Is Reunification the Answer to Low Fertility in South Korea?
Lessons Learned from German Reunification

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South Korea experienced below replacement fertility for the first time in 1983, which continued to decline over the next 20 years until it reached 1.2 in 2003 and has remained near that level ever since. In spite of recent pronatalist policies such as Saero-Maji and Vision 2020, fertility has not increased appreciably. The reasons for sustained low fertility in South Korea are complex and solutions remain elusive. One option that has been suggested is that reunification with North Korea could solve the eventual decline in the population.

This paper examines current fertility and mortality trends in the two Koreas and prepares population projections for 2015-2050 for a reunified country. Although the conditions surrounding the German reunification experience were vastly different than what Korea will likely undergo, it is informative to look at Germany as a guide to the demographic parameters of reunification.

Projections from South Korea and data from the 2008 North Korea census are used for this analysis. Three models are presented, using three sets of assumptions. Even the highest fertility models show that reunification will not be the answer to population restructuring already underway in South Korea as a result of sustained low fertility.
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South Korea reached below-replacement fertility in 1983 and the implications of low fertility have been a concern since that time. By 2005 the total fertility rate (TFR) had declined to 1.076, but it rebounded to 1.3 in 2012 (KOSIS 2013). As seen in Figure 1 the sustained low fertility has resulted in a population distribution with a bulge in the middle section, but by 2050 the population is expected to be weighted heavily toward the elderly (Figure 2). Options for increasing fertility include protanalist policies or increasing immigration, but to date neither one has had a positive effect in increasing fertility (Stephen 2011).

The trend of extremely low fertility has not been evident in North Korea where the total fertility rate in 2008 was estimated to be 2.01, based on the 2008 Census, and has remained at that level up through 2013 (UNFPA 2010; US Census Bureau 2013). The total fertility rates over time are shown for the two countries in Figure 3.

Another option for increasing fertility in South Korea would be reunification, which would result in a larger population base and a larger population in the reproductive years. But would reunification really solve the low fertility dilemma? And what of the complex social, political, and economic considerations of reunification?

Although familial ties and history could reunite the Korean continent that has been divided for more than six decades, the two countries have been following two very distinct paths in terms of social, political, economic and demographic structures (Cha 2012). There are so many unknowns that will surely determine the circumstances of the reunification, including the potential for violence, conflict, and humanitarian suffering. In conjunction with the unknown timing of reunification, the devastation of potential conflict and loss of life is impossible to comprehend.
There are many caveats to mentioning the reunification of Germany in the same paragraph as that of Korea. First, although West Germany was far more economically advanced than East Germany, the differences were small compared to North and South Korea. Second, North Korea does have more natural resources than did East Germany, with North Korea having has much as 30 times the known mineral deposits as South Korea (Yoon 2011), which may be worth trillions of dollars although property rights are unclear (Noland 2013). Third, although each country in Central and Eastern Europe who experienced the collapse of the Communist bloc experienced it as a unique country, there was a massive change in the geopolitics of the entire region, whereas a reunification of Korea will almost assuredly happen without any concomitant geopolitical changes in nearby countries. Fourth, West Germany had four times the population of East Germany at the time of reunification, whereas the South Korean population was twice that of North Korea as of 2008. The Korean ratio of 2:1 could potentially result in North Koreans having a greater influence on demographic behavior in a reunified country than was evident in Germany with a ratio of 4:1. Fifth, the political elites in East Germany were not as adverse to the reunification as surely would be the North Korean ruling elite (Klug 2012); the rigid songbun system in North Korea dictates nearly all aspects of life including everything from marriage partners to daily caloric intake (Collins 2012).

