MIGRATION, URBANIZATION, RESOURCES, AND DEVELOPMENT

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PREFACE

Representatives from 132 nations assembled in Vancouver in June of 1976 to convene HABITAT, the United Nations Conference on Human Settlements. The Conference was a global inquiry into solutions of the critical and urgent problems of human settlements created by the convergence of two historic events: unprecedentedly high rates of population growth and massive rural to urban migration.

Rapidly growing populations strain health and education budgets, complicate efforts to utilize a nation's manpower efficiently, and exacerbate problems connected with the provision of adequate supplies of food, energy, water, housing, and transport and sanitary facilities. A better understanding of the dynamics and consequences of population growth, particularly with regard to resource and service demands, is therefore an essential ingredient for informed policy-making.

The Human Settlements and Services Area at IIASA is developing a new research activity that is examining the principal interrelationships among population, resources, and growth. As part of the preparatory work directed at the design of this activity, IIASA invited a distinguished group of scholars to Schloss Laxenburg in May to act in an advisory capacity as a task force (see Appendix). An earlier draft of this paper was circulated among the task force members a month in advance and comments were invited. During the meeting itself, the paper served as the starting point for discussions. While unfortunately it proved to be impossible to incorporate the various comments before this report went to press, they will be taken into account in our subsequent efforts in this research activity.

Andrei Rogers, Chairman
Human Settlements and
Services Area
June 1977

Papers of the Population, Resources and Growth Study

1. Nathan Keyfitz, *Understanding World Models,* RM-77-18, April 1977.
2. Andrei Rogers, *Migration, Urbanization, Resources, and Development,* RR-77-14, June 1977.
3. Roman Kulikowski, *Optimization of Rural-Urban Development and Migration,* Research Memorandum, forthcoming.
4. Frans Willekens, *Spatial Population Growth and Agricultural Change in Developing Countries,* Research Report, forthcoming.

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An earlier version of this paper was presented at the Charles Carter Newman Symposium on Natural Resources Engineering held at Clemson University in South Carolina on April 4-5, 1977.

SUMMARY

World population in 1975 numbered about 4 billion and exhibited a growth rate of just under 2 percent a year. At this rate of growth, the world's population would double in about 35 years and would total approximately 6.5 billion by the end of this century.

Roughly 1.6 billion people, 40 percent of the world's population, live in urban areas today. At the beginning of the last century, the urban population of the world totaled only 25 million. According to recent United Nations estimates, about 3.1 billion people, twice today's urban population, will be living in urban areas by the year 2000.

Rapid rates of urban demographic and economic growth increase the difficulties of providing a population with adequate supplies of food, energy employment, social services, and infrastructure. The investment needed just to maintain present standards in many rapidly urbanizing countries calls for a doubling or tripling of institutional plant within the next 25 years.

Scholars and policy-makers often disagree when it comes to evaluating the desirability of current rapid rates of urban growth in many parts of the globe. Some see this trend as fostering national processes of socioeconomic development, particularly in the poorer and rapidly urbanizing countries of the Third World; whereas others believe the consequences to be largely undesirable and argue that such urban growth should be slowed down.

As part of the search for convincing evidence for or against rapid rates of urban growth, this paper sets out three major components of any complete analysis of human settlement problems: the demographics of rapid urbanization and urban growth, their demoeconomic consequences, and the level and character of the associated resource-service demands. The demographics reveal that very high rates of urban growth are likely to prevail only for a limited time, essentially while a national population is in its early stages of urbanization. Demoeconomic analyses suggest that urbanization policies are likely to be more socially beneficial if their focus is on managing rapid urban growth and reducing social inequities rather than curtailing the flow of migrants to large cities. This policy perspective leads naturally to an interest in the resource and service demands of rapid urban growth, to a concern with the importance of population growth relative to economic growth as a generator of increased levels of demand, and to an examination of the degree to which the management problems associated with meeting these demands would be eased if urban growth rates were significantly reduced.

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WORLD URBANIZATION AND THE PROBLEMS OF HUMAN SETTLEMENTS

Representatives from 132 nations assembled in Vancouver in June of last year to convene Habitat, the United Nations Conference on Human Settlements. The Conference was a global inquiry into solutions of the critical and urgent problems of human settlements created by the convergence of two historic events: unprecedentedly high rates of population growth and massive rural to urban migration.

World population in 1975 numbered about 4 billion and exhibited a growth rate of just under 2 percent a year. At this rate of growth the world's population would double in about 35 years and would total approximately 6.5 billion by the end of this century.

Figure 1 illustrates the enormous increase in the speed with which world population has grown during the past three centuries. From the beginning of human time to 1650 world population grew to about half a billion. The second half-billion came by 1830, and the second billion in only another 100 years. It took just 30 years to increase this total to 3 billion, and the fourth billion came a little over 15 years later.

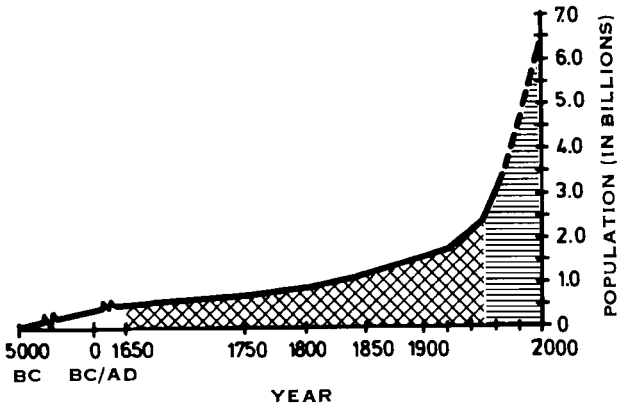

Figure 1. World population through history.
Source: Berelson (1974), p. 4

Urban population growth has been even more explosive (Figure 2). Roughly 1.6 billion people, 40 percent of the world's population, live in urban areas today. At the beginning of the last century, the urban population of the world totaled only 25 million. The United Nations estimates are that about 3.1 billion people, twice today's urban population, will be living in urban areas by the year 2000.

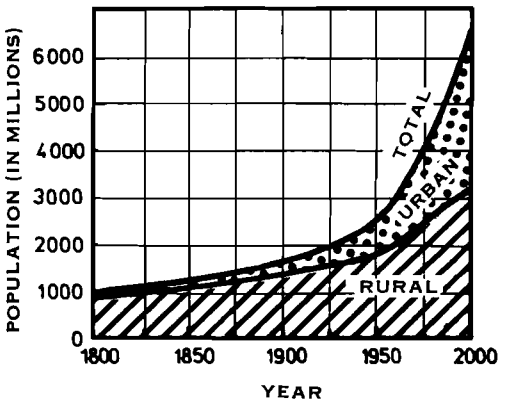

Figure 2. The growth of the world's urban and rural populations, 1800-2000.

Source: United Nations (1976), p. 3

Rapid rates of population growth and urbanization occurred first among nations that modernized first. Thus, for two thirds of the world these rates did not reach significant levels until very recently, generally after World War II. It is convenient, therefore, to examine the population situation separately for the developed and the less developed parts of the world.

Urbanization in Developed and Less Developed Countries

Less than a third of the world's population lives in developed parts of the world, defined by the United Nations to comprise all of Europe, Northern America, Japan, Temperate South America, Australia and New Zealand, and the USSR. The rest of the world's people, about 2.9 billion of them, live in the economically poorer, less developed parts.

Birth rates in less developed countries are, on the average, about twice as high as those in developed countries. Although death rates in the former also exceed those in the latter, the gap is smaller and becoming smaller still. The difference between births and deaths is natural increase, and rates of natural increase in the less developed countries far exceed those in the developed ones. Consequently, the less developed world has a population growth rate of 2.5 times that of the developed (2.4 percent against 0.9 percent); its share of the global total is rapidly increasing and is expected to exceed three fourths by the year 2000 (Figure 3).

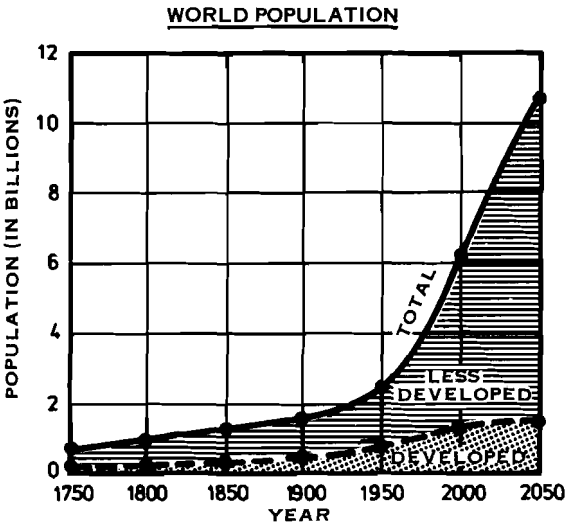

Figure 3. Population growth of today's developed and less developed countries.

Source: Keyfitz (1976), p. 29

A large proportion of the population of the less developed world is engaged in agriculture. In consequence, a relatively small fraction of this population is urban: only about one fourth. The corresponding fraction for the developed world is close to seven tenths (Figure 4). But because of their much larger share of the world's population, less developed countries today have as large an urban population as do the developed countries: just under four fifths of a billion people each.

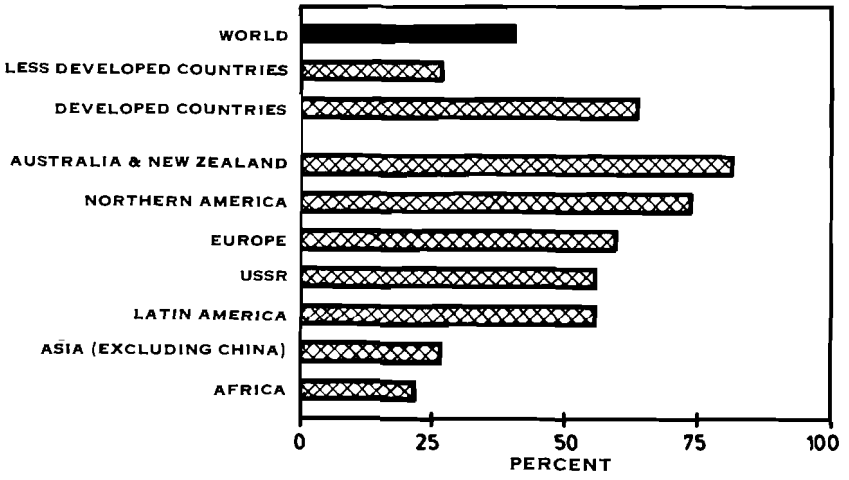

Figure 4. Percentage population urban in major world regions, 1970.

Source: Berelson (1974), p. 14

Urban populations are growing much more rapidly than the total populations of which they are a part. Table 1 shows that this is especially true in the less developed world. Between 1950 and 1970 the total population of the developed countries increased by 26 percent and that of the less developed countries by 54 percent; during the same period the urban population of the former grew by 57 percent while that of the latter increased by over 146 percent.

The latest United Nations projections of urban populations up to the year 2000 for seven major areas of the world are graphed in Figure 5. These are drawn on a logarithmic scale so that parallel slopes depict equal rates of growth. They indicate that urban growth rates in Europe, Northern America, and the USSR are likely to slow down to moderate levels, whereas those of East and South Asia, Latin America, and Africa are likely to continue to be comparatively high. Between 1975 and the year 2000 the urban population of Europe is likely to increase by a third, that of Northern America and the USSR by half. It may double in East Asia, treble in South Asia and Africa, and grow two-and-a-half-fold in Latin America.

Historically, urban growth and urbanization have occurred together, but they do not measure the same attribute of national population. Urban growth refers to an increase in the number of people living in urban settlements and urbanization to a rise in the proportion of a total population that is concentrated in urban settlements. The latter measure, therefore, is a function not only of urban growth but also of rural growth (Figure 6). Thus, urban growth can occur without urbanization if the rural population increases at a rate equal to or greater than that of the urban population.

Table 2 traces the urbanization process in the world's developed and less developed regions and in eight of its major geographical areas. In striking contrast to the substantial differences among urban growth rates in Table 1 and Figure 5, differences in the rates of urbanization are relatively minor, except in three instances. The USSR and Latin America exhibit above-average rates of urbanization; in Oceania the pace of urbanization is below average. Urbanization in the remaining regions, however, is proceeding at a rather similar pace, with their urban shares increasing by about 0.5 percent every year. The differences are a consequence of variations in rates of rural growth.

The Problems of Human Settlements

Problems of urbanization are problems of national human settlement systems: those networks of spatially dispersed concentrations of people and economic activities. Cities, towns, and urban agglomerations are nodal centers of life in modern societies, and changes in urbanization trends appear as changes in the spatial and hierarchically structured patterns of such centers.

Table 1. Population estimates and projections (medium variant) and average annual rate of growth: world total, regions, countries or areas, urban and rural, 1950-2000.

Regions, countries or areas	Total: T Urban: U Rural: R	Total population (in thousands) and annual rate of growth (in percent)												
		1950	Rate	1960	Rate	1970	Rate	1975	Rate	1980	Rate	1990	Rate	2000
WORLD TOTAL	T	2501243	1.8	2985937	1.9	3609600	1.9	3967005	2.0	4373210	1.9	5279041	1.7	6253135
	U	714681	3.4	1006942	2.9	1350032	2.9	1557685	2.9	1799528	2.8	2385646	2.6	3103214
	R	1786562	1.0	1978995	1.3	2259568	1.3	2409320	1.3	2573682	1.1	2893395	0.9	3149921
More Developed Regions	T	857305	1.3	975748	1.1	1084018	0.9	1131715	0.9	1181072	0.8	1277570	0.6	1360557
	U	457339	2.5	586192	2.0	717626	1.7	782582	1.6	849670	1.5	983935	1.1	1106942
	R	399966	-0.3	389556	-0.6	366393	-1.0	349133	-1.0	331402	-1.2	293635	-1.5	253615
Less Developed Regions	T	1643938	2.0	2010189	2.3	2525582	2.3	2835290	2.4	3192138	2.3	4001471	2.0	4892579
	U	257342	4.9	420750	4.1	632407	4.1	775103	4.1	949858	3.9	1401711	3.5	1996272
	R	1386596	1.4	1589439	1.4	1893175	1.7	2060187	1.7	2242280	1.5	2599760	1.1	2896307
AFRICA	T	218833	2.2	272753	2.5	351594	2.6	401138	2.8	460686	2.9	613714	2.8	813119
	U	28878	5.1	47991	4.7	76997	4.8	98059	4.8	124789	4.7	199300	4.3	306780
	R	189955	1.7	224762	2.0	274597	2.0	303079	2.1	335897	2.1	414414	2.0	506339
EUROPE	T	391968	0.8	42514	0.8	459085	0.6	473128	0.6	486611	0.5	513779	0.5	539812
	U	214751	1.6	251785	1.6	296903	1.4	317700	1.3	338548	1.2	381799	1.1	424996
	R	177217	-0.2	173369	-0.7	162182	-0.9	155428	-1.0	148063	-1.1	131980	-1.4	114816
AMERICA, NORTH	T	218633	2.0	267577	1.7	318008	1.5	342609	1.6	371480	1.7	440143	1.5	513373
	U	125371	3.0	168589	2.4	214936	2.1	239241	2.2	267408	2.2	334545	2.0	408618
	R	93262	0.6	98988	0.4	103072	0.1	103368	0.1	104072	0.1	105598	-0.1	104755
AMERICA, SOUTH	T	111365	2.8	146662	2.7	191401	2.6	218324	2.6	248984	2.5	320578	2.3	402755
	U	47371	4.6	74725	4.2	113845	3.8	137825	3.7	165587	3.4	232133	2.9	311050
	R	63994	1.2	71937	0.8	77556	0.7	80499	0.7	83397	0.6	88445	0.4	91705
ASIA	T	1367737	1.8	1643691	2.1	2027420	2.1	2255458	2.2	2513851	2.0	3068977	1.7	3636335
	U	219284	4.6	348495	3.5	496462	3.6	595268	3.6	713856	3.5	1008499	3.2	1385689
	R	1148453	1.2	1295196	1.7	1530958	1.6	1660190	1.6	1799995	1.4	2060478	0.9	2250646
OCEANIA	T	12632	2.2	15771	2.0	19323	2.0	21308	1.9	23482	1.8	28109	1.5	32715
	U	8142	2.4	10396	2.7	13561	2.4	15262	2.3	17156	2.2	21298	1.8	25584
	R	4490	1.8	5375	0.7	5762	1.0	6046	0.9	6326	0.7	6811	0.5	7131
USSR	T	180075	1.7	214329	1.3	242768	1.0	255038	1.0	268115	0.9	293742	0.7	315027
	U	70884	3.9	104961	2.7	137328	2.3	154330	2.2	172185	1.9	208071	1.5	240498
	R	109191	0.0	109368	-0.4	105440	-0.9	100708	-1.0	95930	-1.1	85671	-1.4	74529

Source: United Nations (1976), pp. 22-49

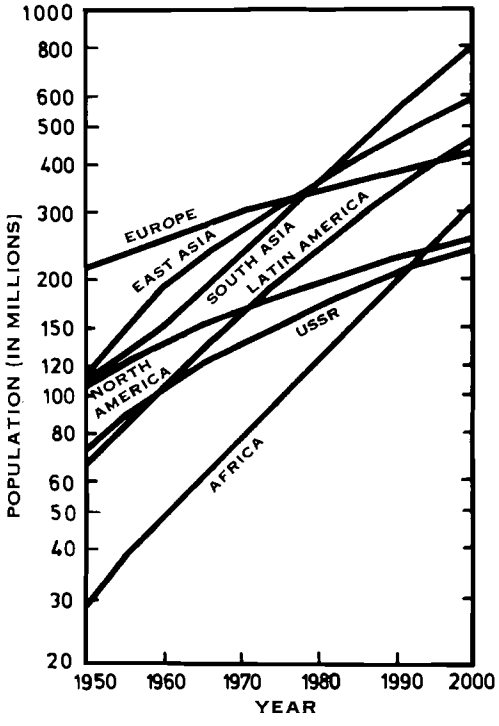

Figure 5. Urban population, 1950-2000, in seven major areas.

