836.23	2.21%

Source: Angel et al. (2006)

Night-Lights: Image of Shanghai

Source: Elvidge (2006)

Rising Sea Levels: Shanghai and Yellow Sea Region



"Low-elevation coastal zone" depicted in blue shading—area at risk from storm surges and flooding (McGranahan, Balk and Anderson, 2007).

Conclusions: Spatially-Disaggregated Population Data

- Remote sensing provides information on spatial extents, but not on population.
- National and local planners often operate with only rudimentary population data lacking spatial content.
- National censuses available but typically not processed to yield information useful at municipal and local levels.
- Need to train and involve national statistical offices (hands-on UN-HABITAT workshops effective).
- Need to organize intra-urban data in geographic information systems (GIS)—mapping is an attention-getting political tool.