The literature comparing Germany before and after unification tends to describe it as a “natural experiment,” which gives social scientists an opportunity to study the effect of a major societal revolution on the demographic behaviors and attitudes of citizens and the complexities of the process (Conrad et al. 1996; Giesen and Leggewie 1991; Goldstein and Kreyenfeld 2011). Conrad et al. (1996:341) characterize it as, “What makes the East German experience unique is the radical transformation of the institutional, economic, and psychological environment in which decisions about family formation and fertility are made. Given such sweeping changes, it is difficult, if not impossible, to identify a single explanatory factor for the shift in fertility behavior.” If that
was the case for East Germany, we expect that reunification of the Koreas will be unsettling, in the
best of circumstances, particularly for North Koreans. No one expects the Korean reunification to
mirror that of Germany, but rather we look to see what happened in the German reunification to
consider what might happen following a Korean reunification.

Terminology for pre- and post-reunification can be problematic. In this paper South Korea
and North Korea are used in place of the formal names (respectively) of the Republic of Korea and
the Democratic People's Republic of Korea. Similarly West Germany and East Germany are used in
place of (respectively) the Federal Republic of Germany and the German Democratic Republic. In
discussing the two parts of Germany post-reunification, West Germany and East Germany refer to
the geographic areas that correspond to pre-unification Germany. This terminology is consistent
with other demographic literature on Germany, although Goldstein and Kreyenfeld (2011:2) note,
“For the time after German unification, ‘western Germany’ and ‘eastern Germany’ would probably
be more appropriate terms for distinguishing the two parts of the country.”

**German reunification**

Prior to reunification East Germany experienced fertility levels at or near replacement levels
(2.1 children per woman), but following reunification fertility levels dropped from 200,000 births in
1989 to 79,000 births in 1994, which accounts for a 60 percent decline in five years (Conrad et al.
1996; Goldstein and Kreyenfeld 2011). The fall of the Berlin Wall was followed by the monetary
union in June 1990 and the political union in October 1990. The rapidity of changes did not allow
for East Germans to assimilate gradually; rather new political, economic and social institutions were
in place seemingly overnight. The dramatic changes were manifested in the fertility decline as a
multifaceted response to the societal and individual effects of: 1) uncertainty; 2) loss of
free/inexpensive childcare; 3) migration. Total fertility rates dropped from 1.57 children per woman
in 1989 to 0.98 in 1991 (Eberstadt 1994), and the period TFR fell to 0.8 (Goldstein and Kreyenfeld 2011).

Not only did birth rates decline, but marriage rates declined as well in East Germany, as well as in many of the former Soviet bloc countries. East German marriage rates declined by 60 percent between 1989 and 1992, while Bulgaria, Hungary, and Romania, experienced 35-40 percent declines (Conrad et al. 1996).

East Germany period fertility rates caught up with West German rates (TFR of 1.4) by 2008, even though the economic situation is still much less favorable in the eastern part of the country (Goldstein and Kreyenfeld 2011). Although the TFRs have converged, mean age at first birth remains much lower in East Germany than West, and there is less childlessness in the East than the West. The East German family model had higher levels of gender equality--particularly in terms of integration of work and family--than West Germany, and that has not changed dramatically in the ensuing years (Goldstein and Kreyenfeld 2011). West Germany has experienced less availability of childcare than in East Germany, thus leading to lower rates of employment among mothers. West German women have had to choose between having children or having a career, which has led to high levels of childlessness. Therefore, it is possible that if fertility in West Germany remains at the same level as it is currently, then fertility in East Germany will begin to surpass that of West Germany.

One of the most positive features of unification for Germany has been the decline in mortality in East Germany (Vogt and Kluesener 2011). The near convergence of life expectancy is not such a surprise given that there was less than a year difference near the time of reunification. For males, the roughly 1.5-year gap between the two countries in 1988 (66.61 in East Germany; 68.04 in West Germany) remained in 1996/97 (67.86 in East Germany; 69.12 in West Germany) (Nolte et al. 2002). In the 18 years between 1990 and 2008, Eastern German men gained 7.4 years
in life expectancy, compared with 4.9 years for West German men; for women the gains were 6.0 years (East Germans) and 3.4 years (West Germans). This has resulted in a 0.05 year gap for women and 1.1 year gap for males (Vogt and Kluesener 2010).