Source: United Nations (1976), p. 21

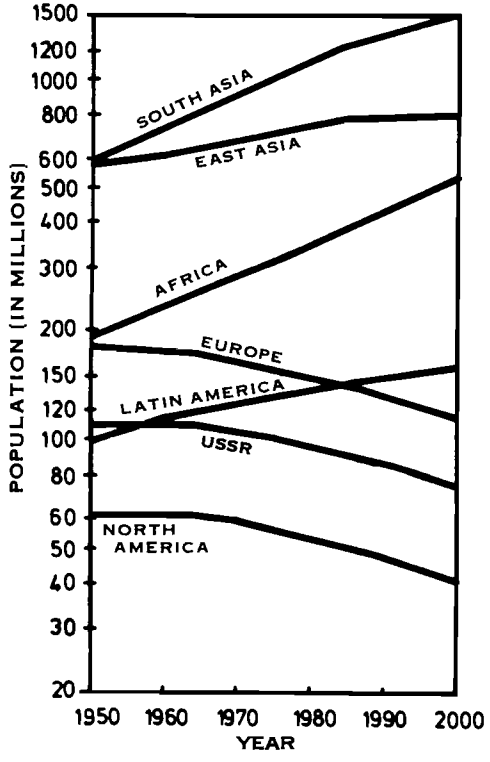

Figure 6. Rural population, 1950-2000, in seven major areas.

Source: United Nations (1976), p. 23

Table 2. Estimated and projected percentage of population (medium variant) in urban areas: world total, macro regions, and regions, 1950-2000.

Macro regions and regions	Estimated and projected population in urban areas (in percent)						
	1950	1960	1970	1975	1980	1990	2000
WORLD TOTAL	28.57	33.72	37.40	39.27	41.15	45.19	49.63
More Developed Regions	53.35	60.08	66.20	69.15	71.94	77.02	81.36
Less Developed Regions	15.65	20.93	25.04	27.34	29.76	35.03	40.80
AFRICA	13.20	17.60	21.90	24.45	27.09	32.47	37.73
LATIN AMERICA	40.90	48.51	56.85	60.42	63.76	69.74	74.80
NORTHERN AMERICA	63.65	69.83	74.15	76.53	78.78	82.88	86.41
EAST ASIA	16.55	24.63	28.53	30.66	32.90	37.73	43.19
SOUTH ASIA	15.53	18.05	21.09	22.96	24.97	29.59	35.04
EUROPE	54.79	59.22	64.67	67.15	69.57	74.31	78.73
OCEANIA	64.46	65.92	70.18	71.63	73.06	75.77	78.20
USSR	39.36	48.97	56.57	60.51	64.22	70.83	76.34

Source: United Nations (1976), p. 54

The major problems of urbanization arise because urban growth is polarized and spatially imbalanced. Growth does not generally occur proportionally at all nodes of a national settlement system. Particularly in less developed countries, it usually falls unequally on the larger (20,000 or more), and often already overcrowded, centers of urban life (Table 3).

Regional disparities in rates of urban growth are even more dramatic at the level of the individual urban settlement. Table 4 sets out recent United Nations projections of the growth of some of the largest urban centers in the less developed world. The size of the population growth multiplier, the urban momentum, for some cities is truly awesome. During the 25 years between 1975 and 2000, Lima, Mexico City, Jakarta, and Teheran all are expected to triple their populations; São Paulo and Seoul are projected to grow by a factor of 2.5; and Addis Ababa, Nairobi, Lagos, and Kinshasa are to increase four-fold.

As with rapid population growth in general, rapid urban growth increases the difficulties of providing a population with the necessary sustenance, employment, services, and infrastructure. A rapidly burgeoning urban population strains health and education budgets, complicates the reduction of unemployment levels, and exacerbates problems connected with provision of adequate housing, food, energy supplies, transport, water, and sanitary facilities. The "demographic investment" needed just to maintain present standards in many rapidly urbanizing areas means a doubling or tripling of institutional plant within the next 25 years. That these areas are to be found mostly in countries least able to afford such an investment only multiplies the difficulties associated with the resolution of human settlement problems.

The magnitude of the accumulating demands for services and infrastructure in less developed countries may be illustrated with data on the provision of housing. According to the 1965 United Nations estimates (Table 5) the less developed regions of Africa, Asia, and Latin America required the construction of 392 million housing units during the 15-year period 1960-1975, almost three fourths of them in Asia. This means that an annual average of 19.4 million housing units needed to be built to satisfy demands arising from population increase, replacement of obsolescent stock, and elimination of existing shortages. Translated into per capita terms, the estimated requirement for this region is about 11 units per 1000 population. Available statistics indicate that in most countries of Asia less than two housing units per 1000 population were built each year during the 1960s (Mok, 1975, p. 98).

Rapid rates of urban population growth are but one cause of the increase in total demand. Increased consumption arising out of a growing per capita income also plays an important role. Continued urban growth at an annual rate of 4 to 5 percent,

accompanied by a growth rate of urban per capita income of a similar level, means an annual growth rate of total urban income and demand for goods and services of about 9 percent. Compounded over the 30 years from 1970 to the end of this century, such a rate leads to a 13-fold increase in throughput of materials and services.

> This rate of increase is hard to comprehend. It means, for example, that the metropolitan area of Mexico City, which in 1970 generated about $8 billion in total income (assuming that per capita income was $1,000 and population 8 million), would have a total income of $104 billion in the year 2000. This figure is greater than the total income today of any country in the world with the exception of the United States, the Soviet Union, West Germany, Japan, France, and the United Kingdom. (Ridker and Crosson, 1975, p. 217.)

An examination of the prospects for world population growth and urbanization reveals very forcefully that the twin historical developments that have created the problems of today's human settlements will continue for the rest of this century and beyond in most parts of the world. The rate of world population growth, though apparently declining, will still be considerable for some time to come, and rural-urban migration shows no signs of abating in most of the less developed world. Therefore, the number of people in the world will continue to increase in the near future, as will the proportion of people living in urban settlements. Populations in urban centers will continue to grow at an alarming rate, particularly in the larger urban agglomerations of the less developed world. The problems created by this transformation are manifold and involve large private and social costs. But there are obvious benefits too, and it is important to keep these in mind when considering policies for intervening in the urbanization process. A better understanding of the dynamics and consequences of urban-rural population growth and economic development appears to be an essential ingredient of such considerations, and this requires a focus on the processes of change together with their manifestations. In the remainder of this paper, we turn to such an examination.

THE DEMOGRAPHIC TRANSITION

Accelerated rates of population growth and urbanization are direct consequences of higher rates of natural increase (births minus deaths) and of net urban migration (urban inmigration minus urban outmigration). Explanations of temporal and spatial variations in the patterns exhibited by these two sets of rates generally have taken the form of descriptive generalizations phrased in terms of "transitions" or "revolutions".

Table 3. Average annual growth rates in total, urban, and rural populations: selected countries, 1950-1960.

Major area and country	Total population	Reported rural population	Reported urban population*	Urban population in localities of: 20,000 or more	100,000 or more	500,000 or more
SOUTH ASIA	2.1	1.8	3.4	4.3	4.6	4.8
India	1.9	1.8	2.3	3.5	3.9	4.0
Turkey	2.8	2.3	4.7	6.8	6.6	7.4
Philippines	3.0	2.2	5.1	4.0	4.1	3.8
Thailand	3.0	2.2	8.3	6.9	5.3	4.9
Iraq	2.9	2.0	4.3	6.6	6.9	n.a.
LATIN AMERICA	2.8	1.3	4.5	5.5	5.5	5.8
Brazil	3.0	1.5	5.2	6.3	5.8	6.8
Mexico	3.0	1.5	7.8	6.9	7.8	7.3
Colombia	2.8	1.2	5.0	6.6	7.5	9.4
Chile	2.3	-0.2	3.7	4.7	4.1	5.1
Peru	2.3	1.2	3.7	6.0	5.3	4.7
AFRICA	2.1	1.6	4.5	5.4	6.5	5.3
Egypt**	2.4	1.5	4.1	4.1	4.9	3.5
Nigeria	2.6	2.1	5.4	7.6	11.6	n.a.
Algeria	2.3	1.1	5.5	7.1	6.3	3.4
Zaire	1.9	1.1	4.9	10.8	6.9	n.a.

n.a. = Not applicable.

*According to the national definition of an urban area.

**United Arab Republic.

Source: Farooq (1975), p. 137

Table 4. Population estimates and projections for fifteen large cities.

City	Population (millions)			Multiple increase over base year	
	1950	1975	2000	1950-1975	1975-2000
Cairo, Egypt	2.4	6.9	16.4	2.9	2.4
Addis Ababa, Ethiopia	0.2	1.1	4.2	4.8	3.9
Nairobi, Kenya	0.1	0.7	3.4	5.5	4.5
Lagos, Nigeria	2.9	2.1	9.4	7.2	4.6
Kinshasa, Zaire	0.2	2.0	9.1	12.5	4.4
Mexico City, Mexico	2.9	10.9	31.6	3.8	2.9
São Paulo, Brazil	2.4	10.0	26.0	4.1	2.6
Bogota, Colombia	0.7	3.4	9.5	5.2	2.8
Guayaquil, Ecuador	0.3	1.0	3.1	4.0	3.1
Lima, Peru	0.6	3.9	12.1	6.4	3.1
Jakarta, Indonesia	1.6	5.6	16.9	3.6	3.0
Teheran, Iran	1.0	4.4	13.8	4.3	3.1
Seoul, Korea	1.0	7.3	18.7	7.1	2.6
Karachi, Pakistan	1.0	4.5	15.9	4.3	3.6
Bangkok, Thailand	1.0	3.3	11.0	3.4	3.4

Source: United Nations (1976), pp. 77-83

Table 5. Estimated housing needs of Africa, Asia, and Latin America, 1960-1975 (in millions of housing units).

Housing required to provide for	Average annual requirements						Total requirements	
	1960-1965		1965-1970		1970-1975		1960-1975	
	Urban	Rural	Urban	Rural	Urban	Rural	Urban	Rural
Population increase								
Africa	0.4	0.9	0.5	1.0	0.7	1.1	7.8	14.7
Asia	2.2	4.0	2.7	4.2	3.2	4.5	41.0	62.1
Latin America	0.9	0.4	1.3	0.3	1.5	0.3	18.7	4.8
Subtotal	3.5	5.3	4.5	5.5	5.4	5.7	67.5	81.6
Replacement of obsolescent stock								
Africa	0.1	1.1	0.1	1.1	0.1	1.1	1.8	16.1
Asia	1.1	6.3	1.1	6.3	1.1	6.3	16.5	94.0
Latin America	0.3	0.7	0.3	0,7	0.3	0.7	4.1	10.3
Subtotal	1.5	8.1	1.5	8.1	1.5	8.1	22.4	120.4
Elimination of existing shortages								
Africa	0.1	0.7	0.1	0.7	0.1	0.7	1.8	10.7
Asia	0.7	4.2	0.7	4.2	0.7	4.2	14.6	62.6
Latin America	0.2	0.5	0.2	0.5	0.2	0.5	3.4	6.9
Subtotal	1.0	5.4	1.0	5.4	1.0	5.4	19.8	80.2
TOTAL	6.0	18.8	7.0	18.0	7.9	19.2	109.7	282.2

Source: Mok (1975), p. 99

Specifically, the *vital revolution* is commonly held to be the process whereby societies with high birth and death rates move to low birth and death rates. The *mobility revolution* is the transformation experienced by societies with low migration rates as they advance to high migration rates. These two revolutions occur simultaneously and jointly constitute the *demographic transition*.

The Vital Revolution

As traditional, largely illiterate, rural and agricultural-based populations have become transformed into modern, largely literate, urban, industrial-service-dominated societies, they have moved from high levels to low levels of mortality and fertility. The belief that such a transition inevitably follows modernization has fostered the now often-voiced view that "development is the best contraceptive".

The general description of the vital revolution was originally developed some fifty years ago as an explanation of the demographic experiences of 19th century Europe. This revolution begins with the control of deaths. Improvements in health care, in sanitation, in general standards of living, in nutrition, and in personal cleanliness act to postpone death and to reduce mortality rates.

Control over deaths is followed, after some lag, by control over births. The principal factor in the reduction of the birth rate appears to be the voluntary regulation of fertility. The lag between the onset of mortality decline and that of fertility decline creates an asymmetry that leads to rapid population growth due to natural increase (Figure 7).

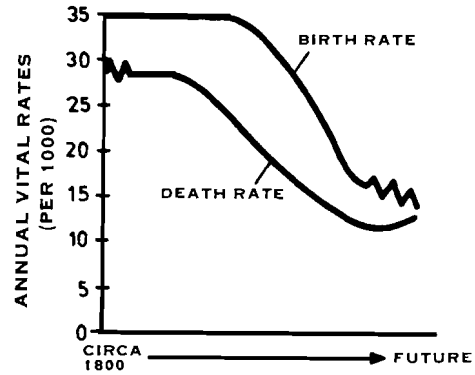

Figure 7. The vital revolution in developed countries.

Source: Berelson (1974), p. 6

The changes in fertility and mortality that constitute the vital revolution are more readily understood if the developed and the less developed countries of the world are considered separately. The birth rate in the less developed world in 1960 was approximately 42.8 per 1000, while the rate in the developed world was half that (Table 6). The death rate in the less developed regions also was higher than that of the developed regions, but the difference was roughly half of that between the two birth rates. As a result, the population of the developed countries in 1960 was growing at a rate of 12.5 per 1000, whereas that of the less developed countries was growing at the rate of 22.5 per 1000.

Because of their much higher fertility, less developed nations have a much "younger" age composition than developed countries and therefore a far greater built-in tendency for further growth. A country with a recent history of high birth rates, such as Mexico, for example, exhibits an age pyramid with a broad base that tapers off sharply at the older age groups. On the other hand, a country with a history of low birth rates, such as Sweden, has an age composition that yields an almost rectangular age pyramid (Figure 8).

Populations in which children outnumber parents potentially have a larger number of parents in the next generation than today and therefore acquire a built-in *momentum* for further growth, even if their fertility immediately drops to bare replacement level. Bare replacement level under conditions of modern mortality means that each family reduces its fertility to about 2.1 to 2.3 children on the average. If average family size in developing countries dropped to bare replacement immediately, this would produce a zero growth population only after 80 years or more, and that population would be about two thirds larger than the current one (Figure 9). If the drop were to take about 70 years to achieve, this increase would be 450 percent. In other words, the momentum with the immediate fertility decline is about one and two thirds, and with delayed decline about five and a half.

Populations in all developed countries have gone through a process of demographic change in which a decline in mortality eventually was followed by a drop in fertility. Demographers refer to this transformation as the demographic transition and associate it with socioeconomic changes that arise during a nation's industrialization and modernization. Although the process has been far from uniform, and its linkages with changes in socioeconomic variables have not been clearly identified, the universality of this revolution in developed countries is nevertheless quite impressive.

The vital revolution deals only with vital rates and neglects internal displacements attributable to migration. The latter contributor to spatial demographic change also exhibits a historical pattern--one that is described by the generalization known as the *mobility revolution.*

Table 6. Component rates of population growth: world total and regions, 1960.

Regions	Growth rate	Birth rate	Death rate	Natural increase rate
	r	b	d	n
Total population:				
WORLD	19.2	35.8	16.6	19.2
More developed regions	12.5	21.5	9.0	12.5
Less developed regions	22.5	42.8	20.3	22.5
AFRICA	22.9	46.7	23.8	22.9
Western Africa	22.8	48.8	26.0	22.8
Eastern Africa	22.3	46.7	24.4	22.3
Northern Africa	25.7	46.5	20.6	25.7
Middle Africa	18.2	45.1	26.9	18.2
Southern Africa	23.1	41.1	18.0	23.1
NORTHERN AMERICA	16.5	24.4	9.1	15.3
LATIN AMERICA	28.0	39.9	11.8	28.1
Tropical South America	29.3	41.4	12.1	29.3
Middle America (Mainland)	32.6	45.0	12.4	32.6
Temperate South America	18.9	27.2	9.2	18.0
Caribbean	22.2	37.9	12.3	25.6
EAST ASIA	17.4	35.2	17.8	17.4
China	17.7	37.4	19.7	17.7
Japan	9.6	17.3	7.7	9.6
Other East Asia	28.7	40.8	12.1	28.7
SOUTH ASIA	23.9	45.8	21.9	23.9
Middle South Asia	23.0	45.9	22.9	23.0
South East Asia	25.6	45.9	20.3	25.6
South West Asia	27.3	45.4	18.1	27.3
EUROPE	8.8	19.4	10.1	9.3
Western Europe	11.4	18.5	10.8	7.7
Southern Europe	8.2	21.3	9.3	12.0
Eastern Europe	7.4	20.0	9.4	10.6
Northern Europe	6.4	17.4	11.0	6.4
OCEANIA	21.7	27.2	10.3	16.9
Australia and New Zealand	20.9	23.6	8.6	15.0
Melanesia	23.0	42.8	19.8	23.0
Micronesia and Polynesia	29.1	41.4	12.3	29.1
USSR	16.2	23.7	7.5	16.2

Source: United Nations (1976), p. 50

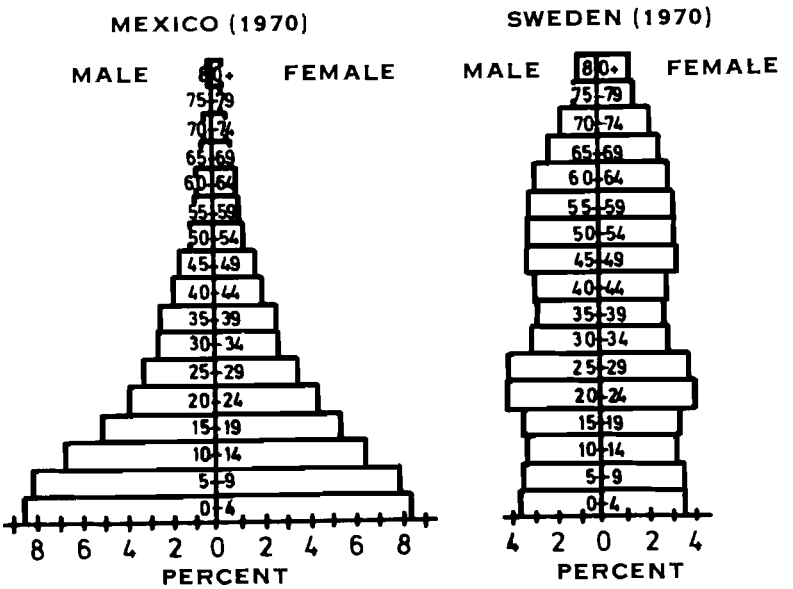

Figure 8. Young and old population age compositions.
Source: Berelson (1974), p. 12

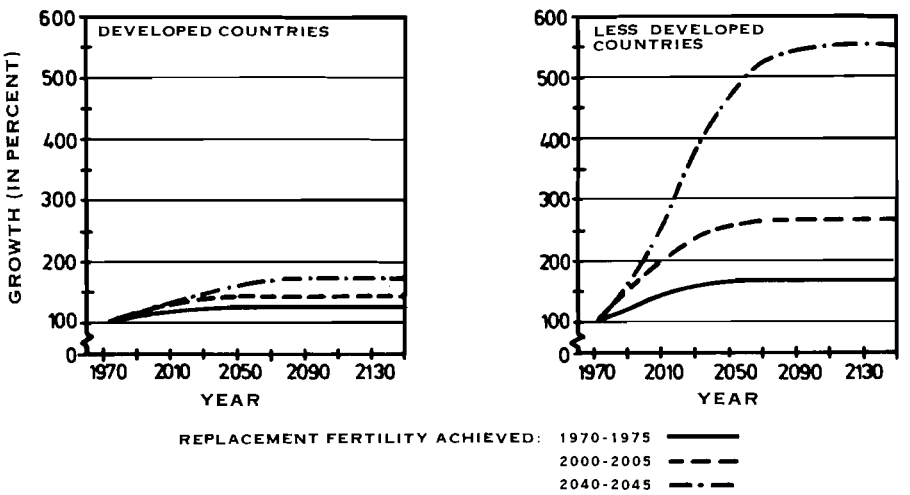

Figure 9. Momenta of population growth for developed and less developed countries.

