

## Urbanization and Migration in the ESCAP Region

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Policy makers will have to plan for megacities of a size and complexity never before seen in history

By the turn of the century, almost half of the world's population will be living in towns and cities; mankind's future will be primarily an urban future. The proportion of the population of the ESCAP region that is urban currently is somewhat lower than that of the world as a whole, being estimated in mid-1997 at 37 per cent. That proportion, however, represents some 1.3 billion people, or almost one in four of the world's population. The annual average growth rate of the urban population of the ESCAP region is currently around 2.9 per cent, compared with 1.3 per cent for the regional population as a whole. However, overall figures on the level of urbanization and urban growth for so large and diverse a region do not mean that there is homogeneity in the ESCAP region; in fact there are significant and policy-relevant differences in the pattern of urbanization from one part of the region to another.

Direct comparison of urbanization from one country to another is complicated by differences in definition of what constitutes an urban area, but a regional picture becomes impossible unless comparisons are made. Nevertheless, it must always be borne in mind that in using cross-country information we are often comparing quite different definitions of what is an urban place. Very generally, we can identify four main country patterns on the basis of urbanization and urban growth in the ESCAP region (table 1): group 1, countries with high levels of urbanization (above 70 per cent) but low urban growth rates (1-2 per cent per annum); group 2, countries with medium levels of urbanization (30-60 per cent) and medium to high urban growth rates (2-4 per cent per annum); group 3, countries with low levels of urbanization (less than 30 per cent) and relatively high urban growth rates (greater than around 3.5 per cent per annum); and group 4, small countries with highly variable patterns.

Table 1. Level and projected levels of urbanization and associated variables, ESCAP region, 1994-2010  
Country or economy Level of urbanization

Country or economy	Level of urbanization 1994 (%)	Annual growth rate (%)	Urban population 1994 (000s)	Level of urbanization 2005 (%)	Level of urbanization 2010 (%)	Growth in per capita GNP 1985-1994 (%)	Total fertility rate 1990-1995
ESCAP region	37	2.9	1,230,163	n.a.	n.a.	n.a.	2.6
Group 1							
Singapore	100.0	1.03	2,821	100.0	100.0	6.1	1.73
Macau	98.8	3.65	393	99.0	99.1		
Hong Kong, China	94.9	0.75	5,539	96.2	96.6	5.3	1.21
Republic of Korea	80.0	2.89	35,645	89.4	91.4	7.8	1.73
Japan	77.5	0.37	96,763	79.4	80.6	3.2	1.50
New Zealand	85.8	1.53	3,031	88.3	89.2	0.7	2.17
Australia	84.7	1.28	15,129	85.0	85.6	1.2	1.87
Russian Federation	75.6	0.41	111,429	79.7	81.4	-4.1	1.53
Turkey	67.3	4.40	1,554	79.3	82.4	1.4	3.35
Group 2a							
Armenia	68.4	1.79	2,428	72.1	74.1	-13.0	2.60
Kazakhstan	59.3	1.24	10,092	64.6	67.2	-6.5	2.50
Azerbaijan	55.5	1.69	4,144	60.0	62.7	-12.2	2.50

Turkmenistan	44.8	2.28	1,796	47.7	50.5	n.a.	4.00
Uzbekistan	41.1	2.59	9,179	45.1	48.2	-2.3	3.90
Kyrgyzstan	38.7	2.07	1,807	42.9	46.0	-5.0	3.70
Tajikistan	32.1	2.86	1,906	35.0	38.0	-11.4	4.90
Mongolia	60.3	3.03	1,436	66.7	69.4	-3.2	3.56
Islamic Republic of Iran	58.5	3.61	38,452	64.7	67.4	n.a.	5.00
Democratic People's Republic of Korea	60.9	2.35	14,308	65.3	67.8	n.a.	2.37
Group 2b							
Brunei Darussalam	57.7	2.09	162	61.2	64.3	n.a.	3.07
Malaysia	52.9	3.88	10,422	61.1	64.4	5.6	3.62
Philippines	53.1	4.21	35,175	63.2	66.6	1.7	3.93
Indonesia	34.4	4.49	67,024	45.2	49.7	6.0	2.90
Thailand	19.7 (32)	2.49	11,487	24.3	27.4	8.6	2.10
China	29.4	3.99	355,597	38.8	43.0	7.8	1.95
India	26.5	2.87	243,486	30.9	33.8	2.9	3.75
Pakistan	34.1	4.44	46,615	41.5	45.4	1.3	6.17
Group 3							
Cambodia	20.1	6.23	1,999	27.8	31.6	n.a.	5.25
Lao People's Democratic Republic	21.1	6.08	999	28.8	32.6	n.a.	6.69
Myanmar	25.8	3.27	11,774	31.4	35.4	n.a.	4.16
Viet Nam	20.5	3.10	14,980	24.4	27.4	n.a.	3.87
Afghanistan	19.6	7.66	3,701	24.9	28.2	n.a.	6.90
Bangladesh	17.7	5.26	20,899	24.6	28.2	2.0	4.35
Sri Lanka	22.1	2.20	4,009	26.9	30.7	2.9	2.48
Nepal	13.1	7.07	2,797	19.9	23.2	2.3	5.42
Bhutan	6.2	4.81	99	9.4	11.4	4.4	5.86
Papua New Guinea	15.8	3.63	665	19.4	21.8	2.2	5.05
Group 4							
American Samoa	49.4	3.84	26	54.8	57.6	n.a.	3.74
Cook Islands	59.9	1.83	11	65.8	68.5	n.a.	3.74
Fiji	40.4	2.22	311	45.4	48.7	2.4	2.98
French Polynesia	56.3	2.15	121	58.9	61.3	n.a.	3.20
Guam	38.0	2.36	56	41.4	44.4	n.a.	3.24
Kiribati	35.5	2.38	27	39.7	42.6	n.a.	4.36
Marshall Islands	68.5	3.96	36	74.8	77.1	n.a.	4.36
Micronesia (Federated States of)	27.6	4.01	33	33.6	37.6	n.a.	4.36
Nauru	100.0	2.57	11	100.0	100.0	n.a.	4.36
Niue	29.6	-3.11	1	30.0	31.7	n.a.	n.a.
Northern Mariana Islands	53.5	2.04	25	57.3	60.0	n.a.	4.36

Palau	70.3	2.70	12	74.3	76.2	n.a.	4.36
Samoa	21.0	1.07	35	23.0	25.0	-0.3	4.50
Solomon Islands	16.6	6.49	61	23.2	26.7	2.2	5.39
Tonga	39.9	3.53	39	51.9	56.2	0.3	3.74
Tuvalu	45.0	4.07	4	56.5	60.9	n.a.	3.74
Vanuatu	19.1	3.38	32	22.8	25.7	-0.3	4.68
Maldives	38.7	3.97	65	30.7	33.9	7.7	6.80

Sources: World Urbanization Prospects: The 1994 Revision (New York: United Nations), ST/ESA/SER.A/150, 1995; World Population Prospects: The 1994 Revision (New York: United Nations), ST/ESA/SER.A/145, 1995; 1997 ESCAP Population Data Sheet, Bangkok, United Nations Economic and Social Commission for Asia and the Pacific, 1997; and From Plan to Market: World Development Report 1996 (New York: Oxford University Press, 1996).

The very general groupings described above can be used not only to examine the patterns of urbanization and urban growth, but also to examine migration and to consider the relationships among development, urbanization and migration. For example, group 1 countries, with the exception of the city-economies of Hong Kong China, Macau and Singapore, tend to be on the periphery of the ESCAP region, but incorporate the most developed core economies of North-East Asia, Australasia and Europe. Group 3 countries are among the poorest countries in the region and among the least integrated into the international community. Group 2 countries cover a wide range of other conditions and are best subdivided: subgroup 2a, the South-West Asian and Central Asian economies, and subgroup 2b, the rapidly growing economies of China and India, and (until recently) those of South-East Asia. Group 4 countries are all small economies, heavily dependent upon larger external countries.

The levels and growth rates stipulated above to separate the countries into "urbanization" groups have been taken as very general guidelines and some exceptions have been made to create more meaningful divisions. Of these, perhaps the most significant are Turkey (which has a high level of urbanization as well as a high annual rate of urban growth, but has been allocated according to its level of urbanization not according to its growth); Thailand (although it has a level of urbanization of just 20 per cent, it is included in subgroup 2b because it is a classic case of urban "underbounding", which will be explained in the discussion below); and India (which has been placed in the table according to its urban growth rather than its level of urbanization). These urbanization groupings do bear some relationship to the geographical regions used by ESCAP, although clearly there are significant deviations from them. As functional groupings they are, nevertheless, more useful for analytical purposes than strict geographical criteria where there are enormous variations in functional characteristics within each region. Equally clearly, there are significant variations within individual countries used for the functional groupings. For example, within huge states such as China, India or Indonesia, there are great ranges in the patterns of urbanization that complicate the use of national boundaries for the analysis of any particular social or economic variable. The functional groupings used in this particular section for the analysis of urbanization and migration do seem, however, to offer a reasonable compromise between the use of country boundaries and the need for some kind of analytically meaningful units.

#### Summary of regional urbanization prospects

The prospects for future urbanization clearly vary by group. We cannot expect levels of urbanization to increase significantly in group 1 economies: they have reached levels equivalent to those of the most developed countries in the world where there is an observed stabilization once levels above 70 per cent are reached. Among the countries under examination, only the Republic of Korea is expected to increase significantly its level of urbanization to 2010 when urbanization is projected to reach 91.4 per cent, one of the highest levels in the world for a country of equivalent size at that time. Rates of natural increase among the countries of this group are low, which will mean that migration will be the leading component of any urban growth, with international migration towards the largest cities becoming increasingly important. Urban deconcentration rather than concentration is likely to characterize patterns of urbanization among the countries and economies in this group.

Among group 3 countries, urban growth is likely to continue to be fast, but levels of urbanization are rarely likely to achieve significantly higher levels than at present over the immediate future. By the year 2010, almost no country in this group is expected to have more than one-third of its population living in urban areas. This is due to the rapid rates of overall population growth that will cause rural populations to grow almost as fast as urban populations. The weak, or limited, economic base, and the political instability in

several of the countries among this group, are factors unlikely to generate stable urban growth. Perhaps the one exception in this group will be Viet Nam which, after many decades of instability and isolation, is emerging as a potential centre of dynamism in the region.

It is among group 2 countries that we can expect to see the most dramatic shifts in urbanization over the near future. Group 2b contains some of the largest and most rapidly growing economies in the world, and the concentration of their populations in urban areas will be an integral part of their development. The natural growth of populations generally remains moderate to high and urban growth will be fuelled both by migration and by natural increase, as well as the reclassification of rural places to urban centres. While the importance of natural increase to urban growth is common to group 2a countries, these are quite distinct in their recent economic growth, the vast majority showing very slow or negative growth. Stagnant rural sectors, and recent independence for many which stimulates urban administrative functions, will continue to favour a transition towards a more urban society.

The small group 4 countries, as expected with such small populations, show both highly variable patterns of urbanization and highly variable projected urban growth rates. These range from islands with over half the population living in urban centres such as the Cook Islands, the Marshall Islands and Palau to those with less than one quarter of their populations in towns such as Samoa and the relatively larger Vanuatu and Solomon Islands. Growth rates vary from the very fast in the Federated States of Micronesia, Solomon Islands and Vanuatu to much more moderate rates, with that for Niue actually being negative. Meaningful comparison of urban places in the countries of this group with those in other groups is virtually impossible as what is considered to be a town in Solomon Islands or Micronesia is going to be very different from the town in China or India.

#### The components of urban growth

There are three components of urban growth: natural increase, net migration and reclassification. Natural increase can be calculated either through assumptions about urban fertility and mortality, or retrospectively through census survival ratios.<sup>1</sup> Migration and reclassification are calculated retrospectively as a residual by subtracting the component of natural increase from the real urban population, or by projecting urban immigration rates. It is extremely difficult to separate the importance of reclassification from net migration, and many studies simply choose to ignore reclassification or assume that it is negligible. However, reclassification can be a significant component indeed. For example, about 30 per cent of urban growth in Thailand between 1970 and 1979 was estimated to have been due to the physical extension of urban boundaries.<sup>2</sup>

Table 2. Components of urban growth in the 1960s, 1970s and 1980s for all-Asia (including Western Asia) and selected countries

Region and countries	1960s		1970s		1980s	
	Natural increase	Net migration	Natural increase	Net migration	Natural increase	Net migration
Asia	59.6	40.4	53.3	46.7	36.4	63.6
Bangladesh	41.4	58.6	34.4	65.6		
India	68.7	31.3	54.9	45.1		
Indonesia	68.5	31.5	49.4	50.6	41.2	58.8
Islamic Republic of Iran			56.8	43.2	70.4	29.6
Malaysia			45.2	54.8		
Nepal	67.1	32.9	39.1	60.9		
Pakistan			82.9	17.1		
Philippines			59.8	40.2	47.6	52.4
Republic of Korea	39.7	60.3	43.7	56.3	45.0	55.0
Sri Lanka	50.2	49.8	118.0	-18.0		
Thailand			42.2	57.8	55.5	44.5
Turkey	38.3	61.7	47.7	52.3		

Source: Unpublished United Nations tables.

At the regional level, and assuming for the moment negligible reclassification, we can see a marked increase in the importance of rural-to-urban migration as a component of urban growth in Asia in the 1980s

over the previous two decades (table 2). From accounting for just over 40 per cent of urban growth in the 1960s, net rural-to-urban migration increased its share to 46.7 per cent in the 1970s and to 63.6 per cent in the 1980s showing an apparent growing significance of population mobility in Asia. The annual net addition to urban areas through migration in the 1980s was estimated to be in the region of 11.4 million people.

However, the above estimates have to be treated with a great deal of caution. All but 3.3 million of the annual net increase was added by the net migration in China and, when that country is excluded from the calculations, the percentage increase in urban areas comes down to a much more modest 48.9 per cent. Estimates for China, where the one-child policy was more rigorously implemented in urban areas, suggests that over 70 per cent of the urban growth in the 1980s was due to net rural-to-urban migration. The estimates for other countries where appropriate data were available suggest a steady increase in the importance of migration as a component of urban growth in Indonesia and the Philippines, but declines in Thailand and the Islamic Republic of Iran. Given Thailand's growth rate in per capita GNP of 8.6 per cent per annum during the second half of the 1980s, this decline in the contribution of migration to Thailand's urban growth seems surprising. However, the results of the estimation procedure amply illustrate one problem: the lack of reclassification. It is recognized that Thailand's urban areas are underbounded, which is to say that the boundaries of the statistical areas of the urban areas, excluding Bangkok, have not kept pace with the physical growth of the towns and cities. A similar situation may exist in Malaysia, where the use of the 1990 urban boundaries to redefine the 1980 census data revealed the very rapid growth of the newly redefined urban areas at 17.5 per cent as against a 3 per cent per annum growth in the urban core, yet the contribution of net migration to urban growth was estimated at -6.7 per cent. Natural increase contributed 57.1 per cent while reclassification added 49.6 per cent.<sup>3</sup> As migration to urban areas is known to be marked in Malaysia, it is assumed to be mainly to areas beyond even the 1990 urban boundaries.

Thus, much of the migration to towns is not captured as movement to the urban sector but either to peri-urban areas that are still classified statistically as rural, or, in the case of Thailand, to "sanitary districts", a term for settlements which generally have urban characteristics but have not yet been classified as urban. When the populations of the larger sanitary districts, those with populations of 5,000 or more, are added to the urban population, the proportion urban rises from 17.0 to 23.6 per cent in 1980 and from 18.7 to 27.1 per cent in 1990.<sup>4</sup> These higher proportions give a more realistic estimate of Thailand's urban population than simply using the official statistical definition of urban.