Much of the improvement in life expectancy at birth in East Germany in the 1990s was a result of funds invested into the medical system; for instance the number of dialysis facilities in East Germany increased two-to-three fold (Nolte et al. 2002). Vogt and Kluesener (2010) argue that the gain in life expectancy was primarily a result in the reduction of cardiovascular mortality as a result of modern pharmaceuticals and medical facilities, particularly in urban areas.

Immigration from East to West Germany ceased officially from 1961 until the fall of the Wall, although immigration had been very high up until 1961. A limited number of asylum seekers from other friendly Communist regimes did migrate to East Germany although it is unclear to what extent they were integrated into the country and most were repatriated back to the country of origin (Fritz 2011). Following unification, 2 million East Germans migrated to West Germany between 1990 and 1996, which was approximately 12.5 percent of the East German population as of 1990 (Heiland 2004).

Korean reunification: Three Views

This paper models three potential outcomes for Korean reunification: optimistic, pessimistic and a steady state. For all three scenarios we will assume that there will be an initial “birth shock” among the North Korean population--such as was experienced in Eastern Germany--for two primary reasons: 1) the social/economic/political upheaval for North Korea; and 2) a potential war would not only result in a loss of life, but would likely disproportionately affect young men in their 20s, which would lower fertility immediately.

The pessimistic hypothesis emphasizes a demographic free-fall. Goldstein and Kreyenfeld (2011:7) stated in relation to Germany, “At the time of unification, it was argued that, because the
two regions shared a common cultural heritage, East and West German attitudes and values would swiftly converge. However, this assumption failed to adequately take into account how profound the exposure to 40 years of communism had been.” If the ideological shift was difficult in Germany, it is mind-boggling to think of the change over from the entire Songbun system for North Koreans.

The optimistic interpretation hypothesizes that fertility and marital declines during reunification are a rational response to uncertainty. In this adaptive model we expect to see a temporary abstinence from marriage and childbearing, that is, there is an avoidance of long-term commitments during uncertain periods. As economic and political systems are put into place demographic behaviors are expected to adjust to the new situation and return to pre-transition levels.

The steady state hypothesis assumes that following the demographic shock of reunification that the demographic behavior remains at that new level for a period of time: neither increasing to pre-transition levels as in the optimistic scenario nor in a demographic free-fall as in the pessimistic scenario. This freezing of demographic behavior reflects a cautious, rational approach to the adjustment to a new economic and political order.

Migration is one of the greatest unknowns for a unified Korea. Eberstadt (1995) noted that higher wages would surely be a draw for North Koreans, but that it could result in a marginal and/or underemployed population, particularly in the peripheries of the South’s largest cities. Assimilation would likely prove to be very difficult as it has been for the handful of refugees currently in the South (Fackler 2012). While the primary migration would be from North to South, there are also possibilities of South Koreans wishing to reclaim property in the North. Land issues will be very difficult to resolve since ownership of private property is basically non-existent in the North and old land records may be difficult to find and/or authenticate.

North Korea is in essence a closed migration country with virtually no one entering (other
than rogue abductions) and no one leaving legally. Approximately 23,000 North Korean refugees are living in South Korea and as of 2007 the US State Department estimated that 30,000-50,000 North Korean refugees were living in China, although some NGOs estimate the number to be as high as 300,000 (Fackler 2012; Margesson et al. 2007).

The status of Koreans in China after reunification is not likely to improve greatly; China will be a major player with regard to migration as either a destination or a transit country, even if it is unlikely to embrace a large number of North Koreans. Proximity, kin, and current trade patterns may make China a more attractive destination than South Korea for some North Koreans. There are estimated to be one million Chinese of Korean descent living in the Yenbian Korean Autonomous Prefecture in China (Margesson et al. 2007). It remains to be seen how many North Koreans seek to live in China—as well as other countries such as Viet Nam, Thailand and Japan—rather than stay in their current homes or move to South Korea. Movement into, out of, and within a reunified Korea will no doubt be very different that what occurred in Germany.

**Korean reunification: the pessimistic model**

The pessimistic model hypothesizes that the divergent economic, political, and social systems of South and North Korea will dominate all aspects of life and lead to demographic disarray. The scale of economic integration will be so much larger in Korea than in Germany, with the primitive infrastructure of North Korea and the vast ideological differences in political systems taking years to overcome.

