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Population growth in the world's largest cities ☆

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This paper uses recent UN data to examine population growth in the world's 485 largest cities between 1950 and 2010. Three themes guide the analysis. First, the changing population size distribution of these large cities is studied. Second, the changing global urban center of gravity is calculated and mapped. As expected, this urban centroid drifted steadily to the south and east after 1950. Third, the cities are grouped into 10 clusters, ranked from fastest growing to slowest growing, based on the similarity of their 5-year population growth rates during the 60-year study period. Some generalizations regarding size and location are given for the cities in these clusters and future trends for the world's largest cities are briefly discussed.

Keywords: Large cities, size distribution, global urban centroid, population growth

Introduction

Academics, policy-makers, international agencies, and the media all continue to show great interest in the world's largest urban settlements. A variety of issues—in both the First and Third Worlds—has attracted wide attention, including: rural-to-urban migration (Ray, 1998), deprivation and inequality (Ley and Smith, 2000), housing availability and costs (Economist, 2003), the provision of basic services (Otiso, 2003), business occupancy costs (Economist, 2004), metropolitan governance (Brennner, 2002), city leadership (Grosveld, 2002), the quality of urban living (Mercer HRC, 2004), and the increasing centralization of financial and corporate control (Poon, 2003). Many of these issues are examined in the well-known volumes edited by Knox and Taylor (1995); Scott (2001), and Sassen (2002). In this paper, we confine our interest to the remarkable population growth experienced by the world's largest cities since the middle of the 20th century.

Large cities are characterized by the size, density, and heterogeneity of their populations (Wirth, 1938), but significant differences exist in their historic growth patterns (Berry, 1973). Some grow suddenly because of fortuitous locations, either with regard to ''resources that count'' or in relation to important trade or transportation routes (Berry and Horton, 1970; Gallup et al., 1999). In fact, many observers now believe that export-led development in the Third World favors the growth of large cities instead of their smaller rivals. Moreover, and especially in the First World, amenities and public investment are now widely acknowledged as factors underlying differential urban growth rates (Gyourko et al., 1999). Some observers also stress the roles of innovation, external economies in production, and local contextual conditions as being especially critical for sustaining high-tech or high-information firms and for attracting talented employees (Jacobs, 1969; Glaeser et al., 1992; Glaeser et al., 1995; Quigley, 1998; Florida, 2002). Other observers have pointed to the parts played by culture and national pride in the sustained growth of special-function urban centers, usually seats of government (Jefferson, 1939; Mommaas, 2004). Moreover, because cities are systemically related, the most populous and most urbanized nations will always generate a wide array of cities exhibiting different sizes, functions, and

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growth trajectories (Robson, 1973; Berry and Parr, 1988; Moomaw and Alwosabi, 2004). These issues are revisited at the end of the paper.

In the past two decades, much interest has turned to the greatest and most influential cities as globalization has renewed the importance of some places as decision and control centers. Here, the contributions of three persons seem especially influential. First, Hall (1984) initiated the contemporary study of world cities, mostly First World mega-cities like London and Tokyo that had common origins in national government and international trade but had successfully evolved into important global centers of business control, professional services, and culture. Hall's book has passed through numerous editions and in the most recent version, he compares eight especially large conurbations. His wisdom on urban topics is summarized in Hall (1999), a wonderful commentary on the important role of cities throughout history. Next, Friedmann (1986), in extending Friedmann and Goetz (1982), must be noted for advancing the world city hypothesis. Here he conjectures that our very largest cities should not only be ranked by their economic attributes but also by their place in history, their multicultural features, and their role in the evolving global economy. Later, in Friedmann (1995), he argued that positioning in the world urban hierarchy is fluid at all but the highest levels. Finally, the more recent ideas of Saskia Sassen (1991, 2000) must be recognized. Sassen has argued that three factors especially determine the importance of the *global city* in a rapidly changing world order—the presence of the headquarters of multinational corporations, major financial institutions, and other related corporate services. Her underlying argument is that globalization of the economy concentrates decision-making power and wealth in a decreasing number of cities. While others are notable in the discussion—see Beaverstock et al. (2000); Castells (1989); Meyer (1986); Smith and Timberlake (1995, 2002); Taylor (1997), and Taylor et al. (2002)—current inquiry regarding the world's largest cities seems mainly to conform to ideas initiated by Peter Hall, John Friedmann, and Saskia Sassen.

However, some very different perspectives are taken in the discussion of city growth in the less developed regions—Africa, Asia, and Latin America—where urbanization reached 42% in 2003 (compared to 74% in the more developed regions). A more radical literature on Third World urbanization stems in part from the popular reader prepared by Agu-Lughod and Hay (1977), whose contributors largely offered stinging criticisms of capitalism. Current concerns are somewhat more practical and focus on the daunting planning and management issues facing literally hundreds of large Third World cities, where the scale and complexity of providing urban services remains very challenging to both the private and public sectors. The introduction of property rights and strategies like public intervention in urban land markets are often advocated as measures that could alleviate in part a whole host of very pressing urban problems (Devas and Rakodi, 1993).

From demography and economics comes the less radical view that city growth in modernizing societies represents a sudden transition between agrarian poverty and, hopefully, some degree of material affluence (Kelley and Williamson, 1984). Here city in-migration is seen as being especially problematic, for numbers rise quickly during the earliest stages of national economic growth—the so-called take-off—before they fall off afterward, as the economy matures (Harris and Todaro, 1970; Zelinsky, 1971). This migration behavior is increasingly seen by many as being entirely rational, given that many large Third World cities provide better wages, more consumer opportunities, and a wider range of public goods than smaller-sized places or rural areas (Zhao et al., 2003). Moreover, there is increasing evidence from the modernizing nations that city growth behaves in some sort of stochastic manner, much like it occurs in the more advanced nations (Resende, 2004).

In this paper, we confine our analysis to the population growth experienced by the world's largest cities between 1950 and the present time, using data recently provided by the United Nations (2004) in *World Urbanization Prospects: The 2003 Revision*. Here is population information for all urban agglomerations having 750,000 or more inhabitants in the year 2000. Historical data go back to 1950 and projections are made to 2015, but in this paper we confine our interest to the 485 cities having a population of one million or higher (pop > 1m) *sometime* during that time period, while paying special attention to the 60-year period 1950–2010. We do note that a handful of very important cities, especially in Europe, are not included in the UN data set simply because these places failed to satisfy the 0.75 million population threshold. Moreover, in the paper we have two somewhat different applications of the data set. Usually we make use of the *full* data set, where we include all 485 cities at all points in time. But sometimes we are more selective and only make use of that *part* of the data set that includes cities having populations of one million or higher at a specific point in time.

We note at the outset that these 485 large and significant cities comprised a greater and greater share of the world's total population as the 20th century progressed. Using other UN data given in the same report, we calculate that these cities accounted for 13.3% of the world's total population in 1950, 17.4% of the world total in 1980, and should account for a remarkable 20.3% of the world total in 2010. A similar story ensues when we compute the elasticity of (average) city population with respect to global population, based on seven points in time between

1950 and 2010. For every 1% increase in the global population, the average city in our data set experienced a population increase of 1.37%. Clearly, the million-person cities in our data set were growing much more quickly than overall global population between 1950 and 2010.

Throughout this paper, we only focus on the population features per se of the million-person cities and do not attempt to develop models about their growth. This will be the subject of other research. In fact, we restrict our interest to three main issues. First, we analyze the global size distribution of large urban places and see how this size distribution has changed over time. Here, simple models are introduced that estimate: (i) the number of million-person cities and (ii) the number of million-person cities in specific population size classes, at all years between 1950 and 2010. Later, we study the mobility of these cities across the population size classes, an exercise that sheds light on the remarkable large-city growth that continues to be experienced around the entire world. Second, we address the geographic distribution of the world's largest cities. Here, we show how the *world's urban center of gravity* has shifted substantially in recent times, as population growth has exploded to the south and east of the world's ''initial'' urban centroid, which is calculated using the UN's 1950 data. Third, we focus explicitly on the *population growth histories* of the million-person cities and identify some of the different temporal paths that these metropolises have followed in getting to their present population levels. The 5-year population growth rates of the 485 large cities in the data set are used to identify 10 clusters of places, having somewhat different growth trajectories. Some attributes of these clusters, including the locations of the clustered cities, are then briefly discussed.

Population sizes and size classes

Of initial interest are two basic questions. First, how many cities actually had a population equal to or exceeding 1 million at the beginning of each decade of our study period? And second, what was the average size of these cities at the beginning of each decade? As *Table 1* indicates, in 1950 there were 86 million-person places and their mean population size was 2.31 million; in 2010 it is expected that there will be 463 million-person places and they will have a mean population size of 2.91 million. The numbers and mean population sizes for the various intermediate years are as follows: 1960, 115, 2.59m; 1970, 174, 2.59m; 1980, 238, 2.61m; 1990, 315, 2.65m; and 2000, 388, 2.76m.

