PROJECTIONS OF POPULATION GROWTH AND URBANIZATION FOR FIVE SOUTHEAST ASIAN PACIFIC NATIONS

Andrei Rogers

October 1981
WP-81-137

Presented at the Seventh Pacific Regional Science Conference, Surfers Paradise, Australia, August 16-20, 1981

INTERNATIONAL INSTITUTE FOR APPLIED SYSTEMS ANALYSIS
A-2361 Laxenburg, Austria

FOREWORD

Roughly 1.8 billion people, 42 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, almost twice today's urban population, will be living in urban areas by the year 2000.

Scholars and policy makers often disagree when it comes to evaluating the desirability of current rapid rates of urban growth and urbanization 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 its continuing analysis of global patterns of urbanization and development, this paper sets out a procedure with which it may be possible in the future to develop consistent, transparent global projections of population growth and urbanization.

A list of the papers in the Population, Resources, and Growth Series appears at the end of this report.

Andrei Rogers
Chairman
Human Settlements
and Services Area

ABSTRACT

This paper sets out a series of alternative projections of population growth and urbanization for five Southeast Asian Pacific nations. Fundamental to the development of these projections are alternative assumptions regarding the number of years remaining until replacement level fertility is achieved and the pace of rural-to-urban migration.

CONTENTS

PROJECTIONS OF POPULATION GROWTH AND URBANIZATION FOR FIVE SOUTHEAST ASIAN PACIFIC NATIONS

1. INTRODUCTION

Modern projections of world population growth, disaggregated by nation and region, are distinctly a phenomenon of the second half of this century. They have been made possible by recent advances in demographic theory, data, and computational methods. Developments in computer technology have played an essential supporting role in promoting all of the above advances. Reviewing the history of such projections, Frejka (1981:9) observes:

> Almost all global population projections since the early 1950s have not been extrapolations of total population numbers, but rather, relatively complex operations involving, in varying modifications, the following features and steps:
> -- a theoretical framework of the mechanism of population change, which guides the formulation of assumptions about future changes in demographic trends;
> -- a wealth of accumulated demographic information, which serves as the empirical base for the framework and makes possible a disaggregated approach;
> -- separate assessment and projection of national and/or regional populations, which, when aggregated, yield global projections or which provide a check on separately computed global projections; and
> --separate assessment of an initial age structure and separate projection of the two motor forces of demographic dynamics in a closed population: mortality and fertility. Combination of these elements yields the so-called "component" projection of a population.

During the 1950s and early 1960s the sole producer of global population projections was the United Nations, which during this period published four successive sets of projections: in 1951, 1954, 1957, and 1963. Starting with the late 1960s, a number of such global projections have been developed by individual scholars, national institutions, and international agencies (e.g., Littman and Keyfitz, 1977; U.S. Bureau of the Census, 1979; World Bank, 1978).

Projections of global urban and rural population growth and urbanization levels require more data and more complex calculations. It is not surprising, therefore, that they have been regularly issued only by the United Nations, which published its most recent set of urban and rural population projections last year (United Nations, 1980). It is likely that, following the historical pattern exhibited by global national projections, a number of global urban and rural population projections, produced by individuals and national and international agencies, will soon appear. This paper is an initial step toward the development of such a set. It seeks to demonstrate that relatively crude, simple *transparent* models of urban and rural population growth can produce useful "back-of-the-envelope" projections, and they also may be used to assess the reasonableness of published projections. This spirit of such comparisons was aptly captured by Keyfitz (1977:5-4):

> One way of enabling clients to understand the model they are to buy is to compare its results with alternative forms simple enough to be called transparent... With much consideration of detail, the United Nations in 1968 arrived at 6.5 billion for the world in the year 2000; in 1972 they gave the figure as 6.2 billion. Can we judge such totals by formulas simple enough to be worked out on a hand calculator?

During the past few years, several scholars in the Human Settlements and Services (HSS) Area of the International Institute for Applied Systems Analysis (IIASA) have focused on the problem of designing simple transparent models of the urbanization process. The first attempt, presented in 1977 (Rogers, 1977) sought to apply multiregional demography to this problem, using discrete biregional components-of-change and cohort-survival models. Data on India and the Soviet Union were used to illustrate the former class of models, and a generalization of a hypothetical population studied by Coale (1969) was used to demonstrate the dynamics of the latter. In 1978, at an HSS workshop focusing on urbanization in Mexico, Nathan Keyfitz presented a single-region components-of-change model to study the demographic sources of urban growth and urbanization (Keyfitz, 1978). Later that year Jacques Ledent addressed the same question using a biregional model (Ledent, 1978a, 1978b, 1978c). The following year Ledent and Rogers (1979) introduced economics into the model by incorporating per capita income as a principal explanatory variable, and Rogers and Philipov (1979) examined the bias introduced by the aggregation of age and by the single-region model's use of net migration. Several papers written in 1980 and 1981 consider these topics in greater depth (Ledent, 1980, 1981; Rogers, 1981; and Keyfitz and Philipov, 1981).

This paper is the latest in the above sequence, and it draws several of its ideas from that series. Starting with the relatively well-established regularities in patterns of natural increase and net rural-to-urban migration, it suggests simple transparent models that may be used to produce projections of national population totals, disaggregated into urban and rural regions of residence. The two principal regularities that it adopts are those known as the *vital* and *mobility* revolutions. According to the first, the sudden and rapid population growth experienced by the less developed countries during the past three decades is attributed to a process whereby societies with initially high birth and death rates move to a situation of low birth and death rates in the course of development, generally following birth and death rate trajectories illustrated in Figure 1. According to the second, urbanization is a consequence of the structural transformation experienced by societies with initially low net rural-to-urban migration rates as they advance to a condition of high migration rates in the course of development and then subsequently revert back to the initial condition, as illustrated in Figure 1. Note that the net effects of the birth and death trajectories set out in Figure 1 give rise to a bell-shaped curve which is similiar

