3

Anthropometric Perspectives

3.1 Perception

Anthropometry, from Greek "measurement of humans," has been an area of major concern by the North Korean government. Because typical anthropometrical measurements such as height and weight are a manifestation of underlying socioeconomic deficits in society and malnutrition in childhood (Chapter 3.2), North Korea has been paying special attention to this issue quite early. In 1979, hence already before the Great Famine of the 1990, Kim Il-Sung was worried about child stunting (Lee, 2001). To solve this, he promoted the planting of runner beans at fences and walls of households to increase the protein supply of the people. Needless to say, the amount of food grown this way was too little to contribute to a sustainable nutritional improvement of children. In the mid–1980s, Kim Il-Sung initiated the "movement to become taller" (Chong, 1998). It aimed at increasing students' stature through physical training. For this purpose, schools were ordered to organize extra physical exercises believed to make children taller. However, human height is not influenced by physical exercise, but by genes, nutrition and epidemiological factors (Chapter 3.2). Hence, the "movement to become taller" might have even been counterproductive, since growth in childhood is also dependent on energy waste for physical activity. As already mentioned, children were already considerably undernourished at that time (Figure 8, Chapter 2), therefore, on the contrary, extra physical activity at schools might have led to even further growth retardation. Nonetheless, as late as the 2000s, a South Korean anthropologist reported that the North Korean government set up "increase-your-height" banners in public places — indicating continuing concerns by the government about the people's anthropometric status at that time. Already mentioned was that dwarfs were sent to regions in secluded areas and that extremely short people are banned from Kim Il-Sung's dream city Pyongyang as the regime evidently felt too embarrassed about them (Savada, 1994: 72). In 2003, the DPRK lowered the minimum height requirements for conscription from 150 cm to 127 cm — providing evidence that nutrition of recruits during their childhood must have had deteriorated.[28]

Not only the shortest, but also the tallest North Koreans are a source of anthropometric concern for the government. The DMZ, established after the Korean War (Chapter

regime must have felt unutterably relieved after the first successful test in 2006. Pulitzer Prize-winning political cartoonist Walt Handelsman once drew a picture showing a tall Osama Bin Laden beside a small Kim Jong-Il, and in another picture an equally tall Kim Jong-Il — standing on a nuclear missile. Indeed, nukes are the ultimate upgrade a military can have in its arsenal. Their possession has also often been compared to the Colt .45 in America's wild west: even the weakest person suddenly becomes deadly dangerous.

In conclusion, North Korea's aim of militarization and fortification of the nation has been achieved early and at high costs. Since 2006, its last aim, the ultimate modernization of its military through nuclear weapons, has evidently been achieved as well. The most dangerous situation by now is that the DPRK could use this weapon in its endgame strategy if the regime falls. A second concern is that it is could start dealing with nuclear weapon technology — similarly to its considerable missile trade since the 1980s — to keep access to urgently needed foreign exchange.

1.6), is a political arena to demonstrate ideological superiority: the DPRK flagpole at the DMZ is taller than its Southern counterpart to visually indicate that North Korea is a greater nation.[29] In a similar manner, only the tallest recruits may serve at the DMZ: the minimum height requirements for South Korean soldiers are 170 cm and for American soldiers 180 cm.[30] Though no minimum height requirements are known for the DPRK, it is clear that Pyongyang also only sends the best-fed recruits to the DMZ. However, even the tallest North Korean soldiers were reported to be half a head shorter than their southern counterparts — indicating that North Korea has difficulties recruiting soldiers with both adequate minimum height (for general conscription) and maximum stature (for serving at the DMZ). What the example of the DMZ also quite well illustrates is that the DPRK may have easily won the flag competition between the two systems by simply erecting a taller flagpole, but clearly lost the biological competition in human height. Exactly the idea of taking less corruptible average height measurements as a sensitive indicator of a biosocial and socioeconomic development of a nation will be used in this part of the book. In summation, there can be no doubt that the DPRK has been paying special attention to anthropometric issues already for a long time and with increasing concerns.

Beyond anthropometric issues among North Korean students and recruits, the anthropometric measurements of the North Korean leaders per se became a topic of mockery from abroad: even Kim Il-Sung — who was impressively tall, standing at over 180 cm (Cumings, 2004: 155) — was occasionally called a "fat Communist" by foreigners, as he was visibly overweight compared to his people around him. Similarly, his son and successor Kim Jong-Il, being only 160 cm tall but weighing 80 kg before his stroke in 2008 (Oh and Hassig, 2000: 94), was accused of being "the one fat man in the whole country" during the 1990s when the Great Famine was ravaging in the country (Breen, 2004: 184). Furthermore, U.S. President George W. Bush once even stated that "Kim Jong-Il is a pygmy" — alluding to the dictator's small stature. Indeed, Kim Jong-Il himself seems to be dissatisfied with his short height (yet evidently not with his obesity resulting from overnutrition), as he wears high-heeled boots[31] and combs his permed hair back[32] to add a few artificial centimeters on the top and bottom.

More importantly, the low average height of North Korean children frequently became part of political discussions in the West to exemplify the miserable lives of ordinary North Koreans. Astonishingly, this even became part of a campaign in the U.S. presidential election of 2008 between Barack Obama and John McCain — the latter claiming during one of the public television debates that North Korea is the "most repressive and brutal regime probably on earth. The average South Korean is three inches taller than the average North Korean."[33] McCain was not the first politician corroborating the hostile living conditions of ordinary North Koreans by anthropometric evidence: in 2006, U.S. Secretary of Defense Donald Rumsfeld stated, "The people in the north are starving, their growth is stunted. It's a shame, a tragedy."[34] In a similar

vein, President George W. Bush once said: "I just can't respect anybody that would really let his people starve, and shrink in size as a result of malnutrition. It's a sad, sad situation for the North Korean people."[35]

In summation, anthropometry in North Korea certainly is a delicate issue. In this light, as stated in my previous work (Schwekendiek, 2009f), "Virtually every centimeter and gram that is measured becomes political" in North Korea.

3.2 Concept

First of all, in this chapter I focus on height and not weight, as height is a more common indicator for social status than weight, and as it is also more often applied in research. Moreover, weight includes the aspect of overnutrition and obesity, whereas height is an unambiguous indicator of chronic undernutrition and famine.

Recently, in the social sciences, the number of height-related articles published in international journals has quadrupled from the period from 1995 to 2008 compared to the period from 1977 to 1994 — indicating that stature now is a common social welfare indicator like gross domestic product, life expectancy or mortality (Steckel, 2009). Since the 1970s, economic and social historians have employed human anthropometry as a sensitive marker of the development of societies. Perhaps the most prominent scholar utilizing such measurements in socioeconomic research is Nobel Prize winner Robert Fogel. In the 1980s and 1990s, economic and social historians influenced by Fogel therefore suggested and coined the term "biological standard of living" (Komlos, 1985; Komlos and Baten, 1998).

Moreover, in development studies, height and weight measurements of babies and children are common indicators of child malnutrition. In the 1970s, the United Nations World Health Organization established the assessment of malnutrition of children on the basis of their height and weight measurements (Waterlow et al., 1977; WHO, 1995). Nowadays, epidemiologists, nutritionists, and even psychologists take anthropometric measurements of children to assess their net-nutritional state and even mental-health status.