Source: Berelson (1974), p. 13

The Mobility Revolution

The primarily *temporal* aspect of the *vital* revolution has a *spatial* counterpart that Zelinsky has called the *mobility* transition or revolution, describing it in the following terms:

> There are definite, patterned regularities in the growth of personal mobility through space-time during recent history, and these regularities comprise an essential component of the modernization process....A transition from a...condition of severely limited physical and social mobility toward much higher rates of such movement always occurs as a community experiences the process of modernization. (Zelinsky, 1971, pp. 221-222.)

Zelinsky's hypothesis is that for any specific community the vital and the mobility revolutions follow a parallel transitional sequence. He argues that, as man has extended his control first over deaths and then over births, he also has increased his ability to move from one community to another. Thus, whereas in premodern societies opportunities for territorial movement were limited, in most modern societies many individuals can migrate without major difficulties. The transition from the premodern to the modern condition is the mobility revolution, and its three principal phases* appear to be:

1. Premodern Society: High fertility and mortality, low natural increase, and little geographical mobility.

2. Transitional Society: A decline in mortality in the early stages of this phase, followed, after a lag, by a corresponding decline in fertility; the lag produces a rapid increase in population, accompanied by massive rural to urban migration which gradually rises to a peak and then slackens.

3. Modern Society: Low fertility and mortality; vigorous urban to urban migration and intraurban commuting; net rural to urban migration declines, even taking on negative values as the population increasingly shifts outward from metropolitan agglomerations toward smaller communities.

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*This three-way division essentially collapses Zelinsky's five phases. The first is his premodern traditional society; the second combines his early and late transitional societies; and the third represents his advanced and superadvanced societies.

In the premodern traditional societies of medieval Europe, early 19th century Japan, and most of pre-World-War-II Asia and Africa, individually motivated migration over substantial distances was rather uncommon. Difficulties of long-distance transportation, low levels of communication between distant localities, minimal disposable per capita incomes, and strong social ties all contributed toward the evolution of communities whose demographic growth was relatively undisturbed by migration. Such societies were in Phase 1 of the mobility revolution.

Phase 2 begins with the onset of industrialization and modernization. Physical and social barriers to internal migration decline, and the incentives for territorial movement increase. Rapidly growing rural populations experiencing the second phase of the vital revolution, combined with structural changes in the technology of agricultural production, impel increasing numbers of individuals to migrate in search of improved social and economic opportunities. This geographical shift is directed mostly toward the larger urban centers.

During the final phase of the mobility revolution urban to urban migration and commuting are the predominant forms of territorial movement. Rural to urban migration declines; but the associated decrement in rural population may be more than offset by the size of the reverse flow. This late stage of Phase 3 has been called "counterurbanization", and it appears to be occurring today in the USA, in Sweden, and in the FRG (Morrison and Wheeler, 1976).

The hypothesis that rates of internal migration rise in the course of national socioeconomic development has been proposed on several occasions and has received empirical support in a number of studies (e.g., Zelinksi, 1971; Parish, 1973; and Long and Boertlein, 1976). Residential mobility in Japan, for example, has increased from a one-year rate of 9.5 percent in 1960 to 12.8 percent in 1970. Kuroda (1973) reports a parallel rise in Japan's interdistrict migration rate, from about 5.8 percent in the early 1950s to about 8.0 percent in 1970. A simple plot of these rates against per capita income as a proxy for development and modernization suggests a decidedly positive association.

Data for nations in the late stages of modernization indicate that rates of geographical mobility ultimately tend to stabilize and perhaps even decline. For example, annual migration data for the USA between 1948 and 1971 exhibit insignificant year-to-year variations in the rate of residential mobility (U.S. Bureau of the Census, 1976). Figure 10 shows that a slight *decline* may have occurred in the USA during the decade 1960-70.

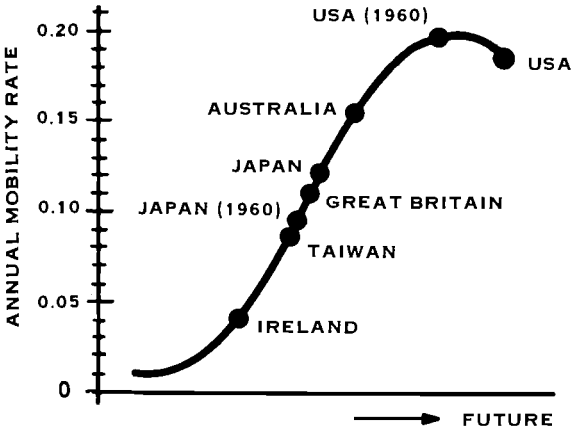

Figure 10. Residential mobility rate in six countries around 1970 (and 1960 where so identified).

Source: L.H. Long and C.G. Boertlein (1976), pp. 3 and 17

Rising income and declining family size give households more freedom to move. Thus increased economic development and reduced fertility levels should raise rates of internal migration. But other factors push in the reverse direction. Economic development stimulates the labor force participation of wives, and working wives reduce the ease with which couples can relocate. Low fertility populations have a rather high proportion of the aged, whose rates of migration are low. This compositional effect acts to reduce aggregate movement rates. The gradual reduction of regional differentials in well-being that seem to follow modernization dampens some of the stimulus for migration. Finally, the greater ease of access characteristic of modern societies allows people to increasingly substitute commuting for migration.

The transitional society of Phase 2 of the mobility revolution experiences the particular form of population redistribution that is urbanization. As Kingsley Davis has observed, this is a new and relatively recent step in the social evolution of human society.

> Although cities themselves first appeared some 5,500 years ago,...before 1850 no society could be described as predominantly urbanized, and by 1900 only one--Great Britain--would be so regarded. Today,... all industrial nations are highly urbanized, and in the world as a whole the process of urbanization is accelerating rapidly. (Davis, 1965, pp. 41-53.)

Urbanization is a finite process all nations go through in their transition from an agrarian to an industrial society. Such urbanization transitions can be depicted by attenuated S-shaped curves (Figure 11). These tend to show a swift rise around 20 percent, a flattening out at a point somewhere between 40 and 60 percent, and a halt or even a decline in the proportion urban at levels above 75 percent.

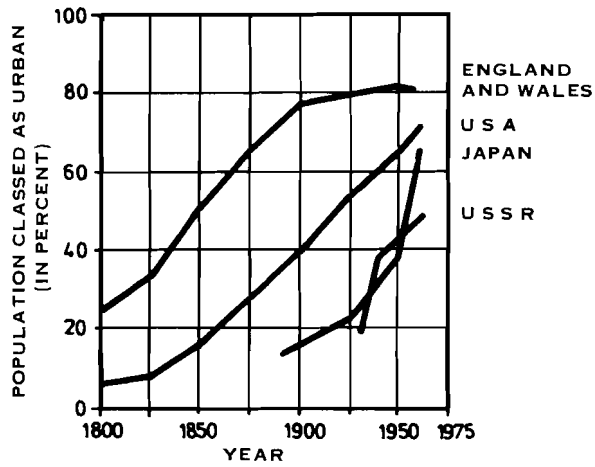

Figure 11. Historical evolution of population classed as urban.

Source: Davis (1965), p. 47

Nations that are still predominantly agricultural and rural have a built-in tendency for continued urbanization. This "urbanization momentum" is the spatial counterpart of the growth momentum that was described as part of the vital revolution. In most instances the size of the former is considerably larger than that of the latter. Figure 12 documents this for the case of India today. The principal spatial dynamics that contribute to such urbanization momenta are examined next.

The Demographics of Urbanization

Urbanization results from a particular spatial interaction of the vital and the mobility revolutions. It is characterized by distinct urban-rural differentials in fertility-mortality levels and patterns of decline, and by a massive net transfer of population from rural to urban areas through internal migration.

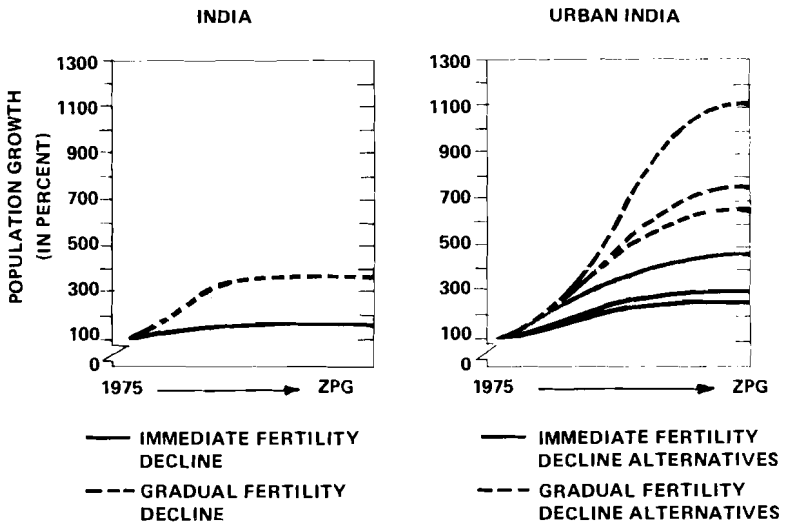

Figure 12. Urbanization momenta of India's population.
Source: Rogers and Willekens (1976), p. 32

The few theoretical statements that have sought to explain the urbanization process seem to concur that this social phenomenon generally evolves physically in the following sequence (e.g., Gibbs, 1963):

1. During the initial period of city formation the rate of urban growth is exceeded by the rate of rural growth.

2. At some point in the history of the nation or region, a reversal occurs and the urban growth rate outstrips the rate of increase of the rural population, thereby initiating the growth of urbanization.

3. Eventually a "turning point" is reached as the proportion of the population that is urban exceeds 50 percent for the first time.

4. With the continuous decline in agriculture's share of the total labor force, the rural population ceases to grow and begins to decline in number.

5. In the late stages of industrialization, a decentralization of urban population occurs within urban centers and beyond, producing a more dispersed spatial pattern of population. In some instances rural (non-farm) growth overtakes and once again exceeds urban growth.

Figure 13 illustrates the path followed by urban and rural growth rates in the USA as the nation was transformed from a 5 percent urban population in 1790 to a 70 percent urban population in 1960. By 1790, the nation was already in the second stage of the above sequence, reaching the "turning point" just before 1920 and entering the fourth stage in the late 1940s. It currently is well into the fifth stage and recently has experienced the second reversal in growth rates: rural growth rates once again are higher than urban (Morrison and Wheeler, 1976).

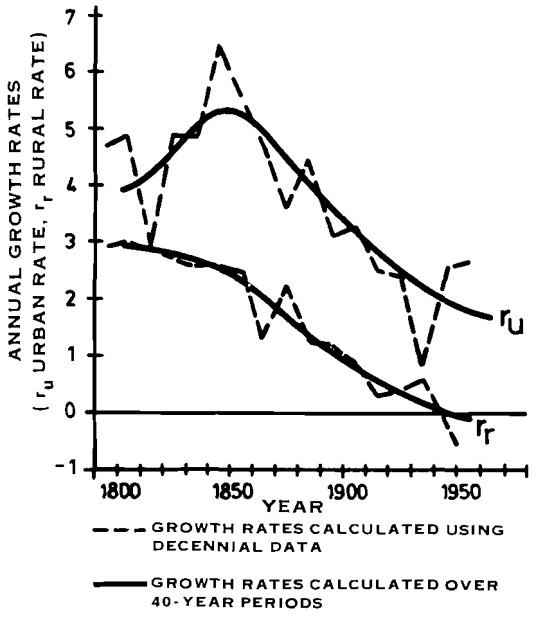

Figure 13. Annual growth rates of urban and rural populations in the United States: 1790-1960.

Source: Eldridge and Thomas (1964), p. 194

The pattern illustrated in Figure 13 for the USA seems to have some generality and apparently has also occurred in other countries, such as the USSR:

> After more than a century of rising rates of increase in the urban population, from an average of 1.3 per cent per annum early in the 19th century to 6.5 per cent per

> annum average for the period between the censuses of 1926 and 1939, the Soviet Union is now experiencing declining growth rates. The highest rates of urban growth were achieved...when the proportion of urban population was still low...the peak was reached in 1938 with an increase of 12.2 per cent in one year...But the long-range trend has been downward with average annual increases of 4.1 per cent, 1950-1959, and 2.8 per cent, 1959-1970. A study of individual years, reveals a drop from 4.6 per cent in 1958 to 2.3 per cent in 1969, or a decline of one-half in a dozen years. (Harris, 1975, p. 77.)

If urbanization is a finite process, what are the spatial population dynamics that underlie it? How do urban and rural birth, death, and migration rates vary over time to produce the paths taken by urban and rural growth rates in countries such as the United States? We shall examine the three components of population change in turn, starting with mortality. Since the necessary data are very scarce and, in many instances, nonexistent, much of our discussion must necessarily be speculative.

Factors affecting mortality are likely to differ between urban and rural areas. Health care facilities, for example, are more readily available in urban areas. The number of deaths attributed to contagious diseases or automobile accidents, on the other hand, is apt to be lower in rural areas. On balance, it appears that post-1930 rural mortality exceeds urban mortality, although in developed countries the differences have been narrowed considerably (Table 7). A recent United Nations calculation estimates the urban death rate around 1960 to have been "almost 8 points less than the rural in Africa, about 6 points less in East Asia and South Asia, and considerably less also in Oceania; in Europe and Northern America, on the other hand, the difference, if any, could have been only slight." (United Nations, 1974, pp. 17-18.)

The fertility of urban women is lower than that of rural women virtually everywhere (Table 7). The principal factors associated with lowered birth rates, such as education, income, labor force participation of women, age at marriage, all are correlates of urbanization. Thus fertility decline has tended to spread from city to village and from village to farm. United Nations estimates of urban and rural crude birth rates around 1960 revealed that "the urban crude birth rate was in general considerably below the rural crude birth rate. Only in Northern America was the difference rather slight. In Europe, the rural birth rate exceeded the urban by 4 points, in East Asia and South Asia by about 7 points, in Latin America by 9 points, and in Oceania by 14 points." (United Nations, 1974, p. 18.)

Table 7. Component rates of urban and rural population growth: world total and regions, 1960.

Macro regions, regions, urban and rural	Growth rate r_u	Birth rate b_u	Death rate d_u	Growth rate r_r	Birth rate b_r	Death rate d_r
	Urban Population			Rural Population		
WORLD	33.0	27.7	11.6	12.5	39.8	19.1
More developed regions	23.5	20.1	8.9	-2.6	23.3	9.3
Less developed regions	45.5	37.9	15.4	16.5	44.1	21.7
AFRICA	44.8	41.6	18.0	18.0	47.8	25.1
Western Africa	49.9	41.1	20.0	17.9	50.2	27.1
Eastern Africa	49.9	44.6	18.9	20.1	46.9	24.8
Northern Africa	42.3	43.8	17.1	18.5	47.4	22.1
Middle Africa	58.6	47.2	20.6	13.0	44.8	27.7
Southern Africa	32.9	32.1	15.1	16.3	47.6	20.1
NORTHERN AMERICA	24.3	24.2	8.9	-1.2	24.8	9.3
LATIN AMERICA	44.6	35.1	10.8	12.7	44.2	12.6
Tropical South America	49.6	31.1	11.2	11.7	45.0	12.8
Middle America (Mainland)	47.0	42.7	11.5	21.1	47.0	13.0
Temperate South America	30.2	24.3	9.1	-9.1	34.3	9.5
Caribbean	34.2	30.8	11.3	15.1	41.9	12.9
EAST ASIA	48.6	29.8	12.9	8.6	36.7	19.3
China	50.3	33.9	15.4	9.7	38.2	20.7
Japan	29.2	15.8	6.6	-5.9	18.5	8.6
Other East Asia	56.2	35.8	9.0	14.9	43.3	13.6
SOUTH ASIA	36.7	40.0	17.2	21.2	47.1	22.9
Middle South Asia	32.6	39.6	17.9	21.1	47.2	23.9
South East Asia	43.3	42.2	16.2	21.9	46.7	21.1
South West Asia	46.4	38.0	15.1	18.6	48.9	19.5
EUROPE	17.9	17.8	10.2	-4.2	21.8	10.0
Western Europe	19.5	17.4	10.6	-6.5	20.9	11.2
Southern Europe	21.0	19.3	9.1	-2.2	23.0	9.4
Eastern Europe	19.2	17.3	9.6	-3.8	22.6	9.3
Northern Europe	11.2	17.4	11.0	-6.4	17.6	11.1
OCEANIA	26.2	22.5	8.9	13.2	36.3	13.1
Australia and New Zealand	25.8	22.2	8.9	1.8	29.0	7.5
Melanesia	47.9	45.8	13.8	22.4	42.7	19.8
Micronesia and Polynesia	47.6	35.5	9.1	25.8	42.6	12.9
USSR	34.5	20.8	6.5	-1.4	26.5	8.4

Source: United Nations (1976), pp. 51-52

The difference between the birth rate and the death rate is natural increase, and rural natural increase exceeds urban natural increase in most parts of the world (Table 7). Yet urban areas have been growing much more rapidly than rural areas. Clearly, the component of change fostering this growth is migration.