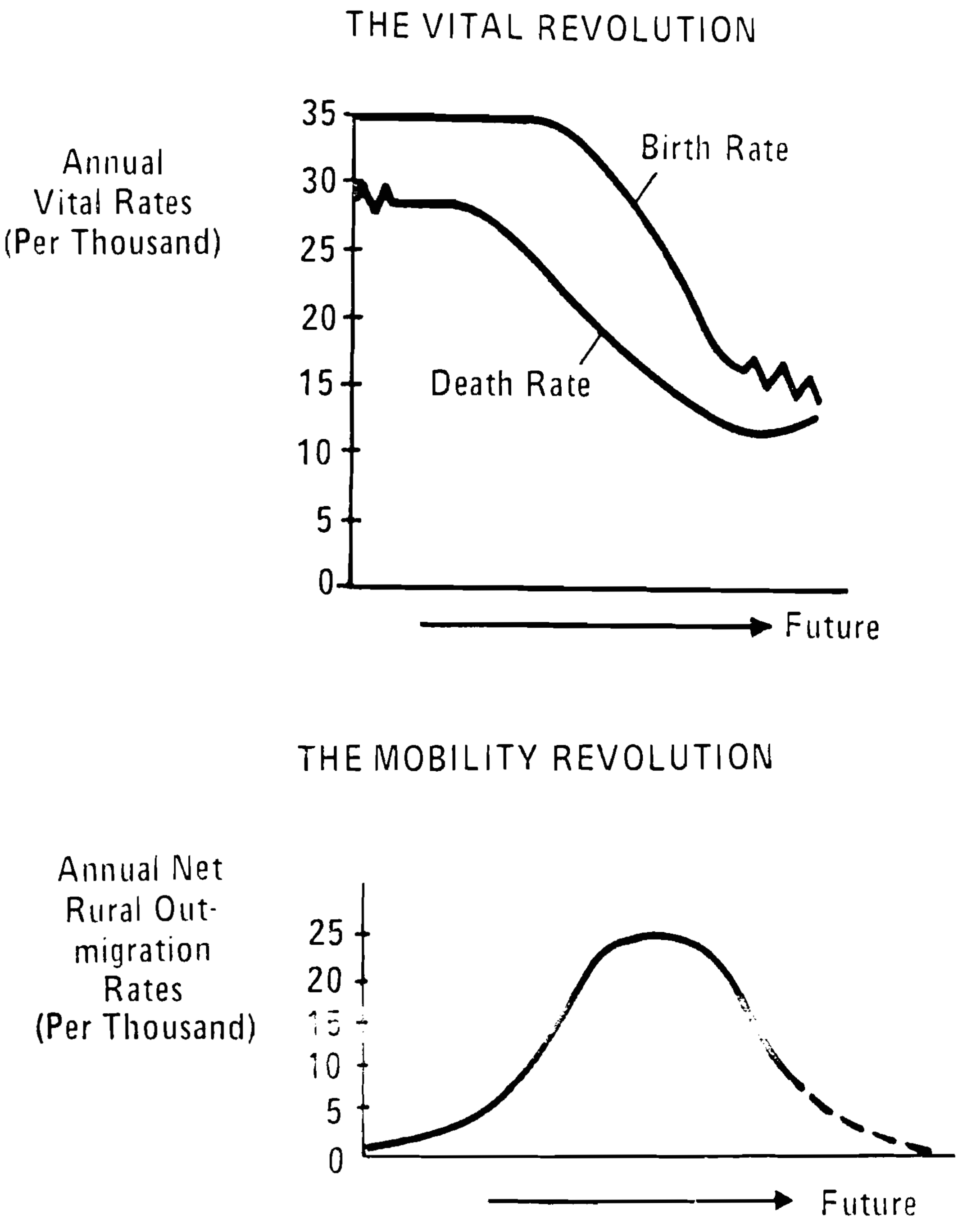

Figure 1. The demographic transition.

Source: Berelson (1974) and Zelinsky (1971).

to the one presented for the mobility revolution. No decomposition of the corresponding two trajectories underlying the bell-shaped curve for net rural-to-urban migration have been suggested in the literature. However, the trajectories for *gross* rural-to-urban and urban-to-rural migration developed in Rogers (1977) seem to yield reasonable projections and are adopted in this paper.

2. ALTERNATIVE PROJECTIONS OF NATIONAL POPULATION GROWTH

In 1980, the United Nations projected a population of 238 million for Indonesia in the year 2000. Table 1 presents the average annual rates of growth underlying that projection and includes pre-1975 estimates for purposes of comparison. Table 2 shows that this recent projection adds 16 million more people to the total projected by the United Nations three years earlier, and it exceeds the World Bank projection by some 31 million people. How are we to judge its reasonableness?

The U.N. estimate of Indonesia's population in 1975 is 136 million (Table 2). During the preceding five years this population was growing at an annual average rate of 2.6 percent (Table 1). Were it to continue to increase at that pace, its total by the year 2000 would be

$$P(2000) = 136\ e^{.026(25)} = 261$$

a total of 23 million more people than projected by the United Nations in 1980.

One can argue that the 261 million figure is undoubtedly too high. The 1970-75 rate is likely to decline as national development proceeds. Thus we need an expression that links the trajectory of $r_T(t)$, the annual rate of growth, with that of the trajectory of the population $P_T(t)$:

$$P_T(t) = P_T(0)\ \exp \int_0^t r_T(s)ds \qquad (1)$$

Table 1. Average annual national population growth rates (per thousand) implied by current United Nations estimates and projections, 1950-2000.

	Historical Data			UN80 Projection		
Nation	1950-60	1960-70	1970-75	1975-80	1980-90	1990-2000
Cambodia	25.3	27.5	27.7	29.7	28.3	23.6
Indonesia	20.6	25.4	26.0	25.9	23.8	18.9
Malaysia	24.5	28.0	28.9	29.3	26.6	18.9
Philippines	27.2	31.0	33.6	32.2	29.5	24.6
Thailand	27.7	30.3	32.7	32.3	30.0	24.9

Source: United Nations (1980).

