

***Analysis of Democratic People's Republic of Korea
1993 Population Census Data and Population Projections***

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Population characteristics and trends have important implications for the economy, military, and social stability of the Democratic People's Republic of Korea (DPRK). Information and data on the population, as well as other aspects of the economy and society, for North Korea are very limited (Eberstadt and Banister, 1992). The most recent data available are the results of North Korea's population census conducted on December 31, 1993. This is the first census since 1945, when North Korea was under Japanese occupation. This study analyzes these data and assesses changes in the population to determine the demographic characteristics of North Korea today and in the future.

Base Population for Projections

The data from the December 31, 1993, census is accepted as reported. DPRK reported a total population for the country that exceeded the total population reported by individual ages and by administrative area. We assumed this difference to be the total military population. The reason for this assumption is the prominent role China played in providing technical assistance to DPRK in the preparation and processing of the 1993 DPRK census. The published presentation of results from the DPRK census are very similar to those published from China's 1982 and 1990 population censuses. Tables presenting China census results by age, region, and other characteristics contain footnotes explaining that the data do not include the military population. We assume that the DPRK data presented by individual ages includes only the civilian population; however, no specific explanation is available from North Korean sources. An examination of the age-sex structure did not reveal any obvious, major problems in the reporting of the data. It was necessary to add the assumed military population to the civilian population to arrive at a total population figure. Information on the sex structure of the assumed military population was reported but not the age structure. Males and females in the military were distributed by age using methods detailed in the appendix.

The population of North Korea, including and excluding the military, on the census date is shown in Figure 1.

Projections: Modeling the Famine

In order to estimate North Korea's current population and project its future population using the 1993 population census results, additional assumptions need to be made about the various components of population change. There have been several major events in the 1990s that are likely to affect these demographic trends. The first is the breakup of the Soviet Union, which had been the biggest supporter of North Korea in terms of aid. Soviet exports to DPRK fell from \$1.97 billion in 1990 to \$0.58 billion in 1991 and \$0.25 billion (exports from Russia only) in 1992 (Rubin, 1996). With the loss of the Soviet Union as a major supplier, North Korea turned to China, which was able to fill only a small portion of the gap left by the Soviet Union.¹ Second are a series of natural disasters which have negatively affected food production in 1995, 1996, and 1997.

The combination of the above events and the general collapse of the DPRK economy has raised the specter of a famine. Information on the natural disasters, including their scope and severity, and the functioning of the economy is limited, and what is available often is not representative or objectively reported. With this caveat, available information reported in cables, newspapers, magazines, and other media were reviewed.

Various parts of the country suffered from floods during the growing seasons in 1995 and 1996. The floods in 1995 were especially bad in North Pyongan and Chagang provinces in the northwestern part of the country (Table 1). Huichon city in Chagang province was visited by a delegation from the Carter Center in June 1996, nearly a year after the devastating floods of 1995. There was no visible evidence of famine or malnutrition, but clear evidence of the 1995 flooding still existed (Carter Center Agricultural Delegation, 1996). North Korea reported a grain harvest of 3.49 million tons in 1995 (Pak, 1997). The floods of late July 1996, while not as severe as the 1995 floods, caused the most damage in North Hwanghae, South Hwanghae, and Kangwon provinces and Kaesong municipality across the southern part of the country. About 60 percent of the country's food grain (primarily rice) is produced in this region. One estimate placed the reduction in grain output caused by the 1996 floods at about 300,000 tons or 7 percent (Food and Agriculture Organization, 1996). It would appear that these natural disasters alone would be unlikely to result in a famine. However, when coupled with the collapse of the economy and limited access to world markets, the effects of the natural disasters could be magnified. The drop off in food availability can have an affect on mortality, fertility, and international migration.

Early prospects for the 1997 crop were favorable, following an early winter thaw in March and good rains in May (Food and Agriculture Organization, 1997). Unfortunately, June and July were characterized by above-average temperatures and below-average rainfall. The official Korean Central News Agency reported on July 25 that, owing to the 2-month drought, water levels in large reservoirs were down to 10 to 20

¹ China's exports to North Korea rose from \$0.39 billion in 1990 to \$0.58 billion in 1991 and \$0.66 billion in 1993 (Eberstadt, et al., 1995).

percent of normal and over 620 small reservoirs were nearly empty (*The People's Korea*, 1997b). The areas most seriously affected by the drought are North Pyongan, South Pyongan, North Hwanghae, and Kangwon provinces. Grain losses are estimated at 700,000 tons (*The People's Korea*, 1997a).

Evidence of a famine was first reported in 1995 and reports of food shortages and negative effects on the health of the population have been increasing. Deaths from famine have been reported for North Hamgyong, Yanggang, and Kangwon provinces (Chong, 1996). While a wide range of figures have been reported in the press, reliable estimates of excess deaths attributable to the famine are not available. One estimate of 1,000 deaths due to the famine was attributed to the U.S. State Department (Chong, 1996). Another source claims "U.S. intelligence reports say perhaps 100,000 North Koreans died in the winter of 1996/97 from famine conditions; ..." (Jordan, 1997). The North Korean Health Ministry told UN officials 134 children recently died of malnutrition (Owen, 1997). A defector reported the collapse of the food rationing system by late 1996 in Hoeryong City in the northeastern province of North Hamgyong (*The Digital Chosun Ilbo*, 1996). A few households visited by a Food and Agriculture Organization and World Food Program (FAO/WFP) mission in May 1997 reported deaths due to starvation and a number of children and adults observed had symptoms of wasting and edema due to protein deficiency and possibly Kwashiorkor (Food and Agriculture Organization, 1997). Areas visited by the FAO/WFP mission in the north were slightly better off nutritionally than those in the south. A UN official allowed to travel extensively in North Korea recently has estimated that 25 percent of the children in Pyongyang were malnourished and that the majority of the population outside of the capital, other than the military and the elite, were seriously malnourished.

Quoting official statistics provided by North Korea, the U.S. Centers for Disease Control announced that the mortality rate of North Korean children under 5 years old in 1994 was 31 per 1,000 children (Centers for Disease Control, 1997). By 1996, the rate had nearly doubled – 58 deaths per 1,000 children under 5 years old, implying famine related excess deaths of 27 per 1,000 children under 5 years old.

The above anecdotal information at best can be used only to judge the severity of the famine and not to model the famine. It is necessary to rely on assessments of earlier famines in other regions of the world to model the current situation in North Korea. In particular, we draw on the famine situation of China in 1958-1960. Extensive analysis has been done on the demographic effect of this famine in China utilizing demographic data reported before and after the famine (Banister, 1987).

Because of the uncertainty of the magnitude of the famine in North Korea, we model two scenarios of the effects of the famine on the population. The first scenario is similar to the moderate famine conditions that prevailed in China in 1958 and 1959, before the height of the famine in 1960. Under scenario I, the effect of lack of food availability begins to be felt in 1995 with a rise in the mortality rate and a slightly greater

drop in fertility than would have been assumed if there were no food shortage. The effect of the famine peaks in 1996 and recovery begins in 1997.

The second scenario assumes that the famine deepens and is more prolonged. Famine reaches a peak in 1996 and continues in 1997 at a similar level, and then the recovery begins in 1998. (See appendix for details.)

Other Assumptions for Projections

Fertility

Reported crude birth rates show a sharp decline following the early 1970s. The reported crude birth rate was 44.7 per 1,000 population in 1970, fell sharply to 25.9 by 1975 and stabilized at about 22 in the first half of the 1980s (Eberstadt and Banister, 1992, p. 42). The smaller cohorts for ages 15-19 and younger reported in the 1993 census are consistent with the previously reported decline in crude birth rates (Figure 1). These data also lend credence to claims that North Korea launched a family planning program limiting births to only one child, perhaps starting in the early 1980s (Yonhap, 1996). Sources indicate that the one-child policy was reversed recently and replaced by a campaign calling for as many births as possible (Yonhap, 1996 and Pak, 1997). Given the current food shortage, an increase in births may not be desired by most of the population. There are reports that women are not eager to have more children right now (Yonhap, 1996). One source reported that women who have no resources to feed their families bribe doctors to have abortions (Pak, 1997).

Other scholars assert that North Korea has been implementing a pronatalist policy by conferring the title of "maternal heroine" on women who give birth to more than 10 children, discouraging divorces, and granting 70-day paid leave to pregnant women and nursing mothers (Pak, 1997). However, China grants as generous or more generous maternity leave but still implements a one-child policy in urban areas. The 1993 census results yield a crude birth rate of 20.1, indicating a continuing decline in fertility from the mid 1980s. Therefore, projections assume that, absent famine effects, fertility will continue a gradual decline from 2.2 births per woman in 1993 to 1.7 by 2050.

North Korean women delay childbearing longer than women in China, with peak births occurring for women age 25 in North Korea as opposed to age 20 in China (Figure 2). The age specific fertility pattern of North Korean women is very similar to that for South Korean women with the exception that fertility in the peak childbearing age of 25 is higher in North Korea (Figure 2).

Mortality

Analysis of the 1993 census data shows a crude death rate of 6.1 per 1,000 population and a life expectancy at birth of 70.7 years (67.8 years for males and 73.9 for

females). Life expectancy is quite high--1 year higher than for China and only 2 years less than for South Korea. North Korea and South Korea have similar age patterns of mortality (Figures 3 and 4). Because such a low level of mortality has already been achieved, a long-term trend of gradual further improvements is assumed. Life expectancy is expected to reach 83 years by 2050.