The urban population of the USSR was growing at an annual rate of approximately 2.5 percent during the early 1970s. At the same time, its rural population was declining at an annual rate of 1.1 percent. The urban growth rate was the sum of a rate of natural increase of 0.9 and a net migration rate of 1.6 percent. The urban rate of natural increase, in turn, was the difference between a birth rate of 17 per 1000 and a death rate of 8 per 1000. The net migration rate was the difference between an inmigration rate of 27 per 1000 and an outmigration rate of 11 per 1000. Expressing these rates on a per capita basis, we have the fundamental accounting identity (Rogers, 1976):

$$\begin{aligned} r_u &= (b_u - d_u) + (i_u - o_u) = n_u + m_u \\ &= (0.017 - 0.008) + (0.027 - 0.011) \\ &= 0.009 + 0.016 = 0.025 \quad . \end{aligned} \tag{1}$$

The corresponding identity for the rural population was

$$\begin{aligned} r_r &= (b_r - d_r) + (i_r - o_r) = n_r + m_r \\ &= (0.019 - 0.009) + (0.014 - 0.035) \\ &= 0.010 - 0.021 = -0.011 \quad . \end{aligned} \tag{2}$$

We may contrast the above data for the USSR, which is about 56 percent urban, with corresponding data for India, which is only 20 percent urban. The two accounting identities for India in the late 1960s were, respectively (Rogers and Willekens, 1976):

$$\begin{aligned} r_u &= (0.030 - 0.010) + (0.027 - 0.010) \\ &= 0.020 + 0.017 = 0.037 \end{aligned} \tag{3}$$

and

$$\begin{aligned} r_r &= (0.039 - 0.017) + (0.002 - 0.007) \\ &= 0.022 - 0.005 = 0.017 \quad . \end{aligned} \tag{4}$$

Observe that the outmigration rates from urban areas in the two countries are almost identical (0.011 and 0.010), and that in India the rural outmigration rate is *lower* than the urban outmigration rate. This at first glance seems to contradict the view of a massive net transfer of people from rural to urban areas, but a closer examination of the fundamental accounting identity in Equation 1 readily shows that no such contradiction exists.

Return migration and the much larger base population in rural India together account for much of the observed outmigration from urban areas. To see this more clearly we may rewrite Equation 1 as

$$r_u = b_u - d_u + \frac{1 - U}{U} o_r - o_u \quad , \tag{5}$$

where U is the fraction of the population that is urban. Since India's population is about 20 percent urban and o_r is 0.007 we find that

$$i_u = \frac{1 - U}{U} o_r = \frac{0.80}{0.20} 0.007 = 0.028 \quad , \tag{6}$$

which is what we had in Equation 3 (except for a unit difference in the third decimal place due to rounding).

Equation 5 may be rearranged to give

$$o_u = \frac{1 - U}{U} o_r + (n_u - r_u) \quad , \tag{7}$$

a relationship which reveals that so long as U is small o_u is likely to be large. Thus, for India, we have that

$$o_u = 4(0.007) + (-0.017) = 0.010 \quad , \tag{8}$$

whereas the corresponding data for the USSR give

$$o_u = 0.78(0.035) + (-0.016) = 0.011 \quad . \tag{9}$$

Curiously, both sets of data yield nearly identical values for o_u and $n_u - r_u$.*

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*(Footnote next page.)

ALTERNATIVE PROJECTIONS OF URBANIZATION

In a now classic analysis of the demoeconomic consequences of fertility reduction, Ansley Coale (1969) examined some of the ways in which the population characteristics of less developed countries are related to their poverty and how alternative demographic trends might affect their modernization. Coale focused on nations rather than regions within nations and consequently could ignore population gains or losses arising through migration. Moreover, he assumed that widespread famine could be averted, at least in the short run, and therefore posited only a single future course for mortality--a reduction that could be achieved and maintained. Thus fertility was left as the sole population change variable considered to be responsive to governmental policy.

> We shall be concerned here with the implications, for the growth in per capita income and for the provision of productive employment, of alternative possible future courses of fertility. The specific alternatives to be considered are the maintenance of fertility at its current level and, as the contrasting alternative, a rapid reduction in fertility, amounting to fifty per cent of the initial level and occupying a transitional period of about twenty-five years. (Coale, 1969, p. 63.)

After generating the two alternative projections or "scenarios", Coale went on to

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*This near equivalence suggests the potentially more useful alternative rearrangement of Equation 5:

$$o_r = \frac{U}{1 - U}\left[o_u + (r_u - n_u)\right] \quad . \qquad (10)$$

In both the USSR and India the quantity in square brackets is 0.027. When this quantity may be assumed to be approximately fixed (which is likely to hold only for countries not yet over 60 percent urban), one can crudely estimate the rural to urban migration rate to be about $0.027 \frac{U}{1 - U}$. This would give Mexico, for example, which in 1970 was roughly 59 percent urban, a rural to urban migration rate of 0.039. With a birth rate of 44 per 1000 and a death rate of 10 per 1000, Mexico's urban population should then have been increasing at an annual rate of approximately 7.3 percent per annum. The reported rate for the 1950-1960 decade was 7.8 percent (Table 3).

> ...inquire what effects these contrasting trends in fertility would have on three important population characteristics: first, the burden of dependency, defined as the total number of persons in the population divided by the number in the labor force ages (fifteen to sixty-four); second, the rate of growth of the labor force, or, more precisely, the annual per cent rate of increase of the population fifteen to sixty-four; and third, the density of the population, or, more precisely, the number of persons at labor force age relative to land area and other resources. Then we shall consider how these three characteristics of dependency, rate of growth, and density influence the increase in per capita income. (Coale, 1969, p. 63.)

In this section of our paper we shall adopt Coale's scenario-building approach to focus on some of the demoeconomic consequences of rapid urbanization. Because this requires a view of urban and rural regions with interacting populations, we cannot ignore the impact of migration. We begin by describing the construction and evolution of four alternative population scenarios and then examine the implications that these alternative trends in migration and fertility would have for Coale's three important population characteristics: the dependency burden, the growth rate of labor force "eligibles", and the density of the population.

The Dynamics of Urbanization: Four Scenarios

Multiregional population projections translate assumptions about future trends in mortality, fertility, and migration with respect to a specific initial population into numerical estimates of the future size, age composition, and spatial distribution of that population. Tables 8 and 9 present several such illustrative projections. As in the Coale paper, a hypothetical initial population of one million with an age composition and fertility-mortality rates typical of a Latin American country is projected 150 years into the future. To his two alternative projections (A, fertility unchanged, and B, fertility reduced), however, we have added two others by varying our assumptions on internal migration (a, migration unchanged, and b, migration increased). This gives the following four possible combinations:

	a. Migration unchanged	b. Migration increased
A. Fertility unchanged	Projection Aa	Projection Ab
B. Fertility reduced	Projection Ba	Projection Bb

Table 8. Alternative projections of the population of a less developed country: migration unchanged.*

A. Fertility Unchanged

		Population (in thousands)							
Projection Aa	Year	0	10	20	30	40	50	60	150
	0-14	89.	147.	241.	378.	583.	902.	1377.	54145.
URBAN	15-64	104.	168.	265.	420.	656.	1005.	1536.	60897.
	65+	7.	8.	12.	20.	31.	52.	83.	3360.
	Total	200.	323.	518.	817.	1270.	1959.	2996.	118402.
	0-14	394.	511.	745.	1084.	1587.	2352.	3481.	122989.
RURAL	15-64	378.	534.	731.	1042.	1531.	2252.	3313.	117276.
	65+	29.	29.	38.	58.	84.	116.	181.	5926.
	Total	800.	1073.	1514.	2184.	3202.	4721.	6974.	246191.

B. Fertility Reduced

		Population (in thousands)							
Projection Ba	Year	0	10	20	30	40	50	60	150
	0-14	89.	127.	151.	185.	235.	285.	339.	1432.
URBAN	15-64	104.	168.	259.	369.	487.	618.	754.	3195.
	65+	7.	8.	12.	20.	31.	52.	83.	463.
	Total	200.	302.	422.	574.	754.	955.	1176.	5090.
	0-14	394.	461.	545.	592.	663.	783.	886.	3213.
RURAL	15-64	378.	534.	718.	940.	1188.	1419.	1662.	6014.
	65+	29.	29.	38.	58.	84.	116.	181.	821.
	Total	800.	1023.	1302.	1590.	1934.	2318.	2729.	10048.

*Column values do not always sum exactly to given totals because of independent rounding.

Table 9. Alternative projections of the population of a less developed country: migration increased.*

A. Fertility Unchanged

Projection Ab	Year	Population (in thousands) 0	10	20	30	40	50	60	150
URBAN	0-14	89.	174.	356.	667.	1161.	1940.	2958.	75126.
	15-64	104.	193.	375.	710.	1270.	2128.	3293.	85388.
	65+	7.	9.	14.	24.	44.	84.	157.	5146.
	Total	200.	376.	745.	1402.	2475.	4152.	6408.	165661.
RURAL	0-14	394.	482.	617.	751.	886.	1034.	1331.	46645.
	15-64	378.	508.	622.	750.	896.	1046.	1325.	45280.
	65+	29.	28.	37.	53.	71.	84.	108.	2459.
	Total	800.	1018.	1276.	1554.	1852.	2164.	2764.	94384.

B. Fertility Reduced

Projection Bb	Year	Population (in thousands) 0	10	20	30	40	50	60	150
URBAN	0-14	89.	150.	226.	334.	475.	625.	738.	1982.
	15-64	104.	193.	368.	630.	954.	1318.	1633.	4487.
	65+	7.	9.	14.	24.	44.	84.	157.	709.
	Total	200.	352.	607.	988.	1473.	2028.	2529.	7178.
RURAL	0-14	394.	435.	452.	409.	368.	340.	334.	1216.
	15-64	378.	508.	610.	675.	694.	664.	668.	2330.
	65+	29.	28.	37.	53.	71.	84.	108.	338.
	Total	800.	971.	1099.	1138.	1133.	1088.	1109.	3884.

*Column values do not always sum exactly to given totals because of independent rounding.

Coale's assumptions on initial and future patterns of mortality and fertility were a crude birth rate of about 44 per 1000 and a crude death rate of 14 per 1000, giving rise to a population growing at 3 percent per year. Starting with an expectation of life at birth of approximately 53 years, he assumes that during the next 30 years it will rise to about 70 years, at which point no further improvement will occur. In Coale's Projection A current age-specific rates of childbearing are fixed for 150 years; in Projection B they are reduced by 2 percent each year for 25 years (reducing fertility to half of its initial level), at which point they too are fixed for the remainder of the projection period.

For our four urbanization scenarios we have spatially disaggregated Coale's data and assumptions in the following manner. Twenty percent of the initial population of a million is taken to be urban. The initial values for birth and death rates are assumed to be lower in urban areas than in rural areas (40 against 45 per 1000 for the birth rate, and 11 against 15 per 1000 for the death rate). Mortality and fertility are reduced as in the Coale projections, but the declines are assumed to occur 10 years sooner in urban areas (25 instead of 35 years for the decline in mortality, and 20 instead of 30 years for the decline in fertility).

A multiregional population projection also requires specification of the initial values and future course of internal migration (see Rogers, 1975). To generate the four scenarios, initial rates of outmigration were set equal to those prevailing in India in 1960 (Bose, 1973); that is, a crude outmigration rate from urban areas of 10 per 1000 and a corresponding rate from rural areas of 7 per 1000. The age-specific rates of outmigration from urban areas are held fixed in all four projections, as are the corresponding rates from rural areas in the two "a" projections. Outmigration from rural areas in the two "b" projections, however, is assumed to increase six-fold over a period of 50 years and then to drop to half its peak value over the following 30 years, after which it is held unchanged for the remaining 70 years of the projection period (Figure 14).

Table 10 lists the principal parametric assumptions that generated Coale's two illustrative projections and contrasts them with those that produced the four scenarios summarized in Tables 8 and 9. The assumptions appear to be reasonable in that the hypothetical urbanization paths they chart are plausible. For example, the percentage-urban paths for the "b" projections in Figure 15 resemble the general shape of the observed urbanization paths set out in Figure 11, and Figure 16 shows that the trajectories of urban and rural growth rates for these projections are in general similar to those exhibited by the US data graphed in Figure 13.

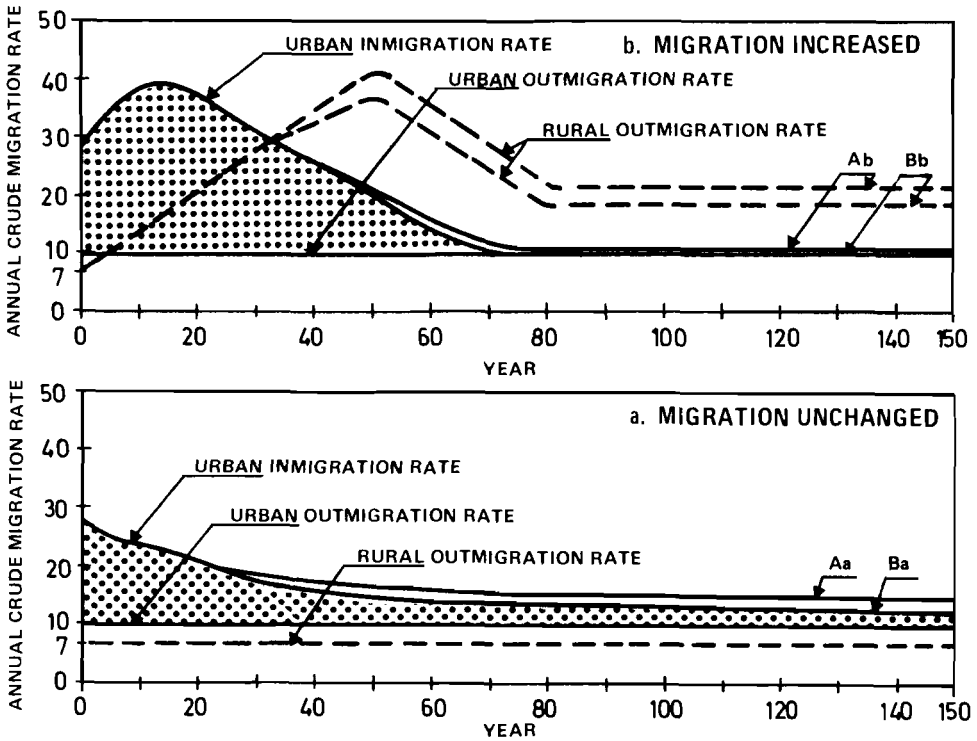

Figure 14. Migration rates: alternative mobility transitions.

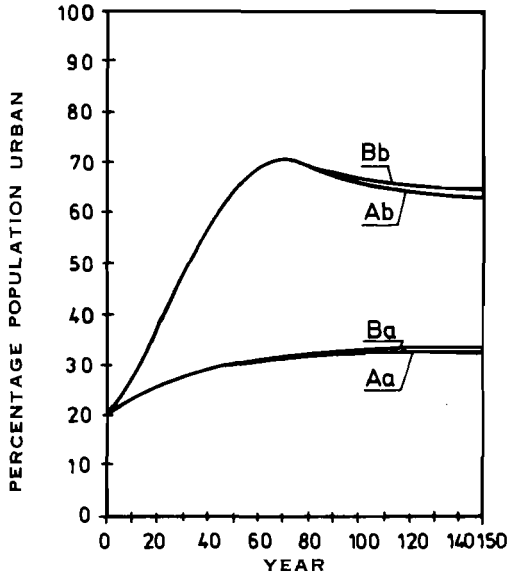

Figure 15. Alternative urbanization paths: four scenarios.

Table 10. Assumptions in the Coale and the Rogers models.

	Coale	Rogers	
		Urban	Rural
INITIAL VALUES			
Population	1,000,000	200,000	800,000
Death Rate	14/1000	11/1000	15/1000
Birth Rate	44/1000	40/1000	45/1000
Outmigration Rate	-	10/1000	7/1000
FUTURE PATHS			
Mortality	Decline over 30 years to level with an expectation of life at birth of 70 years; then unchanged	Decline as in Coale's model, but over 25 years; then unchanged	Decline as in Coale's model, but over 35 years; then unchanged
Fertility	A. Unchanged	A. Unchanged	A. Unchanged
	B. Reduction of 50% over 25 years; then unchanged	B. Reduction as in Coale's model but over 20 years; then unchanged	B. Reduction as in Coale's model, but over 30 years; then unchanged
Migration		a. Unchanged	a. Unchanged
		b. Unchanged	b. Increase of 500% over 50 years; then a reduction to 50% of that peak over 30 years; then unchanged

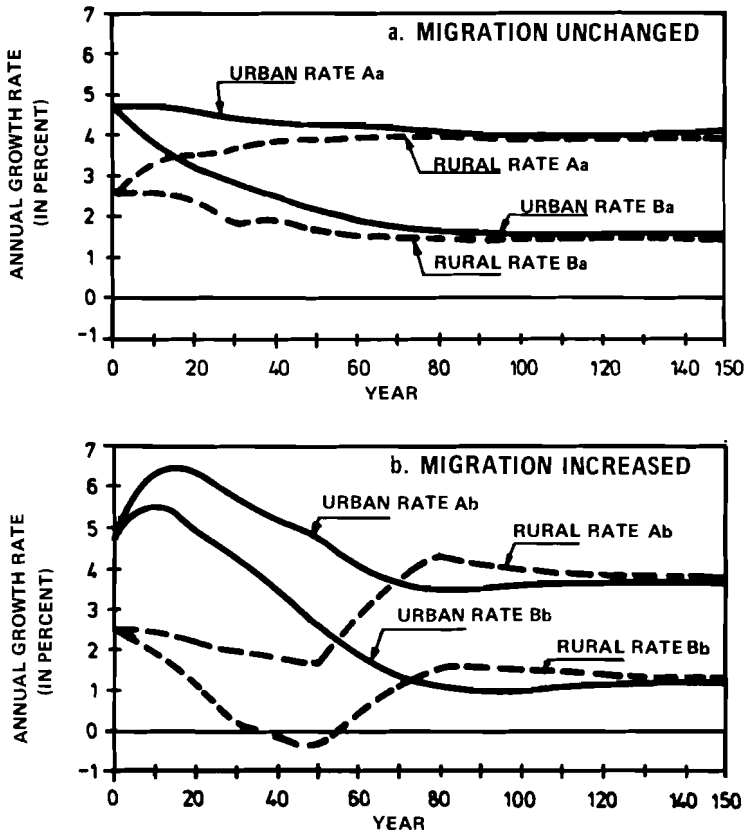

Figure 16. Urban and rural growth rates: four alternative scenarios.

As in Coale's scenarios, the initial population and the future regime of mortality are the same for all of the four population projections summarized in Tables 8 and 9. The major impact of the drop in fertility appears in the projected totals: the "A" projection totals are about 24 times as large as the "B" projection totals after 150 years. Migration's impact, on the other hand, appears principally in the spatial distribution of these totals: the "a" projections allocate approximately a third of the national population to urban areas after 150 years, whereas the "b" projections double this share.