A more common difficulty in assessing the importance of the component of migration in urban growth is the underenumeration of urban populations through the census methodologies adopted. For example, de jure census registration, which is adopted in China, Indonesia, the Philippines and Thailand at least, tends to allocate long-term urban residents to the rural sector rather than to towns, hence severely underestimating the size of the urban sector and the importance of rural-to-urban migration.<sup>5</sup> It is now well recognized that population censuses capture only a part, and possibly only a small part, of total population mobility. For example, according to the population census of Thailand, only 8 per cent of the population changed its usual place of residence in the five years preceding the 1990 census. Using much more refined definitions, the mid-1992 National Migration Survey of Thailand identified almost 15 per cent of the population moving in the six months prior to the survey, which rose to 22 per cent when a one-month reference period was used.<sup>6</sup> Even Malaysia, which uses de facto census enumeration, was shown to miss about one-tenth of the number of migrants in its basic census definitions.<sup>7</sup> Thus, policy makers would be ill-advised to base policy on data that indicate only moderate increases in the contribution of migration to urban growth. They must assume that real estimates of urban growth, and of the rate of change to urban populations, are probably underestimated from most basic census data.

As fertility declines, migration should increase its share of the proportion of urban growth. Also, as a majority of migrants are young adults, there should be cohort effects which can increase yet further the number of migrants: past high fertility will give rise to increased numbers of migrants 15-20 years later. However, declining fertility will eventually lead to declining numbers of migrants, other things being equal as will be seen in the subsequent discussion.

#### Patterns and characteristics of migration

The significance of migration as a component of urban growth was examined in the previous section. In group 3 countries, and in many group 2 countries, the dominant pattern of migration is, however, rural-to-rural movement. Much of this would be associated with inter-village movements for marriage, but there are other important population flows within the rural sector: of agricultural labourers to plantations; of labour to rural infrastructural projects such as road construction or the building of dams; of settlers to areas of land settlement such as the transmigration projects in Indonesia; and of the movement of government functionaries into village areas to carry out specific tasks. Much of this movement, as well as of the

migration to the towns and cities, is short-term and it is the increase in this human circulation between origins and destinations that has been such a dominant characteristic of population mobility in Asia and the Pacific in recent times.<sup>8</sup>

This circulation links the urban and rural sectors and lets villagers tap the resources of the cities on a short-term, often seasonal, basis to enable rural families to diversify their risk by giving them access to another economic niche. In this way, migration can help to alleviate rural poverty and authorities need to bear these benefits in mind when they attempt to introduce policies that might act to restrict population mobility. Those policies that accept the wider mobility of the population are likely to accord with policies that will enhance the well-being of greater numbers of people.<sup>9</sup> As stressed above, however, much of this type of short-term mobility is not captured by most national data-gathering systems and we still know relatively little about its form and function. In China, for example, only those who change their place of official registration (*hukou*) are recognized migrants. Yet, by the mid-1990s, there were between 80 million and 100 million who moved without changing their official place of residence -- the "floating population" -- compared with about 20 million recognized migrants. At least 64 million among the floating population were involved in circulation from rural areas.<sup>10</sup>

The form of mobility, long- and short-term, internal and international, varies across the ESCAP region. Group 1 countries are essentially countries of immigration, even if for different reasons and of different types of migrants and, with the exception of the Russian Federation, countries of population deconcentration. Group 2 countries are countries of both immigration and emigration and internal population concentration. It is among this group of countries that we can most clearly observe migration transitions from emigration to immigration. Group 3 countries are those with increasing but variable emigration, increasing concentration and the areas most likely to experience distress movements. Group 4 countries often exhibit intense emigration. Migration in, from and to each of these country groupings will be briefly discussed.

#### Group 1: the developed periphery

All group 1 countries and economies exhibit sustained low levels of fertility that have led to slow growth of the labour force. They are all areas of immigration from other countries and the majority show definite tendencies towards the deconcentration of their urban populations. Within these two broad generalizations, however, there are very important differences. Overall mobility in Australia and New Zealand is perhaps twice as high as it is in Japan, for example.<sup>11</sup> Both, however, demonstrate the effects of changing cohorts on the rates of mobility: as those in the age groups most likely to migrate have stabilized or declined in Japan and the Republic of Korea, so too have the number of migrants (table 3). In both these countries it is the more long-distance movements which have declined more than the more localized movements, reflecting the importance of the urban spread of the largest metropolitan areas as people move to the periphery of these cities. In Australia, on the other hand, although total mobility has declined marginally during the second half of the 1980s, this was primarily a function of the decline in intermediate distance moves with long-distance interstate and short-distance, intra-urban moves continuing to increase.<sup>12</sup> In Australia too, there was an upward shift in mobility rates with age, with older people showing increasing propensities to move over time. In the Russian Federation, the volume of migration also seems to have decreased in recent years, although this is more likely to have been caused by the economic and political shocks associated with the restructuring of the former Union of Soviet Socialist Republics (USSR) than by cohort effects.<sup>13</sup>

Table 3. Annual number of migrants in Japan and the Republic of Korea, 1970-1995

Year	Japan			Republic of Korea		
	Total	Intra-prefectural migration	Inter-prefectural migration	Total	Intra-prefectural migration	Inter-prefectural migration
1970	8,273	4,038	4,235			
1971	8,360	4,103	4,257			
1972	8,350	4,193	4,157	3,688	2,619	1,067
1973	8,539	4,304	4,234	4,860	3,436	1,425
1974	8,027	4,094	3,932	5,298	3,709	1,589
1975	7,544	3,846	3,698	9,011	6,143	2,868
1976	7,392	3,827	3,565	6,773	4,620	2,153
1977	7,395	3,828	3,568	7,398	5,234	2,163

1978	7,292	3,804	3,487	8,410	5,867	2,543
1979	7,295	3,826	3,469	7,324	4,975	2,350
1980	7,067	3,711	3,356	8,259	5,653	2,606
1981	6,901	3,583	3,318	8,195	5,401	2,793
1982	6,852	3,564	3,288	8,616	5,806	2,816
1983	6,674	3,478	3,196	9,796	6,585	3,211
1984	6,559	3,422	3,137	9,043	6,034	3,009
1985	6,482	3,365	3,117	8,679	5,754	2,925
1986	6,468	3,339	3,129	8,660	5,639	3,021
1987	6,536	3,365	3,171	9,309	6,065	3,243
1988	6,465	3,328	3,137	9,969	6,617	3,352
1989	6,518	3,359	3,159	9,316	6,127	3,190
1990	6,518	3,350	3,168	9,459	6,228	3,231
1991	6,403	3,272	3,131	8,980	6,023	2,958
1992	6,388	3,280	3,108	9,032	6,172	2,860
1993	6,503	3,424	3,079	8,807	5,943	2,864
1994	6,561	3,359	3,022	8,792	6,052	2,740
1995	6,633	3,583	3,050	9,073	6,208	2,865

In all the countries and economies of this group there has been a process of urban deconcentration. Only in Australia, however, was this truly an "urban turnaround", with smaller urban areas growing faster than the metropolitan areas. There, too, this process slowed in the 1990s as urban sprawl around the main cities has taken on renewed importance.<sup>14</sup> In Asia and in the Russian Federation, it has been a movement from the cores to the peripheries of the principal cities that has been the principal pattern of internal migration to create truly massive metropolitan areas in terms of spatial extent and population. Often, however, these metropolitan regions are not recognized as unitary urban areas for statistical purposes as they transcend regional and even national boundaries, for example, Hong Kong China extends into the Pearl River Delta, and Singapore virtually into Johor State in Malaysia.

All the countries and economies of this grouping are areas of net immigration from other countries, although once again this generalization obscures fundamental differences. Australia and New Zealand are traditional settler societies which literally have been created through immigration. They now follow policies of multiculturalism, with immigration accounting for about one-third of population growth in the case of Australia, where up to 40 per cent of the migrants in recent years have come from Asia. Immigration to the Russian Federation is largely the product of the structural transformation of the former USSR, with millions of ethnic Russians returning to the Russian Federation from the newly independent republics. Between 1990 and 1995, there was a net immigration of some 1.8 million, which was by far the most significant component of the population growth of the whole state.<sup>15</sup> Asian countries, on the other hand, implement tight policies of immigration control and it is extremely difficult to become a permanent resident or a citizen. Rather, these countries and economies have come to depend upon foreign labour and, as will be seen in more detail below, intra-Asian migration emerged as a major characteristic of the global migration system from the mid-1980s. While there are still flows of labour out of the ESCAP region to the oil-rich countries of West Asia, the main flows today from countries such as Malaysia, the Philippines and Thailand are towards the boom economies of Hong Kong China, Japan, the Republic of Korea and Taiwan Province of China.

Much of this movement to the developed economies of Asia has become illegal as many of those who entered legally have stayed on after the expiration of their visas to become overstayers. This situation is due to the conflict between the rising demand for labour on one hand, the consequence of rapidly growing economies in the context of sustained declines in fertility, and the fear of allowing large-scale immigration on the other. Policy makers are well aware of the experience of European countries with migrant labour and how temporary labourers turned into a permanent feature: "there is nothing more permanent than temporary workers".<sup>16</sup> The admission of large numbers of migrants who are culturally distinct from the populations of the host countries and areas has profound social and political, as well as economic, implications for these once homogeneous Asian countries and areas. The patterns of migration are creating new economic and social relations within Asia and these form an integral part of the process of globalization. The migration systems are reinforcing and redefining trade and political linkages which will have far-reaching consequences into the twenty-first century.

The last point to be made on the migration from these group 1 countries and economies is that there is also

emigration. These flows are also various, ranging from the exodus of the highly skilled from a stagnant economy in the Russian Federation, through the expansion of highly dynamic entrepreneurial groups out of Hong Kong China or the creation of skilled migrant networks through the medium of transnational corporations from Japan or the Republic of Korea, to retirement migration from Australia and New Zealand.<sup>17</sup> All of these flows, both of emigration and of immigration, are tying countries in the region more closely with each other and with the wider international community.

#### Group 2: countries in transition

These countries of medium levels of urbanization and medium rates of urban growth exhibit two sharply different patterns: first, the subgroup 2a countries in West and Central Asia, with negative economic growth, with centralizing patterns of migration towards urban areas, but marked emigration also from those urban areas primarily to the Russian Federation and to Israel; second, subgroup 2b countries experiencing rapid economic growth where there are also strong centralizing internal flows but where there are a variety of patterns of emigration depending very generally upon whether countries are labour-surplus or labour-deficit. The trends in the former subregion can be understood only within the context of the restructuring of the republics of the former USSR, and their patterns of emigration continue to link them strongly with the Russian Federation even if, paradoxically, these flows ultimately may lead to a loosening of ties through the repatriation of ethnic Russians, Germans and other Europeans as well as peoples of the Jewish religion. The exodus has been so intense from Kazakhstan, for example, that the total population of over 16 million is in decline with, between 1989 and 1995, some 1.3 million leaving the State. Many left the most industrially advanced oblasts, with the majority being ethnic Russians, Germans and Ukrainians.<sup>18</sup> A loss of skilled personnel and a stagnant rural sector that for so long was devoted to the supply of raw materials for the urban centres of the former USSR are immediate problems that need to be overcome before we can expect to see a sustained economic upturn in this region and the emergence of different patterns of migration.

The countries of group 2b are very different, exhibiting rapid urban growth, and they are expected to show a marked increase in their level of urbanization by 2010. Included here are two of the Asian "tiger" economies of Malaysia and Thailand which, together with Hong Kong China, the Republic of Korea, Singapore and Taiwan Province of China, have experienced one of the longest and most sustained periods of economic growth in history.<sup>19</sup> Although both Malaysia and Thailand still export labour, mainly to Singapore and the economies of North-East Asia, they emerged as significant destinations for migration in their own right as their demand for cheap labour, at least until recently, had outstripped local supply. Employment growth in Malaysia, for example, during the period 1991-1995, was 3.2 per cent per annum whereas labour force growth was only 2.7 per cent per annum.<sup>20</sup> It is estimated that there are as many as 1 million foreign labourers in Malaysia, the majority of them from Indonesia, and over 1 million in Thailand, the majority of them from the Lao People's Democratic Republic and Myanmar. More highly skilled workers come from India, Pakistan and the Philippines.<sup>21</sup> Many of the unskilled workers coming to these countries are doing so illegally and thus have no protection against abuse or the non-payment of wages.

Malaysia and Thailand can be considered to be on their way towards a "turnaround" in their patterns of migration as they move towards economies of labour-deficit.<sup>22</sup> We must await future analysis to see whether this turnaround is unidirectional and whether there will be a reversal as a consequence of the current (late 1997) economic turmoil in South-East Asia. In any economic recession, however, migrants will almost certainly be among the first to be laid off, particularly when they have no legal rights of employment or residence, and we may expect to see a reversal of interregional migration flows. The other countries among this group are a long way from any turnaround and will remain essentially as suppliers of migrants over the immediate future.<sup>23</sup>

Although emigration did occur from group 1 economies, it was immigration which formed the dominant migration-related characteristic of that group. Similarly, while there was certainly immigration to the countries of group 2b, it is emigration that has emerged as the key indicator. That emigration is exceedingly complex and consists of several distinct, though not mutually exclusive, flows: settlers who emigrate to live mainly in the countries of North America and Australasia; students who go overseas to pursue their studies, again mostly to North America and to Australasia, but also to Europe and Japan; contract labourers who are moving mainly to destinations in West Asia and within South-East and East Asia; illegal migrants who are smuggled within the Asian region and to North American destinations.<sup>24</sup>

The growing number of Asian migrants going as settlers was raised previously in the discussion of Australia and New Zealand, but the principal destination for migrants from the majority of countries is the United States of America. By the mid-1990s, some 35 per cent of the annual number of immigrants into the United States, or 282,449 in 1994, were from Asia. The rise in their numbers in that country and elsewhere is primarily a function of changing immigration laws in the destination countries implemented from the

mid-1960s. This flow is mainly a family migration, although the movement to Canada and Australia in particular is heavily biased towards the better educated and more highly skilled migrants. No direct evidence exists, however, to suggest that these migrations have had any negative impact on the countries of origin through a "brain drain". Emigration from the Republic of Korea and Hong Kong China occurred at the same time as they were embarking on their most rapid economic growth, for example, and it is unlikely that the experience of subgroup 2b countries will be markedly different. There are important "brain gains" resulting from the return of migrants from these developed country destinations.

Students make up one component of the transnational circulation of people from Asia to North America and Australasia. Asians accounted for almost 60 per cent of all foreign students enrolled in degree-granting programmes in the United States in the mid-1990s, representing 264,693 students in the period 1993-1994. Asians accounted for almost half of the foreign students in Canada and for virtually 85 per cent of foreign students in Australia. Assuming only a proportion return to their countries of origin, they can, nevertheless, have a profound impact on their home economies and societies as they become the future business and political leaders.<sup>25</sup> From a policy point of view within the ESCAP region, however, it is not the elite flows of settlers and students that are of primary concern, but the movement of labourers and the increasing clandestine flows. These will be briefly examined in turn.

The movement of labourers out of Asia dates well back into the nineteenth century when hundreds of thousands of Indians and Chinese were moved as indentured workers through colonial, mainly British, networks. Since the 1970s, the emigration of labour on a large scale has become an enduring feature of many Asian countries, and particularly of those in subgroup 2b. The Philippines has become the example of a country of emigration par excellence with an estimated stock of about 6.5 million migrants overseas at the end of 1996. Over 1.9 million were estimated to be settlers, mainly in the United States, with 2.7 million overseas labourers and another 1.9 million undocumented migrants.<sup>26</sup> India, Indonesia, Pakistan, Thailand, and increasingly China, all participate in the export of labour. In 1993, there were 173,000 workers from China in over 100 countries.

The importance of these movements lies perhaps not so much in their sheer numbers but in the remittances sent back home. Remittances are notoriously difficult to measure accurately and it is known that significant amounts, perhaps the larger part, are remitted through informal channels. Hence, official figures are likely to underestimate their real importance. In 1996, US\$ 4.24 billion was sent to the Philippines by its migrants overseas; in the mid-1980s, annual amounts approached US\$ 3 billion to Pakistan, representing almost 9 per cent of its GDP at that time.<sup>27</sup> Globally, remittances have been estimated to be second only to oil in terms of value in international trade.<sup>28</sup> While considerable debate continues about the impact of remittances upon the communities and economies of origin, the overall assessment is that the benefits outweigh the disadvantages and that they are positive for development.

