

# The Demographic Impacts of Prolonged Famine in North Korea

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## 1. Introduction

North Korea was faced with economic difficulties in 1990s following the collapse of the Soviet Union in 1991 and Eastern Europe in the early-1990s. It could no longer import raw materials from these regions at a so-called friendly-price which was much lower than the international market price. The huge reduction in the import of crude oil from Russia and China particularly paralyzed factories, transportation, and electricity generation nationwide.

The decrease in agricultural production caused by a series of natural disasters also became a big drag on North Korean economy: floods in 1995 through 1996, droughts in 1997 and 1999, and cold-weather damage in 1993 and 1998. Among them, the 1995 flood was the most devastating, damaging almost 75% of the country, and displacing some 5.2 million people. GNI dropped by 46% from 23.2 billion dollars in 1990 to 12.6 billion dollars in 1998. Such severe economic difficulties prevented the national system of food rationing, medical services and sanitation from functioning normally.

In fact, a widespread shortage of food in North Korea began in the late-1980s and emerged as an acute social crisis when beset with the aforementioned multiple natural disasters in the early-1990s. Accordingly, the amount of food available for rationing started to decrease from 1993. The worst years of the famine occurred in 1997-1998. North Korea named the years from 1996 to 2000 as the Marching Period of Suffering. Kim Jeong-il came into power at the peak of the crisis in 1998.

Experiencing severe famine, the social system in North Korea also saw many changes. In 1998, North Korea permitted further private economic activities through the legalization of cultivating vegetable gardens. The average annual economic growth rate in 1999-2005 was around 2% due to large-scale international aid from South Korea and other foreign countries.

We have a variety of estimates on the number of excess deaths caused by famine in North Korea. In 1999, Statistics Korea estimated a total of 268 thousand famine victims through the utilization of several sources such as interviewing defectors, reports submitted by North Korea to the UN and surveys conducted by international agencies. Statistics Korea assumed that the average death rate by famine for the period of 1995-1997 was 3.35‰, decreasing by 50% in 1998. Based on the reports submitted to the central labor party by local labor parties, Whang Jang-yeup(1999) claimed that excess deaths by famine totaled as many as 3 million persons: 500 thousand in 1995, 1 million in 1996 and 1.5 million in 1997. Eberstadt(2000) also estimated excess deaths by famine to be 3 million persons judging from changes in the total number of delegates in the Supreme People's Assembly between 1990 and 1998, in which one member represents 30 thousand persons<sup>1)</sup>. Sam-sik Lee(2000) calculated 230 thousand excess deaths from 1995 to 1997 on the assumption that the average death rate by famine would be approximately 3.35‰. Goodkind and West(2001) applied the mortality pattern of the Chinese famine that occurred in 1958-1961 to the results of the 1998 Nutrition Survey in North Korea done by UNICEF, resulting in range of 0.6 to 1 million excess deaths by famine between 1996 and 2000.

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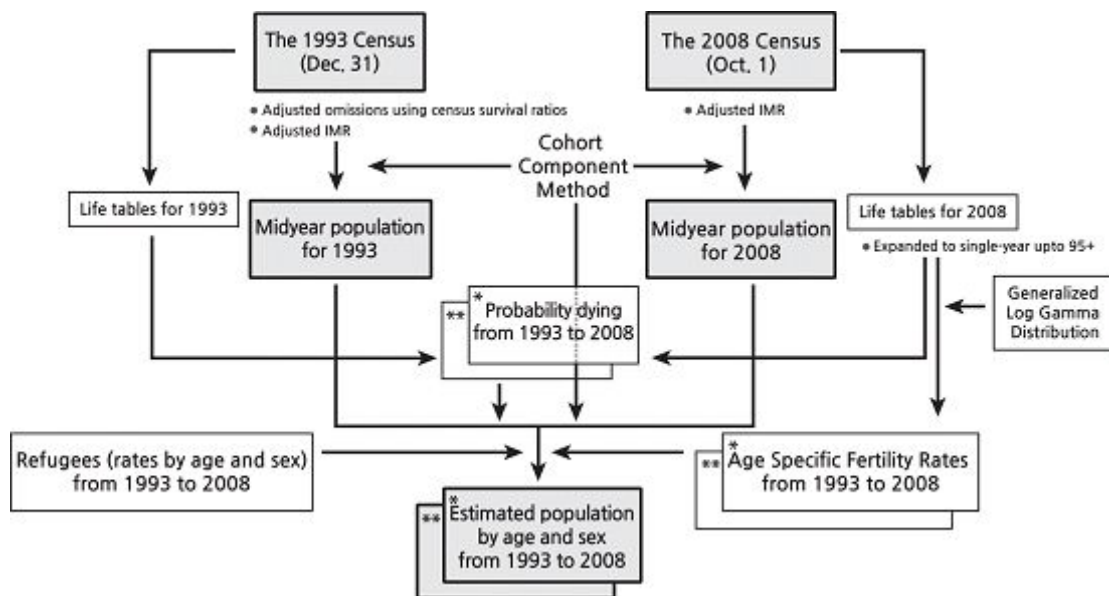
1) Eberstadt's story seems to be groundless because North Korea changed the regulation on the number of delegates in the Supreme People's Assembly in 1992.