An overview of fields applying anthropometrics in research is given in Table 16, which is given in Schwekendiek (2009a), based on Juergens et al. (1990). First, ergonomic anthropometricians make use of anthropometrics to adapt consumer goods: clothes, shoes, and seats in cars or planes. Historical sources of data are books of tailors or carpenters, and for modern periods, massive surveys carried out for the textile or automobile industry. In my previous work and in this book, I have made use of such a survey, which was carried out by the South Korean government to adapt consumer goods for the industry (Korean Agency for Technology and Standards, 2004). An advantage of such ergonomic surveys is that they are commonly based on random sampling, as commodities have to be matched for average people in the country. Second, by far

the largest number of studies comes from anthropological anthropometricians who are generally investigating ethnic aspects of groups. The drawback of these field studies is that they are often based on low sample sizes, making it difficult to generalize findings from the individual to the population. In earlier anthropological studies, measurements of male and female or different birth cohorts were frequently reported jointly, hence gender dimorphism and secular anthropometric trends are often ignored in studies of this nature. Third, anthropometric evidence is provided by medical anthropometricians who are interested in the documentation of etiopathology. For this purpose, medical records of patients are frequently retrieved. Fourth, sports anthropometricians analyze human measurements of individuals to research the performance of athletes in sports competitions. Fifth, forensic anthropometricians use anthropometric data for the biometric identification of individuals. Data often stem from passports in which the height of the individuals are recorded, or from prison registers to reidentify convicts. The aforementioned study on stature of colonial Koreans has been based on such data. The drawback of such prison data is that often only the poorest of the society were measured, yet — as seen in Choi and Schwekendiek (2008) — sometimes the whole social stratum was included due to both economic and political reasons for incarceration. Sixth, development anthropometricians widely employ anthropometric measurements for the health surveillance of a population or to assess the degree of food calamities in developing countries. A major source of data are nutritional surveys, which have been

Table 16: Applied Anthropometry in Research

Applied Field	*Purpose*	*Frequent Sources of Data*
Ergonomic anthropometrics	Adapting consumer goods	Surveys for the textile and automobile industry, books of tailors and carpenters
Anthropological anthropometrics	Anthropological research on the definition and differences of ethnic groups	Field studies of anthropologists
Medical anthropometrics	Documentation of etiopathology, assess mental health issues among presumably abused children	Medical records of patients
Sport anthropometrics	Investigations of the performance of athletes	Measurements of athletes
Forensic anthropometrics	Biometric identification of individuals	Passports, measurements of convicts
Development anthropometrics	Health surveillance, assess gross-nutritional status in developing countries	Food and nutrition surveys
Economic-historical anthropometrics	Estimating the biological standard of living in the past, assessing the net-nutritional status in historical societies	Records of military recruits, entrance examinations in schools

Source: Based on Schwekendiek (2009a); Juergens et al. (1990).

frequently implemented by the United Nations and other international organizations, as discussed above, to investigate the prevalence of child malnutrition in a country. From this source of data, my colleagues and I have previously analyzed heights, weights and body-mass indices (BMI) of preschool children in the two Koreas (Schwekendiek and Pak, 2009). Seventh and last, anthropometrics have been widely employed in social sciences, particularly in economic history. Heights and weights serve as an indicator for net-nutritional status in historical societies, hence, as distinct from development anthropometricians focusing on the nutritional or health aspects, anthropometric measurements are seen from a net-nutritional perspective (Schwekendiek, 2009a).

According to Moradi (2005) and Schwekendiek (2009a) — both using UN frameworks to assess human well-being — height and weight are manifestations of underlying social and economic conditions on the macro level, which affect economic income, access to medical care and food on the household level, that in turn determine food consumption, workload and medical care for individuals.

In a similar manner, the separation of net-nutritional versus gross nutritional components is reflected by the following equation given in Coll (1998): H = F (N, D, L), where *H* refers to average height, *N* represents gross nutritional intake, *D* is the disease environment, *L* refers to child labor. (Note that, as discussed below, the genetic effect cancels out when taking average heights of a population; and that energy used for biological maintenance is constant in stable climatic environments, hence negligible). Thus, average height becomes a function of underlying nutritional inputs, disease environment and workload during childhood. Making use of data collected by development anthropometricians and applying the net-nutritional concept from economic history, I have previously investigated the socioeconomic welfare of North Korean children during and after the Great Famine (Schwekendiek, 2008a, 2008b).

What are the advantages of considering height and weight measurements as human welfare indicators compared to conventional proxies? Following Schwekendiek (2009a), first of all, let me introduce some basic concepts of human well-being. Lasswell and Kaplan (1950) once elaborated the following four welfare values: well-being, which included health and safety; wealth, referring to income and consumption; skill, being a matter of proficiency; and enlightenment as a manifestation of knowledge and information (Table 17). What can be seen is that hard factors (food, money) and soft factors (skill, enlightenment) are identified as integral components of our human welfare concept. However, Lasswell and Kaplan on purpose did not assign any order to these welfare values: "No assumptions will be made here as to the comparative intensity with which these values are held, or the importance assigned to them by various persons and groups." Yet, if we want to measure the human welfare state of a population, it would make sense to have a ranking of these values. Perhaps the most accepted order of human welfare values is Maslow's hierarchy of needs (Maslow, 1943). First and foremost, humans long to satisfy physiological needs (food, water, homeostasis, and sexual activity). Sec-

ond, humans strive after safety needs (security from violence, loss of property, and unemployment). Third, needs for love and belongingness — including aspects of emotional and social relations — start to matter. Fourth, the need for esteem emerges, including self-respect and respect from others. Fifth and last, individuals aim at self-actualization as manifested by private and professional self-realization.

Table 17: Systemizing Human Welfare Values

Maslow's "Hierarchy of Needs"	*Examples*	*Lasswell and Kaplan's "Welfare Values"*	*Examples*
Physiological needs	Food, water, homeostatis, sexual activity	*Well-being*	Health, safety
Safety	Security from violence, loss of property, unemployment	*Wealth*	Income, consumption
Love and belongingness	Emotional and social relations	*Skill*	Proficiency
Esteem	Self-respect, respect from others	*Enlightenment*	Knowledge, information
Self-actualization	Private and professional self-realization		

Source: Based on Schwekendiek (2009a); Maslow (1943); Lasswell and Kaplan (1950).

What can be seen from both concepts is that health and wealth are major components of our human welfare concept, where Maslow states that these come before nonphysical or intellectual aims are targeted. Anthropometric measurements are a good proxy for the health and wealth of those populations where daily food and health provisions are not met. This is the case for historical societies, and for today's developing countries — North Korea, since its political formation in 1948, undoubtedly belongs to both categories. Facing a statistical terra incognita like the DPRK, not only do anthropometric measurements provide further socioeconomic evidence on North Korea, data are also less corruptible than conventional human welfare indicators such as GDP per capita or infant mortality rates. Height and weight are measured physically, hence measurement errors — a common problem for macroeconomic indicators or in social surveys relying on the memory of respondents — become negligible. Also, no underlying background information is necessary, leaving less room for political manipulation by uncommon classifications or fine-tuning by the regime (as previously seen). Weight and height are also easily measured compared to macroeconomic or demographic welfare indicators, as only easy equipment such as scales or stadiometers and at the most 1 or 2 researchers are required to collect data. Beyond this, according to economist Richard Steckel (1995), stature fulfills all requirements for being a social welfare indicator. First, it is a timeless indicator as it is applicable to all historical periods and years. Second, it expresses global preferences, as nutrition and health represent basic human values — as also argued by Kaplan and Lasswell (1950) and Maslow (1943). Third, height is an output indicator

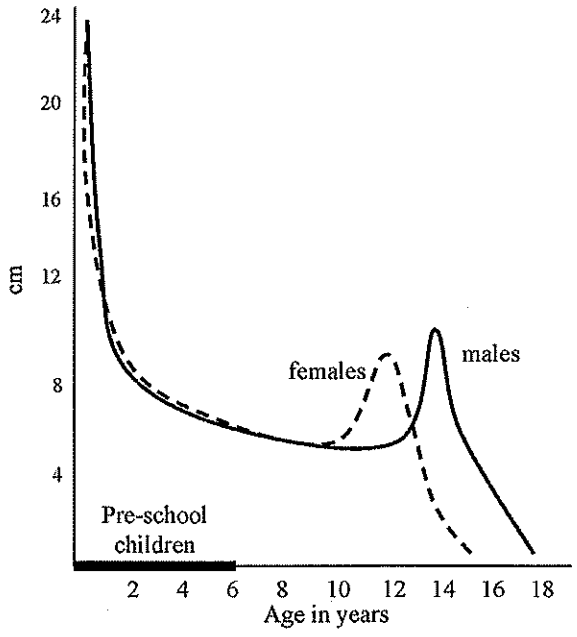
accounting for the distributional effect on individuals (unlike food consumption or health provision indicators). Fourth, transforming and calculating of data is not necessary and understanding of height does not require any statistical or technical know-how. Last, height can be employed for international comparisons.