Table 2. Alternative national population projections (in thousands) to the year 2000 and beyond.

			Alternative Projections						
	Historial Data		Published Projections			Transparent Models*			
Nation	1950	1975	UN80	UN77	World Bank	Const. r_T	Decl. r_T	ZPG Yr.	ZPG Pop.
Cambodia	4,163	8,110	15,819	13,403	15,603	16,210	14,722	2065	28,208
Indonesia	75,449	136,044	237,507	221,626	206,925	260,598	241,768	2083	556,302
Malaysia	6,187	12,093	22,054	20,181	20,241	24,906	22,284	2056	39,082
Philippines	20,988	44,437	89,707	83,434	75,705	102,932	86,840	2037	125,426
Thailand	20,010	42,093	85,618	76,061	68,661	95,334	81,339	2039	120,582

*Constant r_T means the 1970-75 value given for the country in Table 1; declining r_T means a linear decline to r_T = 20 by the year 2000; continuing this linear decline to zero gives, in the final two columns, the year at which zero population growth (ZPG) first occurs and the ZPG total, respectively.

Source: United Nations (1980), Keyfitz et al. (1981), and calculations by the author.

Table 1 shows the trajectory of a decline to 1.89 percent by the year 2000, a trajectory that yielded the total of 238 million. A linear decline to 2.0 percent produces instead a total of 242 million, according to Table 2. Extrapolating this latter pace of decline into the 21st century, drops the rate to zero by 2083 and gives an ultimate zero-growth population of 556 million.

Population projections generated on the basis of specified times to replacement levels of fertility appear to have been first produced about a decade ago by Frejka (1973). Their use as a basis for assessing the reasonableness of alternative projections in a formal way apparently is first suggested in Keyfitz (1977) and Keyfitz et al. (1981). We may illustrate the procedure with the hypothetical simple projections presented in Table 3. Three different times to zero growth (ZPG) are posited (2025, 2050, and 2075) and a linear decline from current levels to zero growth is assumed. Interpolating among these three totals allows one to infer the times at which ZPG will occur in various published projections. For example, if the momentum of growth contributed by age can be ignored (something we take up later in this paper) then the U.N. 1980 projections for Indonesia imply ZPG after 2075, those of the World Bank around 2042.

3. ALTERNATIVE PROJECTIONS OF URBANIZATION

Table 4 presents rough estimates of the past and future net rural outmigration rates that are implied by the U.N. 1980 urban and rural population projections (Ledent and Rogers, 1979). It shows, for example, that during the 1970-75 period rural areas in Indonesia were losing population at a net annual rate of 3.31 per thousand. Adopting the simplifying assumption that urban and rural populations, $P_u(t)$ and $P_r(t)$, respectively, were then both exhibiting an annual rate of natural increase that was equal to the national rate of growth r_T, and assuming fixed rates of national increase and migration, gives the following simple transparent model of urbanization dynamics (Keyfitz, 1978):

Table 3 Alternative national population projections (in thousands) to the year 2000: United Nations, the World Bank, and projections on the basis of 3 different times to zero growth.

	Alternative Projections					
	Published Projections			ZPG by 2025	ZPG by 2050	ZPG by 2075
Nation	UN80	UN77	World Bank			
Cambodia	15,819	13,403	15,603	12,160	13,045	14,182
Indonesia	237,507	221,626	206,925	198,321	210,921	226,830
Malaysia	22,054	20,181	20,241	18,500	19,977	21,894
Philippines	89,707	83,434	75,705	73,684	86,762	92,935
Thailand	85,618	76,061	68,661	68,714	75,886	84,548

SOURCE: Table 2 and calculations by the author.

Table 4 Average annual rural net outmigration rates (per thousand) implied by current United Nations estimates and projections, 1950-2000.

	Historical Data			UN80 Projection		
Nation	1950-60	1960-70	1970-75	1975-80	1980-90	1990-2000
Cambodia	0.55	1.12	2.14	2.94	4.52	7.55
Indonesia	2.52	2.95	3.31	4.39	6.42	9.95
Malaysia	6.28	2.38	2.49	4.16	7.09	11.92
Philippines	4.44	3.76	4.32	5.88	8.90	13.55
Thailand	2.30	0.81	0.84	1.83	3.66	7.20

SOURCE: Ledent and Rogers (1979).

$$P_T(t) = P_T(0)\ e^{r_T t}$$

$$P_r(t) = P_r(0)\ e^{(r_T - m_r)t} \qquad (2)$$

$$P_u(t) = P_T(t) - P_r(t)$$

Relaxing the assumption of fixed rates by allowing r_T to follow the trajectory defined in Table 1 and setting m_r equal to the 1970-75 value presented in Table 4, gives for Indonesia an urbanization level of 24.9 percent by the year 2000. The U.N. 1980 projection gives 32.3 percent for this figure, a consequence of the assumed gradual increase in net rural outmigration to an annual rate of 9.95 per thousand. To bracket this U.N. 1980 projection, we also show in Table 5 the corresponding projection with the net rural outmigration rate increasing linearly from its 1970-75 value to 16 per thousand by the year 2000. This assumption, of course, produces a higher urbanization level than is envisioned in the U.N. projections, a level of 39.5 percent. Extrapolating the linearly increasing rate of net rural outmigration until it reaches its maximum (here assumed to be 20 per thousand) gives 2008 as the date at which this peak is attained. From that point on, the net rate begins to decline as shown in Figure 1.

4. THE INTRODUCTION OF AGE COMPOSITION

All of the preceding discussion has ignored age. Yet it is well known that patterns of fertility, mortality, and migration vary regularly with age and that the relatively young age compositions of populations in the developing countries create a "momentum" for further growth that is hidden in aggregated models such as those used above. A country with a recent history of high birth rates, such as Mexico, develops an age pyramid with a broad base that tapers off sharply at the older age groups. On the other hand, a nation with a recent history of low birth rates, such as Sweden, evolves an age composition that gives rise to an almost rectangular pyramid (Figure 2).