This study aims at estimating the demographic impacts of famine including deaths, births, and refugees in North Korea. Since the results of the 2008 Population Census of North Korea have recently become available to the public, this study attempted to employ various available tools using two consecutive census data (refer to Figure 1).

## 2. Methodology

When observing the 1993 Census data of North Korea, it is not difficult to notice a glaring discrepancy as many as 691,027 persons (652,036 men, 38,991 women) between the categories of population by age (20,522,351) and population by region (21,213,378). Specific groups of people such as soldiers, key officers of the labor party, and prisoners do not seem to be included into the category of population by age in the population censuses of North Korea. Due to such omissions in the 1993 Census, the survival ratios between 1993 and 2008 appear larger than one in certain ages: specially 16-28 for males, and 16-21 for females (refer to Figure 2). As shown in Figure 3, this study adjusted such unusual survival ratios using the survival ratios of life table,  $L_{x+1}/L_x$ .

Figure 1. Analytical framework



Note: \* estimated with famine, \*\* estimated without famine

Figure 2. Census survival ratio without adjustment: 1993-2008

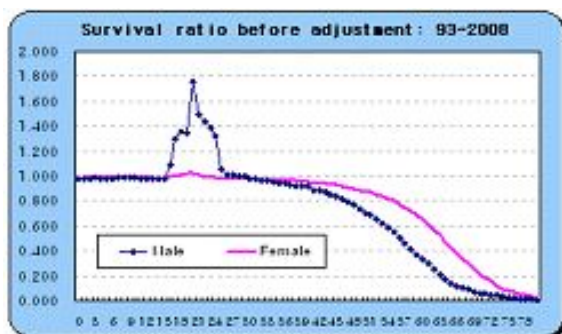
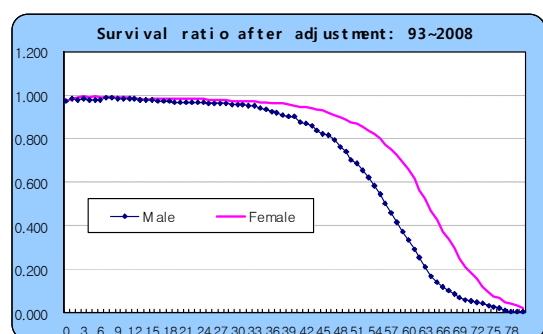