The pattern of labour migration has changed markedly since it began to be important to ESCAP countries in the 1970s. Initially directed primarily towards the oil-rich countries of West Asia, it originated mainly in the countries of South Asia. In recent years, labour migration has been increasingly focused on the countries and economies of East and South-East Asia and has originated more in the countries of that subregion itself, with South Asian countries, except for Sri Lanka, playing a lesser role. The number of labourers deployed from Bangladesh, India and Pakistan has either stabilized or declined in the 1990s as those from other Asian countries have increased markedly.<sup>29</sup> As the total number of Thai workers deployed overseas increased from 69,676 in 1985 to 137,223 in 1993, the proportion going to the Middle East declined from 88 per cent to just over 12 per cent. The principal destination for Thai workers in the 1990s has become Taiwan Province of China, with Brunei Darussalam, Malaysia and Singapore also being important. An examination of the sources of the remittances to the Philippines in 1996 reveals that the United States was by far the most important, accounting for 55.6 per cent, with citizens in Asian countries contributing 11.6 per cent, and less than 1 per cent originating in the Middle East. Warfare in the Persian Gulf during the early 1990s, the shift from a construction to a maintenance phase in Middle Eastern economies, and a general economic downturn in the region as the real price of oil has declined, all have contributed to a switch in the volume and composition of migrant workers. The flexibility of the Asian migrant-worker system has been remarkable in making the adjustment to the changed conditions in West Asia by focusing on growth areas in East and South-East Asia. A cause for possible future concern would be if these growth areas enter a period of prolonged downturn that would leave a vast pool of highly mobile workers in search of alternative opportunities in the region or beyond. Almost certainly, such a scenario would lead to an increase in clandestine movements, with possibly destabilizing consequences for some areas.

The gender composition of the flows has also varied. Initially dominated by men in the construction industry in West Asia, there has been increasing participation of women as the destinations and the occupations have diversified. Overall, the labour migrant flows are still dominated by young males, unlike

the settler flows which are much more balanced in terms of age and sex. Nevertheless, certain flows, out of Sri Lanka among the group 3 economies, for example, are dominated by women going overseas as domestic servants. Almost half of the workers from the Philippines are women, going as domestic servants mainly to Hong Kong China and Singapore, but also as nurses and "entertainers".

As mentioned above in relation to group 1 countries, the vast majority of countries in the ESCAP region are non-immigrant countries and inflows of workers are restricted or tightly controlled. Given the available supply of workers in the region, and the demand for workers in particular areas, there is intense pressure to increase worker flows, which results in rising illegal migration and overstaying once visitor visas have expired. The total volume of illegal migration is, almost by definition, not known, except that it is substantial and that it is growing. In the early 1990s, there were perhaps 300,000 undocumented migrants in Japan, an estimate of some 100,000 illegal migrants from China alone going to the United States every year and, in Malaysia, some 450,000 undocumented foreign workers had been registered up to 1994.<sup>30</sup>

Although the sheer volume of undocumented migrants is a problem for host governments in the region, it is perhaps the link between illegal movements and organized crime that is of greatest concern. The smuggling of Chinese alone is estimated as a US\$ 3 billion-a-year business and there are clear linkages with the international trade in narcotics.<sup>31</sup> The movement of young women as "entertainers" is again often clandestine and controlled by international criminal groups. The potential for abuse and exploitation of the migrants at the destinations as they are held as virtual bonded labourers is not only an affront to human dignity, but also counterproductive for the development of destination areas as outmoded industries are maintained through the supply of cheap labour, rather than being forced to move up the technological ladder through increased investment.

#### Group 3: countries at low levels of urbanization

Some of the countries in this group exhibit patterns of migration that are similar to those described for the previous group. The movement of labour from Bangladesh, the participation of Sri Lankan women in domestic servant networks and the increasing settler migration from Viet Nam, all bear strong similarities with the systems outlined above. Again, like the countries in the previous group, there are strong centralizing flows towards urban areas, although much of the migration is circular. It is among countries of this group, however, as well as in some of the countries of subgroup 2a, that much distress migration has been found in the recent past, and still persists to this day in some areas.

The more orderly settler migration from Viet Nam today towards North America and Australasia is a direct consequence of the refugee flows after the end of the warfare in that country in 1975 when over 1 million people fled. Today, unsettled conditions in Afghanistan, Cambodia and Sri Lanka have generated forced population movements into neighbouring countries and beyond and there are also groups of displaced persons around the borders of Myanmar. The political stability and rapid economic development in the countries of East and South-East Asia over the last 25 years have seen a decline in the numbers of refugees there. Pockets of distress migration remain, but it is in many western parts of the ESCAP region where there is slow, or even negative, economic growth that forced movements will continue to provide difficulties for some time to come.<sup>32</sup>

#### Group 4: small countries

The characteristics of urbanization, migration and development among small countries are so variable and particular that they merit brief mention in their own right. All are dependent upon larger and more powerful countries and the majority have been characterized by intense emigration. There are often as many, if not more, people from the Pacific islands in cities in North America or Australasia as there are in the islands themselves. Their development has come to depend upon externally generated sources of wealth through remittances to such an extent that a special term has been coined to describe their economies: MIRAB, or migration, remittances and bureaucracy.<sup>33</sup> While the flows of wealth can indeed have positive impacts on the island economies, the emigration has become such an accepted part of life for so many islanders that the long-term demographic as well as economic viability of some of the small states is open to question. In this subregion, there is the possibility that, over the long term, towns become but outliers of communities based in the largest cities in developed countries, to oversee the exploitation of raw materials and the environment for tourism for the benefit of populations in those developed areas.

#### Discussion and policy implications

The next 10 to 15 years will see an overall shift in the ESCAP region towards more urban societies. This shift will, however, vary from one part of the region to another. In the most urbanized parts of the region, the trend is likely to be towards decentralization and the creation of massive, sprawling urban regions. In

other parts of the region there will be intense concentration in densely populated primate cities; in yet other parts of the region urban development will be much more uncertain. The patterns of migration are also highly variable, but migration is tying rural hinterlands and nation states alike into broader circuits of human and economic interaction. These are integral parts of the process of globalization, but a globalization from which certain areas are either excluded or to which they are only tenuously attached. The policy requirements will thus vary from one part of the region to another and it is important that these should be formulated according to specific needs and capabilities so that they fit the particular pattern of urbanization and migration in each region.

Ten of the largest 15 cities in the world are located in the ESCAP region. The mobility of the region's populations is increasing, particularly in the demographic giants of China, India and Indonesia. Yet, the volumes of international movements from the vast majority of countries in the region (the Philippines is the clear exception) are small in the context of the historical experience of Europe. Should emigration approaching those historical levels ever emerge from Asian countries, then a mixing of peoples and cultures on a scale never seen before will engender a true global transformation. Such a scenario is largely hypothetical. What is certain is that policy makers will have to plan for megacities in the region of a size and complexity never before seen in history. They will have to cater for increasing volumes and types of migrations. The patterns will be highly variable and the impacts will be highly variable, but across the region urbanization and migration will have profound economic, social and, ultimately, political consequences. With mortality having now declined to relatively low levels and fertility now well on its way to the replacement level, or below, throughout much of the region, migration, together with ageing, represents the principal challenge in the population area as we move into the twenty-first century. Governments and international agencies must be prepared to act accordingly.

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The effects of the development of township and village enterprises are not yet evident, but their potential is enormous, especially with regard to the need for urban planning

In most parts of the developing world, urbanization has been characterized by unprecedented urban population growth and highly concentrated urban population distribution. This in turn is closely associated with serious urban problems and regional disparities (Rondinelli, 1983:28-32; United Nations, 1993; Bronger, 1993:35). These problems offset or reduce the benefits of urbanization in developing countries. Therefore, seeking more balanced urbanization patterns is an important topic with both theoretical and practical significance in the study of urbanization in developing countries.

China's experience is of particular significance in this kind of study. Since 1978, a new pattern of "urbanization from below" has been emerging in the Chinese countryside (Ma and Lin, 1993:584). One of the major effects of this urbanization pattern has been the decline in the degree of primacy in the city system. This trend is in sharp contrast to the experience of most developing countries, and at odds with conventional theories (Xu and Li, 1990:67). Not surprisingly, China's new urbanization pattern has attracted many scholars' attention (Xu and Li, 1990; Ebanks and Cheng, 1990; Ma and Lin, 1993).

Nevertheless, most research on China's urbanization has been confined within the limits of official urban definitions and statistics. The in situ transformations of formerly agricultural populations into quasi-urban ones, which have been driven largely by the development of township and village enterprises (TVEs),<sup>1</sup> are still neglected in the study of China's urbanization. To a lesser extent, temporary residents are also under-researched. In this article, these two forms of rural-urban transformation, which are neither sponsored by the state nor officially recognized in government statistics, are called "informal urbanization", and the population involved in these processes is referred to as the "informal urban population". They correspond to "formal urbanization" and "formal urban population", with the latter term describing a population officially recognized and sponsored by the government, assigned an urban, non-agricultural status in China's household registration system, and counted as the non-agricultural population of cities and towns in official statistics.

Before 1978, urbanization in China was mainly a process of "formal urbanization". In Fujian Province, the research area of this article, the non-agricultural population of cities and towns accounted for 70 per cent of the total population of the cities and towns, which covers the entire population inside an urban administrative area regardless of official household registration status. However, since the 1980s, this has no longer been the case. Rural-urban transformation has been increasingly driven by the development of TVEs and the increase in temporary residents since then. In Fujian Province, the size of the non-agricultural population of cities and towns increased from 2,755,200 in 1978 to 5,734,400 in 1995, with an average annual growth rate of 4.4 per cent. During the same period, the number of TVE employees increased from 870,824 to 4,709,956, with an average annual growth rate of 10.4 per cent, which is much faster than that of the non-agricultural population of cities and towns (Statistical Bureau, 1996:47-49, 186). In fact, if the dependants of the TVE employees are taken into account, the number of people involved in the rural-urban transformation caused by the development of TVEs is much greater than the number of TVE employees would suggest. These figures suggest that TVE development has been far more important in China's rural-urban transformation than the increase in the non-agricultural population of cities and towns sponsored by the Government. Similarly, the number of temporary residents who are not included in the official urban statistics has also increased dramatically since the 1980s.<sup>2</sup>

Despite this major change, rarely has an effort been made so far to incorporate the "informal urbanization" into the analysis of the spatial patterns of urbanization. In most cases this kind of analysis is still based on the non-agricultural population of cities and towns<sup>3</sup> (for example, Yeh and Xu, 1990; Kojima, 1995). On this basis, the essence of the new patterns of "urbanization from below" is ignored, and our understanding of the spatial effects of China's new urbanization patterns remains superficial. To tackle this problem, this article will analyse some evidence from Fujian Province.

Located in south-eastern China directly west of Taiwan Province of China, Fujian Province is one of the trial bases of China's reform and open-door policies, and it has been at the forefront of social and economic development in China. The fast development of TVEs and the rapid increase in the number of temporary residents have been the two most important characteristics of this development. In recent years, half of the total industrial output in Fujian

Province has been produced by TVEs (Zhu, 1992), and as will be seen later, the numbers of TVE employees and of temporary residents have increased drastically. Thus, the spatial effects of China's new urbanization patterns can be revealed more deeply through this study. It is hoped that other developing countries can draw some benefit from Fujians experience.

#### Urban definition and classification, and analytical method

To start with, some definition problems need to be addressed. In China, urban places are initially classified as cities and towns, with cities being further classified into different categories. The criteria for this kind of classification are based on the size of the "formal urban population", i.e. the non-agricultural population of the cities and towns (Standing Committee of the NPC, 1989). Cities with a non-agricultural population of more than 500,000 are classified as "large cities"; those with a non-agricultural population of between 200,000 and 500,000 are "medium-sized cities", and those with a non-agricultural population of less than 200,000 are "small cities". In practice, cities with a non-agricultural population of over 1 million are called "very large cities" (Liu, Wu and Li, 1986:367; Laquian, 1991:238-239). Because a population size of 100,000 is an important criterion for designating a city in China and is regarded by some scholars as the lower limit of the population size of secondary cities (Rondinelli, 1983:48), cities larger or smaller than 100,000 are also separated in this study. The final categories are set out in table 1. The following analysis will be conducted in the light of the above criteria and classification.

Table 1. Categories of Chinese towns and cities

Category	Non-agricultural population of cities and towns
Town	<100,00
Small city (1)	<100,000
Small city (2)	100,000-200,000
Medium-sized city	200,000-500,000
Large city	500,000-1,000,000
Very large city	>1,000,000

A problem arises, however, in using this urban definition and classification. As pointed out previously, the non-agricultural population of cities and towns comprises only the de jure urban residents, who are officially recognized and sponsored by the government. It misses out de facto urban residents classified as "agricultural" by household registration, who are actually engaged in non-agricultural activities, or cater to nearby urban markets, and use the urban infrastructure intensively in the urban administrative area (Hu and Zhang, 1984:269; Kirkby, 1985:89-93; Tian, 1989:5; Linge and Forbes, 1990:193). Before 1978, this was not a big problem in analysing the urban system, as the de facto urban population was not large at that time and the effects of underestimation by using the non-agricultural population of cities and towns for cities of different size would cancel each other out, as implied by Kojima (1995:140).

Nevertheless, this has not been the case since the 1980s as a result of the considerable increase in the number of TVE employees and temporary residents. Although it is disputable whether the populations involved in TVE development are real urban populations, the fact that they are absorbed outside the existing cities has already had a tremendous influence on the spatial patterns of China's urbanization. In fact, as an increase in the proportion of people engaged in non-agricultural activities is an important component of urbanization (de Vries, 1984:11; United Nations, 1993), it is quite reasonable to regard TVE development as part of the urbanization process and incorporate it in the analysis of urbanization. Similarly, temporary residents are not included in official urban statistics. Moreover, the distribution of this population has greatly affected the spatial pattern of China's urbanization.

In what follows, an effort will be made to reveal these effects. The basic idea is to take the distribution of the non-agricultural population within the residential hierarchy as the reference frame, and compare it with the distribution of TVE employees and temporary residents within the residential hierarchy in order to identify the general direction of such effects. It should be noted that the residential hierarchy, rather than the urban system, and the non-agricultural population, rather than non-agricultural population of cities and towns, are used for the analysis. The difference between the residential hierarchy and the urban system is that, while the urban system consists of large, medium-sized, and small cities and towns, the residential hierarchy includes one more residential level at the bottom, i.e. rural townships.

There are three reasons to chose the residential hierarchy rather than the urban system as the reference frame for the following analysis. First, with the available data, the number of TVE employees and temporary residents in the towns cannot be separated from those in the townships; thus, the following analysis can be conducted only on the basis of the residential hierarchy rather than the urban system. Second, because many TVEs are located in places which have not been designated as urban places, it is necessary to use the residential hierarchy rather than the urban

system so that those TVEs can be included in the analysis. Third, the difference is small between the distribution of the non-agricultural population by the residential hierarchy and the non-agricultural population of cities and towns by the urban system. The inclusion of the non-agricultural population living in rural areas, whose number in Fujian Province was only 165,900 or 2.9 per cent of the non-agricultural population of cities and towns in 1995, accounts for the small difference. In some cases, many Chinese scholars even use the non-agricultural population as a proxy for the urban population (Yu, 1995:40). Therefore, the conclusions for the residential hierarchy in the following analysis can be used to infer the situation existing in the urban system.

Table 2. Number and percentage distribution of employees of township and village enterprises by residential hierarchy, Fujian Province, 1995

Urban category	Number of TVE employees	Percentage
Towns and townships <sup>a</sup>	2,436,796	51.74
Cities with NAP of less than 100,000	824,053	17.50
Cities with NAP of 100,000-200,000	914,497	19.42
Cities with NAP of 200,000-500,000	336,985	7.15
Cities with NAP of 500,000 or more	197,623	4.20
Total	4,709,954	100

Source: Statistical Bureau of Fujian Province, 1996:442-443.