Demographers and geographers are often interested in the distribution of cities across various population size classes. For our purposes, the UN data have been placed into six different size classes using appropriate population intervals. Size class 0 contains places with populations less than 1 million (i.e., <1m), size class 1 contains places with populations between 1 million and 2 million (>1m but <2m), and so on. These intervals, which are smaller than those of most UN studies, have been chosen intentionally so that, for the most part, the midpoint population doubles from one size class to the next. This would seem the most reasonable way to present frequency data for skewed distributions of this type. *Table 1* assigns the 485 cities in our data set to these six different population size classes at the beginning, middle, and ending years of our 60-year study period.

In 1950, 82.3% of the places had populations below 1m and only two mega-cities (New York and London) had populations exceeding 8m. But 30 years later, in 1980, only 50.9% of those places had populations below 1m and 13 more mega-cities had grown to have populations exceeding 8m. The UN projections indicate that, in 2010, only 4.5% of the world's largest cities in our data set will have populations below 1m and, incredibly, 27 mega-cities should have populations exceeding 8m.

By plotting the appropriate city numbers, for the same seven years as before, we see that a linear relationship approximates the relationship between time (the year) and the ever-growing number of million-person cities. The OLS regression estimate is:

$$N(\text{pop} \geqslant 1\text{m}) = 59.321 + 6.504 * (\text{year} - 1950),$$

where the slope coefficient is significant at the 0.01 level. This estimate indicates 6.50 cities were added *on average* to the million-person city club each and every year during the study period. Moreover, other plots indicate that linear relationships approximate

Table 1 Numbers of cities in population size classes, *N* = 485

Interval	Class	1950		1980		2010	
		No.	%	No.	%	No.	%
<1m	0	399	82.3	247	50.9	22	4.5
1m–2m	1	52	10.7	143	29.5	257	53.0
2m–4m	2	22	4.5	61	12.6	130	26.8
4m–8m	3	10	2.1	19	3.9	49	10.1
8m–16m	4	2	0.4	14	2.9	20	4.1
>16m	5	0	0.0	1	0.2	7	1.4

Note. m refers to million persons.

each of the six population size class allocations during that same time period. Here, the appropriate OLS regression estimates are as follows:

$$N(0) = 425.679 - 6.504 * (\text{year} - 1950),$$
$$N(1) = 39.286 + 3.643 * (\text{year} - 1950),$$
$$N(2) = 13.536 + 1.854 * (\text{year} - 1950),$$
$$N(3) = 5.143 + 0.571 * (\text{year} - 1950),$$
$$N(4) = 2.250 + 0.325 * (\text{year} - 1950),$$
$$N(5) = -0.894 + 0.111 * (\text{year} - 1950).$$

Again our greatest interest is in the six slope estimates, all of which are statistically significant at the 0.01 level. These coefficients indicate that, on average, the 6.50 cities that grew out of the lowest size class each year were ''added'' to the other five size classes in the following proportions: 1, 56.0%; 2, 28.5%; 3, 8.8%; 4, 5.0%; and 5, 1.7%. So, to draw a specific comparison, cities were entering the second highest size class (>8m but <16m) at about three times the rate that they were entering the very highest size class (>16m). It is interesting to note, too, that the ratios of the slope coefficients for $N(5)$ through $N(1)$, when standardized by the coefficient of 0.111 for $N(5)$, are 1, 2.92, 5.14, 16.7, and 32.8, indicating that the average annual size-class allocations for 1950–2010 were very similar to those that would be generated by a hierarchical process (Mulligan, 1984).

At this juncture, we should make a few cautionary observations about our findings. First, data from another source (Mountjoy, 1976) allows consideration of counts for the million-person cities reaching back further in time until 1920. A new regression suggests that the slope estimate given above is too high for the entire 20th century (the alternative estimate is 4.722). Second, there is some evidence that near the middle year of our study period, 1980, a change took place in the various allocation rates. Smaller places began to join the million-person city club much faster during 1980–2010 than they did during the earlier period 1950–1980. But the allocations to the various population size classes are more complex and seem to defy an easy explanation. In any case, the exact reasons for this break with the past remain somewhat unclear and a better-fitting family of models will not be estimated until the issue has been given more study. Moreover, we fully recognize that ours is a very simplistic interpretation of the actual allocations that occurred during 1950–2010, one that does not trace out the continuous movements of the various million-person cities across the six size classes.

Geographic distribution

Now we shed some light on the geographic distribution of the world's largest cities. As is well known, the 485 metropolises are distributed around the world somewhat unevenly. *Figure 1* shows the locations of all cities having populations of one million or more in 1950, *Figure 2* shows those city locations in 1980, and *Figure 3* shows those city locations expected in 2010. The numbers of places (in the full data set) on each continent are as follows: Africa, 45 [9.3% of the total]; Asia, 245 [50.5%]; Europe (including all of the former USSR), 70 [14.4%]; North America, 73 [15.1%]; Oceania, 6 [1.2%]; and South America, 46 [9.5%]. In 1950, Europe contained cities that were on average the most populous (1.6 million), but by 2010 the South American cities should be on average the largest (3.3m). Moreover, the handful of million-population cities found in Australia and New Zealand are expected to be on average the smallest (2.3 million) at the end of our study period.

Some standard macroscopic features of the data set are very informative and should be shared at this time. In this paper, we confine our interest to the two coordinates on the earth's surface and do not include the third coordinate relative to the earth's center (Yuill, 1987). We begin with a few properties that do *not* take into account the different population sizes of the cities. The mean longitude of the 485 cities, which must be adjusted for convergence of the meridians at high latitudes, is 35.68° East and the mean latitude is 25.53° North. This point is usually called the (unweighted) population centroid, but frequently it is called either the center of gravity or the spatial mean. When considering only that portion of the 485 cities (the partial data set) whose population is 1m or higher, this centroid migrated as more and more cities eventually achieved the required population threshold. In 1950, the centroid was at 31.69°E, 31.57°N, in 1980 it was at 32.71°E, 29.87°N, and in 2010 it is expected to be at 36.39°E, 25.52°N. Evidently those new cities satisfying the million-person threshold after 1950 were largely found to the south and east of the 1950 ''initial'' center of gravity, inexorably driving the center of gravity in those same directions.

Great circle distances can be computed between each city location and this ''initial'' population centroid. In fact, we have computed (unweighted) standard distances for all 485 cities. These distances vary between a minimum of 261 miles (to Medina, Saudi Arabia) and a maximum of 9899 miles (to Auckland, New Zealand) and their average is 4261 miles. However, what is really interesting is the number of places that are included within circles of ever increasing radii that are centered on the point 35.68°E, 25.53°N. Using equal intervals of 1000 miles, 21 cities are captured in the smallest circle having a radius of 1000 miles. The numbers of places captured by rings of ever larger size are as follows: between 1000 and 2000 miles, 42; 2000–3000 miles, 120; 3000–4000 miles, 27; 4000–5000 miles, 102; 5000–6000 miles, 61; 6000–7000 miles, 50; 7000–8000 miles, 48; and greater than 8000 miles, 14. This

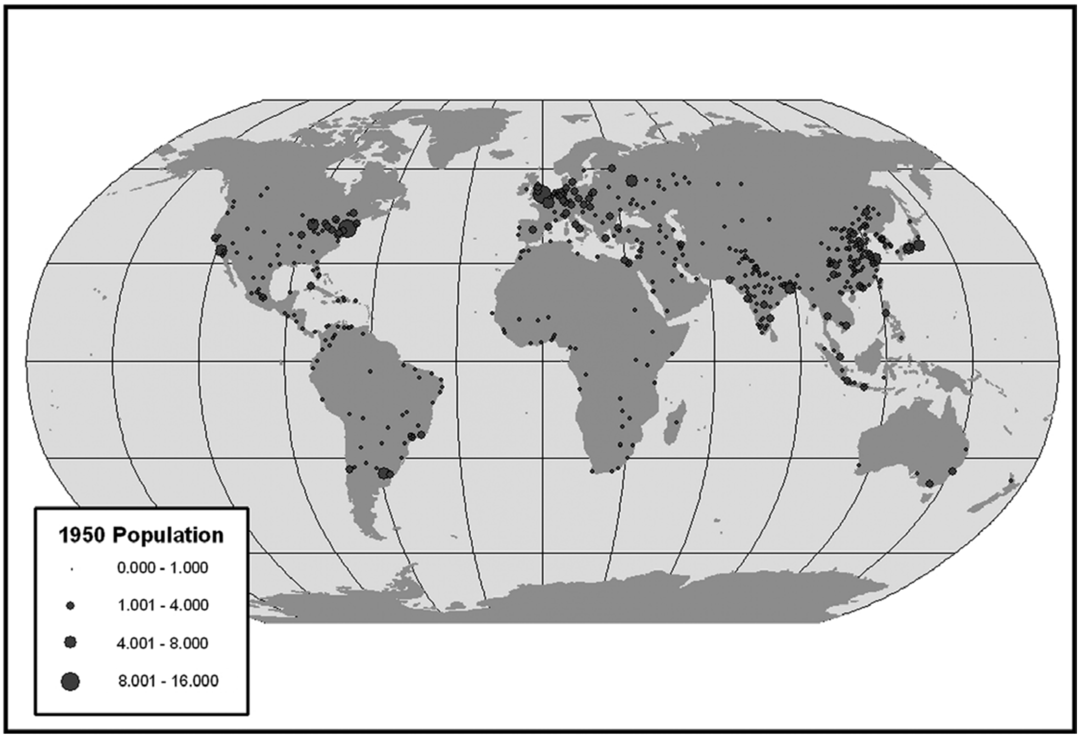

Figure 1 Million-person cities in the beginning year.

provides clear evidence of a bimodal geographic distribution, where numerous places are found in the third ring (24.7% of the total, dominated by India) and the fifth ring (21.0%, dominated by China), but there is a relative absence of cities found in the fourth (5.6%). Unfortunately, this makes any application of the standard distance measure, a statistic that is analogous to the well-known standard deviation of descriptive statistics, somewhat problematic.