Table 5 Alternative national urbanization projections (in percent) to the year 2000 and beyond.

Nation	Historical Data		Alternative Projections: Published Projections			Alternative Projections: Transparent Models*		
	1950	1975	UN80	UN76	Other	Constant m_r	Inc. m_r	Max. yr.
Cambodia	10.21	12.64	23.70	40.00		17.19	34.57	2007
Indonesia	12.41	18.43	32.26	31.44	49.0	24.92	39.48	2008
Malaysia	20.37	27.88	41.59	45.08	45.6	32.22	46.13	2007
Philippines	27.13	34.30	49.04	50.82	44.3	41.03	51.65	2009
Thailand	10.47	13.58	23.18	27.36		15.39	34.61	2007

*Constant m_r means the 1970-75 value given for the country in Table 4; increasing m_r means a linear increase to m_r=16 by the year 2000; continuing this linear increase to the maximum value of m_r=20 gives, in the final column the year at which this maximum occurs.

SOURCE: United Nations (1976, 1980), CICRED (1974, 1975), ESCAP (1978), Ledent and Rogers (1979), and calculations by the author. The projected level for Malaysia was obtained by averaging the eight projections to 1990 published in CICRED (1975) and then extrapolating this total linearly to 2000. For the Philippines, we selected the "moderate" projection given on p. 96 of ESCAP (1978).

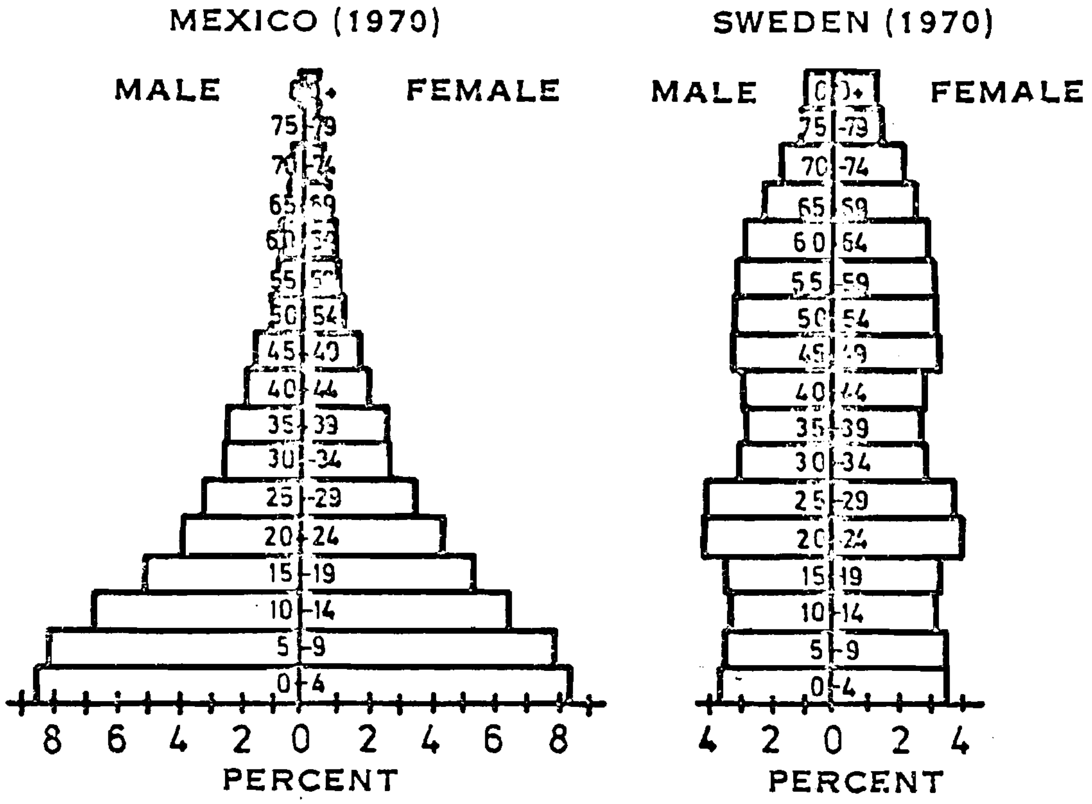

Figure 2. Young and old population age compositions.
Source: Berelson (1974).

Populations in which children outnumber parents potentially have a larger number of parents in the next generation than today and thereby acquire a built-in momentum for additional growth, even if their fertility immediately drops to bare replacement level. Under conditions of modern mortality regimes, bare replacement level means a reduction of each family's fertility to about 2.1 to 2.3 children on the average. If average family size in the less developed world dropped to bare replacement *immediately*, zero population growth would not be achieved for another 70 to 80 years and the population would be about two-thirds larger than the current one (Figure 3). 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 1 2/3, and with delayed decline about 5 1/2.

During the past several years, Keyfitz and his colleagues have developed a computer program that produces estimates of the population of the world and of its 150 major national territories,