Note: NAP = non-agricultural population;

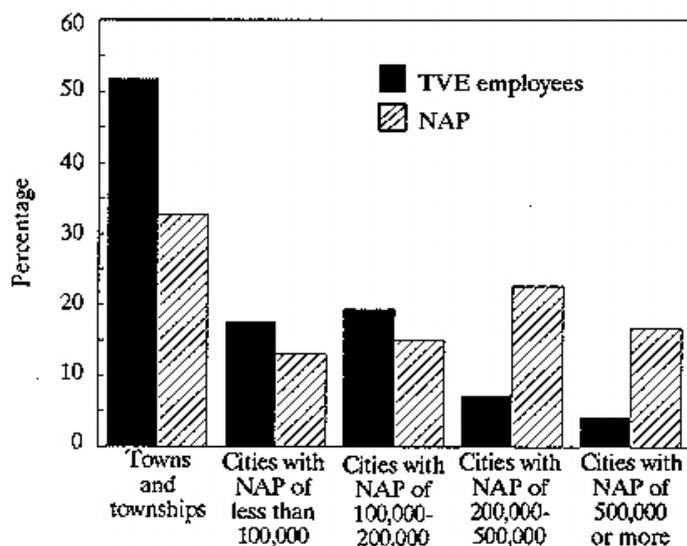
TVE = township and village enterprise.

a Only towns and townships under county administration; towns and townships under city administration are not separated from the relevant cities.

#### Spatial effects of the development of township and village enterprises

Table 2 shows the distribution of TVE employees by the residential hierarchy in Fujian Province in 1995. It is further compared with the distribution of the non-agricultural population in figure 1. The influence of the development of TVEs on the residential hierarchy, and then on the urban system, can be analysed on the basis of the table and figure. While it is not surprising that a dispersed spatial pattern of TVEs can be clearly identified from the table and the figure, it should be noted that once these TVE employees and their dependants are incorporated, there will be significant changes in Fujians residential hierarchy and urban system, which would not be revealed by merely analysing the distribution of the non-agricultural population of cities and towns.

Figure 1. Comparison of the distribution of employees of township and village enterprises with that of the non-agricultural population in Fujian Province, 1995



Source: Based on table 2 and Statistical Bureau of Fujian Province, 1996:49, 420-421.

Notes: NAP = non-agricultural population;

TVE = township and village enterprises.

In general, the incorporation of TVE employees and their dependants will further decentralize Fujians residential hierarchy and urban system. As figure 1 clearly shows, compared with the non-agricultural population, a much higher proportion (nearly 90 per cent) of TVE employees was distributed in small places, i.e. in townships and towns under county administration and cities with a non-agricultural population of less than 200,000. Correspondingly, the proportions of TVE employees distributed in the medium-sized and large cities were much lower compared with the distribution of the non-agricultural population. Only 4 per cent of the TVE employees were distributed in the largest cities in Fujian Province compared with 16.7 per cent of the non-agricultural population. This comparison suggests that, as "informal urbanization" progresses further, the lower level of the residential hierarchy and urban system will be greatly strengthened and the higher level weakened.

This change in the urban system will be realized largely by a significant increase in the number of towns and town populations. This is because TVE employees in the towns or townships under county administration accounted for more than half of the total number of TVE employees. While the development of TVEs in existing towns will promote the growth of town populations, the development of TVEs in townships will facilitate the emergence of new towns, leading to a strengthened lower level of the urban system. In addition, the effect of the development of TVEs on the residential hierarchy and the urban system should also be appreciated in the sense that, if those employees had not been absorbed in local non-agricultural activities, they would have migrated to the primate city, leading to a higher degree of urban population concentration.

Table 3. Ten cities with the largest numbers of non-agricultural population and the 10 places with the largest numbers of township and village enterprise employees, 1995

NAP (thousands)		TVE employees (thousands)	
Name	Number	Name	Number
Fuzhou	982.9	Jinjiang	393.6
Xiamen	472.3	Nanan	280.2
Longyan	221.6	Putian (county)	263.0
Quanzhou	217.9	Fuzhou	197.6
Nanping	217.7	Fuqing	179.0
Zhangzhou	202.7	Huian	178.9
Sanming	184.2	Xianyou	168.1
Fuding	137.3	Longhai	156.2
Yongan	122.6	Shishi	137.3
Putian (city)	120.6	Minhou	120.9

Source: Statistical Bureau of Fujian Province, 1996:420-421, 442-443.

Note: NAP = non-agricultural population;

TVE = township and village enterprises.

The spatial effect of the development of TVEs can be examined from another perspective. As can be seen from table 3, the rank of places according to the number of TVE employees is totally different from that of the non-agricultural population (and non-agricultural population of cities and towns). The place with the largest number of TVE employees is Jinjiang, which was designated as a city in 1992 and had a non-agricultural population of only 107,700 in 1995. But there were as many as 393,600 TVE employees there in the same year compared with 197,600 such employees in the largest city, Fuzhou. The place with the second largest number of TVE employees is Nanan, which was designated a city even more recently than Jinjiang. It is noteworthy that in table 3 only one place, the provincial capital, Fuzhou, appears in both the list of the 10 cities with the largest non-agricultural population and the list of 10 places with the largest number of TVE employees. In fact, most places with the largest number of TVE employees are newly designated cities, or they are still counties. By contrast, most of the cities among the 10 having the largest non-agricultural population are administrative centres, being either the provincial capital, or the government seats of prefectures, or prefecture-level municipalities. The correlation coefficient between the number of TVE employees and the non-agricultural population, calculated according to the data for 69 cities and counties in Fujian Province, is only 0.3338 ( $P=0.005$ ), which can be attributed mostly to the overlapping distribution of TVE employees with the non-agricultural population in the towns. This situation suggests that the development of TVEs will lead to the creation of many new economic growth centres, rather than enhance the old administrative centres, at least in terms of employment. One result of the emergence of these new growth centres will be an enhancement of the lower part of the residential hierarchy and the urban system, as has just been mentioned; another result is that the distribution of urban centres will be geographically more dispersed, leading to a more regionally based, rather than city-based, urbanization process.

In addition to the direct spatial effects of TVE development, the development of TVEs has an indirect effect on the position of small cities in the urban system. Since 1986, the designation of cities has been related to the economic

performance of places in China. Under the definitions of a city in 1984, the designation of a city was related to annual gross domestic product. In 1993, criteria on the economic structure were introduced in the definition to stress further the importance of the development of second and tertiary sectors, and the criterion concerning gross domestic product was increased further. As a result of those changes, TVEs are important not only for town development but also for the development of small cities, because TVEs are the major source of economic development in many places of China. The designation of many small cities in the coastal area of Fujian Province with a non-agricultural population of up to 100,000 can be attributed largely to this reason. Cities designated after the late 1980s, such as Fuqing, Jinjiang, Longhai, Changle, Nanan and Shishi, are all places experiencing a rapid growth in TVEs. The case of Jinjiang best illustrates this situation. When it was designated a city in 1992, the official non-agricultural population was only 95,500, actually below the official criterion for a city. But its gross domestic product was valued at almost 35 billion yuan, 8.7 times that of the official economic criterion for an urban area to be designated a city. This high level of economic development was largely a result of the development of TVEs, because 74.3 per cent of the total social output of this county was produced by TVEs in that year. The problem of not being up to the official standard in terms of its non-agricultural population (120,000) was sorted out by including temporary residents who were engaged in non-agricultural activities in the official non-agricultural population.<sup>4</sup> This is reasonable for places such as Jinjiang, because many temporary residents actually comprise part of the urban population. In this way Jinjiang obtained its official city status, which was closely related to TVE development.

#### Spatial effects of temporary residents

A similar approach to that used in the preceding section can also be taken to explore the general trend of the spatial effects of temporary residents. One useful piece of information about the spatial distribution of temporary residents can be obtained from 1990 population census data. As was done for the TVE employees, the distribution of those temporary residents who had lived for one year or more in a county-level place other than where they had their household registration can be calculated by residential hierarchy (table 4). As can be seen in figure 2, the number of temporary residents resembles very much the distribution of the non-agricultural population in the same year. Similarly, this can be further confirmed by the fact that the correlation coefficient between the number of temporary residents in the 1990 census and the non-agricultural population calculated according to the data for all 69 cities and counties in Fujian Province in the same year was as high as 0.9310 ( $P=0.0001$ ). Comparison of tables 4 and 2 shows less similarity between the spatial distribution of temporary residents by residential hierarchy and that of TVE employees. The correlation coefficient between the number of TVE employees and the number of temporary residents, calculated in the same way, is only 0.3519 ( $P=0.003$ ), and the partial correlation coefficient ( $R=0.1187$ ,  $P=0.335$ ) is even not significant when the size of non-agricultural population is controlled.

Table 4. Number and percentage distribution of temporary residents<sup>a</sup> by residential hierarchy, Fujian Province, according to 1990 census data

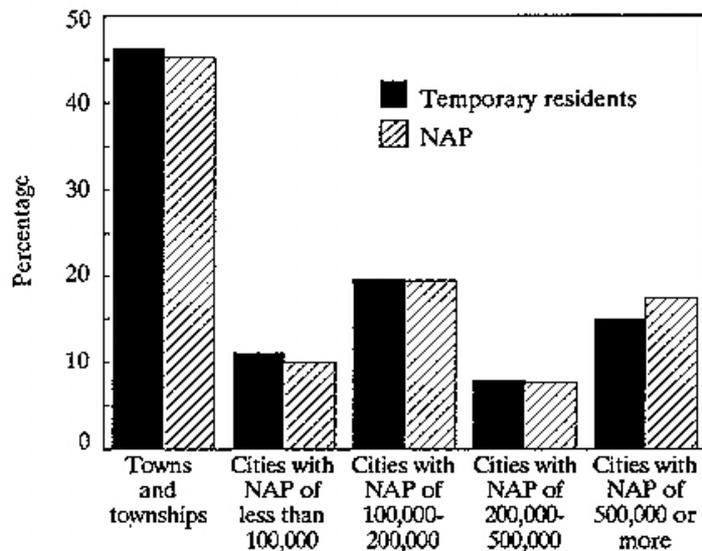
Urban category	Number of temporary residents	Percentage
Towns and townships	340,315	46.31
Cities with NAP of less than 100,000	81,632	11.11
Cities with NAP of 100,000-200,000	144,544	19.67
Cities with NAP of 200,000-500,000	58,753	7.99
Cities with NAP of 500,000 or more	109,668	14.92
Total	734,912	100

Source: Calculated according to Population Census Office of Fujian Province, 1990:8-11.

Note: NAP = non-agricultural population.

<sup>a</sup> Temporary residents here are those who had lived for one year or more in a county-level place other than where they had their household registration. Towns and townships under city administration are not separated from the relevant cities.

Figure 2. Comparison of the distribution of temporary residents with that of the non-agricultural population in Fujian Province, 1990



Source: Based on table 4 and Statistical Bureau of Fujian Province, 1991:43; 461-462.  
Notes: NAP = non-agricultural population.

The above analysis suggests in general that the distribution of temporary residents follows mainly the distribution of the non-agricultural population. Given the fact that most of the non-agricultural population (more than 90 per cent) is distributed in cities and towns, and that the distribution of the non-agricultural population of cities and towns is quite dispersed (60 per cent are distributed in towns and small cities, see Statistical Bureau of Fujian Province, 1996:49), it is clear that the temporary residents will not cause a highly concentrated urban population distribution. The fact that 46.3 per cent of the temporary residents lived in towns or townships and only 14.9 per cent of them lived in the largest city is already a good indication of this situation. In fact, it suggests that, as with the distribution of the non-agricultural population of cities and towns, most long-term temporary residents tend to stay in small residential places.

The above analysis has to be further extended for two purposes. First, the number of temporary residents has increased rapidly since 1990, so it is necessary to examine the new situation since then. Second, most temporary residents live in a place for less than one year, and some temporary residents migrate only within a county-level place. It is difficult to conduct both kinds of analysis because of the problem of data availability; however, some information, although not ideal, can be used for this purpose.

Table 5. Number and percentage distribution of temporary residents<sup>a</sup> by residential hierarchy, Fujian Province 1995, according to One Per Cent Population Sample Survey

Urban category	Number of temporary residents	Percentage
Towns and townships	4,660	29.71
Cities with NAP of less than 100,000	1,931	12.31
Cities with NAP of 100,000-200,000	3,043	19.40
Cities with NAP of 200,000-500,000	3,257	20.77
Cities with NAP of 500,000 or more	2,793	17.81
Total	15,684	100

Source: Calculated according to data provided by Population Census Bureau of Fujian Province.

Note: NAP = non-agricultural population.

<sup>a</sup> Temporary residents here are those who had lived for half a year or more in a township-level place other than where they had their household registration.

Table 5 provides some information about the distribution of temporary residents by residential hierarchy obtained from the 1995 One Per Cent Population Sample Survey. The temporary residents referred to in that table are those who by October 1995 had lived for half a year or more in a township-level place other than where they had their household registration, and therefore met the analytical requirement mentioned above. Although not absolutely reliable, the number should represent largely the real distribution of temporary residents, because urban-rural distribution was one of the main criteria for selecting the population sample in that survey.<sup>5</sup> Comparing tables 5 and

4 reveals two noticeable differences. As could be expected, the number of temporary residents in table 5 is much higher as a result of both the increase in temporary residents over time and the inclusion of shorter-staying temporary residents. Inferred from table 5, the total number of temporary residents under the corresponding definition will be 1,568,400, i.e. almost double the figure in table 4. Another difference is that a much smaller proportion of temporary residents were distributed in the towns or townships, while a much higher proportion of temporary residents were distributed in the medium-sized and large cities, especially the former. It is noteworthy that Xiamen, one of China's special economic zones, accounted for a significant proportion (43.9 per cent) of temporary residents in medium-sized cities. On the whole, the distribution of temporary residents staying longer than half a year still does not exhibit much of a concentration trend and does not lead to urban primacy, as the proportion of this kind of temporary resident distributed in the largest city is very similar to that of the non-agricultural population.

Table 6. Number and percentage distribution of temporary residents<sup>a</sup> by residential hierarchy, selected areas<sup>b</sup> in Fujian, 1994

Urban category	Number of temporary residents	Percentage
Towns and townships	201,311	15.78
Cities with NAP of less than 100,000	144,490	11.33
Cities with NAP of 100,000-200,000	309,469	24.26
Cities with NAP of 200,000-500,000	407,051	31.92
Cities with NAP of 500,000 or more	181,145	14.20
Total	1,275,412	100

Source: Provided by Public Security Bureau of Fujian Province.

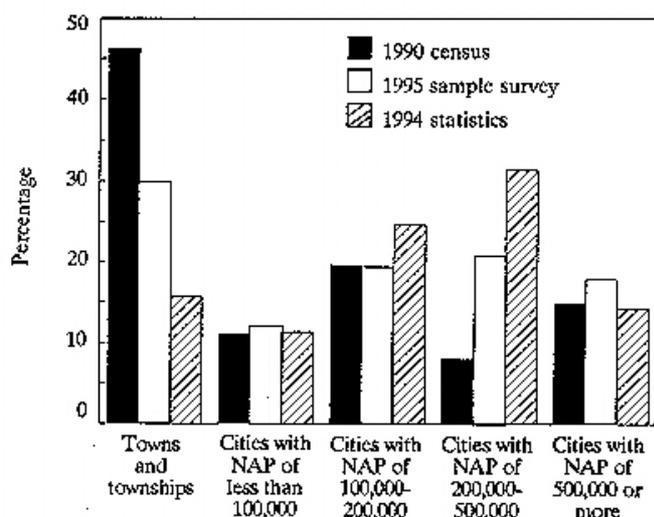
Note: NAP = non-agricultural population.

a Temporary residents here are those who had lived for one month or more in a township-level place other than where they had their household registration.

b Including counties and city districts under the administration of Fuzhou, Putian, Quanzhou, Zhangzhou and Xiamen.