International migration

No official data on migration into or out of North Korea are available. Nearly all international migration is illegal and small scale. Data from China reveal that Chinese authorities detained and repatriated about 100 North Koreans annually in the 1990s (Table 2). China is concerned about the threat of massive refugee migration into their country and has stepped up propaganda on border control. At the same time, North Korea has increased the number of guards on its side of the border (Yonhap, 1996). In spite of reports of up to 100,000 North Koreans along the border "waiting for a chance to escape from North Korea" in fall 1996, a mass exodus has not occurred (Chong, 1996). In the absence of credible data on migration flows, we assume no international migration.

Characteristics of the Projected Population

Size

North Korea's total population was 21,213,378 on December 31, 1993, according to the census. Under scenario I (moderate famine) North Korea's mid-year 1997 population is estimated to be 22.0 million, while under scenario II (more severe famine) it is estimated to be 21.3 million. By the year 2000, after recovery from the famine is underway, the population is projected to rise to 22.5 or 21.5 million for the moderate and severe famine scenarios, respectively. The distribution of the population by age and sex in 2000 is shown in Figure 5. By 2025, the difference between scenario I and II has narrowed and the total population is 26.0 or 25.5 million, respectively. By 2050, the projected population is 26.3 or 26.0 million under scenarios I and II, respectively.

The sex ratio of the total population as reported in the 1993 census was 95 (males per 100 females), while for the civilian population the sex ratio was only 89. These ratios are relatively low and reflect the effect of the Korean War. There is no evidence of son preference among the North Korean population. The sex ratios for the individual ages 0 through 14 range from 104.5 to 106.0, which are well within the bounds for what is expected if there are no external factors such as sex-selective abortion or female infanticide (Table 3).

Spatial Distribution

North Korea's civilian population is concentrated in the western and southwestern portion of the country (Map 1). The northern provinces of Chagang, Yanggang, and

North Hamgyong are sparsely populated but fairly highly urbanized (Map 2). Overall North Korea is a highly-urbanized country with an urbanization rate among the civilian population of 61 percent. South Hwanghae, North Hwanghae, and Kangwon are the only provinces where more than half the population is not residing in an urban area (Map 2). Approximately 30 percent of the civilian population resides in the four provinces bordering China and Russia (North Pyongan, Chagang, Yanggang, and North Hamgyong). South Hwanghae, Kaesong, and Kangwon, which border South Korea, comprise only 18 percent of the civilian population. Among provinces and cities, Pyongyang experienced the fastest growth over the 1987-1993 period at an average annual rate of 2.5 percent (Table 4). Chagang was the only province to experience a decline in population over the period.

Labor Force

Population in the labor force ages of 20 to 59 numbered 11.8 million in 1993, accounting for 56 percent of the total population. The size of the potential labor force will continue to grow, albeit at a rate of less than 1 percent annually, until 2020 (Table 5). After 2020, the population in the working ages of 20 to 59 will decline. By the middle of next century, this segment of the population will account for only 49 and 50 percent of the total population under scenarios I and II, respectively.

Women represent 50.5 percent of the population in the age group 20 to 59 and appear to have very high labor force participation rates. According to DPRK's delegate to the Fourth World Conference on Women, women account for approximately 48 percent of North Korea's total labor force. Specifically, women account for 44 percent of the labor force in the industrial sector, 53 percent in the agricultural sector, 73 percent in the commercial distribution sector, 76 percent in the service sector, and 65 percent in the health sector (*Chugan Pukhan Tonghyang*, 1995).

One incentive for women, especially unmarried women, to participate in the labor force is that rationed food is distributed through work units (Kim, C., 1996). All households are registered at either an agricultural cooperative, village or town by, inter alia, family status and composition: newborns, infants, nursery/school age children, adults by work grade (heavy/light), or pensioners. Each person is registered at a cooperative or the nearest Public Distribution System center by category of entitlement based on age and type of work. Rice, maize, meat, fish, and vegetables are channeled through these centers and distributed to the non-agricultural population, usually twice a month, according to a ration scale that is determined centrally, based on overall availability at a given time. The annual ration for cooperative members is allocated at harvest (Food and Agriculture Organization, 1996, p. 13). About 78 percent of the population receives food through the Public Distribution System, while 5 million collective farm workers and their families are not covered by the Public Distribution System (Food and Agriculture Organization, 1997).

Military

Data reported from the 1993 census imply a military population of 691,027 (3.3 percent of the total population) of which 652,036 were males and 38,991 were females. The military population appears to be concentrated in ages 15 to 19 for females and 15 to 24 for males (Table 6). At year end 1993, an estimated 4.3 percent of females ages 15 to 19 were in the military and 25.8 percent of males ages 15 to 24 were in the military. One source stated that men are typically drafted at age 17 and serve for anywhere from 42 months to more than ten years (Savada, 1994). The reported census data indicate that only a small proportion of the military is actually serving long periods. In the year 2000, there will be about 0.9 million females in the prime military ages of 15 to 19 and 1.7 to 1.8 million males in the prime military ages of 15 to 24.

Aging of the Population

North Korea's median age in 1993 was 27 years, older than the average of less-developed countries (23 years) but younger than the average for more-developed countries (36 years) (International Programs Center, 1996, p. 20). As the aging of the population progresses, the median age will rise, reaching 38 years in 2025 and 45 years in 2050.

The elderly population (ages 65 and older) at the time of the census numbered 1.1 million, accounting for only 5 percent of the population. The demographic effects of the Korean War will be felt for several generations and contributes to the rapid aging of the population until about 2010 when aging slows for a decade or so before growing rapidly again (Table 7). By 2010, the elderly share of the total population will have doubled from its 1993 level under both scenarios. By 2025, North Korea's population age structure will have lost its pyramid shape as the large cohorts born in the 1960s and the first half of the 1970s prepare to enter the ranks of the elderly (Figure 6). The elderly will represent 14 and 24 percent of the total population in 2025 and 2050, respectively.

Appendix

Technical Notes for Fertility, Mortality, and Population Estimates and Projections of North Korea: 1993-2050

On December 31, 1993, North Korea conducted its first census since 1945. The data available from this census are as follows:

1. Distribution of the population by single year of age and sex.
2. Number of deaths by age during the 12 months before the census.
3. Number of births by age of women during the 12 months before the census.
4. Distribution of population by province and rural-urban areas.

Data from the first three items above are used to prepare baseline 1993 estimates of fertility, mortality, and population by age and sex at the national level. These 1993 baseline estimates and assumptions on the future course of fertility, mortality, and international migration are then used to prepare population projections for North Korea through 2050. Using two different scenarios of famine and its resulting effect on fertility and mortality in North Korea, two alternative sets of population projections are generated. One projection assumes North Korea experienced famine conditions during 1995-97 roughly similar to those that existed in China in 1958 and 1959, and the other assumes that famine was as severe in its impact as the famine in China during 1958 to 1960. The estimation details and underlying assumptions for projecting the population of North Korea are described in the following sections.

Base Population

The 1993 North Korea census tabulations provide age distribution of the civilian population only. However, a figure for the total population of North Korea by sex is also published. The difference between the total population figure and the total civilian population figure, in the absence of any other information, is assumed to represent the size of the North Korean military for which the census does not provide a distribution by age.² This missing information is obtained by a method which utilizes census female age distribution, census sex ratios, and sex ratios from a reconstructed population for North Korea (Eberstadt and Banister, 1992).

²The presentation of data in this manner is the same as China published for its 1982 and 1990 population census results. China footnotes and explains that the difference is the military population. The China's State Statistical Bureau provided technical assistance to North Korea on the 1993 census and may have influenced the presentation of results (Suharto, telephone conversation), but no specific explanation of the difference is available from DPRK sources.

Military Population: Estimating Age Distribution

The 1993 census data implies 38,991 females and 652,036 males in the North Korea military. The methods used to distribute them by age are explained below.

Females in the military

A review of the civilian female population by single year of age showed a deficit of females in ages 14 through 18 when compared with the number of females at age 13 and at age 19; the numbers were especially smaller in ages 15, 16, and 17. This led us to believe that females in the military are from the age cohorts 14 to 18, especially the 15, 16, and 17 year age cohorts. A simple procedure is used to distribute the 38,991 females among these ages. First, an estimate of total females by age for ages 14 to 18 was derived by a linear interpolation of enumerated women in ages 13 and 19. Second, this distribution was proportionately adjusted to agree with the total number of females in the military. The distribution is given in Table 8 which shows that over two-thirds of women in the military are 16 and 17 year olds.

Males in the military

The age distribution of the 652,036 males in the military is obtained by utilizing information on the number of females by age and a set of plausible sex ratios (number of males per female) representative of the 1993 North Korean population. We tried three alternative sets of sex ratios: (i) from the 1993 life tables for North Korea, (ii) from Eberstadt and Banister's reconstructed population, and (iii) reconstructed population sex ratios for age groups under 35 and the interpolated census sex ratios for 5-year age groups for ages 35 and over (hereafter referred to as "Hybrid Set"). Among the three alternatives, which are described below, the results of the hybrid method were accepted.

Initially we used the current life table sex ratios to estimate the age distribution of males in the military, but it soon became clear that results could not be accepted. The current life table does not represent accurately the mortality difference between males and females experienced in the past by different age cohorts. In North Korea, as in other countries with improvements in mortality over time, the sex difference in mortality has progressively increased in favor of women.