More interesting, though, are the centroids when they are *weighted* for the different population sizes of the cities. These are shown in *Table 2* for each decade between 1950 and 2010. In fact, the weighted centroids can been computed in two different ways: (a) for all 485 cities and (b) only for those cities having one million or more persons in that year. In either case, however, we see again that the population centroid steadily migrated from the higher latitudes to the lower latitudes and from the moderate-eastern longitudes to the far-eastern longitudes. Yuill (1987) made the same observation some time ago in his study of the world's 25 largest cities. Consult *Figure 4* to get a better geographic perspective on how these two slightly different weighted centroids migrated during the late 20th century. In case a, the centroid began just off Alexandria in 1950, migrated up the Nile valley for 30 years, and then drifted over to the western shore of the Red Sea near the Egypt-Sudan border. But in case b, the centroid began somewhat farther to the west, near Benghazi, and moved roughly along a southeastern diagonal until it ends up at virtually the same location as case a in 2010. Future research should decompose the movement of this centroid (and the associated standard distance) into separate effects related to the growth in numbers (for "new" places) and the growth in populations (for "existing" places) of the million-person cities between 1950 and 2010.

Mobility, stability, and drift in city size

A simple cross-tabulation of class membership, for appropriate beginning and ending years, provides useful insights into the mobility of the world's largest cities across the designated population size classes. We are particularly interested in the *stability* and *drift* of the population size distribution of these cities. By stability, we refer to whether or not cities are, relatively speaking, remaining in or leaving their initial size classes. If no city ever left its beginning size class we would have perfect stability (no mobility) and if all cities left their beginning size classes we would have perfect instability (total mobility). Of course, both of these are very unlikely scenarios, especially for global urban growth. By drift, we mean whether the cities are mostly ascending or descending in numbers across the tiered population size classes. If more cities are ascending than descending the population ladder, then we have evidence of upward drift in city populations, and vice versa.

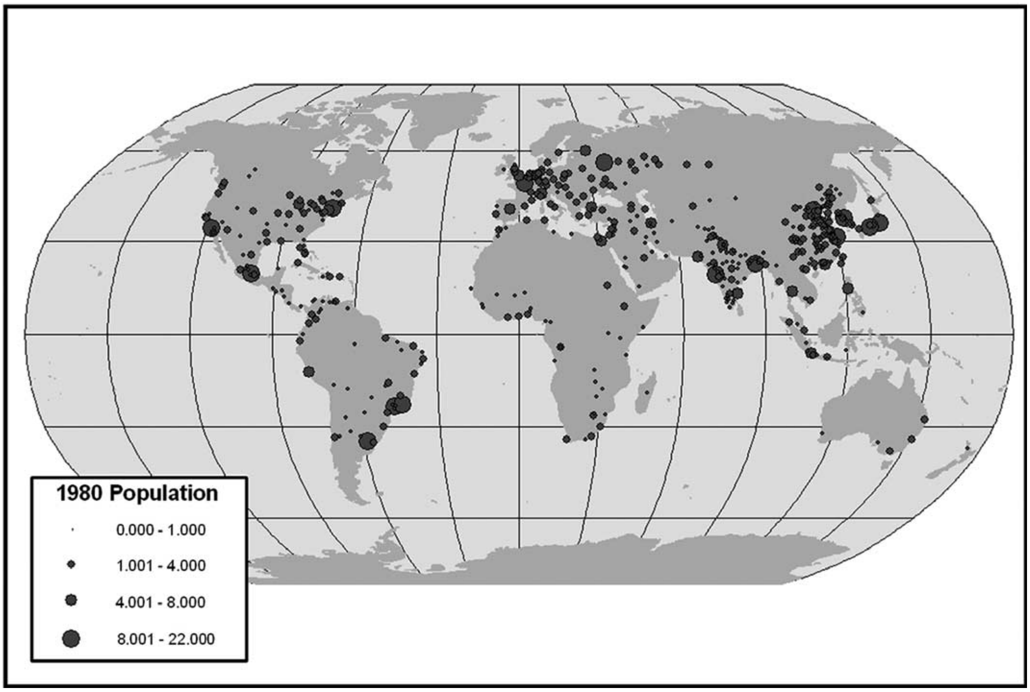

Figure 2 Million-person cities in the middle year.

To investigate these two related properties, we simply trace the growth fortunes of each of the 485 cities for appropriate beginning and ending years. *Table 3* shows cross-tabulations for the two adjacent time periods, 1950–1980 and 1980–2010. Of the 399 places found in the lowest size class (<1m) in 1950, 246 places (61.6% of the beginning total) remained in this same size class 30 years later. But 126 cities ascended one tier to class 1, 26 more cities jumped two tiers to class 2, and one city leaped three tiers all the way to class 3. In other words, 246 places stayed at their initial population level, 153 places ascended to higher population levels, but no city descended to any lower population level. However, the growth fortunes of cities beginning in other population size categories could be somewhat different. For instance, of the 22 larger cities that began in class 2 (>2m but <4m), 11 (50%) remained at the same level, 5 ascended one level, 5 ascended two levels, but one place descended two levels.

The simplest measure of overall stability results from adding up the numbers along the main diagonal (i.e., 246 + 17 + 11 + 2 + 1 = 277) of the table and then dividing this number by 485, the total number of observations. This leads to a stability index of 57.1%. By adding up the numbers of places above and below the main diagonal, we can quickly ascertain the direction of drift in the overall growth process. Note for 1950–1980 that 206 places ascended to higher population size classes and only two places descended to lower size classes. Obviously, and not surprisingly, this is evidence of a strong upward drift in the population sizes of the world's largest cities. But during the subsequent decade, 1980–2010, urban growth should be even less stable. Only 141 places are expected to remain in their initial population size classes, indicating that stability is anticipated to be only 29.1% over this second 30-year time period. A remarkable total of 339 places is expected to ascend the population ladder and only 5 places are expected to descend to lower size classes. In other words, the drift of the world's largest cities to even higher population tiers is expected to be even stronger during 1980–2010 than it was during the earlier period of 1950–1980.

One way to measure both the magnitude and direction of drift is to weight each of these individual city moves by the number of population tiers that are involved. So, if over some time span 10 places moved up 1 level, 5 places moved up 2 levels, and 2 places moved down 1 level, a drift score [DS] could be calculated as $18 = 10(1) + 5(2) - 2(1)$. Using this method, we can compute DS (1950–1980) = 250 and DS (1980–2010) = 446. Evidently, the positive drift expected for the second half of the study period will be about three-quarters stronger than the already remarkable positive drift that was exhibited during the first half of the study period. A cross-tabulation was also generated for the entire time period, 1950–2010. In fact, the population intervals were in part chosen to properly summarize size-class mobility between these two points in time. Not surprisingly, the overall stability of the city system is estimated to be even lower (i.e., 9.1%) because only

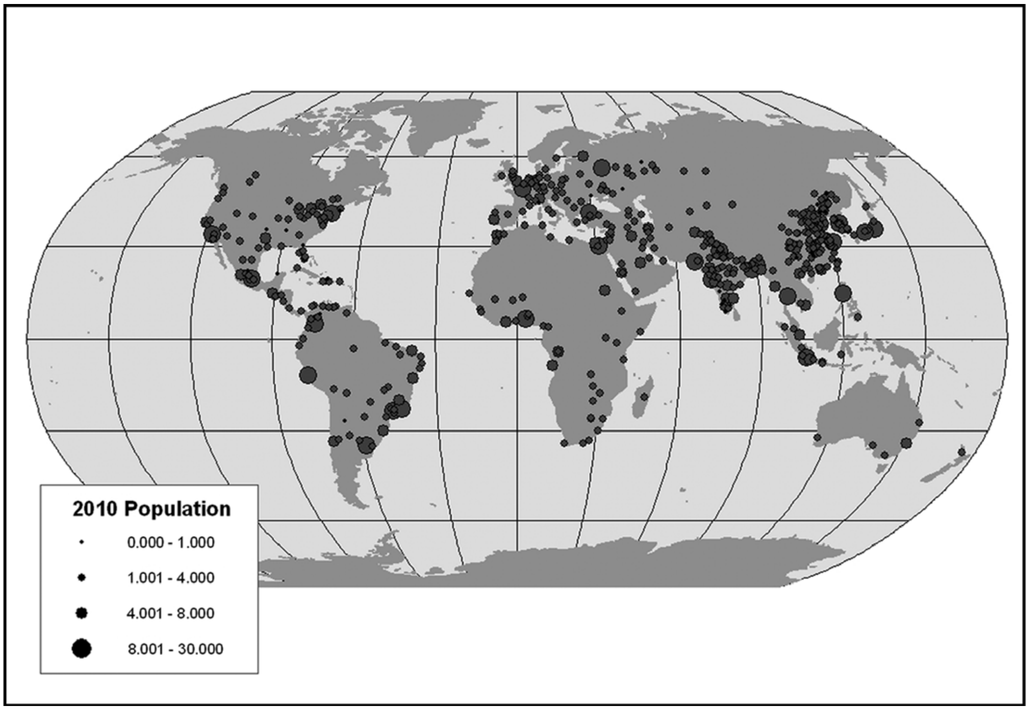

Figure 3 Million-person cities in the ending year.