Table 6 provides another piece of information about the distribution of temporary residents. The area covered by this table is the most economically developed in Fujian Province, and many cities, including the largest and second-largest cities in Fujian Province, are located there. The temporary residents referred to in this table are those who had lived in their provisional living places for more than one month. If the proportion of temporary residents in this area to the total temporary residents in Fujian Province is the same as the proportion of this area's population to Fujian's total population (64 per cent), it can be inferred from this table that the temporary residents who had lived in Fujian Province in 1994 for more than one month could be as many as 1,993,100. Interestingly, as more short-staying temporary residents are included, the proportion of temporary residents in towns and townships decreases again, with increasing proportions of temporary residents in cities with a non-agricultural population of 100,000-200,000 and cities with a non-agricultural population of 200,000-500,000, especially the latter. Again Xiamen, the special economic zone, played a big role, absorbing 82.4 per cent of temporary residents living in medium-sized cities. The proportion of temporary residents living in the largest city still did not increase; on the contrary, it actually decreased. If this is not a coincidence, it seems to indicate that towns and townships are less likely to be the destination for short-term temporary residents than for the longer-term ones, and medium-sized cities, especially the special economic zones, are most likely to be their provisional living places. These aspects are illustrated in figure 3.

Figure 3. Distribution of temporary residents by residential hierarchy



Source: Tables 4, 5 and 6.

Notes: NAP = non-agricultural population.

The actual or de facto urban population in Fujian Province in 1995 and its distribution by size of town or city may be estimated by combining the informal and formal urban populations, as has been done in table 7.

Table 7. Comparison of the distributions of various "formal" and "informal" urban populations

	Total		Towns and townships		Cities with NAP of less than 100,000		Cities with NAP of 100,000-200,000		Cities with NAP of 200,000-500,000		Cities with NAP of 500,000 or more	
	Number	%	Number	%	Number	%	Number	%	Number	%	Number	%
TVE employees and their dependants, 1995 (1) <sup>a</sup>	8,948,913	100	4,629,912	51.74	1,565,701	17.50	1,737,544	19.42	640,272	7.15	375,484	4.20
Temporary residents, 1995 sample survey (2) <sup>b</sup>	1,568,400	100	466,000	29.71	193,100	12.31	304,300	19.40	325,700	20.77	279,300	17.81
Non-agricultural population 1995 (3) <sup>c</sup>	5,903,800	100	1,931,200	32.71	773,300	13.10	884,200	14.98	1,332,200	22.57	982,900	16.65
Temporary residents among the NAP, 1995 sample survey (4) <sup>d</sup>	360,732	100	117,995	32.71	47,256	13.10	54,038	14.98	81,417	22.57	60,062	16.65
"Formal" plus "informal" urban population (5) <sup>e</sup>	16,060,381	100	6,909,117	43.02	2,484,845	15.47	2,872,006	17.88	2,216,755	13.80	1,577,62	29.82

Note: NAP = non-agricultural population;

TVE = township and village enterprise.

a Calculated by multiplying the number of TVE employees from table 2 by 1.9, the ratio of the number of TVE employees and their dependants to the number of TVE employees. It is assumed that this ratio is slightly lower than the ratio of the total population of Fujian Province to its working population, which was 2.0 according to the 1995 One Per Cent Population Sample Survey. This assumption is based on the fact that, in the areas with well-developed TVEs, more women participate in economic activities.

b Inferred from table 5.

c Statistical Bureau of Fujian Province, 1996:49, 420-421.

d The total number of temporary residents among the NAP is calculated using the 1995 One Per Cent Population

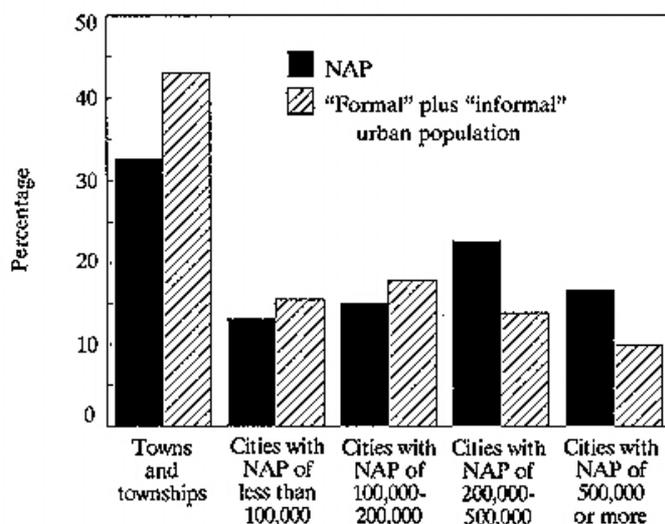
Sample Survey data. The rest of this row gives the distribution of these temporary residents by their place of origin and residential hierarchy. It is assumed that this distribution is the same as that of the NAP.

$e(5) = (1) + (2) + (3) - (4)$ ; (4) is deducted because the number of temporary residents among the NAP is included in both rows (2) and (3).

The first row of table 7 presents the number of TVE employees multiplied by a factor of 1.9 in order to estimate the total number of such employees and their dependents. It may be noted that the total of 8.9 million persons is greater than the official total of the non-agricultural population, which is 5.9 million. Slightly over half of TVE employees and their dependants reside in towns and townships, but nearly half are living in cities, with 11.3 per cent in cities of at least 200,000 inhabitants.

The second row of table 7 shows the number of temporary residents of at least six months, estimated from the aforementioned 1995 sample survey. The third row gives the non-agricultural population of Fujian Province in 1995. Because the usual residence of some temporary residents (shown in row 3) is a town or city, they are already included among the non-agricultural population and they should be subtracted from the summation of the urban population in order to avoid counting them twice. Their number is shown in row 4 of table 7. The total urban population, comprising both the informal and formal definitions, is shown in the final row of table 7. It equals 16 million and shows a much more decentralized pattern than the official definition of the non-agricultural population of cities and towns. The distribution of the urban population by size of town or city is shown in figure 4 for only the non-agricultural population (formal definition) and for the combined informal and formal urban population.

Figure 4. Comparison of the distribution of "formal" plus "informal" urban population with that of the non-cultural population in Fujian Province, 1995



Source: Table 7.

Notes: NAP = non-agricultural populations.

## Conclusions

Because of its "informal" nature, the spatial effects of the development of township and village enterprises and temporary residents on China's urbanization process is still neglected in the study of its urbanization. People rely too much on official urban statistics, which do not cover "informal urbanization", and thus miss some increasingly important aspects of China's urbanization and the driving forces behind them. This article has taken a preliminary step in tackling these problems. Although the analytical depth is constrained by the availability of data, some new insights into the evolution of Fujian's urban system can still be gained from the above analysis.

First, the development of TVEs has been, and will remain, the most important driving force behind the evolution of the residential hierarchy and the urban system in Fujian. It will lead to a much more decentralized residential hierarchy and urban system than is suggested by the analysis based on the non-agricultural population of cities and towns. The creation of new towns and small cities on a widespread geographical basis, and the growth of existing small urban centres, are the most important effects of TVE development.

Second, the increase in temporary residents is less a decentralizing factor than the development of TVEs. In fact, the distribution of long-term, long-distance, migrating, temporary residents tends to correspond to that of the non-agricultural population. It is a noteworthy trend that the less time temporary residents stay in their provisional places,

the more likely it is that they are staying in medium-sized cities. In this sense, short-term temporary residents tend to increase the concentration of the residential hierarchy and the urban system. Nevertheless, no evidence has come to light that would indicate that temporary residents, whether short-term or long-term, will increase urban primacy, as their proportion in the largest city is very similar to that of the non-agricultural population.

Third, the effects of TVE development on the evolution of the residential hierarchy and the urban system are much stronger than those of temporary residents. This is because the number of estimated TVE employees and their dependants amounted to 8.9 million in 1995 (see table 7), while the number of estimated short-term temporary residents was less than 2 million. Therefore, temporary residents will reduce the effects of TVE development on the urban system, but the decentralizing effects of TVE development will still dominate. The comprehensive effects of "informal urbanization" on the residential hierarchy and urban system can be seen in table 7 and figure 4.

The above analysis can be used as a reference to infer the spatial effect of TVE development and temporary residents on urbanization as a whole in China. More importantly, it suggests strongly that more efforts should be made to incorporate the development of TVEs and temporary residents in the analysis of spatial patterns of urbanization in China. This point is supported by the fact that the number of TVE employees had reached 129 million by the end of 1995 (China State Statistical Bureau, 1996:388), and that there is a "floating population" in China of at least 80 million (Chen, 1996:1). In fact, the rapid increase in temporary residents has already caused major concerns in urban areas (Chen, 1996; Wang, 1996). The effects of the development of TVEs are not evident at the moment, but the potential of such effects is enormous, especially when one considers the need for urban planning in a large number of towns. Moreover, "informal urbanization" is the essence of China's new urbanization patterns: China's success in achieving more balanced urbanization can be attributed largely to this kind of urbanization. Without the successful development of TVEs and the effective management of temporary residents, China would not have been exceptional in the expansion of large cities. Therefore, China's experience can be properly appreciated only when "informal urbanization" is fully incorporated in the study of urbanization. The experience of China in terms of urbanization, especially these forms of "informal urbanization", may be beneficial to other developing countries.

#### Endnotes

1. The term "township and village enterprises" is actually not a good translation of the corresponding Chinese term, because towns are not covered and these have been the focus of China's rural industrialization process. However, because it is a widely used term, it is used in this article.
2. The number of temporary residents depends on the criterion used. Detailed information can be seen in the later analysis.
3. "Total population of cities and towns" and the "second criterion" of urban population introduced in the 1990 census, are also commonly used urban definitions. However, since the 1980s, the "total population of cities and towns" has seriously exaggerated the real urban population, with different effects on different levels of the urban system. The "second criterion" takes different criteria for city population and town population, making the urban population data not comparable among cities and towns and different regions (Zhou, 1993:122-128). Therefore, they are not appropriate for the analysis of the urban system.
4. Personal communication with local officials in civil affairs departments.
5. Personal communication with the Provincial Population Census Bureau.

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## Contraceptive Failure and Its Subsequent Effects in China: A Two- Stage Event History Analysis

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Replacement of cheap IUDs with more effective ones could significantly reduce China's high contraceptive failure rate

Information on the determinants of contraceptive failure and the effects or outcome of such failure has important implications for the study of fertility as well as for women's health. Contraceptive failure becomes a progressively more important determinant of fertility as the fertility target of couples declines and as the prevalence of contraceptive use increases. Bongaarts and Rodriguez (1990) showed that, when the fertility target is two or three children, most couples are likely to need protection against unwanted births before the woman's reproductive period ends, i.e. for more than 10 years. However, if contraception is practised with 90 per cent efficacy, more than two-thirds of couples can expect a contraceptive failure within 10 years. Unless couples resort to induced abortion, the births resulting from contraceptive failure would contribute substantially to a population's aggregate level of fertility.

The proportion of births due to contraceptive failure is likely to rise as fertility targets decline to a degree that depends on the aggregate contraceptive efficacy of the mix of methods used in the population. On the other hand, if the contraceptive failure results in an induced abortion this may increase the risk of maternal morbidity and mortality. The need to understand the predictors of contraceptive failure and its outcome is particularly acute in China where there are high levels of contraceptive use (around 70 per cent throughout the 1980s) coupled with high levels of failure (Delfs, 1990; Poston, 1986; Weinberger, 1991).

Although there is quite a substantial literature on contraceptive failure, only limited work is available on the socio-demographic determinants of contraceptive failure (Grady, Hayward and Florey, 1988; Jones and Forrest, 1992; Grady, Hayward and Yagi, 1986; Schirm and others, 1982; Trussell and Kost, 1987), most of which have examined contraceptive failure in the first year of use in the United States of America. Also, data constraints have meant that several contraceptive methods are combined and introduced as a control variable in a multivariate analysis, and it is possible that socio-economic and demographic factors may influence contraceptive failure differently for different methods. In addition, sterilization is excluded from most of the analyses; determinants of sterilization failure should be examined even though the failure rate is very low in most societies. With regard to the subsequent outcomes of failure, to our knowledge, there is no study of the predictors of the outcomes of contraceptive failure.

This study aims to explore the socio-demographic and contraceptive use factors affecting the occurrence of contraceptive failure during the first eight and a half years of contraceptive use and the ways such pregnancies are resolved, by method and urban-rural residence. The data come from China's National Survey of Fertility and Birth Control, often referred to as the "Two-per-Thousand Fertility Survey", which collected information on the complete fertility and contraceptive history of currently married women aged 15-57 and on 27 contraceptive methods as well as on women's background characteristics. Such data make it possible to examine the determinants of the occurrence of contraceptive failure and the resolution of the pregnancy.

### Data and methods

The Two-per-Thousand Fertility Survey, which provides the data for this study, was conducted in 1988 by China's State Family Planning Commission. The survey, representing a sample of two per thousand persons in mainland China, targeted ever-married resident women aged 15-57. It was a single-stage disproportionate stratified-cluster sampling survey. The sample fraction was 1.98 per thousand for the entire mainland population; 13,966 sampling points throughout the country were selected. Each sampling point comprised a small area with an average of 150 residents. The sample was stratified by province. However, within provinces, various sample fractions were taken with the aim of obtaining representative data for each province (Chen, 1991; Lavelly, 1991).

The central elements of the survey were pregnancy and contraceptive use histories, but data on both husband and wife, on other household members, and on characteristics of the small residence group were also gathered. In the pregnancy history, each woman was asked to provide information on the outcomes of

all pregnancies, including live births, miscarriages, induced abortions and still births; breastfeeding; and postpartum amenorrhea as well as the month and year in which the pregnancy ended. In the complete contraceptive history, the woman was asked to name the month and year she had started practising contraception for each continuous period of contraceptive use, the method she had adopted, the date she had stopped using that method and the reasons she stopped at that specific time.

A total of 27 contraceptive methods were listed in the questionnaire.<sup>1</sup> For convenience, these have been classified into six types based on the failure rates and number of users: (a) male sterilization; (b) female sterilization; (c) IUDs; (d) pills; (e) condoms; (f) other methods (including a variety of contraceptives such as injectables, vaginal methods, rhythm and withdrawal).

The data for this analysis come from a 10 per cent randomly selected subsample of the Two-per-Thousand Fertility Survey. The unit of analysis for contraceptive failure is the use interval, with the sample being restricted to all use intervals that began since 1980 following the introduction of the one-child policy. The resulting number of method use-intervals is 30,027, representing the experience of 17,887 currently married women aged 15-57. Among the 30,027 periods of contraceptive use, 4,053 eventually ended in contraceptive failure within the study period. Failures occurring within nine months of the interview are excluded from the analysis of the subsequent outcome of contraceptive failure because their exposure to the outcome may be censored. The sample for the analysis of the determinants of the outcome of contraceptive failure thus consists of 3,658 failures.

Contraceptive failure is here defined as a pregnancy occurring while contraception is being practised. This definition of failure includes both method failure and failures attributed to inconsistent or incorrect use, which is also called "use failure" (Jejeebhoy, 1990)<sup>2</sup>.

The outcome of contraceptive failure is modelled as a two-stage process: stage one is the occurrence of a contraceptive failure, and stage two is the outcome of the pregnancy given that contraceptive failure has occurred. This two-stage process model has been used by Yamaguchi and Kandel (1987) and Mensch and Kandel (1992) to study the predictors of pre-marital pregnancy and its outcome.

For the first step, either continuous-time or discrete-time hazards models can be employed. Here log-rate models for piece-wise constant rates for continuous time are used to estimate the method-specific hazard models of contraceptive failure (Trussell and Hammerslough, 1983) in the first stage of the analysis. This technique has been used frequently in the study of contraceptive use dynamics (Schirm and others, 1982; Hammerslough, 1984; Grady and others, 1986 and 1988; Jones and Forrest, 1992).

In the second stage, logistic regression is used to model the conditional probability of the accidental pregnancy resulting in a live birth rather than abortion. In order to understand the predictors of a particular outcome of contraceptive failure, multinomial logistic regression should perhaps ideally be performed to estimate the determinants of multiple outcomes (i.e. live birth, abortion, spontaneous abortion or still-birth). In this study, just two outcomes of contraceptive failure (live birth and abortion) are considered while spontaneous abortion and still birth are excluded from the analysis, because the reported incidence of the last two of the four outcomes is relatively very small. Therefore, the influence of the predictors of experiencing a live birth versus an abortion is estimated by logistic regression. Since independence of parameters is assumed between the two steps, the parameters for each step are estimated independently.