Second, we tried the sex ratios from the 1993 projected population by Eberstadt and Banister based on their reconstruction of the North Korean population. The reconstruction begins in 1960 with a modified South Korean 1960 census population by age and sex. The modifications in the case of males were especially large because the male losses due to the Korean war were much larger in North Korea. Eberstadt and Banister reconstruct the North Korean population through 1987 using the 1960 modified South Korean population, estimated levels of fertility, mortality, and international migration. The 1987 population was projected to 2050 using assumed levels of fertility

and mortality for future years. A quick comparison of the 1993 North Korea census age-sex structure with the projected age-sex structure indicates that the two are not necessarily compatible. However, the sex ratios for individual ages 0 to 33, who are those born between the base population year 1960 and the census year, could still be valid for North Korea. The sex ratios for these ages are the result of the assumed sex ratio at birth and estimated and projected differences in mortality between males and females. The sex ratio at birth and mortality differentials by sex for a population can be estimated with less error than the population age distribution, particularly for a population with a past history of wars. Therefore, the age structure of the military males estimated by the use of the sex ratios from this reconstructed population and reported female distribution was accepted for ages under 30 only. For ages 30 and over, we assumed that the reported sex ratio for the age group 50 to 54 was correct (this assumes the upper age of 50 for a person to be in the military). The sex ratios between ages 30 and 50 by 5-year age groups were derived by interpolation in such a way that the difference between preceding and succeeding age groups sex ratios increased by a constant amount with increases in age. The estimated age distribution of males in the military using this hybrid method and females using the simple linear interpolation is shown in Table 6.

The 1993 total population of North Korea by age and sex including the estimated age-sex distribution of the military population is shown in Table 9. Past experience from South Korea suggests that most Koreans know their ages well and thus their population data suffers from minimal age-reporting errors. Any errors that may exist in the North Korean census data are further reduced by aggregating the data into 5-year age groups. Consequently the population distribution by 5-year age groups and sex in Table 9 is accepted without any further adjustment as representing the age structure of the total population of North Korea on December 31, 1993. This census date population was moved back to mid-year 1993 by making allowance for births and deaths that occurred in about half a year in 1993 (Table 10).

Fertility

Table 11 shows the 1993 age-specific fertility rates for North Korea. They are based on the births during the 12 months of 1993 reported in the census. Women were on average one-half year younger at the time the births occurred than their reported age at the time of the census. Therefore the rates have been adjusted for one-half year of age of women. These rates show that in 1993 North Korea had achieved nearly replacement fertility with a total fertility rate (TFR) of 2.2 births per woman.

Projected Levels of Fertility

To project fertility in the future, slightly differing assumptions are made for the two scenarios of the famine.

Scenario I: Moderate famine conditions

For this scenario, we assume that during 1995 to 1997 North Korea experienced famine conditions similar to those that existed in China in 1958 and 1959 before the famine peaked in 1960. During the 1950s in China, the total fertility rate was nearly 6 births per woman, a rate about 3 times the 1993 rate for North Korea. During the famine years, fertility in China dropped by as much as 50 percent between 1957 and 1960. Because North Korea starts at a much lower level of fertility, it is unlikely that a food shortage would have reduced fertility to the same extent as occurred in China. Consequently, we assume a relatively fast decline in fertility between 1995 and 1996 and between 1996 and 1997, but the magnitude of the decline is about 50 percent of the proportionate decline in fertility in China during the early famine years.

For the years 1994 and 1995 we assume a normal decline in fertility implied by the change between the 1993 TFR and the assumed TFR value of 1.8 children in 2000 (Table 12). For 1996 and 1997 we assume a faster drop in TFR-- about 6.5 percent per year-- nearly one-half of the percent change that occurred in China between 1957 and 1959. Fertility remains at about the 1997 level through the year 2000 and then declines slowly and linearly to reach a TFR level of 1.7 children in 2050.

Scenario II: More-severe famine conditions

For this scenario, we assume that the impact of the food shortage on fertility in North Korea continues through 1998 and is about 50 percent of the proportionate decline experienced by the Chinese population during the 1957 to 1960 period. After 1998, as was the case in China, fertility is assumed to rise from a TFR of 1.6 in 1998 to 2.3 in 1999 and 2000 to make up for the lost births during the famine. Beyond 2000, fertility is assumed to decline to a TFR of 1.8 in 2005 and 1.7 in 2050 (Table 13).

Mortality

To estimate the 1993 level of mortality, data on deaths for the 12 months prior to the census were used along with the model life table (MLT) for the Far East region. Because military males were apparently missing from the age distribution, we analyzed data on female deaths only. MLTs and the United Nations 'Match' program (United Nations, 1988) were employed to determine the life expectancies corresponding to each age-specific death rate. Such implied life expectancies varied greatly, although the variation was much smaller for the five age groupings beginning at 10-14 and ending at 30-34. We took the median of those five implied life expectancies as the true level of female mortality, age-specific rates for which followed the Far Eastern regional MLT. The matching MLT for males was then assumed to represent male mortality in 1993. The resulting life tables for males and females are shown in Tables 14 and 15, respectively.

Scenario I: Moderate famine conditions

For this scenario we made an approximate use of change in life expectancy experienced by the Chinese population during 1957 to 1959 to build in the impact of famine conditions on mortality in North Korea for the years 1995, 1996, and 1997. We assumed that life expectancy in 1994 was the same as in 1993 and was lower by 1.5 years in 1995 ($e_0=69.2$), another 3 years each in 1996 (66.2) and 1997 (63.2), and thereafter it will increase slowly to reach the 1993 level in the year 2000.

To obtain life expectancies beyond the year 2000, we assumed that by the year 2050 life expectancies in South and North Korea will be identical and fitted a logistic curve to the values in 2000 and 2050 with upper asymptotes of 81 for males and 87 for females and lower asymptote of 25 for both males and females to obtain life expectancies for every 5 years beginning in 2005.

Scenario II: More-severe famine conditions

For this scenario we used the Chinese population experience throughout the famine years and used detailed data by age available for China (Luo, 1988) for 1957 to 1960 to construct age-specific death rates for North Korea for the years 1995 to 2000.

From the life tables for China constructed by Luo, we made estimates of excess mortality by age caused by the food shortage for 1959 and 1960. We defined excess mortality as the difference between the rate for a specific year and the rate for 1957, which was a normal year.

For this scenario we again assume that death rates in 1994 were the same as in 1993 and excess mortality in 1995 and 1996 was the same as in China in 1959 and 1960, respectively. For 1997, we assume the same death rates as in 1996. After 1997, we assume that mortality will begin to improve and reach the 1993 level in the year 2000. Beyond the year 2000, projected mortality is the same as for scenario I.

International Migration

No information on international migration is available. It is assumed zero throughout the projection period.

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Table 1. Areas and Population Affected by July-August 1995 Floods

Province (affected counties and ri's)	Inhabitants in damaged areas	Population left homeless
South Pyongan (20 counties, 226 ri's)	537,000	17,130
North Pyongan (24 counties, 394 ri's)	2,048,000	192,560
Chagang (18 counties, 208 ri's)	828,000	78,250
South Hwanghae (15 counties, 151 ri's)	482,000	4,635
North Hwanghae (14 counties, 143 ri's)	690,000	99,840
Kwangwon (12 counties, 126 ri's)	155,000	46,155
South Hamgyong (2 counties, 24 ri's)	80,000	4,050
North Hamgyong (8 counties, 62 ri's)	229,000	840
Yanggang (7 counties, 57 ri's)	157,000	38,280
Total	5,206,000	481,740

Source: DHA, 1995.

Table 2. Detected North Korean Escapees to China

Year	Number
1989	400
1993	140
1994-95	*140
1996	78

*Separate figures for 1994 and 1995
are unavailable.

Source: Yi and Kong, 1996.

Table 3. North Korea Civilian Population by Age and Sex
and Sex Ratio, 1993 Census

Age	Total	Male	Female	Sex ratio
Total	20,522,351	9,677,663	10,844,688	89.24
0-4	2,088,508	1,071,954	1,016,554	105.45
0	416,088	213,149	202,939	105.03
1	430,828	220,786	210,042	105.12
2	417,751	214,576	203,175	105.61
3	411,963	211,464	200,499	105.47
4	411,878	211,979	199,899	106.04
5-9	1,866,583	957,583	909,000	105.34
5	375,776	193,007	182,769	105.60
6	375,229	192,598	182,631	105.46
7	375,550	192,717	182,833	105.41
8	365,661	187,220	178,441	104.92
9	374,367	192,041	182,326	105.33
10-14	1,767,112	904,764	862,348	104.92
10	351,889	179,774	172,115	104.45
11	362,999	186,063	176,936	105.16
12	350,896	180,004	170,892	105.33
13	354,202	181,345	172,857	104.91
14	347,126	177,578	169,548	104.74
15-19	1,528,298	708,790	819,508	86.49
20-24	1,862,989	765,479	1,097,510	69.75
25-29	2,019,525	987,095	1,032,430	95.61
30-34	1,607,929	791,117	816,812	96.85
35-39	1,386,454	682,990	703,464	97.09
40-44	990,787	482,309	508,478	94.85
45-49	1,243,077	603,230	639,847	94.28
50-54	1,208,802	582,990	625,812	93.16
55-59	1,063,657	487,276	576,381	84.54
60-64	748,594	301,764	446,830	67.53
65-69	506,061	174,925	331,136	52.83
70-74	339,533	102,975	236,558	43.53
75-79	187,260	49,324	137,936	35.76
80-84	81,332	19,005	62,327	30.49
85-89	20,835	3,565	17,270	20.64
90-94	4,100	485	3,615	13.42
95-99	818	40	778	5.14
100+	97	3	94	3.19

Source: DPRK Central Bureau of Statistics, 1995.