Economic historians have widely analyzed backward-projected average height of adult cohorts by their birth year to proxy living standards prevailing in early life (Komlos, 1994; Komlos and Baten, 1998; Komlos and Cuff, 1998). The basic idea behind this is that living conditions in early life largely affect terminal stature. Figure 15 depicts the average velocity of human growth, which was modified from Tanner (1990). This curve is called the "Yearly Age and Sex-Specific Increase in Stature-Curve" (YASSIS-curve), and what can be seen is that height gains are largest in the first two years of life where both girls and boys gain over 10 to 20 cm per year. Nutrition and disease have large effects on growth at this age. The basic idea of taking average height is that cohorts born in different years primarily differ in living conditions prevailing at birth, as the environmental impact on stature at this time is by far the largest throughout life (Figure 15). This is, by the way, also the underlying concept when considering infant mortality or birth weight as a welfare indicator (yet, not for the first year *after* birth, but for the 9 months *before* birth, i.e. during pregnancy)—with the exception that adult height can be easier and more reliably retrieved for many underdeveloped countries that often lack well-organized statistical offices, or, in the case of North Korea, are prone to fine-tune or withhold data. Another critical timing is puberty, occurring on average in females at age 12–13 and at age 14–15 in males (Figure 15). As previously seen, height is negatively affected by energy wasted to fight disease and by workload (which particularly poses an issue in countries where child labor is a problem). And yet, even though catch-up growth mechanisms of height occur after infancy, the effect on terminal stature is rather small if individuals were exposed to considerable nutritional and epidemiological stress after birth. In the case of Korea, two striking examples corroborate this. First, refugee children having spent their early years in the developing country of North Korea have not caught up in growth to their Southern counterparts after entering the OECD-country of South Korea, where they receive enough food and medical treatment and are raised in a stable, healthy and rich environment. For these reasons, North Korean children are called "dwarfs" in South Korean schools as their height does not recover visibly—indicating that the first years of life have had an overarching effect on their growth status (Kang and Grangereau, 2005: 182). Second, height of South Korean children adopted in the past by mid-upper class parents living in healthy and wealthy Western countries does not really improve (Jung et al., 2008). Though overseas adoptions in early life represent a sudden, permanent, and enormous environmental enrichment for the baby, overseas South Korean adoptees were on average not found to be taller than their South Korean age peers—indicating that the early-life impact must have been dominant. For all these reasons, economic and social historians commonly

apply terminal heights — being constant from the age of 20, when individuals are grown out, until the age of 40 (before people start to shrink) as indicators of long-term living standards. Though this has been done for many periods and countries in applied socioeconomic research, there are currently only two studies offering this kind of long-term anthropometric evidence on the DPRK. Sunyoung Pak was the first to apply this concept of the biological standard of living on North Korea in 2004 (Pak, 2004a, 2004b). A second study conducted in 2009 and drawing from a sample that had twice the size of that in 2004 was co-authored by me (Pak et al., 2009) and will be discussed in a later section of this chapter.

Yet, are there any disadvantages of taking anthropometric indicators? Newcomers to this area of research often argue that genetic effects bias findings. Indeed, about 80 percent of height on an individual level is subject to genes (McEvoy and Visscher, 2009). However, as put by Eveleth and Tanner (1990): "Two genotypes which produce the same adult height under optimal environmental circumstances may produce different heights under circumstances of deprivation. Thus children who would be the taller in a well-off community would be smaller under poor economic conditions." Though some 50 genes and regions of the human genome have been found to interact with height (McEvoy and Visscher, 2009), genes are far from fixedly determining human stature. Nutrition and disease environment have a great impact on stature as well: in a study of monozygotic twins who were separated at birth and raised under quite opposite circumstances, the adult height of the twins differed by more than 8 cm (Tanner, 1990). Moreover, history offers a few natural experiments to measure the socioeconomic differences of a homogenous people. For instance, in the case of the two Germanies, East Germans were found to be on average 1 cm shorter than their Western counterparts living in a free-market economy (Komlos and Kriwy, 2003). In a similar vein, the two Koreas offer another natural experiment to investigate environmental impacts under ceteris paribus genetic conditions (Pak, 2004a; Schwekendiek, 2009e; Schwekendiek and Pak, 2009) — as will be discussed in

Figure 15: YASSIS-Curve of Height



Source: Based on Tanner (1990).

depth in a later section of this chapter. In sum, as shown in studies that control for the same genotype, the environmental impact is enormous. More importantly, height of birth cohorts are considered on average, so genetic differences of short versus tall genotypes cancel out. Thus, in the following, it is important to note that height refers to average height only — not speaking of any individuals at all.

Moreover, the small-but-healthy hypothesis has gained some popularity in the 1980s, yet it is now only voiced by a small and diminishing group of scholars. As seen above, since the 1990s, anthropometric research in social sciences is flourishing more than ever (Steckel, 2009), as the small-but-healthy thesis has in fact never been proven. The hypothesis claims that people might be small in size though being actually healthy. This is because growing human beings might adapt to environmental stress by reducing their size because a smaller body requires less energy for physical maintenance. However, the crux of the argument is that underlying deteriorating living conditions lead to the phenomenon of small size. Thus, as a matter of causality, small size is a manifestation of nutritional and epidemiological stress in the past. Therefore, even if this hypothesis were true, it would not question the scientific validity of taking anthropometric measurements as indicators of overall living standards during childhood — on the contrary, it would even corroborate it. Nevertheless, classifying children as "undernourished" on the basis of their current size (WHO, 1995) might indeed become problematic because a stunted or underweight child (relative to a healthy one) might not necessarily be in need of immediate medical or nutritional assistance.

Moreover, does "more" also imply "better" in anthropometric research? The best example against this is certainly overweight, as obesity significantly decreases a person's quality of life. However, also tall height has negative consequences: research found an inverted U-shaped relationship between mortality and stature, indicating that very short and very tall people are dying earlier (Waaler, 1984). Taller people were in fact found to have a higher risk of cancer, whereas shorter people face a higher risk of diabetes and heart disease (McEvoy and Visscher, 2009). Also, as argued in Schwekendiek (2009a), comparing highly developed countries to each other might become problematic, as high energy consumption patterns and food culture issues start to strongly bias findings. Perhaps the most illustrious example of this is that Americans, economically found to be the richest in the world, are by far not the tallest though one of the fattest on earth (Komlos and Baur, 2004). Hence, height and weight seem rather to be applicable in today's developing countries and historical societies, where — in a Maslowian sense — physiological needs are not met. This Korean peninsula provides a good example for such cases where anthropometric measurements become unbiased social welfare indicators: colonial Korea (Choi and Schwekendiek, 2009; Gill, 1998), industrializing South Korea (Schwekendiek and Jun, 2010), and North Korea in the past (Pak, 2004a; Pak et al., 2009) as well as during and after the Great Famine of the 1990s (Schwekendiek, 2008a, 2008b).