The analysis focuses on three sets of factors likely to influence the occurrence of contraceptive failure and the decision to terminate it: socio-economic, demographic and contraceptive-use factors. Each of the independent variables is defined as a categorical variable and is measured at the time of initiating the particular period of contraceptive use. The variables in each group are described below and the categories defined for each variable and percentage distribution of use periods by method are presented in table 1.

Table 1. Percentage distributions of variables used in method-specific hazards models for China

Variables/categories	Sterilization		IUD	Pill	Condom	Other
	Male	Female				
Socio-economic characteristics						
Residence:						
Urban	5.4	10.5	28.3	34.2	78.7	70.4
Rural	94.6	89.5	71.7	65.8	21.3	29.6
Geographic region of residence:						
North	4.0	16.9	17.1	26.4	43.4	25.1

North-East	0.1	10.0	14.9	7.5	15.1	7.3
East	33.0	27.3	27.5	28.5	20.5	25.9
South	34.4	26.4	20.5	12.2	9.0	17.9
South-West	26.8	5.6	10.8	6.6	5.8	8.6
North-West	1.7	13.8	9.2	18.7	6.2	15.3
Education:						
No school	58.1	46.5	26.3	24.6	3.3	8.9
Primary	25.5	32.7	25.4	25.8	12.0	14.9
Junior	12.5	15.2	30.7	31.3	38.7	38.2
Senior +	3.8	5.6	17.5	18.2	46.0	38.0
Occupation:						
Agriculture	95.4	87.8	69.7	62.3	19.2	27.9
Others	4.6	12.2	30.3	37.7	80.8	72.1
Ethnicity:						
Han	90.3	93.3	92.0	88.2	94.5	90.5
Minority	9.7	6.7	8.0	11.8	5.5	9.5
Demographic characteristics						
Age at the beginning of the use interval:						
≤24	10.0	13.9	35.7	29.0	24.2	20.9
25-27	20.0	23.1	28.0	26.2	32.7	26.8
28-30	28.6	27.1	18.7	19.7	21.6	19.8
≥31	41.4	35.9	17.7	25.2	21.5	32.5
Number of living children:						
0	0.0	0.2	0.4	3.8	10.6	7.8
1	0.8	1.4	50.8	48.0	72.4	59.8
2	39.4	46.7	28.8	26.8	12.8	18.8
3+	59.8	51.7	20.0	21.5	4.2	13.5
If there is a son:						
No	10.2	8.0	29.7	33.6	50.3	40.8
Yes	89.8	92.0	70.3	66.4	49.7	59.2
Contraceptive use characteristics						
Prior use:						
No	46.0	44.2	71.8	55.2	55.0	45.6
Yes	54.0	55.8	28.2	44.8	45.0	54.4
Prior use failure:						
No	77.1	80.8	83.9	73.1	68.0	67.0
Yes	22.9	19.2	16.1	26.9	32.0	33.0
Motivation of use response to campaign:						
No	7.7	10.5	11.2	25.4	24.2	27.6
Yes	92.3	89.5	88.8	74.6	75.8	72.4
Period at the initiation of use:						
<1984	49.8	55.5	42.1	38.9	32.3	37.5
≥1984	50.2	44.5	57.9	61.1	67.7	62.5
Duration of use						
0-11	23.8	21.4	33.3	41.8	41.8	38.2
12-23	19.0	18.6	21.7	23.3	23.1	22.4
24-35	16.1	16.6	15.0	13.7	13.9	14.3
36-47	14.1	15.2	11.0	8.5	8.8	9.1
48-59	11.9	13.1	7.8	5.5	5.5	6.4
60-71	7.9	8.0	5.3	3.5	3.6	4.5
72-83	4.1	3.8	3.2	2.1	1.9	2.8
84-102	3.1	3.3	2.5	1.6	1.5	2.4



estimate the parameters of the hazards models and logistic regressions. Parsimonious proportional hazards and logistic models are obtained by using a combination of forward selection and backward elimination.

## Results

### Determinants of contraceptive failure

Table 2 presents the results from the final parsimonious proportional hazards models for the six methods by urban-rural residence. The parameter estimates are omitted here. Instead, the effects of the various covariates are expressed as relative risks, which are calculated as the exponentiated coefficients. These relative risks represent the relative change in the hazard rate of contraceptive failure for the specific category compared to the reference group of this variable, controlling for other variables. For example, in the hazard model for rural male sterilization users, the relative risk of about 6.8 during the first year of male sterilization means that the risks of experiencing a male sterilization failure are 6.8 times higher than risks for the reference category "after three years of use". The chi-squared statistic compares the final model with the null model which includes only the parameter for the intercept. All variables in these final models are significant at the 5 per cent or higher level.

Initially, seven dummy variables for the first seven 12-month intervals of duration (with reference interval 84-102) were used to estimate the method-specific hazards. After much exploratory analysis the intervals above 36 months were collapsed into one category. Models using this simpler specification of the hazard fit the data almost as well and do not change the results significantly.

Table 2. Estimated relative risks for parsimonious proportional hazards models of contraceptive failure, by method and residence, China

Variable	Sterilization Male	IUD	Pill	Condom	Other
<b>Urban</b>					
Duration of use:					
0-11	x	x	3.94**	2.10**	3.02** 2.48**
12-23	x	x	2.45**	2.32**	2.68** 2.40**
24-35	x	x	1.61**	1.45**	1.71* 1.63
36-102	x	x	1.00	1.00	1.00 1.00
Age at start of use:					
≤24	x	x	1.00	1.00	1.00 1.00
25-27	x	x	1.07	.74	1.05 1.03
28-30	x	x	.66**	.51**	.76 .67
31+	x	x	.44**	.22**	.52** .42**
Number of living children:					
0	--	--	-	1.00	1.00 1.00
1	--	--	x	.65*	.44** .50**
2	x	x	x	.48*	.43** .39**
3+	x	x	x	.51	.13** .34*
Prior failure:					
No	x	x	1.00	1.00	x 1.00
Yes	x	x	1.51**	1.80**	x 1.38**
Period at initiation of use:					
<1984	x	x	x	1.00	1.00 1.00
≥1984	x	x	x	.68**	.69** .66**
Chi-square	x	x	239.37	108.21**	167.77** 93.93**
Df	x	x	7	11	10 11
N	84	805	4,143	1,117	1,380 822
<b>Rural</b>					
Duration of use:					

0-11	6.79**	4.13**	2.99**	2.18**	x	x
12-23	4.80**	4.05**	2.54**	2.35**	x	x
24-35	3.84**	1.36	1.95**	1.46	x	x
36-102	1.00	1.00	1.00	1.00	x	x
Age at start of use:						
≤24	x	x	1.00	1.00	1.00	1.00
25-27	x	x	.76**	.72*	.75	.72
28-30	x	x	.42**	.48**	.87	.53
31+	x	x	.18**	.19**	.37**	.14**
Number of living children:						
0	--	--	-	x	x	x
1	--	--	1.00	x	x	x
2	1.00	1.00	1.24**	x	x	x
3+	2.68**	4.01**	1.42**	x	x	x
Prior failure:						
No	x	1.00	1.00	1.00	x	1.00
Yes	x	1.73*	1.67**	1.74**	x	1.97*
Period at initiation of use:						
<1984	x	x	1.00	1.00	x	x
≥1984	x	x	.82**	.72*	x	x
Geographic region of residence:						
North	x	x	1.34*	x	x	x
North-East	x	x	1.39**	x	x	x
East	x	x	1.67**	x	x	x
South	x	x	1.40**	x	x	x
South-West	x	x	1.66**	x	x	x
North-West	x	x	1.00	x	x	x
Chi-square	74.51**	76.94**	749.78**	101.66**	10.18**	37.04**
Df	4	5	15	8	3	4
N	1,471	6,841	10,496	2,149	373	346

Note: - category collapsed with one-child group;

-- category collapsed with two-children group;

x variable deleted (did not improve the fit of the model at the P=.05 level);

\* P<.05;

\*\* P<.01;

N = number of use intervals.

For male sterilization, table 2 shows that duration of use and number of living children are strong determinants of contraceptive failure for rural couples and not at all for urban couples. The duration effect shows that the rate of contraceptive failure decreases rapidly in the first few months and is very rare after 36 months. For rural women whose husbands have been sterilized, the risks of contraceptive failure are 6.8, 4.8 and 3.8 times higher within the first year, second year and third year of use respectively, than subsequently. The effect of the number of living children reveals that rural women with three or more children have a significantly higher rate of contraceptive failure. For example, the hazard of failure is about 2.7 times greater for women with three or more children compared with women who have fewer than three children.

For female sterilization, duration of use together with number of living children and previous contraceptive failure are found to be important predictors of contraceptive failure for rural women but not for urban women. The effects of duration of use and number of living children are similar to that for male sterilization but with a smaller effect of duration. In addition, for rural sterilized women, prior experience of contraceptive failure strongly increases the chance of experiencing another accidental pregnancy.

For urban users, table 2 indicates that duration of use, age at the start of use and number of living children are all significant determinants of contraceptive failure for all reversible methods, except for the effect of number of living children on IUD use. Contraceptive failure occurs more frequently at shorter durations of use; older women have a relatively low rate of contraceptive failure. The chance of having an accidental pregnancy for women without a child is much higher than for women with children. For rural users, age at the initiation of use is found to be the only variable that has a significant influence on contraceptive failure for all reversible methods.

Women living in both urban and rural areas with prior contraceptive failure have an elevated risk of another failure for all reversible methods except for condoms.

For rural IUD users, number of living children is positively associated with failure. Regional differentials in failure rates are also observed for IUD users, IUD failure being lowest in the rural North-West.

There are significant differentials in the contraceptive failure rates between the two periods of use for all reversible methods. The results in table 2 indicate that the risk of contraceptive failure since 1984 has been reduced by 32 per cent, 31 per cent and 34 per cent, respectively, for users of the pill, condom and other methods in urban areas, and 18 per cent and 28 per cent, respectively, for users of IUDs and the pill in rural areas compared with the period before 1984.

Education, ethnicity, occupation and motivation are found to have no significant effect on contraceptive failure for each method after controlling for other factors. The presence of a son also has no significant effect on contraceptive failure. These results suggest that in general demographic factors are more important determinants of contraceptive failure than socio-economic variables.

#### Determinants of the outcome of contraceptive failure

Table 3 presents the distribution of the outcomes of the 3,658 contraceptive failures by method and residence. It shows the striking differences in the way urban and rural couples resolve a contraceptive failure. Only 9.1 per cent of failures result in a live birth for urban couples compared with 42.0 per cent for rural couples. The marked differentials in the outcomes of contraceptive failure also exist among different methods for rural couples. As shown in table 3, for rural couples, 61.7 per cent and 62.4 per cent of contraceptive failures for male and female sterilization, respectively, lead to live births, whereas 45.0 per cent of IUD failures and less than 25.0 per cent of other reversible method failures lead to live births. The distribution of the outcome of contraceptive failure by residence and method may reflect the nature and implementation of the family planning programmes associated with different contraceptive mixes. For example, reversible methods are more prevalent among couples in urban areas and those having a higher education who have more (government-enforced) motivation to avoid births than among sterilization and IUD users in rural areas. Large urban-rural differences are seen in IUD failure outcomes, a situation which probably reflects the Government's pressure on couples in urban areas to have an abortion.

Table 3. Percentage distribution of outcomes of pregnancy given contraceptive failure, by method and residence (weighted), China

Method	Live birth	Abortion	Still-birth/ spontaneous abortion	Total (%)	N
<b>Urban</b>					
Male sterilization	n.a.	n.a.	n.a.	n.a.	2
Female sterilization	n.a.	n.a.	n.a.	n.a.	5
IUD	5.6	93.7	.7	(45.4)	515
Pill	13.8	83.7	2.5	(16.4)	231
Condom	12.0	85.4	2.6	(21.4)	332
Others	9.6	89.1	1.3	(16.2)	224
Total (%)	9.1	89.5	1.5	(100.0)	1,309
<b>Rural</b>					
Male sterilization	61.7	34.8	3.5	(6.8)	120
Female sterilization	62.4	34.2	3.4	(4.0)	95
IUD	45.0	51.4	3.6	(72.3)	1,618
Pill	16.1	81.9	2.0	(12.4)	387
Condom	13.4	81.7	4.9	(2.7)	79

Others	24.9	74.2	.9	(1.9)	50
Total (%)	42.0	54.6	3.3	(100.0)	2,349

Note: Figures in parentheses are compositional proportions of all 3,658 contraceptive failures; N is the number of unweighted contraceptive failures; n.a. = not applicable.

Logistic regression is used to identify the factors which are most important in predicting the outcome of contraceptive failure. The results of the best logistic regression models based on all the contraceptive failures are shown in table 4. They are reported as odds ratios which give the change in the odds of a live birth versus an abortion for a category of a variable compared to the reference category for that variable.

Table 4. Estimated odds ratios for parsimonious logistic regression models of live birth versus abortion, by method and residence, China

Variable	Sterilization		IUD	Pill	Condom	Other
	Male	Female				
Urban						
Age:						
≤24	n.a.	n.a.	1.00	1.00	x	x
25-27	n.a.	n.a.	.21	.10**	x	x
28-30	n.a.	n.a.	.04**	.06**	x	x
31+	n.a.	n.a.	.01**	.01**	x	x
Living children:						
0	--	--	-	31.61**	48.06**	--
1	--	--	1.00	1.00	1.00	1.00
2	n.a.	n.a.	242.8**	154.8**	12.12**	29.93**
3+	n.a.	n.a.	1,384**	456.2**	--	--
Chi-square	n.a.	n.a.	139.58**	86.74**	101.60**	36.43**
Df	n.a.	n.a.	5	6	2	1
N	2	5	511	228	324	219
Rural						
Age:						
≤24	x	x	1.00	1.00	x	x
25-27	x	x	.45**	.22**	x	x
28-30	x	x	.14**	.06**	x	x
31+	x	x	.06**	.05**	x	x
Living children:						
0	--	--	-	44.24**	--	--
1	--	--	1.00	1.00	1.00	1.00
2	1.00	1.00	1,009**	274.4**	40.50**	38.89**
3+	22.18**	28.3**	2,977**	794.8**	--	--
Prior failure:						
No	x	x	1.00	1.00	x	x
Yes	x	x	.40**	.32**	x	x
Chi-square	29.81**	119.20**	1,245.19**	164.14**	20.51**	21.10**
Df	1	6	7	1	1	1
N	117	91	1,562	377	76	49

Note: - category collapsed with one-child group;

-- category collapsed with two-children group;

x variable deleted (did not improve the fit of the model at the P=.05 level);

\* P<.05;

\* \*  $P < .01$ ;

n.a. = category not applicable;

N = number of failures.

The number of living children has a very strong effect for all methods on whether the contraceptive failure will end in a live birth or an abortion. For IUD failures, almost all those which occur among women who have one or no child are aborted and this holds true for both urban and rural women. However, IUD users with more than one child have a higher probability of having a live birth. The distribution of outcome of contraceptive failures for other reversible methods is similar to that for IUDs. If a woman has a living child and unintentionally becomes pregnant because of reversible method failure, she is almost certain to have an induced abortion. However, the more children the woman has, the more likely she is to have a live birth as a result of contraceptive failure.

It can also be seen from table 4 that IUD and pill users in all age groups over 24 years old have significantly lower odds of a live birth than the reference group for both urban and rural users. The results indicate that older women have higher odds of an abortion compared with their younger counterparts. In addition, women with a previous contraceptive failure are more likely to have the current failure end in an abortion rather than a live birth when compared with women with no prior failure.

The duration of use in which the contraceptive failure occurs and other variables, such as occupation, ethnicity, son preference and motivation, are found to be insignificant in determining the outcome of failure.

#### Discussion and conclusion

Using the 1988 Two-per-Thousand Fertility Survey, this study has investigated the determinants of contraceptive failure and its outcome in China in the 1980s through a two-step event history approach. Several socio-demographic factors are found to be associated with the occurrence of contraceptive failure and the decision on how to resolve the pregnancy.