Table 4. North Korea Civilian Population by Sex and Sex Ratio, 1987 and 1993 and 1987-93 Growth Rates by Province

	1987	1987	1987	1987	1993	1993	1993	1993	1987-93
	Total	Male	Female	Sex	Total	Male	Female	Sex	average annual
	population	population	population	ratio	population	population	population	ratio	growth rate (%)
	(1,000)	(1,000)	(1,000)		(1,000)	(1,000)	(1,000)		
Pyongyang city	2355	1070	1285	83.27	2,741	1,303	1,439	90.54	2.53
South Pyongan	2653	1222	1431	85.39	2,866	1,358	1,509	89.99	1.29
North Pyongan	2380	1086	1294	83.93	2,404	1,133	1,272	89.06	0.17
Chagang	1156	543	613	88.58	1,153	547	605	90.43	-0.05
South Hwanghae	1914	873	1041	83.86	2,011	943	1,068	88.25	0.82
North Hwanghae	1409	652	757	86.13	1,512	707	805	87.87	1.18
Kangwon	1227	546	681	80.18	1,304	609	696	87.54	1.02
South Hamgyong	2547	1161	1386	83.77	2,732	1,281	1,451	88.27	1.17
North Hamgyong	2003	919	1084	84.78	2,061	976	1,085	89.90	0.47
Yanggang	628	279	349	79.94	638	303	335	90.50	0.28
Kaesong city	331	146	185	78.92	334	156	179	87.23	0.17
Nampo city	715	330	385	85.71	731	347	384	90.44	0.38
Hyangsan county	28	14	14	100.00	33	15	17	88.65	2.71
Total	19346	8841	10505	84.16	20,522	9,678	10,845	89.24	0.98

Note: 1993 male and female population may not add to total due to rounding.

Sources: DPRK Central Bureau of Statistics, 1995 and Eberstadt and Banister, 1992.

Table 5. Estimated and Projected North Korea Population, Ages 20 to 59, by Sex, 1993 to 2050 and Period Growth Rates, Alternative Scenarios

Population						
Year	Total	Scenario I		Total	Scenario II	
		Males	Females		Males	Females
1993	11,783,522	5,824,511	5,959,011	11,783,522	5,824,511	5,959,011
1997	12,164,567	6,039,305	6,125,262	11,914,107	5,863,995	6,050,112
2000	12,372,979	6,156,421	6,216,558	12,052,019	5,935,281	6,116,738
2010	13,600,046	6,827,480	6,772,566	13,333,298	6,656,504	6,676,794
2020	14,770,906	7,447,038	7,323,868	14,374,300	7,225,913	7,148,387
2030	13,968,772	7,071,071	6,897,701	13,827,037	6,989,333	6,837,704
2040	13,564,178	6,892,405	6,671,773	13,395,526	6,804,334	6,591,192
2050	12,944,879	6,579,293	6,365,586	12,819,254	6,521,136	6,298,118

Growth rates (in percent)						
Period	Total	Scenario I		Total	Scenario II	
		Males	Females		Males	Females
1993-1997	0.80	0.91	0.69	0.28	0.17	0.38
1997-2000	0.57	0.64	0.49	0.38	0.40	0.37
2000-2010	0.95	1.03	0.86	1.01	1.15	0.88
2010-2020	0.83	0.87	0.78	0.75	0.82	0.68
2020-2030	-0.56	-0.52	-0.60	-0.39	-0.33	-0.44
2030-2040	-0.29	-0.26	-0.33	-0.32	-0.27	-0.37
2040-2050	-0.47	-0.46	-0.47	-0.44	-0.43	-0.45

Source: U.S. Bureau of the Census, International Programs Center.

Table 6. Estimated Population in the North Korea Military
by Age and Sex: 1993

Age	Males	Females
Total	652,036	38,991
14		2,340
15-19	169,229	36,651
20-24	342,404	
25-29	66,732	
30-34	33,935	
35-39	17,398	
40-44	14,146	
45-49	8,192	

Source: U.S. Bureau of the Census, International Programs Center.

Table 7. Estimated and Projected Population of North Korea, Ages 65 and Older, by Sex, 1993 to 2050, and Period Growth Rates, Alternative Scenarios

Population						
Year	Total	Scenario I		Total	Scenario II	
		Males	Females		Males	Females
1993	1,132,109	347,886	784,223	1,132,109	347,886	784,223
1997	1,372,025	439,116	932,909	1,251,439	382,407	869,032
2000	1,573,523	527,653	1,045,870	1,413,737	448,271	965,466
2010	2,531,360	975,009	1,556,351	2,357,287	870,186	1,487,101
2020	3,056,491	1,228,850	1,827,641	2,891,287	1,127,489	1,763,798
2030	4,245,788	1,809,202	2,436,586	4,104,584	1,725,984	2,378,600
2040	5,844,737	2,557,086	3,287,651	5,727,013	2,489,799	3,237,214
2050	6,330,322	2,775,897	3,554,425	6,220,959	2,711,840	3,509,119

Growth rates (in percent)						
Period	Total	Scenario I		Total	Scenario II	
		Males	Females		Males	Females
1993-1997	4.81	5.82	4.34	2.51	2.37	2.57
1997-2000	4.57	6.12	3.81	4.06	5.30	3.51
2000-2010	4.75	6.14	3.97	5.11	6.63	4.32
2010-2020	1.89	2.31	1.61	2.04	2.59	1.71
2020-2030	3.29	3.87	2.88	3.50	4.26	2.99
2030-2040	3.20	3.46	3.00	3.33	3.66	3.08
2040-2050	0.80	0.82	0.78	0.83	0.85	0.81

Source: U.S. Bureau of the Census, International Programs Center.

Table 8. Estimation of the Age Distribution of Females in the North Korea Military: 1993

	Census population (a)	Interpolated population (b)	Difference (b-a)	Adjusted distribution	Estimated population including military
Total			82,225	38,991	
13	172,857	172,857	0	0	172,857
14	169,548	174,483	4,935	2,340	171,888
15	157,932	176,108	18,176	8,619	166,551
16	144,342	177,734	33,392	15,834	160,176
17	154,284	179,360	25,076	11,891	166,175
18	180,339	180,985	646	306	180,645
19	182,611	182,611	0	0	182,611

Note: See text for explanation of method.

Sources: DPRK Central Bureau of Statistics, 1995 and U.S. Bureau of the Census, International Programs Center.

Table 9. North Korea Population by Age and Sex including Military: 1993 Census

Age	Male	Female
All ages	10,329,699	10,883,678
0-1	213,149	202,939
1-4	858,805	813,615
5-9	957,583	909,000
10-14	904,764	864,688
15-19	878,019	856,158
20-24	1,107,883	1,097,510
25-29	1,053,827	1,032,430
30-34	825,052	816,812
35-39	700,388	703,464
40-44	496,455	508,478
45-49	611,422	639,847
50-54	582,990	625,812
55-59	487,276	576,381
60-64	301,764	446,830
65-69	174,925	331,136
70-74	102,975	236,558
75-79	49,324	137,936
80+	23,098	84,084

Sources: Table 6 and DPRK Central Bureau of Statistics, 1995.

Table 10. Estimated Mid-year Population by Age and Sex for North Korea: 1993

Age	Census Reported		Census Adjusted for Military		Mid-year	
	Male	Female	Male	Female	Male	Female
Total	9,677,663	10,844,688	10,329,699	10,883,678	10,258,939	10,808,007
0-4	1,071,954	1,016,554	1,071,954	1,016,554	1,064,501	1,009,486
5-9	957,583	909,000	957,583	909,000	950,925	902,680
10-14	904,764	862,348	904,764	864,688	899,533	858,676
15-19	708,790	819,508	878,019	856,158	871,914	850,206
20-24	765,479	1,097,510	1,107,883	1,097,510	1,100,180	1,089,879
25-29	987,095	1,032,430	1,053,827	1,032,430	1,046,501	1,025,252
30-34	791,117	816,812	825,052	816,812	819,316	811,133
35-39	682,990	703,464	700,388	703,464	695,518	698,573
40-44	482,309	508,478	496,455	508,478	493,003	504,942
45-49	603,230	639,847	611,422	639,847	607,171	635,399
50-54	582,990	625,812	582,990	625,812	578,936	621,461
55-59	487,276	576,381	487,276	576,381	483,889	572,373
60-64	301,764	446,830	301,764	446,830	299,666	443,724
65-69	174,925	331,136	174,925	331,136	173,708	328,833
70-74	102,975	236,558	102,975	236,558	102,259	234,914
75-79	49,324	137,936	49,324	137,936	48,981	136,977
80+	23,098	84,084	23,098	84,084	22,938	83,499

Sources: Table 9 and U.S. Bureau of the Census, International Programs Center.

Table 11. Age-Specific Fertility Rates for North Korea: 1993

Age	Reported	Adjusted
15-19	0.0000	0.0017
20-24	0.0499	0.0646
25-29	0.2603	0.2635
30-34	0.1004	0.0837
35-39	0.0179	0.0156
40-44	0.0033	0.0030
45-49	0.0011	0.0008
TFR	2.1650	2.1650

Note: Adjusted for average 6-month interval between the reported birth and the census.

Sources: DPRK Central Bureau of Statistics, 1995 and U.S. Bureau of the Census, International Programs Center.

Table 12. North Korea Fertility Assumptions
Under Scenario I: 1993 to 2050

Year	Total Fertility Rate
1993	2.20
1994	2.11
1995	2.06
1996	1.93
1997	1.80
2000	1.80
2050	1.70

Source: U.S. Bureau of the Census,
International Programs Center.