The largest single factor of unification will be the severe economic conditions in North Korea, which will take years to improve substantially. If we assume that fertility and mortality trends are related to economic conditions, we would expect that North Korea fertility would not rebound from the initial demographic shock and will decline to levels lower than South Korea.
The mortality experience of the Korean reunification will likely be very different than what was observed in Germany. South Korea is currently ranked 42nd in the world in terms of life expectancy at birth (79.55 years, surpassing the United States) and North Korea at 69.51 years as 155th (CIA 2013). As of 2013, the gap in life expectancy between South and North Korean men was nearly 11 years, and just over 9 years for women. These gaps will be an extreme challenge to bridge in a reunified Korea, particularly in light of the difference in the way medicine is practiced in the two countries. As a comparison, life expectancy (as of 1988) for females was 70.27 years in East Germany and was 71.18 in West Germany; the gap for life expectancy for men was about 1.5 years.

The potentially enormous estimated costs of Korean integration will need to include an investment in medical technology and supplies to bring the North Korean medical facilities anywhere near the level currently existing in South Korea. Medical facilities and a health care system were put into place in North Korea after the Korean War in order to monitor each citizen’s health conditions and for a national vaccination system (Schwekendiek 2011), however the inability to import medical equipment and pharmaceuticals has left the country with shortages that are sometimes only available through the black market (Médecins Sans Frontières 1998). Although South Korea was slow to develop a strong health care system, 96.3 percent of the population is now covered by the National Health Insurance Policy. South Korea is already facing the challenge of a rapidly increasing elderly population that will strain the resources of the South Korean health care system (Song 2009). The challenge of integrating and funding two very different health care systems is likely to affect mortality levels, at least in certain parts of the reunified country and for some subpopulations.

The training of medical personnel in North Korea will also be a challenge that will likely incur significant costs for educating medical professionals. It is likely that the mortality reductions can first be seen in the major cities if the adoption of modern medical facilities and pharmaceuticals
are required to reduce degenerative and man-made diseases in the fourth stage of the epidemiological transition posited by Omran (1971). However, North Korea is also still dealing with the effects of famine that characterize the first stage of the epidemiological transition and will require nutritional stabilization, particularly in rural areas, in addition to the development of a network of general practitioners and medical specialists throughout the entire country.

Mortality may climb in North Korea if humanitarian assistance is unable to provide even minimal food levels for the 6 million North Koreans to be in need of food assistance, as estimated by the United Nations Office for the Coordination of Humanitarian Affairs (2011). The long-term effects of famine are seen acutely among North Korean children where stunting in particular continues to be a large problem, with 45 percent of rural children aged 0-59 months classified as stunted and 23 percent of urban children. Stunting increases with age among children; 47 percent of the children 48-59 months of age were stunted. These children were born long after the famine of the 1990s. This level of stunting indicates the long-term affect of poor nutrition and chronic food shortages, which can cause impaired cognitive function, impaired immune function, and chronic metabolic disease (Hoffman and Lee 2005).

The reunification of the two countries will require a massive shift in food distribution, which will require updating and upgrading the transportation system in North Korea. In addition, modernization of farms and farm equipment will be required, as well as consistent supplies of fertilizer and fuel. It will not be enough to increase the overall food supply; everyone must have access to food, which has not been the case to date in North Korea. The North Korean agricultural sector has been micromanaged centrally with target-setting formulas and farmers being prohibited from selling grain legally in the market (Noland 2013). The adjustment to open markets would be complex with North Korean farmers having to pay for fertilizer, seed, and farming implements. Another drought would be a disaster particularly during a time of change-over.
And it is not merely a question of increasing food production. Opening markets and stabilizing currency will be a massive undertaking, as well as potentially shutting down the black markets that have tended to be a source for food and income in North Korea.