Figure 3. Census survival ratio with adjustment: 1993-2008



Unlike the 1993 Census, data on death are restricted to 5-year age groupings in the 2008 Census. Also, the upper limit of age, which is 100 and over in the 1993 Census, is decreased to 80 and over. To expand death data by 5-year age group to single-year increments, Beer's ordinary minimized fifth difference formula was employed as follows:

$$P_{x+k} = C_{k,x-10} {}_5P_{x-10} + C_{k,x-5} {}_5P_{x-5} + C_{k,x} {}_5P_x + C_{k,x+5} {}_5P_{x+5} + C_{k,x+10} {}_5P_{x+10} \quad (1)$$

$${}_5D_0^* = 2.45580V - 0.59332{}_5D_5 - 0.01965{}_5D_{10} + 0.22004{}_5D_{15} - 0.08255{}_5D_{20}$$

Instead of  ${}_5D_0$ ,  ${}_5D_0^*$  was used because of the high mortality rates among infants and young children. V is the sum of deaths aged 2 to 4. The deaths aged 2 to 4 in 2008 were estimated using the change rates of probability dying between two consecutive ages in 1993. Finally, the probability dying at each age was smoothed by Greville's moving-average-smoothing.

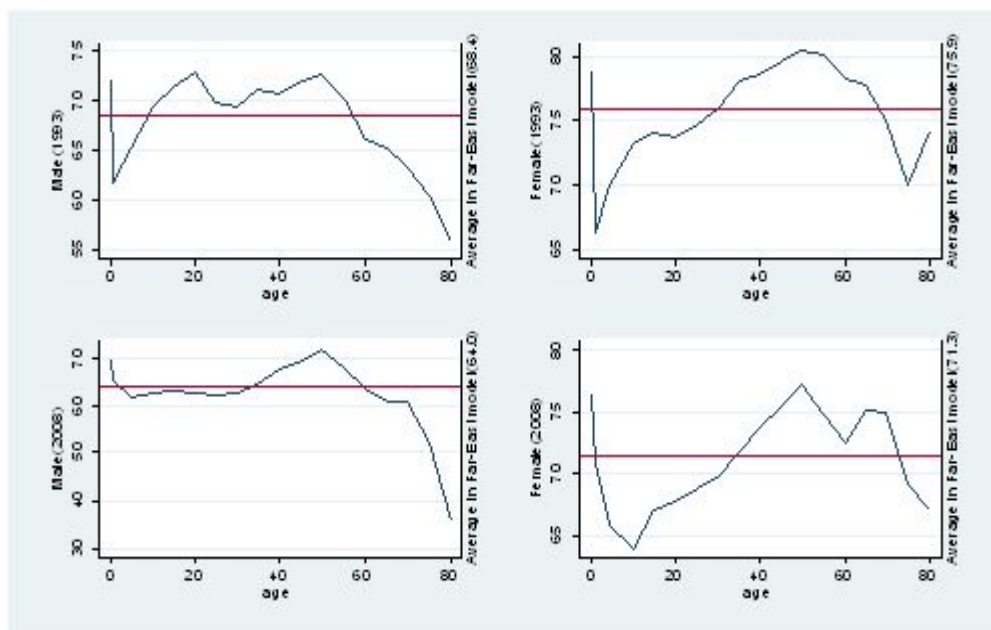
The linear relationship of two consecutive log-probabilities-dying by age, that is,  $\ln(qx)-\ln(qx-1)=kx$ , in older ages in 1993 were used to expand the upper limit of age up to 95 and over in 2008.

Intercensal population were estimated by the Cohort-component Method which repeatedly adds births and subtracts deaths and migrants for any given years. This method requires a series of probability dying according to sex and age in 1993-2008. They were interpolated using both the probability dying according to sex and age in 1993 and 2008, wherein, the annual trends of mortality rates under 5 years old between 1993 and 2002 reported officially by either North Korea or UNICEF served as a good criterion to go by among others.

Compared with the UN regional life tables, the age pattern of probability dying in North Korea in 1993 and 2008 are more or less similar to that of the Far-East Pattern which is mainly characterized by high mortality rates among older aged men. The age pattern of probability dying in North Korea, however, shows a different aspect from that of the Far-East Pattern: higher mortality rates among young adults and the elderly, and lower mortality rates among infants and middle ages (refer to Figure 4).

Due to the principle of least adjustment of official statistics employed in this study, only the probability dying among infants, which is believed to suffer highly from under-counting, is substituted by the value of the Far-East Pattern in 1993 and 2008 respectively.