Recently published statistics show population declines in the larger metropolitan regions of many major industrialized nations (Vining and Kontuly, 1977). In the US, for example, net migration into metropolitan areas has been negative since the early 1970s. Thus, whereas the average annual growth rate of metropolitan populations exceeded the nonmetropolitan rate by 1.6 percent to 0.4 percent in the 1960s, a reversal occurred between 1970 and 1973 which transformed these rates to 0.9 percent and 1.3 percent, respectively (Morrison, 1975, p. 10).

The dynamics leading to the decline of metropolitan rates of growth are reflected in Table 11, which describes the evolution of Projection Bb in greater detail. Note that the rural growth rate declines and even takes on negative values for a 15-year period, then increases gradually and ultimately overtakes the urban growth rate. Observe that this does not occur in the intervals in which net migration to urban areas is negative.

Demoeconomic Consequences of Growth and Urbanization

Figure 17 shows that the three population characteristics examined by Coale vary in their relative significance in the short, medium, and long runs. Changes in age composition appear as changes in the dependency burden during the first 30 years and constitute the first principal impact of reduced fertility. After the first generation, however, the established difference in dependency burdens remains relatively fixed. The variation between the annual growth rates of labor force age groups begins to appear after 15 years and reaches a maximum in about 70 years, i.e., 45 years after fertility stabilizes at its reduced value. Once established, this difference continues virtually unchanged forever after in the two scenarios. Finally, the long run effect of reduced fertility starts to become significant after 70 years; at this point the two alternative projections assume essentially fixed differences in age compositions and in rates of growth, and vary primarily in their relative sizes. This variation assumes enormous dimensions after 150 years, when, in the population with constant fertility, the total size of the population in the age bracket 15-64 is about 18 times larger than that in the population with reduced fertility.

Table 11. Annual component rates of change and urbanization levels: Scenario Bb.

Year	Component rates of change (per thousand)						Regional share (in percent)	
	Natural Growth		Net Migration		Growth Rate			
	Urban	Rural	Urban	Rural	Urban	Rural	Urban	Rural
0	29.00	30.00	18.00	-4.50	47.00	25.50	20.00	80.00
5	28.47	29.76	24.81	-7.36	53.28	22.40	22.89	77.11
10	26.52	29.56	28.47	-10.32	54.99	19.24	26.61	73.39
15	23.86	28.96	29.49	-13.21	53.35	15.75	30.94	69.06
20	20.35	26.92	28.17	-15.56	48.52	11.36	35.58	64.42
25	21.56	23.84	24.76	-17.14	46.32	6.70	40.91	59.09
30	21.10	20.20	20.98	-18.22	42.09	1.98	46.48	53.52
35	20.20	20.40	18.11	-19.34	38.31	1.05	51.65	48.35
40	19.12	19.12	15.44	-20.08	34.57	-0.96	56.53	43.47
45	17.95	17.38	12.84	-20.10	30.79	-2.72	61.02	38.98
50	16.78	15.66	10.50	-19.57	27.28	-3.91	65.08	34.92
55	15.52	14.69	6.81	-14.32	22.33	0.37	67.77	32.23
60	14.43	14.41	4.41	-10.04	18.84	4.37	69.50	30.50
65	13.40	14.26	2.69	-6.43	16.09	7.83	70.47	29.53
70	12.37	14.22	1.40	-3.40	13.77	10.82	70.83	29.17
75	11.43	14.52	0.36	-0.87	11.80	13.65	70.67	29.33
80	10.71	15.19	-0.53	1.25	10.17	16.44	70.05	29.95
85	10.24	15.65	-0.22	0.51	10.01	16.15	69.41	30.59
90	9.92	15.92	0.05	-0.11	9.97	15.81	68.79	31.21
95	9.78	16.13	0.30	-0.64	10.08	15.49	68.20	31.80
100	9.81	16.29	0.52	-1.09	10.33	15.20	67.65	32.35
105	9.81	16.29	0.72	-1.47	10.53	14.82	67.15	32.85
110	9.87	16.21	0.88	-1.77	10.76	14.44	66.71	33.29
115	9.81	15.97	1.02	-2.01	10.83	13.96	66.33	33.67
120	9.86	15.84	1.14	-2.21	11.01	13.63	66.00	34.00
125	9.97	15.78	1.24	-2.39	11.21	13.39	65.73	34.27
130	10.07	15.75	1.33	-2.53	11.40	13.22	65.50	34.50
135	10.14	15.72	1.41	-2.65	11.54	13.07	65.30	34.70
140	10.16	15.68	1.47	-2.75	11.63	12.94	65.14	34.86
145	10.17	15.64	1.52	-2.83	11.70	12.81	65.01	34.99
150	10.19	15.61	1.57	-2.90	11.76	12.71	64.89	35.11

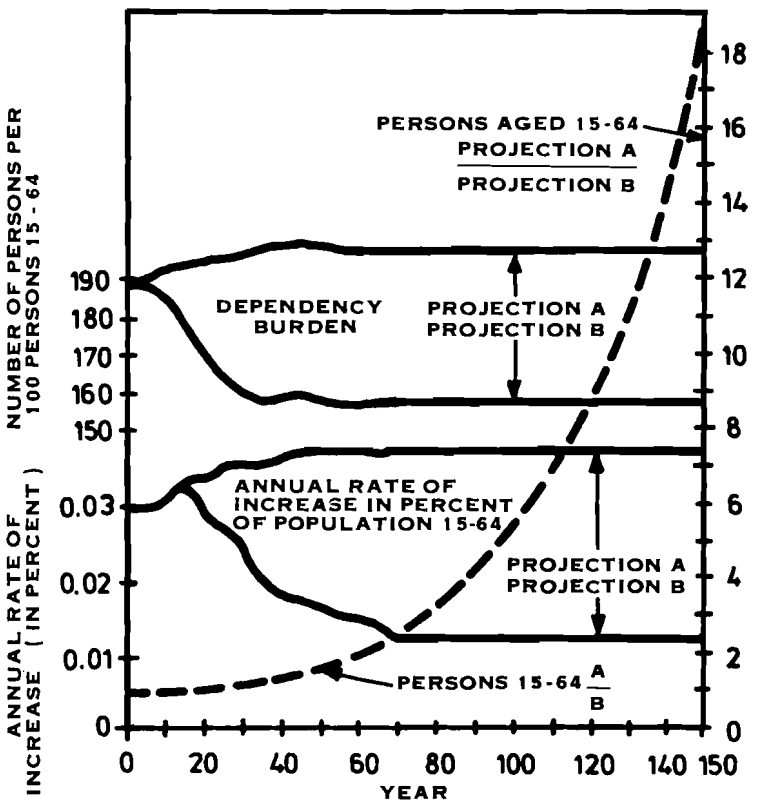

Figure 17. Dependency burden, annual rate of increase and relative size of population aged 15-64 years: two alternative projections.

Source: Coale (1969), p. 66

The process of national modernization and development depends in a very direct way on the capacity of an economy to increase its level of net investment. Recognizing that this is only a necessary and not a sufficient condition, Coale argues that the low fertility population can better divert resources from production for current consumption to net investment aimed at the enhancement of future productivity.

The two projected populations in the labor force age groups in Figure 17 differ by only 4 percent after 25 years. It is not unreasonable, therefore, to assume that national income is at that point the same for the two scenarios. The pressure for allocating a much higher proportion of the national product for consumption then would be greater in the higher fertility population because of its greater dependency burden. Families with many children, it is frequently argued, save less than those with fewer children, and the capacity of their governments and economies to raise the level of net investment, therefore, will be seriously impaired.

The short run depressing influence of high dependency on savings and investment is exacerbated in the middle run by a high growth rate of the labor force population. A larger labor force requires a larger capital stock to achieve the same productivity per capita. Adopting as a rule of thumb a capital-output ratio of 3, Coale concludes that with net investment growing at the respectable rate of 15 percent of national income, a "population with a rate of growth of three percent in its labor force can, with such a level of investment, add about two percent per year to the endowment of capital per worker" (Coale, 1969, pp. 70-71). It therefore will be able to add less to the productive capacity of the economy than a population with a less rapid rate of labor force growth. Thus, reduced fertility not only generates, in the short run, a population with fewer consumers among whom to divide a given output; it also helps, in the middle run, to generate a larger national output which to divide.

Finally, the concern with too great a density of people for available resources, i.e., with "overpopulation", stems from the belief that per capita output declines above some ratio of workers to resources. It is argued that at some point an excessively large population produces a depressing effect on per capita output. As Coale points out, however, the usefulness of the density concept in diagnosing population problems of less developed countries is limited. The politically feasible and realistic policies to influence the size of a national population are largely limited to fertility control, and such policies can affect the density of the labor force relative to resources only in the long run, i.e., after changes in dependency and labor force growth rates have already produced their major economic effects. Also, density is relevant primarily in economies that do not participate in international trade or that are principally organized around extractive activities such as mining, agriculture, and forestry.

The main demographic impacts of reduced fertility, described above, are not altered substantially by the introduction of migration as a component of change and the concomitant spatial subdivision of the national population into urban and rural sectors. Figures 18 and 19 show that for a given regime of migration ("a" or "b"), the major impacts of reduced fertility are, as in the Coale model: a decline in the burden of dependency in the short run, a lowering of the growth rate of the labor force population in the medium run, and a very much lower density of people to resources in the long run. The spatial model, however, does bring into sharp focus urban-rural differentials: (1) in dependency burdens and in the relative magnitudes of their decline following fertility reduction, and (2) in initial growth rates of the labor force population and the paths of their gradual convergence in the long run.

The dependency ratio in urban areas is 19 points lower than its rural counterpart at the start of the projection period. With constant fertility, the regional dependency burdens remain essentially unchanged. Declining fertility, however, narrows these differentials to almost a third of their original values, as the urban drop of 33 points is matched by a corresponding decline of 45 points in rural areas.

The annual growth rates of the labor force population in urban and rural areas initially are 0.05 and 0.03, respectively. For both migration regimes, however, they converge to approximately the same values in the long run: 0.04 in the constant fertility scenario and slightly above 0.01 in the reduced fertility projection.

The major demographic impacts of increased rural-urban migration for a given regime of fertility are set out in Figures 20 and 21, in which are graphed the "a" and "b" projections for each of the two fertility regimes: fixed and reduced. These diagrams show that the influence of migration patterns in our scenarios is negligible with respect to dependency burdens and is of paramount importance, in the short and medium runs, with regard to the growth rate of the population aged 15-64. In the long run migration also has a moderately powerful impact on the density of workers to resources in rural areas.

Perhaps the most interesting observation suggested by Figures 20 and 21 is the transitory nature of high rates of urban growth. In the "b" projections, urban growth rates in excess of 6 percent per annum occur only in the short run, as the national population is in its early phases of urbanization. This sudden spurt of growth of urban areas in the short run declines over the medium run, and in the long run levels off at a rate below that generated by the fixed migration regime. The growth curve of rural areas, of course, assumes a reverse trajectory, with the growth of the rural working population declining to relatively low, even negative, levels before increasing to stabilize at about the same level as that prevailing in the urban population.

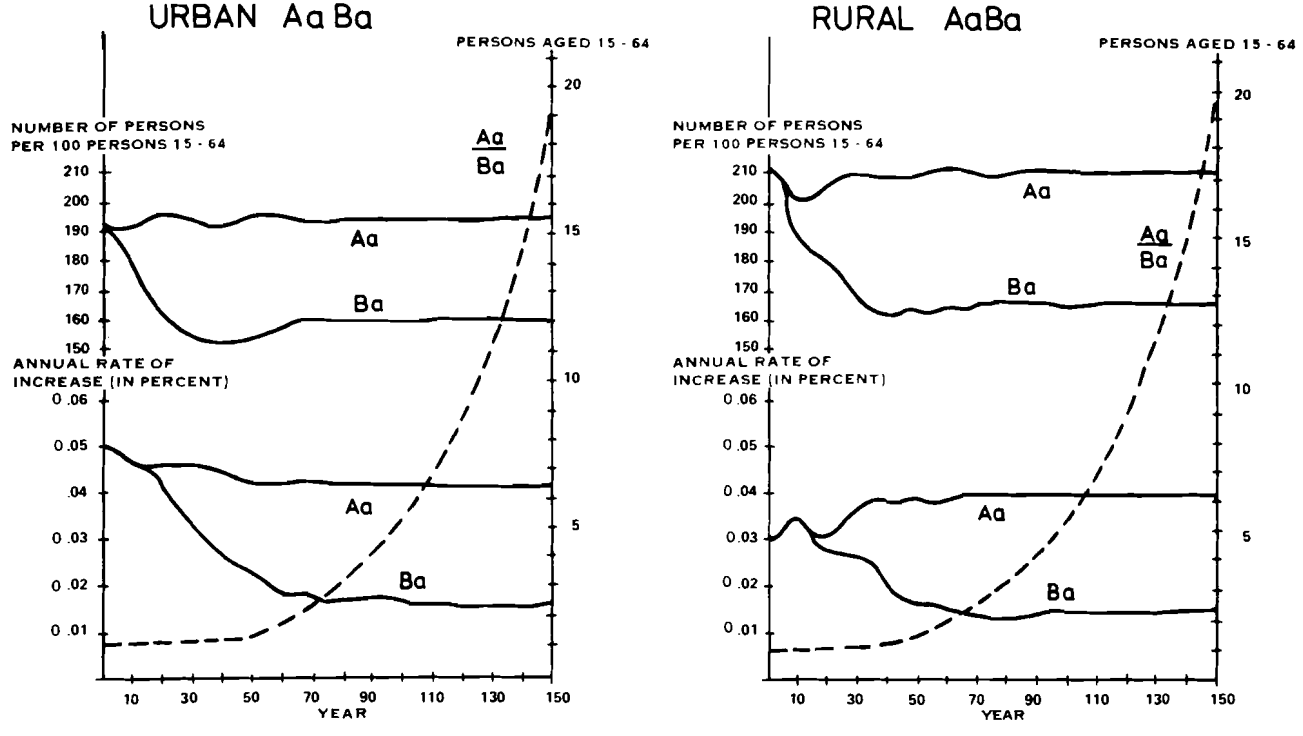

Figure 18. Dependency burden, annual rate of increase, and relative size of population aged 15-64 years: alternative urban-rural projections.

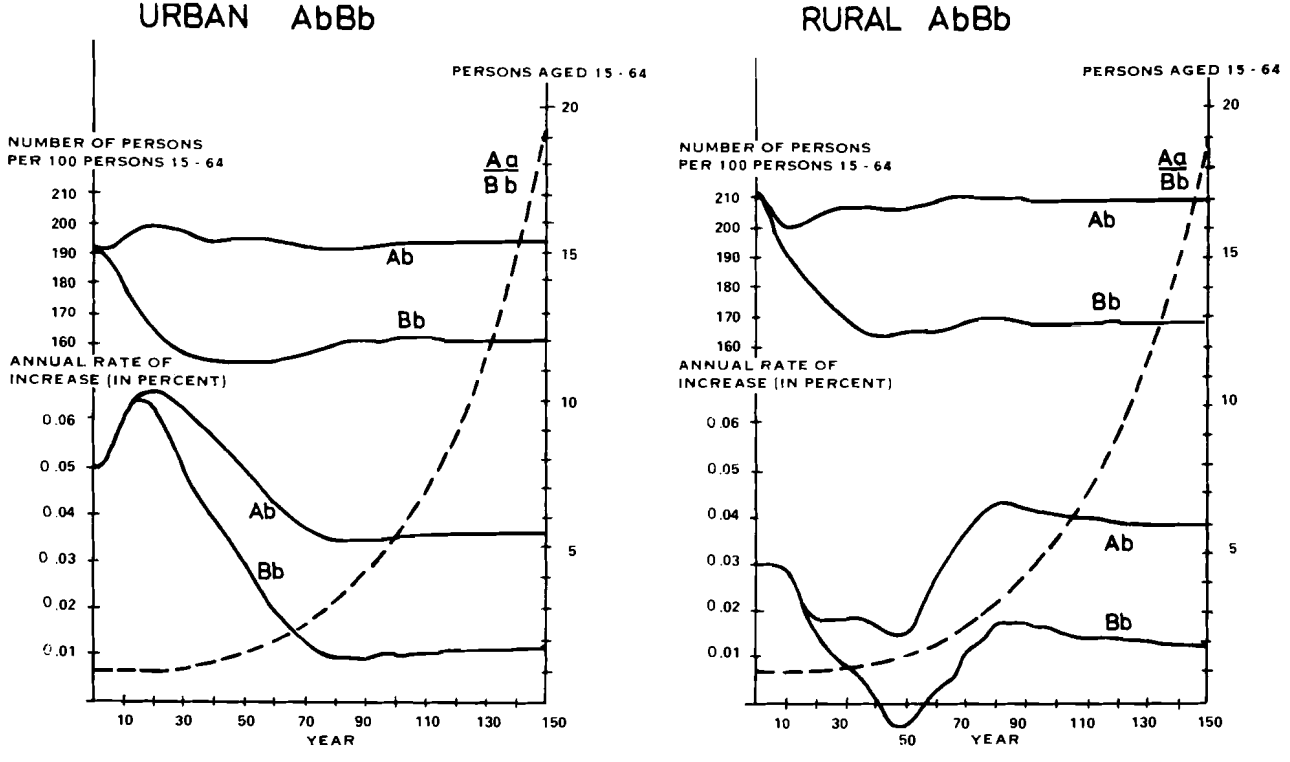

Figure 19. Dependency burden, annual rate of increase, and relative size of population aged 15-64 years: alternative urban-rural projections.