Environmental health concerns will also need to be addressed, including the use of wood and/or coal for heating homes and/or cooking foods in 93 percent of North Korean homes (Stephen 2013). Housing will be another area that needs to be addressed. As of 2008, nearly three-quarters of all North Korean households had a floor area of 50-75 square meters; only 2 percent had a floor area of 100 square meters or larger (Stephen 2013). Not only are homes very small, but the plumbing and electrical systems are antiquated. Although plumbing is in most homes (90 percent in urban areas and 78 percent in rural areas), the piped water system is inadequate and not fully functional. According to the 2009 Multiple Indicator Cluster Survey (CBS and UNICEF 2010: 54-55), “…when people are asked to identify their main source of drinking water they are likely to state ‘piped water’ even if that is not their only source of drinking water and even if they can only obtain water from this source for a short period in a day.”

Another difficult sector that will take years to bring into compatibility is education. South Korea is one of the most highly educated populations in the world with 43 percent of males and 36 percent of females aged 25-64 having completed a tertiary degree (KOSIS 2013). The comparable figures for North Korea are 14 percent for males and 8 percent for females (Central Bureau of Statistics 2010). Not only is the percentage of college graduates high in South Korea, the educational system is ranked as one of the top in the world (The Economist Intelligence Unit 2012). One of the greatest challenges for unifying the educational system will be the training of teachers for elementary through high school, and then the development of universities and recruitment of a faculty for those universities.
Optimistic scenario

Fertility for the optimistic scenario is based on the East German experience in the past ten years in which the TFR rebounded and then surpassed that of the West German TFR. The fertility pattern over time for South Korea is very similar to what West Germany has experienced; both countries have had very long, continuous histories of low fertility. Similar to East Germany prior to reunification, North Korea has much higher fertility than South Korea; the optimistic scenario then assumes the demographic shock will be short-lived once the social and economic transformation begins to take place and fertility in North Korea will return to levels nearly as high as pre-transition.

The optimistic model relies on two marital behaviors that drive fertility behavior: 1) the percentage of people who marry (and remain married); and 2) the mean age at first marriage. Marriage in North Korea is nearly universal with 96 percent of women aged 30-34 and 98 percent of men aged 35-39 reporting that they have married. Divorce and separation are rare in North Korea with only 0.2 percent of men and 0.7 percent of women reporting in the 2008 census that they were divorced or separated (Stephen 2013). If North Korea experiences the 30-60 percent decline in marital rates as did Eastern European countries and Eastern Germany, it would seriously destabilize household composition and fertility for a period of time, but the optimistic model predicts that marital behavior will rebound quickly and return to post-unification rates of nearly universal marriage.

As of 2008 the mean age at first marriage in North Korea was 29.0 years for men and 25.5 years for women; in South Korea the comparable figures were 31.4 years (men) and 28.3 years (women). Currently military service delays marriage, so it is possible the mean age at marriage would decline if military service is no longer required, or if required military service is for a shorter period of time. A continued mean age at first marriage in the 20s for North Koreans will also be instrumental in the return of fertility to pre-unification levels.
Sixty-two percent of North Korean women and 80 percent of men aged 16 and over report working as their usual activity. Little is known about the quantity or quality of child care facilities in North Korea, but it is likely that they are provided at the workplace for young children who are not yet of age to attend state-based kindergartens and primary school. The optimistic model assumes that North Koreans will continue to be able to integrate working and parenting roles.

There are four essential elements to reducing mortality for the optimistic model, all of which can be addressed with sufficient funding. First is the availability of clean water. There has been a deterioration in the North Korean water supply system since the 1990s, which has resulted in the significant decrease in the supply of potable water. UNICEF estimated that water was only available from 2-4 hours per day, even in cities, and access to piped water declined from 83 percent in 1994 to 53 percent in 1996 (United Nations Office for the Coordination of Humanitarian Affairs 2002). The cost to improve the water/sanitation infrastructure is significant, but critical, and the resulting decrease in water-borne illness and death will be tremendous. One option being pursued by UNICEF is gravity fed water systems, which is a cost-effective and environmentally friendly intervention.