Finally, to compare anthropometric indicators to conventional welfare proxies, consider Table 18, which has been adapted from Schwekendiek (2009a) showing typical standard of living indicators for selected countries around the year 2000. For comparative purposes, beside self-suggesting South Korea, China was selected as being another country under socialism, Bangladesh because it is a similar undeveloped country in Asia, and Japan and the USA as typical benchmarks for developed nations. What can be seen is that chronic child malnutrition is quite well corresponding to GDP per capita. As chronic child malnutrition is based on height measurements, stature becomes a better socioeconomic indicator compared to life expectancy or infant mortality, which are actually found to be too good (hence, subject to fine-tuning) for the DPRK, which was characterized by famines and economic collapse at that time — especially compared to China or Bangladesh. More importantly, many standard indicators like unemployment rates or the Human Development Index (HDI) introduced by the United Nations — a composite indicator of life expectancy, educational attainment, and GDP per capita — are frequenlty not available for the DPRK because of the aforementioned statistical void of the DPRK. Finally, "soft" indicators like literacy or liberty do not necessarily indicate Maslowian primary needs like malnutrition indicators do. Also, literacy in socialist countries like the DPRK reflects the degree of political indoctrination

Table 18: Human Welfare Indicators for Selected Countries Around Year 2000

Standard of Living Indicator	*North Korea*	*South Korea*	*China*	*Bangladesh*	*Japan*	*USA*
Economy						
GDP per capita, 2000	1379	15702	4002	1851	23971	34365
Unemployment, 1997	n/a	2.7	3	n/a	3.2	5
Health						
Infant mortality, 1999	23	5	33	58	4	7
Life expectancy, 1999	73	73	70	59	80	77
Chronic child malnutrition in percent, 2000	45.2	n/a	14.2	44.6	5.6 (1978–1981)	2.0 (1988–1994)
Education						
Adult literacy rate, Index, 1999	100	99	84	56	n/a	n/a
Composite Indicator						
Human Development Index, 1999	n/a	0.890	0.730	0.510	0.939	0.940
Political Liberty						
Democratization, 2000*	-9	8	-7	6	10	10

Notes: *A rating of 10 indicates the highest degree of democracy and -10 the least amount of democracy.
Source: Schwekendiek (2009a); Pennwordtables 6.2; World Bank; UNICEF (2001); Freedomhouse; Polity IV; UNDP (2006).

rather than being a manifestation of the universial right for education — hence, also showing the limitations of such secondary indicators compared to physiological ones. For all these reasons, malnutrition indicators — commonly based on anthropmoetric measurements — do evidently quite well reflect the level of living in the DPRK.

3.3 Sources

Impressively enough, 25 studies gathered anthropometric information of North Koreans, which is indeed quite a high number considering an otherwise statistical terra incognita. An overview of anthropometric surveys was given in Schwekendiek (2009f). Table 19 summarizes findings from Schwekendiek (2009f) and Norton and Wallace (1997), as well as some additional information (Centers for Disease Control and Prevention, 1997; Chang, 2003; Pak, 2004a; Pak et al., 2009; Pietri, 2003; Schwekendiek and Pak, 2009). About 20 of these anthropometric studies were conducted during the food crisis of the 1990s to investigate the prevalence of malnutrition through anthropometric measurements. Whereas the large majority of these studies is based on only a few dozens of individuals, only nine studies were characterized by a sample size of over 1,000 individuals. Most of the smaller studies were also only conducted in one out of twelve North Korean provinces. What can also be seen in Table 19 (pages 102-103) is that almost all studies which were carried out in the 1990s targeted children, whereas afterwards anthropometric studies also focused on North Korean adults — often including mothers of surveyed children or adult North Korean refugees starting to cross the border in large numbers in the late 1990s.

In spatial terms, surveys fall into two categories: surveys conducted inside the DPRK, and surveys conducted among North Koreans staying abroad — either in China or South Korea. Mid-upper arm circumference measurements or just visual inspections were sometimes made instead of recommended height and weight measurements. This is because eyeball inspections or mid-upper arm circumference measurements can be done faster and under extreme circumstances (to collect mid-upper arm circumference measurements, all you need is one person with a tape measure in his pocket). For instance, if researchers wanted to assess the anthropometric status of North Korean refugees who were illegally residing in China, or if the government was opposed to measuring individuals in institutions, such quick anthropometric checkups could have been used instead of commonly recommended height and weight assessments. For the sake of completeness, I left these surveys in the anthropometric overview (Table 19), but all surveys drawing upon large sample sizes or representative of several regions are based on common height and weight measurements.

The earliest known anthropometric assessment was conducted in 1987, hence during the Cold War and prior to the onset of the famine. This survey was already discussed

Table 19: Overview of Anthropometric Surveys in North Korea

Date of Measurement	*Agency or Researcher*	*N*	*Group*	*Province*	*Anthropometry*
1987	DPRK (Institute of Child Health)	3095	Children	Kangwon	Height, weight
1991	DPRK	n/a	Children	N. Pyongan	Height, weight
Oct 1995	WHO	134	Children	N. Hwangae, Chagang, N. Pyongan	Mid-upper arm circumference
1996	DPRK (Ministry of Public Health)	ca. 2 Mio.	Children	All	n/a
Mar 1997	European Commission's Humanitarian Aid Office	n/a	n/a	n/a	Mid-upper arm circumference
Mar 1997	European Commission's Humanitarian Aid Office	n/a	Children	N. Pyongan	n/a
Apr 1997	Centers for Disease Control	9	Children	N. Pyongan	Height, weight, visual inspection
Apr 1997	UNICEF	18	Children	Chagang	n/a, visual inspection
Jun 1997	DPRK (Ministry of Public Health)	n/a	Children	n/a	n/a
May 1997	International Federation of Red Cross and Red Crescent Societies	230	Children	n/a	Visual inspection
Jul 1997	World Vision	52	Children	n/a, 19 counties in 4 provinces	n/a
Jul 1997 to Aug 1998; Jan 2000	North Korean Famine Study Group (S. Pak)	55	Children	n/a	Height, weight, mid-upper arm circumference, subcutaneous fat thickness
Aug 1997	UN (WFP)	3984	Children	S. Pyongyang, S. Hamgyong; S. and N. Hwanghae, Kangwon	Height, weight
Jul to Sep 1998	Johns Hopkins School of Public Health	440	Adults	N. Hamgyong (78 percent), S. Hamgyong (12 percent)	Mid-upper arm circumference
Sep to Oct 1998	EU (ECHO), UN (WFP, UNICEF), DPRK	1762	Children	All but Kaesong	Height, weight, birth weight (only children <5 years)
Jul to Sep 1999	Johns Hopkins School of Public Health	381	Adults	N. Hamgyong (73 percent), S. Hamgyong (10 percent)	Mid-upper arm circumference
Jul 1999 to Jun 2000	Johns Hopkins School of Public Health	2692	Adults	N. Hamgyong, (">80 percent," no details)	Mid-upper arm circumference
Sep 1999 to Oct 1999	Action Contre La Faim	582	Children	N. Hamgyong	Height, weight

Date of Measurement	*Agency or Researcher*	*N*	*Group*	*Province*	*Anthropometry*
1999–2003	S. Pak	2667	Adults and children	All	Height, weight
1999–2007	S. Pak, D. Schwekendiek, H. Kim	6512	Adults	All	Height
1999–2007	D. Schwekendiek, S. Pak	135	Children	All	Height, weight, body mass index
May 2000	DPRK (Central Bureau of Statistics)	3600	Children	All	Height, weight
Oct 2002	UN (WFP, UNICEF), DPRK	6000	Children, mothers	All but Kaesong and Chagang	Height, weight, mid-upper arm circumference of mothers
n/a (published in 2003)	N. Chang	n/a	Adults	n/a	Height, weight
Oct 2004	UN (WFP, UNICEF), DPRK	4800	Children, mothers	All but Kaesong, Nampo, Chagang and Ryangang	Height, weight, mid-upper arm circumference of mothers

Source: Schwekendiek (2009f); Norton and Wallace (1997), Chang (2003); Pak (2003); Pak (2004a); Schwekendiek and Pak (2009); Pak et al. (2009).

previously (Figure 8, Chapter 2). Interestingly, although anthropometric issues have been a source of major concern by Kim Il-Sung since the 1970s, no systematic survey had been carried out until then. One reason for this could have been that the DPRK was largely lacking experts and know-how to carry out such assessments. As previously mentioned, because it stopped releasing statistics in the 1960s, trained statisticians and data collection teams have largely been lacking in the DPRK. Although the survey carried out in 1987 was published by the North Korean Institute of Child Health—hence by a government authority—it was largely implemented under the assistance of an Australian professor of nutrition (Smith, 2004)—somewhat indicating that lack of technical knowledge could have been an explanation for not having conducted an anthropometric-based nutritional survey earlier.