Table 13. North Korea Scenerio II and Famine in China: Comparison of Fertility and Mortality

Year	China		North Korea		Year
	Life expectancy	Total fertility rate	Life expectancy	Total fertility rate	
1957	50.5	6.4	70.7	2.2	1993
1958	50.2	5.7	70.7	2.1	1994
1959	38.4	4.3	51.3	2.1	1995
1960	31.6	4.0	40.4	1.8	1996
1961	34.1	3.3	40.4	1.6	1997
1961	34.1	3.3	51.3	1.6	1998
1962	44.5	6.0	70.1	2.3	1999
1963	52.0	7.5	70.7	2.3	2000

Sources:

China: TFR, Banister (1987); Life expectancy, Sheng (1988).

North Korea: U.S. Bureau of the Census, International Programs Center.

Table 14.

UNITED NATIONS MODEL LIFE TABLE FOR THE FAR EASTERN
 PATTERN OF THE MALE SEX WITH A VALUE OF $E(0) = 67.80000$
 FOR THE STUDY OF NORTH KOREA MALES 1993

AGE	M(X,N)	Q(X,N)	I(X)	D(X,N)	L(X,N)	S(X,N)	T(X)	E(X)	A(X,N)
0	.02564	.02507	100000.	2507.	97780.	.97291 /A/	6780012.	67.800	.115
1	.00137	.00548	97493.	534.	388677.	.99542 /B/	6682232.	68.541	1.577
5	.00046	.00232	96959.	225.	484231.	.99771	6293555.	64.910	2.500
10	.00045	.00226	96734.	219.	483122.	.99711	5809324.	60.055	2.500
15	.00076	.00380	96515.	367.	481727.	.99528	5326202.	55.185	2.688
20	.00112	.00561	96148.	539.	479454.	.99383	4844475.	50.386	2.615
25	.00134	.00667	95609.	638.	476496.	.99273	4365021.	45.655	2.573
30	.00162	.00804	94971.	764.	473032.	.99034	3888525.	40.944	2.615
35	.00236	.01174	94207.	1106.	468462.	.98506	3415493.	36.255	2.673
40	.00379	.01881	93101.	1751.	461463.	.97608	2947030.	31.654	2.690
45	.00611	.03013	91351.	2753.	450427.	.95988	2485567.	27.209	2.702
50	.01064	.05192	88598.	4600.	432354.	.93490	2035140.	22.971	2.688
55	.01676	.08063	83998.	6773.	404209.	.89522	1602786.	19.081	2.670
60	.02843	.13321	77225.	10287.	361856.	.83637	1198577.	15.521	2.641
65	.04377	.19790	66938.	13247.	302644.	.76411	836721.	12.500	2.581
70	.06494	.27971	53691.	15018.	231254.	.67550	534076.	9.947	2.523
75	.09353	.37779	38673.	14610.	156213.	.56876	302822.	7.830	2.457
80	.13473	.49746	24063.	11970.	88847.	.39398 /C/	146609.	6.093	2.371
85	.20935	.....	12092.	12092.	57761.	.....	57761.	4.777	4.777

/A/ VALUE GIVEN IS FOR SURVIVORSHIP OF 5 COHORTS OF BIRTH TO AGE GROUP 0-4 = $L(0,5)/500000$

/B/ VALUE GIVEN IS FOR $S(0,5) = L(5,5)/L(0,5)$

/C/ VALUE GIVEN IS $S(80+,5) = T(85)/T(80)$

Source: United Nations, 1988.

Table 15.

UNITED NATIONS MODEL LIFE TABLE FOR THE FAR EASTERN
PATTERN OF THE FEMALE SEX WITH A VALUE OF $E(0) = 68.00000$
FOR THE STUDY OF NORTH KOREA FEMALES 1993

AGE	M(X,N)	Q(X,N)	I(X)	D(X,N)	L(X,N)	S(X,N)	T(X)	E(X)	A(X,N)
0	.03889	.03767	100000.	3767.	96847.	.95856 /A/	6800018.	68.000	.163
1	.00258	.01024	96233.	985.	382433.	.99214 /B/	6703171.	69.655	1.463
5	.00061	.00306	95248.	291.	475512.	.99726	6320738.	66.361	2.500
10	.00049	.00243	94957.	231.	474207.	.99662	5845226.	61.557	2.500
15	.00095	.00473	94726.	448.	472603.	.99430	5371018.	56.700	2.707
20	.00133	.00661	94278.	623.	469911.	.99230	4898415.	51.957	2.627
25	.00177	.00882	93655.	826.	466292.	.99020	4428505.	47.285	2.601
30	.00219	.01090	92829.	1012.	461720.	.98731	3962213.	42.683	2.604
35	.00298	.01482	91817.	1360.	455861.	.98244	3500493.	38.125	2.629
40	.00420	.02077	90457.	1879.	447858.	.97467	3044632.	33.658	2.645
45	.00623	.03069	88578.	2718.	436512.	.96231	2596775.	29.316	2.654
50	.00936	.04580	85859.	3933.	420061.	.94368	2160262.	25.160	2.652
55	.01416	.06849	81927.	5611.	396404.	.91619	1740201.	21.241	2.642
60	.02136	.10167	76315.	7759.	363183.	.87544	1343797.	17.608	2.629
65	.03262	.15130	68556.	10372.	317945.	.81720	980614.	14.304	2.605
70	.04912	.21936	58184.	12763.	259825.	.74123	662669.	11.389	2.564
75	.07241	.30702	45421.	13945.	192589.	.63211	402843.	8.869	2.525
80	.11426	.44192	31476.	13910.	121739.	.42099 /C/	210254.	6.680	2.438
85	.19845	.....	17566.	17566.	88515.	.....	88515.	5.039	5.039

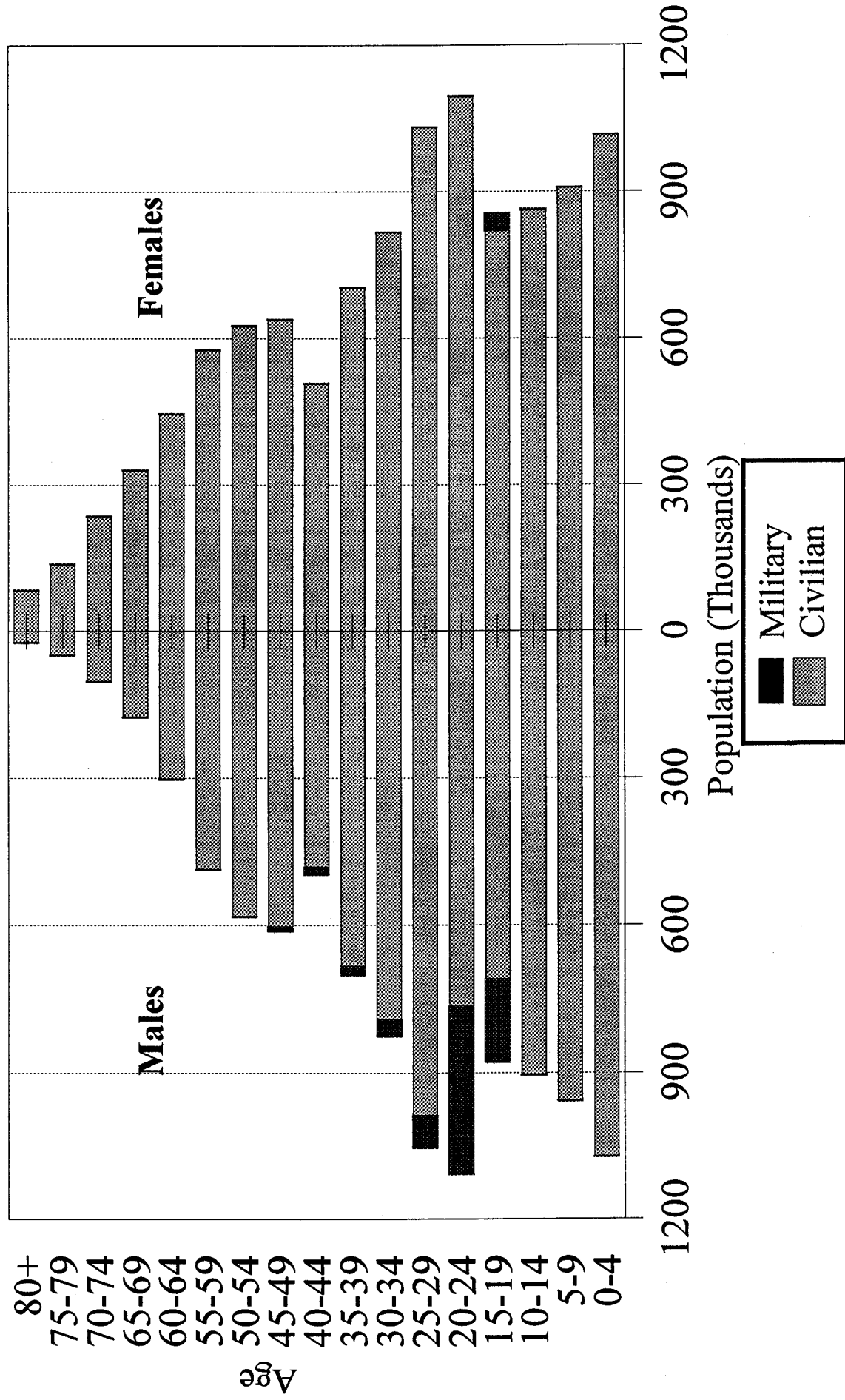
/A/ VALUE GIVEN IS FOR SURVIVORSHIP OF 5 COHORTS OF BIRTH TO AGE GROUP 0-4 = $L(0,5)/500000$