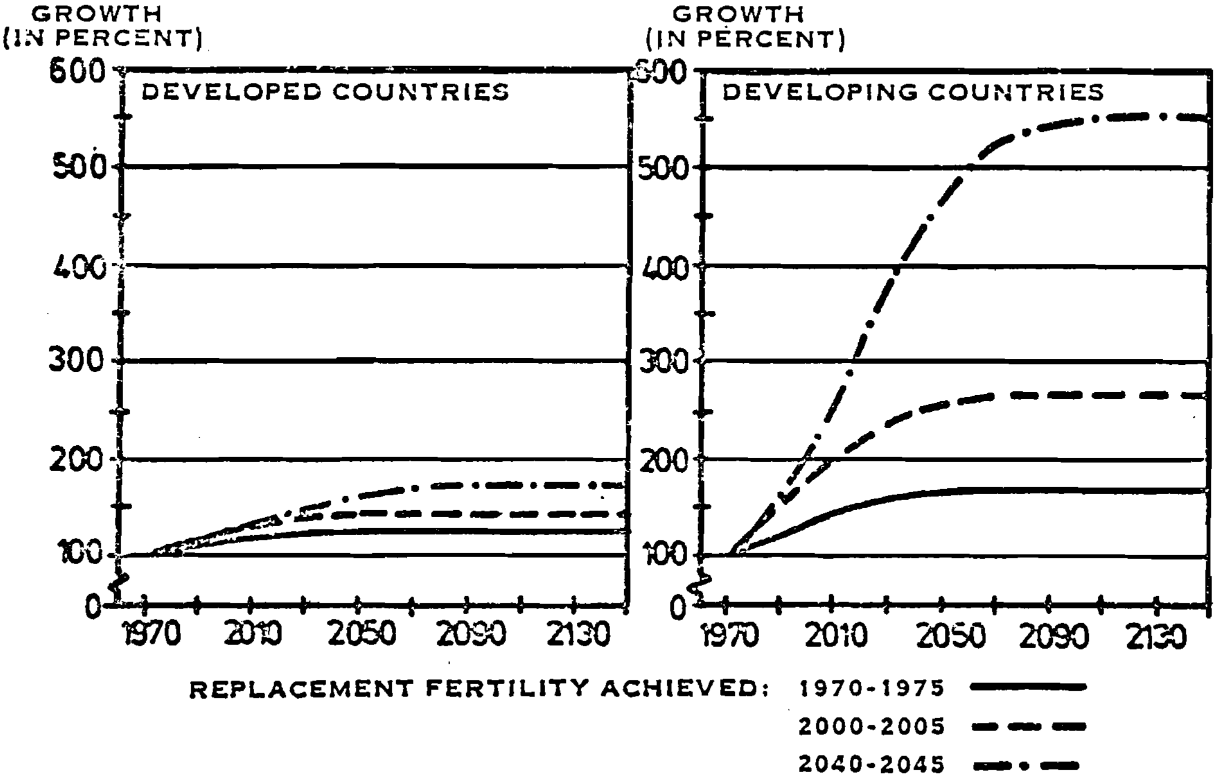

Figure 3. Momenta of population growth for developed and less developed countries.

Source: Berelson (1974).

by age and sex, for the century from 1975 to 2075 (Littman and Keyfitz, 1977; Keyfitz, 1979; Keyfitz et al., 1981; Keyfitz, 1981). The program calculates these numbers using a uniform procedure that is simple enough to be called transparent and that can be readily duplicated by others. The projection expects continued improvements in mortality throughout the globe, to levels slightly more favorable than those found in today's most developed countries, and it assumes that fertility will decline to replacement levels everywhere during the 21st century or earlier.

The results set out in Table 6 are excerpts from an extensive set of detailed computer outputs, which show for each of the 154 countries with initial populations over 250,000, a series of projected totals by age and sex for 21 moments in time—1975 to 2075 at five year intervals. Since a new life table is calculated for each of these points in time, over 6,000 life tables underlie the program's results.

Table 6. The Littman-Keyfitz projections (in thousands), 1975-2075.

Nation	1975	2000	2025	2050	2075
Cambodia					
Total	8,110	14,486	19,720	23,044	24,041
<15	3,672	5,072	4,885	4,797	4,778
15-64	4,219	8,906	13,516	15,028	15,252
65+	219	508	1,319	3,219	4,011
Indonesia					
Total	136,041	228,794	302,631	348,831	362,749
<15	59,486	75,753	73,347	72,293	72,012
15-64	73,159	142,900	207,294	226,515	229,701
65+	3,396	10,141	21,990	50,023	61,036
Malaysia					
Total	12,096	21,733	29,360	33,816	34,969
<15	5,311	7,231	7,014	6,893	6,870
15-64	6,384	13,650	20,039	21,848	22,060
65+	401	852	2,307	5,075	6,039
Philippines					
Total	44,439	83,035	113,891	132,943	137,775
<15	20,401	28,713	27,677	27,183	27,080
15-64	22,708	51,355	78,225	86,149	86,940
65+	1,330	2,967	7,989	19,611	23,755
Thailand					
Total	42,093	79,106	108,889	127,501	132,432
<15	19,298	27,530	26,608	26,145	26,056
15-64	21,557	48,541	74,705	82,668	83,564
65+	1,238	3,035	7,576	18,688	22,812

Source: Littman and Keyfitz (1977).

Keyfitz et al. (1981) seek a framework that will aid users in judging the relative reasonableness of alternative projections produced by unknown "black-box" models. They illustrate their procedure with Indonesia, whose total population for the year 2000 has been projected by a number of groups as follows (millions):

Littman and Keyfitz	229
Population Reference Bureau	211
World Bank	207
United Nations	222
U.S. Bureau of the Census	226
Community and Family Service Center	194

Their approach in assessing these published projections is to start with 1975 United Nations statistics

> ...extrapolating mortality improvements, and assuming that replacement will come by the year 2000-2005, we arrive at an estimate of 233 million. This means that each of the estimates noted above assumes sharper declines in fertility than merely falling to replacement by the beginning of the 21st century. If the mortality improvements that we incorporated are realistic, even the U.S. Bureau of the Census figure implies a fall in replacement within this century (Keyfitz et al. 1981:5).

In the Keyfitz schema, projections associated with various times to replacement level fertility constitute the frame within which alternative forecasts are to be judged. Table 7 shows them for three of the five countries studied in this paper. In each case, the computer program assumes a straight-line interpolation of the net reproduction rate between that shown for 1975 and unity.

Table 7 shows that, for the three countries, the time to replacement level fertility affects significantly the population total to be expected at the year 2000. It also indicates that the projections of the United Nations and the World Bank set out earlier in Table 3 generally imply a drop to replacement level fertility around the turn of the century. Note that the ZPG projections in Table 3 underestimate the size of the ultimate stationary population because they ignore the "momentum" of age distributions.

Table 7. Alternative national population projections (in millions) to the year 2000 at four different times to replacement level fertility.