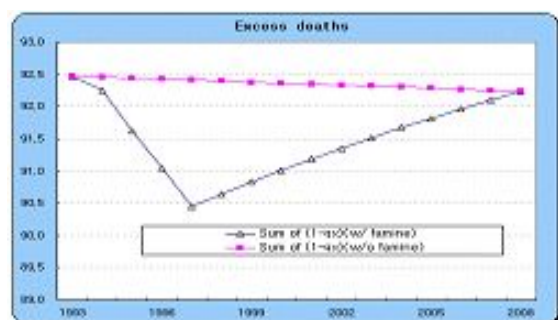
Figure 4. UN level of life expectancy for North Korea by age: 1993, 2008



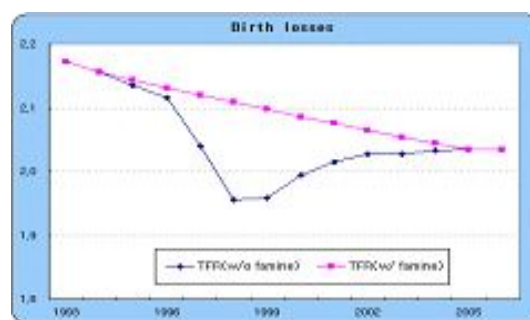
On the other hand, the Generalized Log Gamma Distribution (GLDG) was used to estimate ASFRs from 1993 to 2008. Published according to 5-year age groupings, the ASFR of 2008 in North Korea needed to be expanded to single year increments with the help of GLGD graph-fitting. The feasibility of estimated ASFRs was reviewed by comparing two different figures of births: one obtained by multiplying ASFR by female population aged 15-49 for each year, and the other obtained by dividing population at each age in 2008 by the stationary population of life table in 2008.

Finally, the demographic impacts of the famine were estimated by comparing the difference between deaths both as a result of and unrelated to the famine for excess deaths in 1993-2008; and likewise, for birth losses (refer to Figure 5 and Figure 6).

**Figure 5. Excess deaths due to famine**



**Figure 6. Birth losses due to famine**



### 3. Major Findings

Unlike the Chinese famine during its Great Leap Forward in 1958-1961 and the Russian famine in 1932-1933, the famine in North Korea was considered as a famine in slow motion, in which the speed of progress/recovery is quite slow. The study reveals that excess deaths lasted for 12 years in 1994-2005 while birth losses continued for 10 years in 1995-2004. According to the results, as shown in Table 1, excess deaths were estimated as many as 482 thousand in 1994-2005 while birth losses were approximately 128 thousand in 1995-2004. During the Marching Period of Suffering, that is, between 1996 and 2000, it was estimated that 336 thousand people might have died and 99 thousand babies might not have been born due to the famine. Those under 5 years old for both males and females and around 60 years old for males and 70 years old and over for females were the most pronounced among all deaths.

As the famine got worse in the early-1990s, the life expectancy at birth also decreased sharply and plunged to its lowest level in 1998 as the food shortage reached its peak. The life expectancy of males decreased by 7.5 years from 67.0 years in 1993 to 59.5 years in 1998 and that of females declined by 7.7 years from 74.1 years in 1993 to 66.4 years in 1998. The life expectancy in North Korea started to increase gradually in the late-1990s as the food shortage crisis eased due not only to continuous international food aid but also improved agricultural production. Nevertheless, the life expectancy in 2008 remained far from the levels in the early-1990s, marking 64.1 years for males and 71.0 years for females. The level of life expectancy for North Korean males in 2008 was similar to that of South Korean males in 1984 whereas life expectancy for North Korean females in 2008 was analogous to that of South Korean females in 1982.

There is a high probability that people of every age category in North Korea were badly affected by the famine. Wide-spread malnutrition leads to catastrophe where people become more vulnerable to diseases through immunity deficiencies. The height and weight of North Korean defectors who immigrated to South Korea in 2009 provides evidence that they are much smaller and thinner than their South Korean

counterparts. The younger the age, the bigger the differences in height and weight seem to be. The largest height gap between South and North Koreans appears at ages 19-29: that is, 8.8 cm for males, 6.5 cm for females. In terms of the weight of females, the largest gap was 4.5 kg at ages 19-29 and 60-69.