/B/ VALUE GIVEN IS FOR $S(0,5)=L(5,5)/L(0,5)$

/C/ VALUE GIVEN IS $S(80+,5)=T(85)/T(80)$

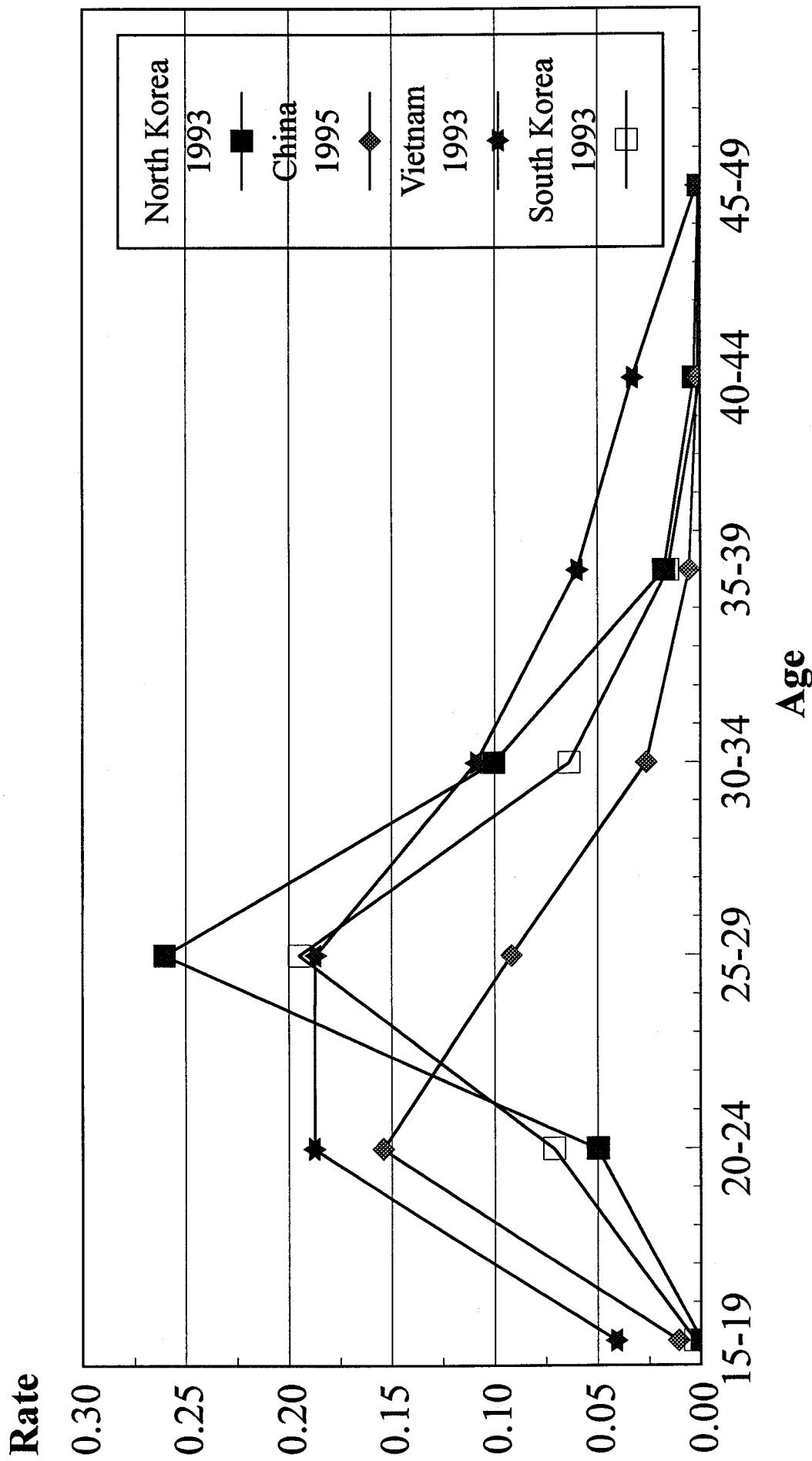
Source: United Nations, 1988.

Figure 1.
Military and Civilian Population of North Korea by Age and Sex:
December 31, 1993



Source: DPRK Central Statistics Bureau, 1995 and U.S. Bureau of the Census, International Programs Center estimates.

Figure 2. Comparison of North Korea 1993, Vietnam 1993, China 1995, and South Korea 1993 Age-Specific Fertility Rate Patterns



Sources: North Korea, DPRK Central Statistics Bureau, 1995; China, 1995 National 1% Population Sample Survey Data, p. 498; Vietnam, Vietnam Intercensal Demographic Survey 1994 Major findings, p. 33; South Korea, National Fertility and Family Health Survey 1994.

Figure 3. Male Reported and Adjusted Death Rates for North Korea 1993 and Reported South Korea 1991

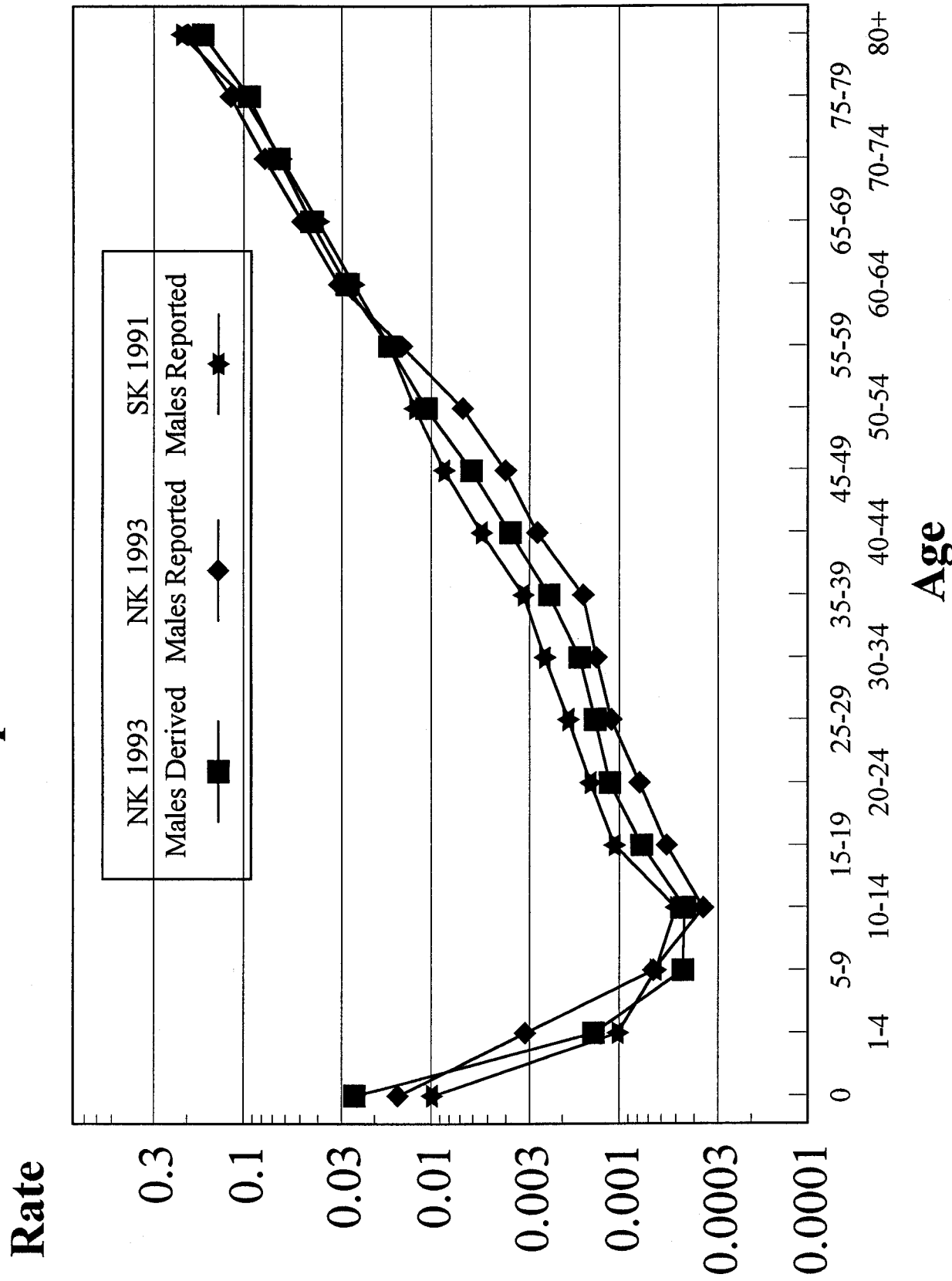


Figure 4. Female Reported and Adjusted Death Rates for North Korea 1993 and Reported South Korea 1991