The latest anthropometric survey was conducted in October 2004. Even though further nutritional surveys (collecting anthropometric data) were announced by the government from 2004 to 2006 (DPRK and UNICEF, 2004), none has been implemented after 2004. Perhaps one reason this has not happened was that the next nutrition survey was supposed to be conducted in 2006, as previous surveys from 1998 to 2004 were scheduled on a biennial basis. Moreover, previous assessments were conducted in the fall of the respective years. However, on October 9, 2006, the DPRK tested its first nuclear bomb. Already in late summer 2006, some Westerners told me that they could not receive a visa for the DPRK in that year—suggesting that the government might have denied access to foreigners at that time in anticipation of the test. More importantly, around 2005, the DPRK closed down most UN offices, arguing that the food crisis was

over, which significantly reduced the number of international personnel in the DPRK. Ever since then, international organizations in the DPRK have been badly lacking staff to implement another large nutrition survey. Lastly, in 2008, the second national census (which collected demographic but no anthropometric data) was conducted in the DPRK under the supervision and assistance of the United Nations Population Fund (UNFPA), which might have likewise lowered Pyongyang's willingness to carry out an additional nutritional survey inside North Korean households in 2008 and thereafter.

Among surveys conducted inside North Korea, five international surveys were conducted under the assistance of the United Nations. The first survey was carried out by the United Nations World Food Program in 1997 in 40 child-caring institutions and is extensively discussed elsewhere (Katona-Apte and Mokdad, 1998; Schwekendiek, 2008b). It is the first international survey that measured a large number of individuals (almost 4000), and remains one of the largest anthropometric surveys on the DPRK up to date (Table 19). However, it was characterized by a few drawbacks. First, height and weight were measured in institutions and not households — thus, children too sick or hospitalized because of nutritional stress could not be measured systematically. Second, only 5 out of 12 provinces were selected — as distinct from follow-up UN-assisted nutritional surveys that cover most provinces. Third and last, all institutions were preselected by the government. Whether or not the government did this to manipulate the degree of child malnutrition at that time is not known. Though World Food Program director Catherine Bertini pointed out, "It is not the random sample we had hoped to carry out" (Emergency Nutrition Network, 1998), Bennett (1999) argued that the government had true interests to reveal the extent of the food crisis, but technical pride, misunderstanding and political reasons (including military concerns) might have been the reasons for denying a random survey. Moreover, as argued in Schwekendiek (2008b), a completely "whitewashed" sample would not have been in the interest of the dictator: extremely low prevalence of child malnutrition would have questioned the urgency of the delivery of needed food aid, while extremely high prevalence of child malnutrition would have been too embarrassing for the regime. Hence, probably average institutions were selected which would imply that mean anthropometric heights and weights collected were not biased too much at that time. As suggested in Schwekendiek (2009h), a major concern by the government could have been that the international survey teams were staying too long inside the country, particularly considering that the reclusive regime allowed a comprehensive international survey on its territory for the first time in its 50-year history. Therefore, primarily institutes which could be reached within a reasonable amount of travel time seemed to have been selected at that time to facilitate implementation and minimize contact with locals (Schwekendiek, 2008b).

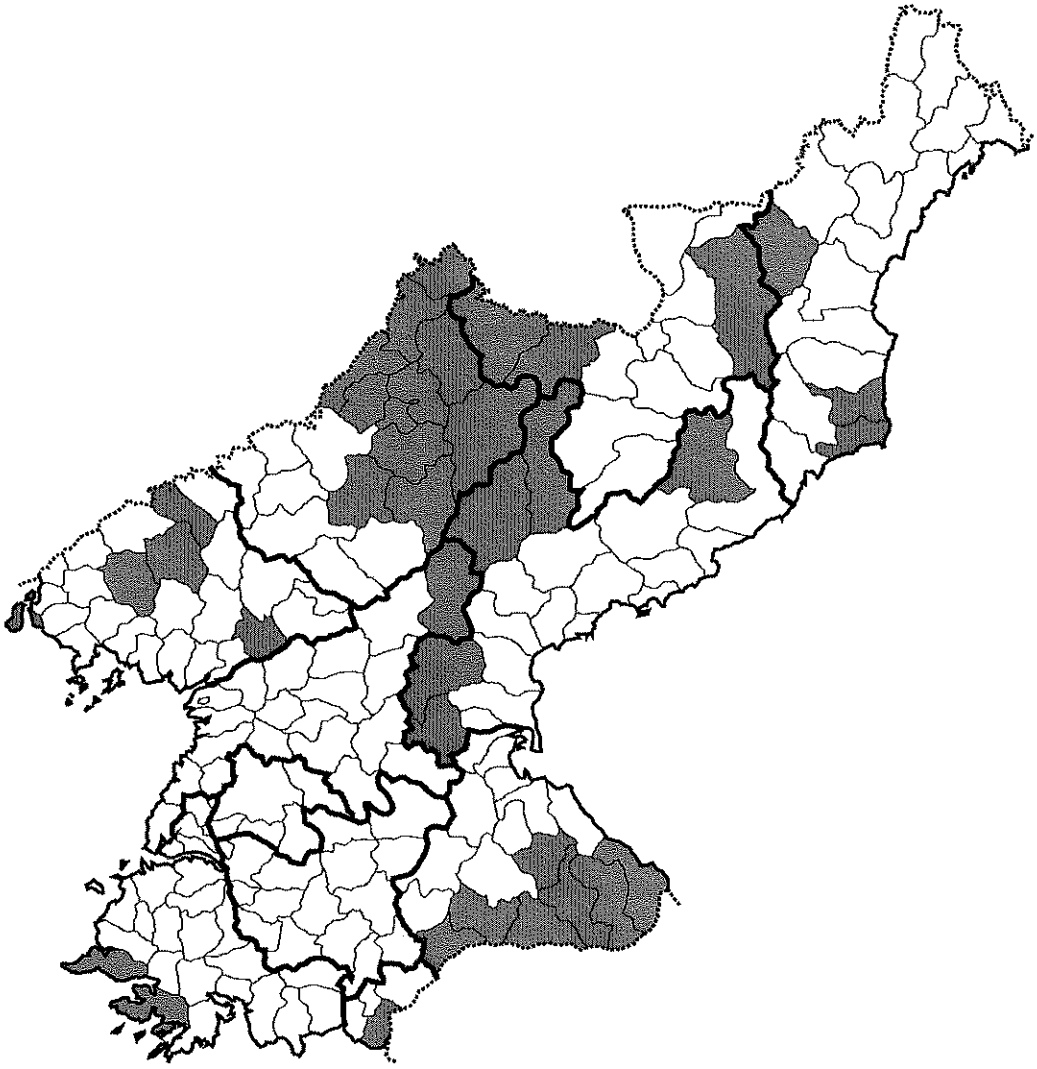
After 1997, four follow-up surveys were conducted under the assistance of United Nations agencies in 1998, 2000, 2002 and 2004 (CBS, 2000, 2004; CBS et al., 2002; EU et al., 1998; UNICEF, 1998, 1999). However, only the 1998 and 2002 surveys were

also monitored by international staff. In the remainder, United Nations staff only assisted in training and preparation of the survey. Yet, as previously discussed, this does not necessarily mean that the government manipulated the survey and findings. In fact, results reported by the DPRK in 2000 were quite plausible compared to internationally observed surveys conducted before and afterwards (Figure 8, Chapter 2). Unfortunately, the 1998 and 2002 surveys that were internationally monitored were not fully representative for the country. This is because some counties were declared inaccessible by the North Korean military because of security concerns. Inaccessible counties as of December 2002 are shown in Figure 16 based on information published in UNICEF (2003). As population in the accessible areas was reported to be about 20 million in 2002 (Schwekendiek, 2009b), about 2 million of the population (estimated at about 22 million) are believed to live in these inaccessible areas. Whether or not dwellers living in there were worse off during the famine is not known. There are contradictory results for this. For example, height of male adults was reported to be the second tallest and mortality rates reported from 1995 to 1998 the third lowest in Ryanggang province, indicating that living conditions were among the best in this mostly inaccessible province compared to the rest of the nation (Table 3, Chapter 2). However, chronic malnutrition rates of children and mortality rates in 1993 were paradoxically reported to be among the highest. The main problem for a meta-analysis of this issue is that the government does not make any data available on these classified counties. Besides nutritional and anthropometric data, also agricultural and demographic statistics have been excluded by the government when handing in data to other UN agencies such as the Food and Agricultural Organization or the United Nations Childrens' Fund. Worst of all, even anecdotal evidence is largely lacking, as pointed out by a United Nations representative in the DPRK: "We are absolutely refused access. We cannot pass through those [inaccessible] areas in transit to somewhere else. So we simply don't go there at all" (Committee on International Relations, 2002).