Table 2 Population and location attributes of the cities

Year	Mean pop	Mean latitude (degrees North)		Mean longitude (degrees East)	
	N = 485	*N* = 485	Pop > 1m	*N* = 485	Pop > 1m
1950	0.693	31.65	33.48	30.73	22.06
1960	0.947	30.27	31.84	30.29	23.53
1970	1.265	28.63	30.11	31.02	26.69
1980	1.599	26.80	28.02	32.72	30.96
1990	1.980	25.78	26.26	34.61	34.88
2000	2.382	24.43	24.44	34.01	34.39
2010	2.820	23.32	23.28	34.91	35.15

Note. $N = 485$ includes all cities in the data set; Pop>1m includes only those cities with a population of 1 million or higher in that year. The mean latitudes and longitudes of the year-specific centroids are weighted, appropriately taking into account the different populations of cities.

44 places occupy the same population size class both at the beginning and at the end of the study period. A remarkable total of 439 places ascend the population ladder while only 2 places actually descend to a lower size class. The 60-year drift is strongly upward as indicated by DS (1950–2010) = 640. Obviously, though, the measures of both stability and drift are sensitive to the time span of the population growth study and the 60-year indices cannot be compared to the 30-year indices.

Period-specific *transition probabilities* can be computed for each of the two 30-year time periods and these can be used to estimate the numbers of places that are expected to move through the specific population states, a property of city mobility that is not disclosed in the last table. So, to take an example, the probability that a place begins in state 0 and ends up in state 1 is $p_1(0,1) = 126/399 = 0.3157$ for 1950–1980 and the probability that this place then moves from state 1 to state 2 is $p_2(1,2) = 60/143 = 0.4196$ for 1980–2010. Consequently the conditional probability that a place moves through the states (0,1,2) in direct sequence can be computed as $p_1(0,1) * p_2(1,2) = 0.1325$, which translates into 52.87 places. This is very close to the actual number $N(0,1,2) = 54$ of cities that should sequentially pass through these three population states. However, the cross-tabulation of moves for the entire period 1950–2010 indicates that a somewhat larger total (of 102) cities is expected to begin in state 0 and end

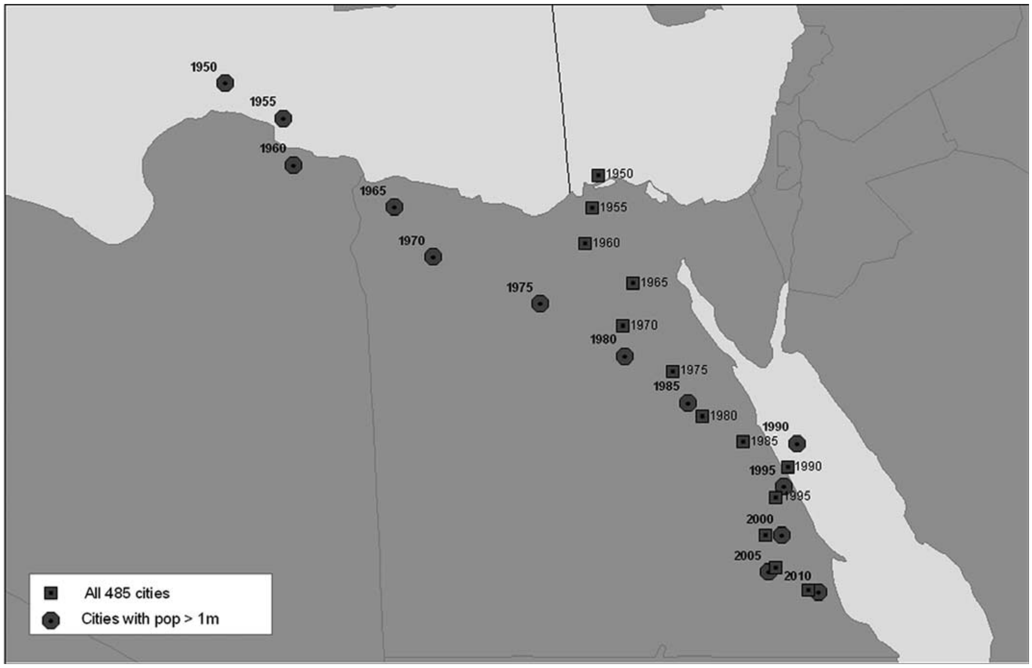

Figure 4 Drift of the world's urban center of gravity 1950–2010.

in state 2. But upon some reflection, we recognize that there are several other ways for cities to move from state 0 to state 2 over this long period. As a matter of fact, though, the "extra" 48 observations arise from only two other mobility routes—$N(0,0,2) = 37$ and $N(0,2,2) = 11$.

Table 3 Shifts in population size class numbers, 1950–2010

		Class in 1980						
		0	1	2	3	4	5	Total
Class in 1950	0	246	126	26	1	0	0	399
	1	0	17	24	10	1	0	52
	2	1	0	11	5	5	0	22
	3	0	0	0	2	7	1	10
	4	0	0	0	1	1	0	2
	5	0	0	0	0	0	0	0
Total		247	143	61	19	14	1	485

		Class in 2010						
		0	1	2	3	4	5	Total
Class in 1980	0	19	186	37	5	0	0	247
	1	3	70	60	10	0	0	143
	2	0	1	32	25	2	1	61
	3	0	0	1	9	8	1	19
	4	0	0	0	0	10	4	14
	5	0	0	0	0	0	1	1
Total		22	257	130	49	20	7	485

		Class in 2010						
		0	1	2	3	4	5	Total
Class in 1950	0	22	244	102	27	3	1	399
	1	0	12	20	13	6	1	52
	2	0	1	8	6	4	3	22
	3	0	0	0	2	7	1	10
	4	0	0	0	1	0	1	2
	5	0	0	0	0	0	0	0
Total		22	257	130	49	20	7	485

One reason for the dramatic upward drift in these city populations during 1980–2010, especially in the less developed nations, was the high incidence of youthful population cohorts (Ray, 1998). Demographic data, taken from Marlin et al. (1986) and Showers (1989), shed some light on the regional unevenness of this very important attribute in 1980. At that time, the average percentage of city population under age 19 was estimated to be as follows across the six continents: Africa, 47.4%, based on 1 city; Asia, 38.8%, 14; Europe, 26.6%, 25; North America, 30.7%, 22; Oceania, 34.0%, 4; and South America, 39.7%, 4. The global average for the incidence of urban youth was 31.8%, an estimate that is, however, based on a sample of only 70 cities that constitutes 14.4% of all places in our panel data set. Although the percentage youth estimates for the cities in the global periphery are based on very small samples indeed, they nevertheless align well with the more reliable national figures of the day. A correlation coefficient of $r = 0.600$ exists between percentage youth and the percentage population growth 1980–2010, clearly indicating that the youthful cities of Asia, Africa, and South America were particularly well poised in 1980 for rapid population growth. In fact, as was anticipated, this variable explains future population growth much better than does the crude birth rate (for 1980), whose correlation coefficient with percentage population growth 1980–2010 (for the same 70 cities as well as for a total 79 cities) was somewhat lower, $r = 0.386$. So, the data suggest that the remarkable population growth experienced by so many large cities during 1980–2010 was in large part due to the population momentum built up by individuals who entered these cities—through birth or migration—during the earlier period 1950–1980, and then subsequently formed families.

Population growth rates

The population growth across all 485 million-person cities averaged 953% over the 60-year study period, so the average city was 10.53 times larger in 2010 than it was in 1950. Of present interest is the temporal or historical growth pattern of each place. To begin, we simply identify the decade of most rapid population growth for each city. Then we cluster cities together according to the degree of similarity in their historical growth patterns.