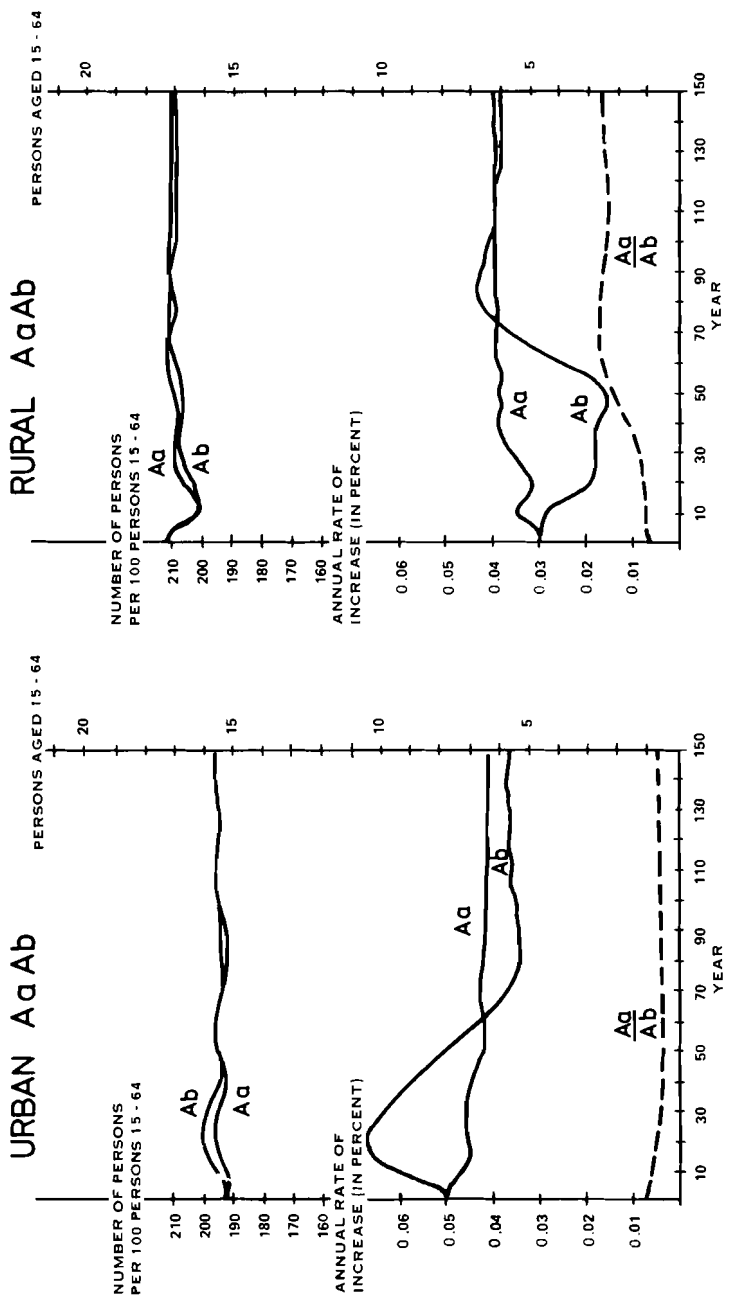

Figure 20. Dependency burden, annual rate of increase, and relative size of population aged 15-64 years: alternative urban-rural projections.

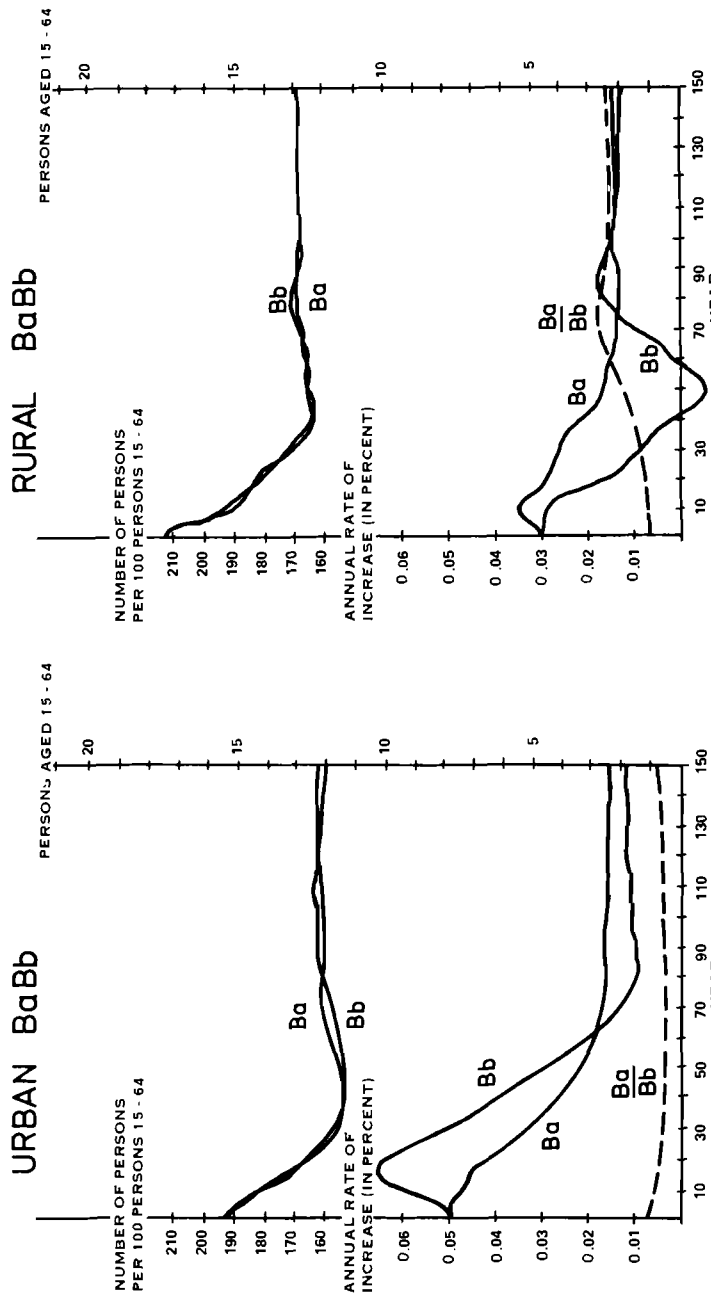

Figure 21. Dependency burden, annual rate of increase, and relative size of population aged 15-64 years: alternative urban-rural projections.

Increased migration into cities reduces the size of rural populations and hence their density with respect to rural resources such as agricultural land. Figures 20 and 21 show that the relative size of the rural population aged 15-64 is over 2.5 times larger under the fixed migration schedules of projections "a" than under the increased rural-urban migration rates of projections "b". Thus the "b" scenarios create rapid urban growth and exacerbate human settlement problems, but at the same time reduce the density of rural populations to land and other rural resources. The "a" scenarios, on the other hand, give urban areas more time to cope with growth, but do so at the cost of increasing rural population densities. "Hyper-urbanization" and "rural overpopulation", therefore, are the two sides of a fundamental policy question regarding development.

The economic implications of the spatio-temporal behavior of dependency, growth, and density in the urbanization scenarios are much the same as those described by Coale (1969), but they now include a spatial dimension. First, it is commonly believed that urban households save a larger fraction of their income than rural households. Thus the rapid urbanization arising out of increased rural-urban migration could have a positive impact on the national savings rate. But increased rural-urban migration creates rapid urban growth, thereby reducing the per capita endowment of capital and infrastructure in cities and contributing to high rates of unemployment in exploding urban centers. Finally, rapid urban growth in less developed countries tends to be concentrated in a few very large cities, and "city bigness" is viewed by many as a negative feature of development. The argument is that urban agglomerations become inefficient once they pass a certain size threshold, and thereafter the social costs of further growth begin to exceed the corresponding social benefits. However, several economists have put forward the view that large urban agglomerations generate more benefits than costs and that efforts to retard their growth, therefore, are likely to reduce national economic growth rates (Gilbert, 1976).

Until recently, research on the economic influences of rural-urban migration in less developed countries has been largely ignored by national economic planners who have tended to emphasize

> ...traditional economic variables such as output growth rates, terms of trade, savings and investment, and relative efficiency. The efficient allocation of human resources between sectors, if discussed at all, has been assumed to be a natural out-growth of a self-adjusting mechanism which functioned to equate sectoral marginal productivities. Rural-urban migration was portrayed as a manifestation of this self-adjusting mechanism (with its implicit full-employment

> assumptions) and, as such, was not deemed to be of sufficient intrinsic importance to warrant detailed theoretical and empirical investigation. (Todaro, 1975, p. 367.)

Growing levels of urban employment and underemployment in less developed countries have sharply underlined the inadequacy of ignoring the impacts of migration on development and have exposed to question the applicability of traditional economic models as descriptors of the practical socioeconomic realities of today's less developed world. The determinants and consequences of rural-urban migration and the relationships between such migration and the economic development of urban and rural areas are currently subjects of utmost importance and warrant careful scholarly examination. Agreement on this seems to be widespread. What is less evident is the conceptual framework one could profitably adopt in such an endeavor. Can the Coale-Hoover (1958) paradigm and its successors, which have served as an economic framework for examining the probable consequences of a drastic decline in the fertility rates of low-income countries such as India, be generalized and extended to serve as a framework for examining the probable consequences of significant increases in the rural-urban migration levels and urbanization rates of such countries? We now turn to a consideration of this question.

MIGRATION AND DEVELOPMENT

In developed countries, high levels of urbanization and high rates of urban growth have historically been associated with high and increasing per capita income. Figure 22, for example, indicates that the higher the percentage of a national population that is urban, the higher the national per capita gross national product (GNP). This positive association is generally attributed to factors such as rapid industrialization, increases in productivity, widespread literacy, improved nutrition, and advances in health services.

Figure 23 shows that it is important to distinguish the effects of high levels of urbanization from those of high rates of urban population growth. The positive relationship between per capita GNP and urbanization level is difficult to discern in the plot of urban and per capita GNP growth rates that appears there. Indeed there seems to be a lack of any association whatsoever. We conclude, therefore, that although high proportions of national populations in urban areas appear to be positively associated with high levels of per capita GNP, one cannot infer from this that rapid urban growth fosters rapid increases in a nation's wealth or productivity.

Most nations of the developing world are less urbanized than the developed countries, but are urbanizing more rapidly.

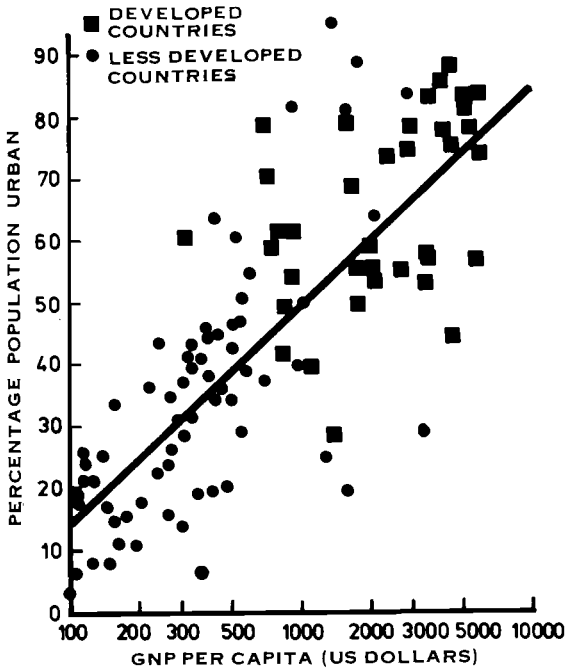

Figure 22. Degree of urbanization compared with GNP per capita, 1973.

Source: United Nations (1976), p. 27

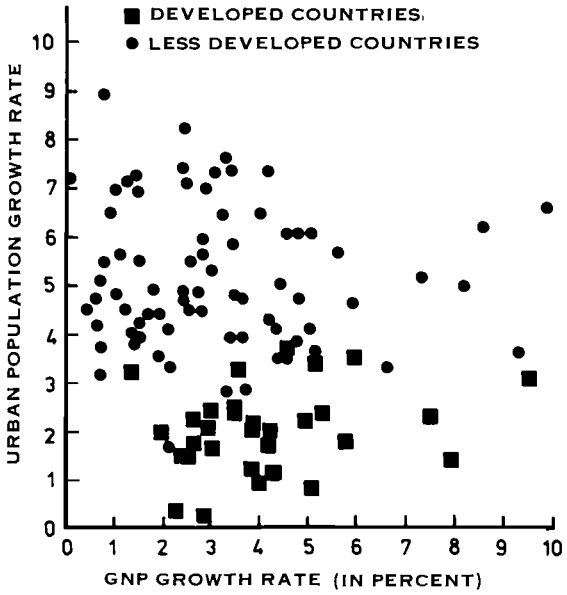

Figure 23. Comparison of annual average percentage rates of growth of urban population and annual percentage rates of growth in GNP per capita, 1965-1973.

Source: United Nations (1976), p. 28

With a few notable exceptions, their per capita income is growing slowly relative to their population increase, and their development is much too complex to be studied with the aid of simple plots such as those found in Figures 22 and 23. A fuller understanding of the important relationships that are hidden in these graphs requires the specification and estimation of a model that interconnects the principal contributing sectors of demoeconomic growth.

Figure 24 sets out the underlying structure of such a macrodemoeconomic model. Here changes in population are allowed to influence the level of output directly, and the contribution of natural resources (e.g. land) can be included in the same aggregate production function. Ideally the demoeconomic growth model should disaggregate population into urban and rural components and distinguish agricultural from non-agricultural production.

Dualistic Models of Demoeconomic Growth

A large number of studies have concluded that migration usually is a response to economic differentials and that the migrant generally improves his well-being by moving. The net benefits of his move to society, however, are much more difficult to determine. Since the relationships between migration and development are multidimensional and complex, evaluations of their interaction and their societal impacts call for a general equilibrium systems framework.

Migration between rural and urban areas changes population and labor force growth in both regions. It also changes savings-investment behavior and the growth of capital stock. It alters labor force productivity and both affects and is affected by rural-urban income differentials. A focus on the behavior of only one of these aspects while the others are held unchanged can lead to erroneous policy conclusions.

A fuller set of social consequences of rural-urban migration can be captured with a modelling framework that explicitly incorporates relationships between demographic and economic change. But progress in the development of such macroeconomic models has been slow, with the result that we have not advanced much beyond the pioneering framework provided by Coale and Hoover two decades ago. Nonetheless, the outlines of a profitable and robust paradigm are emerging out of studies that have tried to exploit the natural intersection within economics of dualistic growth theory, general equilibrium analysis, and quantitative economic history. The utility of such models can be defended with an argument based not solely on their usefulness "as abstract analytical constructs, but rather on their usefulness as quantitative tools for interpreting the historical experience of developing countries" (Kelley and Williamson, 1973, p. 450).

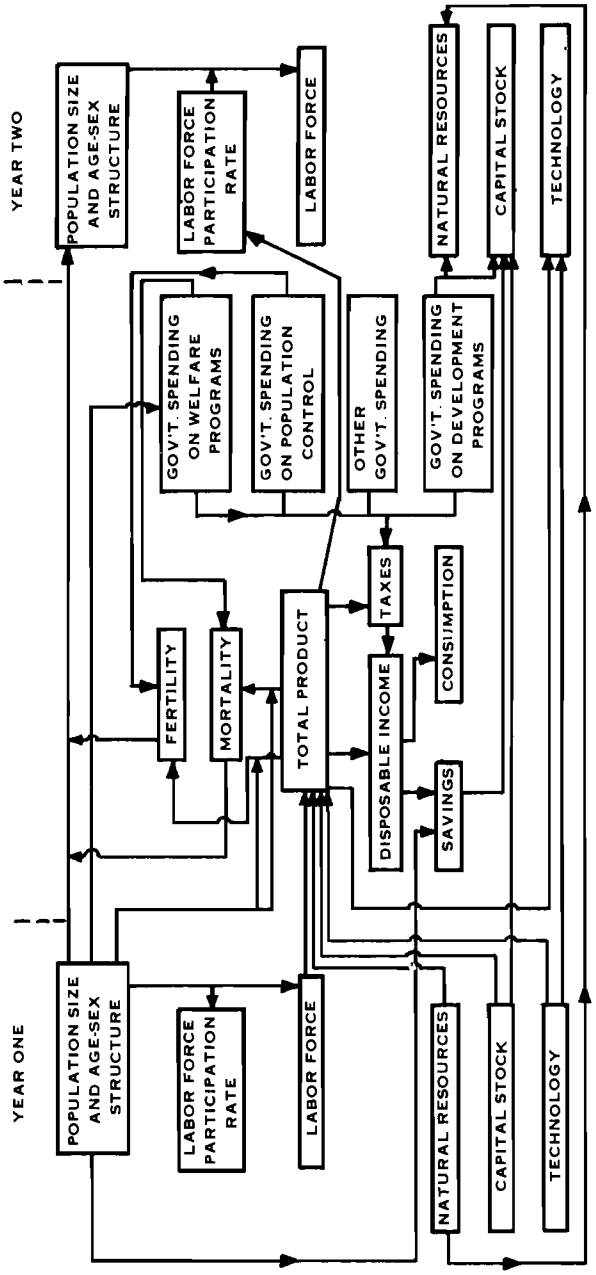

Figure 24. An interactive economic-demographic macro model.
Source: Robinson (1975), p. 20

Dualistic models of modern economic growth typically divide a low-income economy into an agricultural-rural sector, which produces a single consumption good, and an industrial-urban sector, whose output is divided between consumption and investment. Both sectors employ labor and capital to produce their outputs; the agricultural sector, in addition, utilizes land. Cobb-Douglas production functions are normally adopted for the agricultural sector and CES production functions are often assumed for the industrial sector. Technological change is specified differentially to capture dualism in production, and urban and rural residents are assumed to differ in their consumption and savings behavior. Growth of the labor force is given exogenously, in most instances, whereas growth of capital stock is determined endogenously by means of a savings-investment equation.

Several directions for dualistic model development were suggested by Kelley (1973) in a recent review of the role of population in models of modern economic growth. Heading the list of desired revisions of the "standard" model was the endogenization of population growth:

> Models in which population is endogenous are particularly relevant for two specific policy-oriented reasons. First, if population growth responds to economic conditions, then typical theoretical and empirical estimates of population's impact will be biased. For example, if population growth exerts a negative impact on the level and the pace of economic progress, and if family size varies inversely with economic conditions, then population growth will *decline* in response to its own hypothesized negative impact on the economy. Its *net* adverse impact on growth will therefore be quantitatively less than in the case where population growth is assumed to be exogenously given.... Second, if population growth is endogenous and sensitive to the variables used to assess its impact--pollution, economic growth, social stability, employment--then policy recommendations should be formulated in a framework analyzing population's *net* impact. The relevant research issues include the speed of adjustment of population growth to policy objectives--and the extent to which the adjustment level is in some sense 'appropriate'. (Kelley, 1973, p. 40.)

Kelley also emphasizes the importance of sectoral disaggregation. He argues that because the rate of economic development is associated with the rate of structural change, along such dimensions as degrees of industrialization and urbanization, models used for policy purposes should incorporate sectoral disaggregations. Such disaggregations should include, for example, the impact of population growth on the *composition* of demand as between urban and rural goods and the response of population growth to the rate of structural economic change when urban areas are assumed to foster a lower family size than is found in rural areas. The latter has already received some attention in the preceding section of this paper; the former will be examined in the next section. Here we shall return to our discussion of dualistic models of demoeconomic growth and closely examine a recent prototype of such a model in which the most important endogenous population variable is internal migration.