Comparing urban and rural dwellers, rural couples are more likely to become pregnant because of sterilization failure, and they would also be more likely to have a live birth as a result of contraceptive failure. On the other hand, urban couples are more likely to have an induced abortion as opposed to a live birth if contraceptive failure occurs. Although both urban and rural IUD users have about the same chance of having a contraceptive failure, quite different resolutions of the pregnancy may be observed: about 45 per cent of IUD failures for rural women will end in a live birth compared with just 5.6 per cent for urban women. These results demonstrate the importance of analysing separately the determinants of contraceptive failure and its outcome by method and by urban-rural residence.

For sterilization, number of living children is identified as a very strong predictor of contraceptive failure as well as of its outcome for rural women. Rural women with three or more children have a significantly higher rate of contraceptive failure, and also a significantly higher chance of a subsequent live birth rather than an abortion, compared with women having fewer than three children. This suggests that some of the "failures" may be deliberate pregnancies. Table 3 also shows that, for rural sterilization users, over 60 per cent of failures lead to a live birth compared with 45.0 per cent for IUD failures, and less than 25 per cent for other reversible methods. If those are not deliberate pregnancies, then a low motivation to prevent pregnancy may be another cause.

Age at the start of the period of contraceptive use, number of living children and prior contraceptive failure are found to be the important determinants of IUD failure and its outcome, especially for rural IUD users. The IUD failure rate decreases as a woman's age increases. Younger women have a higher risk of failure, and if they experience a failure, they are more likely than older women to have a live birth as opposed to an abortion. This is expected because as a woman becomes older her fecundity decreases; also, advancing age probably strengthens women's motivation to use IUDs effectively and thus restrict their childbearing. Rural women with two or more children experience a higher failure rate than women with no or one child. If IUD failure occurs among women with two or more children, they, whether living in urban or rural areas, are extremely likely to have a live birth as a result of IUD failure. This result is hardly surprising. In China, some women, especially multiparous mothers in rural areas, may have their IUDs removed privately and subsequently get pregnant, and then report the pregnancy as a method failure. In doing this, they can avoid incurring a penalty from the government. Previous contraceptive failure not only increases the risk of IUD failure, but also increases the odds of an abortion versus a live birth compared with women with no prior failures.

For other reversible methods, the number of living children is a consistently significant determinant of how

a contraceptive failure is resolved for both urban and rural women even though the extent to which those variables are influential varies somewhat. Once a contraceptive failure of a reversible method occurs, a woman with one child will almost definitely have an induced abortion, which indicates a strong commitment to the one-child policy by some Chinese women. An alternative interpretation could be that the programme puts pressure on these women to terminate their pregnancy.

The patterns of contraceptive failure and its outcome discussed above show that women's demographic characteristics are more important than socio-economic background with regard to the occurrence of contraceptive failure and the decision to terminate the pregnancy.

The results of this study suggest some potential evidence of defiance of, and resistance to, the family planning policies and programmes by some groups of Chinese women. "Intended" contraceptive failure or deliberate pregnancy before sterilization or removal of an IUD in order to have a child are perhaps examples. Also, some women, who already had two or more children, still preferred to have a live birth rather than an abortion if they experienced a failure.

The finding that there are some reductions in contraceptive failure rates for some reversible methods since 1984 compared with the period before 1984 suggests that the relaxation of the family planning programme after 1984 may have played some role in reducing contraceptive failure because couples may be more motivated to use contraceptives efficiently when they enjoy a lenient family planning policy. It may also suggest the improved promotion of family planning services.

The results of this study have important policy implications. The distribution of the outcomes of contraceptive failure indicate that there may be a different demographic impact of contraceptive failure by method and area of residence. Contraceptive failure which terminates in a live birth will contribute to the aggregate level of fertility. Wang and Diamond (1995) find that contraceptive failure accounted for about 7 per cent of the general fertility rate in the 1980s; also, 87 per cent of that percentage related to sterilization and, most importantly, IUD failure. On the other hand, contraceptive failure which results in abortion, mainly among young users of reversible methods in urban areas, may increase the risk of disease and even operation-related death for women. Therefore, greater efforts should be made to reduce contraceptive failure for the sake of both birth control and women's health. The Chinese family planning programme should pay special attention to those who are young users of reversible methods; who are multiple-birth sterilization users; who are nulliparous users of reversible methods; and also those who have previous experience of unwanted pregnancy. Motivating users in their commitment to method use is also important to reduce the occurrence of contraceptive failure.

The provision of methods other than IUD for couples with no or only one child may also help to increase user satisfaction, since the wide availability of more contraceptive options facilitates a better meeting of particular individual needs for contraception. The flexibility of switching methods may pose additional demands on services but could increase long-term continuation and user-satisfaction.

The key to reducing the failure rate is to improve the effectiveness of IUDs. Of all contraceptive method failures, 64.3 per cent are due to IUD failure. The IUD discontinuation rates for contraceptive failure and expulsion in China are among the highest in the world, and there are a number of socio-demographic and family planning programme factors that result in the low effectiveness of IUDs (Wang, 1996).

Replacement of the cheap and widely used stainless steel ring with newer IUDs such as the copper-T could reduce such high levels of IUD failure. High quality IUDs of various sizes and types should be provided and made widely available for users. Training of family planning workers and the provision of improved information and counselling to clients are also essential.

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#### Endnotes

1. Those 27 contraceptive methods listed in the questionnaire can be divided into two categories: modern and traditional methods. Modern contraceptive methods include the following: male sterilization (vasectomy, vas deferens sticker blockade and suppository blockade); female sterilization (tubectomy, fallopian sticker blockade and fallopian suppository blockade); IUDs; pills (various types of oral

contraceptive methods commonly used in China); injectables (injection and implant); condoms; vaginal methods (barrier methods such as cervical cap and diaphragm and spermicidal methods such as jelly, foam, contraceptive suppository, external contraceptive pill and external contraceptive sponge). The following contraceptives are considered as traditional methods: rhythm (safe period or periodic abstinence); withdrawal (coitus interruptus); and all remaining methods, such as the use of Chinese herbs, natural methods and combinations of several short-term methods. Of all types of contraceptives used, modern methods account for 98.6 per cent, whereas traditional methods account for only 1.4 per cent.

2. Three main measures of contraceptive failure are found in the demographic literature: method failure, user failure and extended-use failure. Method failure includes only pregnancies directly attributable to the method under ideal conditions and perfect use. User failure refers to pregnancies that occur while a couple consider themselves to be users of a method; it includes both method failure and failure attributable to inconsistent or incorrect use. Extended failure includes unintended pregnancies during and subsequent to actual contraceptive use, but prior to a subsequent pregnancy (Jejeebhoy, 1990). In this study, contraceptive failure refers to user failure.

3. China can be described as a mosaic of different cultures, living in an area of over 9.6 million square kilometres divided into 31 administrative regions, with each region having its own cultural and geographic characteristics. Also, there is diversity in fertility patterns and family planning programmes (Peng, 1991; Wang, 1996). The grouping of the 29 regions covered in this study into six large areas, namely North, North-East, East, South, South-West and North-West, based on geographic criteria, is somewhat arbitrary. It may conceal internal differences in terms of economic, environmental and cultural heritage, but it still would capture some regional variability.

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One of the purposes of family planning programmes in developing countries is to provide for the unmet needs of couples for contraception. In KAP (knowledge, attitude and practice) surveys, a large proportion of women usually state that, even though they want no more children, they are not using contraception. Under such circumstances, it is usually assumed that, if contraceptive methods were to be made easily available to them, many women with unmet needs for contraception would adopt those methods. In reality, however, this does not always happen. Nevertheless, in many East Asian countries, following the introduction of family planning programmes, fertility has reached the replacement level. The fertility transition is under way in some Asian countries, but it has yet to begin in others (Caldwell, 1993). In fact, such variations in fertility, despite the wide-spread availability of contraceptive methods, raises the issue of whether existing family planning services need to be modified.

The family planning programme of Bangladesh is considered to be successful because fertility has been declining consistently despite the country's unfavourable socio-economic conditions. None the less, the level of fertility is still high owing to a combination of factors including couples' desire for a large family and the existence of unwanted births. The success of a family planning programme depends largely on the reduction of unwanted births, yet a programme cannot reduce family size desires (Razzaque, 1996). Using World Fertility Survey data, Bongaarts (1990) estimated that about 24 per cent of all births in Bangladesh during 1975 were unwanted. In the Matlab study area, Razzaque (1998) reported that, among women who wanted no more children, 34 per cent gave birth in the treatment area during the five-year follow-up period compared with 43 per cent in the comparison area.

In the treatment area of Matlab, a remarkable decline in fertility has been observed since the introduction of the MCH-FP (maternal and child-health/family planning) programme. Fertility has also been declining in the comparison area where the government's family planning programme is being implemented. Despite the extraordinary decline in fertility in the treatment area, the difference in fertility levels between the two areas has remained almost unchanged over time; however, the difference in levels of contraceptive use has widened. Such a change in the relationship between fertility and contraception is due mainly to an increase in the proportion of contraceptive use for birth-spacing purposes. Among the users, in 1977, 83 per cent of women in the treatment area were using contraception to limit births compared with 54 per cent doing so in 1990 (Koenig and others, 1987 and 1992). Again, Koenig and others (1992) reported that in the treatment area the effect of education on contraception has diminished over time.

Our study proposes that the effect of various socio-economic variables associated with contraceptive use might be different for limiters and spacers in the treatment and comparison areas. The objective of the study is to examine contraceptive use and continuation among limiters and spacers. More specifically, this study examines levels and determinants of contraceptive use, continuation, method mix and reasons for non-use among limiters and spacers; it also investigates whether there is any change in the socio-economic determinants of contraceptive use over time.

## Methods and materials

### The study area

The data for the present study come from Matlab thana (district) where the International Centre for Diarrhoeal Disease Research, Bangladesh, has been maintaining its Demographic Surveillance System (DSS) since 1966. Matlab is about 70 kilometres south-east of Dhaka, the capital of Bangladesh. The area is a low-lying deltaic plain intersected by the tidal river Gumti and its numerous canals (for details, see Ruzicka and Chowdhury, 1978; D'Souza, 1981).

The Matlab study area was divided into treatment and comparison areas. The treatment area was exposed to a contraceptive distribution programme during the period 1975-1977 and has been exposed to the Family Planning and Health Services Programme since October 1977. That Programme was introduced to test the hypothesis that demographic change can be induced and sustained through an intensive service delivery programme, even in the absence of extensive socio-economic development. In the comparison area, services have been limited to those received through the conventional government service programme (for details, see Bhatia and others, 1980). In both areas, contraceptive use was relatively low in 1975. In the treatment area, however, it increased from 12.6 per cent in 1977 to 31.1 per cent in 1978 after the introduction of the Family Planning and Health Services Programme. It remained at this level until 1982. Then, between 1982 and 1990 contraceptive use rose from 31.1 per cent to 60.6 per

cent. In the comparison area, contraceptive use is much lower than in the treatment area, but it has also been increasing: from 4.7 per cent in 1977 to 16.5 per cent in 1984 and 27.2 per cent in 1990.

Since the introduction of the Family Planning and Health Services Programme in 1977, a remarkable decline in fertility has been observed in the treatment area. The total fertility rate (TFR) declined from 6.9 children per woman in 1976 to 5.1 in 1980, 4.1 in 1987 to 3.6 in 1990. The TFR in the comparison area declined from 7.2 in 1976 to 6.7 in 1980 and 5.2 in both 1987 and 1990. The crude death rate (CDR) in the treatment area also declined remarkably from 12.5 per thousand in 1978 to 10.0 per thousand in 1985, falling further to 7.6 per thousand in 1990. Simultaneously, the CDR in the comparison area declined, with some fluctuation, from 13.8 per thousand in 1978 to 14.1 per thousand in 1985 and 9.4 per thousand in 1990. The decline in overall mortality has been the result largely of a decrease in infant and child mortality.

#### The data

The study utilizes three sets of data from the Matlab study area: the 1984 In-depth Survey, the 1990 KAP Survey, and 1984-1987 and 1990-1993 Record Keeping System (RKS) data. The primary objectives of both the In-depth and the KAP surveys were to provide updated information on contraceptive use and maternal and child health service performance in both the treatment and comparison areas (for details, see Koenig and others, 1987 and 1992). The In-depth Survey consisted of random cluster samples of 3,785 women of reproductive age from 37 villages in the treatment area and 2,429 women in 40 villages from the comparison area. However, young women were underrepresented in the In-depth Survey owing to sampling procedures that excluded newly married women (Koenig and others, 1987). The KAP Survey used a multi-stage sampling procedure. Thirty-one villages from the treatment area and 36 villages from the comparison area were randomly selected to include every alternate woman of reproductive age. The total number of respondents interviewed in the KAP Survey was 4,238 in the treatment area and 3,708 in the comparison area. Women who were married and non-pregnant at the time of the survey were included in the analysis.

To examine contraceptive use, In-depth and KAP survey data from both the treatment and comparison areas were used. For contraceptive use, the dependent variable took the value of 1 if a woman was using a modern or traditional method of contraception and 0 if she was not (logistic regression). In the logistic model, an odds ratio below 1.00 means that the independent variable has a negative impact while an odds ratio above 1.00 means that the independent variable has a positive effect. The independent variables here are the woman's age, number of living children, number of living sons, woman's education, religion and year of survey. In the logistic model, the woman's age and number of living children were treated as continuous variables, while the number of living sons (fewer than two sons, and two or more sons), religion (Muslim and Hindu), woman's education (no education and some education) and year of survey (1984 and 1990) were grouped into two categories. To examine whether the effects of sex preference, religion and woman's education on contraceptive use have changed over time, interaction between these variables and the year of survey was also tested.

To examine contraceptive continuation, In-depth, KAP and RKS data from the treatment area were used. The In-depth (cohort-84) and the KAP (cohort-90) survey data were matched with RKS records for the subsequent three-year period in order to ascertain survival status, contraceptive continuation and migration status. To examine continuation, the dependent variable is the interval between the survey date and the date of discontinuation, out-migration or censoring (life table). In the life table analysis, continuation of contraception was compared for two different periods. Because a woman might have started using contraception before the survey was conducted, the calculation of duration from the onset of the survey is an underestimation. All-method duration is considered here; it is different from the first method duration because switching is no longer a terminal event. The all-method continuation rate assesses the cumulative probability of practising any contraceptive method between the initial adoption of the first method and non-use of any method, without an intervening pregnancy.

Table 1. Percentage of contraceptive use \* among limiters and spacers in treatment and comparison areas of Matlab, Bangladesh, 1984 and 1990

Year	Treatment area			Comparison area		
	Limiters	Spacers	Total	Limiters	Spacers	Total
1984 %	47.2	31.7	39.8	23.0	6.4	16.9
N	1,771	1,045	2,987	1,190	545	1,837
1990 %	74.6	55.0	62.5	42.4	19.9	31.8
N	2,003	1,315	3,699	1,699	954	2,913

\* Currently married, non-pregnant women aged 15-49.

#### Results

## Levels and trends

Table 1 presents contraceptive use in the treatment and comparison areas for two different years. Overall contraceptive use increased by 23 percentage points (from 39.8 per cent to 62.5 per cent) between 1984 and 1990 in the treatment area compared with 15 percentage points (from 16.9 per cent to 31.8 per cent) in the comparison area. The increase in contraceptive use was greater among limiters than spacers. In the treatment area, there was a 27 percentage point increase among limiters and a 23 percentage point increase among spacers compared with an increase of 19 percentage points and 13 percentage points, respectively, in the comparison area. This large increase in contraceptive use among spacers indicates that women are becoming more aware of the positive benefits of longer birth intervals. Moreover, in a recent study, Razzaque (1994) observed that in both the treatment and comparison areas, most of the respondents reported that longer birth-spacing results in greater health benefits for both mothers and children.