Growth rates were first computed over six adjacent 10-year periods beginning with 1950–1960 and ending with 2000–2010. While these 10-year periods smooth out some of the rapid changes that are more apparent when adopting 5-year time periods (see below), they prove sufficient for our immediate purposes. We first note the decade in which percentage growth was the greatest. This growth was greatest during 1950–1960 for 240 places; during 1960–1970 for 97; 1970–1980; 60; 1980–1990, 44; 1990–2000, 21; and 2000–2010, 23. In other words, while 49.5% of the world's million-person cities experienced their most rapid growth during the first decade, only 4.7% of these places will experience their most rapid growth during the sixth and final decade of the study period. This information can be cross-tabulated with the information given earlier to disclose the periods of most rapid growth for cities of different population size, adopting either the perspective of the beginning year, 1950, or the ending year, 2010; see *Table 4*. For example, of the 52 places that were designated as class 1 (>1m but <2m) in 1950, 33 (63.5%) experienced their most rapid growth during the 1950s and 9 (17.3%) more experienced their most rapid growth a decade later during the 1960s. And, of the 131 places that are projected to be class 2 (>2m but <4m) in 2010, 68 (51.9%) experienced their most rapid growth during the 1950s but only 26 (19.8%) experienced their most rapid growth a decade later during the 1960s. It is worth noting that the world's seven very largest cities (occupying class 5 in 2010) all experienced their most rapid growth either during the 1950s (4 cities), 1960s (2 cities), or 1970s (1 city). Moreover, *Table 4* indicates that only 9 of the world's 49 class 3 cities (i.e., >4m but <8m persons) experienced their most rapid growth after the first two decades of the study period.

We next turn to clustering the million cities based on the temporal pattern of their population *growth rates* during the study period 1950–2010. Our intention now is to assign the cities to groups that have very similar growth trajectories over the 60-year study period. In order to bring more precision to the exercise, a series of growth rates was calculated for each of the 12 adjacent 5-year time periods, 1950–1955 through 2005–2010. Furthermore, an overall growth rate was calculated for the entire time period. All of these growth rates were calculated in natural logarithmic form instead of percentage form (as was done earlier) so that the sum of the 12 mean 5-year rates would equal the overall mean of the 60-year rate. Finally, city population in the starting year 1950, transformed by logarithms in order to normalize the heavily skewed distribution, was introduced as a 14th variable.

Some experimentation was carried out but a straightforward clustering of the 14 z-scores, using Ward's algorithm to ensure that the frequency distribution was fairly balanced in membership, provided results that appeared as reasonable and as stable as any others. Further multivariate analysis did not seem to create any new insights. So 10 different clusters of cities were identified and the salient properties of these clusters were next examined. Some of these properties are shown in *Table 5*, where the 10 clusters are ordered in terms of descending population growth rates between 1950 and 2010. Broad continental allocations of the 10 clusters are given in *Table 6* and, in *Table 7* names the very largest cities of each cluster. A much better sense of the geographic distribution of the cities allocated to the various growth-rate clusters can be gained by examining *Figures 5–8*.

Five groups of cities, covering nearly one-quarter of all 485 million cities, experienced truly amazing rates of population growth during the entire study period. The seven places in cluster 1 (e.g., Brasilia), which were all very small to begin with (averaging

Table 4 The decade of most rapid growth, 1950 and 2010

Decade	0	1	2	3	4	5	Total
Size class in beginning year 1950							
1950–1960	182	33	15	8	2	0	240
1960–1970	82	9	5	1	0	0	97
1970–1980	55	3	1	1	0	0	60
1980–1990	41	2	1	0	0	0	44
1990–2000	20	1	0	0	0	0	21
2000–2010	19	4	0	0	0	0	23
Total	399	52	22	10	2	0	485
Size class in ending year 2010							
1950–1960	8	117	68	26	17	4	240
1960–1970	5	49	26	14	1	2	97
1970–1980	4	35	13	5	2	1	60
1980–1990	3	23	15	3	0	0	44
1990–2000	0	16	4	1	0	0	21
2000–2010	1	17	5	0	0	0	23
Total	21	257	131	49	20	7	485

Note. Size classes are as follows: 0, <1m; 1, 1m–2m; 2, 2m–4m; 3, 4m–8m; 4, 8m–16m, 5, >16m.

only 34,000 in 1950), and the 26 places in cluster 2 (e.g., Riyadh), which were also fairly small to begin with (averaging 65,000 in 1950), exhibited truly spectacular growth. In cluster 1 population growth was extremely high until the mid-1970s and averaged a remarkable 8440% over the entire study period. Population growth in cluster 2 was much more uniform throughout the study period, peaking in both the 1970s and the 1990s, and averaged 4216% between 1950 and 2010. Cluster 3 includes 55 places (e.g., Las Vegas) which were all relatively small in 1950 (averaging 118,000 persons). These cities grew especially rapidly between 1960 and 1985, and averaged 1913% for the 60-year period. Cluster 4, with only 6 places, grew slowly at first, experienced astronomical growth rates during the 1980s, and then subsequently had much lower rates. Population growth averaged 1668% over the study period in these cities. Finally, cluster 5 has 23 cities (e.g., Orlando), each of moderate initial population size (171,000), where population growth was very high during 1950–1965 but then much lower afterward. Nevertheless the populations of these places grew on average 1476% between 1950 and 2010. In general, though, nearly all of the 117 cities in these five rapid-growth clusters remain small by today's world-city population standards. Only in cluster 2 does the average 2010 population (2.76m) of the cluster approach the average 2010 population (2.82m) of all 485 million-person cities in the data set. In fact, fact clusters 4, 5, 1, and 3 exhibit the lowest mean city population sizes in 2010 among all 10 clusters. *Figure 5* provides evidence about the geographic distribution of each of these five especially high-growth clusters. Many of the cities are located either in the low latitudes or in China. Those cities in clusters 1 and 2 are found especially close to the equator and are typically in Africa or the Middle East.

These extremely fast-growth places can be distinguished from the remaining five clusters, each of which experienced much slower population growth over the entire study period. Clusters 6 and 7 are comprised of cities having growth rates that were only marginally higher than the average growth for all cities. Cluster 6 consists of 69 cities (e.g., Kuala Lumpur) that were moderately large to begin with (averaging 366,000), and that experienced steady but ever-increasing growth over the entire study period. On average these places were 9.38 times as large in 2010 as in 1950. Cluster 7, on the other hand, is comprised of 56 cities (e.g., Calgary) that were large in 1950 (averaging 465,000), and that grew fairly rapidly until 1990, when their population growth rates began to diminish. Nevertheless these cities were on average 7.40 times as large in 2010 as in 1950. In fact, many of these cities are the largest places (and often the capitals) of Third World nations and in 2010 this cluster exhibited the largest average population (3.41m) of all 10 clusters. *Figure 6* indicates that most of the cities in cluster 6 are in either

Table 5 Numbers of cities with similar 5-year growth patterns, 1950–2010

Cluster	*N*	Mean population 2010	% Population growth rate 1950–1980	% Population growth rate 1980–2010	Mean latitude	Mean longitude
1	7	2.29	2394	238	1.13°N	14.19°E
2	26	2.76	722	460	17.52°N	49.84°E
3	55	2.34	573	206	17.13°N	23.53°E
4	6	1.57	247	422	28.65°N	70.35°E
5	23	2.16	672	99	25.29°N	19.08°E
6	69	3.30	256	166	15.46°N	29.90°E
7	56	3.41	301	88	25.71°N	35.63°E
8	32	2.52	94	172	22.84°N	64.52°E
9	81	3.20	146	68	21.54°N	42.17°E
10	130	2.56	64	15	40.31°N	31.76°E
All	485	2.82	292	122	25.53°N	35.85°E

Note. The mean latitude and mean longitude are both unweighted. Moreover longitude is not adjusted for convergence of the meridians.

Table 6 Continental allocation of cities in the ten growth clusters

Cluster	1	2	3	4	5	6	7	8	9	10	Total
Africa	3	6	17	0	1	8	1	4	5	0	45
Asia	2	17	24	5	12	40	36	23	48	38	245
Europe	0	0	0	0	0	1	1	2	2	64	70
N. America	0	1	7	1	6	5	13	2	15	23	73
Oceania	0	0	0	0	0	0	0	0	3	3	6
S. America	2	2	7	0	4	15	5	1	8	2	46
Total	7	26	55	6	23	69	56	32	81	130	485

Table 7 The largest cities in each cluster

Cluster 1	Cluster 2	Cluster 3	Cluster 4	Cluster 5
Abidjan	Dhaka	Lagos	Yantai	Belo Horizonte
Brasilia	Riyadh	Kinshasa	Ludhiana	Pôrto Alegre
Lusaka	Jidda	Chittagong	Neijiang	Fortaleza
Khulua	Luanda	Surat	Shenzhen	Guiyang
Conakry	Dar es Salaam	Hanoi	Nanchong	Curitiba
C. Guyana	Toluca	Kabul	Querétaro	Phoenix
Tegal	Sonala	Khartoum		Handan
	Songnam	Nairobi		Riverside
	Yaoundé	Inch'on		Lanzhou
	Ansan	S. Domingo		San Jose
Cluster 6	**Cluster 7**	**Cluster 8**	**Cluster 9**	**Cluster 10**
Mumbai	Sâo Paulo	Wuhan	Tokyo	New York
Delhi	Mexico City	Hyderabad	Calcutta	Shanghai
Jakarta	Manila	Chongqing	Los Angeles	Buenos Aires
Karachi	Istanbul	Guatemala C.	Rio de Janeiro	Beijing
Bangkok	Seoul	Lisbon	Cairo	Osaka
Bangalore	Lima	Changchun	Tianjin	Paris
Lahore	Bogotá	Johannesburg	Hong Kong	Moscow
Ahmadabad	Tehran	Lucknow	Madras	London
Yangon	Baghdad	Durban	Santiago	Chicago
Pune	Guadalajara	Changsha	Ho C.Minh.C.	R.-Ruhr North

Note. Cities are ranked in descending order by 2010 population.