	Alternative Projections			
	Replacement by			
Nation	2000-2005	2005-2010	2010-2015	2015-2020
Indonesia	233	241	247	252
Philippines	85	89	92	94
Thailand	81	85	88	90

Source: Keyfitz et al. (1981).

5. THE INTRODUCTION OF REGIONS

To generate transparent *biregional* projections of urbanization we need to define trajectories for the gross rural outmigration rate $o_r(t)$ and the gross urban outmigration rate $o_u(t)$. These trajectories should have shapes that, when appropriately weighted by levels of urbanization described by a logistic curve, produce the bell-shaped *net* rural outmigration profile posited by the mobility revolution perspective illustrated earlier in Figure 1. Figure 4 defines such migration trajectories.

In the absence of time series data on rural and urban outmigration flows for any country, it is necessary to adopt several simplifying assumptions. First, we assume that the rate of outmigration from urban areas $o_u(t)$ remains constant. Second, we assume that the rate of outmigration from rural areas $o_r(t)$ starts out at a level below that of the urban rate, during the nation's pre-modern traditional phase of development, begins to rise during the initial periods of the national economy's structural transformation from an agrarian to an industrial society, reaches a maximum value of o_M during the later periods of this stage of development, and finally falls to some fixed value o_s, say, at which point it stabilizes and levels off. These two trajectories illustrated in Figure 4 were used in Rogers (1977) as the basis

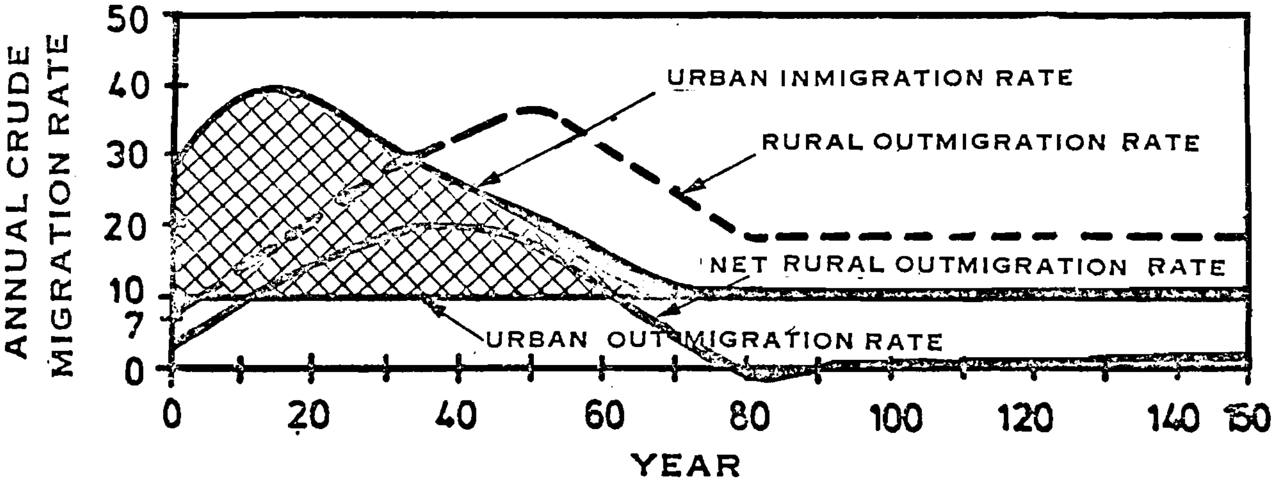

Figure 4. The evolution of migration rates.

Source: Rogers (1977).

of several scenarios of urban and rural population growth. The population growth rates and the associated logistic urbanization profile that they produced follow historical patterns, as Figures 5 and 6 demonstrate. And when appropriately weighted by the proportion of the national population that is urban, U(t), as shown below:

$$m_r(t) = o_u(t) \frac{U(t)}{1 - U(t)} - o_r(t) \qquad (3)$$

they produce the bell-shaped curve for the net rural outmigration rate $m_r(t)$ defined by the mobility revolution.

Table 8 presents the results of a very crude age-specific biregional projection of urbanization in the five Southeast Asian Pacific nations that have been the focus of this paper. The computer program that produced these is a combination of the Keyfitz program mentioned in the previous section and IIASA's spatial population programs (Willekens and Rogers, 1978). Keyfitz's data bank was augmented by the following:

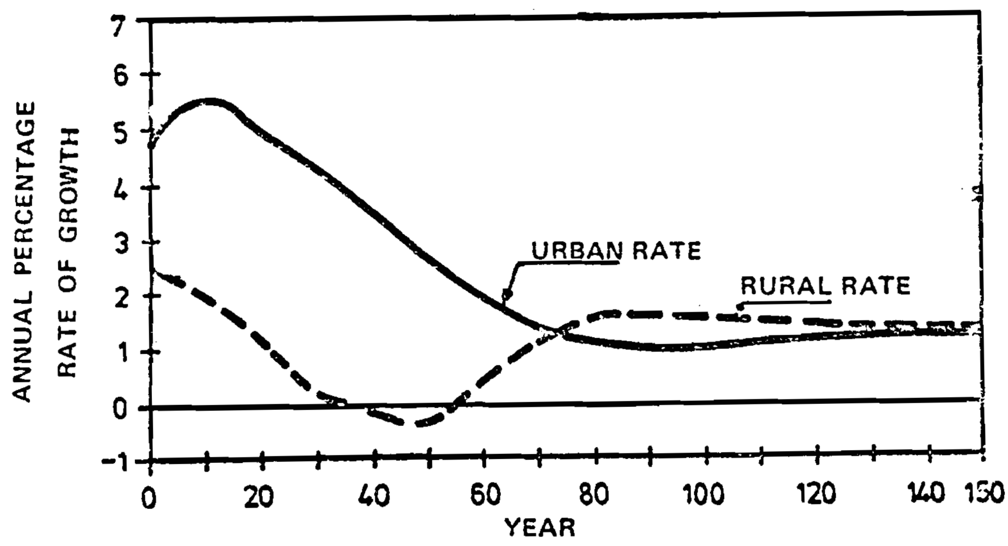

Figure 5. The evolution of the urban and rural growth rates.