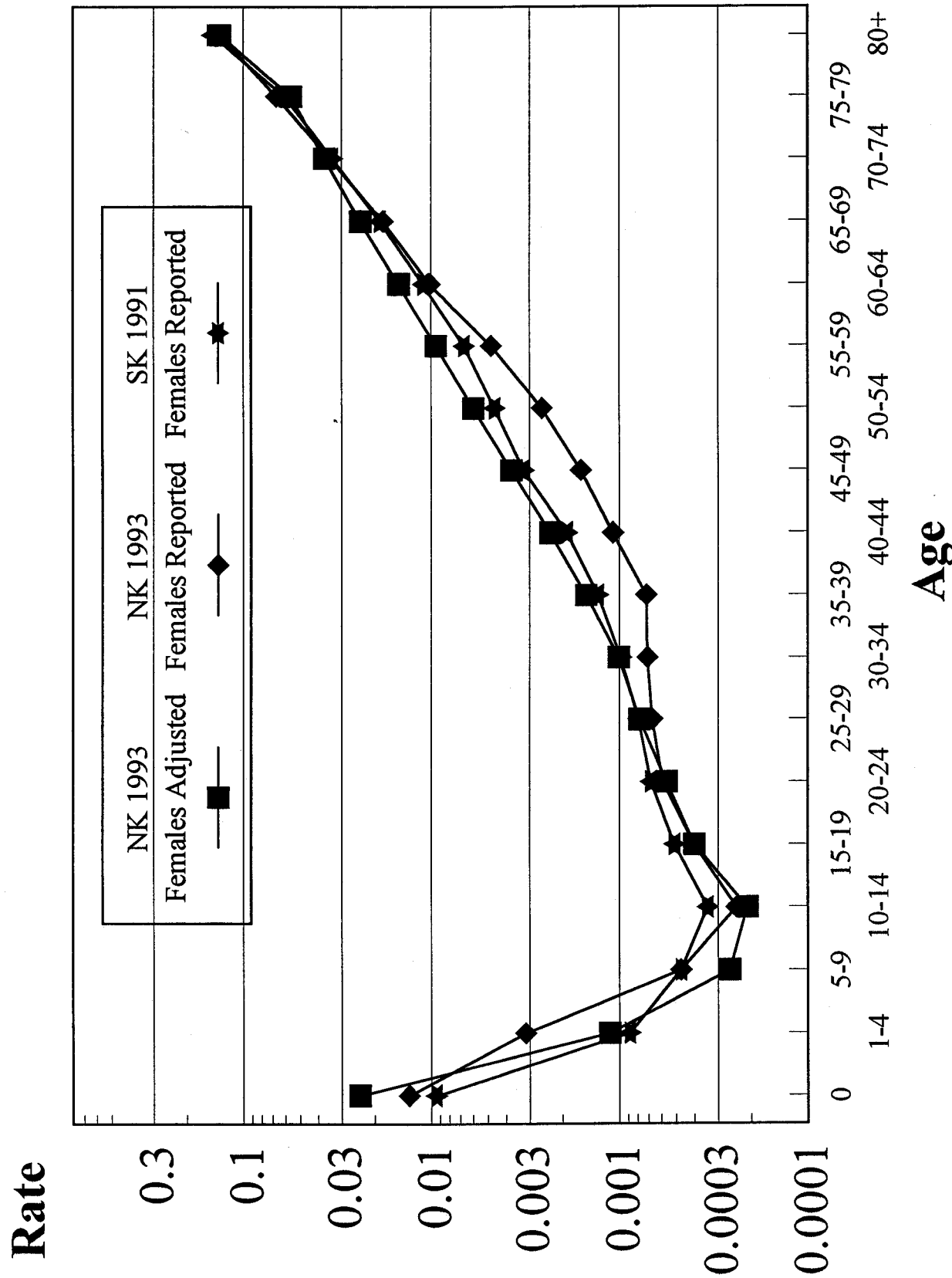
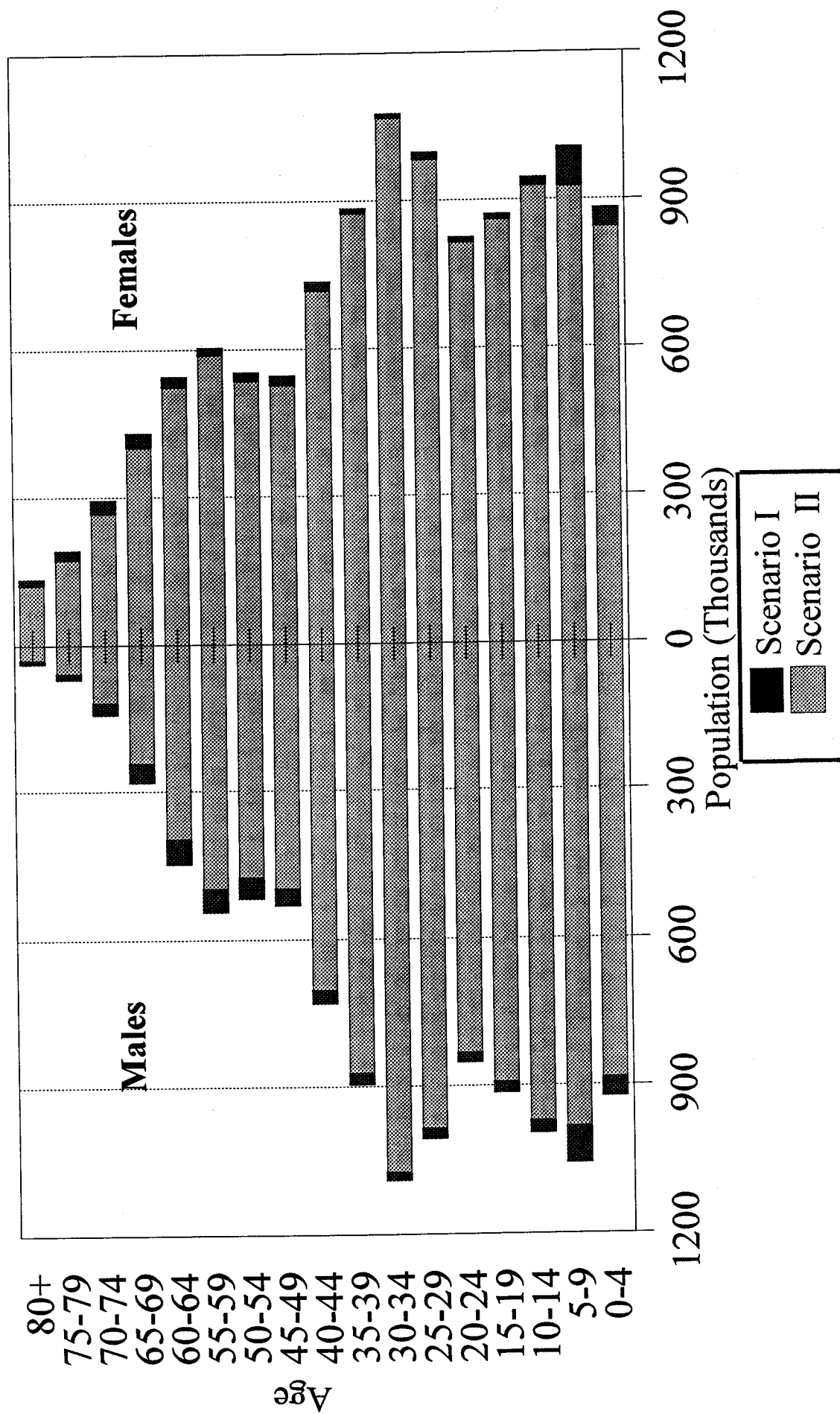
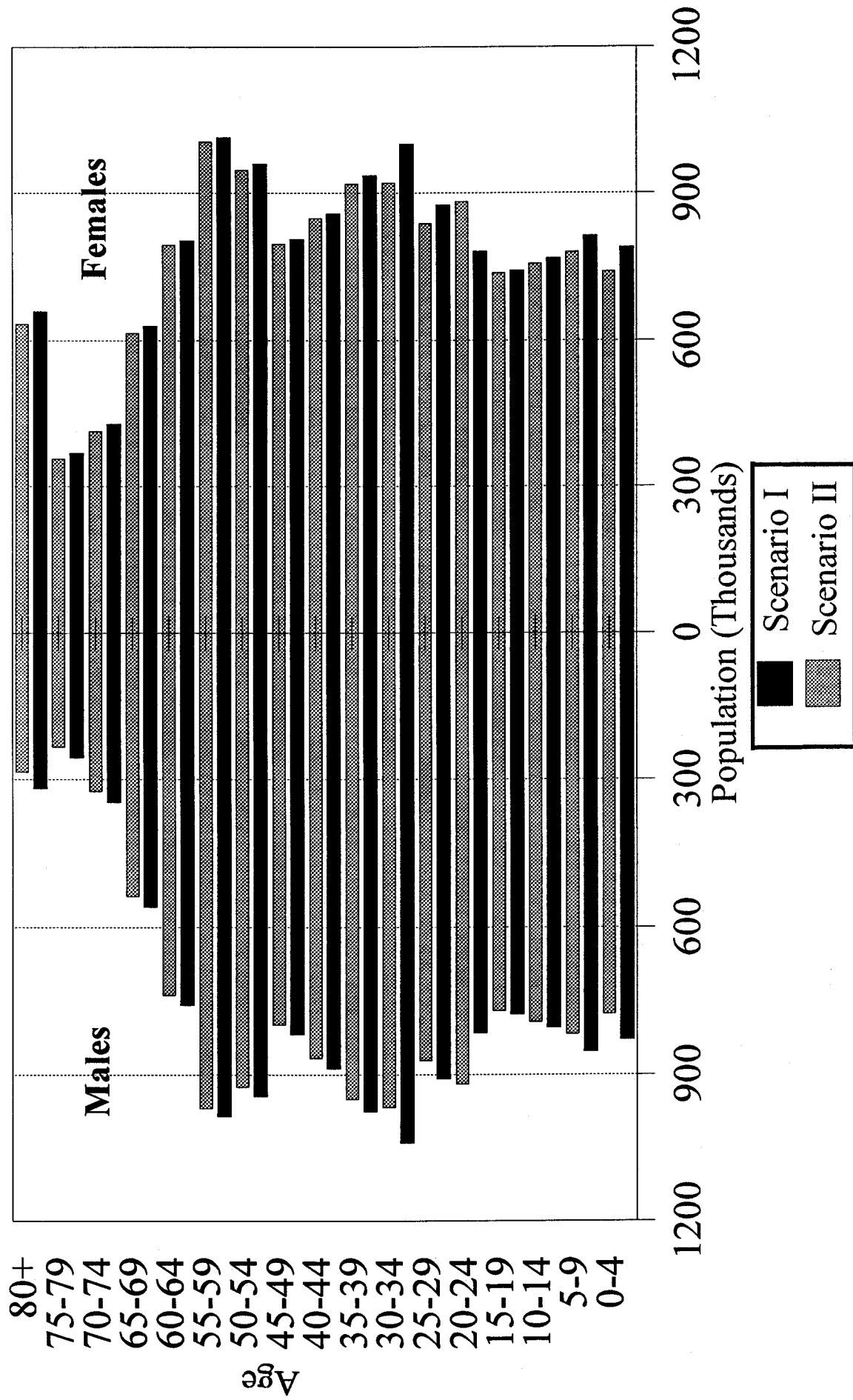