India or Latin America and most of the cities in cluster 7 are in either China or North America.

Cluster 8 consists of 32 cities that had relatively slow growth (157%) during 1950–1980 but then explosive growth (506%) during the subsequent 30-year period, which amounted to overall growth of 420%. However, very few of these cities are widely known. The next group of cities, cluster 9, consists of 81 places (e.g., Toronto) that were initially large (averaging 796,000 persons in 1950), and that grew steadily but only moderately fast (312%) over the entire study period. Finally, cluster

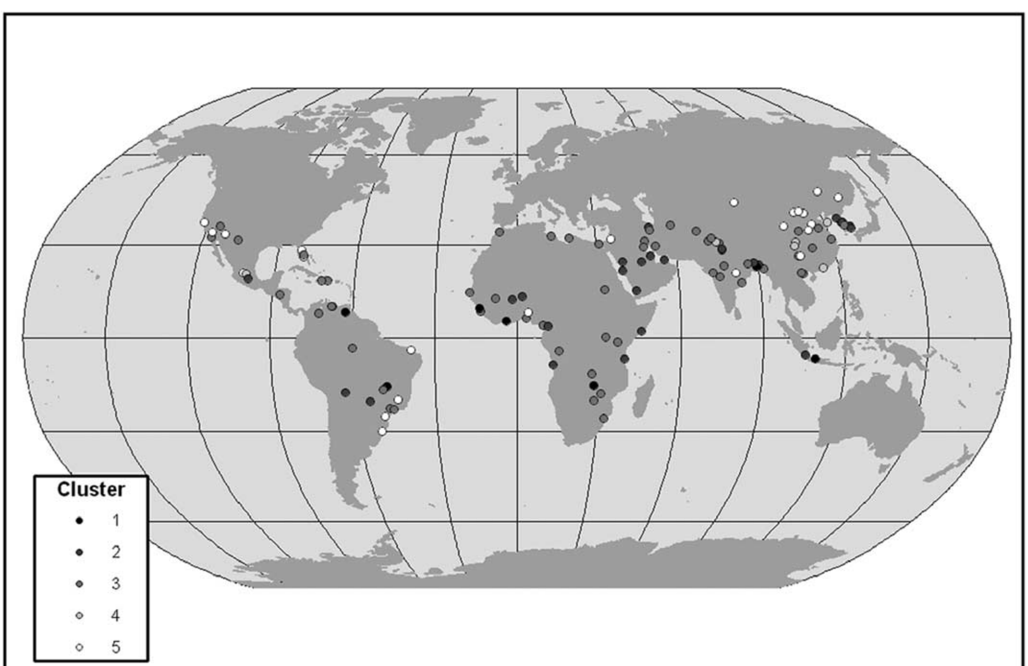

Figure 5 Extremely fast-growing cities.

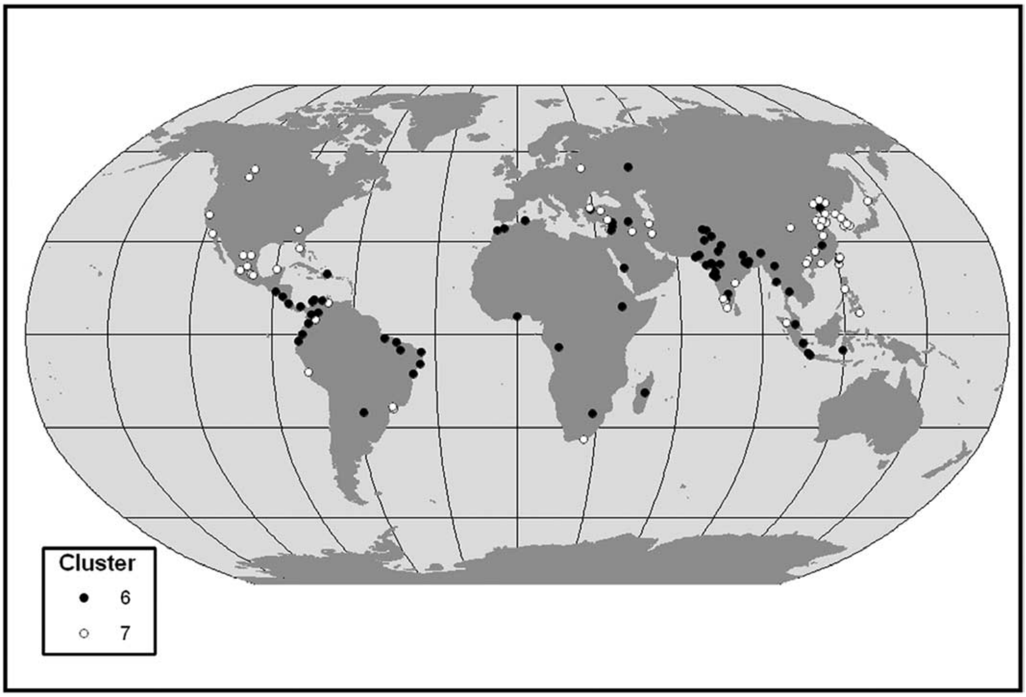

Figure 6 Very fast-growing cities.

10 includes many of the world's largest and most famous cities (e.g., Sydney). This group, with 130 places exhibited relatively slow growth (177%) during 1950–1980 and then even slower growth (62%) during 1980–2010 (but on a much higher base), and did not quite double in size (91%) over the entire study period. These cities were already large in 1950 (averaging 1.46m) and continued to enhance their domination of international and national urban systems during the period 1950–2010. *Figure 7* shows that most of the cities in clusters 8 and 9 are in India and China, but a number are also in Anglo-America. And, as expected, *Figure 8* indicates that many of the cities in cluster 10 are found focused on the North Atlantic basin, including Eastern Europe and Russia; however, a surprising number of places are also in China.

We thought it also worthwhile to examine how the cluster frequencies are distributed among some of the more populous nations. China, which has 111 of the million-person cities, was represented in eight of the 10 clusters. The greatest number of Chinese cities, 33, was found in cluster 10 and another 24 places were found in cluster 9. India's 50 cities were also spread over eight different clusters, with 16 cities found in cluster 6 and another 14 places in cluster 9. The USA, with 44 eligible cities, had cities allocated to six different clusters, with 21 cities classified to group 10 and a further 11 to group 9. Finally, Brazil's 20 eligible cities were distributed over 7 clusters, with 6 cities included in cluster 6 and 4 cities each included in clusters 3 and 5. Apparently, it is difficult to generalize about the growth patterns of the million cities in the world's most populous nations.

Beaverstock et al. (1999) recently have categorized many of these cities according to their global importance in terms of accountancy, advertising, banking, and legal services. We note that all of their alpha-12 world cities (London, Paris, New York, Tokyo) and all of their alpha-10 world cities (Chicago, Frankfurt, Hong Kong, Los Angeles, Milan, Singapore) are found either in cluster 9 or cluster 10. However, the beta cities, found at the next level of the global hierarchy, are not only well represented in clusters 9 and 10, but they also include several cities in cluster 7—Mexico City, Sao Paulo, and Seoul. The smaller and less important gamma cities in turn exhibit even wider membership, and include Jakarta and Bangkok in cluster 6, Istanbul in cluster 7, and Johannesburg in cluster 8. And several of those places showing some evidence of world-city formation are distributed among even the faster-growing clusters; for example, Brasilia is in cluster 1 and Riyadh is in cluster 2. Clearly there is a general inverse relationship holding between the global prominence of the cities in our data set and the population growth rates they exhibited between 1950 and 2010.