Source: Rogers (1977).

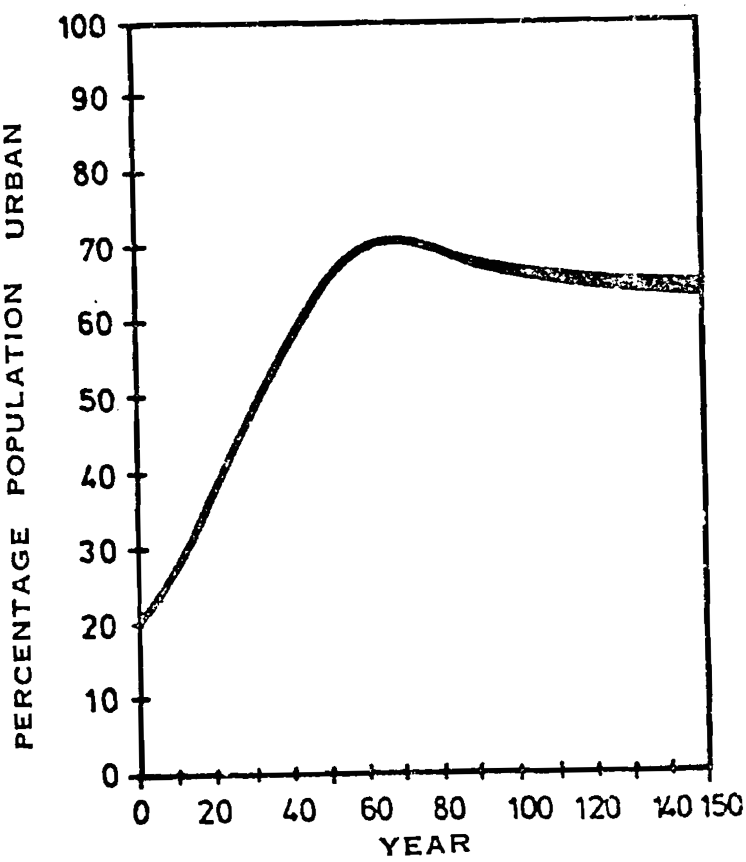

Figure 6. The evolution of the urbanization level.

Source: Rogers (1977).

Table 8. The IIASA projections of national urbanization to the year 2000.

	Cambodia		Indonesia		Malaysia		Philippines		Thailand	
	Urban	Rural	Urban	Rural	Urban	Rural	Urban	Rural	Urban	Rural
15	0.42	0.40	0.43	0.42	0.43	0.43	0.43	0.44	0.44	0.43
15-64	0.56	0.56	0.55	0.54	0.54	0.54	0.54	0.53	0.54	0.53
65+	0.02	0.04	0.02	0.04	0.03	0.04	0.03	0.03	0.02	0.04
Total	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Mean age	22.75	24.64	22.49	24.16	22.86	23.49	22.70	22.80	32.82	23.36
Growth rate	0.052	-0.001	0.049	0.003	0.048	0.012	0.045	0.014	0.061	0.010
Share	38.61	61.39	41.71	58.29	45.63	54.37	48.27	51.73	38.89	61.11

(1) a 1970 urban age composition borrowed from India;

(2) the trajectory of rural-to-urban migration illustrated in Table 4;

(3) a fixed crude rate of urban-to-rural migration set at 10 per thousand as in Figure 4;

(4) a model age profile for the two internal migration flows.

Further, it was assumed that the effects of urban-rural differentials in fertility and mortality on urbanization levels and urban growth rates was small enough to be ignored. Thus Keyfitz's national schedules were used throughout for both sectors.

The urbanization levels set out in Table 8 may be compared with those listed earlier in Table 5. With the exception of Thailand, they fall within the ranges of percentage urban defined by the three sets of published projections presented in the latter table. With the exception of the Philippines, they project higher urbanization levels than the most recent projections published by the United Nations. This is a consequence of the assumed trajectory of rural-to-urban migration. A delay in the start of this trajectory would of course lead to much lower percentages urban. So would a widening of the mobility transition period. In future projections both of these extensions will be incorporated, and differentials in urban-rural fertility and mortality will be included. It is, of course, precisely because the latter were ignored, that the urban-rural age composition of the five national populations are almost identical.

6. MIGRATION, URBANIZATION, AND DEVELOPMENT

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

Multiregional cohort-survival projection models that reflect these characteristics are useful in producing scenarios of expected future national population growth, disaggregated by urban and rural regions of residence. Yet an adequate simulation of the urbanization process all nations go through, in the course of their transition from agrarian to industrial societies, cannot ignore the state of the national economy. Nobel-Laureate economist Simon Kuznets (1966) has characterized this state as exhibiting the following features during the structural transformation:

- o high rates of growth of per capita income and product
- o relatively high rates of population growth
- o a sharp decline in the relative importance of the agricultural sector.

Since the spatial redistribution of a nation's labor force and population away from rural to urban settlements is a major correlate of the structural transformation of a national economy, a satisfactory transparent model of urbanization should contain an explicit interconnection between economic and demographic sectors.

A very simple transparent linkage between economic and demographic sectors was proposed by Ledent and Rogers (1979). Recognizing the strong association between a nation's degree of urbanization and its level of per capita GNP (Figure 7), they suggest a model that draws on this "stylized fact" to infer the growth path of per capita GNP that is implied by a projected pace of urbanization. Applying a "standard" logistic fitted to World Bank data, they find that in 1975 Malaysia and Thailand had lower levels of urbanization than other countries with comparable per capita GNPs, whereas Cambodia, Indonesia, and the Philippines showed higher levels of urbanization than their per capita GNPs would imply. Figure 8 illustrates these results. Applying this same perspective to the 1980 U.N. projections presented earlier in Table 4, Ledent and Rogers conclude that the levels of future per capita GNPs implied are reasonable in the light of historical experience.