A second element to reduce mortality will be the availability of vaccinations, antibiotics, and other critical drugs. Other than clean water, vaccinations have the largest effect in reducing the burden of infectious diseases (Andre et al. 2008). For instance, tuberculosis has reportedly increased in North Korea from fewer than 50 cases per 100,000 people in 1994 to 380 cases per 100,000 in 2011 (Phelan 2013), which is the highest in the world outside of sub-Saharan Africa and there are reports of an increase in multidrug-resistant tuberculosis with 5,000 cases per year being reported (Cain and Phelan 2013).

The third aspect to decrease mortality is the transference of medical technology; to have the largest and most immediate effect, this should occur first in the urban areas. Sixty percent of the
North Korean population lives in urban areas, so the introduction of a few key elements of public health could have a rapid effect. For instance, the maternal mortality ratio remains high at 81 maternal deaths per 100,000 births (WHO et al. 2012). UNFPA currently has a 5-year assistance program to lower maternal mortality at 300 North Korean health facilities, but this could be institutionalized and expanded for a greater effect.

The fourth element for reducing mortality to support the optimistic model will be the immediate and wide spread effort to reduce and to eventually eliminate chronic food shortages and malnutrition. It will be critical that the first tier of support go to infants, children, and mothers, particularly to increase their intake of protein and to ensure key vitamins are included. The reduction and elimination of wasting and stunting among children will provide long-term benefits to the entire population.

With the caveat that the East German health care system was far more advanced than the North Korean system, the German experience has shown that the pace of mortality decline can be very rapid. Vogt and Kluesner (2011) estimate that by 2010 East German males had gained 5 years of life expectancy as a result of reunification. While it will require a unified approach and the assistance of international organizations to lower mortality in North Korea, the benefits will be immediate and large.

**Steady state**

The critical element of the steady state scenario is that following reunification and the nearly instantaneous demographic shock, the unified country reaches an equilibrium. For South Korea, this will be at the current level of fertility and for North Korea, this will be at the level of the demographic shock.

The lowest low fertility behavior of South Koreans over the past thirty years has been one of the more remarkable demographic stories of the late 20th and early 21st centuries. Similar to South
Korea, Western Germany has also displayed consistent fertility levels over the past forty years, though the TFR has held steady at 1.4 in Germany as compared with 1.2 in South Korea. The reasons behind the low South Korean fertility rate are myriad and complex, but are not likely to see a turnaround in the near future even with the existence of government pronatalist policies. Anderson and Kohler (2012) argue that the cost of children, particularly in light of the competition among parents to get children into the best schools and jobs, or what they term “educational fever” is one of the primary drivers of low fertility in South Korea. In addition, unless it becomes easier and less expensive for young adults to get launched into careers and housing, postponement of marriage and childbearing is likely and the lowest-low fertility of South Korea will continue.

For North Korea the steady state model assumes that following the demographic shock, fertility will not bounce back up to pre-reunification levels, nor will fertility drop to South Korean levels or lower. The factors that would be likely to maintain the steady state model would be the continued dissonance of adjusting to a new economic and political order and the likelihood that women (and men to a lesser degree) will not be able to integrate worker and parenting roles in the new economy. Although these would dampen fertility, we would not expect fertility to cease. Indeed external conditions--such as a decrease in mortality and an improvement in the economy--would provide a new base for North Korean couples to either start or continue childbearing. There is no doubt that reunification would affect different cohorts differently. For women toward the end of their childbearing years, the disruption of unification would likely end childbearing. For women at the very start of their childbearing years, they might postpone having children until their lives become more settled. The steady state approach assumes that marriage rates would remain very high for North Koreans and nearly all women would have at least one child, with about half of the women progressing to having a second child.
The mortality assumptions of the steady state are not as dire as with the pessimistic model, nor as rosy as with the optimistic model. In this model we assume that mortality will decrease, but that the infrastructure for clean water, hospitals and medical personnel will be developed slowly. Nutrition will improve, but again, slowly. Improvements in mortality are likely to occur first in cities, and will eventually reach rural areas.