As a final exercise the 485 million-person cities were ranked in descending order according to their projected 2010 populations. A (somewhat arbitrary) threshold of 10 million persons was then selected, and the frequencies of the clusters were noted for the world's 20 largest cities. In fact, six different population growth-rate types were represented: there

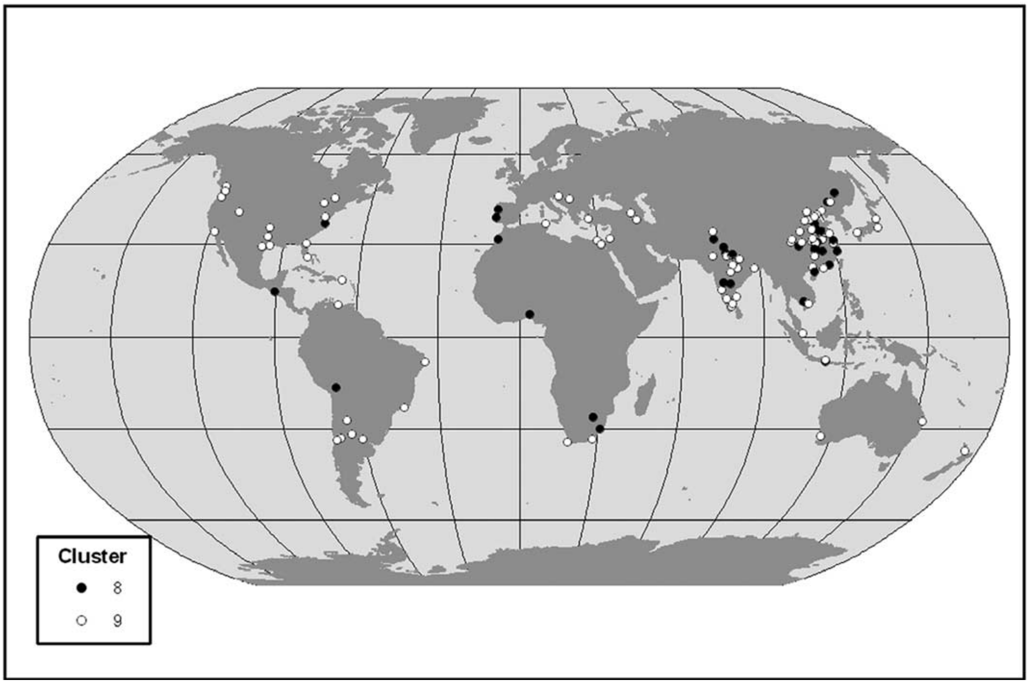

Figure 7 Moderately fast-growing cities.

was 1 city each in clusters 2 and 3, 4 cities in cluster 6, 4 more cities in cluster 7, 5 cities in cluster 9, and the remaining 5 cities were in cluster 10. None of the world's largest cities was allocated to either cluster 1, 4, 5, or 8. However, the world's largest and best known cities did come from an array of population growth-rate clusters, indicating that a variety of growth trajectories were followed by these urban centers as they rose to their positions of dominance atop the world's urban population pyramid.

Concluding remarks

The population sizes and growth rates of large cities depend on a myriad of global, national, and regional factors. Nevertheless most empirical studies focus squarely on *national*-level city systems while controlling for forces operating at other scales: for example, international openness is typically assessed by the relative importance of exports or foreign direct investment and interregional balance is typically measured by the relative degree of fiscal or political decentralization. From a *systemic* perspective, the size of any one city is tied to the overall national system and position in the national hierarchy is of greatest importance. Here city size is intimately tied to overall national population size, where populous nations simply have more and larger cities; the rural-urban balance, which reflects overall levels of national development; and national policy, which determines in part the differential growth rates experienced between the core and the periphery. But from a *competitive* perspective, the size of any one city depends upon how its various private and public attributes compare to all other national rivals. Here factors like location, the availability of natural and human-made amenities, and the creation of human and social capital are of critical importance to a city's continued success. We now briefly review some of the insights that different literatures provide regarding the future growth of the world's largest cities, especially in the more advanced economies.

Sustained large-city employment growth in manufacturing is known to be positively influenced by industrial diversity, apparently because knowledge spillovers count more across industries than within industries (Glaeser et al., 1992). This conclusion is endorsed by other more recent work, in high-tech and i-tech industries, suggesting that occupational diversity is even more important than industrial diversity for sustained urban growth (Chapple et al., 2004). In part because spatial dependency in innovation persists at the metropolitan level, innovative activity is believed to be even more highly concentrated than overall economic activity. But, innovation, it has been argued, actually reflects the urban geography of talent, where talented people flow to places that are diverse (in all senses), tolerant, and cool (Florida, 2002). Talented people—those possessing high levels of human capital in the arts, sciences, and professions—are known to seek locations especially known for having positive amenities. Moreover, these people, who are often relatively young, flock to large cities in order to meet partners, enhance their skill base or deepen their human capital, or simply enjoy the many consumption

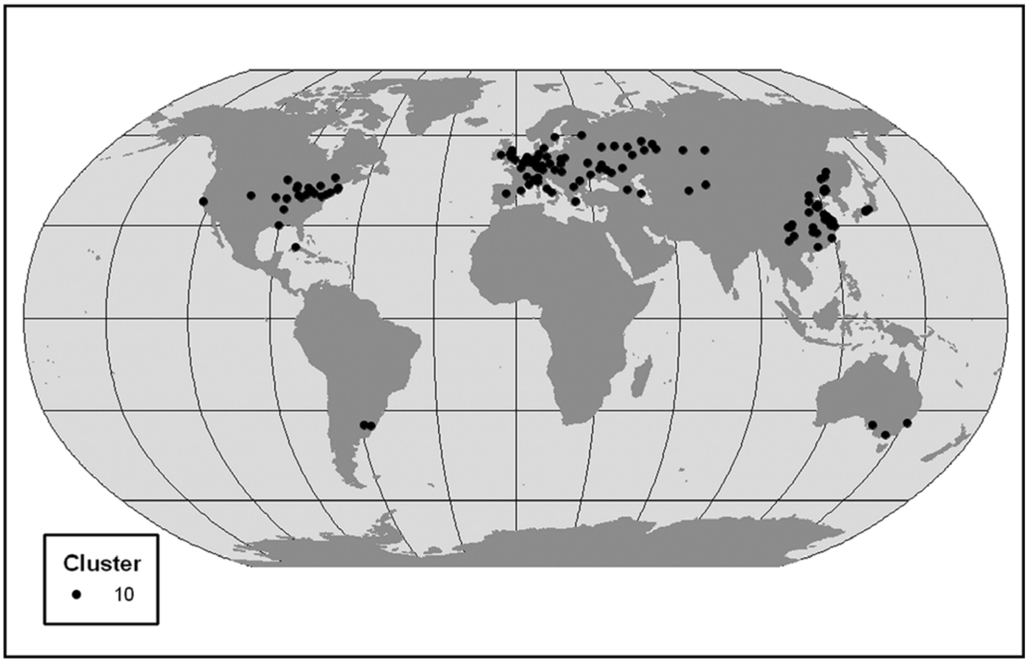

Figure 8 Slow-growing cities.

advantages of such places. In short, many large cities will continue to grow simply because they are successful in attracting young and creative people, as Gunnar Myrdal pointed out some decades ago. But how this will play out spatially across the entire city-size distributions of the different advanced nations is somewhat unclear. What we do know is that during early stages of economic development most nations show a significant increase in city numbers but, during later stages of development, urbanization largely consists of those existing cities simply growing larger and larger. Moreover, we know with some certainty that, across all levels of development, any large cities that are established as decision-and-control centers—typically having wide support services and diversified labor pools—and any intermediate-sized cities that enjoy substantial amenities, will continue to experience substantial population growth.

Another stream of research suggests that underlying social, political, and cultural factors are perhaps just as important as purely economic factors in determining long-run urban population growth (Inglehart, 1997). National societies are all polarized to various degrees and regional inequalities can be accurately assessed, in many cases, with regard to income streams, assets (including land), and levels of human capital. National economic growth during recent times depends upon such factors, where Barro-like convergence occurs in overall per capita income (Keefer and Knack, 2002). However, it is more unclear how interregional differences in social capital (e.g., Olson and Putnam groups), the availability of financial capital, transparency and trust, and the incidence of property rights have affected differential rates of urban growth across a range of national societies (Knack, 2003). Nevertheless, evidence does exist, at least for the NUTS1 regions of Europe, that bridging social capital and entrepreneurial attitudes play an important role in eliciting different rates of economic growth at the sub-national level (Beugelsdijk, 2003). Moreover, significant interregional income and wealth disparities persist in even the more developed nations, and recent work suggests that fiscal decentralization, combined with the ideology of the dominant political party, can play a more important role than political decentralization in redressing these interregional imbalances (Canaleta et al., 2004). It is again difficult to gauge precisely just what the spatial implications of these factors are as they play out across the city systems of different nations;. Nevertheless, it is relatively safe to conclude that cities located in regions enjoying secure property rights, high levels of trust, and healthy entrepreneurial climates will tend to outperform their urban rivals found in other regions.

In this paper, we have taken a more global perspective, where we analyze some of the growth features of the world's largest cities between 1950 and 2010. First, the remarkable upward drift in the numbers of these million-person cities was shown, and then regression-based temporal models for estimating cities in various population size-classes were developed. In turn, the world's ever-shifting urban center of gravity was examined. Finally, ten different growth trajectories were identified for these large and significant cities during the 60-year time span. As expected, the fastest-growth groups were found in the low latitudes of the east and the slowest-growth groups were found in the higher latitudes of the west.

In many ways, our paper complements the recent work of Henderson and Wang (2003), who have included some of the very factors we discuss above in a cross-national study of global urbanization during the (shorter) period 1960–2000. Their data set, which includes places having 100,000 or more people, is much larger in size and geographic coverage than the one we have used. Their more analytical research supports many of the contentions that we have made above, but what is especially interesting is that Henderson and Wang found little or no systemic change in the global city-size distribution during this 40-year period. On reflection, these findings are actually consistent with ours because the post-1980 break we uncovered above reflects the fact that global population *numbers*—the actual source for urban population numbers—not only grew but accelerated somewhat during the closing decades of the 20th century. In fact, we fully concur with their observation that there seems to be a role for cities of diverse population sizes—small, intermediate, large, and very large—as nations become increasingly developed, affluent, and urbanized. Furthermore, we agree that the very grim warnings about unbalanced national hierarchies, which remain popular in both the academic and popular presses, are perhaps more the exception than the general rule.