A Prototype Model of Migration and Development

Population's role in models of economic growth has been substantially enlarged in recent years. Most of the well-known models developed thus far have focused on impacts of population growth on per capita output (or income). Only a few models have also taken into account the influences of economic variables on population growth. Fewer yet have included internal migration as an endogenous variable affecting growth and development.

A prototype model of macrodemoeconomic growth should sketch out the main relationships determining the demographic and economic evolution of a nation experiencing modernization and development. It should contribute to the understanding of population's principal impacts on socioeconomic change and of the consequences of such change on demographic growth and distribution. In order to deal with questions of urbanization, such a model should distinguish between agricultural and non-agricultural production sectors and between rural and urban populations. Differential patterns of fertility, mortality, and internal migration should be incorporated explicitly, and governmental policy variables should constitute an important part of the model.

Instead of reviewing the several existing demoeconomic models that in general satisfy these criteria, we shall describe a single prototype model that resembles and draws on the others.*

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*Several reviews and assessments of demoeconomic modelling have been published. Among the best are those of Robinson (1975), Robinson and Horlacher (1971), and Arthur and McNicoll (1975).

The model outlined below was developed by Lorene Yap as part of a doctoral dissertation and is described in greater detail in Yap (1976). It is representative of a growing class of dualistic demoeconomic models that could contribute to an improved understanding of the societal consequences of rural-urban migration in developing countries.

Yap presents a three-sector neoclassical model of rural-urban growth with internal migration explicitly specified as an endogenous variable that both influences and is influenced by regional differentials in economic well-being. The model describes a disequilibrium process of growth in which firms maximize profits and individuals maximize utility. Migration between urban and rural sectors is viewed as a means of equalizing factor returns.

> ...rural-urban sectoral differences are emphasized in the model. In particular, there are higher capital and labor productivity and rates of technological change in the modern urban than in the rural and traditional urban sectors; higher rates of natural population growth for the rural than for the urban population; and higher marginal savings propensities for urban workers and businesses, and higher tax rates for urban workers, than for their rural counterparts. Urban population growth also generates pressures for more urban investment by the government, as well as for higher per capita public service expenditures in urban than in rural areas. With these sectoral differences a transfer of population from rural to urban areas will change the productivity of both labor and capital in the two areas, the growth of both factors, and therefore, the growth potential of the sectors. (Yap, 1976, p. 122.)

The Yap model was estimated using 1950-1965 data for Brazil, and simulation techniques were used to assess the impact of rural-urban migration on the growth of the Brazilian GNP during that 15-year period. A historical growth path and two alternative paths of the Brazilian economy were simulated, each with a different rate of internal migration. The differences between the historical simulation and simulations using a lower migration flow were assumed to reflect the importance of migration in determining the growth rate of GNP during the period 1950 to 1965.

Table 12 sets out the principal results of Yap's three simulations. Run R1 is the historical simulation with observed

Table 12. Simulation runs with alternative migration levels.

Variables	Run R1 (actual migration level)			Run R2 (migration parameters reduced by 0.5)		Run R3 (migration parameters set to zero)	
	Average growth rate (%)	Initial year	Final year	Average growth rate (%)	Final year	Average growth rate (%)	Final year
1. Migration as proportion of urban population		0.03	0.02		0.02		0
2. Urban population (mill.)	5.1	17.5	37.3	4.1	32.0	2.4	25.0
a. Proportion of total population		0.35	0.47		0.39		0.31
3. Income per capita ($)	*2.7*	*300*	*441*	*2.4*	*418*	*1.9*	*391*
a. Rural	1.5	162	200	1.3	193	1.0	186
b. Urban	1.9	557	716	2.2	759	3.0	852
4. Income or value added ($bill.)	*5.9*	*15.0*	*35.2*	*5.6*	*33.6*	*5.2*	*31.7*
a. Agriculture	3.3	5.3	8.4	3.9	9.3	4.7	10.4
a. Modern	7.1	9.2	25.6	6.5	23.4	5.7	20.9
c. Traditional	4.9	0.5	1.2	2.9	0.9	−2.1	0.4
5. Capital stock ($bill.)	*6.4*	*37.0*	*79.6*	*6.2*	*77.6*	*4.9*	*76.1*
a. Agriculture	3.3	13.1	21.1	3.4	21.5	3.6	22.0
b. Modern sector	6.3	23.9	58.4	6.0	56.0	5.6	53.1
6. Sectoral employment as proportion of total employment							
a. Agriculture	1.8	0.65	0.53	2.7	0.60	3.7	0.69
b. Modern	*5.2*	*0.26*	*0.35*	*4.5*	*0.31*	*3.5*	*0.27*
(1) skilled	5.5	0.10	0.15	4.6	0.12	3.3	0.10
(2) unskilled	5.0	0.16	0.20	4.4	0.19	3.6	0.17
c. Traditional	4.9	0.09	0.12	2.9	0.09	−2.1	0.04
7. Wage differentials							
a. Rural-urban		0.37	0.36		0.33		0.29
b. Rural-urban: Unskilled only		0.59	0.57		0.53		0.47
c. Urban unskilled-urban skilled		0.33	0.35		0.34		0.34
8. Sectoral wage inequality		3.43	4.34		4.63		6.93

Source: Yap (1976), pp. 133-134

migration levels. Runs R2 and R3 are the two "counterfactual" simulations: the first assumed that migration was half as sensitive to regional wage differentials as it actually was; the second assumed that migration did not occur at all.

An examination of the major economic consequences of the two counterfactual experiments reveals four significant impacts occasioned by the reduction in rural-urban migration:

1. Reducing migration reduces the growth rates of total and per capita GNP;

2. Reducing migration increases agriculture's share of total output;

3. Reducing migration reduces the accumulation of capacity for future growth;

4. Reducing migration increases sectoral inequalities.

Yap's simulations indicate that migration made a positive contribution to Brazil's postwar development. A 50 percent reduction in the values taken on by the parameters of the migration function lowers the average annual growth rate of GNP from 5.9 to 5.6 percent. A further drop to 5.2 percent follows from a complete prohibition of migration. A similar decline occurs in per capita terms, with the annual per capita GNP growth rate declining from 2.7 to 2.4 and 1.9 percent, respectively.

A reduction in rural-urban migration increases the growth of agricultural output from 3.3 to 3.9 percent annually, as migration's sensitivity to wage differentials is reduced to half of its previous level, and to 4.7 percent annually as migration drops to zero. At the same time, the annual growth rate of the modern sector's output decreases from 7.1 to 6.5 and 5.7 percent, respectively. The output of the traditional sector also declines, and actually contracts at the rate of -2.1 percent per year in the run with zero migration.

A reduction in migration lowers the capacity for future growth, according to the counterfactual simulations reported in Table 12. Growth capacity, measured in terms of physical and human capital stocks, declines with reduced migration. Terminal stocks of physical and human capital (the latter measured by the fraction of skilled workers), which are $79.5 billion and 15 percent, respectively, in the historical simulation, drop to $77.5 and $75.1 billion and to 12 and 10 percent, respectively, in the two counterfactual simulations with lowered migration levels.

Finally, the counterfactual simulations indicate that migration contributes positively to a reduction in the growing inequality between the urban and the rural sector. Yap's model

shows that both the extent of wage inequality in the labor force and the differential in per capita income between sectors increase when rural-urban migration is reduced below its historical level. More wage inequality and a larger differential in per capita income are reported in Table 12 for the final year of the two counterfactuals than for the historical simulation.

The principal results of the prototype model of migration and development described above add further weight to arguments directed against major efforts to curb rural to urban migration in the less developed world. The powerful private incentives and the apparently substantial social gains associated with such migration are apt to make policies to restrict rural-urban migration very costly. Urbanization policies in the less developed nations, therefore, are likely to be more socially beneficial if their focus is on managing rapid urban growth and reducing urban poverty rather than curtailing the flow of migrants to cities. Such a policy perspective leads naturally to an interest in the resource and service demands of rapid urbanization.

RESOURCE AND SERVICE DEMANDS OF A RAPIDLY URBANIZING POPULATION

What are the resource and service demands of urbanization likely to be during the next 30 to 50 years in the less developed nations of the world? How important will urban *population* growth be relative to urban *economic* growth as a generator of increased levels of demand? To what extent would the management problems associated with meeting these demands be eased if urbanization rates were significantly reduced? These and related questions are receiving increasing attention as part of a general concern over whether population increase will ultimately outstrip the growth in food supplies and exhaust the world's stock of natural resources.

Resources and services are demanded by people; hence, if all else is fixed, the level of demand should be approximately proportional to population size. Demand above this level may be attributed to affluence. For example, Keyfitz (1976) calculates that US energy consumption would have risen from its 1947 level of 1.21 billion tons of coal equivalent to 1.77 billion tons in 1973 if it merely kept pace with population increase. The fact that energy consumption rose beyond that total to 2.55 billion tons in 1973 was due to affluence, according to Keyfitz. Thus of the total increment of 1.34 billion tons, 0.56 billion was due to population growth and 0.78 billion to affluence (Figure 25).

The association between energy consumption and affluence is more explicitly shown in Figure 26, which plots per capita energy consumption against per capita income for 96 nations. The correlation is striking, and it reflects the fact that as

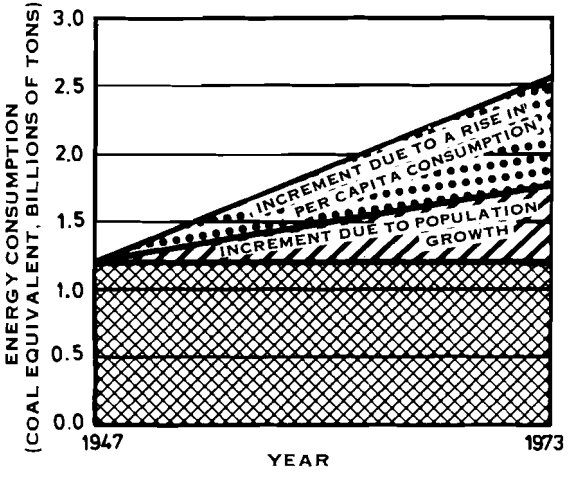

Figure 25. U.S. energy consumption.
Source: Keyfitz (1976), p. 32

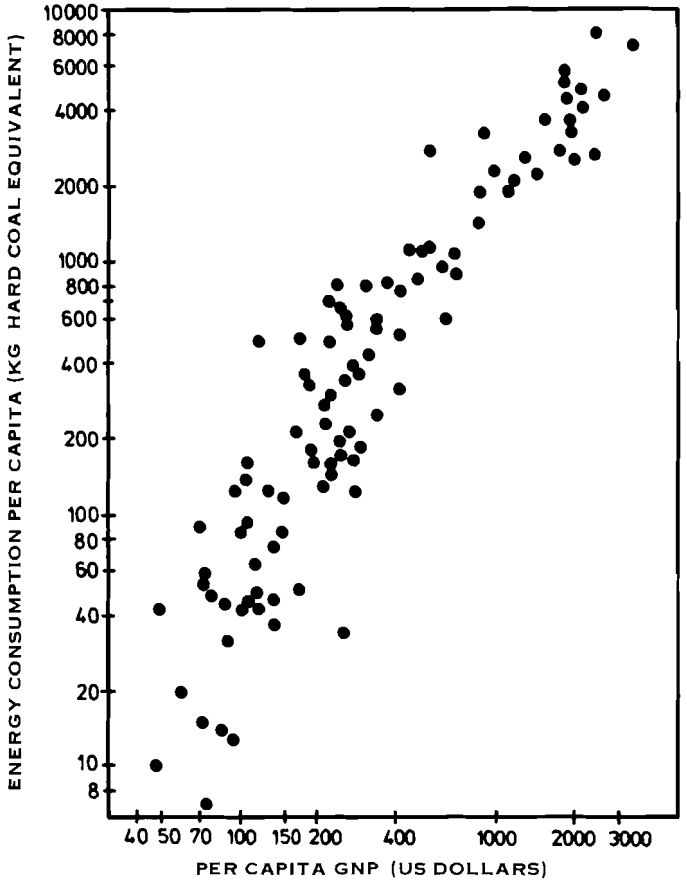

Figure 26. Per capita energy use and GNP, 1965.
Source: Fisher and Potter (1971), p. 237

a poor country develops, it requires a larger throughput of energy resources to run its economy and supply the needs of its population.

The relationships between demoeconomic change and patterns of resource and service demands are imperfectly understood. The demographic and economic determinants of the level and composition of demand are several, but a satisfactory first approximation may be obtained by considering only the impacts of changes in the size of a given population and in the total income at its disposal.

If tastes and relative prices remain stable, then the demand for a given commodity or service may be shown to grow at a rate approximately equal to the sum of 1) the income demand elasticity times the growth rate of per capita real income, and 2) the population demand elasticity times the rate of population growth (Kaneda, 1968, p. 6):

$$\frac{\dot{D}}{D} = \xi\frac{\dot{P}}{P} + \eta\frac{\dot{Y}}{Y} \quad , \tag{11}$$

where D denotes demand, Y is real income, P is population, η is the elasticity of demand with respect to income, and ξ is the elasticity of demand with respect to population, and where the dots indicate time derivatives (i.e., changes in the value of the variable over time).* If, in addition, the postulated demand function is homogeneous of degree one, i.e., if there are no scale economies of demand, then $\xi = 1 - \eta$ and (11) simplifies to

$$\frac{\dot{D}}{D} = \frac{\dot{P}}{P} + \eta\left(\frac{\dot{Y}}{Y} - \frac{\dot{P}}{P}\right) \tag{12}$$

This equation usefully connects the income elasticity of demand for food with data on income, population, and agricultural production. For example, taking as given a 1 percent annual population growth rate, a 3.8 percent rate of growth of per capita income per year, and a 1.6 percent annual growth rate of rice available for consumption, Kaneda used Equation 12 to infer that the income elasticity of demand for rice in Japan must have been $\eta = 0.21$ (Kaneda, 1968, p. 7). Thus, approximately one half of the observed percentage increase in the amount of rice demanded was due to growth in per capita income, and the other half to population increase.

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*Elasticities of demand measure the percentage change in demand generated by a unit percentage change in a variable thought to be influencing the level of that demand.

The Influence of Spatial Distribution: The Demand for Food

Patterns of food consumption undergo considerable change during the process of a country's urbanization and development. Two fundamental shifts are (1) a decline in the fraction of total per capita income that is spent on food (Engel's law), and (2) the change in the composition of the per capita food bundle. The share of food in private consumption expenditures (the so-called Engel ratio) declines from levels as high as 75 to 80 percent in traditional poor societies to less than half of that in modern developed societies. The composition of the per capita food bundle also changes as consumers substitute "preferred" food products, such as animal protein foods, for "inferior" food products such as starchy staples.

Rapid urbanization has helped to shape new food consumption patterns in developing nations. Electrical kitchen appliances have expanded the range and variety of methods for preparing food. Increasing affluence in urban centers has led to growing importation of exotic foods and such essential food items as meat and dairy products.

Urbanization influences the level and composition of food consumption in a number of related ways. First, urban and rural populations typically have different consumption patterns. Thus a rapid change in the geographical distribution of a national population is bound to alter the aggregate demand for food. Second, an important consequence of rural-urban migration is a change in the pattern of income distribution as migrants gradually improve their income status. This change influences aggregate food consumption patterns; e.g., a given improvement in the income level of lower income groups would be expected to increase aggregate food demand more rapidly than in higher income groups. Finally, changes in tastes induced by urban development processes would be expected to further increase the aggregate elasticity of food demand.

Recently published data for Japan indicate very clearly the substantial reduction in urban and rural Engel ratios that has followed the high growth rates of per capita income during the postwar years (Figure 27). For each of the three years included in Figure 27, the Engel ratio for urban households is lower than that for farm households. This in part reflects the higher per capita income of urban households. The fraction of total expenditure that is devoted to starchy staples (cereals, potatoes, etc.) is also lower for the urban population. As urban households are able, with increasing incomes, to modify their dietary habits, they tend to consume ever larger quantities of animal protein foods such as meat, dairy products, eggs, and fish.

The differences in urban and rural food consumption patterns illustrated in Figure 27 also may be observed in the recent estimates of income elasticities developed by Kaneda (1968).

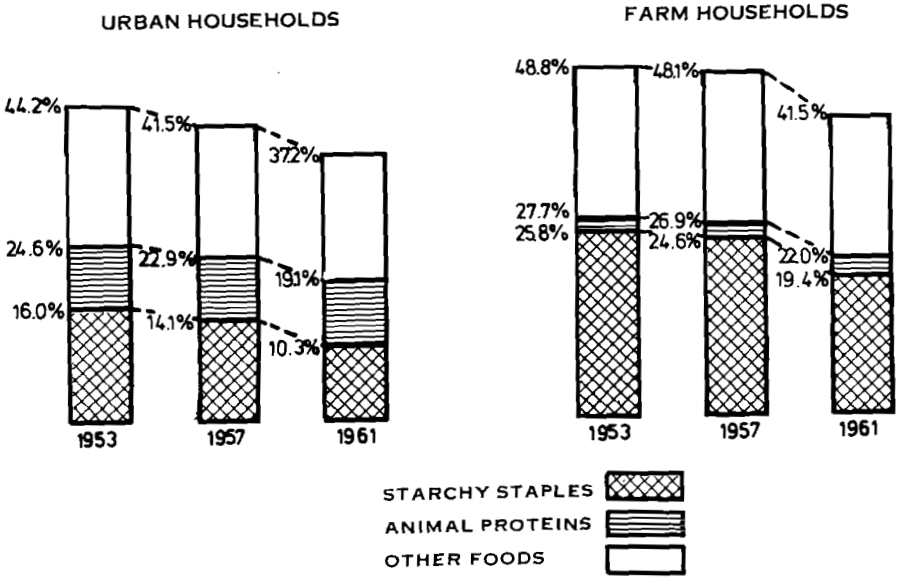

Figure 27. Percent of total household expenditures for specified food groups by urban and farm households in Japan.

Source: Kaneda (1970), p. 423

These are set out in Table 13 and reveal that, as in the case of Engel ratios, the elasticities for all food, starchy staples, and animal proteins are smaller for the urban than for the rural (farm) population. A possible explanation of this fact is the greater variety and availability of alternative goods in urban centers. As a consequence, income expansion among farm households would increase aggregate food consumption more than a similar growth in income among urban households.

Table 13. Measured income elasticities based on household budget surveys: urban workers' households and farm households, 1953, 1957, and 1961.

Year	Total food	Starchy staples[a]	Animal proteins[b]	Other food
		Urban Workers' Households		
1953	.481	.196	.750	.590
1957	.456	.062	.773	.602
1961	.472	.075	.700	.585
		Farm Households		
1953	.529	.466	1.117	.412
1957	.531	.363	1.156	.507
1961	.529	.159[c]	1.087	.720

Estimates were derived by weighted logarithmic regressions; observations were weighted according to the number of households represented in each group.