Besides the five large UN-assisted surveys, the DPRK started to make its own anthropometric investigations after the pioneering survey co-assisted by a Western researcher in 1987, including a smaller survey in 1991 in North Pyongan and a comprehensive survey conducted by the North Korean Ministry of Public Health among all children aged less than five in 1996. However, the government never released any data or official reports of these assessments, and it even refused to report cut-offs or indicators used to assess malnutrition in these surveys. Therefore, these surveys have largely been discarded by international researchers when discussing the levels of living for North Korean children in the 1990s.

Furthermore, refugee surveys offer anthropometric evidence. Four anthropometric studies were collected among refugees in China (Pak, 2003; Robinson et al., 1999; Robinson et al., 2001a; Robinson et al., 2001b), and four among refugees in South Korea (Chang, 2003; Pak, 2004a; Pak et al., 2009; Schwekendiek and Pak, 2009). The

Figure 16: Inaccessible* Counties in 2002



Notes : gray = inaccessible county, white = accessible county.
*As declared by the North Korean military for security concerns.
Source: Based on UNICEF (2003): 4.

studies conducted in China are not frequently referred to in anthropometric research because they either were based on small sample sizes, or did not collect common height and weight measurements but mid-upper arm circumference (MUAC) measurements. As discussed above, MUAC measurements are a quick way to assess the nutritional status of individuals since only a tape measure is required; however, this indicator is just taken as a rough proxy for height or weight — hence, it represents only a supple-

mentary indicator. Above all, the major drawback of these refugee surveys is the self-selection of individuals: by definition, no refugee acts voluntarily, so some individuals might have had stronger incentives to escape than others. However, socioeconomic biases (in turn affecting height and weight) might largely cancel out each other: on the one hand, better-off individuals can be supposed to have escaped abroad. For instance, a household might send out the strongest member of the family to obtain food in China or remit money from South Korea. Moreover, brokers have to be paid and border controls sometimes bribed, suggesting that rather better-off North Koreans can escape. Also, rather healthy and physically robust North Koreans will be able to cross the Sino-Korean border. On the other hand, it can be reasonably assumed that only the economically most desperate attempt to defect. Specifically, the hungry will risk the venture to escape — including the possibility of being executed or sent to a concentration camp. For all these reasons, though North Korean refugees might not be fully representative for the nation, they nevertheless seem to come from all social strata. Indeed, an analysis of the socioeconomic profile of North Korean refugees entering South Korea revealed that this is the case: refugees come from all social strata, from lowest to highest (Pak et al., 2009), and — as previously mentioned — the educational status of North Korean refugee women and randomly selected North Korean females in North Korea were found to correspond almost perfectly to a random population sample (Schwekendiek, 2009h).

In summation, there is no fully representative anthropometric survey conducted by the United Nations or any other international organization in the DPRK up to now. However, this does not mean that the present UN-assisted anthropometric studies are flawed, as only a small proportion was living in these inaccessible areas, and because this subpopulation might not necessarily be better off or worse off than the rest of the population. In a similar vein, refugee surveys conducted in South Korea may not be fully representative for the North Korean population due to the self-selectivity of the respondents; however, such assessments seem to be good enough for an anthropometric analysis because all social strata are reflected in these surveys, and because these surveys are based on large sample sizes, allowing the estimation of reliable anthropometric means. Most importantly, in any event, anthropometric assessments are a more reliable source of data and have also more regularly been carried out than any other socioeconomic data collected in the DPRK — hence, they remain the first-best solution in applied research to investigate living standards in the DPRK.

What is important to note is that raw height and weight measurements of anthropometric surveys were often not made public in the official nutrition reports. However, based on raw datasets and extra information stemming from the UN co-conducted surveys in 1997, 1998 and 2002, as well as based on the refugee surveys conducted South Korea (Chang, 2003; Pak et al., 2009; Schwekendiek and Pak, 2009), I have summarized basic anthropometric findings of North Korea in the next chapter.

3.4 Evidence

The aforementioned statement that "the average South Korean is three inches [7.6 cm] taller than the average North Korean" during the Obama-McCain U.S. presidential debate in 2008 triggered a debate in the media afterwards as to whether or not this statement is true. Journalists from the *Wall Street Journal* or the *New York Times* reported on this by either referring to my North Korean household-based study (Schwekendiek, 2009e), or by citing my postdoctoral supervisor's refugee study (Pak, 2004a).[36] The statement on the height gaps is true if related to children but not really to adults. On average, the former study found that North Korean children were 7–8 cm (hence 2.76 to 3.15 inches) shorter than their Southern peers (Schwekendiek, 2009e), whereas the latter study (Pak, 2004a) found that adult North Koreans were about 6–7 cm (thus 2.36 to 2.76 inches) shorter than their South Korean counterparts — hence the study based on adults is closer to 2 than 3 inches, whereas the study among children is closer to 3 inches. A McCain spokesman, unfortunately, did not respond to a request to specify the source of the claim during the presidential debate.[37] Either way, the widespread media attention to this topic showed two things: first, anthropometric gaps between the two Koreas are of considerable political and public interest; and second, whether adults or children should be taken as the reference for socioeconomic differences is actually not a trivial matter. Indeed, as previously seen, height is — among other factors — greatly dependent on living conditions in the first years of life. Thus, considering North Korean children measured during the 1990s proxies the environmental impact of the food crisis, whereas taking North Korean adults escaping in the 1990s proxies underlying living conditions during the decades of the Cold War.

An overview of anthropometric differences between the two Koreas is given in Table 20 and Table 21. Results are stratified by sex and age, where roughly five-birth year cohorts were applied. Data are partially based on an anthropometric meta-analysis conducted by Schwekendiek and Pak (2009), borrowing from raw data and published statistics of other studies (Chang, 2003; Pak et al., 2009; Schwekendiek, 2008b, , 2009e). What can be seen is that Korean-Korean height differed between 4 to 8 cm for preschool boys and 3 to 8 cm for preschool girls — where South Koreans were found, as expected, to be taller than North Koreans. In a similar vein, weight between the two Koreas differs by 1–3 kg for preschool boys and also by 1–3 kg by preschool girls. An extreme outlier to these studies is Eberstadt (2007) making use of data derived from the 1998 nutritional survey (EU et al., 1998; UNICEF, 1998) and finding double-digit anthropometric differences between the two Koreas: 7-year-old South Korean boys were found to be 20 cm taller and a 10 kg heavier than their North Korean age peers (Table 20).