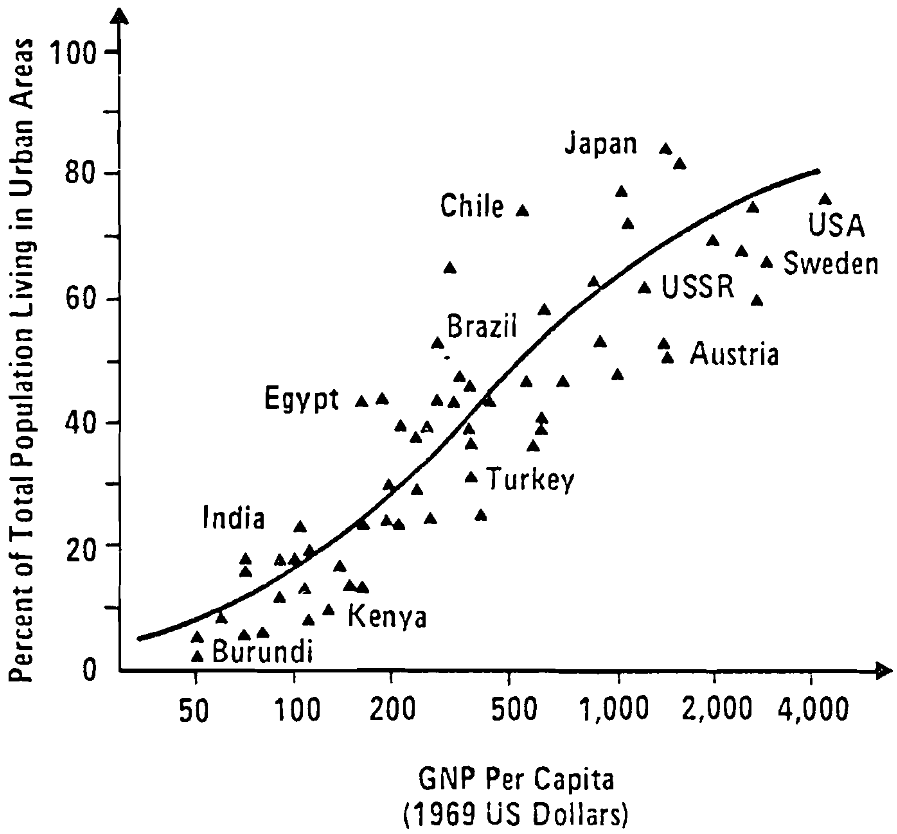

Figure 7. Degree of urbanization compared with per capita GNP.

Source: Berry (1973).

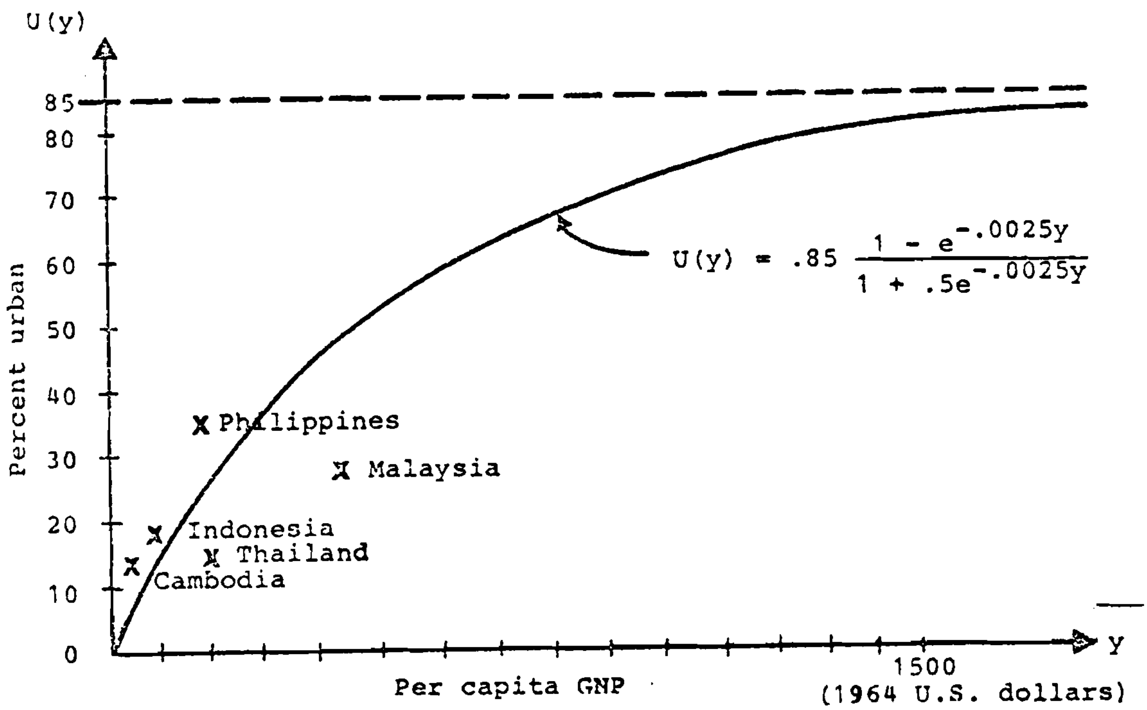

Figure 8. The "standard" relationship between urbanization and per capita GNP.

Source: Ledent and Rogers (1979).

7. CONCLUSION

No international agency regularly issues updated, globally consistent projections of urban and rural population growth for the over 150 national territories of the world. IIASA may find it appropriate, therefore, to undertake such a responsibility. This paper outlines a simple, transparent methodology for carrying out an activity of this kind. Preliminary efforts are underway to assemble the required data base and computer programs. Future efforts will be devoted to expanding the number of countries modeled from five to over 150 and to increasing the degree of realism of the fundamental assumptions underlying the projections.

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