[a]Cereals and starchy roots (e.g. potatoes) for farm households represented in each group.

[b]Meat, dairy products, eggs, and fish.

[c]Not significantly different from zero at 5 percent.

Source: Kaneda (1968), p. 22

Sector-specific income elasticities such as those presented in Table 13 may be combined with urban and rural versions of Equation 12 to yield crude estimates of food demand over time and space. Assume, for example, that the income elasticity for starchy staples is 0.1 in urban areas and 0.4 in rural areas. Let the annual growth rates of urban and rural incomes be 6.5 percent and 3.3 percent, respectively. (The latter are roughly the values presented for Brazil in Table 12.) Finally, assume that Projection "Bb" in Table 11 describes the demographic evolution of the population under study. Then, during the initial years, demand for starchy staples in urban areas will be growing at an annual rate of about

$$\frac{\dot{D}_u}{D_u} = 0.047 + 0.1\ (0.065-0.047) = 0.049 \quad ,$$

whereas the corresponding demand in rural areas will increase at the annual rate of

$$\frac{\dot{D}_r}{D_r} = 0.025 + 0.4\ (0.033-0.025) = 0.028 \quad .$$

If the only changes after 50 years are increases in the annual growth rates of urban income to 10 percent and of rural income to 4 percent, then the growth rate of demand for starchy staples should decline to 0.034 in urban areas and 0.014 in rural areas. Since during this period the urban share of the total national population increased from 20 percent to 65 percent, the aggregate national demand for starchy staples should decline from an initial annual growth rate of about 3.2 percent to one close to 2.7 percent. (If, as is likely, the income elasticities decline with increasing income, then this reduction should of course be even greater.)

Equations 11 and 12 provide crude approximations of demand changes stimulated by population and income growth in settings where the assumption of stable tastes and relative prices is not seriously violated. However, when food consumption patterns change rapidly, as they did in postwar Japan, for example, the impacts of possible shifts in tastes and relative prices should be taken into account. Kaneda (1968) attempts to do this by adopting the following generalization of Equation 11:

$$\frac{\dot{D}}{D} = \frac{\dot{A}}{A} + \xi\frac{\dot{P}}{P} + \eta\frac{\dot{Y}}{Y} \quad , \tag{13}$$

in which the intercept term is interpreted as a measure of *changes* in the structure of demand defined by the parameters ξ and η.

Using household budget data for Japan and relaxing the assumption that ξ must equal $1 - \eta$, Kaneda obtains the partial elasticities of food demand with respect to family income as well as to *family size*. Table 14 presents his estimated elasticities and reveals the following two important points:

1. Urban and rural partial *size* elasticities for total food expenditures do not differ nearly as much as partial *income* elasticities (0.405 against 0.455 for the former, and 0.462 against 0.555 for the latter). This suggests that differences in urban and rural household consumption behavior may be attributed much more to differences in income levels than to variations in family size.

2. Food groups are ranked in terms of partial *income* elasticities, in descending order of magnitude: animal proteins, other foods, total food, and starchy staples. The corresponding ranking in terms of partial *size* elasticities is essentially the reverse. The first ordering reflects consumers' preferences, the second the effects of family size on food consumption. For example, animal proteins are preferred to starchy staples, but an increase in family size makes its members relatively poorer and increases the basic "need" for food energy. As family size for farm households increases, their consumption of animal proteins is reduced.

Table 14. Estimated elasticities with respect to family size and total expenditure, postwar years.

Category of expenditure	Size elasticity	Income elasticity
	Urban Workers' Households	
Total food	.405	.462
Starchy staples	.461	.216
Animal proteins	.327	.722
Other foods	.394	.591
	Farm Households	
Total food	.455	.555
Starchy staples	.921	.343
Animal proteins	-1.125	1.299
Other foods	.274	.579

Source: Kaneda (1968), p. 24

A widely observed regularity associated with urbanization, development, and modernization is the decline of agricultural production and the corresponding rise in the importance of industrial production. The conventional explanation for this regularity points to the declining importance of food expenditures as income rises. But as Kelley (1969) observes, Engel curve analysis, with its primary focus on expenditure and income elasticities, can serve only as crude first approximation in any assessment of the influence of aggregate demand on industrial patterns: "Systematic changes in the rate of population growth, of ages, of average family size, and of urbanization (internal migration) are all part of economic development...each of these factors exerts an impact on the size and composition of demand..." (Kelley, 1969, p. 111).

The Influence of Age Composition: The Demand for Personal Health Services

In discussing the determinants of the demand for health care, we shall focus on personal health services only, i.e., "those provided for individuals by doctors, nurses, and health technicians...to treat illness, prevent disease or disability, or facilitate such normal processes as human reproduction" (Corsa and Oakley, 1971, p. 372). Thus we shall exclude from consideration societal environmental health activities and such services as public information, education, vital registration, and health surveillance.

Crude estimates of personal health care demands may be obtained by the use of appropriate service utilization ratios. Thus, for example, current ratios of health personnel and facilities to population may be applied to alternative population projections to develop estimates of future health care needs. However, as in the case of energy consumption in Figure 25, greater demands for health personnel and facilities arise not only from a growing population but also from an increasing level of income. Figure 28 indicates that this relationship, which is very evident in the less developed countries, may not persist in such a simple form once the countries reach a relatively high level of development.

The spatial distribution of a population also needs to be taken into account in studies of health service requirements. Health service ratios in less developed countries, for example, are generally much higher in the major cities than in the rest of the country (see, for example, Table 15). As a result, most developing countries are striving to narrow the gap in the availability of health services that exists between urban and rural areas. This means that current rural service ratios are inadequate norms with which to scale levels of future health care needs for the rural population.

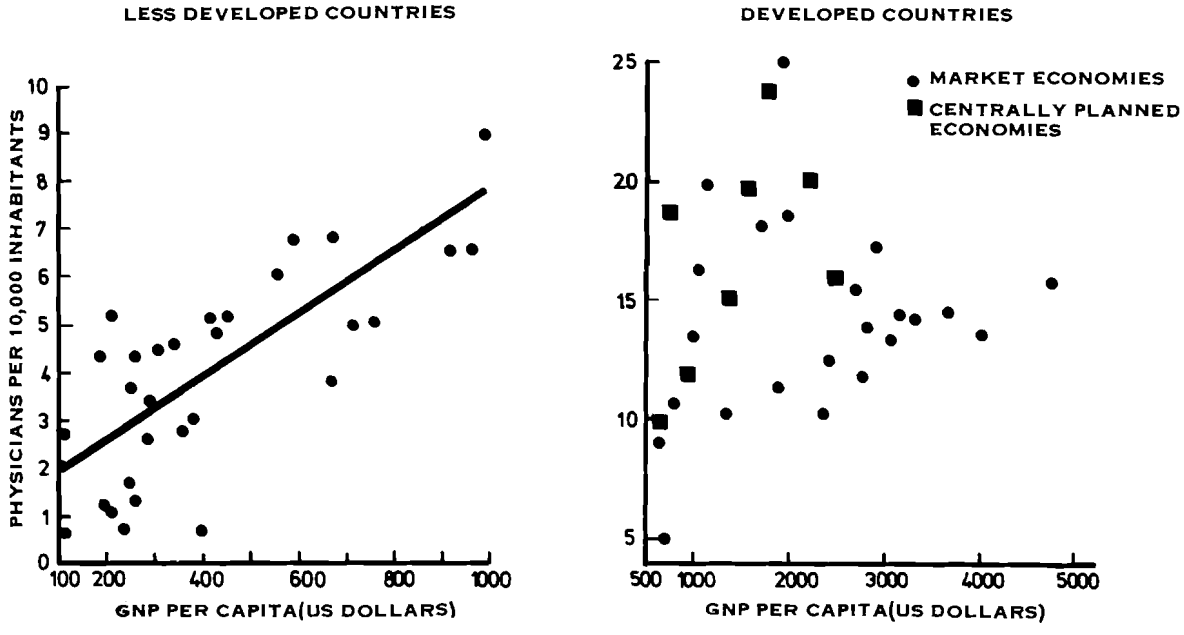

Figure 28. Gross national product per capita in relation to the number of physicians per 10,000 inhabitants, 1970.

Source: United Nations (1976), p. 129

Table 15. Projected service ratios per 10,000 population, Thailand, 1970.

Personnel and facilities	Service ratios in Thailand as a whole	in Bangkok	in the rest of Thailand
Hospital beds	9.14	41.55	5.86
Physicians	0.90	7.27	0.32
Nurses	2.03	14.24	0.92
Practical nurses	1.29	3.76	1.01
Midwives	0.88	0.57	0.91
Sanitarians	0.70	0.71	0.66
Dentists	0.098	0.71	0.043

Source: Jones (1975), p. 119

To obtain a more complete assessment of the impacts of different population trends on resource and service demands it is necessary to go beyond simple per capita ratios and examine the effect of changing age composition on such demands. Figure 29 illustrates the relationships between age composition and demands for a number of services. These data show that demands for educational services, for example, occur largely between the ages of 5 and 20, with a peak at age 10. Housing requirements, on the other hand, increase during the later years of child-bearing and hold steady until the ages of retirement. Jobs are in demand during the labor force participation ages of 15 to 65. Food requirements increase until the late teens, peaking at about age 18; after a slight decline they then level off and remain constant. Finally, health service demands are relatively high for infants and older adults; these age groups have the highest incidence of illness and require the most hospitalization.

Illness and hospitalization rates tend to be higher among adults at all ages above 50 than among children in the 0-5 age group. Nevertheless, because of their relatively large numbers in high fertility populations, young children generate a significant proportion of the total health service demand. A decline in fertility does not reduce total health care requirements,

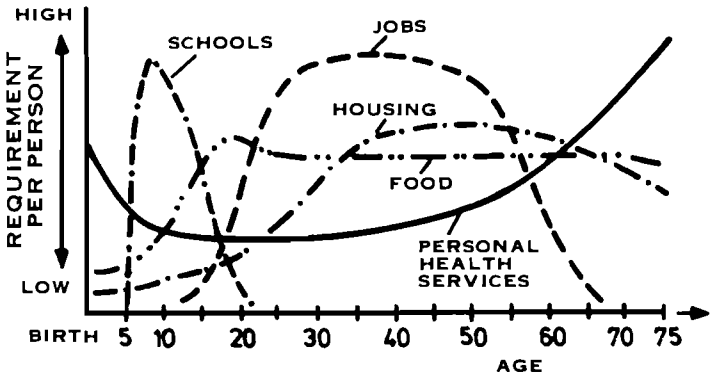

Figure 29. Time relationships between a birth and future service requirements.

Source: Corsa and Oakley (1971), p. 370

however, because the corresponding decline in the proportion of young children is offset by the increase in the proportion of older adults.

Much of the variability in rates of illness (morbidity) and death (mortality) among different age and sex groups in a population can be attributed to differences in their underlying cause-of-illness or cause-of-death structure. By way of illustration, Table 16 presents death rates among US and Swedish males, by cause of death, for three broad age groups. These data reveal a striking variation of mortality with age.

Teenagers and young adults in the USA are, on the average, very healthy, and their probabilities of dying of diseases are extremely small. Their probabilities of dying in accidents, however, are not that small, especially for males. Table 16 indicates that out of 100,000 US males at age 15, over 1100 will die in accidents before reaching age 25. More than half of these will lose their lives in automobile accidents. Combining these totals with deaths due to suicide and homicide, we find that deaths caused by violence in one form or another accounted for three out of every four male deaths in the 15-24 age group. This is in marked contrast to the corresponding aggregate rate for all US males, which is one in every ten.

Table 16. Expected number of deaths by cause per 100,000 males at various ages: USA, 1968, and Sweden, 1967.

	USA (white males only)			Sweden		
	Age					
Cause of Death	15-24	35-44	55-64	15-24	35-44	55-64
Heart diseases	28	999	9940	22	369	5293
Neoplasms	103	507	4697	110	343	3159
Cerebrovascular disease	-	-	1196	6	76	950
Cirrhosis of liver	-	138	645	-	50	204
Other accidents	310	321	508	228	287	426
Influenza and pneumonia	29	79	505	25	30	310
Motor accidents	807	351	382	335	197	285
Suicide	113	232	348	140	427	520
Homicide	75	98	62	9	4	9
All causes	1690	3458	21,902	1045	2286	13,410

Source: Fuchs (1974) pp. 41-45

Heart diseases become the major cause of death from about age 35 on, according to Table 16. Approximately one out of every 100 white US males dies of a heart attack or related disease in the 35-44 age group. Neoplasms, especially lung cancer, and cirrhosis of the liver both become important causes of death among US males from age 35. Thus the combined impact of smoking and drinking on health is considerable.

The probabilities of dying during the 10-year period between ages 55 and 64 are substantially higher than during the entire 40-year period between ages 15 and 55. The principal reason is the striking increase in the probabilities of dying of a heart attack. According to Table 16, the death rate from this cause is ten times greater during late middle age than it is at ages 35-44, and over half of all deaths in the former age group are due to it. The chances of dying from lung cancer also increase to more than ten times the rate observed at ages 35-44.

A comparison of the US and Swedish male death rates (Table 16) sheds some light on the character of health problems among US males. Largely because of the high rate of violent deaths, the US rate at ages 15-24 is more than 60 percent higher than the corresponding rate in Sweden. The number of violent deaths per 100,000 individuals is 83 percent higher in the USA than in Sweden, whereas the differential in nonviolent deaths is only 16 percent.

The pattern changes in the 35-44 age group as the differential in deaths from violence declines and that in deaths from heart diseases increases substantially. Between ages 55 and 65 the US death rate is 63 percent higher than the rate in Sweden, and the US rate for heart diseases is approximately double the Swedish rate.

As better control over such diseases as typhoid fever, diphtheria, whooping cough, and measles leads to major declines in mortality levels, death rates provide an increasingly incomplete description of a national population's general health status. Illnesses and disabilities associated with arthritis, mental illness, and sight and hearing problems are not reflected in mortality statistics, yet much of a nation's requirements for health care is connected with them. Moreover, as more people survive to older ages, chronic degenerative diseases including heart disease, cancer, and stroke become more common. Finally, it is important to recognize that future demands for health services also depend on the combined effects of a number of factors besides population. These include national decisions about the importance of health goals relative to other goals and about the health service functions that should be carried out by various kinds of health personnel: world technological developments; and levels of international technical assistance (Corsa and Oakley, 1971).

POLICY ISSUES AND CONCLUSIONS

Scholars and policymakers often disagree when it comes to evaluating the desirability of current rates of rapid urbanization and massive rural-urban migration in the less developed world. Some see these trends as effectively speeding up national processes of socioeconomic development, whereas others believe their consequences to be largely undesirable and argue that both trends should be slowed down.

Those taking the negative view argue that most developing countries are "overurbanized" in the sense that urban growth rates have greatly outdistanced rates of industrial development and economic growth. This has created an imbalance that finds cities in the less developed world perpetually struggling with crisis. Despite substantial gains in industrial production, new jobs do not appear at anywhere near the rate required to employ a significant portion of the growing urban labor force. Despite impressive improvements in urban housing, food availability, educational services, and transportation facilities, squatter settlements proliferate, hunger and illiteracy are in evidence everywhere, and traffic congestion is worse than before. And, most important, resources that could otherwise be applied to more directly and immediately productive uses instead must be diverted to satisfy the ever-growing demands for urban social services and infrastructure.

Supporters of current urbanization and migration patterns in developing countries point to the modernizing benefits of urbanization and to the improved well-being of most rural-urban migrants. They contend that urbanization transforms people's outlook and behavioral patterns while broadening their skills and fostering in them a greater acceptance of innovations and the rationality necessary for generating sustained wealth and power in a modern society. They also argue that concern on welfare grounds is probably misplaced, because despite job insecurity and squalid living conditions most rural-urban migrants are better off than they were prior to their move. Their transfer from the farm to the city enables them to raise their personal income and to obtain social services of a much wider variety and better quality than were available to them before.

The three population-related policies most frequently suggested for dealing with the urbanization problems of less developed nations are fertility reduction, economic development, and redistribution of the urban population away from the largest cities. Countries that have achieved a high standard of living, it is pointed out, also have experienced substantial declines in birth rates. And sustained reductions in birth rates have not been accomplished without significant economic growth. Moreover, the costs of services and environmental damages appear to increase markedly with city size. Yet, although there is evidence to support all these points, it is by no means irrefutable. Fertility declines have occurred without economic

growth; economic growth has occurred alongside population growth. And convincing arguments have been put forward against a narrow cost-minimization perspective in the debate on city size.

In this paper we have outlined what we believe to be three major components of any complete analysis of human settlement problems: the demographics of rapid urbanization, its demo-economic developmental aspects, and the resource-service demands that it generates. A great deal more needs to be known about these three processes before convincing evidence can be marshalled for or against rapid rates of urbanization. This evidence could shed some light on the following three important policy questions:

1. Is it high fertility or high rural-urban migration that is the principal cause of current rapid rates of urbanization and urban growth in less developed countries, and which of these two components of population change should receive the greater attention of national population policy?

2. Is a strategy of rapid industrialization, with its predominantly urban bias, the appropriate model for most developing countries, or should agricultural and rural development programs play a much larger role than they do today?

3. Are the major urban agglomerations in the less developed world too large, and do they consume a disproportionately large share of national resources and services, or is the problem one not of urban size but of urban growth management?

The countries of the less developed world are currently faced with the problem of accommodating more people in urban areas within a shorter period of time than did the developed countries. The dimensions of the task confronting the cities of developing nations are, therefore, truly gargantuan. But there are grounds for optimism: accelerating population increases in urban areas have been absorbed at rising income levels in a number of developing countries. What is sorely needed, however, is enlightened management of the urbanization process to remove systemic inefficiencies and inequalities, and simultaneous preparation of already growing cities for a very much larger increment of growth in the future.

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APPENDIX

Task Force on Population, Resources, and Growth
May 16-20, 1977, Laxenburg

Dr. Murat Albegov (USSR)
GOSPLAN and IIASA

Dr. Brian Arthur (UK)
The Population Council and IIASA

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Dr. Ronald Ridker (USA)
Resources for the Future

Dr. Evgenii Shigan (USSR)
Ministry of Health and IIASA

Dr. Kalman Tekse (Hungary)
World Health Organization

Dr. Oleg Vasiliev (USSR)
Novosibirsk State University and IIASA

Drs. Nathan Keyfitz (USA) and Simon Kuznets (USA) of Harvard University were unable to attend the meeting and sent in their comments by mail.