Why do the anthropometric data of 1998 indicate such an extreme outlier? There are three explanations for this: socioeconomic reasons, age-specific effects and the pos-

Table 20: Height and Weight Gaps of Males in the Two Koreas

Survey Males	*Age in Years*	*Measurement Period*	*Provinces*	*South-North Height Gap in cm*	*South-North Weight Gap in kg*
UN-assisted survey	1 to 5	1997	5 of 12	6	3
UN-assisted survey	1 to 5	2002	10 of 12	8	3
Refugee survey	1 to 5	1999–2007	12 of 12	4	1
UN-assisted survey	7	1998	11 of 12	20	10
UN-assisted survey	20 to 24	2002	10 of 12		
UN-assisted survey	25 to 29	2002	10 of 12		
UN-assisted survey	30 to 34	2002	10 of 12		
UN-assisted survey	35 to 39	2002	10 of 12		
UN-assisted survey	40 to 49	2002	10 of 12		
Refugee survey	20 to 29	n/a (1995 for South Korea)	n/a	6	7
Refugee survey	20 to 24	1999–2007	12 of 12	8	
Refugee survey	25 to 29	1999–2007	12 of 12	7	
Refugee survey	30 to 34	1999–2007	12 of 12	5	
Refugee survey	35 to 39	1999–2007	12 of 12	5	
Refugee survey	40 to 49	1999–2007	12 of 12	3	

Source: Schwekendiek and Pak (2009); Pak et al. (2009); Eberstadt (2007); Chang (2003).

Table 21: Height and Weight Gaps of Females in the Two Koreas

Survey Females	*Age in Years*	*Measurement Period*	*Provinces*	*South-North Height Gap in cm*	*South-North Weight Gap in kg*
UN-assisted survey	1 to 5	1997	5 of 12	7	3
UN-assisted survey	1 to 5	2002	10 of 12	8	3
Refugee survey	1 to 5	1999–2007	12 of 12	3	1
UN-assisted survey	7	1998	11 of 12		
UN-assisted survey	20 to 24	2002	10 of 12		4
UN-assisted survey	25 to 29	2002	10 of 12		5
UN-assisted survey	30 to 34	2002	10 of 12		6
UN-assisted survey	35 to 39	2002	10 of 12		7
UN-assisted survey	40 to 49	2002	10 of 12		9
Refugee survey	20 to 29	n/a (1995 for South Korea)	n/a	5	4
Refugee survey	20 to 24	1999–2007	12 of 12	6	
Refugee survey	25 to 29	1999–2007	12 of 12	4	
Refugee survey	30 to 34	1999–2007	12 of 12	3	
Refugee survey	35 to 39	1999–2007	12 of 12	2	
Refugee survey	40 to 49	1999–2007	12 of 12	1	

Source: Schwekendiek and Pak (2009); Pak et al. (2009); Schwekendiek (2009e); Chang (2003).

sibility of human error. First, the 1998 nutritional survey found the highest rate for chronic child malnutrition among all surveys ever conducted in the DPRK. At that time, 62 percent of the children were found to be stunted—a rate considerably higher than in 1997 and 2002, when only 38 percent and 39 percent of the children were

found to be stunted. Hence, if children were more frequently found stunted in growth (as mentioned, based on cut-off criteria defined by the WHO since the 1970s), they will on average also be shorter in 1998 compared to 1997 and 2002. This would explain why the study of 1998 is an outlier, but it would not explain why it is such an extreme outlier, as socioeconomic living conditions in 1997 and 2002 might not have drastically differed from 1998.

Second, short stature of pre-school children was found to become more pronounced with age: the more crisis years children were exposed to during the 1990s, the more stunted in growth they became as nutritional stress accumulated over the years in their height. For instance, cohorts born in the years before the Great Famine were found to be significantly better off, but those born during the famine years became increasingly shorter relative to a healthy reference population (Schwekendiek, 2009g). The major difference between the study employing data from 1998 and the other studies conducted among children is that the former is based on 7-year-old children and the latter limit themselves to ages 1 to 5. Note that the reason why the other studies on preschool children shown in Table 20 and Table 21 are limited to these age ranges is that the minimum-age-in-month and maximum-age-in-month differed across the surveys. As a common denominator of all sources of surveys, anthropometric data of 1-to-5-year-old preschool children was shown in Schwekendiek and Pak (2009). Anyhow, because stunting and underweight increased with age during the food crisis of the 1990s, 7-year-old North Korean children (compared to South Koreans) become shorter and lighter than 1-to-5-year-old North Korean children (compared to South Koreans). Hence, a higher anthropometric gap reported by Eberstadt (2007) is plausible because of more cumulated nutritional stress.

Third and last, the extreme height and weight gap between the two Koreas in 1998 could be a result of human error. According to official survey reports released by the DPRK and UN agencies, children measured in 1998 were "six months to seven years of age" (EU et al., 1998; UNICEF, 1998), where the figure reported by Eberstadt (2007) refers to the oldest measured age group of children as being 7 years of age. However, in the UN-assisted survey in 2002, "children aged under seven" (CBS et al., 2002); and in 1997, "children < 7 years of age" (Katona-Apte and Mokdad, 1998) were measured. Thus, children UNDER 7 years of age were measured in 1997 and 2002 (to be precise, they were at the most 6 years, 11 months and 30 days old). In decimal form, children were at maximum 6.99 years of age in 1997 and 2002 — but still just 6 years and not 7 years old! Why were children in 1998 unexpectedly measured up to the age of 7 years (hence 7.00 to 7.99 years) instead of up to 6 years of age? A natural explanation could be that the oldest children measured in 1998 were in fact also just 6 years of age, but an encoder made a mistake by generating an age variable where he used rounded years instead of decimal age. Note that age was not assessed directly during the survey, but was calculated indirectly afterwards by subtracting measurement date from birth

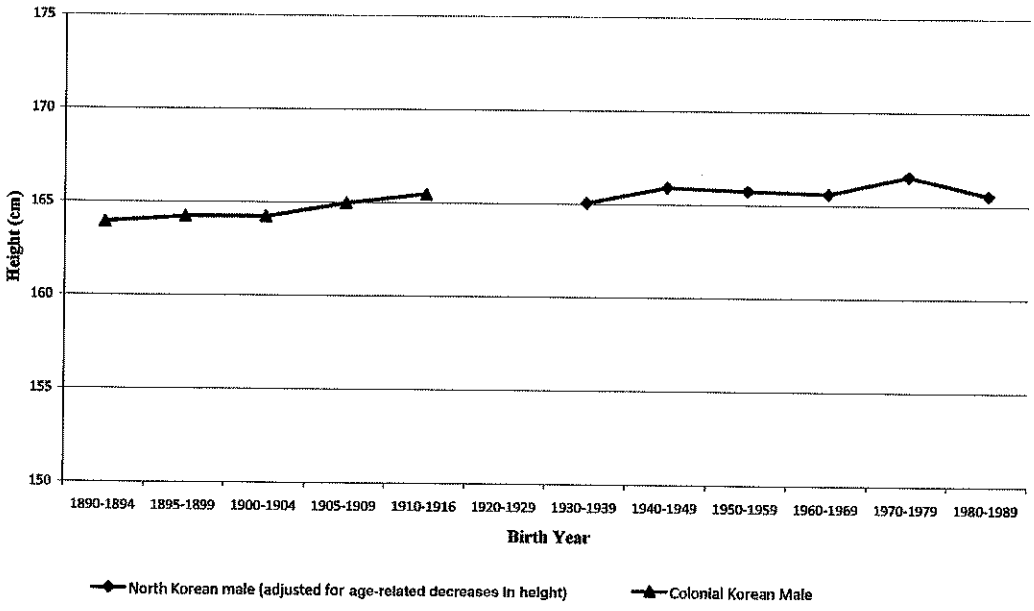
date. Thus, children 6.50 to 6.99 years of age could have been classified as 7 years old (7.00 to 7.99) children, though in fact they were only 6 years old. Note that this would not affect the officially reported malnutrition rates, as these are calculated from the exact date of birth and date of measurements. The crux with the 1998 survey data is that they have never been released to external researchers. Whereas the 1997 and 2002 raw data have been further analyzed by me and other independent researchers (Katona-Apte and Mokdad, 1998; Schwekendiek, 2008a, 2009e; Shrimpton and Kachondham, 2003), the 1998 raw dataset has never left North Korea. To my knowledge, the only independent researchers that accessed parts of the 1998 survey results are Eberstadt (2007), as discussed, using height, weight and age data; and Goodkind (1999) analyzing sex-specific malnutrition rates from the survey. Yet, the full dataset has never been submitted for an independent analysis. A probable reason for this could be that the government might have felt politically too much embarrassed about that survey, as it found the highest prevalence of chronic malnutrition compared to the other surveys. Hence, the DPRK, co-owner of the dataset, might have declined independent analysis of these data. Because raw data remain inaccessible, it is difficult to verify the human-error hypothesis for the height and weight data. Assuming that children were indeed at maximum 6 years of age in 1998 (similar to 1997 and 2002), the anthropometric statistics shown by Eberstadt (2007) and reported in Table 20 would have compared the weights and heights of 7.00- to 7.99-year-old South Korean boys to 6.50- to 6.99-year-old North Korean boys (mistakably rounded to 7 years of age)—which would partially explain why height and weight gaps were found much higher in 1998 compared to the other studies. Perhaps, because of a combination of all three aforementioned factors, anthropometric gaps in 1998 were found drastically differing from all other UN-assisted surveys and refugee studies conducted among preschool children.