DATA AND METHODS

In order to determine population projections of a unified Korea from 2015 through 2050 data are utilized from the Korean Statistical Information Service (KOSIS) for the current South Korea and projections for North Korea were prepared by the author using the DEMPROJ software developed by Heilig (2000). North Korea conducted a census in 2008, with the assistance of the United Nations Population Fund, which gave the rest of the world a rare demographic glimpse into the country (CBS 2010). It is difficult to gauge the coverage and quality of the data, though it appears that the undercount of men in the military in the previous census (1993) was corrected in the 2008 census (Spoorenberg and Schwekiendiek 2012). All calculations of age indices that the author conducted with the 2008 data were inconclusive because of the irregular age distribution of the North Korean population as a result of the Korean War and the famine of the 1990s. (See Goodkind et al. for analysis of mortality data for the North Korean 1993 and 2008 censuses and the intercensal period). The 2008 census data appear to provide a solid base for calculating population projections for five-year age groups in five-year cycles up through 2050.

In order to calculate the projections, several suppositions were made. First is that the timing of the reunification would be between 2015 and 2019. Thus a fertility shock in (the former) North Korea would lower fertility to 1.58 children per woman for the 2015-19 projection period, which is used as the starting TFR for all three projection series. The ending total fertility rates used for the
projections of the current North Korean population are: 1.9 (high/optimistic), remain at 1.58 (medium/steady state); and 1.0 (low/pessimistic). For the KOSIS data, the ending total fertility rates were: 1.79 (high), 1.42 (medium), 1.01 (low).

The projected values of life expectancy at birth for the ending projection period for the North Korean projections for males/females are: 77.0/82.5 (high); 68.9/75.1 (medium); 66.2/70.0 (low). For the KOSIS data the 2050 life expectancies for South Korean males/females respectively are: 87.7/91.6 (high); 85.1/89.3 (medium); and 82.1/86.8 (low). For the purpose of this simulation, there is no out migration from North Korea (other than to the current South Korea).

Comparison data from the United Nations 2010 projection series are also utilized in the analysis as a comparison point for South Korea.

RESULTS

The total population for a unified Korea using the high/optimistic variant is 86.3 million, the medium/steady state is 73.1 million, and for the low/pessimistic variant it is 61.7 million. It is not only the total population that is of concern, but the distribution of the age structure. As seen in Table 1, the population aged 0-14 would range between 8.7 percent (low variant) of the total population to 13.3 percent for the high variant. The working-age population (15-64) would range from 54.6 percent (high variant) to 57.6 percent (medium variant). The elderly population increases to about a third of the total population for all three simulations. The reunified Korean population in 2050 will be dramatically restructured from the existing population in either country, with a very large elderly population (Figures 4 and 5).

To determine if reunification would solve the aging problem of South Korea, it is important to consider what the age distribution of South Korea would look like without reunification. As seen in Table 2, the projected population age distribution of South Korea using three scenarios (for both KOSIS and UN data) shows an extreme population distribution with the elderly projected to
comprise somewhere in the range of 36 to 45 percent of the total population. For illustration purposes Figure 6 shows the percentage age distribution for a reunified Korea in 2050 using the medium variant with the medium variant for South Korea prepared by KOSIS and UN.

Although reunification would add more people to the total population, it is evident that reunification would dampen--but not solve--South Korea’s impending elderly boom. Each of the reunification projections shows that about a third of the population in 2050 will be elderly, which is still going to require a massive redistribution of resources. As a comparison, the elderly population makes up just under 25 percent of the Japanese population as of 2013, which is the highest percentage in the world to date (US Census Bureau 2013).

**SUMMARY AND CONCLUSIONS**

The German reunification is now 24 years in progress. The immediate after effects in East Germany were the tremendous decline in births and marriages, combined with increased life expectancy, and high rates of out-migration. If we now look at what has happened in Germany in the 21st century, once the original shock of reunification was replaced by daily life in a unified country, what might we conclude about the Korean reunification? Will Korea adapt or be in crisis?