Figure 5.
Population of North Korea by Age and Sex, Scenario I and II,
Midyear 2000



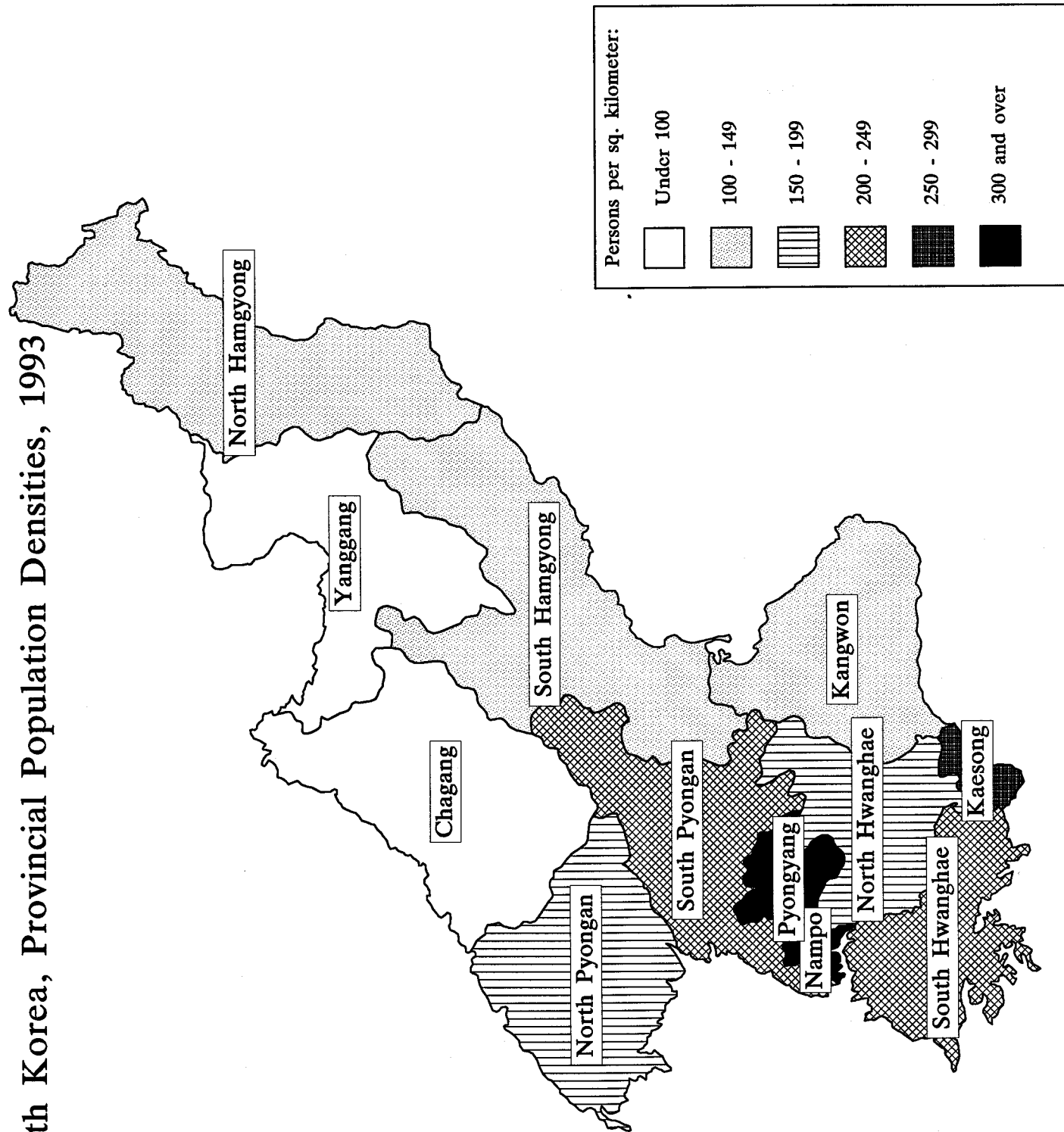
Source: U. S. Bureau of the Census, International Programs Center projections.

Figure 6.
Population of North Korea by Age and Sex, Scenario I and II,
Midyear 2025



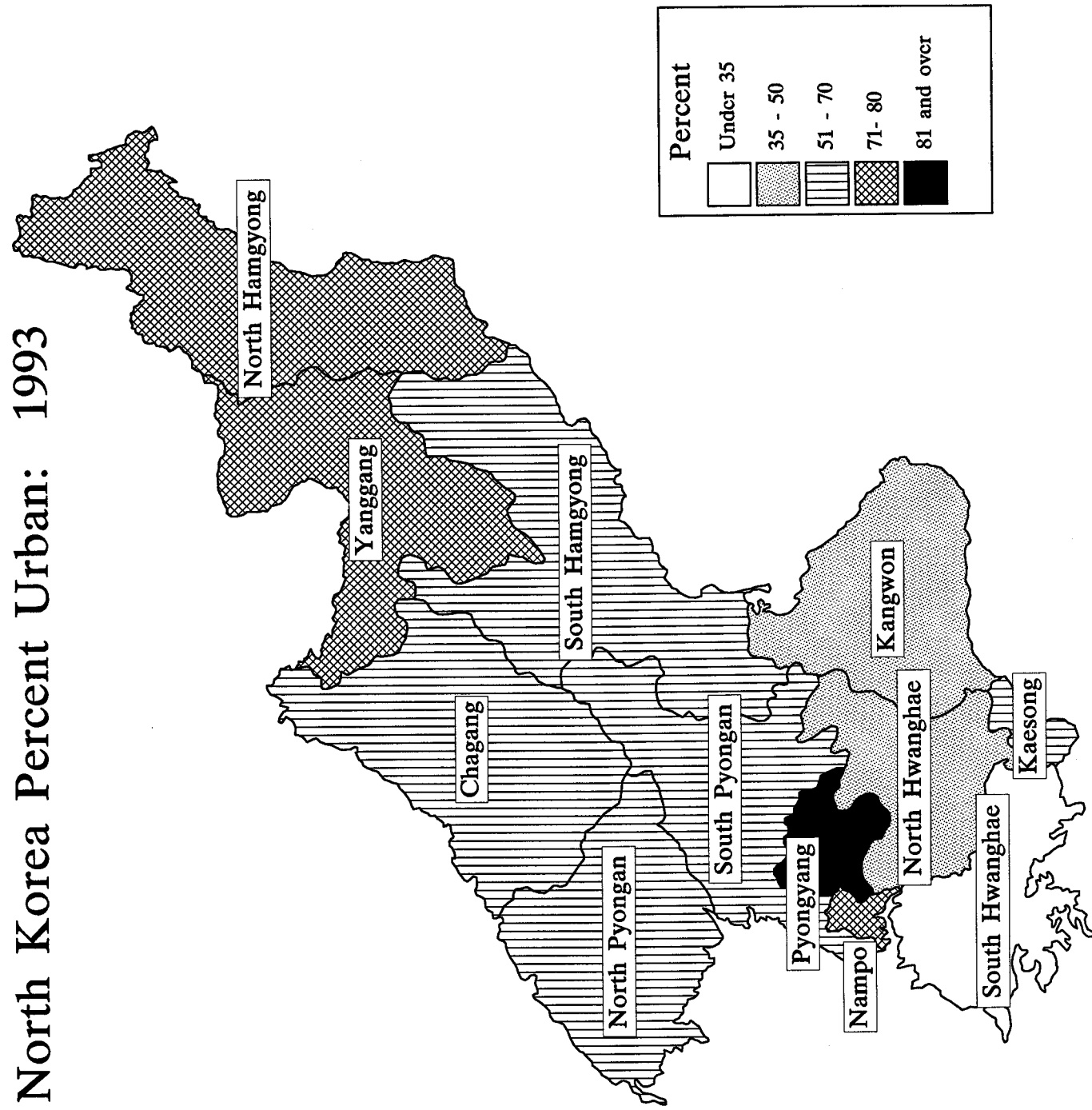
Source: U. S. Bureau of the Census, International Programs Center projections.

Map 1. North Korea, Provincial Population Densities, 1993



Source: DPRK Central Bureau of Statistics, 1995 and Eberstadt and Banister, 1992.

Map 2. North Korea Percent Urban: 1993



Source: DPRK Central Bureau of Statistics, 1995.