Furthermore, height gaps among adults were found at 3 to 8 cm among women and 1 to 6 cm among men. Weight gaps of men were reported to be 7 kg, and for women 4 to 9 kg (Table 20). Note that height and weight gaps estimated by North Korean refugee children and refugee women are based on North Koreans entering and being measured in South Korea on their arrival. Their anthropometric measurements are lower than those measured inside because of catch-up growth and nutritional improvement abroad since the majority of refugees have stayed for several months in China or other transit countries before arriving in Seoul. However, adult North Koreans should not be affected by this because they were raised inside the DPRK, hence height (though not weight) levels and trends of terminal height indicate living standards inside the country. Stature of Korean men were plotted by birth periods. Figure 17 depicts the height of colonial Koreans by making use of data borrowed from Choi and Schwekendiek (2008) to show the level and height trend in Korea before the political separation of the nation. Data are based on males only (because female data have not been reported from that source of data), but include a roughly equal proportion of people living in

the Southern and Northern parts of the peninsula. Data for North Koreans, taken from Pak et al. (2009), were added in Figure 17. Because adult height starts to decrease after age 40 due to aging effects, original terminal height was re-estimated by making use of a transformation technique frequently used in economic history. Additionally, South Korean height was plotted from information published by the Korean Agency for Technology and Standards (2004) for an anthropometric comparison between the two Koreas. As the South Korean data have not been available for this research, adjustments for age effects could not be made with the sample.

Figure 18 depicts the height trends of age-effect unadjusted heights in the two Koreas. Reasonably assuming that the shrinking effects will roughly be uniform in the two Koreas, a direct comparison might be made, yet, the reported levels cannot really be compared to Figure 17 (adjusted height). What can be seen in Figure 17 is that (adjusted) height of male Koreans merely stagnated around 165 cm in the late 19th century. In the 1930s, still under Japanese rule, (adjusted) height of North Koreans was still found at about 165 cm, indicating that their biological living standards had not much increased in colonial Korea (Figure 17). Interestingly, Northern Korean males were even found slightly taller than their Southern Korean age peers (Figure 18)—a result corroborated by Kimura (1993), finding that adults in the north of the peninsula were about 1.1 to 1.4 cm taller than in the south of the peninsula during colonial rule. Furthermore, (adjusted) height of adult North Korean males largely stagnated after the

Figure 17: Height Trend in Korea



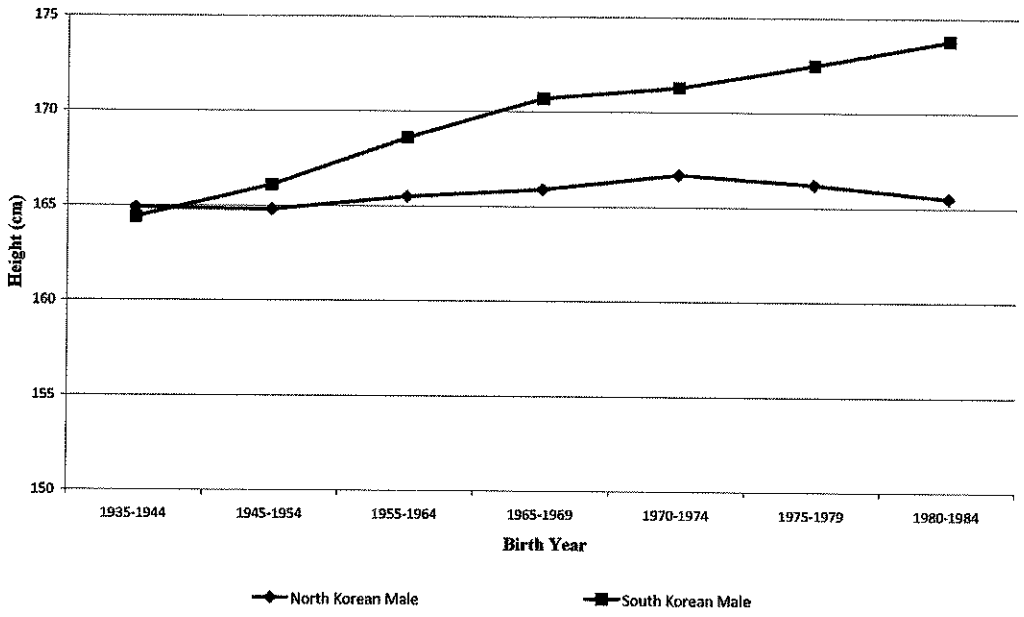
Source: Based on Choi and Schwekendiek (2008); Pak et al. (2009).

political formation (Figure 17). In the 1980s, North Korean men were on average about the same height as their age peers born after the political foundation of the DPRK. Hence, biological living standards had not improved within four decades of socialism — a quite embarrassing result for a regime promising to raise the living standards of the common people.

More importantly, these stagnant anthropometric statistics of North Korea also underline what was previously said about the nutritional and medical welfare status of the DPRK: North Koreans raised during the Cold War probably had the same quality and quantity of food and received the same health provisions as those living before the political formation (Figure 17). Though height of adult North Koreans born during the 1990s is not available (because these cohorts have not yet reached their terminal height), it can be reasonably expected that average height of North Koreans born in that decade might have even decreased to a certain extent because of the Great Famine (whereas that of South Koreans will have further increased as South Korea's economy started booming in the 1990s). This being the case, North Korea's long-term anthropometric performance would even look bleaker.

Furthermore, as seen in Figure 18, the North Korean height slightly increased from the late 1960s (which was followed by an equal decline after the 1970s). As discussed in a later section of this book, the 1960s were North Korea's golden years, when the economy boomed and production quotas were overfilled. Yet, ever since the political

Figure 18: Height in the Two Koreas



Source: Based on Pak et al. (2009).

foundation of the DPRK in 1948, North Koreans have never been found taller than their South Korean counterparts (Figure 18)—indicating that living standards under socialism have always been worse than in the free-market oriented southern part of the peninsula. As noted in my other work (Pak et al., 2009), this finding also clearly contradicts the popular belief that North Koreans fared better in the early years after the political formation—on the contrary, the moment the two Koreas split, height of North Koreans fell below that of South Koreans (Figure 18).

Finally, what can be also seen is that height of South Koreans has remarkably and steadily increased in a few decades (Figure 18)—a result also found in other studies on the secular trend of heights in South Korea (Gill, 1998; Schwekendiek, 2006).

In summation, whereas Northerners were slightly taller than Southerners in colonial Korea, the situation reversed after the political formation of the two Koreas. Whereas a remarkable secular growth spurt of height occurred in South Koreans, North Korean height rather stagnated during that period, hence, height gap between the two Koreas became more pronounced in time. As height is a sensitive indicator for the underlying environment in early life, it is safe to say that nutrition, health and socioeconomic living conditions did not become better in socialist North Korea from the 1940s to the 1980s, yet these factors have obviously greatly improved in market-oriented South Korea during the same period. Because this comparison was limited to the Korean peninsula, which was for centuries a homogenous nation, genetic influences—often and mistakably assumed to be a monocausal factor by newcomers to anthropometric research—cannot have caused this result.