Table 2. Percentage of contraceptive use \* among limiters and spacers by method in treatment and comparison areas of Matlab, Bangladesh, 1984 and 1990

Method	1984						1990					
	Treatment area			Comparison area			Treatment area			Comparison area		
	Limiters	Spacers	Total	Limiters	Spacers	Total	Limiters	Spacers	Total	Limiters	Spacers	Total
Modern												
Pill	7.2	7.9	7.4	2.5	17.6	4.2	18.2	27.8	21.3	21.8	58.9	29.6
IUD	13.5	35.5	19.7	10.9	38.2	13.9	5.9	7.0	6.1	2.1	3.1	2.3
Injectable	31.8	49.1	36.7	2.5	2.9	2.6	45.9	59.9	50.4	3.2	7.3	4.1
Condom	2.0	2.4	2.1	2.2	5.9	2.6	1.5	1.1	1.4	1.1	2.6	1.3
Foam tabs/jelly	0.2	0.6	0.3	-	-	-	0.3	-	0.2	0.3	0.1	0.4
Tubectomy	36.1	-	25.9	56.7	-	50.5	21.0	0.4	14.4	44.9	1.6	35.7
Vasectomy	2.0	-	1.5	2.2	-	1.9	0.9	0.1	0.7	1.1	-	0.9
Traditional	6.8	4.5	6.3	22.6	35.3	24.0	6.6	3.6	5.6	25.7	25.5	25.6
Rhythm	2.6	2.7	2.7	9.5	23.5	11.0	2.9	2.1	2.6	12.2	15.6	12.9
<i>Azal</i> (withdrawal)	1.7	0.9	1.5	2.2	5.9	2.6	1.4	1.1	1.3	4.3	5.2	4.5
Other	2.5	0.9	2.1	10.9	5.9	10.4	2.3	0.4	1.7	9.2	4.7	8.2
Total	100	100	100	100	100	100	100	100	100	100	100	100
N	836	330	1,166	275	34	309	1,533	724	2,257	720	192	912

\* See table 1.

The contraceptive method mix used in the treatment and comparison areas differed significantly (table 2). This reflects the difference in emphasis of the two programmes.

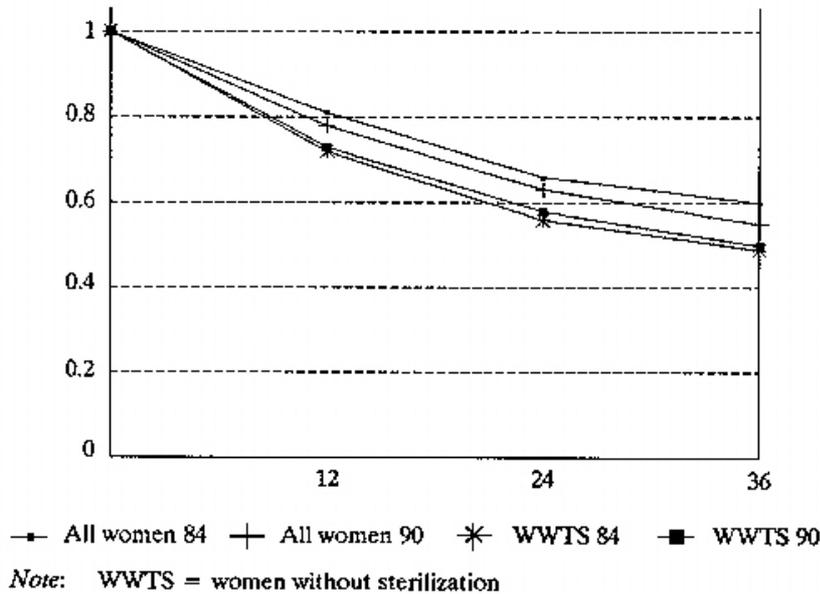
In the treatment area, among limiters, tubectomy was the most frequently used method in 1984, followed by injectables and the IUD, while in 1990, injectables appeared to be the most frequently used method, followed by tubectomy and the pill (table 2). Among spacers, however, injectables comprised the most frequently used method in 1984, followed by the IUD and the pill. In 1990, injectables remained the most frequently used method, followed by the pill and the IUD.

Among limiters in the comparison area, tubectomy was the most frequently used method in 1984, followed by traditional methods and the IUD, while in 1990, tubectomy remained the most frequently used method, followed by traditional methods and the pill (table 2). Among spacers, the IUD was the most frequently used method in 1984, followed by traditional methods and the pill, whereas in 1990, the pill appeared to be the most frequently used method, followed by traditional methods and injectables.

It is evident from table 2 that the use of injectables and the pill in the treatment area increased substantially over that period among both the limiters and spacers, while the use of tubectomy (among limiters) and the IUD decreased. In the comparison area, use of the pill increased substantially among both the limiters and spacers, while the use of tubectomy (among limiters) and the IUD declined. In the comparison area, about a quarter of the women were using traditional methods compared with only about 5 per cent in the treatment area. The lower use of traditional methods in the treatment area than in the comparison area is mainly the result of programmatic efforts which promoted modern methods. In each area, although a modern male contraceptive method has been available since the introduction of the programme, its use remains exceptionally low (about 5 per cent in 1984 and about 4 per cent in

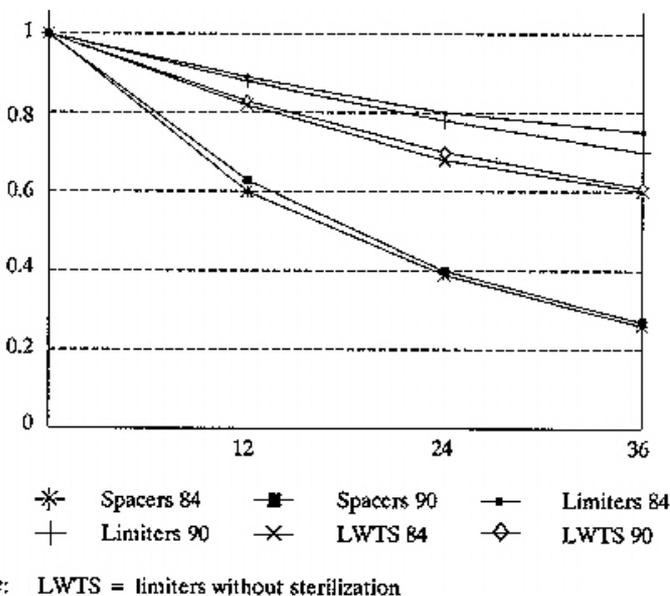
1990).

Figure 1. Continuation of contraception: all women and women without sterilization in treatment area of Matlab, Bangladesh



The contraceptive prevalence rate has long been considered a good indicator by which to evaluate the success of the family planning programme. Another important indicator is contraceptive continuation. Figure 1 depicts the overall contraceptive continuation of cohort-84 and cohort-90 in the treatment area. At 36 months, contraceptive continuation reached 60 per cent for cohort-84, but declined to 55 per cent for cohort-90. However, when sterilization was excluded, continuation rates became similar in the two cohorts. While contraceptive continuation was examined by fertility preference, continuation rates were similar for spacers in these two cohorts but not for limiters (figure 2). When sterilization was excluded, continuation for limiters again became similar. Discontinuation of contraception was due mainly to side-effects, particularly among those who wanted to limit the number of births (Razzaque, 1994; Stewart and others, 1991). A much higher level of discontinuation was expected in the comparison area, since the family planning programme operating there is less intensive.

Figure 2. Continuation of contraception among limiters and spacers in treatment area of Matlab, Bangladesh



In both the treatment and comparison areas, contraceptive use increased over the study period but available data from the treatment area show that contraceptive continuation has declined. The decline in continuation was due mainly to a decline in sterilization. However, an improvement in contraceptive continuation is expected as the family

planning programme develops further.

Table 3. Reasons for non-use of contraception \* among limiters and spacers in treatment and comparison areas of Matlab, Bangladesh, 1990

(per cent)

Reasons	Limiters		Spacers	
	Treatment area	Comparison area	Treatment area	Comparison area
	area	area	area	area
Objection of husband/relative	6.4	5.9	4.7	2.4
Against religion	2.3	3.6	0.5	0.1
Harmful to health/side-effects	35.7	22.4	7.8	7.1
Postpartum amenorrhoea/breastfeeding	30.6	29.0	39.8	38.7
Husband staying elsewhere	7.2	4.7	9.0	8.5
Old age	6.8	14.2	0.3	0.0
Want more children	1.7	1.7	33.5	33.1
Others	9.3	18.5	4.4	10.1
N	470	979	591	762

\* See table 1.

#### Reasons for non-use of contraception

Although an intensive family planning programme has been in operation in the treatment area since 1977, 25 per cent of the women who wanted to limit births were not using contraception in 1990. In contrast, 58 per cent of the women were not using contraception in the comparison area. Among non-users who wanted to limit births, about 30 per cent in each area reported that they were not using contraception because they were experiencing postpartum amenorrhoea. Thirty-six per cent of the women in the treatment area and 22 per cent of the women in the comparison area reported that they were not using contraception owing to side-effects or perceived health risks (table 3). In the treatment area, more women reported side-effects than in the comparison area owing mainly to the higher levels of contraceptive use there. Among other reasons for non-use, about 6 per cent reported objections from husbands or relatives and 3 per cent reported religion as a reason for non-use.

Among non-users who wanted to space births, about 30 per cent in each area reported that they were not using contraception because they wanted to become pregnant. Among other reasons for non-use, about 40 per cent in each area reported that, because of amenorrhoea, they were not using any method, whereas about 7 per cent in each area reported that they were not using contraception owing to side-effects.

Table 4. Logistic regression (odds ratio) of contraceptive use \* for limiters and spacers in treatment and comparison areas of Matlab, Bangladesh

Characteristics	Treatment area		Comparison area	
	Limiters	Spacers	Limiters	Spacers
Constant	-7.54	-4.05	-8.65	-7.16
Age of woman(cont)	1.59**	1.24***	1.60***	1.39**
Age * Age(cont)	0.99***	0.99***	0.99***	0.99**
Living children(cont)	0.96	1.19***	0.92***	1.19
Two or more sons (rc = <2 sons)	1.59***	0.98	1.74***	0.72
Literate (rc = illiterate)	1.35***	1.18**	1.57***	1.82***
Muslim (rc = Hindu)	0.53***	1.20	0.42***	1.00
Year 1990 (rc = 1984)	4.16***	2.89***	1.36	4.70***
Education * Year	-	0.69**	-	-
Religion * Year	-	-	1.93**	-
-2 log likelihood (df)	4,440.3 (3,766)	3,080.6 (2,354)	3,454.3 (2,881)	1,187.2 (1,493)

\* See table 1;  
rc = reference category;  
\* \* p<.05;  
\* \* \* p<.01.

#### Determinants of contraceptive use

Among the limiters, in each area contraceptive use increased with an increase in the women's age; however, at higher ages contraceptive use decreased (table 4, columns 1 and 3). Contraceptive use showed an inverse relationship with the number of living children. In each area and year, for those women who had two or more sons, contraceptive use was significantly higher than for those who had fewer than two sons. In both years, Muslims exhibited lower contraceptive use than Hindus in the treatment area. In the comparison area, although Muslims showed lower overall contraceptive use, levels of use increased over time more among Muslims than Hindus. In the treatment area, women with some education had higher contraceptive use than those who had no education; contraceptive use increased more over time among women who had no education. In both years in the comparison area, contraceptive use was higher among women with some education than those who had no education. Compared with 1984, contraceptive use increased well over 4.1 times in 1990 in the treatment area and over 1.3 times in the comparison area.

Among the spacers, contraceptive use increased with an increase in the women's age, but again decreased at higher ages in each area (table 4, columns 2 and 4). Unlike the limiters, however, contraceptive use among spacers in each area increased with an increase in the number of living children. Contraceptive use did not vary by the gender composition of children or religion in either area and year. Contraceptive use was higher for women who had some education than those who had no education in each area and year. Compared with 1984, contraceptive use increased about 2.8 times in 1990 in the treatment area and 4.7 times in the comparison area.

Determinants of contraceptive use for limiters and spacers were found to vary. Among the limiters, contraceptive use was negatively related to the number of living children in each area, whereas the opposite pattern held true for the spacers. For the limiters, the number of living sons was related to contraceptive use, but this was not the case for the spacers. Also, religious differences in contraceptive use exists for the limiters, but not for the spacers. Education differentials in contraceptive use exist for both limiters and spacers, but among the limiters in the treatment area, contraceptive use has increased more over time among women with no education than women with some education.

#### Discussion

This study has several advantages over those conducted earlier. It is both cross-sectional and longitudinal in nature and has examined not only contraceptive use and its continuation but also method mix and reasons for non-use separately for limiters and spacers in two areas with different family planning programmes. The study also has examined determinants of contraceptive use and changes in these determinants over the study period.

As the family planning programme developed, an increasing proportion of women have been using contraception to space births. Such changes in contraceptive use affect the fertility-contraception relationship, because the magnitude of a fertility decline depends largely on whether contraception is used for limiting rather than spacing births. In the Matlab study area, Razzaque (1998) documented that, among the spacers, a similar proportion of women gave birth during the follow-up periods in the treatment and comparison areas, but a higher proportion of women gave birth in the comparison area among the limiters than in the treatment area. Because birth intervals and postpartum amenorrhoea for Bangladeshi women have long been a result of prolonged breastfeeding (Huffman and others, 1980) and because little has changed over time (Salway and others, 1993), contraception for the purpose of spacing births may have a minimal effect on fertility owing to postpartum redundant use (Curtis, 1996).

The effect of increased contraceptive use on fertility decline depends not only on whether contraception is used for limiting the number of births but also on the method mix: some effective methods might lose popularity while others might gain. In fact, changes in method mix are currently taking place in the treatment area and to some extent in the comparison area, i.e. users are changing from more effective to less effective methods. Such a change in the method mix may affect fertility either through increases in contraceptive failure or discontinuation owing to side-effects or a deterioration in services.

In many countries, family planning programmes, even those in operation for a long period of time, may still be characterized by low contraceptive use. In this regard, Bruce (1990) argues that improvement in the quality of services will result in a larger, more committed clientele of satisfied contraceptive users. In the treatment area of Matlab, contraceptive use was found to be higher than in the comparison area, which is a result of differences in the intensity, coverage and overall quality of their family planning programmes (Koenig and others, 1992). However, Caldwell and Caldwell (1992) contended that the difference in the use of contraceptives between the two areas is due mainly to the difference in method availability. Over the study period, although contraceptive use improved substantially in both the treatment and comparison areas, available data from the treatment area demonstrated that

contraceptive continuation did not improve. This was due to the fact that the programme emphasis is mainly on increasing the use of contraceptives rather than continuing their use. Because about two-thirds of the non-users among the limiters were not using contraception as a result of side-effects or postpartum amenorrhoea, and about two-fifths of the non-users among the spacers were not using contraception as a result of postpartum amenorrhoea, it is proposed that needs-based rather than target-based family planning services be provided to couples in order to improve continuation as well as acceptance of contraception.

Earlier analysis of the 1990 KAP Survey data (combining limiters and spacers) showed that education differentials in contraceptive use had disappeared in the treatment area (Koenig and others, 1992). The present analysis found that the education differential disappeared among the limiters, but remained among the spacers. This result demonstrated that, as far as limiters in the treatment area are concerned, the family planning programme has been able to reach all women irrespective of differences in education. Thus, differential programme inputs for limiters and spacers are required for a more effective programme. The findings in the comparison area, however, confirmed the earlier result: that an education differential does indeed exist for both limiters and spacers. In this regard, Bhatia (1983) reported that, when contraceptive use was low, all occupational categories accepted contraception equally, but with increases in use, differentials appeared.

A preference for sons over daughters exists in Bangladesh (Ahmed, 1981). Some researchers have found that it influences contraceptive use and fertility (Rahman and others, 1992; Chowdhury and Bairagi, 1990). Our study, however, found that the effect of son preference on contraceptive use exists for limiters but not for spacers. This implies that when a woman reports that she wants to cease childbearing, it does not mean that she and her husband are completely satisfied with the sex composition of their children.

This study lends support to the recommendation of the 1994 International Conference on Population and Development: needs-based rather than target-based family planning services should be provided to clients. This means that couples should be provided with reproductive health services in order to determine freely and responsibly the number and spacing of their children. The study also suggests that, until reasons for non-use and discontinuation -- particularly among the limiters -- are adequately addressed, a dramatic decline in fertility cannot be fully achieved. At this level of contraceptive use, doorstep services, with the management of minor side-effects, are unlikely to reduce dramatically the number of unwanted births (Razzaque, 1998). However, couples' motivation and counseling, along with the husband's participation as a contraceptive user, could be a viable alternative for women who experience side-effects or health problems with contraception.

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