**Table 1. Estimated excess deaths and birth losses due to famine in North Korea**

(In '000, ‰, years)

	Estimated Population	Total Deaths	CDR		Excess Deaths **	Life Expectancy		Total Births	CBR		Birth losses ***
			Estimated	DPRK*		Male	Female		Estimated	DPRK*	
1993	21,103	124	5.9	5.5		67.0	74.1	433	20.5	20.0	
1994	21,412	149	7.0		8	66.2	73.3	442	20.7		
1995	21,715	173	8.0	6.5	34	65.4	72.5	447	20.6		2
1996	21,991	207	9.4	6.8	61	63.4	70.5	447	20.3	20.1	3
1997	22,208	240	10.8		88	61.4	68.5	431	19.4		17
1998	22,355	253	11.3	9.3	74	59.5	66.4	408	18.2	18.2	32
1999	22,507	247	11.0	8.9	62	60.0	66.9	400	17.8	17.8	29
2000	22,702	242	10.7	8.8	51	60.5	67.4	397	17.5	17.5	18
2001	22,902	238	10.4		40	61.0	67.9	389	17.0		12
2002	23,088	234	10.1		30	61.4	68.4	379	16.4		7
2003	23,254	231	9.9		20	61.9	68.8	368	15.8		5
2004	23,411	228	9.7		11	62.4	69.3	360	15.4		2
2005	23,561	226	9.6		3	62.8	69.7	354	15.0		
2006	23,707	225	9.5			63.3	70.1	351	14.8		
2007	23,849	223	9.4			63.7	70.5	349	14.6		
2008	23,934	219	9.1	9.0		64.1	71.0	347	14.5	14.4	

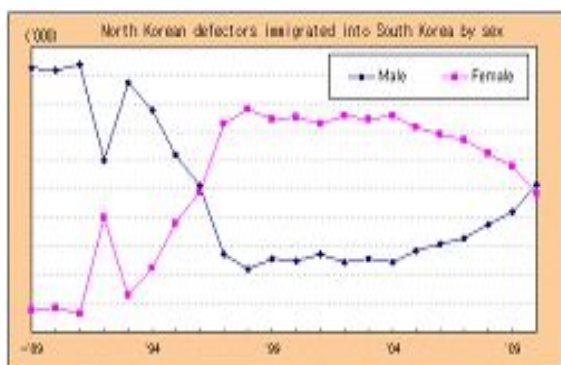
\* Figures published by North Korea

\*\* Excess deaths caused by famine are included into total deaths.

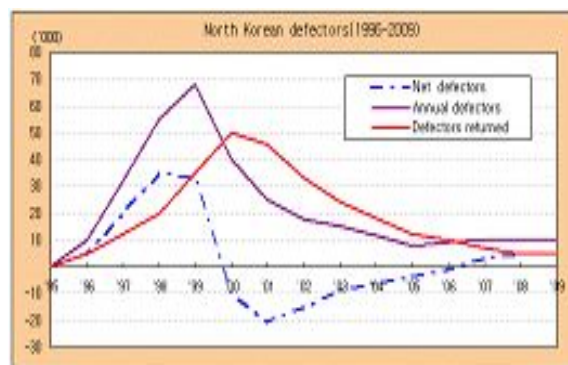
\*\*\* Birth losses caused by famine are not included into total births.

The famine also forced people to cross borders to seek food. According to the statistics on North Korean defectors who immigrated to South Korea, famine refugees increased in 1996 and dramatically soared in 1997 reaching a peak in 1998. Males outnumbered females in the initial stage but females have outnumbered males since 1997. The sex ratio among defectors has become balanced in recent years due to the fact that more males are arriving into South Korea through family networks (refer to Figure 7). There have been more males arriving who are in their 20s and 40s while there has been an increase in females in their 30s. Judging from the various sources of information, there were a sizable number of famine refugees in 1996~1999 but the net migration rate became negative due to more returnees to North Korea since 2000 (refer to Figure 8).

**Figure 7. North Korean defectors by sex**



**Figure 8. Famine refugees: 1996-2009**



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