The three scenarios presented in this paper are all possible outcomes of reunification. Given the tremendous differentiation in all aspects of daily life between the two countries it is difficult to imagine that the optimistic model would come to fruition in 35 years. Even the steady state scenario will require assistance and investment in the current North Korea from other countries, humanitarian groups, and non-governmental organizations. The pessimist might argue that the likely scenarios should be a pessimistic model and a more pessimistic model.

Just as the unification of Germany has been described as a natural experiment, the unification of Korea will provide a rich set of data for social scientists. Whatever circumstances
result in the unification of Korea, or the timing of the reunification, we know that it will be a time of
great social, political, and economic upheaval in both South and North Korea. The German
example predicts a series of immediate behavioral and health changes in response to the upheaval of
reunification that will result in a drop in births and a likely increase in mortality in Korea. The ability
to recover from the demographic shock may take years in what is now North Korea, and at the
same time South Korea will be challenged to integrate and assimilate its northern neighbors with
extreme financial burdens.
ACKNOWLEDGEMENTS

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Table 1. Percentage age distribution by broad age group, North and South Korea, 1993 and 2008; and a unified Korea using three projection assumptions

<table>
<thead>
<tr>
<th>Broad Age Groups</th>
<th>North Korea 1993</th>
<th>North Korea 2008</th>
<th>South Korea 1993</th>
<th>South Korea 2008</th>
<th>Unified 2050-Low</th>
<th>Unified 2050-Medium</th>
<th>Unified 2050-High</th>
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<td>0-14</td>
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<td>8.7</td>
<td>11.4</td>
<td>13.3</td>
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<td>15-64</td>
<td>67.6</td>
<td>67.1</td>
<td>70.1</td>
<td>72.3</td>
<td>57.5</td>
<td>57.6</td>
<td>54.6</td>
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<tr>
<td>65+</td>
<td>5.4</td>
<td>9.0</td>
<td>5.4</td>
<td>10.3</td>
<td>33.8</td>
<td>31.0</td>
<td>32.1</td>
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</tbody>
</table>

SOURCE DATA: KOSIS, US Census Bureau; projections by author.
Table 2. Population projections for South Korea using three different assumptions: 2050

<table>
<thead>
<tr>
<th>KOSIS</th>
<th>Low</th>
<th>Medium</th>
<th>High</th>
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<tbody>
<tr>
<td>0-14</td>
<td>7.61</td>
<td>9.94</td>
<td>12.04</td>
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<tr>
<td>15-64</td>
<td>53.58</td>
<td>52.67</td>
<td>51.70</td>
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<tr>
<td>65+</td>
<td>38.81</td>
<td>37.39</td>
<td>36.26</td>
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<tr>
<td>Total Population (in 000s)</td>
<td>40,272</td>
<td>48,121</td>
<td>56,611</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>UN</th>
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<tr>
<td>0-14</td>
<td>8.24</td>
<td>11.72</td>
<td>15.16</td>
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<tr>
<td>15-64</td>
<td>46.89</td>
<td>48.10</td>
<td>48.73</td>
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<tr>
<td>65+</td>
<td>44.87</td>
<td>40.18</td>
<td>36.11</td>
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<tr>
<td>Total Population (in 000s)</td>
<td>47,339</td>
<td>52,858</td>
<td>58,825</td>
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</table>
Figure 1. Population Pyramid of South Korea, 2012 (in thousands)

- Male
- Female
Figure 2. Population Pyramid of South Korea, 2050 (in thousands)

Population (in thousands)

Age group

- 85+
- 80-84
- 75-79
- 70-74
- 65-69
- 60-64
- 55-59
- 50-54
- 45-49
- 40-44
- 35-39
- 30-34
- 25-29
- 20-24
- 15-19
- 10-14
- 5-9
- 0-4

Male
Female
Figure 3. Total Fertility Rates of North Korea and South Korea, 1970-2008
Figure 4. Reunified Korean Population in 2050 (low)
Figure 5. Reunified Korean Population in 2050 (high)
Figure 6. Population age distribution for broad age groups for reunified Korea and South Korea using the middle projection series: 2050 (in percent)
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