The results of the paper invite further investigation in several areas. First, more attention should be paid to developing theory regarding the ever-changing numbers of the world's largest cities in different population size categories. Evidence from the UN data suggests that logistic-type demographic processes are perhaps responsible for the upward growth in the numbers of these cities in recent times. Second, more attention should be given to modeling historical population growth rates in light of the findings in the paper's last section. City growth rates could be modeled as functions of national population growth, including other demographic attributes, as well as functional position in the world's space-economy. Of course, accommodation would have to be made for varying national settlement policies (Zhao et al., 2003). This emerging research on global urbanization should certainly include in some way the world-city hypotheses being developed and refined by Saskia Sassen, Allen Scott, Peter Taylor, and others.

References

Agu-Lughod, J, Hay, R Jr (eds.) (1977) *Third World Urbanization*. Methuen, New York.

Beaverstock, J V, Smith, R G and Taylor, P J (1999) A roster of world cities. *Cities* **16**, 445–458.

Beaverstock, J V, Smith, R G and Taylor, P J (2000) World city network: a new metageography. *Annals, Association of American Geographers* **90**, 123–134.

Berry, B J L (1973) *The Human Consequences of Urbanization*. St. Martin's, New York.

Berry, B J L, Horton, F E (eds.) (1970) *Geographic Perspectives on Urban Systems*. Prentice-Hall, Englewood Cliffs, NJ.

Berry, B J L and Parr, J B (1988) *Market Centers and Retail Location*. Prentice-Hall, Englewood Cliffs, NJ.

Beugelsdijk, S (2003) *Culture and Economic Development in Europe*. Dissertation #119, Center for Economic Research. Tilburg University, Tilburg, The Netherlands.

Brennner, N (2002) Decoding the newest "metropolitan regionalism" in the USA: a critical overview. *Cities* **19**, 3–21.

Canaleta, C G, Arzoz, P P and Gárate, M R (2004) Regional economic disparities and decentralisation. *Urban Studies* **41**, 71–94.

Castells, M (1989) *The Informational City*. Blackwell, London.

Chapple, K, Markusen, A, Schrock, G, Yamamoto, D and Yu, P (2004) Gauging metropolitan "high-tech" and "i-tech" activity. *Economic Development Quarterly* **18**, 10–29.

Devas, N, Rakodi, C(eds.) (1993) *Managing Fast Growing Cities*. Wiley, New York.

The Economist (2003) *Close to Bursting: A Survey of Property*. May 31 issue, pp. 1–16.

The Economist (2004) *Office Occupancy Costs*. March 27 issue, p. 106.

Florida, R (2002) *The Rise of the Creative Class*. Basic Books, New York.

Friedmann, J (1986) The world city hypothesis. *Development and Change* **17**, 69–83.

Friedmann, J (1995) Where we stand: a decade of world city research. In *World Cities in a World-System*, (eds.) P LKnox, P J Taylor. pp. 21–47. Cambridge University Press, Cambridge.

Friedmann, J and Goetz, W (1982) World city formation: an agenda for research and action. *International Journal of Urban and Regional Research* **6**, 309–344.

Gallup, J L, Sachs, J D and Mellinger, A D (1999) Geography and economic development. *International Regional Science Review* **22**, 179–232.

Glaeser, E L, Kallal, H D, Scheinkman, J A and Shleifer, A (1992) Growth in cities. *Journal of Political Economy* **100**, 1126–1152.

Glaeser, E L, Scheinkman, J and Shleifer, A (1995) Economic growth in a cross-section of cities. *Journal of Monetary Economics* **36**, 117–143.

Grosveld, H (2002) *The Leading Cities of the World and their Competitive Advantages*. World Cities Research, Naarden.

Gyourko, J, Kahn, M and Tracy, J (1999) Quality of life and environmental comparisons In, Cheshire, P, Mills, E S (eds.). *Handbook of Regional and Urban Economics*, Vol. 3. pp. 1412–1454. North Holland, Amsterdam.

Hall, P (1984) *The World Cities*, 3rd ed. St. Martin's, New York.

Hall, P (1999) *Cities in Civilization*. Weidenfeld and Nicolson, London.

Harris, J and Todaro, M (1970) Migration, unemployment and development: a two-sector analysis. *American Economic Review* **40**, 126–142.

Henderson, J V and Wang, H G (2003) Urbanization and city growth. Discussion Paper, Department of Economics. Brown University, Providence, RI.

Inglehart, R (1997) *Modernization and Postmodernization: Cultural, Economic, and Political Change in Forty-Three Societies*. Princeton University Press, Princeton, NJ.

Jacobs, J (1969) *The Economy of Cities*. Vintage Books, New York.

Jefferson, M (1939) The law of the primate city. *Geographical Review* **29**, 1939.

Keefer, P and Knack, S (2002) Polarization, politics and property rights: links between inequality and growth. *Public Choice* **111**, 127–154.

Kelley, A C and Williamson, J G (1984) *What Drives Third World City Growth?* Princeton University Press, Princeton, NJ.

Knack, S (2003) Groups, growth and trust: cross-country evidence on the Olson and Putnam hypotheses. *Public Choice* **117**, 341–355.

Knox, P L, Taylor, P J (eds.) (1995) *World Cities in a World-System*. Cambridge University Press, Cambridge.

Ley, D and Smith, H (2000) Relations between deprivation and immigrant groups in large Canadian cities. *Urban Studies* **37**, 37–62.

Marlin, J T, Ness, I and Collins, S T (1986) *Book of World City Rankings*. Free Press, New York.

Mercer Human Resource Consulting (2004) *2003 Quality of Living Survey*. www.mercerHR.com.

Meyer, D C (1986) The world system of cities: relations between international financial metropolises and South American cities. *Social Forces* **64**, 553–581.

Mommaas, H (2004) Cultural clusters and the post-industrial city: towards the remapping of urban cultural policy. *Urban Studies* **41**, 507–532.

Moomaw, R L and Alwosabi, M A (2004) An empirical analysis of competing explanations of urban primacy evidence from Asia and the Americas. *The Annals of Regional Science* **38**, 149–171.

Mountjoy, A (1976) Urbanization, the squatter, and development in the Third World. *Tijdschrift voor Economische en Social Geografie* **67**, 130–137.

Mulligan, G F (1984) Agglomeration and central place theory: a review of the literature. *International Regional Science Review* **9**, 1–42.

Otiso, K M (2003) State, voluntary and private sector partnerships for slum upgrading and basic service delivery in Nairobi City, Kenya. *Cities* **20**, 221–229.

Poon, J P H (2003) Hierarchical tendencies of capital markets among international financial centers. *Growth and Change* **34**, 135–156.

Quigley, J M (1998) Urban diversity and economic growth. *Journal of Economic Perspectives* **12**, 127–138.

Ray, D (1998) *Development Economics*. Princeton University Press, Princeton, NJ.

Resende, M (2004) Gibrat's law and the growth of cities in Brazil: a panel data investigation. *Urban Studies* **41**, 1537–1549.

Robson, B T (1973) *Urban Growth: An Approach*. Methuen, London.

Sassen, S (1991) *The Global City: New York, London, Tokyo*. Princeton University Press, Princeton, NJ.

Sassen, S (2000) *Cities in a World Economy*, 2nd ed. Pine Forge Press, Thousand Oaks, CA.

Sassen, S (ed.) (2002) *Global Networks: Linked Cities*. Routledge, New York.

Scott, A J (ed.) (2001) *Global City Regions: Trends, Theory, Policy*. Oxford University Press, Oxford.

Showers, V (1989) *World Facts and Figures*, 3rd ed. Wiley, New York.

Smith, D A and Timberlake, M (1995) Conceptualising and mapping the structure of the world system's city system. *Urban Studies* **32**, 287–302.

Smith, D A and Timberlake, M (2002) Hierarchies of dominance among world cities: a network approach. In *Global Networks: Linked Cities*, (ed.) S Sassen. pp. 117–141. Routledge, New York.

Taylor, P J (1997) Hierarchical tendencies amongst world cities: a global research proposal. *Cities* **14**, 323–332.

Taylor, P J, Walker, D R F and Beaverstock, J V (2002) Firms and their global service networks. In *Global Networks: Linked Cities*, (ed.) S Sassen. pp. 93–115. Routledge, New York.

Wirth, L (1938) Urbanism as a way of life. *American Journal of Sociology* **44**, 1–24.

Yuill, R S (1987) Average global locations. *The Professional Geographer* **39**, 69–74.

Zelinsky, W (1971) The hypothesis of the mobility transition. *Geographic Review* **61**, 219–249.

Zhao, S X B, Chan, R C K and Sit, K T O (2003) Globalization and the dominance of large cities in contemporary China. *Cities* **20**, 265–278.